Pacific Gas and Electric Company

Kevin M. Sullivan
Principal Remediation Specialist
Hinkley Remediation Project

3401 Crow Canyon Rd
San Ramon, CA 94583
(925) 818-9069 (cell)
kmsu@pge.com

September 15, 2011

Lisa Dernbach, R.G., C.E.G., R.HG.
Senior Engineering Geologist
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150

Subject: Addendum #3 to the Feasibility Study
Pacific Gas and Electric Company's Hinkley Compressor Station,
Hinkley, California

Dear Ms. Dernbach;

Pacific Gas & Electric (PG&E) is submitting this Addendum #3 to supplement the Feasibility Study submitted August 30, 2010 for the selection of a final groundwater remedy for the PG&E Hinkley Compressor Station site located in Hinkley, California. This Addendum #3 (Addendum) builds on additional analyses contained within Addendum #1 and Addendum #2 to the Feasibility Study, submitted on January 31, 2011, and March 3, 2011, respectively.

This Addendum includes four groundwater remediation alternatives that were developed in response to written comments received from the Regional Water Quality Control Board, Lahontan Region (Water Board) as well as feedback received in Water Board and community participation meetings. These four new enhanced remediation alternatives (4C-1 through 4C-4) illustrate PG&E's continued commitment to implementing a groundwater remedy that combines effective and aggressive treatment with measures that preserve and enhance the agricultural nature of the community.

The alternatives presented here include significant increases in groundwater extraction rates, larger and more conservative plume capture zones and reduced cleanup time frames. Of the four alternatives evaluated in this Addendum, Alternative 4C-2 (In-Situ and Enhanced Agricultural Treatment-2 Crops) provides the best balance of year-round plume capture, reduced clean-up duration and implementability. The primary feature of Alternative 4C-2 is significantly increased annual groundwater extraction rates, particularly during winter months, through the addition of winter crops to the agricultural units.

Further, a comprehensive contingency plan was developed to maintain year-round plume capture in the event of severe or prolonged inclement weather or other unusual events that might render the remedy inoperable for a prolonged period of time.

Additionally, PG&E has incorporated additional extraction and water treatment flexibility into the four alternatives to respond to new plume data as it is obtained. This will allow the remedy to be adjusted in a more timely manner as appropriate.

PG&E looks forward to discussing the results of this Addendum #3 with the Water Board and, most importantly, to implementing the EIR and public participation process that will bring us to a final groundwater remedy. If you have any questions, feel free to contact me at (925) 415-2615.

Sincerely,

Kevin M. Sullivan

Enclosure: Addendum #3 to the Feasibility Study

ADDENDUM #3 TO THE FEASIBILITY STUDY
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY COMPRESSOR STATION
HINKLEY, CALIFORNIA

Prepared for

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Prepared by

HALEY & ALDRICH, INC.
9040 Friars Road, Suite 220
San Diego, California 92108
(619) 280-9210
(619) 280-9415 FAX

REGISTERED PROFESSIONAL ENGINEER
THOMAS HOLDEN
No. 68065
EXP. 6/30/2012
CIVIL
STATE OF CALIFORNIA

Thomas J. Holden, P.E. No. C68065
Senior Specialist, Remediation Engineering

Beth Breitenbach, P.G. No. 8353
Senior Project Manager

PROFESSIONAL GEOLOGIST
ELIZABETH
ANN
BREITENBACH
No. 8353
STATE OF CALIFORNIA

Scott P. Zachary
Vice President

15 September 2011

This report incorporates Site conditions observed and described by others as reported in records available to Haley & Aldrich as of the date of report preparation. Haley & Aldrich relied on such data collected by others in the development of interpretations about environmental conditions at the Site. The accuracy, precision, or representative nature of data, figures, and appendices originally generated by others was not independently verified by Haley & Aldrich and would be beyond the scope of this project.

HALEY & ALDRICH

EXECUTIVE SUMMARY

Pacific Gas and Electric (PG&E) prepared this Addendum #3 to the Feasibility Study (Addendum #3) to continue the process of selecting a final groundwater remedy for the chromium impacts related to historical operations at the PG&E Compressor Station in Hinkley, California (Site). This Addendum #3 is part of the Feasibility Study process involving PG&E, the Lahontan Regional Water Quality Control Board (Water Board), and the Hinkley community.

On 30 August 2010, PG&E submitted a comprehensive Feasibility Study (FS) in accordance with the Cleanup and Abatement Order issued by the Water Board. The FS also contained an analysis regarding the feasibility of remediating groundwater to Site-specific background concentrations in accordance with State Water Resources Control Board Resolution 92-49 (92-49). The FS/92-49 analysis evaluated a broad and comprehensive range of hexavalent chromium treatment technologies and assembled the most promising of these technologies into five implementation alternatives. These five alternatives were then evaluated using groundwater modeling to determine the effectiveness, implementability, and cost aspects of each for comparative purposes. Results of this evaluation indicated that Alternative 4 – Core In-Situ Treatment and Beneficial Agricultural Use – best met these required evaluation criteria.

Since the FS was submitted in August 2010, numerous meetings were held with the Water Board and the Hinkley community to discuss the FS-recommended remedy and path forward. The primary comment received from the Water Board and the Hinkley community related to the projected duration of the remedy to reach background chromium concentrations. In response to these comments, two rounds of remedy enhancements were performed using the FS-proposed Alternative 4 as the foundation for these efforts. The results of these enhancements reduced the estimated cleanup duration from 150 years to less than 50 years and are reported in Addendum #1 and Addendum #2 to the FS.

While the FS and its addenda were being reviewed, PG&E continued with the installation and start-up of numerous components of the proposed remedy, in addition to the already existing groundwater remediation systems. These system modifications were made in an effort to provide more robust plume containment and further expedite plume remediation.

These system modifications included:

- Approximately 780 gallons per minute of additional extraction;
- Three (3) additional Agricultural Units for water treatment;
- Four (4) new extraction wells and five (5) new injection wells in the Source Area;
- Converted four (4) former extraction wells to injection wells in eth Source Area; and
- Converted two (2) extraction wells to injection wells in the Central Area.

Concurrently with these remedy expansion efforts, PG&E continued its groundwater investigation program to delineate the limits of the plume to established background levels.

On 13 July 2011, PG&E received formal written comments regarding the FS and its addenda. Meetings between PG&E and the Water Board to discuss the comments were held during the summer of 2011 and resulted in the development of the primary goals for Addendum #3 to the FS. The primary goals of this Addendum #3 are to evaluate and recommend measures to:

- Ensure year-round capture of the chromium plume and evaluate the need for and effectiveness of varying pumping schedules;
- Further reduce the cleanup time frame from that estimated under Alternative 4 in the previous Addendum #2;
- Develop sectional or "operable units" (OUs) with remediation milestones to track progress and facilitate adaptive management of the remedy; and
- Establish a contingency plan to maintain year-round plume capture.

In response to these goals, four additional remediation alternatives were developed for a detailed evaluation. These four new alternatives were built on the already-improved performance of Alternative 4 from Addendum # 1 and Addendum #2 by adding extraction/treatment features and increases to extraction flow rates. New features added to these alternatives for evaluation included higher winter pumping rates for enhanced year-round hydraulic control, winter-crop AU operation, and the consideration of winter water treatment by an ex-situ treatment plant. Extensive groundwater hydraulic and fate and transport modeling were performed to evaluate the alternatives against the remedial objectives and screening criteria established in the FS: effectiveness, implementability, and cost. To provide an equivalent basis for comparison of the new alternatives to those previously considered, the evaluation was performed using the same plume map (February 2010) used for the analysis in the original FS. However, since the current groundwater plume configuration is different from the February 2010 plume based on the results of ongoing sampling and assessment, the new alternatives were also evaluated for performance based on the First Quarter 2011 plume. Lastly, the ongoing groundwater assessment, combined with a Water Board-requested peer review of the 2007 Background Study and supplemental area background data, may further modify the final plume configuration for remediation. To account for this potential scenario, the recommended alternative was qualitatively evaluated against the FS screening criteria to accommodate an expanded plume scenario. Once a final remedy alternative is selected, the subsequent detailed design process will ensure that the remedy is designed to capture and remediate the entire plume, and is flexible enough to respond to future plume configuration changes.

Results of this Addendum #3 evaluation indicate that the most reasonable plan to achieve the remedial objectives and address the Water Board comments of maintaining year-round plume capture is Alternative 4C-2 In-Situ and Enhanced Agricultural Treatment-2 Crops. This alternative accomplishes the two primary goals set out by the Water Board: 1) maintaining year-round plume hydraulic control; and 2) achieving one of the shortest remediation timeframes to background concentrations among all the alternatives evaluated. The scalability of Alternative 4C-2 also accommodates the potential future expanded plume scenario. Additional benefits of this alternative include: a greater degree of productive groundwater use through fodder crop production and greater containment/removal of historical nitrate concentrations in groundwater through AU operations.

To facilitate efficient operation of the various remediation components, PG&E, in conjunction with the Water Board, established OUs that generally represent major characteristics of the various areas of the Site. The three OUs proposed represent: 1) the source area where in-situ remediation is largely used (OU1); 2) the plume area where low concentrations exist and agricultural treatment is the focus (OU2);

and 3) the monitoring area where groundwater quality monitoring is primarily performed (OU3). To track remediation progress and guide adaptive management of the remediation operations, short- and long-term interim remediation targets for each OU are proposed.

Lastly, to ensure that year-round hydraulic capture of the plume is maintained during prolonged inclement weather, a contingency plan was developed to establish the decision criteria and timeline for the implementation of progressive contingency measures up to the potential deployment of ex-situ treatment systems.

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LIST OF ACRONYMS

Addendum #3	Feasibility Study Addendum #3
AUs	Agricultural Units
CAO	Cleanup and Abatement Order No. R6V-2008-02
Cr(T)	Total Chromium
Cr(VI)	Hexavalent Chromium
DVD	Desert View Dairy
FS	Feasibility Study
FS/92-49	Feasibility Study and Resolution 92-49
General Permit	General Site-Wide Groundwater Remediation Project (General Permit), Board Order No. R6V-2008-0014
gpd	Gallons per Day
gpm	Gallons per Minute
IRT	Interim Remedial Target
IRZ	In-Situ Reactive Zone
LTU	Land Treatment Unit
MCL	California Maximum Contaminant Level
Mn	Manganese
NPV	Net Present Value
OUs	Operable Units
PG&E	Pacific Gas and Electric Company
plume	PG&E's Chromium Plume
Resolution 92-49	State Water Resources Control Board Resolution 92-49
ROs	Remedial Objectives
SCRIA	South Central Reinjection Area
Site	PG&E Compressor Station in Hinkley, California
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
μg/L	Micrograms per Liter
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Water Board	Lahontan Regional Water Quality Control Board

ADDENDUM #3 TO THE FEASIBILITY STUDY
HINKLEY, CALIFORNIA

1. INTRODUCTION

Pacific Gas and Electric Company (PG&E) is working under the direction of the California Regional Water Quality Control Board – Lahontan Region (Water Board) to clean up hexavalent chromium [Cr(VI)] in groundwater resulting from historical operations at the Hinkley Compressor Station (Site) in San Bernardino County, five miles west of Barstow, California (Figure 1). This document is Addendum #3 to the "Feasibility Study, Pacific Gas and Electric Company Compressor Station, Hinkley, California," ([FS]; Haley & Aldrich 2010) and is submitted as part of a continued effort to improve the preferred alternative by incorporating measures to reduce the remediation time frame.

1.1 Existing Cleanup Measures

PG&E has conducted extensive assessment and remediation efforts to characterize the Site's groundwater impacts, stop migration of affected groundwater, and clean up the groundwater. As part of its commitment to clean up the groundwater, PG&E has already:

- Installed over 300 monitoring wells;
- Installed and operated over 30 extraction wells and six treatment systems;
- Established several community based programs, including:
  - The Community Advisory Committee, made up of local residents and community leaders to advise, share concerns with, and provide direct input to PG&E on its environmental and community programs in Hinkley;
  - The Bottled Water Program, which voluntarily supplies bottled drinking water upon the request of any resident who lives within a 1/2 mile from the outermost boundary of the plume;
  - The Domestic Well Sampling Program, which tests for Cr(VI) at residences within and up to 1 mile outside the outermost boundary of the plume; and
  - The Property Purchase Program, which offers to purchase properties on top of or next to the plume and in locations required for the remediation.

This document continues PG&E's commitment to the Hinkley community and groundwater cleanup. On 30 August 2010, PG&E submitted an FS to the Water Board for final remedial measures to complete Site cleanup. To address Water Board questions and suggestions regarding the FS, PG&E produced two addendums to the FS during the first quarter of 2011. PG&E also worked with the Water Board to refine and enhance the final remedy for the Site. This Addendum #3 to the FS presents several enhanced variations of the preferred final groundwater remedy.

1.2 Regulatory Requirement to Complete an FS

The Cleanup and Abatement Order (CAO) issued on 6 August 2008 (Water Board, 2008) included a requirement to submit an FS report to assess remediation strategies and propose a final groundwater remediation alternative to achieve compliance with State Water Resources Control Board (SWRCB)

Resolution 92-49, "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304" (Resolution 92-49).

Resolution 92-49 requires PG&E to:

- Develop a cleanup plan that evaluates multiple remedies and weighs them against numerous factors such as:
  - Ability to achieve background levels;
  - Time frame to achieve background levels; and
  - Potentially significant impacts.
- Propose a cleanup plan that either targets groundwater cleanup to background levels or provides the appropriate justification for a higher standard; and
- Consider what is reasonable when evaluating a cleanup goal, taking into account the technical and economic feasibility of attaining background conditions, the projected time frame to achieve background conditions, and the maximum beneficial use of the resource being protected.

1.3 Evolution of the Preferred Final Remedy

On 30 August 2010, PG&E submitted an FS to the Water Board (Haley & Aldrich, 2010) that presented and evaluated a series of comprehensive cleanup alternatives for the Cr(VI) plume. The FS initially screened 36 cleanup technologies prior to selecting those that were combined to form five comprehensive remedial alternatives for a detailed comparison to the remedial objectives (ROs). The five alternatives discussed in the FS are:

- No Further Action (Alternative 1);
- Containment Only (Alternative 2);
- Plume-wide In-situ Treatment (Alternative 3);
- Core In-situ Treatment and Beneficial Agricultural Use (Alternative 4); and
- Plume-Wide Pump and Treat (Alternative 5).

The results of the FS analysis, along with past Site cleanup experience, show that the most reasonable approach is Alternative 4, which includes:

1. Containment pumping;
2. Agricultural application of the water extracted from the low-concentration northern and fringe portions of the plume; and
3. In-situ treatment of the higher-concentration plume areas.

On 31 January 2011 and 3 March 2011 PG&E submitted addenda to the FS (PG&E, 2011a and 2011b) to address questions and suggestions from the Water Board and the community. A summary of the evolution of the preferred final remedy, Core In-Situ Treatment and Beneficial Agricultural Use, is summarized in Table 1 below.

Table 1 – Evolution of Preferred Final Remedy – In-Situ Treatment and Beneficial Agricultural Use

Major Item	Alternative 4 (FS)	Alternative 4A (Addendum #1)	Alternative 4B (Addendum #2)
Containment Pumping	Base case	Extraction[1] increased by 34% vs. base case	Extraction[1] increased by 34% vs. base case plus optimization of network over time.
Agricultural Application	Base case	Added 2 pivots vs. base case	Same as 4A
In-Situ Treatment	Base case	Added 15 years of In-situ treatment over base case. Increased Central Area IRZ treatment zone length by 100%	Same as 4A
Estimated time to background[4]	Base case	50% faster vs. base case (half the duration of base case)	73% faster vs. base case (roughly one quarter the duration of base case)
Cost[2]	Base case	+ $29M vs. base case	+ $26M[3] vs. base case

Notes:
[1] based on peak extraction rate for the AUs
[2] net present value calculated using a 3.17% discount rate
[3]cost reduction a result of shorter cleanup duration.
[4]background value of 3.1 ug/L Cr (VI)
AU = Agricultural Units
IRZ = In-situ Reactive Zone

1.4 Document Organization

This Addendum #3 discusses groundwater conditions in the vicinity of the Site and the Mojave River Basin in Section 2. Regulatory and community input, as well as FS addenda developed in response to that input are summarized in Section 3. Section 4 discusses the development of operable units (OUs) and interim remedial targets (IRTs) that will be used to measure progress at the Site. Section 5 discusses and evaluates the preferred final remedy (Alternative 4C-2). The recommended approach and summary are discussed in Section 6. A comprehensive response to the Water Board 13 July 2011 comments to the FS and its addenda are included in Appendix A; supporting technical information is included in Appendices B through H.

2. GROUNDWATER CONDITIONS AND FEASIBILITY STUDY BOUNDARY

Groundwater conditions are the fundamental consideration in any FS process. The FS (Haley & Aldrich, 2010) presented details of groundwater characterization efforts as well as discussed Site-specific background water quality conditions and presented a Conceptual Site Model to understand naturally-existing conditions as well as PG&E groundwater impacts. Plume characteristics and boundaries at a given point in time form the basis of the technical evaluation of flow rate, extraction well number and locations, the capacity and type of treatment options, and the related cost estimates.

The FS and its addenda, including this document, utilize the chromium plume distribution represented by samples collected from Site groundwater monitoring wells in February 2010, as agreed to by the Water Board. Since the FS was submitted, extensive characterization efforts have been and continue to be performed. This recent additional characterization has identified areas where the 3.1 micrograms per liter (μg/L) Cr(VI) plume boundary extends beyond the February 2010 FS/Resolution 92-49 (FS/92-49) evaluation area. To facilitate a comparative analysis between previous remediation alternatives and those presented in this addendum, the Water Board agreed in a meeting on 19 July 2011 to continue to use the February 2010 plume configuration. However, the Water Board also requested that a more current plume map (First Quarter 2011) be included in this document with a statement regarding the ability of the new proposed alternative to address the First Quarter 2011 plume configuration and any other plume configuration changes known at the time. This document addresses this request in Section 5. Subsequent to this request, PG&E has prepared a plume map which depicts a different plume boundary configuration than the First Quarter 2011 map. This plume map is a composite representation of the 3.1 μg/L contour and is based on groundwater assessment and monitoring results that were recently reported (Stantec, 2011 and CH2MHILL, 2011a). This figure is included as Figure 3B. Where possible, a discussion regarding the anticipated effectiveness of the alternatives in this Addendum #3 to address the September 2011 interpreted plume extent is also provided. Once a final remedy alternative is selected and approved, the subsequent detailed design process will ensure that the remedy is designed to capture and remediate the entire plume.

Given that SWRCB Resolution 92-49 establishes that remedial alternatives must be evaluated based on the ability to achieve background concentrations, an in-depth understanding of the local and regional background groundwater conditions is critical to selecting a final remedy. The following sections summarize the current understanding of background chromium conditions in the vicinity of the Site as well as summarize the plume boundary conditions applied to this FS addendum evaluation.

2.1 Background Groundwater Conditions

CH2M Hill conducted a background investigation at Hinkley for total chromium [Cr(T)]) and Cr(VI) in groundwater that included samples collected during four quarterly sampling events in 2006 from 48 wells (mostly long-screened agricultural wells) considered representative of groundwater quality in the study area (CH2M Hill, 2007). However, water quality was not distinguished between the Upper Aquifer versus the Lower Aquifer or between different layers of the Upper Aquifer (CH2M Hill, 2011b). The maximum detected Cr(T) value was 3.15 μg/L and the maximum detected Cr(VI) value was 2.69 μg/L (CH2M Hill, 2010). In amended CAO No. R6V-2008-0002A1, the Water Board staff recommended the use of 95th percent upper tolerance limits of 3.23 μg/L for Cr(T), and 3.09 μg/L for Cr(VI) as maximum likely background concentrations for the Hinkley Site. These concentrations are lower than naturally-occurring chromium concentrations in groundwater at other sites in the Mojave Desert.

Water quality data collected by the California Department of Public Health, the SWRCB, and the United States Geological Survey (USGS) confirm that Cr(VI) is naturally present in groundwater throughout California, including the Mojave Desert area and in the immediate vicinity of the Hinkley Valley (CH2M Hill, 2011b). A 2004 occurrence study by the American Water Works Association Research Foundation also found that Cr(VI) occurrence was highest for groundwater in United States Environmental Protection Agency (USEPA) Region 9, which includes California. Drinking water extracted from the Alto and Este sub-basins of the Mojave River Basin show Cr(VI) at levels higher than those determined in the Hinkley background study. Cr(VI) concentrations ranged up to 5.1 μg/L in the Desert View System, and up to 6.3 μg/L in the Apple Valley South system. These data indicate the presence of Cr(VI) in groundwater within the Mojave River watershed, upstream of the Hinkley Site. It is reasonable to conclude that similar and higher Cr(VI) concentrations exist naturally throughout the Mojave River watershed, including the Hinkley Valley. In addition, a detailed study of groundwater conducted by the USGS in 2008 also confirmed that Cr(VI) is present in groundwater throughout the Mojave Area at concentrations up to 16 μg/L, consistent with the SWRCB data.

The geologic conditions in the Hinkley Valley are complex, including differing bedrock types (source rock for the aquifer alluvial materials), regional and local faulting, and differing geologic environments under which the unconsolidated aquifer sediments were deposited (CH2M Hill, 2011b). The background studies completed to date for the Hinkley project have not fully assessed the effect of these geologic conditions on naturally-occurring chromium concentrations, specifically north of the Site. Since sampling results have shown chromium concentrations present in areas outside of those that would be expected to be associated with the Site, a closer examination of the local geochemical environment may be necessary to determine whether the Cr(VI) concentrations are natural or may have been influenced by land use activities such as dairy farming.

Since the 2007 background report was submitted, PG&E has observed a common occurrence in short-screened monitor well clusters, where wells screened near the top of the water table exhibit higher Cr(VI) concentrations than wells screened at greater depths. This may be an indication of natural processes as well as potential other source(s) of Cr(VI) in Hinkley. This is supported by a study by Izbicki (2008), where the impacts of dairy waste on the local geochemistry favored the presence of Cr(VI) in groundwater.

Since a scientifically-based background Cr(VI) concentration is the basis of the FS evaluation, remedy selection and ultimately Site cleanup, the Water Board commissioned a technical peer review panel to specifically re-evaluate the above-referenced background study for representativeness to the Site. This peer review is currently ongoing and is expected to be completed in the Fall of 2011. In the four years since the execution of the background study, a deeper technical understanding of the Site and surrounding groundwater and geochemistry has been obtained through additional on-Site investigative work and the above-referenced background studies conducted in the Mojave Basin. A detailed review of these other background studies was submitted to the Water Board for consideration by the background study peer review group on 17 August 2011 (PG&E, 2011c).

2.2 Plume Boundary

When the FS was submitted on 30 August 2010, the known extent of contamination was depicted using data from the February 2010 sampling event (Figure 2). In order to consistently evaluate the enhancements to Alternative 4, submitted as part of Addenda #1, #2, and this Addendum #3, the Water Board agreed in a meeting on 19 July 2011 to use the same plume boundary used in the FS (February 2010) as the basis for the comparative analysis regarding remedy alternative system conceptual design, costs estimating, and fate and transport modeling. The First Quarter 2011 plume map is included as Figure 3A. The Water Board also requested that a statement be provided regarding the ability of the new proposed alternative to address the First Quarter 2011 plume configuration and any other plume configuration changes known at the time.

From late 2010 and throughout 2011, PG&E has conducted a considerable amount of additional groundwater investigation activities primarily along the northern and northeastern areas of the plume. The results of these investigation efforts have identified Cr(VI) concentrations above background beyond the February 2010 and First Quarter 2011 plume limits. Further investigation of these concentrations is ongoing by PG&E working in conjunction with the Water Board and is expected to be completed in late 2011. Results of the ongoing groundwater assessment were submitted to the Water Board on 1 September 2011 (Stantec, 2011). These results were composited with groundwater data from the Second Quarter 2011 groundwater monitoring report (Ch2MHill, 2011a) to create an approximate depiction of the current groundwater plume (Figure 3B). A final investigation report will likely be submitted in 2012 once the Water Board determines plume delineation is complete. Once a final remedy alternative is selected, the subsequent detailed design process will ensure that the remedy is designed to capture and remediate the entire plume.

Section 5 of this Addendum discusses the anticipated ability of the proposed remedy to address any changes in plume dimensions as a result of the ongoing investigation.

3. FEASIBILITY STUDY AND PREVIOUS ADDENDA

As stated in Section 1, PG&E submitted an FS in compliance with SWRCB Resolution 92-49 on 30 August 2010 in response to a request from the Water Board in CAO Amendment R6V-2008-0002A1. After considering many alternatives, the FS recommended Alternative 4, Core In-situ Treatment and Beneficial Agricultural Use, as the final remedy. In response to Water Board comments contained in the Water Board's letter dated 10 January 2011, PG&E submitted Addendum #1 to the FS on 31 January 2011 (PG&E, 2011a). In response to additional discussions with the Water Board held in January and February of 2011, PG&E submitted Addendum #2 to the FS on 3 March 2011 (PG&E, 2011b). Table 2 presents the comparison of FS-recommended alternative (Alternative 4) and the alternatives included in Addendum #1 and Addendum #2 (Alternatives 4A, and 4B respectively).

3.1 Feasibility Study

The FS evaluation concluded that Alternative 4 represents the best balance of technologies to meet the following groundwater ROs:

- Achieve background conditions;
- Restore groundwater beneficial use;
- Achieve plume containment; and
- Restore productive use of the groundwater resource.

Alternative 4 incorporates all of the Site-specific remedial testing and experience to address the plume containment and mass reduction ROs, using a combination of treatment technologies that not only reduce contaminant mass in a reasonable time frame but productively uses extracted groundwater. The major components of Alternative 4, as previously stated, include:

1. Containment pumping;
2. Agricultural application of the water extracted from the low-concentration northern and fringe portions of the plume; and
3. In-situ treatment of the higher-concentration plume areas.

It is important to keep in mind that the alternatives presented in the original FS were intended to help select between *families* of alternatives. It has always been PG&E's plan and expectation to develop improvements to these basic alternatives during the design and implementation phase, with input from the Water Board and the community.

3.2 Addenda #1

Addendum #1 was submitted on 31 January 2011 and included the development and evaluation of a more aggressive approach to in-situ treatment and beneficial agricultural use (referred to as Alternative 4A) as well as an alternative that combined Alternatives 2, 3, and 5 from the FS (referred to as the Combined Alternative). Each additional alternative employed greater plume containment and provided substantial improvement to the remedial time frame.

After submittal of Addendum #1, the Water Board directed PG&E to further refine the proposed remedy to achieve the background concentrations in less than 50 years. In response to the Water Board's suggestion, PG&E submitted Addendum #2.

3.3 Addendum #2

Addendum #2 was submitted on 3 March 2011 and included the development and evaluation of further enhancements to the Aggressive In-situ Treatment and Beneficial Agricultural Use (Alternative 4A). This improved alternative is referred to as Alternative 4B and applies the same technologies as Alternative 4A of Addendum #1. Alternative 4B uses much of the same general infrastructure as Alternative 4A, but relies on a series of step-wise optimizations that refocus the remediation effort on the more "recalcitrant" areas of the chromium plume as determined by modeling. Alternative 4B varies from Alternative 4A after year 10 when two of the original extraction wells to support the new Agricultural Units (AUs) are shut down, and the same flow is extracted from 12 new extraction wells strategically located to optimize mass extraction.

These additional operational modifications enable Alternative 4B to achieve the ROs in a shorter time frame than the alternatives presented in the FS and Addendum #1. In fact, Alternative 4B reduces cleanup time significantly (47 percent) when compared to Alternative 4A. Groundwater modeling predicted that this alternative would achieve the chromium California Maximum Contaminant Level (MCL) for drinking water in approximately 6 years and reduce the overall time frame to reach background concentrations of chromium to about 40 years, achieving the Water Board-requested time frame of less than 50 years (Table 2).

3.3.1 Public Meeting - 9 March 2011

A public meeting was held on 9 March 2011 to discuss progress on the Site and Alternative 4B. The primary questions raised were:

- Did the Feasibility Study consider enough technologies?
- Do AUs allow plume escape during winter months?
- Is chromium conversion in soil permanent?

As stated previously in Section 1, PG&E screened 36 technologies and thoroughly evaluated 12 remedial alternatives, including the four discussed herein. Extensive hydraulic and transport modeling simulations have been integral to the evaluation of the 12 remedial alternatives. As part of the hydraulic modeling, plume capture has been thoroughly assessed and is discussed further in Section 5 and Appendix C. The question about chromium stability in soil is addressed in Appendix F of this Addendum #3.

3.3.2 Water Board Feedback Regarding Addendum #2

Subsequent to the public meeting, the Water Board initiated a peer review process for the FS and addenda, asking for review of the document by the USEPA and the California Department of Toxic Substances Control. On 13 July 2011, the Water Board (Water Board, 2011b) provided written comments regarding Addendum #2 and the 30 August 2010 FS to PG&E. Several important themes discussed in the comments are summarized below:

- Year-round capture zones should be maintained;
- A contingency plan should be developed for groundwater treatment during periods when AU application is not feasible;
- Additional detail should be provided for the proposed alternatives; and
- Additional detail should be provided for modeling.

This Addendum #3 was prepared to address Water Board comments and includes the evaluation of four additional variations on the final remedy (Alternatives 4C-1, 4C-2, 4C-3, and 4C-4). At the recommendation of the Water Board, OUs were defined in an effort to develop interim goals and track remediation progress of the various approaches across the Site. The following sections define and discuss the utility of the OUs and evaluate the new remediation alternatives. Appendix G provides additional detail for the groundwater model construction and assumptions. A complete detailed response to the Water Board's 13 July 2011 letter is included with this Addendum #3 as Appendix A.

4. OPERABLE UNITS AND INTERIM REMEDIAL TARGETS

In an effort to address the Water Board's request for OUs and short-term ROs, PG&E discussed several options with the Water Board. The discussion resulted in the development of three OUs. The OU configuration is shown in Figure 4; the descriptions, characteristics, and remedial approaches are discussed in Table 3. The three OUs were designated as a means to establish short- and long-term remediation targets that specifically relate to the ROs of the FS/92-49. The OUs were also developed as an administrative tool to track and adaptively manage the operation and maintenance of the remedy in working toward the remediation targets.

It should be noted that the OU terminology simply describes overall areas with different characteristics within the Site and the different remedial emphasis for those areas. As described in Section 3, the Site is dynamic and complex, and it would be inappropriate to interpret the OUs as a strict separation of plume areas or applied remedial technologies given the variable and dynamic conditions at the Site. Rather, the OUs are intended to primarily facilitate a focused tracking of remediation progress to achieve background concentrations within each of the OUs using the short- and long-term remediation targets. This in turn will facilitate timely remedy adjustments as necessary.

4.1 OU1: In-situ Reduction and Agricultural Treatment Area

OU1 is the in-situ reduction and agricultural treatment area generally characterized by higher groundwater Cr(VI) concentrations emanating from the Source Area (Figure 4). OU1 extends from the source area in the south to the approximate northern extent of groundwater concentrations exceeding the MCL (50 μg/L). It includes lower concentration groundwater still exceeding the background concentration (3.1 μg/L) near its northern boundary. No Lower Aquifer impacts are known to be present in OU1.

The remediation emphasis in OU1 is in-situ Cr(VI) mass reduction to minimize potential further downgradient impacts. In-situ treatment in OU1 will use the In-situ Reactive Zone (IRZ) technology and will focus on accomplishing beneficial use conditions (50 μg/L) at the boundary of OU1 and OU2. In-situ reduction byproducts (e.g. manganese [Mn], iron, arsenic) will be generated through the IRZ process and primarily managed within OU1. Due to the aggressive nature of treatment proposed in OU1, the fringes of the plume may temporarily fluctuate over time in response to injection and extraction activities. All remediation activities will be constrained to the OU1 area and every effort will be made to limit plume bulges. To minimize these effects, hydraulic control and inward gradients will be maintained as long as necessary to prevent Cr(VI) and byproduct (Mn) migration. AUs will be used for water treatment as appropriate to assist with inward hydraulic gradients and plume water balance.

4.2 OU2: Agricultural Treatment Area

OU2 is the agricultural treatment area generally characterized by lower concentrations, typically above established background levels but below the chromium MCL. OU2 also includes areas outside the plume boundary that are or may be used for AU operations. OU2 also has a limited area of groundwater impacts above background in the Lower Aquifer. Elevated nitrate and/or total dissolved solids (TDS) concentrations are present in groundwater in the northern portion of OU2 as a result of non-PG&E historical farming and current dairy operations. OU2 extends from the northern boundary of OU1 north to Salinas Road beyond the downgradient edge of the plume as defined for this FS (Figure 4). OU2 also includes non-PG&E dairy operations and a limited number of residences with operable private drinking water wells.

The remediation emphasis in OU2 is on groundwater extraction and treatment via AUs. Chromium plume containment is accomplished through the maintenance of year-round inward hydraulic gradients produced by numerous groundwater extraction wells as well as limited freshwater injection. Water supply pumping in the Lower Aquifer will be minimized to mitigate further Cr(VI) impacts to the Lower Aquifer. Aggressive pumping in the Upper Aquifer over the Lower Aquifer combined with minimizing lower aquifer pumping is also planned to neutralize or reverse downward gradients and mitigate Cr(VI) impacts occuring via downward migration. Limited remedial pumping in the Lower Aquifer may also be considered in the future.

4.3 OU3: Monitoring Area

OU3 is currently defined as the area outside OU1 and OU2 and is generally characterized by Cr(VI) concentrations below 10 µg/L with many locations below background (assessment is ongoing; Figure 4). Monitoring and limited remedial pumping and conveyance (to AU treatement in OU2) are the primary activities anticipated for this area. Elevated TDS and nitrate concentrations are observed in the northern portions of OU3 as a result of non-PG&E historical agricultural operations. Comprehensive groundwater monitoring is carried out in OU3, given that there are residences with private drinking water wells within that area. Groundwater assessment activities are currently ongoing in the northern area of OU3 in coordination with the Water Board. Once these assessment activities are complete, anticipated to be in late 2011, final plume boundaries and a detailed remedial design will be developed. Although no remediation is currently shown for OU3, groundwater extraction with localized AU treatment, AU treatment in OU2, ex-situ treatment, or a combination of these treatment approaches could conceivably be implemented in OU3, if required. The perimeter boundary of OU3 also defines the area to be evaluated during the Environmental Impact Report (EIR). The final EIR may result in an adjustment of the final OU3 boundary.

4.4 Interim Remedial Targets

To address the Water Board comment regarding the development of ROs to inform adaptive remediation system management, OU-specific interim short- and long-term remedial targets were developed. The FS/92-49 analysis defined four Site-wide ROs for addressing chromium impacts to Site groundwater and included:

- Achieve background conditions;
- Restore groundwater beneficial use;
- Achieve plume containment; and
- Restore productive use of the groundwater resource.

The Site-wide ROs provide the over-arching criteria that guide the overall remediation process but do not establish specific short-term goals or benchmarks to measure remediation progress towards the ROs. The establishment of OUs discussed above provides an administrative segregation of certain remediation efforts or activities at the Site. Since remediation activities within each OU will be generally unique, the development of OU-specific short- and long-term remediation targets will facilitate the measurement of remediation progress and inform adaptive management of the final remedy during implementation. These IRTs will be used as guiding metrics to monitor progress over time and indicate if optimization measures or further adjustments to the final remedy are warranted. Interim remedial targets for various time periods (5 years, 10 years and 11+ years) for each OU are presented in Table 3. It is important to note that the IRTs discussed here are not intended to establish strict regulatory thresholds or compliance criteria. Rather, the interim remediation targets are intended to propose aggressive, step-wise remediation goals to work towards and provide a metric to identify the need for further work if progress towards Site cleanup proves more difficult than anticipated. All the alternatives considered as part of this Addendum #3 and Alternative 4B are capable of achieving the IRTs in the periods shown in Table 3 based on operational data and modeling performed to date. Because the IRTs are intended to provide a tool to guide and optimize future remedy operations once implemented, the following alternatives evaluation does not discuss achievement of IRTs but rather focuses on the FS/92-49 ROs and evaluation criteria.

5. UPDATED GROUNDWATER REMEDY – ALTERNATIVE 4C

Four additional variations on the final remedy (Alternative 4) were developed in response to Water Board comments included in the 13 July 2011 letter. The variations include:

- Alternative 4C-1 – In-Situ and Enhanced Agricultural Treatment-1 crop;
- Alternative 4C-2 – In-Situ and Enhanced Agricultural Treatment-2 crops;
- Alternative 4C-3 – In-Situ and Enhanced Agricultural Treatment and Winter Ex-Situ Treatment-Continuous Pumping; and
- Alternative 4C-4 – In-Situ and Enhanced Agricultural Treatment-Continuous Pumping.

This section evaluates these alternatives consistent with the criteria established in the FS/92-49 analysis. Remediation time frames for Alternative 4C variations are provided relative to Alternative 4B from Addendum #2 because this was the last alternative presented to the Water Board and the basis for most of the 13 July 2011 Water Board FS comments. Additionally, the Water Board specified on 19 July 2011 that this addendum should provide a table comparing the attributes of all the Alternative 4 variants (4, 4A, 4B, and 4C) and that the detailed comparative analysis should be made to Alternative 4B (Tables 2 and 9). This convention is used throughout this discussion. The comparative analysis of the alternatives uses the February 2010 plume map presented in the FS/92-49 analysis. An analysis of the alternatives performance relative to the First Quarter 2011 plume is also provided. Table 4 identifies the remediation time frames and estimated costs for each alternative. A contingency plan for maintaining year-round hydraulic capture for cases when irrigation is not feasible for an extended period of time is included in Appendix H.

5.1 In-Situ and Enhanced Agricultural Treatment-1 Crop (Alternative 4C-1)

<u>Conceptual Approach</u>

As discussed in meetings with the Water Board on 29 June and 19 July 2011 regarding the final remedy, additional adjustments to IRZ and AU treatment areas were made and modeled to further enhance Alternative 4B. The goals of the enhancements were to:

- Optimize and increase extraction related to plume capture;
- Mitigate migration to the east;
- Reduce the incidence of untreated areas in the IRZ area;
- Reduce the formation of Mn as a byproduct of in-situ reduction; and
- Attempt to further reduce the overall remediation time frame.

When compared to Alternative 4B, Alternative 4C-1 adds significant remediation effort and infrastructure and relies on additional optimization that refocuses the remediation effort on the more "recalcitrant" areas of the chromium plume. The goal of increasing the annualized extraction rate is to create stronger inward gradients and thus a more extensive hydraulic capture zone. Plume capture performance is discussed further in Section 5.5.

Implementation Details

Alternative 4C-1 adds additional extraction wells and AUs in OU1 and OU2 and has planned optimizations at 5, 10, and 20 years after the initial build-out. Table 5 describes the major components of Alternative 4C-1 infrastructure and optimizations. Refer to Figures 5A and 5B for the conceptual well layout for each optimization period.

When compared to Alternative 4B, the initial build-out of Alternative 4C-1 adds four new AU pivots to accommodate additional extraction including:

- One Northwest pivot located near the OU1/OU2 boundary just south of the Desert View Dairy (DVD) Land Treatment Unit (LTU);
- Two pivots located in the central area of the plume on or near the former Bell property; and
- One pivot located in the southern portion of the South Central Reinjection Area (SCRIA), south east of the Bell pivots but north of the Source Area.

In addition to treating additional extraction flow, the Bell and south SCRIA pivots reduce migration of byproduct formation in the SCRIA and Central IRZ areas. Each pivot is approximately 30 acres (~31 acres of irrigated area in the pivot circumscribed inside a 40-ac square parcel) and will be designed to use drag-drip irrigation.

Relative to Alternative 4B, the initial build-out of Alternative 4C-1 also adds 18 new extraction wells including:

- Three new extraction wells located near the toe of the plume to create larger inward gradients (water applied to the DVD LTU and the Cottrell AU);
- Three new extraction wells located south of the DVD to prevent further impacts above 50 μg/L in OU2 (water applied to the Ranch and Northwest recharge AUs);
- Six new extraction wells located in the Central Area to reduce the incidence of untreated chromium contaminated areas (striping; water applied to the Bell AUs); and
- Six new SCRIA extraction wells located in the injection area to prevent eastern plume movement and promote better recirculation in the SCRIA (water applied to the south SCRIA AU).

The total AU extraction at initial build-out for Alternative 4C-1 is 1,830 gallons per minute ([gpm]; annualized).

Below is a list of the major components of Alternative 4C-1, with optimizations over time noted for each remediation component. The optimizations noted here were developed based on a series of groundwater modeling runs, in an effort to predict the adaptive management changes that will be made in the future. The goal of the adaptive management process and these modeled optimizations is to continually focus the remediation efforts on the areas of the plume that are the slowest to clean up. Refer to Figures 5A and 5B for the conceptual well layout for each optimization period.

- Agricultural Units – groundwater extraction and treatment via nine agricultural pivots and the DVD LTU
  - Year 5 Optimization: no change.
  - Year 10 Optimization: install 12 new extraction wells in OU2 to target lingering mass (no change from Alternative 4B). These 12 new extraction wells will shift the extraction point of 100 gpm of withdrawal for application on AUs located in the distal portion of the plume (Cottrell and Yang). The 12 new extraction wells will be located in areas of the plume toe recalcitrant to cleanup (based on modeling). The total annualized extraction rate of 1,830 gpm does not change during this optimization.
  - Year 20 Optimization: northern extraction reallocated to target lingering concentrations; Bell pivots and extraction may be turned off if concentrations in the plume core achieve background.
- Central Area IRZ – groundwater extraction, amendment with carbon and reinjection (140 gpm; no change from Alternative 4B)
  - Year 5 Optimization – no change.
  - Year 10 Optimization – no change.
  - Year 20 Optimization – Central Area recirculation may be turned off if concentrations in the plume core achieve background.
- SCRIA IRZ – Water from current SCRIA extraction north of Highway 58 (110 gpm) will be diverted to the Northwest Recharge Pivot instead of the SCRIA injection area. New extraction wells will be located in the southern SCRIA to provide 110 gpm for dosed injection (to accelerate insitu treatment) as well as 150 gpm for the south SCRIA pivot (to enchance containment and treatment via extraction). An additional 85 gpm is extracted east of the SCRIA injection area, dosed, and applied to SCRIA Injection (no change from Alternative 4B). The total SCRIA injection equals 195 gpm (no change in total flow from Alternative 4B).
  - Year 5 Optimization: a portion of the dosed water from the SCRIA is redirected to the Source Area IRZ to target remaining plume mass.
  - Year 10 Optimization: three new extraction wells are added for an additional 60 gpm (no change from Alternative 4B). One new injection well is added to the SCRIA. The new total reinjection is 255 gpm split between SCRIA injection and Source Area IRZ to target remaining plume mass.
  - Year 20 Optimization: IRZ applications are modified from continuous to intermittent (e.g., 4 months per year) application of 170 gpm low concentration carbon-amended water to select SCRIA injection and Source Area injection wells.
- Source Area IRZ – extracts, amends with carbon, and reinjects 150 gpm. Over time, optimization/modification of the initial system configuration of Alternative 4B would include shutting down or converting extraction wells to injection points for certain IRZ recirculation zones in the Source Area, Central Area, and/or plume core as the areas respond to treatment as shown on Figure 5A.
  - Year 5 Optimization: select Source Area extraction wells are converted to injection wells (six wells).

  - Year 10 Optimization: two new injection wells are installed in the Source Area. The new total reinjection is 255 gpm split between SCRIA injection and Source Area injection. The southern Source Area injection wells may be shut off if concentrations in the plume core achieve background.
  - Year 20 Optimization: IRZ applications are modified from continuous to intermittent (e.g., 4 months per year) application of 170 gpm low concentration carbon-amended water to select SCRIA injection and Source Area injection wells.
- Northwest injection of up to 80 gpm remains in place until plume containment is no longer required.

Estimated Time Frame and Cost to Reach Background Concentrations

When compared to Alternative 4B, the modeling results indicate Alternative 4C-1 provides no apparent improvement in terms of estimated time to reach background levels of chromium in groundwater. The modeling results also suggest that further reductions in cleanup time frame need to focus on increasing average annual extraction rates by increasing winter pumping. Although Alternative 4C-1 increases the cost by nearly $39 million ($148 million total) relative to Alternative 4B, the duration remains at 40 years, the same as Alternative 4B. Table 4 is a summary of the anticipated time and cost to meet potential remedial milestones for Alternative 4B and the alternatives considered in this Addendum #3. Figure 6 summarizes the operating periods of the active remediation components (AUs and IRZs) and the estimated time frames to reach the background remedial goals for the alternatives evaluated in this Addendum #3. Appendix B includes the groundwater modeling particle tracks for Alternative 4C-1. Appendix C includes the output of the predictive modeling for Alternative 4C-1. Appendix E includes a detailed evaluation of costs for Alternative 4C-1.

5.2 In-Situ and Enhanced Agricultural Treatment- 2 Crops (Alternative 4C-2)

Conceptual Approach

Alternative 4C-2 was developed to maintain year-round extraction/hydraulic gradients and AU utilization. The key difference in this alternative is that it adds the use of winter crops (winter rye or similar crop) to most of the existing and new AUs proposed under Alternative 4C-1. Alternative 4C-2 uses the same existing infrastructure and optimization as Alternative 4C-1, but includes increased extraction during the winter months. In contrast, Alternatives 4B and 4C-1 allow the AUs to largely go dormant during the winter months. The addition of winter crops significantly increases winter extraction flow rates. Alternative 4C-2 significantly increases the annualized flow rate by over 1 million gallons per day (gpd) relative to Alternative 4B and increases the flow rate by over 300,000 gpd on an annual basis as compared to Alternative 4C-1 (2.9 million gpd total annualized AU extraction in Alternative 4C-2). The goal of increasing annualized flow rate and increasing the winter extraction rate is to create stronger inward gradients and thus a more extensive hydraulic capture zone. Plume capture performance is discussed further in Section 5.5

Implementation Details

Alternative 4C-2 adds the same infrastructure as Alternative 4C-1 but significantly increases the total flow due to the addition of winter pumping. The winter pumping will be applied to a hardy variety of winter oats or a similar crop such as winter rye. Table 6 describes the major components of Alternative 4C-2, including existing and new infrastructure, with optimizations planned at 5, 10, and 20 years after initial build-out. Refer to Figures 7A and 7B for the conceptual well layout for each optimization period.

Estimated Time Frame and Cost to Reach Background Concentrations

When compared to Alternative 4B, Alternative 4C-2 is a moderate improvement in terms of estimated time to reach background levels of chromium in groundwater (39 years versus 40 years for Alternative 4B). Table 4 is a summary of the anticipated time and cost to meet potential remedial milestones for Alternative 4B and the alternatives considered in this Addendum #3. The additional cost to implement Alternative 4C-2 over Alternative 4B is $41 million ($150 million total). Figures 6 and Table 10 summarize the operating periods of the active remediation components (AUs and IRZs) and the estimated time frames to reach the background remedial goals for the alternatives evaluated in this Addendum #3. Appendix C includes the output of the predictive modeling for Alternative 4C-2. Appendix E includes a detailed evaluation of costs for Alternative 4C-2.

5.3 In-Situ and Enhanced Agricultural Treatment and Winter Ex-Situ Treatment – Continuous Pumping (Alternative 4C-3)

In response to a specific request by the Water Board, Alternative 4C-3 was developed to evaluate the feasibility of maintaining fixed rate, year-round extraction rates. Since AUs have a reduced capacity to treat water on a per-acre basis in the winter months, the Water Board requested that additional water treatment capacity be added during the winter. To address this issue, Alternative 4C-3 adds temporary winter-only ex-situ water treatment.

Conceptual Approach

Alternative 4C-3 utilizes year-round continuous pumping and treats the excess winter water that cannot be treated by existing AUs with ex-situ treatment followed by reinjection. Alternative 4C-3 uses much of the same general infrastructure and optimization as Alternatives 4B, 4C-1, and 4C-2 but includes a significant amount of additional infrastructure for ex-situ treatment and reinjection during the winter months. In addition to Alternative 4C-1, the initial build-out of Alternative 4C-3 adds:

- Nine treated water injection wells south of the source area in OU1;
- Ten treated water injection wells north of the plume boundary in OU2;
- An extensive network of additional conveyance piping; and
- A winter ex-situ treatment system.

Chemical reduction/precipitation is the ex-situ treatment technology selected for this alternative because it is a common, effective, and proven method applied to Cr(VI) water treatment, was the most feasible treatment option in the FS/92-49 analysis, and is being used successfully at PG&E's Topock site. Appendix A, Section 1, discusses in detail the potential use of other treatment technologies such as ion exchange. Appendix A discusses the Site-specific advantages and disadvantages of other water treatment approaches and identifies the physical and operational conditions that may favor the use of a technology other than chemical reduction/precipitation. Although ion exchange is not currently considered a compatible replacement for chemical reduction/precipitation, a cost estimate for winter-water treatment using ion exchange is also provided for comparison purposes. If this alternative is selected, PG&E will further evaluate the water treatment option, including bench and pilot-scale studies to prove treatment performance. The goal of increasing the annualized and winter extraction rates is to create strong inward gradients for plume capture. Treated water reinjection, however has the potential to reduce the capture zone size. Plume capture performance is discussed further in Section 5.5

Implementation Details

Table 7 describes the major components of Alternative 4C-3. The major components include existing and new infrastructure, with optimizations over time. Refer to Figures 9A and 9B for the conceptual well layout for each optimization period.

Estimated Time Frame and Cost to Reach Background Concentrations

When compared to Alternative 4B, Alternative 4C-3 is a modest improvement in terms of estimated time to reach background levels of chromium in groundwater (36 years versus 40 years for Alternative 4B). This modest improvement comes at a significant increase in cost of $226 million ($335 million total) over Alternative 4B). In short, Alternative 4C-3 yields diminishing returns with respect to a shorter remediation duration for the very large incremental cost as shown on Figure 10.

Table 4 is a summary of the anticipated time and cost to meet potential remedial milestones for Alternative 4B and the alternatives considered in this Addendum #3. Figure 6 summarizes the operating periods of the active remediation components (AUs, IRZs, and ex-situ treatment) and the estimated time frames to reach the background remedial goals for the alternatives evaluated in this Addendum #3. Given the high groundwater extraction rates, groundwater modeling suggests that localized drawdown could potentially exceed 60 feet. As a result, these pumping rates may not be sustainable over the life-span of the alternative because partial dewatering of the aquifer is forecasted to occur in about three to five years. Appendix C includes the output of the predictive modeling for Alternative 4C-3. Appendix E includes a detailed evaluation of costs for Alternative 4C-3.

5.4 In-Situ Treatment and Enhanced Agricultural Treatment – Continuous Pumping (Alternative 4C-4)

Alternative 4C-4 was developed to evaluate the feasibility of maintaining fixed rate, continuous extraction without the need for and potential impacts from an ex-situ treatment plant. In Alternative 4C-4 this is accomplished through water application to additional winter-only AUs.

Conceptual Approach

Alternative 4C-4 not only adds winter crops like Alternatives 4C-2 and 4C-3, but also adds an appropriate number of winter-only AUs to accommodate the excess winter flow. Sixteen additional AUs are required to accommodate the fixed rate winter flow due to the fact that winter crops consume less water than summer crops. The goal of increasing annualized flow and winter extraction rates is to create stronger inward gradients and thus a more extensive hydraulic capture zone. Plume capture performance is discussed further in Section 5.5. Alternative 4C-4 uses much of the same general infrastructure and optimization as Alternatives 4B, 4C-1, and 4C-2, but includes a significant amount of additional infrastructure for the additional AUs. As compared to Alternative 4C-1, the initial build-out of Alternative 4C-4 adds:

- 16 additional AUs; and
- A network of additional conveyance piping.

Implementation Details

Table 8 describes the major components of Alternative 4C-4. The major components include existing and new infrastructure, with optimizations over time. Refer to Figures 11A and 11B for the conceptual well layout for each optimization period.

Estimated Time Frame and Cost to Reach Background Concentrations

When compared to Alternative 4B, Alternative 4C-4 is an improvement in terms of estimated time to reach background levels of chromium in groundwater (29 years versus 40 years for Alternative 4B). This improvement comes at a significant increase in cost of $84 million ($193 million total) over Alternative 4B). Similar to Alternative 4C-3, Alternative 4C-4 yields diminishing returns with respect to faster remediation for the very large incremental cost as shown on Figure 10.

Unlike Alternative 4C-3, this alternative does expand plume hydraulic control relative to Alternative 4B in the summer and winter (Figure 15). Groundwater modeling predicts that Alternative 4C-4 also results in significant drawdown of the water table (potentially over 60 feet of projected drawdown in localized areas) with 20 to 40 feet of drawdown forecasted as far east as Dixie Road to the east of the plume (reaching its maximum eastward extent below Acacia Street), and as far west as Hinkley Road to the west (reaching its maximum westward extent along Highway 58). The localized drawdown could potentially impact other water users in the Hinkley area. While plume capture would be very strong, groundwater modeling also suggests that these pumping rates may not be sustainable over the life-span of the alternative because partial dewatering of the aquifer is forecasted to occur in about three to five years. If selected, pumping rates would be adjusted to balance flow, plume capture, and drawdown.

Table 4 is a summary of the anticipated time and cost to meet potential remedial milestones for Alternative 4B and the alternatives considered in this Addendum #3. Figure 6 summarizes the operating periods of the active remediation components (AUs and IRZs) and the estimated time frames to reach the background remedial goals for the alternatives evaluated in this Addendum #3. Appendix E includes a detailed evaluation of costs for Alternative 4C-4. Appendix C includes the output of the predictive modeling for Alternative 4C-1.

5.5 Evaluation of Alternatives (Resolution 92-49 Criteria)

This section evaluates the four variations of the final remedy (Alternatives 4C-1, 4C-2, 4C-3, and 4C-4) relative to the requirements established in Resolution 92-49, Part III.C and the derived Site-wide ROs defined in Section 5 of the FS (Haley & Aldrich, 2010). A selected alternative is required to satisfy the following key criteria: effectiveness, feasibility (implementability), and cost. The effectiveness criterion evaluates each alternative relative to the following ROs:

- Achieve background concentrations;
- Restore groundwater beneficial use;
- Achieve plume containment; and
- Restore productive use of the groundwater resource.

This section discusses how the alternatives perform relative to these key FS evaluation criteria. It should be noted that the time frames to achieve the ROs were estimated using groundwater modeling, including fate and transport simulations of a complex hydrogeological system. While the actual cleanup durations may vary from the modeled results, the use of the same modeling assumptions for each alternative provides good results for a comparative analysis. Details of the modeling effort to evaluate these alternatives are included in Appendices B, C and G. A comparison of the Alternative 4 variations is presented in Table 9. The estimated cost and time frames for the alternatives considered are presented in Table 10.

5.5.1 Effectiveness

Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 apply similar combination of technologies as Alternative 4B of Addendum #2. However, each of these alternatives incrementally seeks to enhance the effectiveness of the final remedy as follows:

- Alternative 4C-1 – Builds off of Alternative 4B infrastructure and provides additional extraction wells and AUs at build-out and additional optimization;
- Alternative 4C-2 – Builds off of Alternative 4B infrastructure and provides additional extraction wells and AUs at build-out, additional optimization, and winter operations for year-round inward gradients and robust capture;
- Alternative 4C-3 – Builds off of Alternative 4B infrastructure and provides additional extraction wells at build-out, additional optimization, winter operations, and ex-situ treatment with additional injection wells in order to maintain a constant extraction flow year-round; and
- Alternative 4C-4 – Builds off of Alternative 4B infrastructure and provides additional extraction wells and significantly more AUs at build-out, additional optimization, winter operations, and constant extraction flow year-round.

The following is a discussion of how Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 perform relative to the four measures of effectiveness.

<u>Cleanup to Background Conditions for Chromium</u>

Each alternative considered in this Addendum #3, is capable of restoring the aquifer to background groundwater concentrations for Cr(VI) within 99 percent of the plume area within a reasonable amount of time (less than 50 years; Table 9). Although Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 extract increasing quantities of groundwater, they only reduce the cleanup time relative to Alternative 4B marginally. Results of the fate and transport modeling using the February 2010 plume indicate that:

- Although Alternative 4C-1 extracts over 800,000 gpd more on an annual basis than Alternative 4B at initial build-out and background levels of chromium are not achieved any sooner (40 years);
- Although Alternative 4C-2 extracts over 1.1 million gpd more on an annual basis than Alternative 4B at initial build-out and background levels of chromium are achieved only slightly sooner (39 years versus 40 years);
- Although Alternative 4C-3 extracts over 2.2 million gpd more on an annual basis than Alternative 4B at initial build-out and background levels of chromium are achieved only slighter sooner (36 years versus 40 years); and
- Alternative 4C-4 extracts over 2.2 million gpd more on an annual basis than Alternative 4B at initial build-out and and background levels of chromium are achieved sooner (29 years versus 40 years).

<u>Restore Beneficial Use</u>

Like Alternative 4B, Alternatives 4C-1, 4C-2, and 4C-4 combine AUs and IRZs, while 4C-3 combines AUs, IRZs, and ex-situ treatment to contain the plume, reduce Cr(VI) concentrations/mass, and reduce the Cr(VI) footprint. Aggressive IRZ treatment in the plume core (OU1) reduces Cr(VI) mass, which helps achieve the chromium MCL remedial objective and restore beneficial use as quickly as possible. Taking into account the assumptions required for the modeling simulations, the fate and transport model predicts that all of the alternatives will achieve the MCL in approximately 10 years. Specific modeling results of the February 2010 plume predict the MCL will be achieved in roughly the same time for each alternative as follows:

- Alternative 4B is estimated to achieve the MCL in approximately 6 years;
- Alternative 4C-1 is estimated to achieve the MCL in approximately 6 years;
- Alternative 4C-2 is estimated to achieve the MCL in approximately 5.5 years;
- Alternative 4C-3 is estimated to achieve the MCL in approximately 4 years; and
- Alternative 4C-4 is estimated to achieve the MCL in approximately 3 years.

Similar results were achieved using the First Quarter 2011 plume (Figure 3A).

Figure 16 summarizes the operating periods of the active remediation components (AUs, IRZs, and/or ex-situ treatment) and the estimated time frames to reach the background remedial goals for all of the alternatives evaluated in the FS and addenda. Note that similar to Alternative 4B, use of IRZ treatment within the plume core/OU1 for Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 will result in the localized formation of Mn as well as the potential for dissolved iron and/or arsenic byproducts. Byproduct concentrations may at times exceed drinking water standards but are not expected to persist in the aquifer. Experience at the Site also suggests that any exceedances that are not short-lived can be readily mitigated. The alternatives discussed in this Addendum #3 should reduce the overall byproduct formation as compared to Alternative 4B by optimizing IRZ treatment in the plume core (OU1) and performing additional groundwater extraction and AU treatment.

Chromium Plume Containment

Plume containment is largely a function of maintaining adequate hydraulic capture at the leading edge of the plume. The extent of hydraulic capture (or capture zone) can be defined as "the region that contributes the ground water extracted by the extraction well(s). It is a function of the drawdown due to pumping and the background (i.e., without remedy pumping) hydraulic gradient" (USEPA, 2008). The drawdown due to pumping is, in turn, a function of the aquifer characteristics, natural and artificial recharge sources, the well-field extraction flow rate, and the location and number of extraction wells. The extent of hydraulic capture is typically based on groundwater elevation contours and analysis of gradients and can be supplemented by groundwater modeling and evaluation of concentration trends over time.

Given that maintaining a strong capture zone is a critical factor in preventing the spread of groundwater impacts, PG&E, under the direction of the Water Board, has evaluated the extent of hydraulic control and plume capture for Alternative 4B (Addendum #2) and all variations of Alternative 4C. The results of this capture zone evaluation for the FS plume (February 2010) as well as the First Quarter 2011 plume are summarized in the table below. The table also provides a comparative summary of the capture zone of each alternative relative to Alternative 4B. Details of the hydraulic capture zone modeling are presented in Appendix B and the results of the modeling are summarized the following text.

Table 11- Alternative Plume Capture Zone Comparison

Alternative	4B	4C-1	4C-2	4C-3	4C-4
Achieves Summer/Winter Plume Capture-FS Plume	Yes	Yes	Yes	Yes	Yes
Achieves Summer/Winter Plume Capture-First Quarter 2011 Plume	Yes	Yes	Yes	Yes	Yes
Comparative Plume Capture to Alternative 4B (FS-Plume)	Not Applicable	Greater than 4B	Greater than 4B & 4C-1	Uncertain, depends upon reinjection location*	Greater than 4B, 4C-1, 4C-2 & 4C-3*

*Note: Aquifer dewatering may occur within 5 years

Alternative 4B Plume Containment – Modeling results discussed in Addendum #2 indicate that Alternative 4B establishes hydraulic control over the plume boundaries and is anticipated to effectively contain the plume as defined by the February 2010 sampling results. In order to address Water Board concerns with respect to year-round capture, Alternative 4B was re-evaluated for both summer and winter capture zones. In other words, modeled groundwater elevations and gradients were considered for the winter months when the total extraction throughout the Site is lower. Lastly, and for reasons discussed earlier in Section 2, PG&E also evaluated the Alternative 4B hydraulic capture relative to the First Quarter 2011 plume interpretation. This evaluation is summarized in the above table and illustrated in Figure 8.

Alternative 4C-1 Plume Containment – Like Alternative 4B, Alternative 4C-1 allows AUs and their associated groundwater extraction to go dormant during the winter months, thus lowering the total groundwater extraction in the winter. However, Alternative 4C-1 increases the overall hydraulic gradients and the extent of hydraulic control over Alternative 4B by adding six extraction wells in OU2 and 12 extraction wells to OU1. Under this alternative, extraction is increased by over 800,000 gpd on an annual basis relative to Alternative 4B. This evaluation is illustrated on Figure 12.

Alternative 4C-2 Plume Containment – Alternative 4C-2 increases hydraulic capture further by employing a dual crop approach that includes winter oats and allows for AU-related groundwater extraction during the winter. Under Alternative 4C-2, groundwater extraction for AU application continues year-round, effectively increasing the total amount of groundwater extraction by 1.1 million gpd on an annual basis relative to Alternative 4B. This evaluation is summarized in the above table and illustrated on Figure 13. Implementation of Alternative 4C-2 would result in:

- Hydraulic capture of the FS plume boundary for both winter and summer pumping scenarios;
- Hydraulic capture of the First Quarter 2011 plume boundary for summer and winter;
- An increase in the extent of hydraulic capture as compared to Alternative 4B (see Figure 13); and
- An increase in the extent of hydraulic capture as compared to Alternative 4C-1.

Alternative 4C-3 Plume Containment – Alternative 4C-3 includes winter crops in select AUs as well as year-round, fixed rate extraction. Water that cannot be delivered to winter crops is treated via ex-situ treatment as discussed in Section 5.3 and injected immediately upgradient of the source area and immediately downgradient of the toe of the plume. Although Alternative 4C-3 is similar to Alternative 4B in terms of hydraulic control in the summer, the extent of hydraulic control in the winter is smaller than Alternative 4B (Figure 14). This is due to the reinjection of ex-situ treated water during winter operations. Under Alternative 4C-3, groundwater reinjection effectively counteracts an equivalent volume of groundwater extraction on a Site-wide scale, resulting in a smaller winter zone of hydraulic capture than Alternative 4B. Stated differently, under this alternative the extraction wells need not "reach" as far (extent of hydraulic capture) due to the nearby recharge source (winter reinjection). Additional optimization of the water reinjection network may be able to mitigate some if not most of this capture zone reduction. Alternative 4C-3 may also result in localized aquifer drawdown exceeding 60 feet and in some cases aquifer dewatering within five years. This poses design and implementation challenges that would need to be accounted for. It should be noted that while the reinjection results in a smaller capture zone, it is not without certain advantages, including stronger inward gradients, forming a hydraulic barrier at the toe of the plume, and reducing drawdown north of the plume boundary. This evaluation summarized in the above table (Table 11) and illustrated on Figure 14.

Alternative 4C-4 Plume Containment – Alternative 4C-4 was developed to maintain fixed rate, year-round extraction, and AU utilization without the need for an ex-situ treatment plant. Alternative 4C-4 does increase the extent of hydraulic control relative to Alternative 4B in the summer and winter and creates the largest capture zones forecasted for any other alternative. The larger average year-round pumping rates (and associated larger capture zone) of Alternative 4C-4 result in greater drawdown of the water table over a broader area compared to other alternatives. Modeling predicts up to 55 feet of drawdown will occur at the toe of the plume (Figure 15). The plume capture evaluation is summarized in the above table and illustrated on Figure 15. As noted above, Alternative 4C-4 could also result in localized aquifer drawdown exceeding 60 feet and in some cases aquifer dewatering within five years. This poses design and implementation challenges that would need to be accounted for.

In summary, the results of the hydraulic modeling indicate that Alternatives 4C-1, 4C-2, and 4C-4 incrementally increase the extent of hydraulic control relative to Alternative 4B through higher groundwater extraction rates effectively capturing the FS, First Quarter 2011 plume boundary. Alternative 4C-3 increases the amount of extraction but does not show as significant an improvement in the overall extent of hydraulic plume capture due to less drawdown as a result of groundwater reinjection. Optimization of the reinjection areas may be able to improve overall plume capture if this alternative is selected.

Productive Use of Groundwater Resource:

Alternatives 4B, 4C-1, 4C-2, 4C-3, and 4C-4 all use aggressive IRZ combined with plume containment and agricultural application. The emphasis under this criterion is to select an alternative that includes a water treatment method that makes the most current productive use of the resource, which in this case is agricultural application and fodder crop production. The agricultural application is also beneficial to water supply in the basin because it uses an already marginal or unusable resource (groundwater impacted by nitrate/TDS) for crop production, replacing the need for local farmers to import water for the same fodder crop. Alternatives 4C-2, 4C-3, and 4C-4 involve both summer and winter crops, and represent further improvements in productive groundwater use over Alternative 4B and 4C-1.

5.5.2 Implementability

Implementability is defined by how readily constructed and technically feasible the alternative is, considering Site-specific factors that may affect constructability, the technical complexity of the alternative, administrative feasibility (e.g., availability of property, permitting), availability of services and materials to implement the alternative, and other relevant considerations. With the exception of Alternative 4C-3, which includes the deployment of an ex-situ treatment plant, all of the alternatives recommended in this Addendum #3 are reasonably easy to implement because they use technologies and some infrastructure already being successfully used at the Site. The following sections provide a brief comparison of the implementability of the 4C alternatives.

Alternative 4B

Alternative 4B proposed in Addendum #2 is moderately easy to implement, as it consists of the aggressive use of technologies that are already being used successfully at the Site. These include IRZ treatment in OU1 and AU treatment within OU2. Alternative 4B is the basis of comparison for the 4C alternatives in this Addendum #3.

Alternative 4C-1

Alternative 4C-1 is moderately easy to implement compared to Alternative 4B and significantly increases groundwater extraction rates with the addition of:

- Six extraction wells for OU2;
- Twelve Extraction wells for OU1;
- Four AUs; and
- Infrastructure to operate the wells, AUs, and IRZ areas.

Most of the additional wells, AUs, and infrastructure are consistent with systems already in use. Land access should not be an issue as the proposed systems are generally planned to be installed on PG&E-owned property.

Alternative 4C-2

Alternative 4C-2 increases pumping rates and adds a winter crop to the AUs proposed in Alternative 4C-1. Because Alternative 4C-2 uses the same infrastructure proposed in Alternative 4C-1, implementation is no more difficult than Alternative 4C-1, with the exception of summer/winter crop rotation.

Alternative 4C-3

Alternative 4C-3 increases pumping rates, maintains year-round continuous pumping rates, treats water with AUs including winter crops, and adds an ex-situ water treatment system to treat excess winter flow the AUs cannot treat. Alternative 4C-3 will be difficult to implement because it includes all of the components and infrastructure required for 4C-1 plus the entirely separate infrastructure required for the winter operation of an ex-situ treatment plant which would include:

- Nine treated water injection wells south of the Source Area in OU1;
- Ten treated water injection wells north of the plume boundary in OU2;
- An extensive network of additional conveyance piping; and
- Two winter-only ex-situ treatment systems (north and south) that would include treatment system buildings, chemical reagent tanks, a sludge/waste management storage facility/area, and a trucking facility to receive supplies and dispatch treatment system waste products.

Alternative 4C-3 involves the construction of an additional extensive piping network to collect extracted groundwater, deliver it to an ex-situ treatment plant, and distribute treated water to an injection well network located at the two extreme ends of the plume. The construction of this piping network will have to cross several major public streets and at least one major highway, as well as several properties not currently owned by PG&E. This alternative also necessitates operation of the ex-situ treatment systems that will require far more intensive and complicated operation and maintenance compared to the other alternatives (e.g., system adjustments, material delivery coordination, equipment maintenance, well rehabilitation, and waste management).

<u>Alternative 4C-4</u>

Alternative 4C-4 increases pumping rates, maintains year-round continuous pumping rates, and treats water exclusively with AUs including winter crops. The excess winter flow with this option is treated through the addition of winter-only AUs. Alternative 4C-4 will be difficult to implement because it includes all of the components and infrastructure required for 4C-1 plus:

- Sixteen winter-only AUs;
- An extensive additional piping network; and
- Additional land acquisition for the AUs where PG&E does not already own the land.

Similar to Alternative 4B, Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 are anticipated to consist of a modification to the General Permit. A modification/simplification of the agricultural treatment permit process, as well as a modification of the monitoring program consistent with the other agricultural application processes is critical to implementing any of these alternatives.

5.5.3 Costs

Consistent with the FS and Addenda #1 and #2, the development of representative costs for the alternatives utilized the USEPA guidance for preparing feasibility studies (USEPA 2000). Costing methods presented herein are consistent with the FS (Haley & Aldrich, 2010), and its supplemental data submittal (PG&E, 2010), and Addendum #1 and #2 (PG&E 2011a and 2011b). To provide a means of cost comparison of the alternatives in this addendum to the FS and Addendum #1 and #2, the remediation durations of the alternatives were derived from modeling simulations using the February 2010 plume map. This approach was approved by the Water Board in a meeting on 19 July 2011.

Two life-cycle costs are provided for each alternative, one that is "discounted" to account for inflation and interest (as "net present value" [NPV]) and one that is "non-discounted." Quantities and unit costs were selected based on contractor experience at the Hinkley Site and at other sites with similar impacts and subsurface conditions. Primary assumptions or considerations taken into account in the preparation of the alternative costs include:

- Costs were based on 2010/2011 values;
- For the NPV costing scenario, future capital and operation and maintenance costs were adjusted using a discount value of 3.17 percent, which accounts for inflation;
- The non-discounted costing scenario assumes all costs are in today's dollars;
- A 20 percent contingency was used on capital costs and a contingency of 10 percent was used on operation and maintenance costs, based on engineering judgment; and

- Remedy durations to meet the key remedial objectives for each alternative were estimated through the use of fate and transport modeling simulations and based on the time when the starting plume area for the respective concentration value (e.g., 50 μg/L, 3.1 μg/L, and 1.2 μg/L) were reduced by 99 percent in Model Layers 1 and 3. The February 2010 plume boundary was used for the modeling simulations.

Based on these assumptions, the presented costs have an approximate expected accuracy range of minus 30 percent to plus 50 percent. Table 10 summarizes the estimated time frame to reach the 50 μg/L chromium MCL, 80 percent mass removal, and background, as well as the non-discounted and discounted NPV cost estimate to reach background for Alternative 4B in addition to each of the alternatives presented in the FS and Addendum #1. Table 10 provides cost and time frames for all alternative considered to date. In summary, the resultant estimated life cycle costs for Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 to achieve background are:

- Alternative 4C-1 - $148M (non-discounted) and $106M NPV (discounted);
- Alternative 4C-2 - $150M (non-discounted) and $108M NPV (discounted);
- Alternative 4C-3 - $335M (non-discounted) and $226M NPV (discounted); and
- Alternative 4C-4 - $193M (non-discounted) and $148M NPV (discounted).

Detailed cost estimates for Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 are included in Appendix E. Detailed cost estimates for alternatives provided in the FS and Addenda #1 and #2 are included in Appendix D.

6. RECOMMENDED REMEDIATION ALTERNATIVE

Based on the comparative evaluation of Alternatives 4C-1, 4C-2, 4C-3, and 4C-4 discussed above, Alternative 4C-2, In-Situ and Enhanced Agricultural Treatment -2 Crops, best meets the FS evaluation criteria. This section highlights the advantages of Alternative 4C-2 and its ability to address to address a larger plume.

6.1 Alternative 4C-2 Advantages

Alternative 4C-2 includes the following advantages:

- Robust, year-round plume containment. Alternative 4C-2 extracts significantly more groundwater than alternatives 4B and 4C-1 and includes a large increase in winter pumping rates. This pumping generates significant inward hydraulic gradients and year-round capture zones that are larger and more pronounced than the capture zones of Alternatives 4B, 4C-1, and 4C-3. These capture zones also extend beyond the limits of the February 2010, First Quarter 2011 plume.
- Restores beneficial use (reduces chromium levels below the MCL) in one of the shortest time frames (5.5 years). This estimated time frame is accomplished through aggressive in-situ treatment within OU1 combined with robust hydraulic gradients and multiple optimization steps.
- Achieves background Cr(VI) concentrations in 39 years, roughly similar to the most aggressive alternative (4C-4), which takes 29 years. This duration is accomplished through aggressive in-situ treatment of the source area in OU1 and high summer and winter groundwater extraction rates.
- Makes maximum productive use of groundwater during remediation by using the water for both summer and winter agricultural irrigation for fodder crop production.
- Can be implemented more easily than more aggressive Alternatives such as 4C-3 and 4C-4. This alternative uses systems such as AUs and IRZs that have been proven effective for chromium treatment. Further, the alternative uses some of the existing piping infrastructure, thus reducing implementation time and cost.
- Avoids secondary impacts related to treatment plants such as visual impacts, waste generation, noise and trucking of chemicals and sludge.
- Balances remedy cost with diminishing returns relative to cleanup time frame. Alternative 4C-2 has an estimated NPV cost of $108 million versus a NPV cost of $148 million for Alternative 4C-4, which provides approximately ten years of remediation duration reduction.

Table 12 provides a comparative evaluation summary of each of the FS screening criteria presented in Section 5.5.

This Addendum #3 evaluates variations on the preferred final remedy (Alternative 4) based on the plume configuration of February 2010 for consistency with the FS. The evaluation of the 4C alternatives also considers the ability of the recommended remedy to address the First Quarter 2011 plume as requested by the Water Board. As stated above, recommended Alternative 4C-2 also achieves robust year-round containment and expedited remediation of the First Quarter 2011 plume (Figure 3A).

6.2 Ability for Recommended Alternative to Address a Larger Plume

Assessment of the chromium plume is currently continuing and the new data is resulting in a different plume configuration than that represented by the February 2010 and First Quarter 2011 plumes. This new composite plume map is illustrated in Figure 3B. This plume map will continue to be updated as the assessment program is completed and stable data trends are established for each of the new monitoring wells. In an effort to keep the final remedy selection process moving forward while assessment is continuing, the Water Board requested that PG&E provide a qualitative assessment of the ability of the recommended alternative (Alternative 4C-2) to address a potentially larger plume configuration with respect to effectiveness, implementability, and cost.

The FS and addenda have clearly demonstrated that a combination of in-situ treatment coupled with plume remediation using agricultural treatment is the most effective method to restore the aquifer to beneficial use. Including this Addendum #3, 36 technologies have been screened and thorough evaluations have been performed on 12 alternatives, seven of which involved in-situ and agricultural treatment. This exhaustive evaluation indicates that In-situ and Enhanced Agricultural Treatment - 2 Crop (Alternative 4C-2) effectively restores beneficial use (MCL) in less than 10 years, achieves background conditions in 99 percent of the plume area in less than 40 years, will contain the plume, and is reasonably implementable and cost-effective. Given the possibility of a larger plume boundary, the following qualitative statements can be made regarding the feasibility of Alternative 4C-2 to remedy a larger plume (Figure 3B):

- Effectiveness: Expansion of the Cr(VI) plume would likely be at concentrations of less than 10 μg/L. For areas that contain Cr(VI) concentrations around 10 μg/L, groundwater extraction coupled with AU treatment is a proven technology and is the most effective remedy. This approach provides both required hydraulic control as well as reliable and proven treatment.
- Implementability: Implementation becomes more difficult as the plume size increases; however, plume growth to the north would be under land generally used the same as land above the existing plume (agriculture and sparse residential structures). This area also has the potential for elevated nitrate and TDS concentrations from historical agriculture operations. AU treatment is the only method that can tolerate and even remove nitrate concentrations, a benefit for the local groundwater basin. Access for extraction wells could be on PG&E-owned land, private property via access agreement, or in public right-of-ways. The extracted water would either be conveyed via pipeline to existing or new AUs within OU2 or new AUs could be constructed within OU3, if appropriate.
- Cost: Any larger plume would likely be in the low concentration range, and as a result, would primarily require pumping with AU treatment. The cost evaluations prepared to date are largely scalable as a function of plume size and volume of water treated and the feasibility relationship between alternatives not likely to change. Using this assumption, Alternative 4C-2 is still likely to be the most cost effective technology that also provides year-round hydraulic capture and expedited site remediation.

Considering the feasibility conclusions related to the February 2010 and First Quarter 2011 plume configurations, and the consideration of a potentially larger plume such as that illustrated on Figure 3B, Alternative 4C-2 is the preferred alternative to achieve the remedial objectives.

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1. CH2MHILL, "Groundwater Background Study Report, Hinkley Compressor Station," February 2007.

2. Ch2MHILL, "Hinkley Remediation Project – Summary of Groundwater Background Study," 29 May 2010.

3. CH2MHILL, 2011a, "Second Quarter 2011 Groundwater Monitoring Report and Domestic Well Sampling Results, Pacific Gas & Electric Company, Hinkley Compressor Station, Hinkley, California," 29 July 2011.

4. CH2MHILL, 2011b, "Study of Background Chromium Concentrations in Groundwater, PG&E Hinkley Compressor Station, Hinkley, California," 17 August 2011.

5. Haley & Aldrich, Inc., "Feasibility Study, Pacific Gas and Electric Company, Hinkley Compressor Station. Hinkley, California," August 30 2010.

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8. Pacific Gas and Electric Company, "Hinkley Feasibility Study Supplemental Data Submittal, Estimated Timeframe and Costs to Achieve Drinking Water Standards, Maximum Background Concentration, and Average Background Concentration for Chromium," 14 October 2010.

9. Pacific Gas and Electric Company, 2011a, "Addendum #1 to the Feasibility Study, Pacific Gas and Electric Company Compressor Station, Hinkley, California," 31 January 2011.

10. Pacific Gas and Electric Company, 2011b, "Addendum #2 to the Feasibility Study, Pacific Gas and Electric Company Compressor Station, Hinkley, California," 3 March 2011.

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12. Stantec, "Upper Aquifer Report. Technical Report – Response to Investigation Order No. R6V-2011-0043 – Delineation of Chromium in the Upper Aquifer," 1 September 2011.

13. United States Environmental Protection Agency/Army Corps of Engineers, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002, OSWER 9355.0-75," July 2000.

14. United States Environmental Protection Agency (USEPA), "A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems—Final Project Report," January 2008.

TABLE 2
ALTERNATIVES 4, 4A, AND 4B COMPARISON TABLE
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Major Item	Alternative 4 (per FS)	Alternative 4A (Addendum #1)	Alternative 4B (Addendum #2)
Agricultural Units	840/950 gpm[Note 1,2]	1270 gpm	1270 gpm
Northwest Freshwater Injection	40 gpm	80 gpm	80 gpm
Far-field Carbon Amended Injection IRZ	195/0 gpm[Note 1,2]	195/195/255/170 gpm[Note 1]	195/195/255/170 gpm[Note 1]
Near-field Recirculation IRZ	275/0 gpm[Note 1,3]	290/140/140/0 gpm[Note 1,3]	290/140/140/0 gpm[Note 1,3]
Central Area	150/0 gpm[Note 1,3]	140/140/140/0 gpm[Note 1,3]	140/140/140/0 gpm[Note 1,3]
Source Area	125/0 gpm[Note 1,3]	150/0/0/0 gpm[Note 1,3]	150/0/0/0 gpm[Note 1,3]
Primary Differences Between Alternatives			
1. Central Area IRZ	Current horizontal length for the recirculation IRZ, with supplemental SCRIA injection points to the east	Increase the width by 100 percent over the current length, expanding to the east and west to intercept a greater portion of the plume	Increase the width by 100 percent over the current length, expanding to the east and west to intercept a greater portion of the plume ***No change compared to Alternative 4A***
2. Operation of IRZ Components (SCRIA, Source Area, and Central Area)	5 years	20 years (intermittent, low concentration carbon amendment continues beyond 20 years - see text for description)	20 years (intermittent, low concentration carbon amendment continues beyond 20 years in SCRIA Injection Area & Source Area) ***No change compared to Alternative 4A***
3. Plume Containment and Treatment via GW Extraction	950 gallons per minute (gpm) average annual withdrawal, 840 gpm of which is sent to AUs, and 110 gpm is sent to the SCRIA (while IRZ is in operation)	Increase the amount of withdrawal above Alternative 4 by 430 gpm (to a total of 1,380 gpm total). The increased withdrawal all goes to support AU expansion. After year 10, an additional 60 gpm is pumped and sent to the SCRIA.	Increase the amount of withdrawal above Alternative 4 by 430 gpm (to a total of 1,380 gpm total). The increased withdrawal all goes to support AU expansion. After year 10, an additional 60 gpm is pumped and sent to the SCRIA. ***After year 10, 2 of the original extraction wells to support the new AUs are shut down, and the same flow (total of 100 gpm) is extracted from 12 new extraction wells located in the plume toe (10 in the vicinity of the existing SCRIA and DVD AU extraction wells, and 2 in the vicinity of the Gorman AU extraction wells), and redirects this flow to the new AUs.***
4. Duration of GW Extraction	Until background concentrations are achieved	Until background concentrations are achieved	Until background concentrations are achieved ***No change compared to Alternative 4A***
Estimated Timeframe of Alternative to Reach:[Note 4]			
50 µg/L	6 years	6 years	6 years
80% mass removal	13 years	10 years	10 years
3.1 µg/L	150 years	75 years	***40 years***
1.2 µg/L	220 years	130 years	***95 years***

Notes:

1. Flows by each major item are separated by optimization using "/"; Alternative 4 has one optimization at 5 years; Alternative 4A and Alternative 4B have optimizations at 5, 10, and 20 years.
2. Under Alternative 4, 840 gpm is applied to Agricultural Units in initial buildout, then once IRZs are shut down at year 5, the flow from the SCRIA IRZ extraction is sent to the Agricultural Units for a total of 950 gpm applied to AUs.
3. Estimated IRZ recirculation flows (i.e., the water is both extracted and injected) are shown.
4. Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reducec by 99 percent in the Remedial Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility

TABLE 3
OPERABLE UNIT DEFINITIONS AND INTERIM REMEDIAL TARGETS
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OU No.	OU DEFINITION	INTERIM REMEDIAL TARGET (IRT)					
		Short Term (5 years)		Short Term (10 years)		Long Term (11+ years)	
		Interim Remedial Target	Metric(s)	Interim Remedial Target	Metric(s)	Interim Remedial Target	Metric(s)
OU1	**In-situ reduction and agricultural treatment area generally characterized by:** • Higher groundwater concentrations of Cr (IV) emanating from the source area • Extends from the source area in the south to the approximate northern extent of groundwater concentrations exceeding the MCL (50 µg/l) • Includes groundwater exceeding background concentration (3.1 µg/l) below its northern boundary • No Lower Aquifer impacts **Remediation emphasis on:** • In-situ Cr (VI) mass reduction to minimize potential further downgradient impacts • In-situ treatment will focus on accomplishing reaching the drinking water standard (50 µg/L) at the boundary of OU1 and OU2 • In-situ reduction by-products (Mn) will be generated and managed within the OU • Hydraulic control and inward gradients will be maintained as long as necessary to prevent Cr(VI) and by-product (Mn) migration • Agricultural treatment as appropriate to assist with inward hydraulic gradients **Compliance with Remedial Objectives (ROs) and Interim Remedial Targets (IRTs) will be based on the following:** • Plume containment and hydraulic control: o Documentable year-round inward hydraulic gradients, capture zones and favorable particle tracks o No significant outward growth of the west, east and south plume boundary (3.1 µg/L) o Maintain the Cr(VI) and by-product (Mn),concentrations within the OU1 northern boundary • Cr(VI) reduction: o Significant and consistent reduction of source-area Cr(VI) concentrations(>500 µg/L) o Consistent reduction of Cr(VI) concentrations(>50 µg/L) o Manageable production of by-products (Mn) o Maintain total chromium concentrations in soil below regulatory levels (USEPA Residential Preliminary Remediation Goals (PRG)) of 210 mg/Kg	Reduce significant Cr(VI) concentrations focusing on areas that could contribute to mass flux	Chromium MCL	Achieve chromium MCL in 95% of OU.	Chromium MCL	Achieve background concentration within the OU1 area	Cr(VI) = background
		Plume containment	Maintain year-round inward gradients & plume capture zone	Plume containment	Maintain year-round inward gradients & plume capture zone	Plume containment	Maintain year-round inward gradients & plume capture zone
		Productive use of groundwater resource	Ag Unit Operations	Productive use of groundwater resource	Ag Unit Operations	Productive use of groundwater resource	Ag Unit Operations Potable use related to Cr(VI) and in-situ byproducts
		Manage by-product formation to mitigate migration beyond OU1	In-Situ by-products below regulatory levels at OU1/OU2 boundary	Manage by-product formation to mitigate migration beyond OU1	In-Situ by-products below regulatory levels at OU1/OU2 boundary	Monitor and manage if necessary by-products	In-Situ by-products below regulatory levels within OU1

TABLE 3
OPERABLE UNIT DEFINITIONS, INTERIM REMEDIAL TARGETS
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

<table>
<tr><th rowspan="3">OU No.</th><th rowspan="3">OU DEFINITION</th><th colspan="6">INTERIM REMEDIAL TARGET (IRT)</th></tr>
<tr><th colspan="2">Short Term
(5 years)</th><th colspan="2">Short Term
(10 years)</th><th colspan="2">Long Term
(11+ years)</th></tr>
<tr><th>Interim Remedial Target</th><th>Metric(s)</th><th>Interim Remedial Target</th><th>Metric(s)</th><th>Interim Remedial Target</th><th>Metric(s)</th></tr>
<tr><td rowspan="3">OU2</td><td rowspan="3">Agricultural treatment area generally characterized by:
Lower concentrations, typically below the chromium MCL. Includes areas outside the plume boundary that are or may be utilized for agricultural unit operations.
Includes concentrations over background (3.1 µg/L) in the Lower Aquifer groundwater
Elevated nitrate and/or TDS concentrations are present in groundwater in the northern portion of OU2 as a result of non-PG&E historic farming and current dairy operations.
Extends from the northern boundary of OU1 to beyond the down-gradient edge of the plume as defined for this FS. This area is intended to be the primary focus of Agricultural Unit operations.
Includes dairy operations, residences and operable private drinking water wells
Remediation emphasis is on:
Groundwater extraction and treatment via agricultural units (AUs)
Chromium plume containment is accomplished through the maintenance of robust inward hydraulic gradients produced by numerous groundwater extraction wells as well as limited freshwater injection.
Minimization/elimination of water supply pumping in the Lower Aquifer to minimize further Cr(VI) impacts combined with aggressive pumping in the Upper Aquifer over the Lower Aquifer impacts to reverse downward gradients and remediate Cr(VI) impacts.
Compliance with Remedial Objectives (ROs) and Interim Remedial Targets (IRTs) will be based on the following:
Plume and hydraulic containment:
Documentable year-round inward hydraulic gradients to confirm modeled capture zones and favorable particle tracks
Long-term contraction of the plume boundary with no permanent short-term plume expansions.
Nitrate and TDS concentrations remain within predicted ranges
Cr(VI) reduction:
Consistent reduction of Cr(VI) concentrations to background.
Consistent reduction of Cr(VI) concentrations in Lower Aquifer to background (3.1 µg/L)
Monitor by-products and manage if necessary
Maintain total chromium concentrations in soil below regulatory levels (USEPA Residential Preliminary Remediation Goals (PRG)) of 210 mg/Kg.</td><td>Chromium removal to achieve MCL.</td><td>Chromium MCL</td><td>50% reduction in the 10 µg/L</td><td>Cr(VI) = background</td><td>Achieve background concentration within the OU2 area</td><td>Cr(VI) = background</td></tr>
<tr><td>Plume containment</td><td>Maintain year-round inward gradients & plume capture zone</td><td>Plume containment</td><td>Maintain year-round inward gradients & plume capture zone</td><td>Plume containment</td><td>Maintain year-round inward gradients & plume capture zone</td></tr>
<tr><td>Productive use of groundwater resource</td><td>Ag Unit Operations</td><td>Productive use of groundwater resource</td><td>Ag Unit Operations</td><td>Productive use of groundwater resource</td><td>Ag Unit Operations

Potable use related to Cr(VI) and in-situ byproducts</td></tr>
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TABLE 3
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PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

<table>
<tr><th rowspan="3">OU No.</th><th rowspan="3">OU DEFINITION</th><th colspan="6">INTERIM REMEDIAL TARGET (IRT)</th></tr>
<tr><th colspan="2">Short Term
(5 years)</th><th colspan="2">Short Term
(10 years)</th><th colspan="2">Long Term
(11+ years)</th></tr>
<tr><th>Interim Remedial Target</th><th>Metric(s)</th><th>Interim Remedial Target</th><th>Metric(s)</th><th>Interim Remedial Target</th><th>Metric(s)</th></tr>
<tr><td>OU3</td><td>Monitoring Area outside OU1 & OU2 generally characterized by:
• Cr (IV) concentrations below 10 µg/L with many locations below background (assessment is on-going)
• Localized TDS & nitrate concentrations as a result of non-PG&E historic agricultural operations
• Comprehensive groundwater monitoring
• Residences with private drinking water wells
• Perimeter boundary of OU3 defines the area to be evaluated during the Environmental Impact Report. The final EIR may result in an adjustment of the final OU3 boundary.

Compliance with Remedial Objectives (ROs) and Interim Remedial Targets (IRTs) will be based on the following:
• Monitoring/investigation to determine if future remedial actions beyond the scope of the FS/EIR are needed.
• Monitoring to ensure remedial operations within OU1 & OU2 do not adversely impact OU3 groundwater
• Potential use of Agricultural Units for treatment/use of extracted water to maintain plume gradients/capture</td><td>Reduce Cr(VI) concentrations above background</td><td>Cr(VI) = background</td><td>No sustained Cr(VI) concentrations above background</td><td>Cr(VI) = background</td><td>No sustained Cr(VI) concentrations above background</td><td>Cr(VI) = background</td></tr>
</table>

TABLE 4
ALTERNATIVE 4B, 4C-1, 4C-2, 4C-3 AND 4C-4 COST AND TIME FRAMES
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

		Alternative 4B	Alternative 4C-1	Alternative 4C-2	Alternative 4C-3	Alternative 4C-4
MCL Cr(T) 50 ug/L	Years[1]	6	6	6	4	3
	NPV Cost	$34.0M	$50.2M	$50.9M	$79.1M	$63.2M
Maximum Background Cr(VI) 3.1 ug/L	Years[1]	40	40	39	36	29
	NPV Cost	$75.9M	$106M	$108M	$226M	$148M
Average Background Cr(VI) 1.2 ug/L	Years[1]	95	95	90	85	75
	NPV Cost	$84.9M	$116M	$118M	$276M	$173M

Notes:
[1]Durations based on fate and transport modeling performed by Arcadis and represent the time when the starting plume area has been reduced by 99 percent. The durations represent the longer of model layers 1 and 3.

TABLE 5
IMPLEMENTATION DETAILS FOR ALTERNATIVE 4C-1 – IN-SITU AND ENHANCED AGRICULTURAL TREATMENT – 1 CROP
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Alternative Components	**Optimization Periods[1]**			
	0-5 years	**5-10 years**	**10-20 years**	**20+**
Rationale for Optimization	***Initial Build-out***	▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***
Agricultural Units and AU Application	▪ 2 Gorman Pivots (275 gpm) ▪ 1 Cottrell Pivot (150 gpm) ▪ 1 Yang Pivot (150 gpm) ▪ 1 Ranch Pivot AU (150 gpm) ▪ 1 Northwest Recharge Pivot AU (135 gpm) ▪ 1 South SCRIA Pivot (150 gpm) ▪ 2 Bell Pivots (300 gpm) ▪ DVD[2] (520 gpm) ▪ Total AU-related extraction[3] = 1,830 gpm	▪ No change from previous period	▪ Install 12 new extraction wells in the plume toe to support Cottrell and Yang AUs and shift extraction (+100 gpm) to target recalcitrant areas; net extraction remains the same ▪ Reduce extraction (-100 gpm) from select wells in areas where extraction is no longer beneficial; net extraction remains the same ▪ Total AU-related extraction = 1,830 gpm	▪ 2 Bell AU pivots and associated extraction wells are turned off (-300 gpm) ▪ Shift extraction within wells installed during year 10 optimization to target recalcitrant areas. As noted below, some of this additional flow is sent to the combined SCRIA and Source Area dosed injection system ▪ Total extraction = 1,530 gpm
Central Area IRZ	▪ Total recirculation = 140 gpm (same flow as Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ Central Area IRZ turned off
SCRIA IRZ	▪ SCRIA no longer receiving extracted water from north of Highway 58 as in Alt 4B ▪ New extraction wells located in the SCRIA provide 110 gpm for dosed injection as well as 150 gpm for the South Pivot as shown above ▪ Additional 85 gpm extracted east of SCRIA is dosed and injected (no change from Alt 4B) ▪ Total SCRIA dosed injection = 195 gpm (no change in total from Alt 4B)	▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection (no change from Alt 4B)	▪ 3 new extraction wells added north of Highway 58 for additional dosed injection shared by SCRIA and Source Area (no change from Alt 4B) ▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change from Alt 4B)	▪ Eastern SCRIA extraction wells turned off (no change from Alt 4B) ▪ Portion of flow (30 gpm) applied to combined SCRIA and Source area dosed injection system extracted from wells installed in the plume toe at year 10 ▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change from Alt 4B)
Source Area IRZ	▪ Source Area dosed injection = 150 gpm (no change from Alt 4B)	▪ All Source Area extraction wells converted to injection wells (no change from Alt 4B) ▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection (no change from Alt 4B)	▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change from Alt 4B)	▪ SCRIA dosed injection (170 gpm) being shared with Source Area for injection (no change from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L)
Northwest Injection	▪ 80 gpm clean water injection (no change from Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ No change from previous period

Notes:
[1]Only changes are shown for each consecutive period
[2] DVD is a land treatment unit (LTU) and is not considered an agricultural unit (AU) pivot.
[3] All flows are annualized

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TABLE 6
IMPLEMENTATION DETAILS FOR ALTERNATIVE 4C-2 – IN-SITU AND ENHANCED AGRICULTURAL TREATMENT – 2 CROPS
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Alternative Components	**Optimization Periods[1]**			
	0-5 years	**5-10 years**	**10-20 years**	**20+**
Rationale for Optimization	***Initial Build-out***	▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***
Agricultural Units and Estimated Application	▪ 2 Gorman AUs (324.5 gpm) ▪ 1 Cottrell AU (177 gpm) ▪ 1 Yang AU (177 gpm) ▪ 1 Ranch AU (177 gpm) ▪ 1 Northwest Recharge Pivot AU (135 gpm) ▪ 1 Southern SCRIA AU (177 gpm) ▪ 2 Bell AUs (354 gpm) ▪ DVD[2] (520 gpm) ▪ Total extraction[3] = 2,041.5 gpm ▪ Select AUs will be operated year-round, supporting a second crop in the winter time (6 months of the year)	▪ No change from previous period	▪ Install 12 new extraction wells in the plume toe to support Cottrell and Yang AUs and shift extraction (+118 gpm) to target recalcitrant areas; net extraction remains the same ▪ Reduce extraction (-118 gpm) from select wells in areas where extraction is no longer beneficial; net extraction remains the same ▪ Total AU-related extraction = 2,041.5 gpm	▪ 2 Bell AU pivots and associated extraction wells are turned off (-354 gpm) ▪ Shift extraction within wells installed during year 10 optimization to target recalcitrant areas. As noted below, some of this additional flow is sent to the combined SCRIA and Source Area dosed injection system ▪ Total extraction = 1,687.5 gpm
Central Area IRZ	▪ Total recirculation = 140 gpm (same flow as Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ Central Area IRZ turned off
SCRIA IRZ	▪ SCRIA no longer receiving extracted water from north of Highway 58 as in Alt 4B ▪ New extraction wells located in the SCRIA provide 110 gpm for dosed injection as well as 150 gpm for the South SCRIA Pivot as shown above ▪ Additional 85 gpm extracted east of SCRIA is dosed and injected (no change from Alt 4B) ▪ Total SCRIA dosed injection = 195 gpm (no change in total from Alt 4B)	▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection (no change from Alt 4B)	▪ 3 new extraction wells added north of Highway 58 for additional dosed injection shared by SCRIA and Source Area (no change from Alt 4B) ▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change from Alt 4B)	▪ Eastern SCRIA extraction wells turned off (no change from Alt 4B) ▪ Portion of flow (30 gpm) applied to combined SCRIA and Source area dosed injection system extracted from wells installed in the plume toe at year 10 ▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change from Alt 4B)
Source Area IRZ	▪ Source Area dosed injection = 150 gpm (no change from Alt 4B)	▪ All source Area extraction wells converted to dosed injection wells (no change from Alt 4B) ▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection (no change from Alt 4B)	▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change from Alt 4B)	▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change from Alt 4B)
Northwest Injection	▪ 80 gpm clean water injection (no change from Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ No change from previous period

Notes:
[1]Only changes are shown for each consecutive period
[2] DVD is a land treatment unit (LTU) and is not considered an agricultural unit (AU) pivot
[3] All flows are annualized

TABLE 7
IMPLEMENTATION DETAILS FOR ALTERNATIVE 4C-3 – IN-SITU AND ENHANCED AGRICULTURAL TREATMENT AND WINTER EX-SITU TREATMENT – CONTINUOUS PUMPING
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Alternative Components	Optimization Periods[1]			
	0-5 years	**5-10 years**	**10-20 years**	**20+**
Rationale for Optimization	***Initial Build-out***	▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***
Agricultural Units and Estimated Application	▪ 2 Gorman AUs (324.5 gpm) ▪ 1 Cottrell AU (177 gpm) ▪ 1 Yang AU (177 gpm) ▪ 1 Ranch AU (177 gpm) ▪ 1 Northwest Recharge Pivot AU (135 gpm) ▪ 1 South SCRIA AU (177 gpm) ▪ 2 Bell AUs (354 gpm) ▪ DVD[2] (520 gpm) ▪ Total extraction[3] = 2,829 gpm with 787.5 gpm excess extracted that will be treated ex-situ as listed below ▪ Select AUs will be operated year-round, supporting a second crop in the winter time (6 months of the year)	▪ No change from previous period	▪ Install 12 new extraction wells in the plume toe to target recalcitrant areas; water will support existing AUs or be treated ex-situ; net extraction remains the same ▪ Total extraction = 2,829 gpm	▪ 2 Bell AU pivots and associated extraction wells are turned off (-354 gpm applied to AUs; -504 gpm total extracted) ▪ Shift extraction within wells installed during year 10 optimization to target recalcitrant areas. As noted below, some of this additional flow is sent to the combined SCRIA and Source Area dosed injection system ▪ Total extraction = 2,325 gpm with 637.5 gpm excess extracted and treated ex-situ
Central Area IRZ	▪ Total recirculation = 140 gpm (same flow as Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ Central Area IRZ turned off
SCRIA IRZ	▪ SCRIA no longer receiving extracted water from north of Highway 58 as in Alt 4B ▪ New extraction wells located in the SCRIA provide 110 gpm for dosed injection as well as 150 gpm for the South Pivot as shown above ▪ Additional 85 gpm extracted east of SCRIA is dosed and injected (no change from Alt 4B) ▪ Total SCRIA dosed injection = 195 gpm (no change in total from Alt 4B)	▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection	▪ 3 new extraction wells added north of Highway 58 for additional dosed injection shared by SCRIA and Source Area (no change from Alt 4B) ▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change from Alt 4B)	▪ Eastern SCRIA extraction wells turned off ▪ Portion of flow (30 gpm) applied to combined SCRIA and Source area dosed injection system extracted from wells installed in the plume toe at year 10 ▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change from Alt 4B)
Source Area IRZ	▪ Source Area dosed injection = 150 gpm (no change from Alt 4B)	▪ All source Area extraction wells converted to injection wells ▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection	▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection	▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change from Alt 4B)
Northwest Injection	▪ 80 gpm clean water injection (no change from Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ No change from previous period
Ex-situ Treatment	▪ Ex-situ treatment system will be designed to treat excess flow over Alt 4C-2 (787.5 gpm annualized average; 1,658 gpm seasonal maximum) ▪ Chemical reduction / precipitation ex-situ treatment treats excess winter flow that is not supported by the AUs. Cost estimates assume two plants (one that treats approximately 1,200 gpm* derived generally north of Hwy 58 and second plant that treats approximately 450 gpm* derived generally south of Hwy 58). Note: * not annualized	▪ No change from previous period	▪ No change from previous period	▪ Reduction in target flow treated (637.5 gpm annualized average; 1,357 gpm seasonal maximum) ▪ Ex-situ plant treatment flow south of Hwy 58 is reduced to 150 gpm (not annualized) for this period.

Notes:
[1]Only changes are shown for each consecutive period
[2] DVD is a land treatment unit (LTU) and is not considered an agricultural unit (AU) pivot
[3] All flows are annualized, except where noted otherwise

TABLE 8
IMPLEMENTATION DETAILS FOR ALTERNATIVE 4C-4 – IN-SITU AND ENHANCED AGRICULTURAL TREATMENT – CONTINUOUS PUMPING
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Alternative Components	**Optimization Periods**[1]			
	0-5 years	**5-10 years**	**10-20 years**	**20+**
Rationale for Optimization	***Initial Build-out***	▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***	▪ ***Focus extraction in areas of highest remaining mass in OU2*** ▪ ***Focus dosed injection in areas of highest remaining mass in SCRIA and Source Area*** ▪ ***By-product management***
Agricultural Units and Estimated Application	▪ 2 Gorman AUs (324.5 gpm) ▪ 1 Cottrell AU (177 gpm) ▪ 1 Yang AU (177 gpm) ▪ 1 Ranch AU (177 gpm) ▪ 1 Northwest Recharge Pivot AU (135 gpm) ▪ 1 South SCRIA AU (177 gpm) ▪ 2 Bell AUs (354 gpm) ▪ DVD[2] (520 gpm) ▪ Total extraction[3] = 2,829gpm ▪ Select AUs will be operated year-round, supporting a second crop in the winter time (6 months of the year) ▪ 16 additional AUs will be operated for winter crop only (6 months of the year) to treat the excess flow	▪ No change from previous period	▪ Install 12 new extraction wells in the plume toe to target recalcitrant areas; water will be distributed to the various AUs; net extraction remains the same ▪ Total extraction = 2,829 gpm	▪ 2 Bell AU pivots and associated extraction wells are turned off (-354 gpm applied to AUs; -504 gpm total extracted) ▪ Shift extraction within wells installed during year 10 optimization to target recalcitrant areas. As noted below, some of this additional flow is sent to the combined SCRIA and Source Area dosed injection system ▪ Total extraction = 2,325 gpm
Central Area IRZ	▪ Total recirculation = 140 gpm (same flow as Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ Central Area IRZ turned off
SCRIA IRZ	▪ SCRIA no longer receiving extraction from north of Highway 58 as in Alt 4B ▪ New extraction wells located in the SCRIA provide 110 gpm for dosed injection as well as 150 gpm for the South SCRIA Pivot as shown above ▪ Additional 85 gpm extracted east of SCRIA is dosed and injected (no change from Alt 4B) ▪ Total SCRIA dosed injection = 195 gpm (no change in total from Alt 4B)	▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection (no change in total from Alt 4B)	▪ 3 new extraction wells added north of Highway 58 for additional dosed injection shared by SCRIA and Source Area (no change from Alt 4B) ▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change in total from Alt 4B)	▪ Eastern SCRIA extraction wells turned off ▪ Portion of flow (30 gpm) applied to combined SCRIA and Source area dosed injection system extracted from wells installed in the plume toe at year 10 ▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change in total from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change in total from Alt 4B)
Source Area IRZ	▪ Source Area dosed injection = 150 gpm (no change from Alt 4B)	▪ All Source Area extraction wells converted to injection wells (no change in total from Alt 4B) ▪ SCRIA dosed injection (195 gpm) now being shared with Source Area injection	▪ SCRIA dosed injection (255 gpm) being shared with Source Area injection (no change in total from Alt 4B)	▪ SCRIA dosed injection (170 gpm) being shared with Source Area injection (no change in total from Alt 4B) ▪ Reduced carbon dose (from 125 to 25 mg/L) (no change in total from Alt 4B)
Northwest Injection	▪ 80 gpm clean water injection (no change from Alt 4B)	▪ No change from previous period	▪ No change from previous period	▪ No change from previous period

Notes:
[1]Only changes are shown for each consecutive period
[2] DVD is a land treatment unit (LTU) and is not considered an agricultural unit (AU) pivot
[3] All flows are annualized

TABLE 9
ALTERNATIVE 4 VARIATIONS COMPARISON
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Major Item	Alternative 4 (per FS)	Alternative 4A (Addendum #1)	Alternative 4B (Addendum #2)	Alternative 4C-1 (Addendum #3)	Alternative 4C-2 (Addendum #3)	Alternative 4C-3 (Addendum #3)	Alternative 4C-4 (Addendum #3)
AU Pivots[1]	3	5	5	9	9	9	25
Agricultural Treatment Capacity	840/950 gpm[Note 2,3,4]	1270 gpm[Note 2,3,4]	1270 gpm[Note 2,3]	1830/1530 gpm[Note 2,3,5,6]	2041.5/2041.5/2041.5/1687.5 gpm[Note 2,3,5,6]	2829/2829/2829/2325 gpm[Note 2,3,5,6]	2829/2829/2829/2325 gpm[Note 2,3,5,6]
Fresh Water Injection	40 gpm	80 gpm	80 gpm	80 gpm	80 gpm	80 gpm	80 gpm
Central Area IRZ Dosed Injection	150/0 gpm[Note 3,5]	140/140/140/0 gpm[Note 3,5]	140/140/140/0 gpm[Note 3,5]	140/140/140/0 gpm[Note 3,6]	140/140/140/0 gpm[Note 3,6]	140/140/140/0 gpm[Note 3,6]	140/140/140/0 gpm[Note 3,6]
SCRIA IRZ Dosed Injection	195/0 gpm[Note 23,5]	195/195/255/170 gpm[Note 3,5]	195/195/255/170 gpm[Note 3,5]	195/195/255/170 gpm[Note 3,6]	195/195/255/170 gpm[Note 3,6]	195/195/255/170 gpm[Note 3,6]	195/195/255/170 gpm[Note 3,6]
Source Area IRZ Dosed Injection	125/0 gpm[Note 3,5]	150/0/0/0 gpm[Note 3,5]	150/0/0/0 gpm[Note 3,5]	150/0/0/0 gpm[Note 3,6]	150/0/0/0 gpm[Note 3,6]	150/0/0/0 gpm[Note 3,6]	150/0/0/0 gpm[Note 3,6]
Ex-Situ Treated Injection	---	---	---	---	---	787.5/787.5/787.5/637.5 gpm[Note 2]	---
Primary Differences Between Alternatives							
1. Central Area IRZ	Current horizontal length for the recirculation IRZ, with supplemental SCRIA injection points to the east	Increase the width by 100 percent over the current length, expanding to the east and west to intercept a greater portion of the plume	***No change compared to Alternative 4A***	***No change compared to Alternative 4B***	***No change compared to Alternative 4B***	***No change compared to Alternative 4B***	***No change compared to Alternative 4B***
2. Operation of IRZ Components (SCRIA, Source Area, and Central Area)	5 years	20 years (intermittent, low concentration carbon amendment continues beyond 20 years - see text for description)	***No change compared to Alternative 4A***	SCRIA no longer receiving extraction from north of Highway 58 in initial buildout as in Alternative 4B. New extraction wells located in the SCRIA provide 110 gpm for dosed injection (as well as 150 gpm for the South SCRIA Pivot). All other well optimizations remain the same as Alternative 4B.	***No change compared to Alternative 4C-1***	***No change compared to Alternative 4C-1***	***No change compared to Alternative 4C-1***
3. Plume Containment and Treatment via GW Extraction	950 gallons per minute (gpm) average annual withdrawal, 840 gpm of which is sent to AUs, and 110 gpm is sent to the SCRIA (while IRZ is in operation)	Increase the amount of withdrawal above Alternative 4 by 430 gpm (to a total of 1,380 gpm total). The increased withdrawal all goes to support AU expansion. After year 10, an additional 60 gpm is pumped and sent to the SCRIA.	After year 10, 2 of the original extraction wells to support the new AUs are shut down, and the same flow (total of 100 gpm) is extracted from 12 new extraction wells located in the plume toe (10 in the vicinity of the existing SCRIA and DVD AU extraction wells, and 2 in the vicinity of the Gorman AU extraction wells), and redirects this flow to the new AUs.	Increase the amount of initial withdrawal above Alternative 4B by 560 gpm (to a total of 1,830 gpm total when all AUs are in operation). The increased withdrawal all goes to support AU expansion. This alternative supports 4 more AU pivots than Alternative 4B for a total of 9 AU pivots, not including the DVD LTU. After 20 years, the 2 Bell pivots (not included in Alternative 4B) and associated extraction wells are turned off and total flow is reduced to 1,530 gpm. Well optimizations occur at year 10 and year 20 to further address areas of lingering mass, redirecting up to 155 gpm to AUs and SCRIA dosed injections.	Increase the amount of initial withdrawal above Alternative 4C-1 by 211.5 gpm (to a total of 2,041.5 gpm total when all AUs are in operation). The increased withdrawal goes to support winter crops. All other well optimizations remain the same as Alternative 4C-1.	Increase the amount of initial withdrawal above Alternative 4C-2 by 787.5 gpm (to a total of 2,829 gpm total when all AUs are in operation) and pump continuously throughout the year. The increased withdrawal beyond Alt 4C-2 is treated ex-situ. Chemical reduction / precipitation ex-situ treatment treats excess winter flow that is not supported by the AUs. Cost estimates assume two plants (one that treats approximately 1,200 gpm* derived generally north of Hwy 58 and second plant that treats approximately 450 gpm* (reduced to 150 gpm at year 20) derived generally south of Hwy 58). (Note: * not annualized) All other well optimizations remain the same as Alternative 4C-1.	Increase the amount of initial withdrawal above Alternative 4C-2 by 788 gpm (to a total of 2,829 gpm total when all AUs are in operation) and pump continuously throughout the year. This alternative adds 16 pivots above Alternative 4C-2 for a total of 25 pivots. New pivots are used to support excess winter flows in lieu of an ex-situ treatment plant. All other well optimizations remain the same as Alternative 4C-1.
4. Duration of GW Extraction	Until background concentrations are achieved	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***
Estimated Timeframe of Alternative to Reach: [Note 7]							
50 µg/L	6 years	6 years	6 years	6 years	6 years	4 years	3 years
80% mass removal	13 years	10 years	10 years	8 years	7 years	6 years	6 years
3.1 µg/L	150 years	75 years	40 years	40 years	39 years	36 years	29 years
1.2 µg/L	220 years	130 years	95 years	95 years	90 years	85 years	75 years

Notes:
1. Excludes the DVD Land Treatment Unit (LTU), which will be operated for all alternatives shown through all optimizations. Flow for the DVD LTU is included in the agricultural treatment capacity of each alternative.
2. Flows are annualized and based on initial build-out. Treatment capacity includes DVD LTU
3. Flows by each major item are separated by optimization using "/"; Alternative 4 has one optimization at 5 years; Alternative 4A, Alternative 4B, and the Alternative 4C series have optimizations at 5, 10, and 20 years.
4. Under Alternative 4, 840 gpm is applied to Agricultural Units in initial buildout, then once IRZs are shut down at year 5, the flow from the SCRIA IRZ extraction is sent to the Agricultural Units for a total of 950 gpm applied to AUs.
5. Under Alternatives 4C-1, 4C-2, and 4C-3, the agricultural treatment capacity is reduced at year 20 when the 2 Bell pivots are shut down. Under Alternative 4C-4, the agricultural treatment capacity is reduced at year 20 when the 2 Bell pivots and 3 additional winter-only pivots treating excess flow from the Bell extraction wells are shut down.
6. Estimated IRZ recirculation flows (i.e., the water is both extracted and injected) are shown. For Alternatives 4C-1, 4C-2, 4C-3 and 4C-4, a portion of the water extracted for SCRIA IRZ dosed injection is extracted from wells that also support AUs.

7. Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedial Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation. Durations rounded to whole years.

TABLE 10
ESTIMATED COST AND TIME FOR ALL ALTERNATIVES CONSIDERED
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

	MCL Cr(T) 50 ug/L			Estimated Time to 80% Chromium Mass Removal	Maximum Background Cr(VI) 3.1 ug/L			Average Background Cr(VI) 1.2 ug/L		
Alternative	Years*	Non-Discounted Cost*	NPV Cost*	Years*	Years*	Non-Discounted Cost*	NPV Cost*	Years**	Non-Discounted Cost*	NPV Cost*
1: No Further Action	750-1000	$0M	$0M	>780	>1000	$0M	$0M	>1000	$0M	$0M
2: Containment	120	$123M	$35.3M	95	260	$258M	$36.0M	320	$316M	$36.0M
3: Plume-Wide In-Situ Treatment	8	$58.1M	$50.7M	10	110	$399M	$130M	180	$634M	$133M
4: Core In-Situ Treatment and Beneficial Agricultural Use	6	$28.9M	$27.2M	13	150	$154M	$50.2M	220	$215M	$50.4M
5: Plume-Wide Pump and Treat	50	$334M	$180M	37	140	$882M	$218M	210	$1.31B	$221M
4A: Aggressive In-Situ Treatment and Beneficial Agricultural Use	6	$36.1M	$34.0M	10	75	$142M	$78.7M	130	$203M	$81.5M
Combined Alternative	28	$173M	$121M	18	90	$295M	$151M	130	$340M	$153M
4B: Aggressive In-Situ Treatment and Beneficial Agricultural Use with Targeted Pumping	6	$36.1M	$34.0M	10	40	$109M	$75.9M	95	$176M	$84.9M
4C-1: In-Situ and Enhanced Agricultural Treatment - 1 crop	6	$53.2M	$50.2M	8	40	$148M	$106M	95	$221M	$116M
4C-2: In-Situ and Enhanced Agricultural Treatment - 2 crops	6	$54.0M	$50.9M	7	39	$150M	$108M	90	$220M	$118M
4C-3: In-Situ and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuous Pumping	4	$82.0M	$79.1M	6	36	$335M	$226M	85	$638M	$276M
4C-4: In-Situ and Enhanced Agricultural Treatment - Continuous Pumping	3	$64.3M	$63.2M	6	29	$193M	$148M	75	$314M	$173M

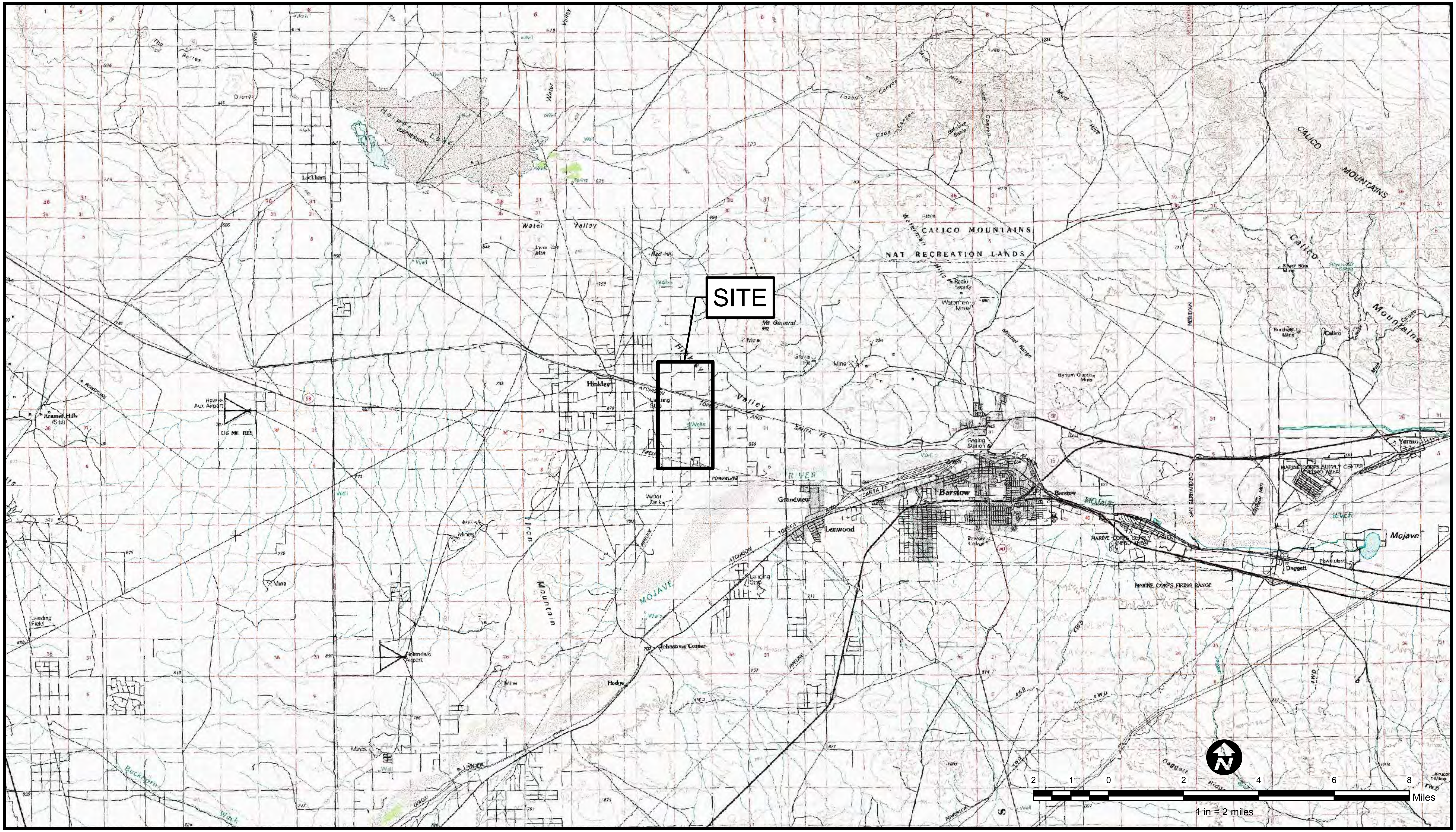
*Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedia
Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation.
**Timeframe to reach 1.2 ug/L shown above, to the extent achieving this criteria is feasible, is based on modeling.
Unless otherwise noted, Non-Discounted and NPV costs in millions and refer to the capital and O&M cost for the duration to reach the criteria.

ug/L - micrograms per liter chromium
NPV = Net present value
$M = Millions of dollars
$B = Billions of dollars

TABLE 12
SUMMARY OF COMPARATIVE EVALUATION OF ALTERNATIVES
PACIFIC GAS AND ELECTRIC
HINKLEY, CALIFORNIA

Alternative	Effectiveness				Ease of Implement-ability	NPV Cost ($ Millions)	Year-Round Extent of Hydraulic Control
	Achieves Background Conditions	Restore Beneficial Use	Chromium Plume Containment	Productive Use of GW Resource			
Alternative 4B - Aggressive In-Situ Treatment and Beneficial Agricultural Use	High	High	High	High	High	$75.9M	High
Alternative 4C-1 – In-Situ and Enhanced Agricultural Treatment - 1 Crop	High	High	High	High	High	$106M	High
Alternative 4C-2 – In-Situ and Enhanced Agricultural Treatment - 2 Crop	High	High	High	High	Medium	$108M	High
Alternative 4C-3 – In-Situ and Enhanced Agricultural Treatment and Winter Ex-Situ Treatment - Continuous Pumping	High	High	High	High	Low	$226M	Medium
Alternative 4C-4 – In-Situ and Enhanced Agricultural Treatment - Continuous Pumping	High	High	High	High	Low	$148M	High

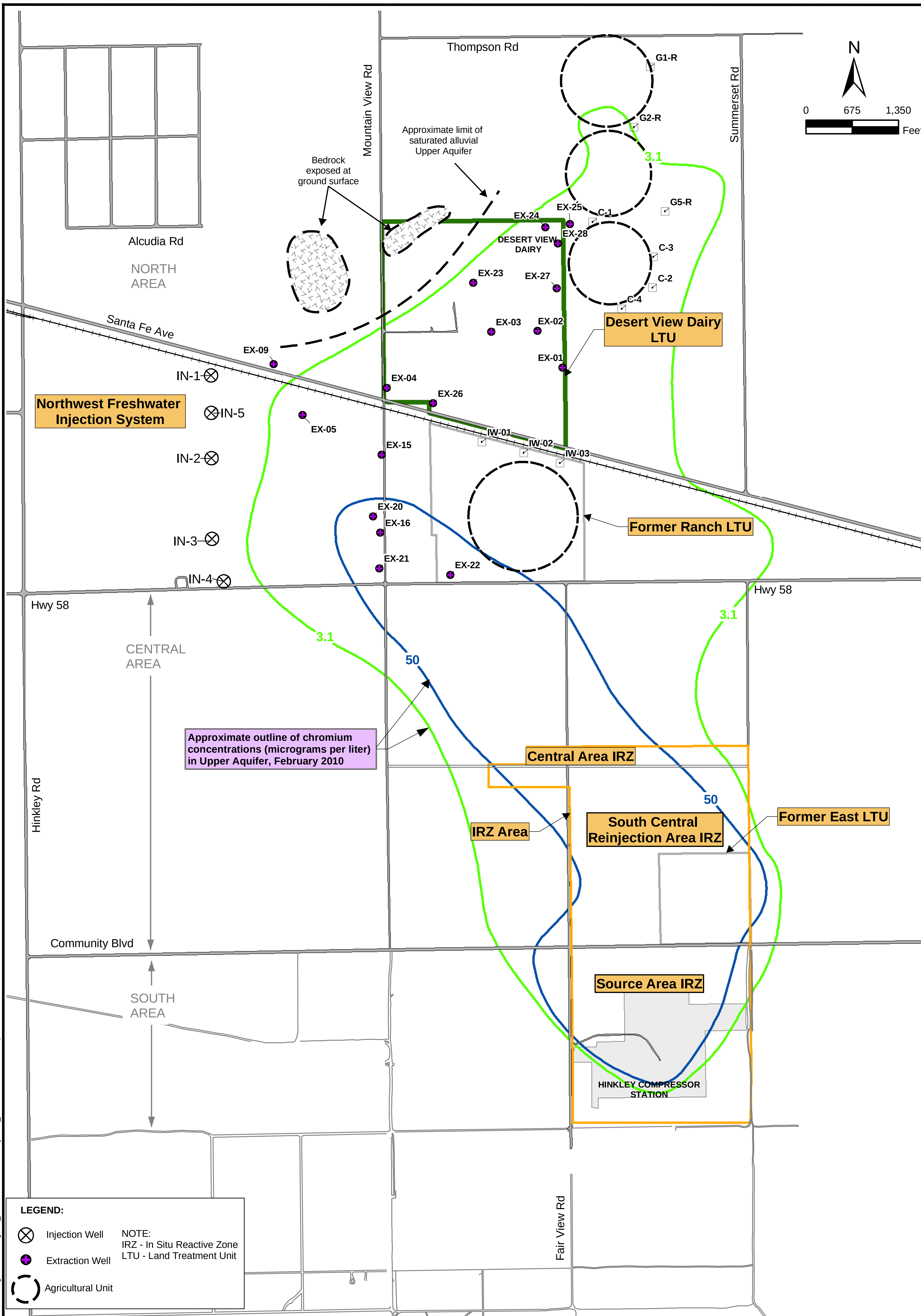
Notes:
High - Alternative likely to meet or support attainment of effectiveness criteria as a primary or likely element. Alternative easy to implement.
Medium - Alternative likely to have a nominal or moderate effect on attainment of relative effectiveness criteria. Alternative moderately difficult to implement.
Low - Alternative unlikely to have even a nominal or moderate effect in attainment of relative effectiveness criteria. Alternative difficult to implement.
Not addressed - Alternative does not address relative effectiveness criteria. Little or no positive effect of alternative on effectiveness driver.
NPV Cost for duration to achieve background chromium concentrations (3.1 µg/L) as estimated by fate and transport modeling.



Source: USGS, 1993

Stantec
57 LAFAYETTE CIRCLE, 2ND FLOOR
LAFAYETTE, CALIFORNIA
PHONE: (925) 299-9300 FAX: (925) 299-9302

FOR:			FIGURE:
Pacific Gas and Electric Groundwater Remediation Project Hinkley, California		SITE LOCATION MAP	1
JOB NUMBER: 185702221	DRAWN BY: TF	CHECKED BY: BD	APPROVED BY: CM
DATE: 08/24/10			



I:\RC000699.0001_PGE_Hinkley\GIS\ArcMap_MXD\Meetings\090911\Fig 4-1_CurrentRemediationSystem_rev1.mxd - 9/13/2011 @ 11:05:38 AM

Program Manager
Lisa Cope

Project Manager
Jenifer Beatty

Task Manager
Margy Gentile

Technical Review
Frank Lenzo

ARCADIS

100 Montgomery Street, Suite 300
San Francisco, California 94104
Tel: 415 374 2744
Fax: 415 374 2745
www.arcadis-us.com

February 2010 Plume Boundary
and Historical and Current Remediation Systems

Feasibility Study for Groundwater Cleanup

Pacific Gas and Electric Company
Hinkley, California

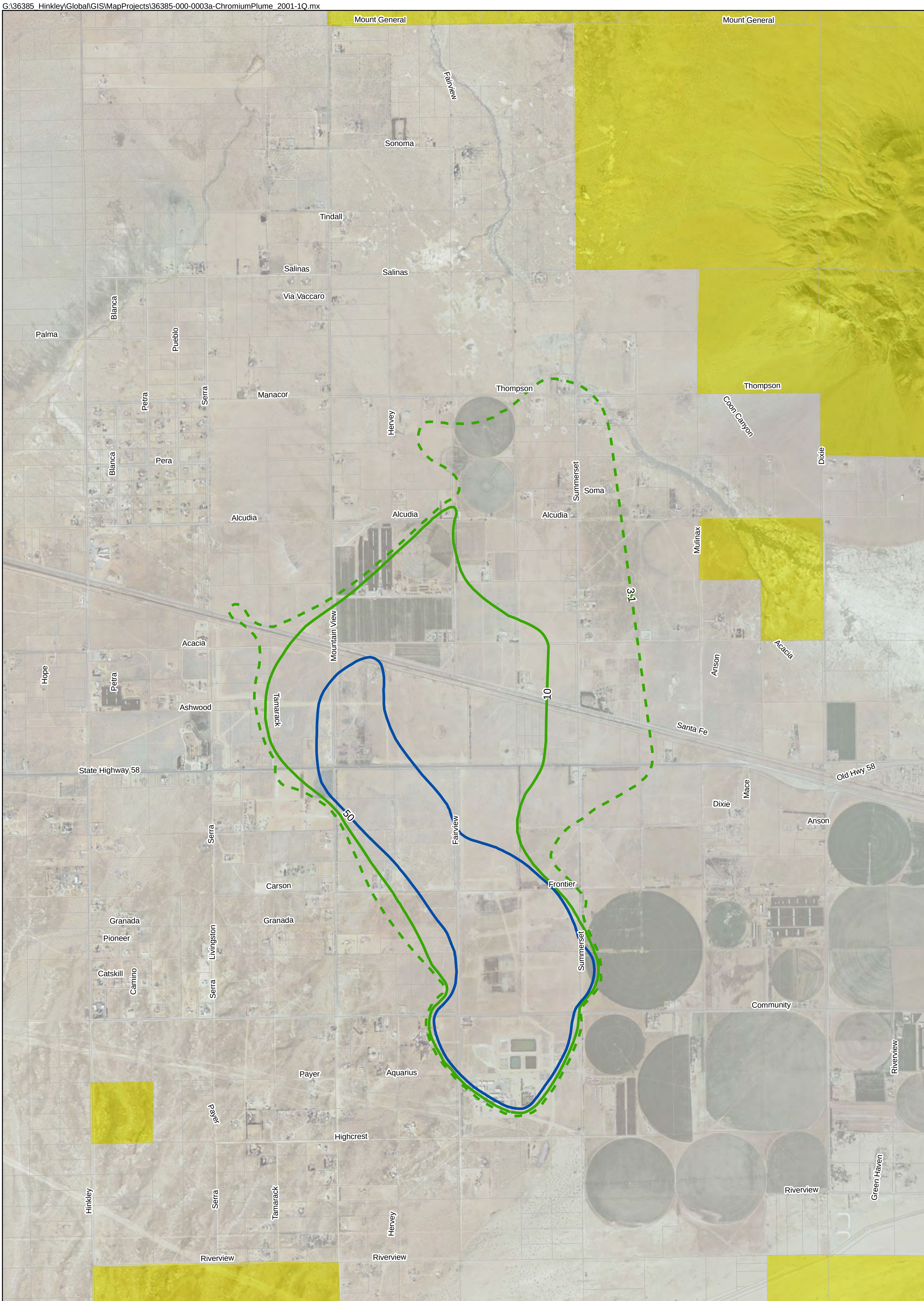
Project Number
RC000699.0002

Date
09/09/2011

Figure

2

G:\36385_Hinkley\Global\GIS\MapProjects\36385-000-0003a-ChromiumPlume_2001-1Q.mx



LEGEND

2011 - FIRST QUARTER

GROUNDWATER CONTOUR

3.1 ug/L

10 ug/L

50 ug/L

U.S. BUREAU OF LAND MANAGEMENT (BLM) LAND

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

N
W E
S

0 2,000 4,000

SCALE IN FEET

HALEY & ALDRICH

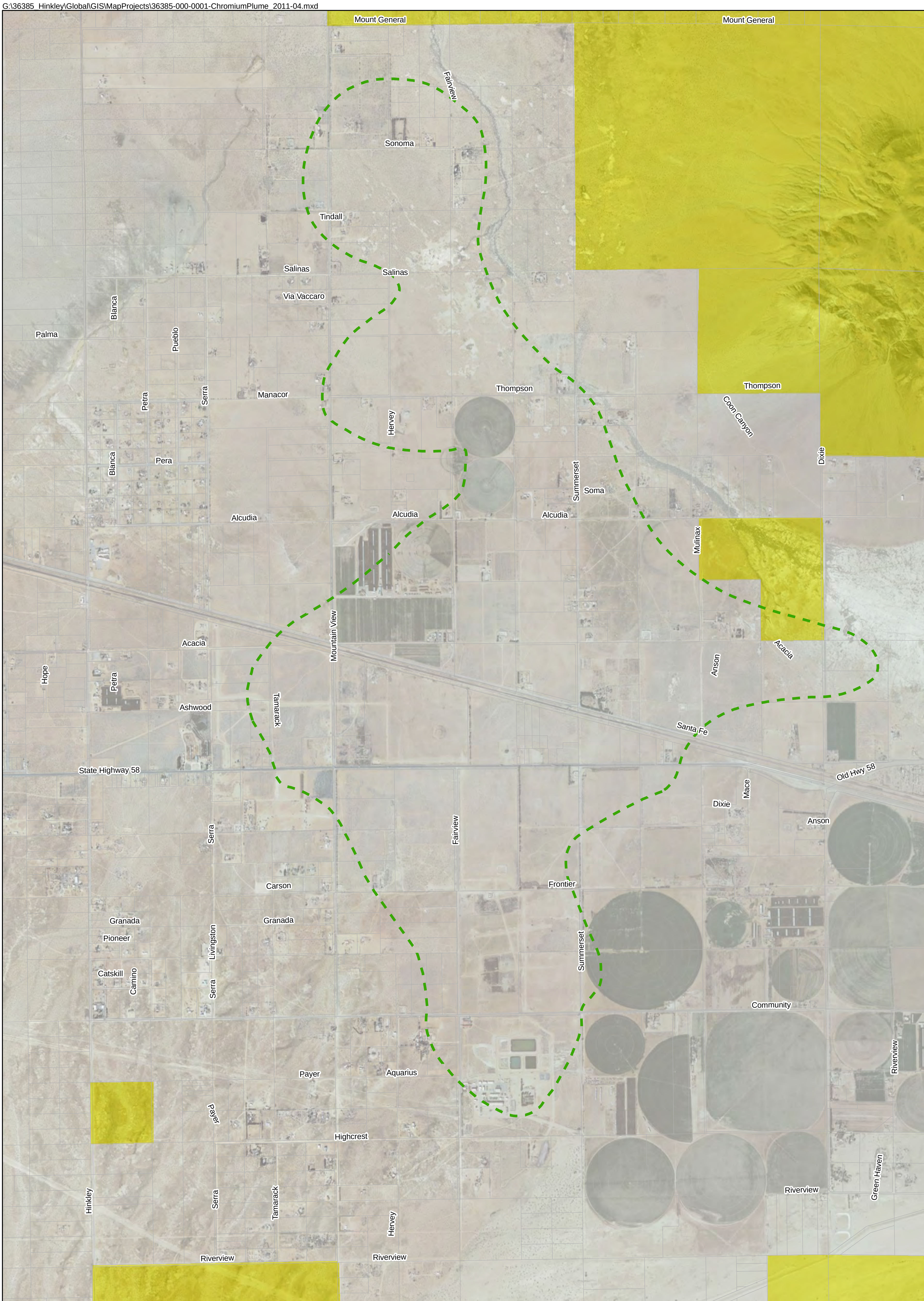
PACIFIC GAS AND ELECTRIC COMPANY (PG&E)
GROUNDWATER REMEDIATION PROJECT
HINKLEY, CALIFORNIA

GROUNDWATER CONTOUR
2011 - FIRST QUARTER

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 3A

G:\36385_Hinkley\Global\GIS\MapProjects\36385-000-0001-ChromiumPlume_2011-04.mxd



LEGEND

COMPOSITE CR(IV)

GROUNDWATER CONTOUR

3.1 ug/L

U.S. BUREAU OF LAND MANAGEMENT (BLM) LAND

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. FOR VISUALIZATION PURPOSES, THE 3.1 UG/L CR(VI) CONTOUR SHOWN HERE IS A COMPOSITE THAT APPROXIMATES THE GENERAL PLUME CONFIGURATION INCORPORATING CONTOURS FROM THE SEPTEMBER 1ST 2011 UPPER AQUIFER INVESTIGATION REPORT TO THE NORTH OF SANTA FE AVENUE AND THE SECOND QUARTER 2011 GMP REPORT PLUME TO THE SOUTH OF SANTA FE AVENUE.
3. REFER TO THE SECOND QUARTER 2011 GMP REPORT FOR THE 10 AND 50 UG/L CONTOURS.
4. AN UPDATED CONTOUR MAP OF THE ENTIRE PLUME WILL BE PROVIDED IN THE THIRD QUARTER GMP REPORT TO BE SUBMITTED OCTOBER 30, 2011.

N
W E
S

0 2,000 4,000

SCALE IN FEET

HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY (PG&E)
GROUNDWATER REMEDIATION PROJECT
HINKLEY, CALIFORNIA

COMPOSITE MAP OF HEXAVALENT CHROMIUM [CR (VI)] PLUME

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 3B

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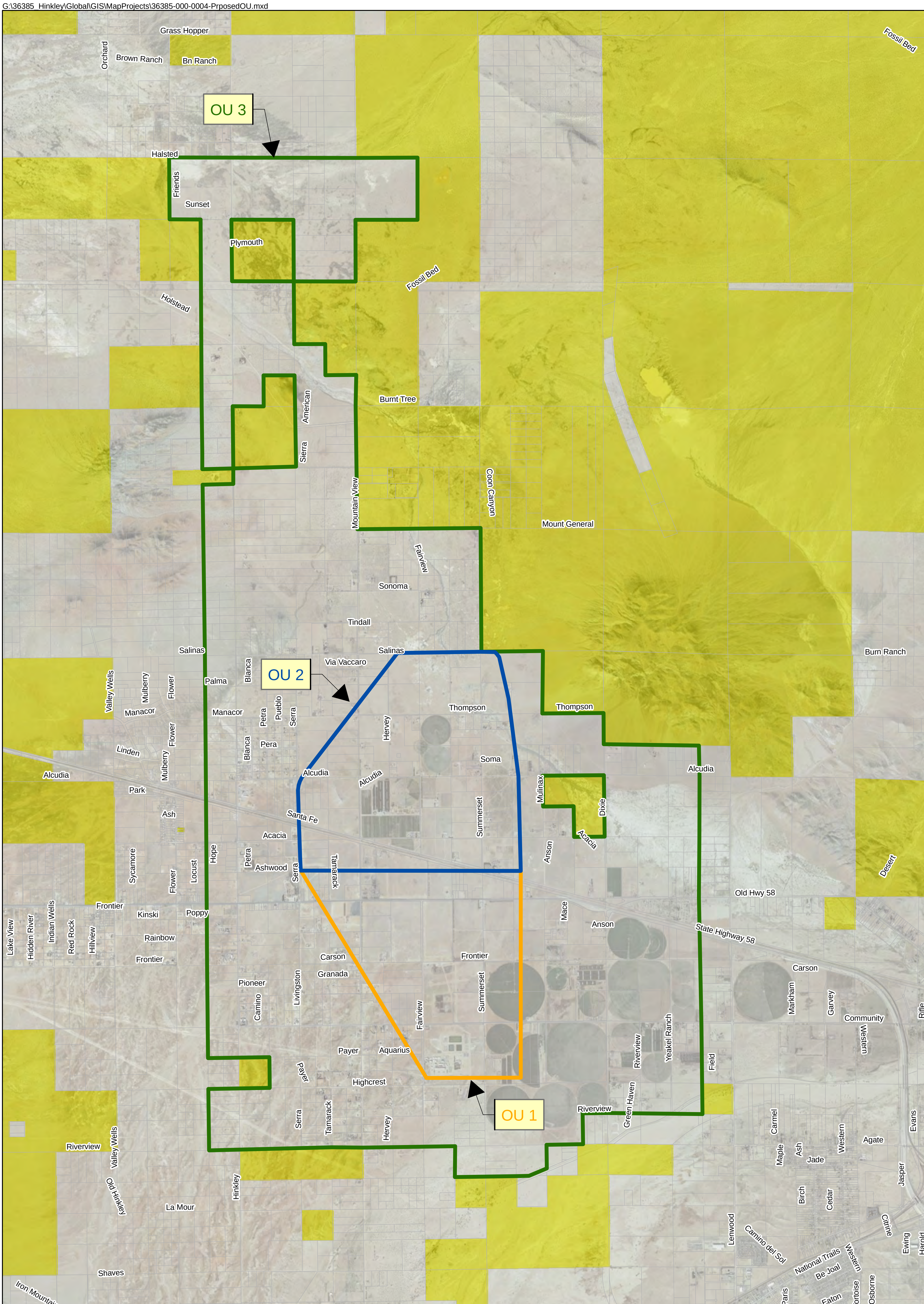


LEGEND

U.S. BUREAU OF LAND MANAGEMENT (BLM) LAND

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

N
W E
S

0 4,000 8,000

SCALE IN FEET

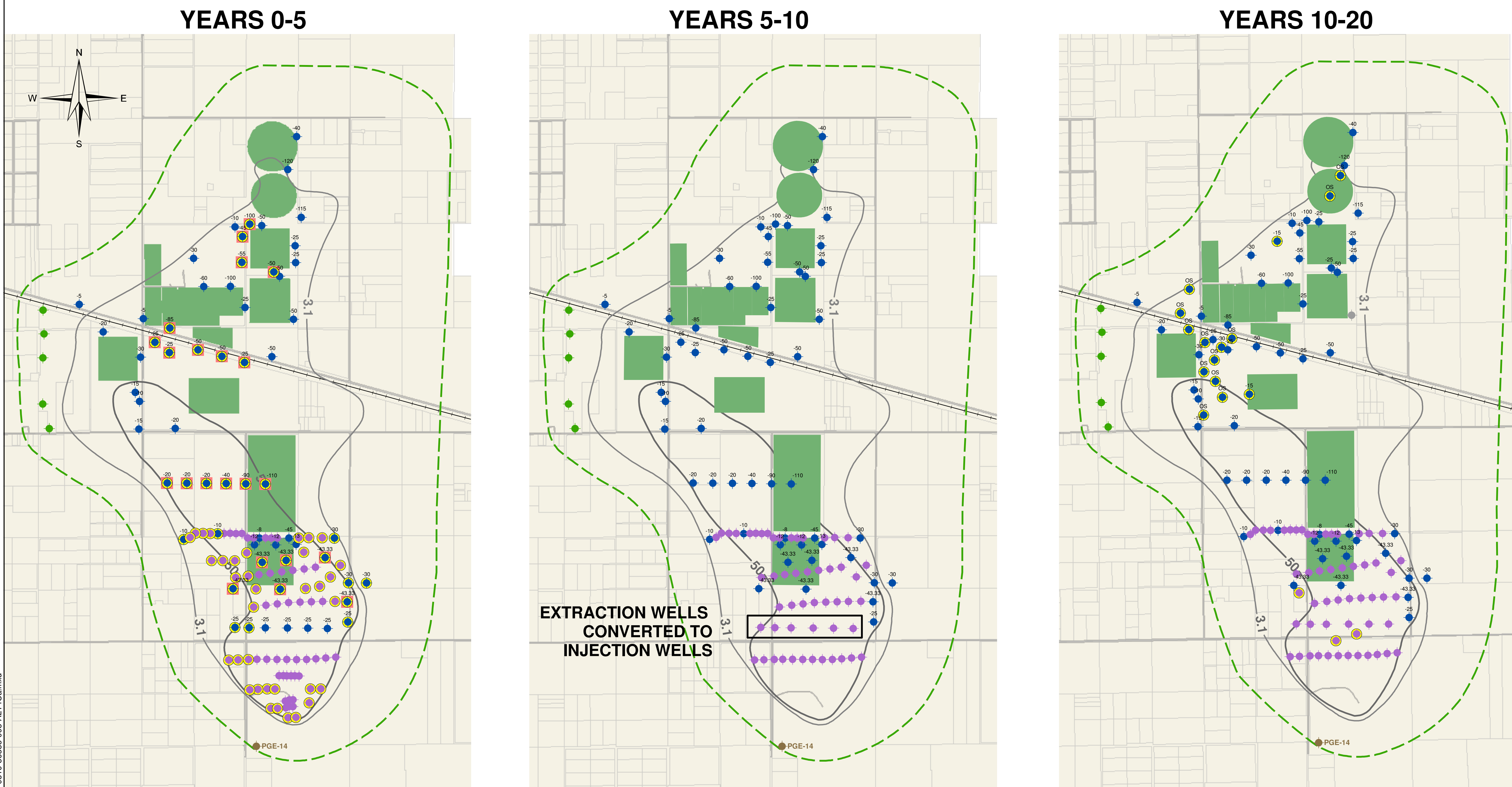
HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY (PG&E)
GROUNDWATER REMEDIATION PROJECT
HINKLEY, CALIFORNIA

PROPOSED OPERABLE UNITS

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 4



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NOTES

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3. THIS FIGURE IS DESIGNED TO BE SHOWN IN COLOR. BLACK-AND-WHITE REPRODUCTIONS WILL NOT CLEARLY SHOW THE INFORMATION CONTAINED IN THIS FIGURE.
4. EXISTING WELLS NOT INCLUDED IN THE REMEDIAL ALTERNATIVE BUILDOUT AND OPERATION FOR THE ASSOCIATED TIME PERIOD ARE EXCLUDED FOR FIGURE CLARITY.

LEGEND

- -75 EXTRACTION WELL (FLOW IN GAL/MIN. BASED ON GW MODEL SETUP) "OS" INDICATES OSCILLATING FLOW RATES
- CARBON-AMENDED WATER INJECTION WELL
- FRESHWATER INJECTION WELL
- AU EXTRACTION WELL TURNED OFF FOR PERIOD
- FRESHWATER EXTRACTION WELL PGE-14
- WELL PART OF ALTERNATIVE'S CONCEPTUAL BUILDOUT (NOT EXISTING OR CURRENTLY IN PROCESS)
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- PROJECT AREA
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- 50 HEXAVALENT CHROMIUM CONCENTRATION (ug/L) (FEB 2010)
- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA

0 2,500 5,000
SCALE IN FEET

HALEY & ALDRICH

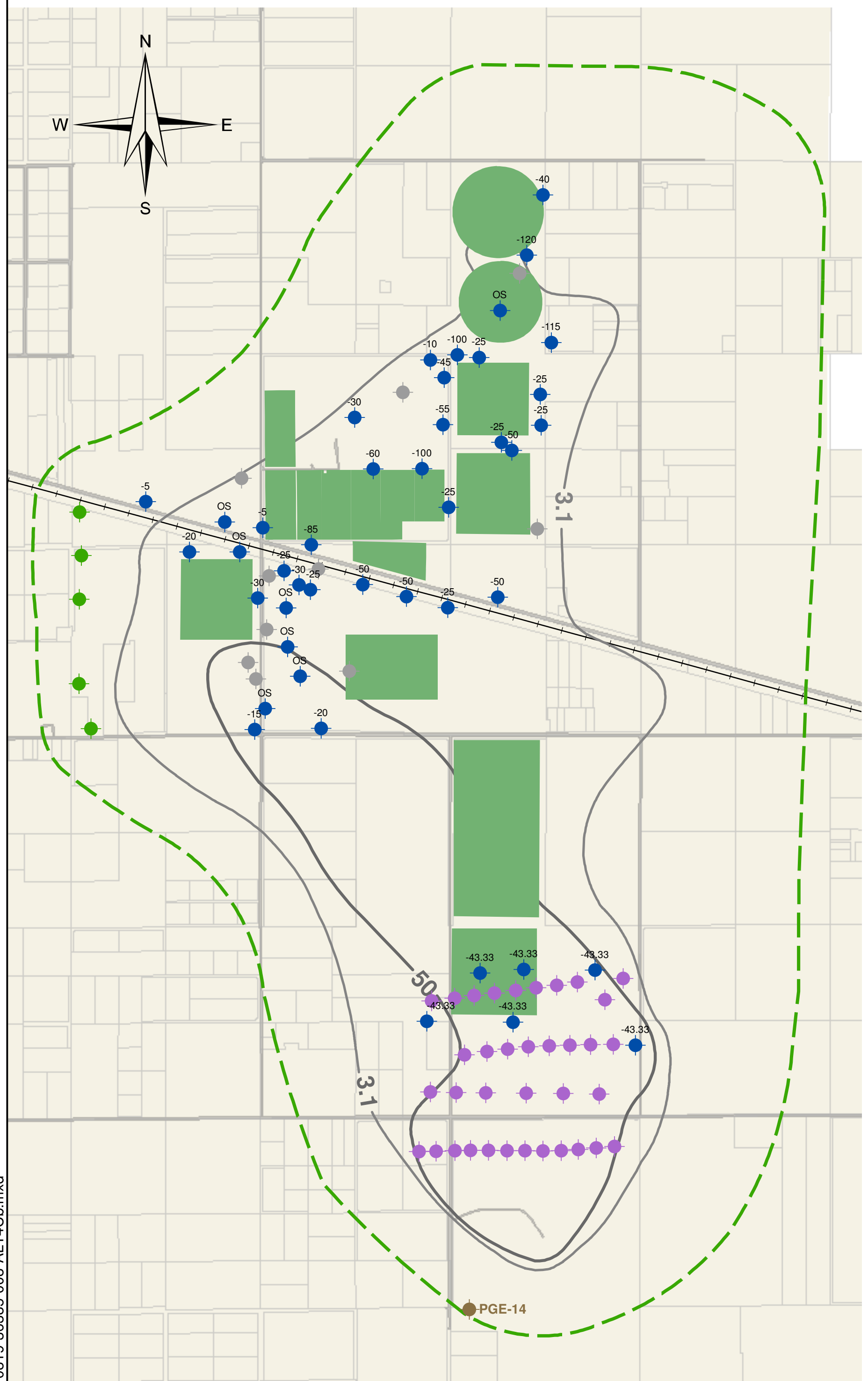
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-1
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT-1 CROP COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 5A

YEARS 20+



NOTES

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- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA

0 2,500 5,000

SCALE IN FEET

HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-1
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT-1 CROP COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 5B

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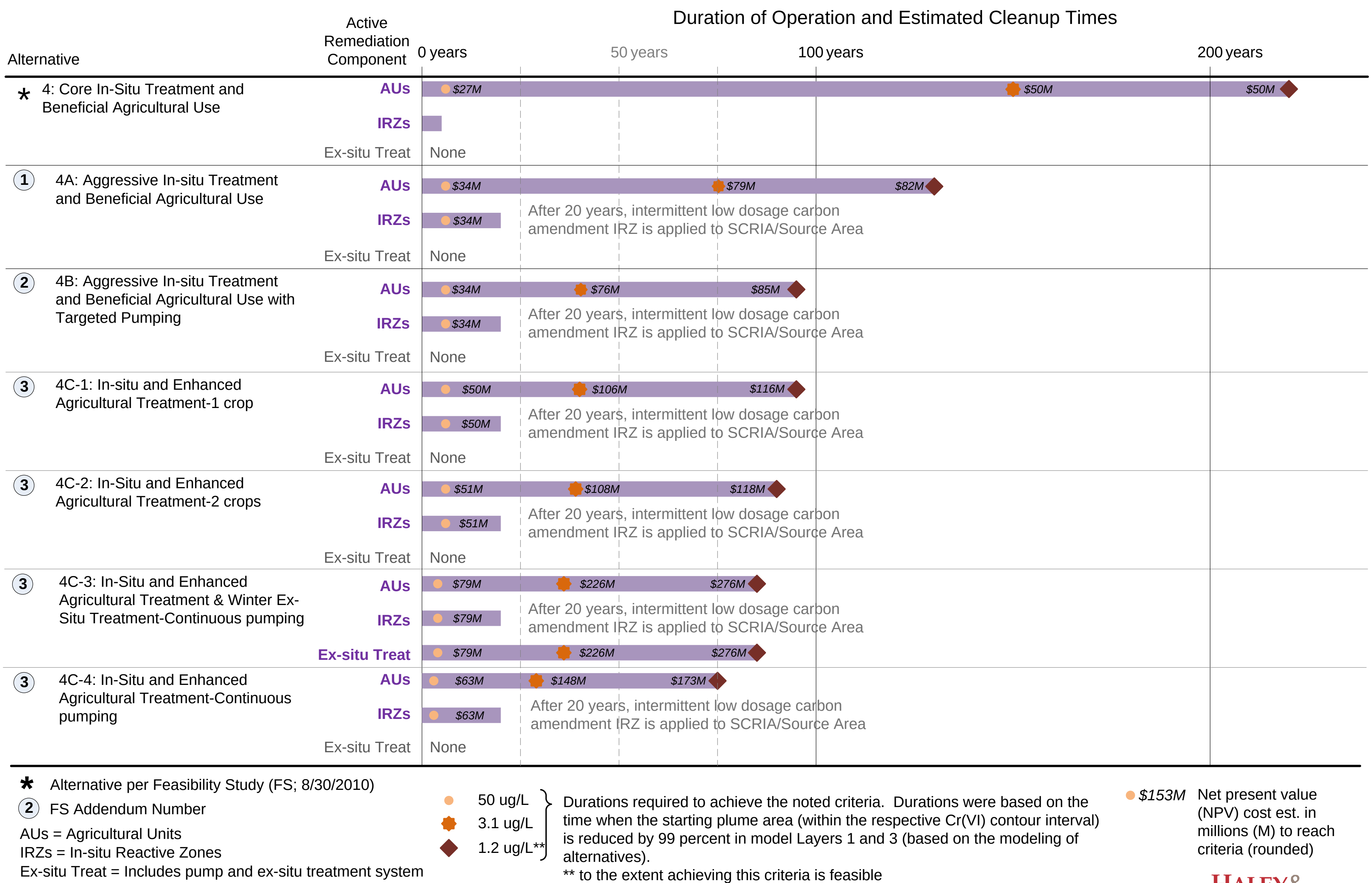
Figure 6 **Alternative 4 Summary – Active Remediation Components and Durations**



HALEY & ALDRICH

YEARS 0-5 | YEARS 5-10 | YEARS 10-20

NOTES

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- SUPPLEMENTAL EXTRACTION WELL INSTALLED FOR AU WATER APPLICATION AS PART OF ALTERNATIVE 4C-2 (BEYOND ALTERNATIVE 4B BUILDOUT)
- PROJECT AREA
- 3.1 OUTLINE OF 92-49 REMEDIAL AREA BASED ON REGIONAL BOARD SPECIFIED BACKGROUND LEVELS OF HEXAVALENT CHROMIUM AND TOTAL CHROMIUM PER FS
- 50 HEXAVALENT CHROMIUM CONCENTRATION (ug/L) (FEB 2010)
- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA

0 2,500 5,000
SCALE IN FEET

HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-2
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT-2 CROPS COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 7A

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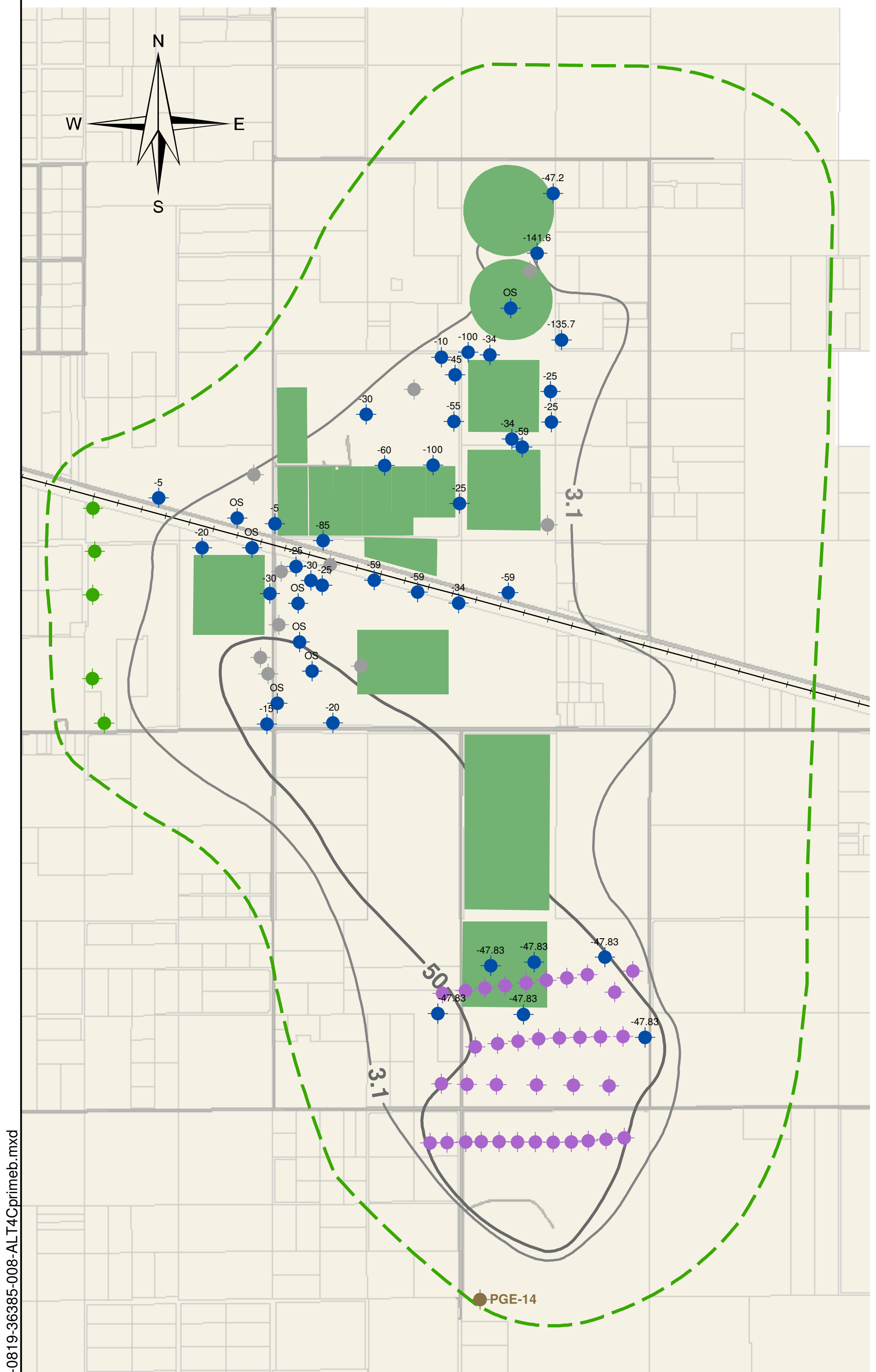
YEARS 20+



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NOTES

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- 50 HEXAVALENT CHROMIUM CONCENTRATION (ug/L) (FEB 2010)
- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA

0 2,500 5,000
SCALE IN FEET

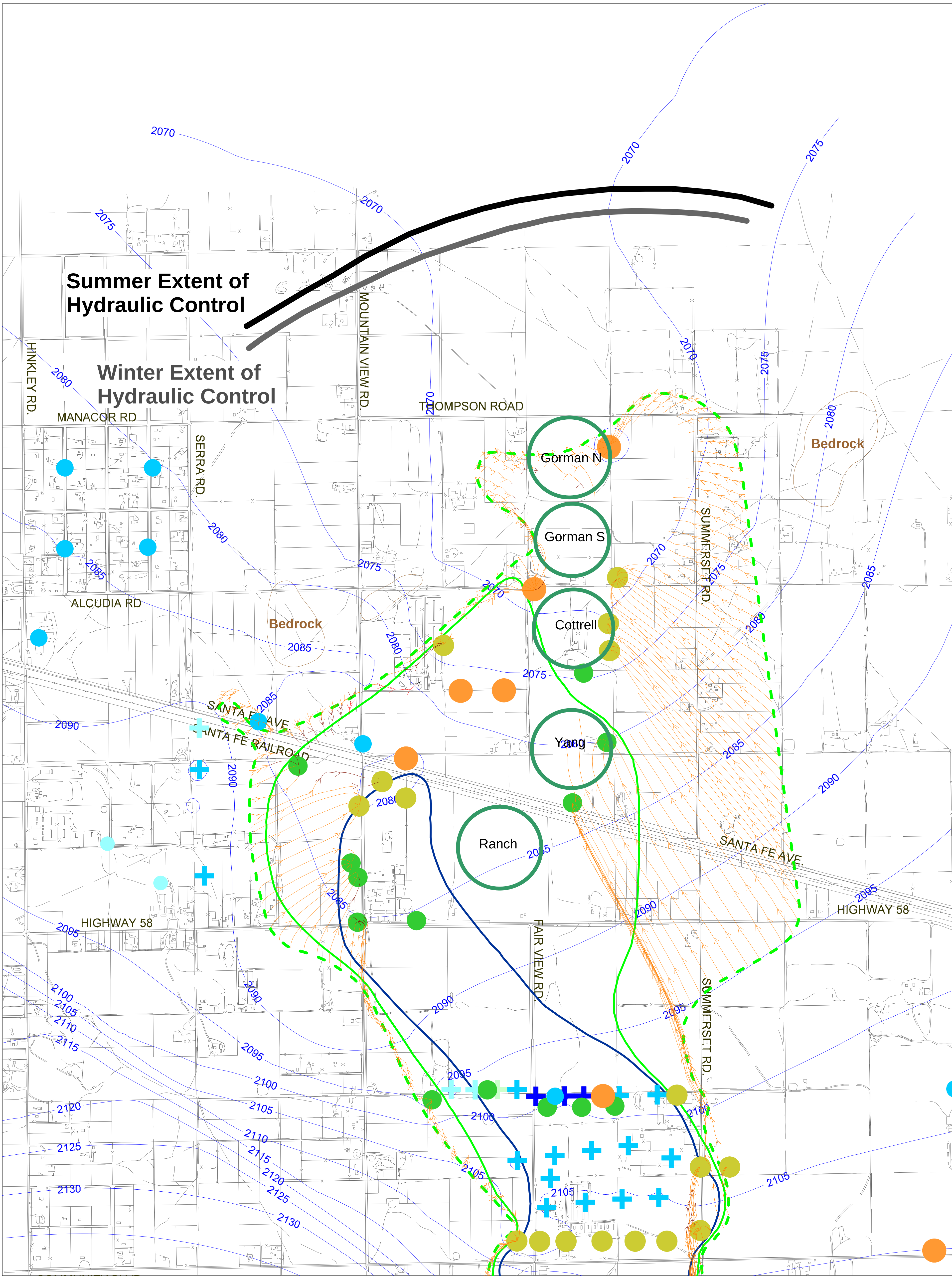
HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-2
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT-2 CROPS COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 7B



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

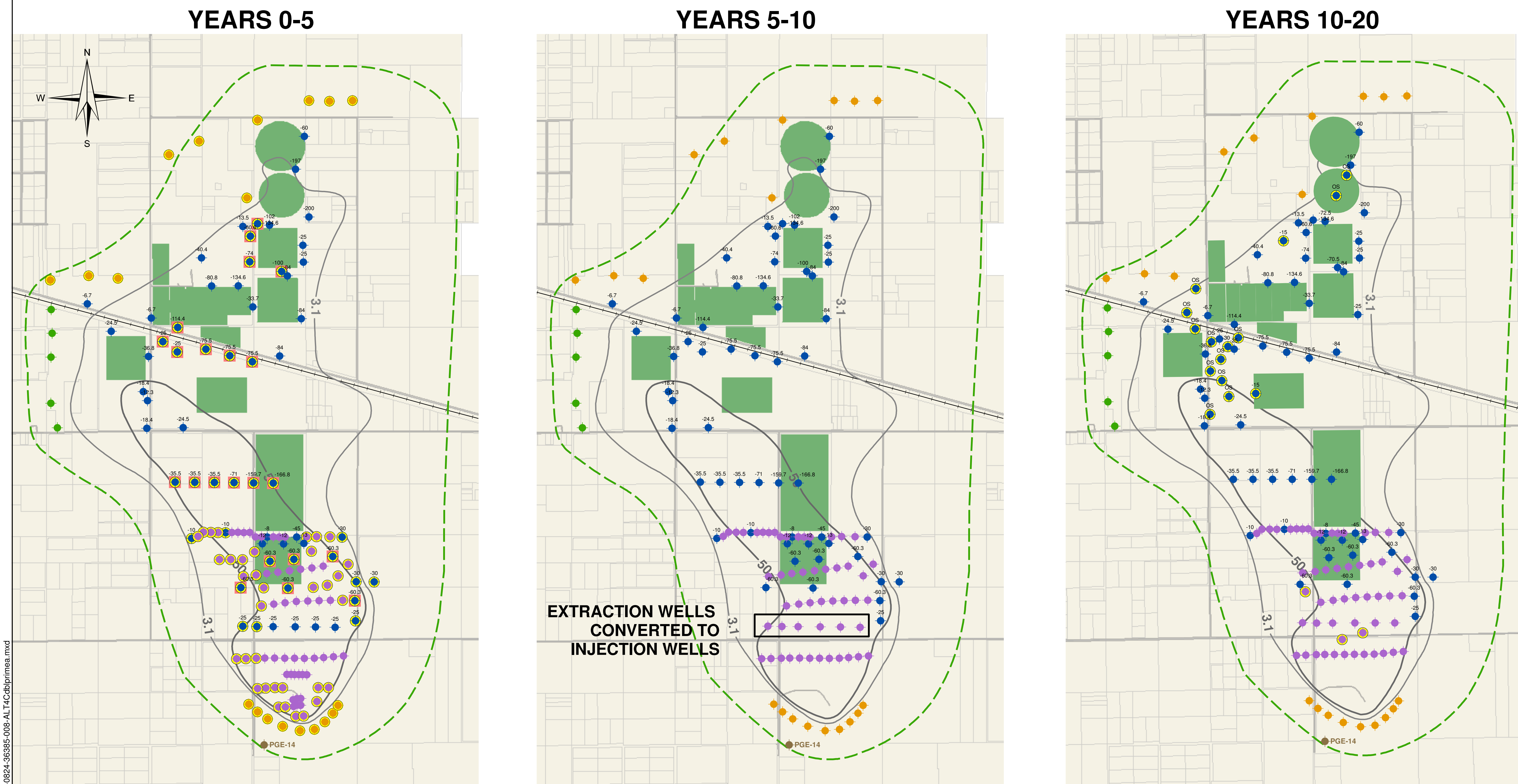
Notes:
1. Alt. 4B includes 5 ag. pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

0 feet 1000 feet 2000 feet

Figure 8
Alternative 4B
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011
CH2MHILL

ES082411032322RDD_B-2



NOTES

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- FRESHWATER INJECTION WELL
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- 50 HEXAVALENT CHROMIUM CONCENTRATION (ug/L) (FEB 2010)
- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA
- SUPPLEMENTAL EXTRACTION WELL INSTALLED FOR AU WATER APPLICATION AS PART OF ALTERNATIVE 4C-3 (BEYOND ALTERNATIVE 4B BUILDOUT)

0 2,500 5,000

SCALE IN FEET

HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-3
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT & WINTER EX-SITU TREATMENT-CONTINUOUS PUMPING COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 9A

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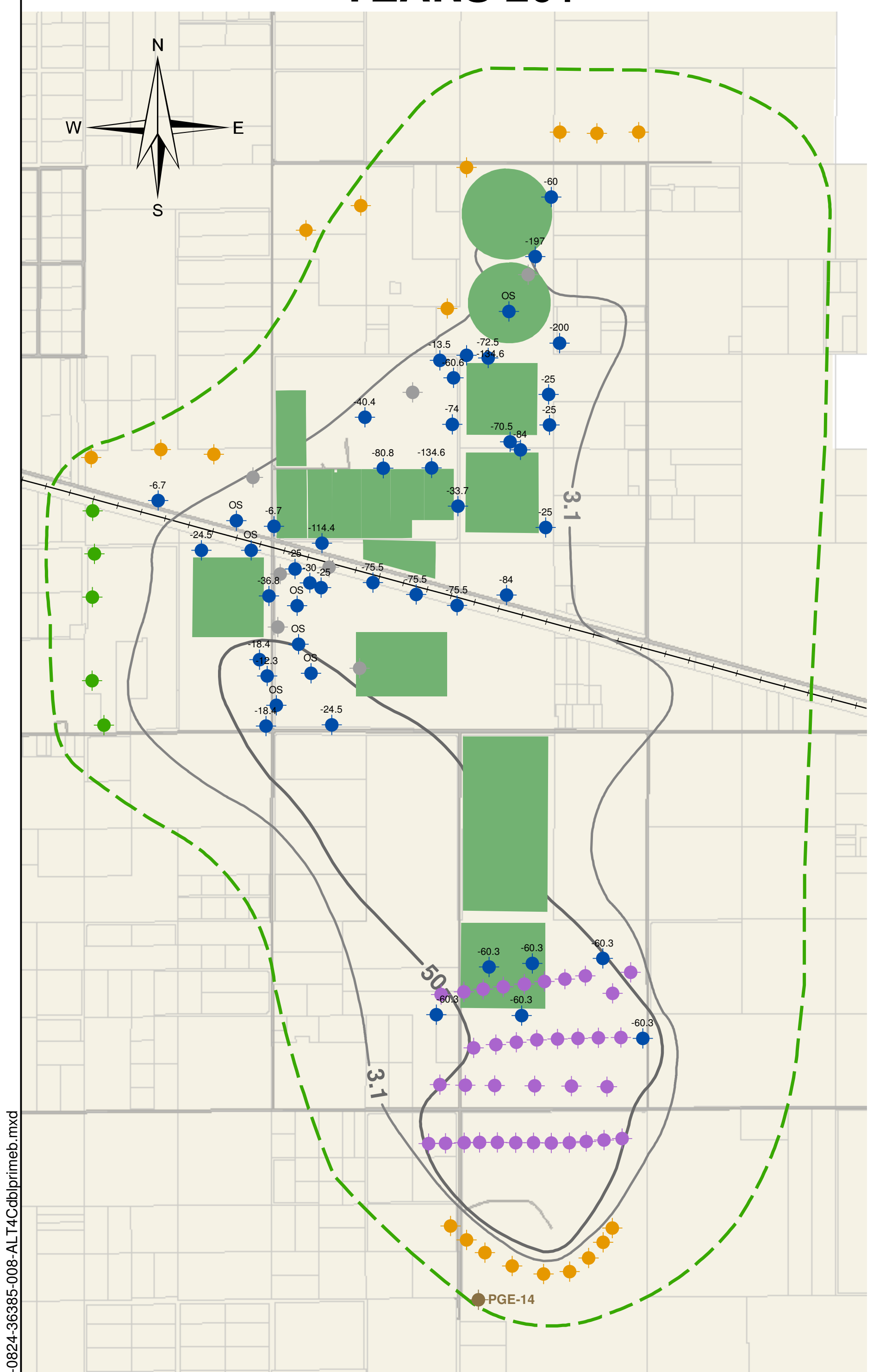
YEARS 20+



NOTES

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EX-SITU TREATED WATER INJECTION WELL
FRESHWATER INJECTION WELL
AU EXTRACTION WELL TURNED OFF FOR PERIOD
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PROJECT AREA
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AGRICULTURAL UNITS, INCLUDING DVD LTU
2011 GENERAL PERMIT WDR PROJECT AREA
SUPPLEMENTAL EXTRACTION WELL INSTALLED FOR AU WATER APPLICATION AS PART OF ALTERNATIVE 4C-3 (BEYOND ALTERNATIVE 4B BUILDOUT)

0 2,500 5,000
SCALE IN FEET

HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-3
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT & WINTER EX-SITU TREATMENT-CONTINUOUS PUMPING COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 9B

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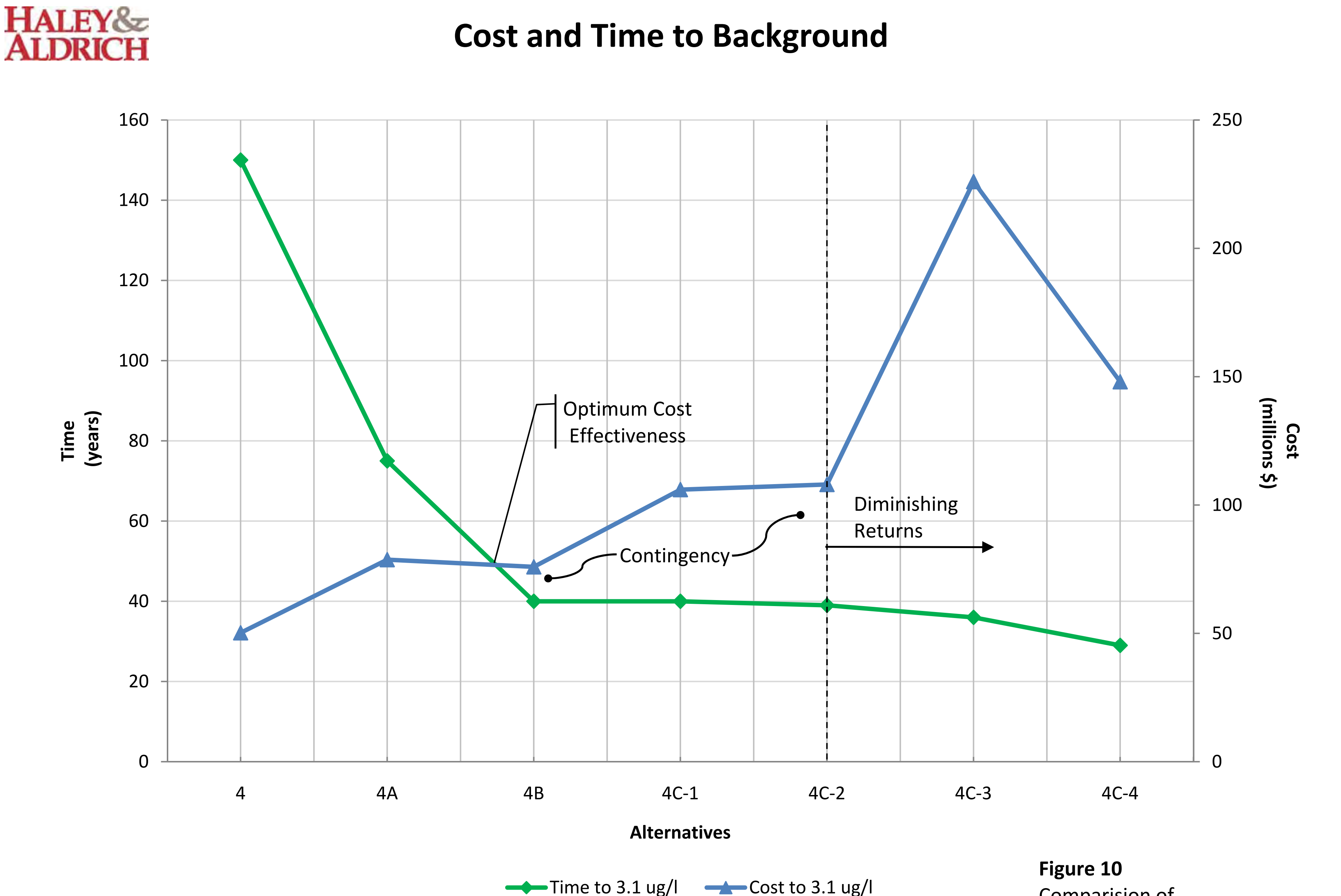


Note: All costs shown represent net present value calculated using a 3.17% discount rate

Figure 10
Comparision of
Cost and Time to
Background Concentrations

YEARS 0-5 | YEARS 5-10 | YEARS 10-20

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. NUMBER AND LOCATION OF WELLS AS PER MODELING PERFORMED BY ARCADIS IN SUPPORT OF THE FEASIBILITY STUDY, INCLUDING ADDENDUM #1, #2, AND #3.
3. THIS FIGURE IS DESIGNED TO BE SHOWN IN COLOR. BLACK-AND-WHITE REPRODUCTIONS WILL NOT CLEARLY SHOW THE INFORMATION CONTAINED IN THIS FIGURE.
4. EXISTING WELLS NOT INCLUDED IN THE REMEDIAL ALTERNATIVE BUILDOUT AND OPERATION FOR THE ASSOCIATED TIME PERIOD ARE EXCLUDED FOR FIGURE CLARITY.

LEGEND

- -75 EXTRACTION WELL (FLOW IN GAL/MIN. BASED ON GW MODEL SETUP) "OS" INDICATES OSCILLATING FLOW RATES
- CARBON-AMENDED WATER INJECTION WELL
- EX-SITU TREATED WATER INJECTION WELL
- FRESHWATER INJECTION WELL
- AU EXTRACTION WELL TURNED OFF FOR PERIOD
- FRESHWATER EXTRACTION WELL PGE-14
- WELL PART OF ALTERNATIVE'S CONCEPTUAL BUILDOUT (NOT EXISTING OR CURRENTLY IN PROCESS)
- PROJECT AREA
- 3.1 OUTLINE OF 92-49 REMEDIAL AREA BASED ON REGIONAL BOARD SPECIFIED BACKGROUND LEVELS OF HEXAVALENT CHROMIUM AND TOTAL CHROMIUM PER FS
- 50 HEXAVALENT CHROMIUM CONCENTRATION (ug/L) (FEB 2010)
- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA
- SUPPLEMENTAL EXTRACTION WELL INSTALLED FOR AU WATER APPLICATION AS PART OF ALTERNATIVE 4C-4 (BEYOND ALTERNATIVE 4B BUILDOUT)

0 2,500 5,000
SCALE IN FEET

HALEY & ALDRICH

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

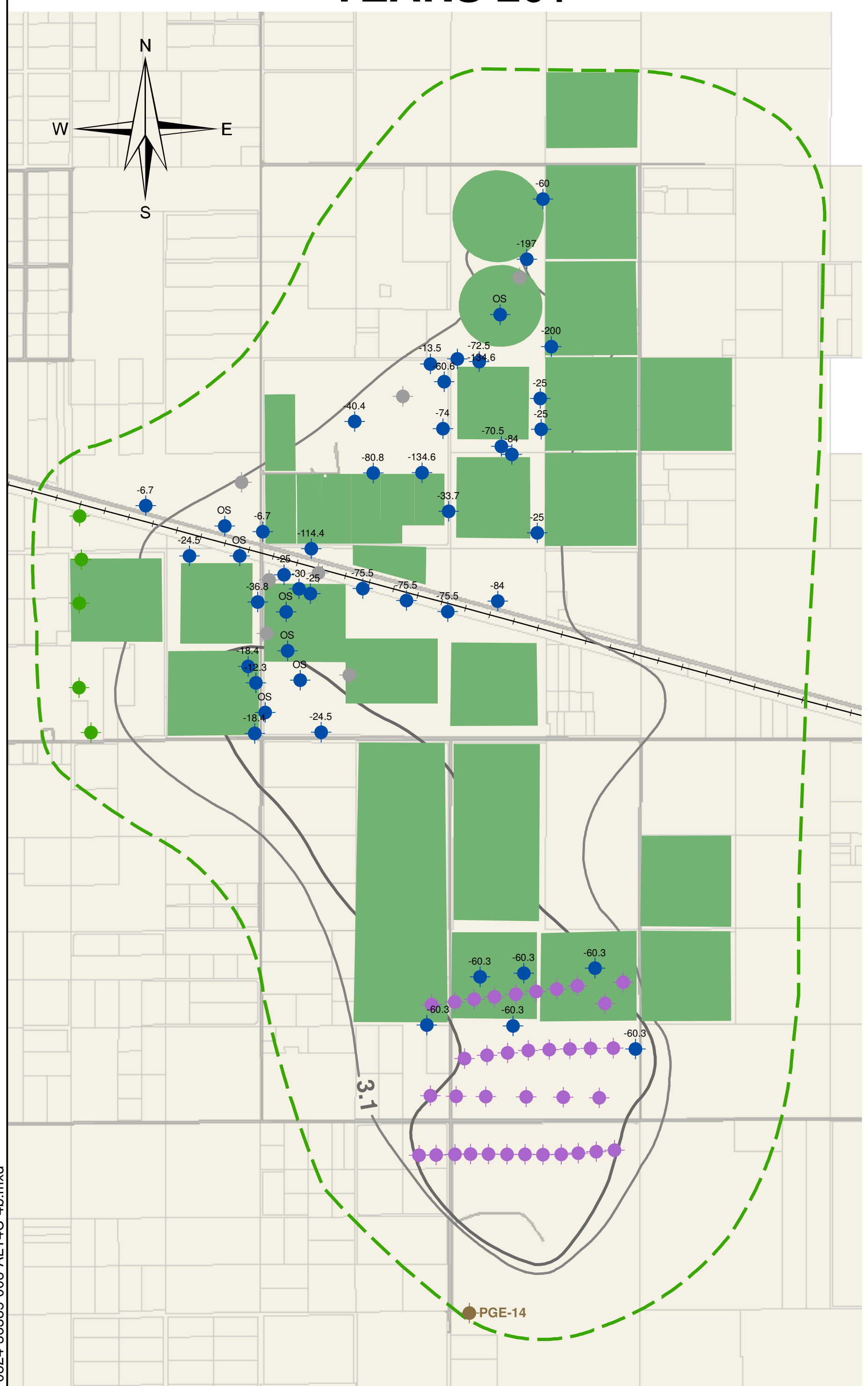
ALTERNATIVE 4C-4
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT-CONTINUOUS PUMPING COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 11A

G:\36385\GLOBAL\GIS\MAP_PROJ\MAP\2011-0824-36385-008-ALT4C-4.mxd

YEARS 20+



NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. NUMBER AND LOCATION OF WELLS AS PER MODELING PERFORMED BY ARCADIS IN SUPPORT OF THE FEASIBILITY STUDY, INCLUDING ADDENDUM #1, #2, AND #3.
3. THIS FIGURE IS DESIGNED TO BE SHOWN IN COLOR. BLACK-AND-WHITE REPRODUCTIONS WILL NOT CLEARLY SHOW THE INFORMATION CONTAINED IN THIS FIGURE.
4. EXISTING WELLS NOT INCLUDED IN THE REMEDIAL ALTERNATIVE BUILDOUT AND OPERATION FOR THE ASSOCIATED TIME PERIOD ARE EXCLUDED FOR FIGURE CLARITY.

LEGEND

- -75 EXTRACTION WELL (FLOW IN GAL/MIN. BASED ON GW MODEL SETUP) "OS" INDICATES OSCILLATING FLOW RATES
- CARBON-AMENDED WATER INJECTION WELL
- EX-SITU TREATED WATER INJECTION WELL
- FRESHWATER INJECTION WELL
- AU EXTRACTION WELL TURNED OFF FOR PERIOD
- FRESHWATER EXTRACTION WELL PGE-14
- WELL PART OF ALTERNATIVE'S CONCEPTUAL BUILDOUT (NOT EXISTING OR CURRENTLY IN PROCESS)
- PROJECT AREA
- 3.1 OUTLINE OF 92-49 REMEDIAL AREA BASED ON REGIONAL BOARD SPECIFIED BACKGROUND LEVELS OF HEXAVALENT CHROMIUM AND TOTAL CHROMIUM PER FS
- 50 HEXAVALENT CHROMIUM CONCENTRATION (ug/L) (FEB 2010)
- AGRICULTURAL UNITS, INCLUDING DVD LTU
- 2011 GENERAL PERMIT WDR PROJECT AREA
- SUPPLEMENTAL EXTRACTION WELL INSTALLED FOR AU WATER APPLICATION AS PART OF ALTERNATIVE 4C-4 (BEYOND ALTERNATIVE 4B BUILDOUT)

0 2,500 5,000
SCALE IN FEET

HALEY & ALDRICH

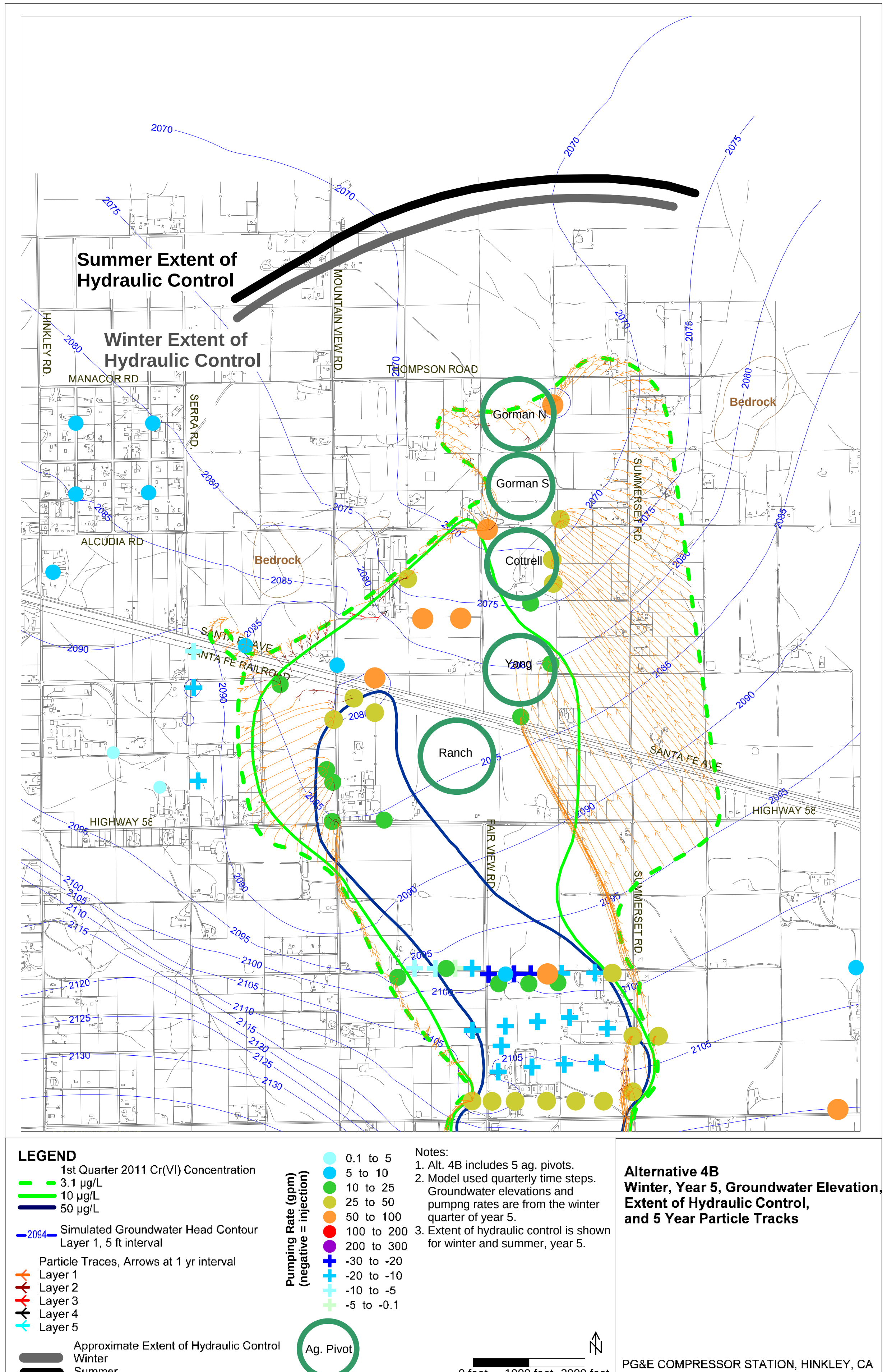
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

ALTERNATIVE 4C-4
IN-SITU AND ENHANCED AGRICULTURAL TREATMENT-CONTINUOUS PUMPING COMPONENTS AND OPTIMIZATION

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 11B

G:\36385\GLOBAL\GIS\MAP_PROJ\MAP\2011-0824-36385-008-ALT4C-4b.mxd



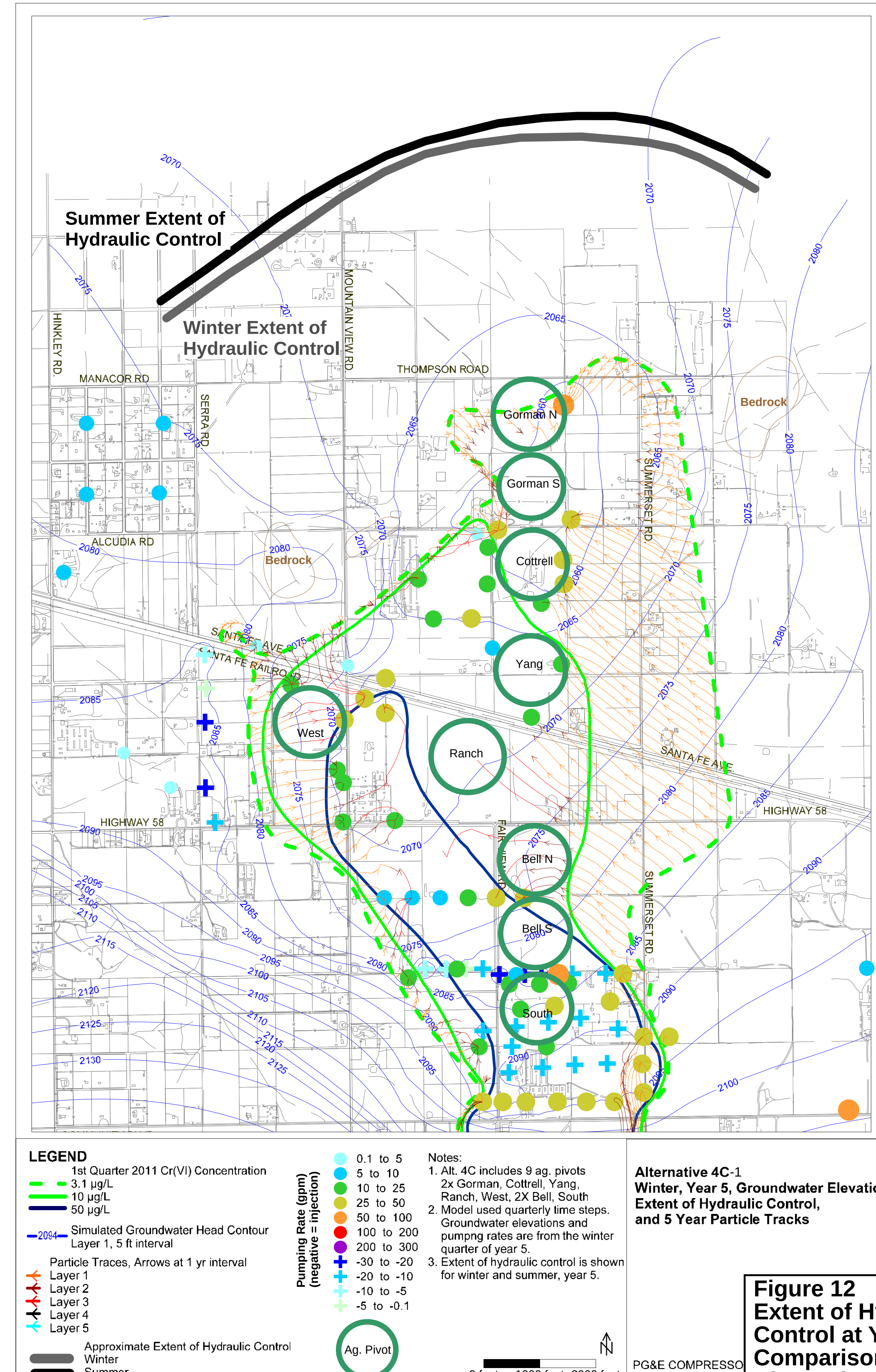
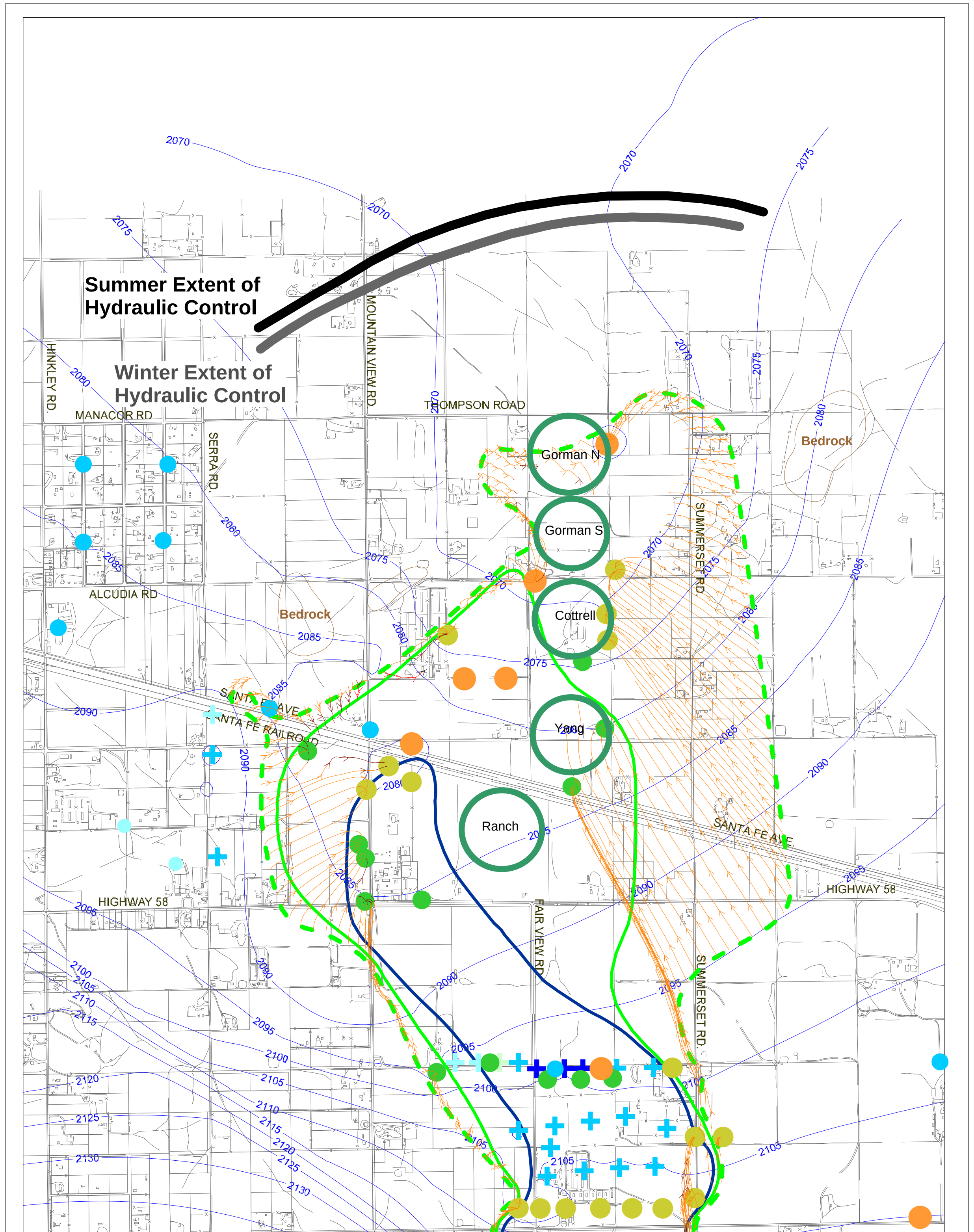


Figure 12
Extent of Hydraulic Control at Year 5 Comparison of Alternatives 4B and 4C-1

CH2MHILL®



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4B includes 5 ag. pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

0 feet 1000 feet 2000 feet

Alternative 4B
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

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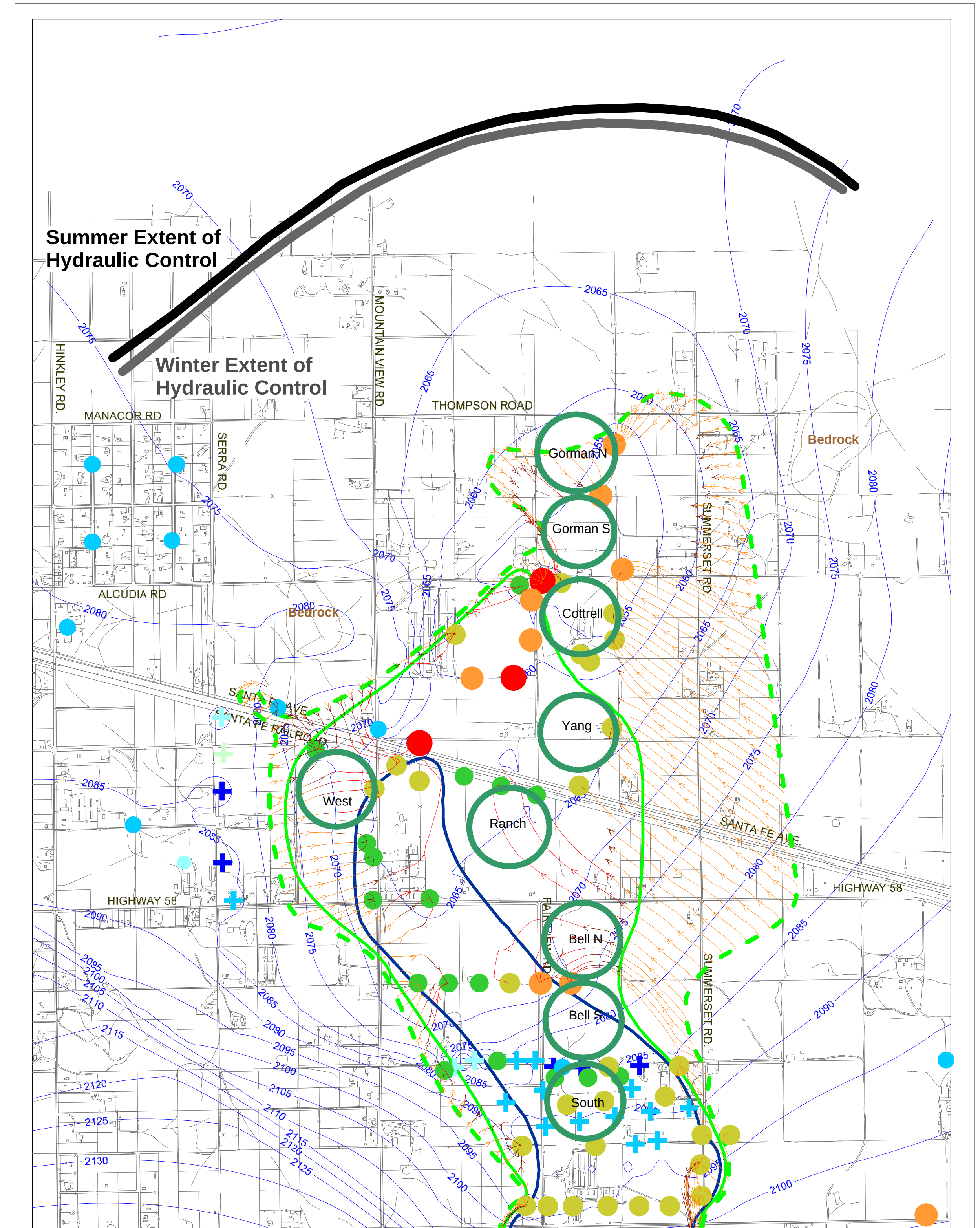


LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell, South
2. Model used quarterly time steps. Groundwater elevations and pumping rtes are from the winter quarter of year 5.
3. Alt. 4C' uses two-crop rotation at all ag. areas except DVD-LTU due to incompatibility with irrigation infrastructure. This increases fall and winter pumping rates.
4. The extent of hydraulic control is shown for winter and summer, year 5.

0 feet 1000 feet 2000 feet

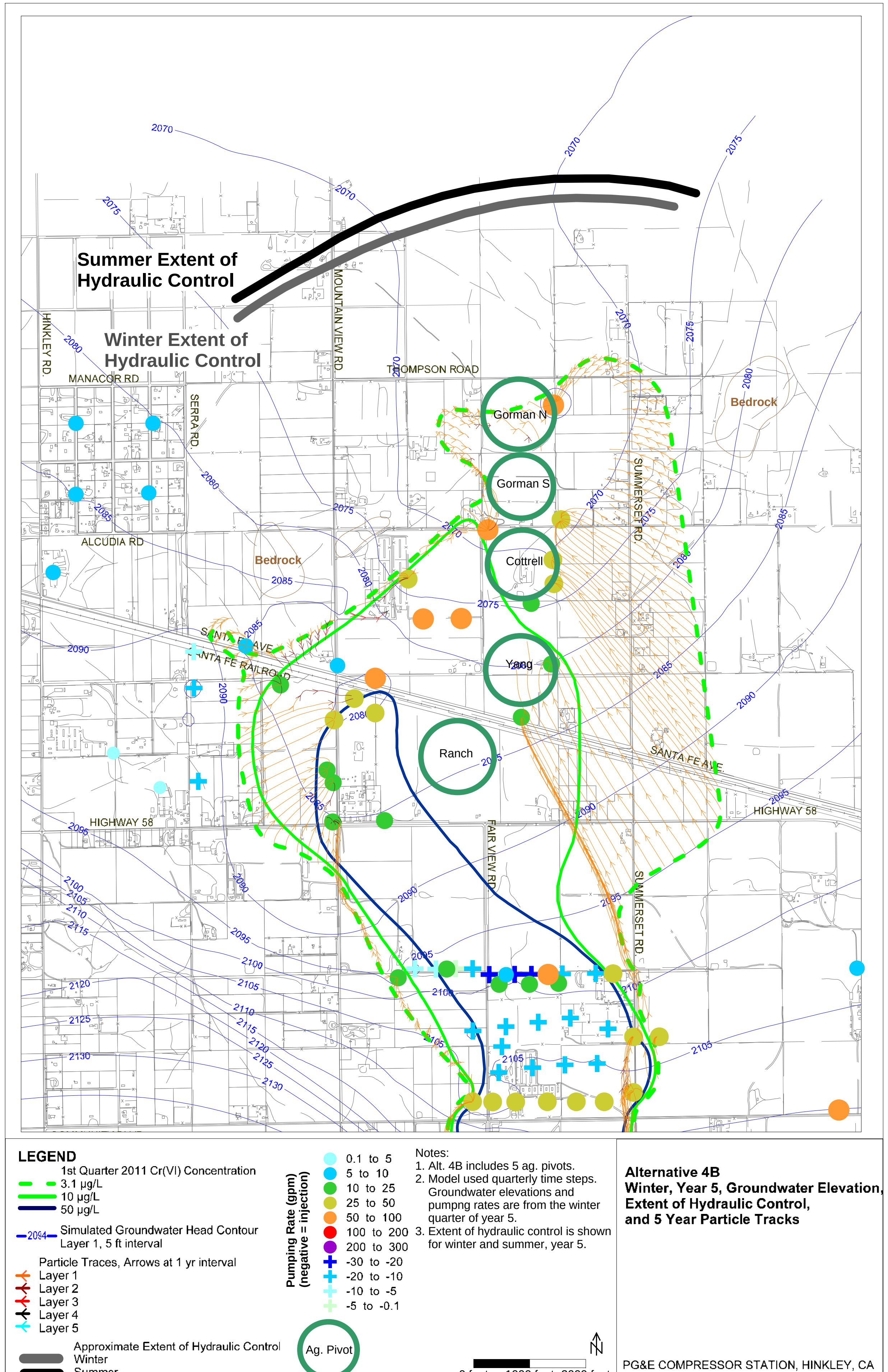
Alternative 4C-2
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR
Aug. 23, 2011

Figure 13
Extent of Hydraulic Control at Year 5 Comparison of Alternatives 4B and 4C-2

CH2MHILL

ES082411032322RDD_13



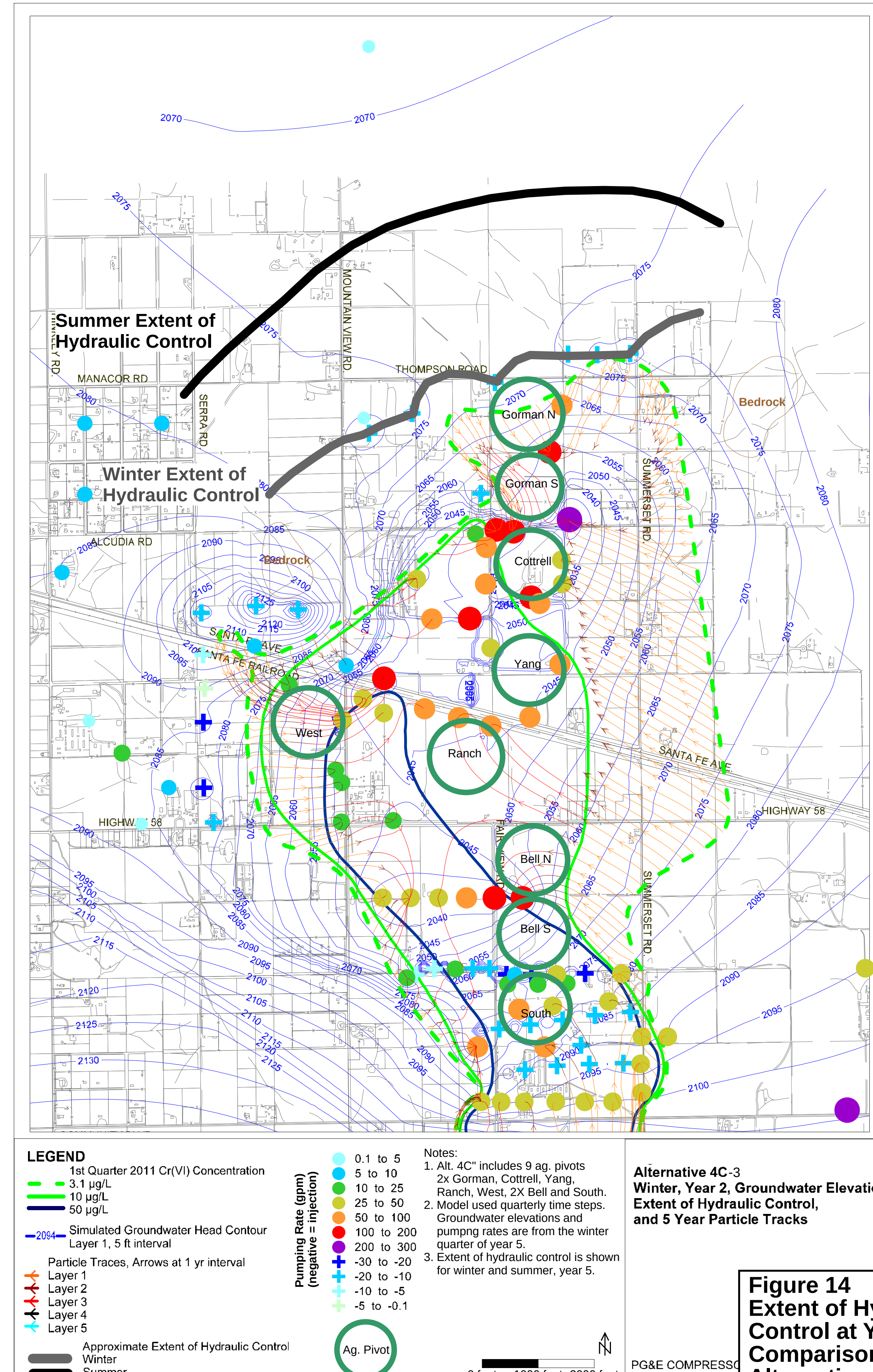
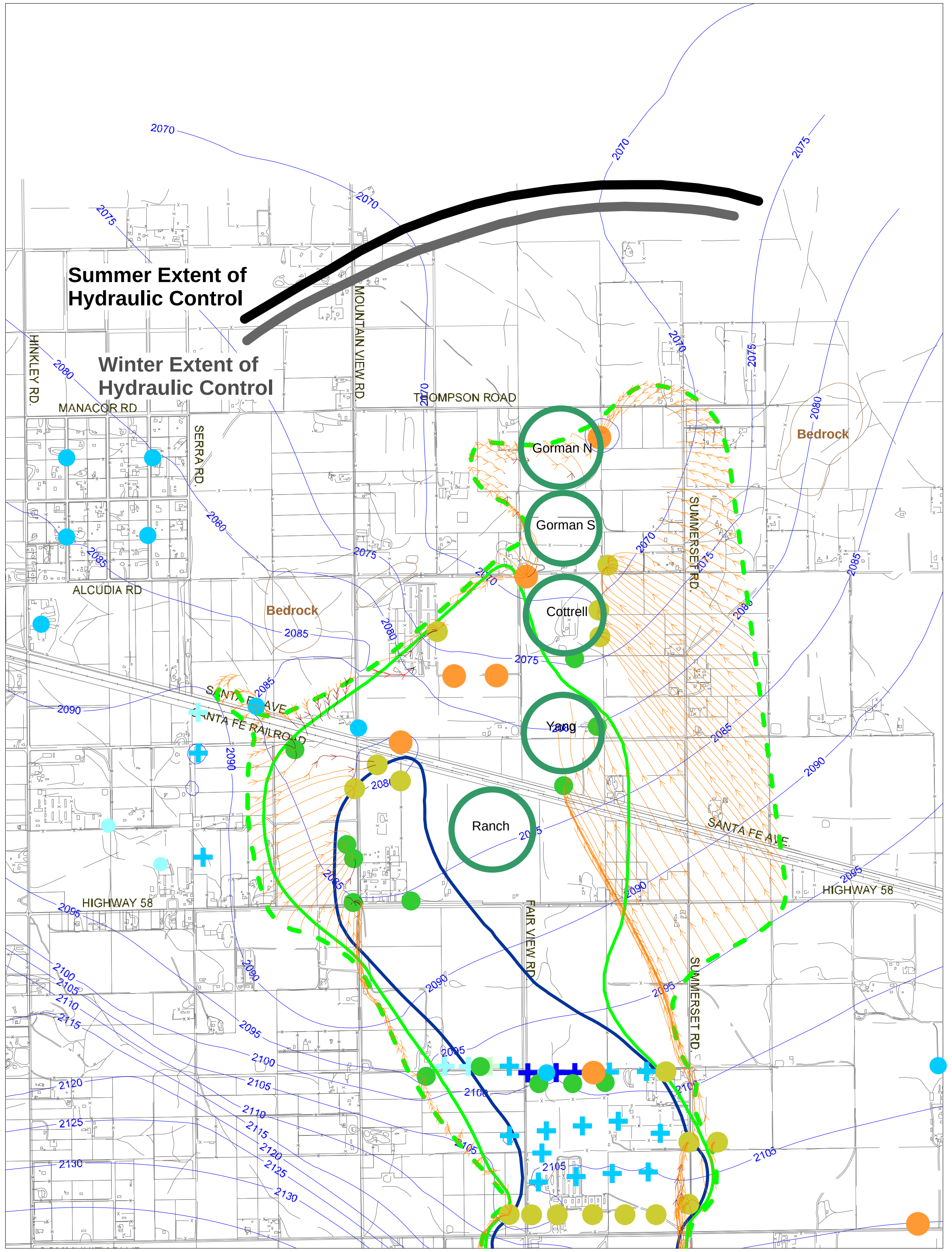


Figure 14
Extent of Hydraulic Control at Year 5 Comparison of Alternatives 4B and 4C-3

CH2MHILL



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

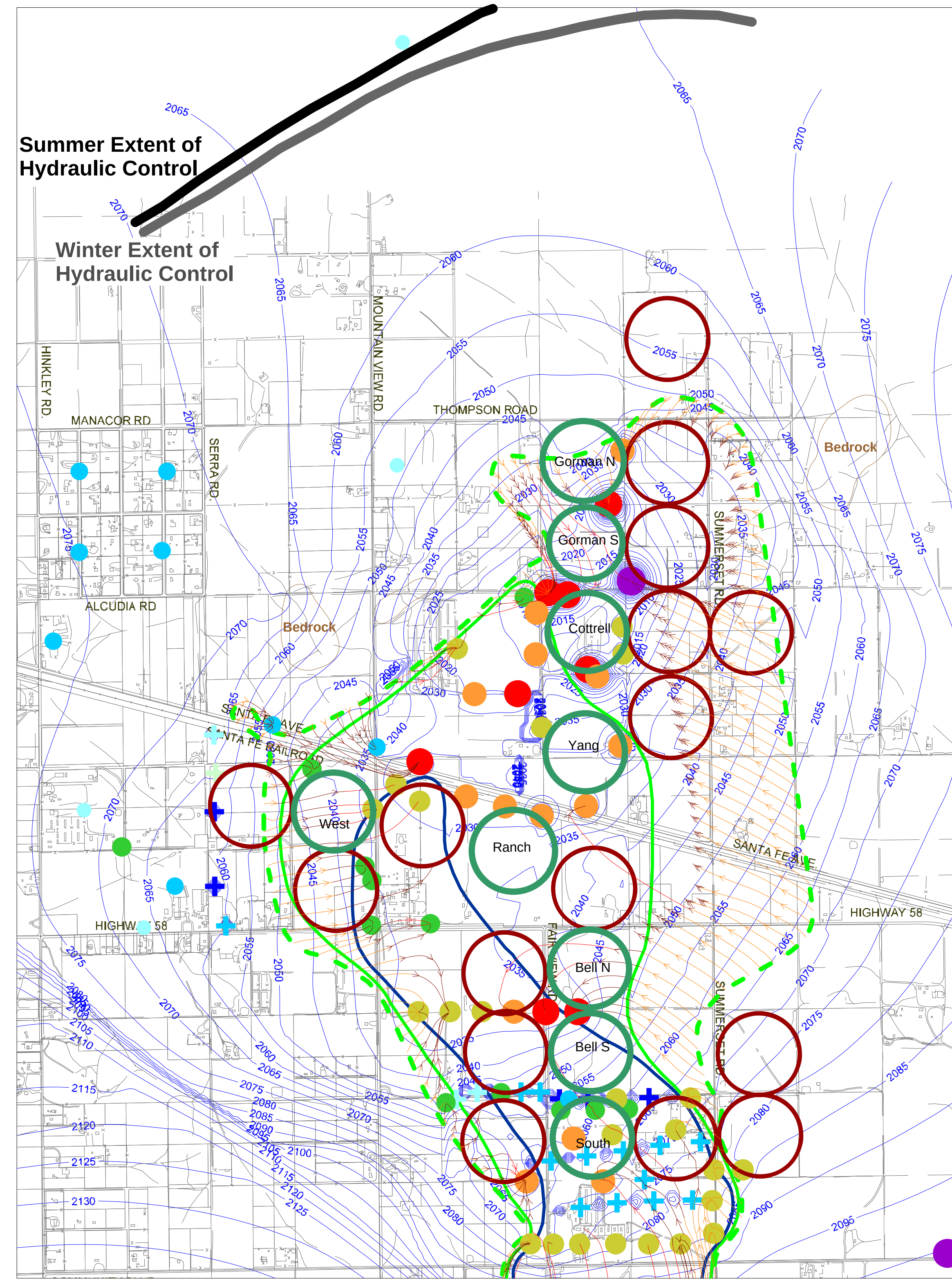
Ag. Pivot

Notes:
1. Alt. 4B includes 5 ag. pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

0 feet 1000 feet 2000 feet

Alternative 4B
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011
CH2MHILL



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot
Winter Only Ag. Pivot

Notes:
1. Alt. 4C" includes 9 full-time ag. pivots and 16 fall & winter-only pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

0 feet 1000 feet 2000 feet

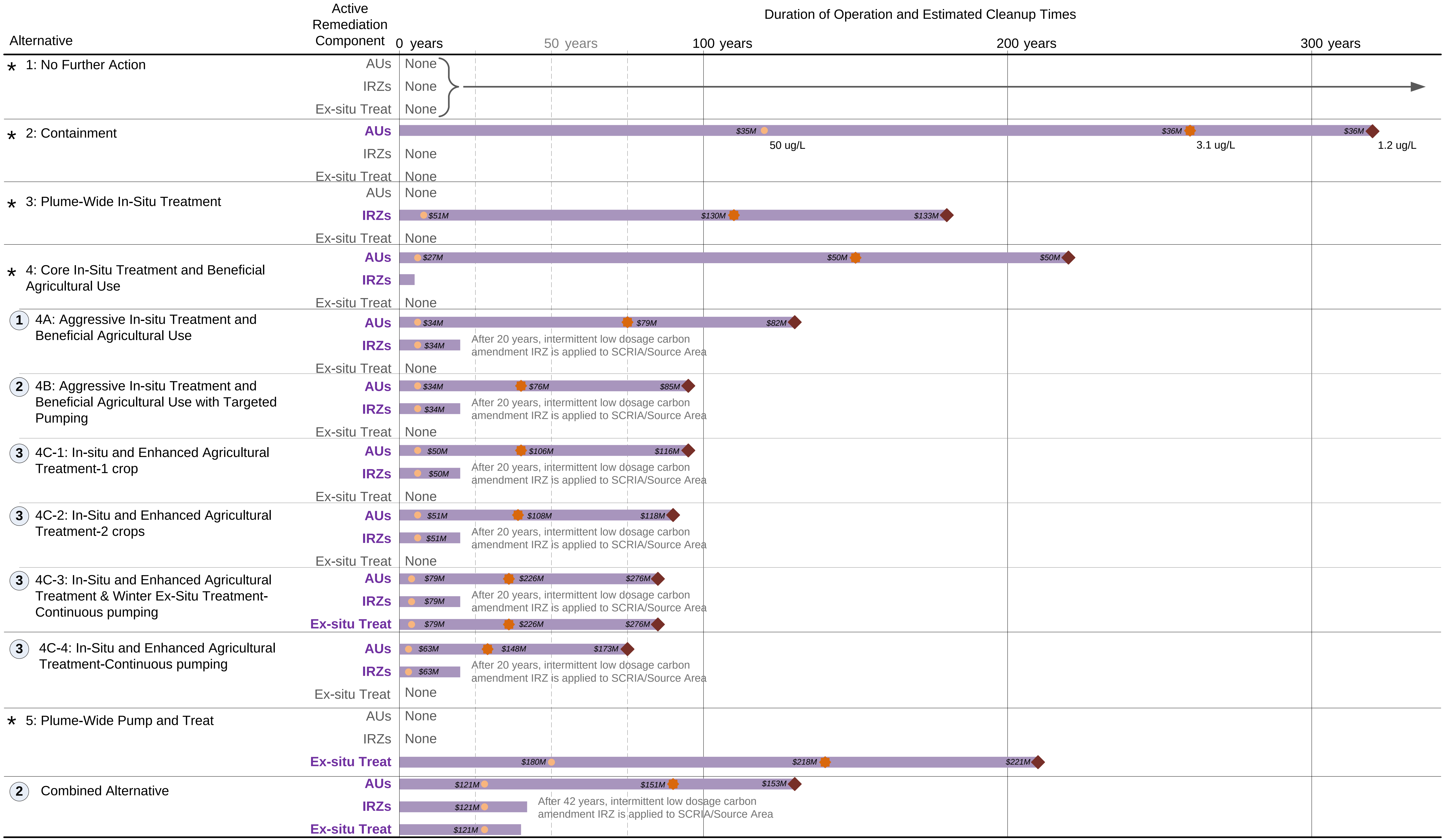
Alternative 4C-4
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION
Aug. 23, 2011

Figure 15
Extent of Hydraulic Control at Year 5 Comparison of Alternatives 4B and 4C-4

CH2MHILL

Figure 16 Feasibility Study and Addenda Remedial Alternative Summary – Active Remediation Components and Durations



* Alternative per Feasibility Study (FS; 8/30/2010)

(2) FS Addendum Number

AUs = Agricultural Units

IRZs = In-situ Reactive Zones

Ex-situ Treat = Includes pump and ex-situ treatment system

● 50 ug/L
✹ 3.1 ug/L
◆ 1.2 ug/L**

Durations required to achieve the noted criteria. Durations were based on the time when the starting plume area (within the respective Cr(VI) contour interval) is reduced by 99 percent in model Layers 1 and 3 (based on the modeling of alternatives).
** to the extent achieving this criteria is feasible

● $153M Net present value (NPV) cost est. in millions (M) to reach criteria (rounded)

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SEPTEMBER 2011 Pacific Gas and Electric Company, Hinkley, CA (36385-008)

HALEY & ALDRICH

APPENDIX A

Detailed Response to LRQCB 13 July 2011 Letter

The California Regional Water Quality Control Board – Lahontan Region (Water Board) submitted comments in Board Order No. R6V-2011-0047, dated 13 July 2011 to the Feasibility Study (FS) for the Pacific Gas and Electric Company (PG&E) Compressor Station in Hinkley, California (Site). This appendix includes each comment followed by a full technical response as it relates to the groundwater remediation alternatives (various configurations of Alternative 4C) included in Addendum #3 to the FS. The responses were prepared by ARCADIS, CH2MHILL, Stantec, and Haley & Aldrich, Inc.

Water Board Comment #1:

Evaluation of best available technology and basis for alternative elimination:
Additional information is needed to support the selection of the alternatives presented in the FS. The FS contains Table 6-1 showing a technology-screening matrix, which includes screening justifications for each technology. Some of the justifications are straightforward and require little additional explanation; for example, technologies like air sparging that aren't applicable to metals remediation.

However, other technologies that may work for chromium remediation should have additional justification for why they were not selected, or be re-examined for inclusion into the upcoming Alternative 4C. For example, some of these technologies may be appropriate to include in Alternative 4C as an element of a contingency plan to irrigation, to maintain year-round capture zones, and to hasten cleanup.

Response to Water Board Comment #1, Evaluation of Chromium Treatment Technologies for Inclusion into Alternative 4C:

PG&E has re-examined six technologies as part of this response to comments, as an element of a contingency plan to irrigation, and as part of one of the alternatives considered in Addendum #3. This discussion first provides an evaluation of water treatment technologies that could be used to maintain year-round extraction rates and subsequently provides additional information of why the specific technologies mentioned in Water Board Comments #1a through #1d were not recommended as components of other remedial alternatives.

The water treatment technologies re-evaluated for potential use to provide year-round summer extraction rates for inclusion into Alternative 4C include strong and weak base anion exchange (Comment #1a), membrane biofilm reactors (Comment #1b), evaporation ponds (Comment #1c), chemical reduction / precipitation (Comment #1) and reverse osmosis (Comment #1).

The technologies listed above are all methods for extracted water management. These methods are potentially applicable in the new alternative 4-C3, specifically to manage winter pumping flows that could not be reasonably managed via agricultural units (AUs).

Expected Winter Treatment Groundwater Extraction Rate

Appendix A-Table 1 provides the expected winter treatment groundwater extraction rate in gallons per minute (gpm) for each AU and the total flow rate. For Alternative 4C-3, agricultural wells will be pumped at a constant rate equal to the maximum predicted quarterly rate during regular seasonal operation (an equivalent rate for Alternatives 4C-1 and 4C-2). This is equal to 252 gpm per 32 acre AU. Surplus water, or the quantity of pumped water in excess of summer agricultural use was calculated by subtracting Alternative 4C-2 (two-crop scenario maximizing winter application rates) quarterly pumping rates from Alternative 4C-3 or 4C-4 pumping rates. This surplus water represents the quarterly average rate to be applied to additional agricultural fields or treated ex-situ.

Expected Winter Treatment Influent Water Quality

Appendix A-Table 2 provides the expected water quality for extracted groundwater that will require ex-situ treatment in Alternative 4C-3 and/or the contingency plan. Groundwater concentrations at the Gorman and Cottrell AUs were based on samples collected from the extraction wells that serve these AUs. For new AUs, concentrations from nearby wells were used in the calculations. Treatment system influent concentrations were estimated by determining the fractional flow contribution from each AU to the total flow and then calculating the total mass for each constituent based on representative well concentrations and the associated flow fraction.

Ex-Situ Treatment Process Options and Screening

Ex-situ groundwater treatment technologies were screened to identify potential process options and treatment technologies that could be incorporated into Alternative 4C-3. Treatment technologies were evaluated based on the expected groundwater extraction rates and water quality. Appendix A-Table 3 provides a screening matrix for treatment technologies that pertain to ex-situ treatment. These technologies were originally evaluated and screened in Table 6-1 of the FS (Haley & Aldrich, 2010).

Potential water treatment options considered for excess winter flow in Alternative 4C-3, in addition to chemical reduction/precipitation proposed in the FS include: Membrane Biofilm Reactor; Strong-Base Anion Exchange; Reverse Osmosis; and Weak Base Anion exchange. Each of these technologies is discussed below.

Membrane Biofilm Reactor (MBfR) and Strong Base Anion Exchange (SBA) were eliminated due to insufficiently demonstrated technical effectiveness and implementability. These technologies were also not selected as the preferred ex-situ treatment process for other alternatives in the FS for many of the same reasons they were not selected as the preferred process for Alternative 4C-3. The response to Water Board Comments #1a and #1b provide further detail on why SBA and MBfR were not selected as preferred treatment process.

Reverse Osmosis (RO) was not selected due to poor implementability; this process requires elaborate pre-treatment, is very energy intensive, and produces a significant waste stream (brine) that requires off-Site transportation and disposal. Pilot-testing would be required to better evaluate implementability. RO also has a very high relative capital and annual cost. As a result, RO is not recommended as an ex-situ treatment process for Alternative 4C-3.

Chemical reduction/precipitation is recommended as a potential supporting or contingency ex-situ treatment process for water generated by Alternative 4C-3 that cannot otherwise be treated agriculturally. This process has been demonstrated to reach required Cr(VI) discharge concentrations without the potential of producing harmful byproducts. The process does not require a large footprint area and solid and liquid waste streams are more manageable than other ex-situ processes, like RO and ion exchange. Chemical reduction/precipitation would still require pilot-testing prior to implementation to determine specific process design parameters and implementability constraints. Chemical reduction/precipitation is recommended as a contingency or supporting process if there is not sufficient area to fully treat winter-extracted water using AUs only.

Weak Base Anion exchange (WBA) is recommended as a potential supporting or contingency ex-situ treatment process for water generated by Alternative 4C-3 that cannot otherwise be treated agriculturally. Primary advantages to WBA are general operation simplicity and process components that can be obtained and assembled in a more temporary/modular configuration. The WBA technology also has potential drawbacks, which include the potential concentration of other anions from the influent stream and potential formaldehyde and N-nitrosodimethylamine (NDMA) formation in effluent and spent resin disposal. Pilot-testing may be required to better evaluate implementability.

Treated Water Disposal

Injection wells and on-Site evaporation ponds were evaluated as the means to dispose of treated water generated during implementation of Alternative 4C-3. Evaporation ponds would mostly accumulate water during the fall and winter and evaporate the accumulated water in the spring and summer. Ponds would be designed with impermeable liners and leak detection systems to prevent infiltration and controls to prevent access by unauthorized personnel or wildlife. The ponds would be sized such that all water would be completely evaporated prior to the beginning of accumulation after the end of the summer. Remaining solid material (sludge) accumulating in the pond would require removal at regular intervals and on-Site or off-Site disposal, depending on the chemical and physical characteristics of the sludge.

At the flow rates estimated for Alternative 4C-3, a minimum of approximately 250 acres would be required to adequately store and evaporate accumulated water. Evaporated water does not serve any beneficial use to the remediation project or community, such as enhancing hydraulic control or agricultural use. Appendix A-Attachment B provides preliminary pond sizing calculations (at an evaluation level, not for design or construction). The large required area, lack of beneficial use of the water, possible sludge disposal, and access control issues make evaporation ponds relatively infeasible for disposing treated water generated by the fixed rate, year-round scenario (Alternatives 4C-3 and 4C-4).

Instead, for Alternative 4C-3, groundwater would be treated ex-situ and reinjected to enhance hydraulic control and facilitate cleanup. Treated water injection locations assumed for Alternative 4C-3 are shown on Figure A-1. Based on the modeling results, treated water would be injected into 10 wells located north of the plume and 9 wells located south and upgradient of the Compressor Station. For the purpose of evaluating the effectiveness of Alternative 4C-3, it was assumed that groundwater would be reinjected during 6 months of the year, that excess water generated from agricultural wells north of Highway 58 would be injected north of the plume, and excess water generated from agricultural wells south of Highway 58 would be injected south of the plume. Assumed injection rates, by area, are included in Figure A-1.

Water Board Comment #1a:

Ex-Situ Treatment Using Ion Exchange Units:
According to the FS, weak base anion (WBA) resins may be effective at the Hinkley site. This technology should be considered for use in the diffuse plume area to augment irrigation use and maintain year-round capture zones.

Response to Comment #1a:

Ion Exchange

As discussed in the FS, ion exchange is a potentially viable technology for treating the Cr(VI) concentrations in the Hinkley groundwater. In the ion exchange process, the Cr(VI) is removed by exchange with another inert ion. There are two categories of ion exchange systems:

- Strong base anion (SBA) exchange; and
- Weak base anion (WBA) exchange.

A. Strong Base Anion Exchange

The SBA exchange process is greatly influenced by sulfate concentrations. The SBA resins have a higher selectivity for sulfate compared to other anions. The selectivity of SBA resins for the various anions in decreasing order is shown below:

- SO_4^{2-}, CrO_4^{2-}, PO_4^{3-}, HSO_4^-, NO_3^-, Br^-, Cl^-, HCO_3^-, F^-, OH^-

Hinkley groundwater has high concentrations of sulfate (relative to comingled Cr(VI) concentrations) that severely affect the performance and feasibility of SBA exchange process. The Lawrence Livermore National Laboratory (LLNL) evaluated the use of SBA resins to remove Cr(VI) from groundwater. At the LLNL Site, the average Cr(VI) and sulfate concentrations were respectively 34 micrograms per liter (μg/L) and 38 milligrams per liter (mg/L) (LLNL, 1997). For the LLNL study, the breakthrough for Cr(VI) occurred at less than 6,000 bed volumes, which translate to approximately 10 days of run time at 2.5 minutes contact time. The City of Glendale evaluated several SBA resins for treating groundwater with Cr(VI) and sulfate concentrations of 100 μg/L and 87 mg/L (WRF Report, 2007). The number of bed volumes for breakthrough was 400 to 1,700, which translate to approximately 1 to 3 days of run time. At the Hinkley Site, Cr(VI) concentrations in the diffuse downgradient area of the plume can range as low as approximately 2.5 to 4.5 μg/L with sulfate concentrations in the range of 186 to 700 mg/L. Sulfate concentrations are several orders of magnitude higher than Cr(VI) concentrations throughout the diffuse downgradient plume. Under these groundwater conditions, anticipated run time before breakthrough for SBA resins is less than one day.

The SBA exchange process also results in "chromatographic peaking" of undesirable ions such as nitrate and Cr(VI). Chromatographic peaking is a phenomenon where less preferentially exchanged ions (e.g., nitrate, phosphate, chromium) appear in the effluent at higher concentrations than they appear in the influent as they are released from ion exchange resin in exchange for more strongly held ions (e.g., sulfate) when the SBA resin is operated beyond the breakthrough time periods. Chromatographic peaking for SBA resins and Cr(VI) removal has been demonstrated in previous pilot studies (McGuire M.J. et al., 2006). Rigorous pilot testing, continuous monitoring and operation of SBA vessels in series are necessary to avoid chromatographic peaking. Due to interference from sulfate and expected short time to breakthough, the SBA exchange process is not recommended for further consideration.

B. Weak Base Anion Exchange

The WBA exchange process is less sensitive to co-occurring ions. However, the potential feasibility of WBA exchange process for Cr(VI) removal from Hinkley groundwater has not been evaluated at bench or pilot-scale level. Extensive pilot testing of the WBA exchange process is recommended to evaluate technical effectiveness and implementability factors described below.

- The performance of the WBA resins is strongly influenced by factors such as the influent water pH. Recent studies indicate the optimum pH for Cr(VI) removal is approximately 5.5 to 6.0. Testing is necessary to confirm and optimize the pH range for Hinkley groundwater.
- In the WBA exchange process, the Cr(VI) can be removed by two mechanisms: ion exchange process and reduction to trivalent chromium [Cr(III)]. The mechanism of removal for the Hinkley groundwater will need to be determined to design a treatment system that can reliably lower the Cr(VI) concentrations to the required target concentrations.
- Recent studies on WBA resins by the City of Glendale indicated potential leaching of harmful byproducts such as formaldehyde and NDMA. The United States Environmental Protection Agency (USEPA) is planning to regulate NDMA or nitrosamines in drinking water in the near future.
- The WBA resins could also accumulate other ions such as radionuclides, which would require special handling and disposal of the spent resin.

Rigorous pilot testing that addresses the technical issues of WBA resins needs to be conducted prior to full-scale implementation. Pending pilot test results that provide data required to fully evaluate technical effectiveness and implementability, WBA exchange cannot be recommended as the preferred ex-situ treatment process for Alternative 4C-3, but may be feasible for the Contingency Plan due to the simplicity of implementation.

Water Board Comment #1b:

Ex-situ Anaerobic Bioreactor (e.g., Membrane Biofilm Reactor [MBfR]):
According to the FS, this technology showed promise in bench-scale tests at the Hinkley site. This technology should be considered for use in the diffuse or down-gradient plume areas as an element of a contingency plan to irrigation, and to maintain year-round capture zones.
Response to Comment #1b:

Membrane Biofilm Reactor (MBfR)

As described in the FS, MBfR is a potentially viable technology for treating relatively low (i.e., ≤ 50 μg/L) Cr(VI) concentrations in groundwater. MBfR was retained as an ex-situ treatment process option during the initial technology screening in the FS, but was not selected as the preferred process option for remediation alternatives that would include ex-situ treatment.

Bench-scale testing conducted by PG&E in 2009 showed proof-of-concept of the process's technical effectiveness for removing Cr(VI) in groundwater. However, MBfR has not yet been fully implemented at a remediation site to treat Cr(VI). As of the last review of the technology, MBfR was being pilot tested for removal of dissolved perchlorate and nitrate in groundwater (based on verbal communication with the vendor). The technology is currently out to market only as a nitrate removal process in the wastewater treatment industry (marketed as the Aronite® process by Applied Process Technology, Inc.). As a result, the technology cannot be fully evaluated for technical effectiveness. At a minimum, the following technical effectiveness factors would need to be better understood before it could rank as "High" in relative technical effectiveness:

1. Treatment to discharge limits: MBfR has not been proven to remove Cr(VI) to project discharge limits at full scale; and
2. Reliability: This technology has not been implemented at a scale similar to the scale described in the Hinkley FS. It is not known whether this process could operate reliably for the extended period of time described in the FS.

While MBfR shows promise as an innovative biological ex-situ treatment process for both Cr(VI) and nitrate, the fact that the technology has not yet been fully implemented at an environmental remediation site does not allow it to be evaluated for implementability without significant prior pilot testing. There are a number of implementability factors that cannot be evaluated due to the lack of any operational history of this technology at a remediation site of similar scale and nature to the Hinkley Site. At a minimum, the following implementability issues would need to be better understood before it could rank as "High" or even "Moderate" in relative implementability:

1. Hydrogen storage and management: MBfR uses diffused hydrogen gas as the electron donor. Hydrogen would have to be delivered and stored or generated on-Site. As MBfR has never been implemented at the scale required at the Hinkley Site, it is currently infeasible to fully evaluate the implementability constraints of effectively and safely delivering, storing, or generating the required quantity of hydrogen gas.
2. Post-MBfR secondary treatment for injection: MBfR generates biomass as part of the process. This excess biomass is usually sloughed into the water stream. As treated water would be returned to groundwater via injection wells, the suspended biomass would likely have to be removed to prevent biofouling in injection wells. Without extensive pilot testing, biomass generation cannot be estimated and the appropriate secondary treatment process required to mitigate biomass generation cannot be evaluated.

The technology requires extensive pilot testing to evaluate technical effectiveness and implementability factors described above. Without this information, MBfR cannot be recommended as the preferred ex-situ treatment process relative to other processes.

Water Board Comment 1c:

Discharge/Injection – Discharge to Evaporation Ponds:
This approach should be considered as an element of a contingency plan to irrigation. Ponds could be used to store water for later irrigation use.

Response to Comment #1c:

Evaporation ponds for temporary storage of extracted water were evaluated as a contingency to injection or agricultural application. Evaporation ponds would be designed with impermeable liners to prevent infiltration of stored water, a leak detection system, and access controls to prevent access to the ponds by unauthorized personnel or wildlife. The ponds would possibly require classification as permitted Waste Management Units, based on the quality of the stored water. Ponds would require large surface areas to completely evaporate stored water in a reasonable time. Assuming flow rates from Alternative 5 of the FS, a minimum of approximately 330 acres of storage ponds would be required to evaporate extracted water within one year. Rough (evaluation level, not for design or construction) pond sizing calculations are included as Appendix A-Attachment A.

The concentration of dissolved constituents would increase as stored water evaporates, possibly requiring further treatment or off-Site disposal of remaining concentrated water or sludge. Evaporated water would not be put to beneficial use, such as agricultural use, or injected to enhance plume control. It is more feasible to treat, irrigate, or otherwise actively manage extracted water at the time of extraction rather than to store it on-Site.

Water Board Comment 1d:

In-Situ Physical/Chemical Treatment – In-Situ Chemical Reductant: Provide a detailed explanation why chemical reductants (e.g., calcium Polysulfide, sodium dithionite, ferrous iron + sulfur-based reductant, nano-scale zero-valent iron) were excluded as part of the remedy for the source zone, and why the use of organic carbon amendments alone are considered more appropriate.

Response to Comment #1d:

Several different reagents, including sodium dithionite, a chemical reductant, were considered for in-situ treatment in the bench testing phase of the project, prior to pilot study implementation and FS preparation. Calcium polysulfide was screened out prior to bench scale testing due to potential problems with precipitation in-well, uncertainty of nitrate treatment, and potential increased sulfur content of the aquifer. Zero-valent iron (ZVI) was screened out due to cost and in-situ delivery challenges (CH2M Hill, 2004).

The bench testing results indicate that the organic carbon substrates (e.g., emulsified vegetable oil, lactate, and ethanol) and sodium dithionite are effective reagents for the treatment of Cr(VI) in groundwater (CH2M Hill, 2004). The organic carbon substrates were retained for pilot testing over sodium dithionite based on safety, ease of handling, material properties, ability to deliver to the aquifer, permitting, and nitrate removal considerations (CH2M Hill, 2004).

Subsequent implementation of in situ treatment with organic carbon substrates, from 2004 to present, has demonstrated effective treatment of Cr(VI) in various locations across the Site, including high concentration source areas, as discussed in Section 4.3 of the FS (Haley and Aldrich, 2010). Based on the results of the bench and pilot scale testing at the Site, organic carbon substrates were retained for consideration for in situ treatment in the FS.

Organic carbon substrates are considered to be the most appropriate reagents for in-situ treatment at the scale proposed in the remedial alternatives. This conclusion is based primarily on the ease of reagent delivery, as discussed below, and treatment effectiveness. The potential to generate secondary byproducts and the relative costs of the various reagents were also considered.

Reagent Delivery

One of the most challenging aspects of in-situ treatment is reagent delivery within the aquifer (Payne et al., 2008), particularly at the spatial scales of the in-situ areas considered in the remedial alternatives presented in the FS. The ease of reagent distribution was therefore a primary consideration supporting the use of organic carbon substrates over chemical reductants for the pilot studies and in the FS.

Reagents which are very reactive will be consumed more quickly in the subsurface and are more difficult to distribute than less reactive reagents that are more slowly consumed. Chemical reductants, including calcium polysulfide, sodium dithionite, and ferrous iron, are very reactive in the subsurface (Amonette et al., 1994, Istok et al., 1999, Fruchter et al., 2002, Wazne et al., 2007). For example, the kinetics of dithionite consumption is on the timescale of minutes (Istok et al., 1999). In contrast, organic carbon consumption rates are on the timescale of days. The slower consumption rates of the organic carbon substrates allow them to persist in the subsurface and be distributed to greater distances from injection locations. Central Area data demonstrates the distances and travel times over which organic carbon substrates, i.e., ethanol and lactate, can be distributed at the Site. Organic carbon has been distributed to the CA-MW-100 series and CA-MW-200 series wells located approximately 75 to 200 feet and several weeks of travel from the injection locations (CH2M Hill and ARCADIS 2011).

A second consideration for reagent distribution is the potential for clogging the aquifer formation, which limits the ability to inject and distribute reductants. Sulfide- and ferrous iron-based reagents may oxidize to elemental sulfur and ferric iron precipitates, respectively, (Fruchter, 2002, EPA, 2000) which can limit injectability much more rapidly than the gradual build up of fouling materials with organic carbon substrates. A combination of ferrous iron with another reductant such as sodium dithionite (Su and Ludwig, 2005) can be used to limit the immediate oxidation of ferrous iron in the aquifer, but the distribution would suffer the same limitations as dithionite alone, discussed above.

Nanoscale zero valent iron (nZVI) distribution is limited by the agglomeration of nZVI particles and incorporation into aquifer solids; this makes it difficult to distribute nZVI via injections for in-situ treatment. Use of ZVI in permeable reactive barriers (PRBs) is not considered a suitable method for source mass treatment; such use was assessed separately in the FS.

Treatment Effectiveness

Organic carbon substrates are just as effective and aggressive as chemical reductants in treating high Cr(VI) concentrations in source areas. Although organic carbon substrates are more mildly reactive than chemical reductants, sufficient reducing conditions for source mass treatment are easily generated with organic carbon substrates. For example, in the Source Area, Cr(VI) concentrations were reduced from greater than 1,000 μg/L to less than 0.2 μg/L at SA-SM-05S within approximately one month of the startup of in-situ injections of sodium lactate of the Source Area In-Situ Reactive Zone (IRZ) (CH2M Hill and ARCADIS 2011). Similarly, in a pilot test conducted at the PG&E Topock Compressor Station in Needles, California, Cr(VI) concentrations of up to 8,000 μg/L were rapidly treated to less than 0.2 μg/L in a pilot test using ethanol (ARCADIS, 2009).

Organic carbon substrates are also as effective as chemical reductants for treatment of Cr(VI) that may be present in immobile porespace in source areas. Treatment of Cr(VI) in immobile porewater is a diffusion driven process, i.e. Cr(VI) must diffuse into mobile porespace or reagents must diffuse into immobile porespace for treatment reactions to occur, rather than a function of the strength of reducing conditions established. These diffusion-driven processes are expected to be comparable for chemical reductants and organic carbon substrates.

Generation of By-products

For both organic carbon substrates and soluble chemical reductants, reduction of aquifer minerals and associated dissolution of iron, manganese, and arsenic will occur with in-situ treatment implementation. Due to the highly reactive nature of chemical reductants, concentrations of metals generated may be comparable to or greater with chemical reductants than with the use of organic carbon substrates, as indicated in EPA comments on the FS (Ludwig, 2011). For example, injection of sodium dithionite is sometimes followed by an extraction phase where several times the injected volume of reagent is extracted due to the production of elevated concentrations of byproducts as well as reagent reaction byproducts (Fruchter et al., 2000). In one field study, the concentration of manganese generated by injection of sodium dithionite was higher (30 mg/L, Khan and Puls, 2003), but on the same order of magnitude as in IRZ areas at Hinkley (maximum of 14 mg/L). The dissolution of metals with ZVI in a permeable reactive barrier would potentially be less than for other reductants.

In addition to dissolution of metals, some chemical reductants may also increase concentrations of other constituents that contribute to total dissolved solids. The reaction products of sodium dithionite include sulfite, thiosulfate, and sulfate (Amonette et al., 1994, Fruchter et al., 2000). Ferrous iron is often provided as ferrous sulfate, thereby increasing the concentration of sulfate through injections.

Cost

The relative cost and value of the various reagents were also considered for reagent selection. The cost of degradable organic carbon substrates is generally less than chemical reagents, thus further supporting the selection of an organic carbon substrate.

Water Board Comment #2a:

Propose operable units, rationales for units, remediation strategies and time frames for each unit. Consider separate operable units based on remediation strategies, geography, or priorities for action. Consider operable units for targeted pumping efforts where supply wells are affected.

Response to Comment #2a:

PG&E developed three Operable Unit (OUs) areas that cover the range of activities anticipated to be needed for the final groundwater remedy. The purpose of establishing the OUs was not to define compliance boundaries, but rather to identify areas where certain Site conditions generally exist where remediation activities have similarities and where common interim remediation goals or targets can be established to facilitate adaptive management and reporting.

Given the size and complexity of the Site, the definition of the conditions that are characteristic of a given OU will generally apply, but there will also be overlap in activities or conditions where OUs share a common boundary. Based on discussions with the Water Board, three OUs were established and include the following:

- OU1: In-Situ reduction and agricultural treatment area;
- OU2: Agricultural treatment area; and
- OU3: Monitoring area outside of OUs 1 and 2 (may include some remediation activities, if necessary).

The proposed boundaries of the OUs are shown on Figure 4 of Addendum #3. Table 3 of Addendum #3 provides a detailed definition of the general conditions that currently exist within each of the OUs, a description of the proposed remediation processes to be implemented and a compliance with the FS Remedial Objectives and Interim Remediation Targets (IRTs) developed specifically for the adaptive management of remediation activities within each OU.

Lastly, assessment of the northern extent of the chromium plume to background levels is currently ongoing. PG&E is working with the Water Board to finalize the plume characterization process. The OUs as defined herein take this ongoing assessment effort into account and should accommodate the final plume delineation. If the final plume delineation results are not adequately encompassed by the OUs as delineated and defined here, the OUs will be appropriately adjusted by the Water Board at that time.

A brief discussion of each of the OUs is presented below.

OU1: In-Situ Reduction and Agricultural Treatment Area

OU1 encompasses the southern portion of the Site and includes the source area/highest chromium concentrations in groundwater. The eastern, southern, and western boundaries of OU1 extend just beyond the chromium plume as defined by the 3.1 μg/L contour (Figure 4 of Addendum #3). The northern boundary of OU1 is located at Ashwood Road and is roughly coincident with the limit of groundwater chromium concentrations that exceed the maximum contaminant level (MCL) of 50 μg/L.

The focus of remediation within OU1 is primarily mass reduction. OU1 encompasses the Source Area and still contains the highest groundwater concentrations. In-situ Cr(VI) reduction through the use of IRZ technology, combined with hydraulic pumping, focus on localized Cr(VI) mass reduction and prevention of chromium concentrations exceeding the MCL from migrating into OU2. Since the IRZ approach generates temporary byproducts such as manganese, a goal for the operation of OU1 is to constrain byproduct migration within OU1 so that it can naturally attenuate or be treated locally if required. Although IRZ treatment is the focus within OU1, AUs are also used within the overall remedial approach.

Short- and long-term IRTs have been developed and are listed in Table 3 of Addendum #3. The primary objectives in operating the OU1 remediation systems are to:

- Achieve significant and consistent Cr(VI) reduction to initially achieve plume-wide MCLs followed by achieving background concentrations; and
- Maintain year-round plume capture.

Additional short-term (5 and 10 years) and long-term (beyond 10 years) IRTs and metrics are detailed in Table 3 of Addendum #3.

OU2: Agricultural Treatment Area

OU2 encompasses the northern portion of the Site and is generally characterized by lower concentrations of Cr(VI) that are mostly below the MCL (Figure 4 of Addendum #3). OU2 is also characterized by elevated nitrate concentrations in groundwater due to historical agricultural operations and historical/current dairy farming operations.

The focus of remediation within OU2 is initially plume containment pumping with AU treatment of the extracted water. Once plume capture is achieved, groundwater remediation to background will be the remediation focus. OU2 also makes use of limited fresh water injection along the northwestern portion of the plume to enhance inward plume gradients and assist in controlling plume migration.

Short- and long-term IRTs have been developed and are listed in Table 3 of Addendum #3. The primary objectives in operating the OU2 remediation systems are to:

- Maintain year-round plume capture; and
- Continue consistent chrome Cr(VI) removal via extraction and reduction via AUs to achieve background concentrations.

OU3: Monitoring Area Outside OU1 and OU2

OU3 was established around OU1 and OU2 primarily to serve as a monitoring zone during the groundwater remediation effort. OU3 generally extends beyond the southern and eastern limits of OU1 and OU2 by approximately one-half mile and the eastern limits by approximately one and one-half mile. To the north, OU3 extends approximately 3 miles beyond the February 2010 plume boundary. As mentioned above, assessment of the northern extent of the chromium plume is ongoing and in collaboration with the Water Board. The current northern boundary of OU3 anticipates defining the limit of chromium plume below Water Valley. If the chromium plume extends into Water Valley, PG&E will revisit the OU3 boundary with the Water Board at that time.

Although some exceptions do occur, groundwater chromium concentrations in OU3 are generally below 10 μg/L with many locations having concentrations below background. The northern area of OU3 contains elevated concentrations of nitrate in groundwater as a result of historical and ongoing agriculture and dairy farming operations.

If groundwater chromium concentrations in OU3 near OU2 require capture and treatment, extraction wells will be installed and AU treatment would likely be applied. AU treatment could be either applied in OU3 or the water conveyed to existing or new AUs in OU2. Localized nitrate concentrations would have to be evaluated to prevent the spreading of the existing nitrate plume. This decision would be made on a case by case basis as directed by the Water Board.

Water Board Comment 2b:

Develop short-term Remedial Action Objectives to be met at 5- and 10-year review periods to inform adaptive management.

Response to Comment #2b:

Table 3 of Addendum #3 provides the IRTs for 5, 10 and 11+ years for each OU and the metric that will be used to show compliance.

Water Board Comment #3a:

Provide additional details for the proposed remedial alternatives that are backed by evidence from a calibrated flow model, with clearly defined assumptions used in the fate and transport evaluation associated with the site conceptual model.

Response to Comment #3a:

Groundwater modeling results, including particle tracks, hydraulic gradients and capture zones, are presented for all of the new alternatives proposed in this addendum as well as Alternative 4B in Appendix B and Appendix C of Addendum #3. Details regarding the construction of the hydraulic flow and fate and transport model including key assumptions are detailed in Appendix G of this Addendum #3.

Water Board Comment #3b:

Provide particle tracking information to ensure that proposed alternatives would truly achieve stated outcomes.

Response to Comment #3b:

Particle tracking results for each alternative are shown on Figures B-1 through B-10 in Appendix B and are discussed in detail, together with data to support proposed hydraulic capture of the plume, in the response to Comment 3c.

Water Board Comment #3c:

Provide data to support proposed hydraulic capture of plume, and the continuous pumping rate needed to sustain maximum year-round hydraulic plume capture, and maximum rate of plume remediation.

Response to Comment #3c:

The Response to Comment #3c refers to Figures B-1 through B-11 which are included in Appendix B.

At the Hinkley Site, the Desert View Dairy (DVD) Land Treatment Unit (LTU) and Gorman AU best exemplify hydraulic capture concepts. Operation of the DVD LTU indicates that groundwater extraction is a viable method to achieve hydraulic capture. Groundwater modeling forecasts that extraction is capable of achieving capture of the target zone for cleanup (First Quarter 2010 plume boundary). These data and model forecasts are discussed in more detail below. The forecasted capture zones for most of the Alternative 4C variants far exceed the dimensions of the target zone for cleanup, whether they include continuous (constant year-round) or varying pumping rates. After four years of pumping (when capture zones and hydraulic gradients have become fully established under each scenario), the forecasted differences between summer and winter hydraulic control are small (and approximately equal) under each alternative, whether they assume constant or variable pumping. The sole exception is Alternative 4C-3, which relies on injection of treated groundwater in winter to maintain continuous year-round extraction. Because Alternative 4C-3 includes injection during the winter, this alternative has the largest difference in summer versus winter zones of hydraulic control after 4 years of pumping. The modeling results (discussed in detail below) indicate that a continuous pumping rate is not needed to sustain year-round optimal hydraulic plume capture.

Operation of the DVD LTU extraction wells, which have seen a general increasing trend in extraction rates as new wells have been installed and permit levels increased, is generating a large area of declining water levels ("cone of depression") which is now present in the upper aquifer in the area of the DVD LTU. In general, greater pumping results in large cones of depression and thus large zones of hydraulic control. Because summer pumping rates are greater than winter pumping rates, summer cones of depression are larger than those in the winter. In unconfined alluvial systems, steady-state water level conditions may take considerable time to develop, on the order of months or even years. Cones of depression and capture zones at the site change in response to variations in seasonal and intra-seasonal pumping rates, including changes in agricultural operations.

Figure B-11 shows groundwater level elevations and contours from the Second Quarter of 2011[1]. Estimated zones of hydraulic control (limit of capture) for both the DVD LTU and Gorman extraction wells are shown on Figure B-11, and indicate that much of the groundwater south of the DVD LTU is being hydraulically captured by DVD LTU wells, and most of the groundwater between the bedrock outcrops (north east of the DVD LTU and east of Gorman) is being hydraulically captured by Gorman wells.

The future anticipated capture zone will be larger than the current capture zone, as a result of the additional pumping and AUs planned under Alternatives 4C-1 through 4C-4. The combined annual average pumping rates for the proposed FS alternatives (4B and 4C-1 through 4C-3) range from 1,830 gpm to 2,829 gpm, which is two to four times the 716 gpm combined pumping rate for the DVD LTU extraction wells and Gorman agricultural supply wells in April 2011. To forecast the future hydraulic capture of the plume resulting from the range of pumping rates assumed under the alternatives presented in this Addendum #3, groundwater flow modeling was performed. The input parameters and calibration results for the flow model are described in Appendix G (see Response to Comment #3a).

Model-forecasted groundwater levels, zones of hydraulic control, and particle paths in the upper aquifer after approximately 1 and 4 years of pumping under Alternatives 4B, 4C-1, 4C-2 and 4C-3 are shown on Figures B-1 through B-10. Particle paths were simulated to start at the First Quarter (February) 2011 plume boundary, which is larger than the First Quarter 2010 plume boundary. Because conclusions regarding plume capture are made using the larger First Quarter 2011 plume outline, these modeling results also apply to the smaller First Quarter 2010 plume outline.

The model is set to run in a transient fashion that includes “stress period” durations of 3 months each for the entire period of the forecasting simulation. Under Alternatives 4B through 4C-4, extraction and agricultural supply pumping rates are assumed to adjust in accordance with AU capacity and agronomic demand each quarter of the year; the quarterly pumping rates input to the model are based on the different assumptions for each alternative, which change from season to season.

Figures B-1 through B-10 show forecasted groundwater levels at the end of winter (March) of the second and fifth simulated year (15 and 51 months into each simulation) following implementation of each alternative. March groundwater levels shown on these figures depict smaller simulated water-level drawdown and zones of hydraulic control in response to lower pumping rates and higher irrigation return flows compared with other seasons. Therefore, these figures illustrate conservatively small drawdown compared to the three other seasons. In response to the significant increases in groundwater extraction and AU water supply pumping proposed under Alternatives 4C-1 and 4C-2, which have similar agricultural unit and extraction well layouts, water-levels in the northern part of the chromium plume are projected to decline approximately 5 feet from current levels in the winter of simulation year 2, and 20 feet in the winter of simulation year 5. Under Alternative 4B, which assumes less pumping than Alternatives 4C-1 and 4C-2, groundwater level declines are forecasted to be less than 5 feet in winter of simulation year 2 and 10 to 15 feet in winter of simulation year 5, compared to April 2011

[1] Monthly average combined pumping rates at the time water levels were measured were 347 gpm and 369 gpm from the DVD LTU and Gorman agricultural extraction, respectively. Because these rates are below typical summer maximum pumping rates, the cones of depression around pumping wells are still developing in response to those increased rates (see Figure B-11).

groundwater levels (Figure B-11). In Alternatives 4C-3 and 4C-4, forecasted groundwater level declines range from 20 to 60 feet (compared to April 2011 groundwater levels), due to the increase in winter pumping (Figures B-7 through B-10).

Simulated groundwater pathlines shown on Figures B-1 through B-10 indicate the forecasted direction and distance of groundwater migration from the First Quarter 2011 plume boundary. The deviations in flow directions visible on the figures are in response to the simulated changes in pumping rates from quarter to quarter. Because the directions of forecasted groundwater pathlines are dominated by the average pumping rate assumed for each alternative, the net direction of groundwater movement is from the First Quarter 2011 plume boundary toward the extraction wells. Consequently, the First Quarter 2011 plume is forecasted to be captured by Alternatives 4B and each of the Alternative 4C variants. The modeled quarterly changes in pumping rates are not projected to result in loss of any part of the plume under these alternatives.

In addition to the particle traces, Figures B-1 through B-10 show the forecasted winter (minimum) extent of hydraulic control for each alternative pumping scenario, which corresponds to the groundwater level contours shown on each figure, and the summer (maximum) extent of hydraulic control. (Forecasted summer groundwater level contours are not depicted on Figures B-1 through B-10 because of the complexity of data presentation). Capture of the First Quarter 2011 plume is projected to be maintained through the winter following the first year of simulated pumping for the entire 4C suite of alternatives. The higher pumping rates assumed during the remainder of the year are forecasted to result in a much larger zone of hydraulic control than required for capture of the First Quarter 2011 plume. By the fifth simulated year of pumping, the growing zones of hydraulic control in winter and summer are forecasted to be much larger than the First Quarter 2011 plume, indicating a capture zone conservatively large compared to the known plume boundaries.

The data provided above, together with the associated modeling results for each proposed alternative presented on Figures B-1 through B-10, support the proposed year-round hydraulic capture of the First Quarter 2011 plume under the alternative pumping scenarios considered. Both the extents of hydraulic control and the particle traces shown on Figures B-1 through B-10 indicate that capture of the First Quarter 2011 chromium plume is forecasted to be maintained during both the summer (maximum) and winter (minimum) pumping seasons for the entire 4C suite of evaluated alternatives[2].

By summer of the first year following commencement of simulated pumping, the zones of hydraulic control for Alternatives 4B through 4C-4 are forecasted to completely envelop the First Quarter 2011 plume outline (Figures B-1 through B-10). The net annual direction of groundwater flow is toward the extraction and AU supply wells; therefore, the entire First Quarter 2011 plume boundary is forecasted to be in the capture zone of these wells under each alternative. After 51 months of the simulation, the zones of hydraulic control are forecasted to expand substantially under most alternatives and to cover

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[2] In some areas on the plume boundary, particles are forecasted to migrate slightly outside the First Quarter 2011 chromium plume outline initially, until the cones of depression associated with each well field have fully developed (Figures B-1 through B-10). This occurs regardless of whether pumping rates are constant year-round (4C-3 and 4C-4) or vary seasonally (4C-1 and 4C-2). However, the particles that initially migrate outside the plume boundary are forecasted to be quickly drawn back toward the extraction wells soon after each alternative pumping scenario is fully implemented and the full cone of depression has developed.

nearly identical areas in the winter and summer. As mentioned above, the exception is Alternative 4C-3, which assumes reinjection of most of the groundwater extracted during winter (following treatment at an ex-situ treatment plant).

Under Alternative 4C-3, groundwater reinjection effectively counteracts an equivalent volume of groundwater extraction on a Site-wide scale, resulting in smaller zones of hydraulic control than Alternative 4C-4. Therefore, Alternative 4C-3, which assumes continuous year-round pumping rates, does not increase capture of the First Quarter 2011 plume over Alternatives 4C-1 and 4C-2, which assumes varying pumping rates. The only significant differences between Alternative 4C-3 compared to Alternatives 4C-1 and 4C-2 are increased overall year-round pumping and associated increased drawdown at extraction and AU supply wells. However, the forecasted zones of hydraulic control under Alternative 4C-3 are smaller than under Alternatives 4C-1 and 4C-2 due to the effect of reinjection of much of the extracted groundwater.

The largest capture zones are forecasted for Alternative 4C-4, which has the highest year-round net extraction rate; although Alternative 4C-3 has the same amount of overall pumping as Alternative 4C-4, the reinjection results in a lower *net* extraction rate relative to Alternative 4C-4. However, the capture zones for Alternatives 4B, 4C-2, and 4C-4 are all forecasted to achieve year-round capture of the First Quarter 2011 plume boundary. Because the larger average year-round pumping rates of Alternative 4C-4 aren't necessary to achieve capture of the First Quarter 2011 plume boundary, the excess net extraction under Alternative 4C-4 could result in unnecessary drawdown of the water table over a broader area compared to Alternatives 4B and 4C-2. The excess net withdrawal may not be sustainable, may increase drawdown in the area to unacceptable levels and have a negative impact on other water users in the Hinkley area, including increased pumping lifts resulting in greater costs to pump groundwater.

Water Board Comment #3d:

More in-depth discussion is warranted to demonstrate through site studies how capture zones will be maintained year round.

Response to Comment #3d:

Please see Response to Comment #3c.

Water Board Comment #3e:

Consider decreasing distance between individual Central Area In-situ Remediation Zone (IRZ) wells for more effective remediation. or propose a monitoring program between Central Area IRZ wells to demonstrate area-wide remediation effectiveness from the SCRIA.

Response to Comment #3e:

An evaluation of Central Area IRZ data to date indicates that 150-foot well spacing has been sufficient across the majority of the IRZ, particularly on the east and west ends of the system. A treatment gap remains in the center of the system which may require additional injection wells to decrease well spacing. A discussion of how system optimizations have improved treatment performance with the existing 150-foot well spacing since the FS was prepared and the potential need for additional wells to address the remaining treatment gap is presented below.

The Central Area IRZ system consists of 12 remediation wells (CA-RW-01 through CA-RW-12) spaced 150 feet apart and installed in a line perpendicular to the direction of groundwater flow. Groundwater is extracted from select wells, amended with organic carbon (i.e., ethanol), and reinjected to create reducing conditions and treat Cr(VI) concentrations in groundwater. The top left panel of Figure A-2 depicts the well layout at system startup and pre-operation Cr(VI) groundwater concentrations. Performance data obtained during implementation of Central Area IRZ has demonstrated that the aerial coverage of reagent distribution and Cr(VI) treatment varies across the Site, likely due to geologic heterogeneities and spatial variations in groundwater flux. To address areas downgradient of the IRZ that have not been treated due to heterogeneities, an adaptive operational approach has been implemented to increase treatment effectiveness using the adaptive approach discussed in Section 4.3 of the FS. The Central Area IRZ has been through several iterations of adjustment or system optimizations to address aquifer heterogeneities and spatial variations as they were discovered. These modifications included:

- Adjustments to groundwater injection and extraction rates;
- Adjustments to organic carbon loading and/or concentration; and/or
- Conversion of extraction wells to injection wells.

Figure A-2 provides an overview of the treatment effectiveness during the past 3.5 years. The white areas show where groundwater has been treated to less than 3.1 μg/L Cr(VI). Comparison of the figures shows how the clean water fronts (areas of treated water) expand overtime downgradient from the various injection well locations.

A comparison of results from the most recent sampling event in May of 2011 (Figure A-2, bottom right panel) to results from February 2010 presented in the FS (Figure A-2, bottom left panel), indicate that recent IRZ system adjustments have greatly improved Cr(VI) treatment across several of the treatment gaps, particularly downgradient of former extraction wells CA-RW-02, CA-RW-08, and CA-RW-10. In addition, the clean water fronts downgradient of the IRZ on both the eastern and western ends of the system have become more uniform, with less apparent “striping”.

A gap in treatment remains in the vicinity of CA-RW-07R. Decreased well spacing may be needed to address this remaining treatment gap. Remediation well CA-RW-07R, located in the center of the IRZ, is currently configured as an extraction well and has been used intermittently as needed to supplement flows. To fill in the treatment gap in this area, CA-RW-07R is being converted into an injection well. If the gap is not addressed using CA-RW-07R, additional injection wells will be installed in the center of the IRZ system, i.e. in the area between CA-RW-06 and CA-RW-08.

Water Board Comment #4a:

DTSC noted that the proposed use of contaminated water for agricultural use should be evaluated very carefully, due to potential for mounding in the agricultural use areas, which could spread

contamination. Please provide seasonal information to demonstrate that irrigation water will be applied at rates which will not induce mounding or spread contaminants.

<u>Response to Comment #4a:</u>

Present and proposed extraction rates far exceed rates of irrigation return flows, resulting in formation of large cones of depression within the Hinkley chromium plume that would prevent mounding and spread of contaminants. Evidence of mounding was not apparent in recent winter/spring groundwater level data from the DVD LTU, when irrigation rates were at their highest. Model forecasts for winter groundwater levels and flow directions under the proposed remedial alternatives similarly do not indicate mounding or spread of contaminants. Details are provided below.

Mounding of groundwater below the AUs, or associated spreading of contaminants is not expected to occur. Some deep percolation of water applied to proposed agricultural units (effectively becoming recharge to the water table, or irrigation return flow) is expected, but it is small relative to the volumes that will be pumped. The majority of the water applied to an AU is consumed in evapotranspiraion. The fraction of applied water estimated to become deep percolation under Alternatives 4B and 4C-1 through 4C-4 ranges from 19 percent in summer to 22 percent in winter. In other words, for every gallon of water that percolates deeply enough under the AUs to become recharge and have a potential to cause mounding of the water table, 5 gallons of groundwater will be pumped. This preponderance of pumping (relative to deep percolation) and the resultant regional drawdown is expected to overwhelm the deep percolation of irrigation return flows at the AUs.

Experience at the DVD LTU, where water has recently been intentionally applied at rates above crop needs (with up to 50 percent deep percolation of the applied water) during the winter and spring months to maintain high groundwater extraction rates, has not indicated any significant mounding issues. Figure B-11 of Appendix B shows groundwater elevations in April 2011, and mounding is not apparent under either the DVD LTU or the new Gorman AUs.

Similarly, groundwater modeling results for Alternatives 4B and 4C-1 through 4C-4 do not forecast mounding of groundwater elevations below the proposed new AUs. The only mounding as a result of the proposed remedial alternatives is forecasted to occur at the injection well locations under Alternative 4C-3. Figures B-1 through B-10 of Appendix B show forecasted groundwater elevations and particle traces in winter of simulation year 2 (15 months after the start of the simulation period) and winter of year 5 (51 months after the start of the simulation period). Winter is when mounding would be most likely to occur, yet it is not apparent in the model-forecast groundwater elevations, nor do particle traces deviate substantially below agricultural units. All AUs under Alternatives 4B and 4C-1 through 4C-4 are forecasted to fall within the capture zone of remedial extraction and agricultural supply wells and no spreading of contaminants is forecasted.

<u>Water Board Comment #4b:</u>

When irrigation is not feasible for use in containing or remediating the plume (e.g., during winter months), develop a contingency plan of alternate remedial methods(s) to maintain a year-round capture zone and to hasten cleanup of the entire chromium plume.

Response to Comment #4b:

Alternative 4C-2, recommended in Addendum #3, features significantly higher winter pumping rates through the addition of winter crops to the AUs. The details of this approach are presented in Section 5 and further discussed in Appendix C of this Addendum #3. In addition to the enhanced remediation alternative, a comprehensive Contingency Plan for containing and remediating the plume during inclement winter weather or other contingency events is presented in Appendix H of this Addendum #3.

Water Board Comment #4c:

Provide information regarding irrigation of groundwater containing nitrates and the potential for nitrate to "use up" the reducing capacity of the soil.

Response to Comment #4c:

Irrigation of groundwater with nitrate is not anticipated to “use up” the reducing capacity of the soil. As described below, irrigation of groundwater with nitrate levels above crop demand may result in some nitrate leaching into the groundwater rather than removal in the root zone. However, it is expected that nitrate entering the groundwater beneath an AU will mostly be captured by remedial pumping, reapplied to the AU, and then removed from the root zone by crops in a cyclical process that is expected to enhance nitrate removal from the upper aquifer over time. Further, although the plant material above ground will be harvested, the plant material under the surface will add organic matter (carbon) in the form of roots and the microbial community that develops during operation of the AUs to a soil system where carbon is currently limited. The additional carbon in the subsurface from the crops planted at the AUs is expected to provide additional soil capacity for nitrate and chromium reduction over time instead of “using up” the reducing capacity of the shallow soils.

Crops such as alfalfa tend to decline in stand density and yield over a period of years, thereby reducing nitrogen uptake, but this is unrelated to any depletion of the reducing capacity of the soil. Fields at the AUs will be rotated periodically to other crops to maximize nitrogen utilization and prevent nitrogen accumulation. Site soils possess low ion exchange capacity, so sorption of nitrate-N will be low at the Hinkley Site and accumulation of unacceptable levels of nitrogen in soil is considered unlikely. The following paragraphs provide details on these topics.

Background Information

It is important to understand that the AUs currently in operation represent less than half of the area planned for AU operation. The currently operational AUs remove significant amounts of nitrogen (approximately 57,000 pounds per year) from an aquifer that already has nitrate-N at concentrations greater than the MCL of 10 mg/L in many wells. The nitrate present in the aquifer is from years of non-PG&E agricultural operations, including dairy farms. Pumping from the upper aquifer to supply irrigation water to AUs will also reduce the potential for migration of nitrate in groundwater to downgradient receptors.

Nitrogen Transformations in Soil

The overall nitrogen cycle is depicted in Figure A-3 below.

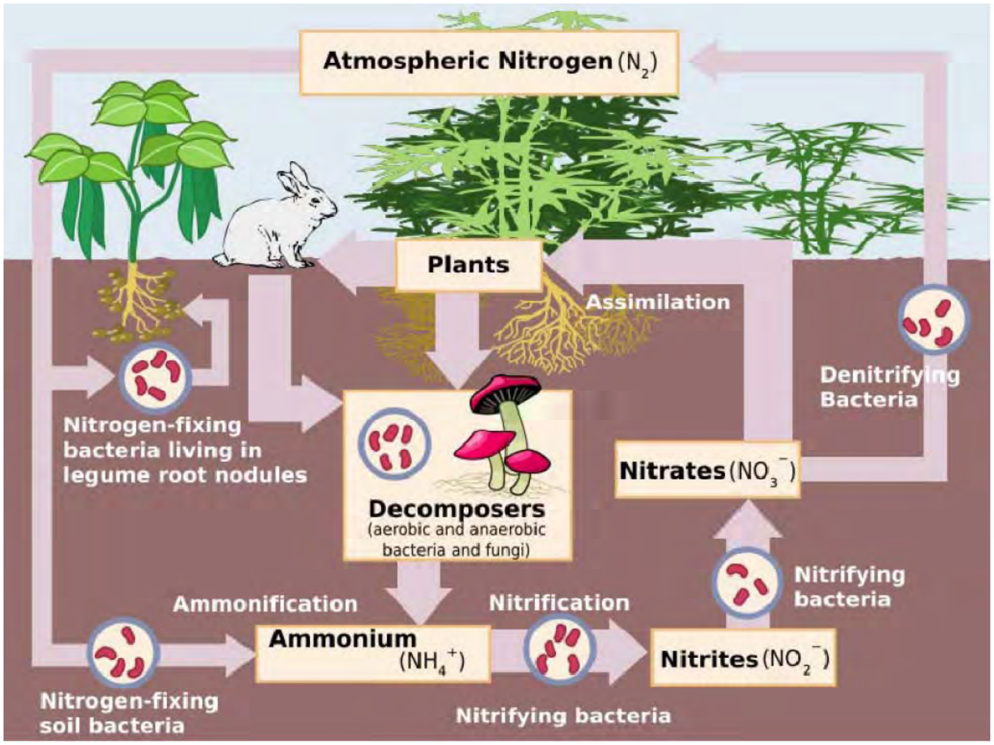


Figure A-3. The Nitrogen Cycle

The bulk of nitrogen storage is in the atmosphere as nitrogen gas. Nitrogen gas in the atmosphere and subsurface is considered inert. When introduced to the subsurface, certain organisms possess specific enzymes that allow the nitrogen to be fixed (transformed) into ammonium by the process known as ammonification. The ammonium form of nitrogen can be taken up by plants (assimilation) or used by microorganisms in the soil to build soil organic matter. Ammonium may be transformed by soil microorganisms (e.g., bacteria) by the process of nitrification to nitrite or nitrate. Nitrifying bacteria that fix the atmospheric nitrogen occur in soil and in some plant roots (e.g., nitrogen fixing legumes). Some plant, animal, and microbial detritus are degraded by microorganisms (decomposers) and transformed (mineralized) back to ammonium.

Nitrite and nitrate, the oxidized forms of nitrogen, have a number of environmental fates. Under most conditions, the nitrite form is rapidly converted to nitrate and does not accumulate. Nitrate may be used by microorganisms to:

- Build soil organic matter,
- Be taken up by plants as a nutrient, or
- Be leached below the root zone.

In addition, if soils are wet and organic matter is available, nitrate can be transformed by other bacteria to N_2 (denitrification) and lost to the atmosphere.

Fertilizer forms of nitrogen include ammonium, nitrate, organic nitrogen (e.g., manure), and urea nitrogen. Non-nitrate forms of fertilizer nitrogen are readily converted to nitrate through the action of soil microorganisms (e.g., aerobic and anaerobic bacteria and fungi). Although plants can directly use either ammonium or nitrate, the bulk of plant nitrogen uptake is typically in the form of nitrate.

Desert soils typically have low organic carbon content due to sparse vegetation, low precipitation, and low availability of nutrients. Nitrogen and irrigation water applied to the AU crops will build substantial biomass both above ground and within the root zone soils. As crops are harvested, the above ground biomass will be removed from the system but the root zone biomass will remain in place and will continue to grow, resulting in a net increase of organic matter (carbon) to the system over time. As the root zone becomes larger and denser, the organic matter in the soil system will be further augmented by the development of a more dense and robust microorganism community (fungi and bacteria) in the root zone as shown on Figure A-3. The organic carbon that builds up in the root zone will remain available in the system even when the crop slows its growth rate in the winter. Therefore the net result of AU operation is expected to be an increase in soil organic matter over time, even with the application of nitrate in irrigation water.

Irrigation using groundwater with nitrate is not anticipated to "use up" the reducing capacity of the soil. As described above and below, under the anticipated irrigation rate, the fate of nitrate will not appreciably vary from the processes depicted on Figure A-3. If irrigation greater than planned rates occurs, crops may not uptake all of the irrigation water and nitrate may drain into the groundwater rather than being removed in the root zone. However, it is expected that nitrate entering the groundwater beneath an AU will be mostly captured by remedial pumping, reapplied to the AU, and removed from the root zone by crops in a cyclical process expected to significantly enhance nitrate removal from the upper aquifer over time.

A review of lysimeter data for the DVD LTU shows that after more than six years of operation, nitrate-N concentrations in samples collected from the 20-foot lysimeters are 90% less than the concentration of irrigated water (when accounting for evapotranspiration), indicating that an efficient and stable system of nitrate removal from irrigation water is occurring. The nitrate removal efficiency of the DVD LTU has been generally steady over the last five years of operation (2007 to 2011) even after increasing irrigation rates. Comparable nitrate-N removal efficiencies are anticipated for the AUs over time.

Nitrate Removal Efficiency over time at Desert View Dairy Land Treatment Unit

From December 2004 through May 2011, the composited extracted groundwater used to irrigate the DVD LTU had nitrate-N concentrations ranging from 9.15 to 17.5 mg/L, with an average sample concentration of 12.8 mg/L. From February 2007 through May 2011, the average concentration of nitrate-N in irrigation water was 14.0 mg/L, while the average deep (20 foot bgs lysimeter) percolation groundwater was 5.0 mg/L (20 foot lysimeter), a greater than 65 percent decrease in concentration. When an annual average evapotranspiration rate of 80 percent is considered, the removal rate is greater than 90 percent of total mass of nitrate-N applied in irrigation water. As presented in Response to Comment #4d, the composited irrigation concentrations at the DVD LTU are typical for many wells in the Hinkley Valley and are likely representative or greater than the concentrations that will be applied to most AUs in the final remedy.

A pilot study was conducted in 2010 at the DVD LTU to evaluate the potential to increase irrigation rates as a way to increase extraction rates and thereby increase the groundwater capture zone and increase Cr(VI) treatment rates (CH2M HILL, 2010). During the pilot study, the groundwater application rate (which varied seasonally from 300 gpm in winter to 600 gpm in summer) was increased by 50 percent on an average annual basis (to simulate the current application rates of 450 gpm in winter and 900 gpm in summer). Lysimeter water samples collected below the root zone of water percolating back towards the water table showed equal treatment efficiency of both Cr(VI) and nitrate-N at standard and increased irrigation rates.

Water Board Comment #4d:

Describe the range of nitrogen concentrations in groundwater and soils expected within the project area. How will these concentrations change in response to chromium remediation activities?

Response to Comment #4d:

Available data for nitrogen in vadose zone soils indicate that concentrations range from elevated (up to 65 mg/kg) in areas where former dairy operations or intensive agriculture occurred to very low (1 to 11 mg/kg) levels in outlying areas. In groundwater, nitrate-N concentrations exceeding the MCL of 10 mg/L occur at many well locations in the project area with generally greater concentrations observed in wells screened near the upper portion of the upper aquifer (water table). It is anticipated that the concentrations of nitrogen in soils and groundwater will decrease over time as the AUs are operated, with a potential short period of increases in concentration during initial startup as crops are established and vadose zone nitrogen is mobilized with irrigation water that leaches through the vadose zone. Over time it is expected that there will be a significant net reduction of nitrogen in groundwater and vadose zone soils.

Vadose zone and groundwater studies in similar desert regions have shown significant natural accumulations of soil nitrate-N in locations with deep groundwater and limited rain fed groundwater recharged. Menon et al. (2010) conducted a study and linked the high natural nitrate accumulations to: 1) low biological demand for nitrogen in these natural desert soils that possess (a) low available moisture and vegetation productivity and (b) low available organic carbon; and 2) low rates of leaching or flushing of nitrates to groundwater.

Background Nitrate Levels in Soil in Project Area

Composite soil samples from test pits of the upper 18 inches of soil were collected in 2005 from the Ranch AU area (Figure A-4) and two additional areas to obtain data related to the chemical and physical soil properties that influence agricultural irrigation system design as summarized in Appendix A-Table 5 (CH2M HILL, 2005).

During a soil investigation of the West Pivot area (West on Figure A-4) in June 2011, soil samples were collected from surface soils down to a depth of 60 inches. This property has not been managed for agricultural practices for at least 30 years and is dominated by perennial desert shrub and winter annual vegetation. The highest nitrate concentrations in Site soils were observed at the deepest depths. While all samples in the surface 22 inches of soil had very low nitrate levels (1 mg/kg), soil nitrate concentrations up to as high as 65 mg/kg were reported for the 22 to 60 inch depth range.

Background Nitrate Levels in Groundwater in Project Area

Figure A-4 shows the average nitrate-N distribution for all wells in the project area and the location of operational and proposed AUs. This figure reveals that wells with average nitrate-N concentrations exceeding the MCL of 10 mg/L occur at many well locations in the project area. The primary sources of nitrate-N in the Hinkley Valley include dairy operations and agricultural areas where chemical or manure fertilizer was or is currently being applied at rates greater than crop uptake rates. The highest concentrations of nitrate-N in groundwater are at the dairy operation area of the DVD (and downgradient) and near feed lot/dairy operations near Green Valley/Vernola, east of the Compressor Station (Figure A-4). Other potential sources include isolated historic livestock pens, the closed Nelson-Diaz Dairy, Field Crop Parcel (Ranch), and extensive crop agriculture east of the Compressor Station (Green Valley/Vernola).

Figure A-5 shows nitrate-N concentration trends for deep lysimeter (20 feet below ground surface [bgs]) data at the DVD LTU. A review of this figure shows that after about two years of operation, the leaching of nitrate-N to groundwater in soils above 20 feet was substantially less than is observed during initial crop startup. Based on results from the DVD LTU, a new AU can be expected to be a net source of nitrate-N to the upper aquifer for approximately the first two years of operation as nitrate-N stored in soils is mobilized and crop root zones become fully established. It is necessary prior to planting crops at new AUs to amend the soils with manure to provide mineral nutrients and increase soil organic matter content during initial crop development, also creating a temporary source of nitrate-N. However, during subsequent seasons it is expected that each AU will be effective in reducing the nitrogen in irrigation water, resulting in a net benefit of nitrogen removal from the upper aquifer over time.

Water Board Comment #4e:

What is the potential to mobilize soil nitrogen into groundwater and increase nitrate-nitrogen concentrations in the groundwater?

Response to Comment #4e:

As presented in Response to Comment #4d, it is expected that operation of AUs will result in a net reduction of nitrate concentrations in groundwater over time, although some nitrate may be mobilized to groundwater during initial AU operation as root zones become established and nitrate in irrigation water and vadose zone soils is leached to groundwater. Based on data from the DVD LTU, where past nitrogen loading from manure loadings was significant, it is expected that new AUs will mobilize nitrate to groundwater for approximately the first two years. Nitrate in soils at most AUs is not anticipated to be as high as levels observed at the DVD LTU due to fewer historical dairy activities (or none) in these areas. However, as described by Menlo et al. (2010), there is a potential for some additional natural accumulations of nitrate in the vadose zone at depths below the root zone, and as stated in Response to Comment #4c, it will be necessary for soils to be amended with manure and possibly chemical fertilizer during the startup phase of new AUs. The nitrate mobilized to groundwater during initial AU operation may cause temporary increases in nitrate groundwater concentrations;

however, the affected groundwater will mostly be captured by supply wells and reapplied to AUs where it will be treated. Over time, the AUs are expected to reduce nitrate concentrations in groundwater, and very limited nitrate is expected to adsorb to soils.

It is reasonable to expect that after the startup phase there will be a greater than 65 percent reduction in concentration of irrigation water that has percolated beneath the root zone, and a greater than 90 percent reduction in the total mass of nitrate-N by the time irrigated water reaches 20 feet bgs. Additional nitrate-N may be transformed to nitrogen gas below the 20-foot bgs depth via denitrification.

Plant Nitrogen Removal with Normal Operations

As described previously, alfalfa (and other legumes) has the capacity to fix its own nitrogen, and therefore does not require nitrogen fertilizer. However, if mineral nitrogen (ammonium or nitrates) is readily available in the soil, alfalfa will preferentially use the existing, freely available N and not fix additional nitrogen (Poole et al., 2004).

Irrigated alfalfa in the region is typically harvested 6 times per year, with 1.5 tons per acre (tons/ac) per harvest. Alfalfa crop uptake of nitrogen is about 56 pounds per ton (lb/ton) (Poole et al., 2004); therefore total uptake may be on the order of up to 500 lb of nitrate-N per year. ‘Fertilization’ with nitrogen is not normally practiced with alfalfa, as it is not required to produce high yields, but manure application, municipal wastewater effluent reuse, and biosolids reuse is nevertheless common. Nitrogen loading rates are agronomic, requiring consideration of crop uptake, crop yield, and plant available nitrogen being applied to the crop.

Sudangrass is harvested twice per year, with yields of about 5 to 6 tons/ac/yr. Crop uptake for sorghum-sudan (similar to sudangrass), is about 41 lb/ton (Poole et al., 2004); therefore total uptake is on the order of 205 to 246 lb of nitrate-N per year (assume an average of 225 lb/ac/yr). Fertilization rates are based on crop yield goal and projected uptake rates.

Bermudagrass yields are on the order of 1 ton per ac per harvest, and is harvested about 5 times per year. Crop uptake is on the order of 50 lb/ton (Poole et al., 2004); therefore total uptake is on the order of 250 lb nitrate-N per acre per year. Fertilization rates are based on crop yield goal and projected uptake rates.

An approximation of current annual nitrogen removal by crops at the DVD LTU and AUs this year is:

Bermudagrass on 80 acres:	20,000 lbs
Sudangrass on 52 acres:	11,700 lbs
Alfalfa on 50 acres:	25,000 lbs
TOTAL ANNUAL	**56,700 lbs**

The annual crop removal of approximately 57,000 lbs of nitrogen from the soil and groundwater system is essentially identical to the mass loading estimated (58,240 lbs) if crops are irrigated at agronomic rates with a conservatively high average nitrate-N concentration of 15 mg/L in irrigation water. These data indicate that once crops are established, up to 57,000 lbs of nitrogen will be removed annually from the aquifer via irrigation at the AUs (and DVD LTU) currently in operation, with minimal leaching to groundwater. The currently operational AUs (and DVD LTU) represent less than 50 percent of the acreage planned for the final remedy), so the actual nitrogen removal quantity from the aquifer will likely be greater than 100,000 lbs annually when all AUs are in operation.

Water Board Comment #4f:

What is the potential to transport nitrate to other areas of groundwater. Causing nitrogen degradation in areas with low background concentrations of nitrogen?

Response to Comment #4f:

As described previously, nitrate-N degradation of the upper aquifer is not considered to be a major concern during AU operation for the following reasons:

- The upper aquifer of the Hinkley Valley has numerous wells with nitrate-N concentrations exceeding California drinking water standards in areas where AUs are in operation or planned due to historical dairy operations, irrigated agriculture, or naturally-occurring nitrate.
- The expected net effect of AU operation will be to extract existing nitrate-N from the upper aquifer, provide hydraulic containment of the nitrate-N in the upper aquifer in the vicinity of the AUs, apply the nitrate-N to crops, and remove nitrate-N from the aquifer.
- The net hydraulic effect of the AUs is to minimize spreading of recharge in the aquifer, since the volume of groundwater extracted is much greater that the volume of return flow under the AU.
- The AUs will also likely improve the water quality of the Hinkley Valley over time by reducing nitrate-N migration towards downgradient receptors where background concentrations may be lower than at the AU locations.
- PG&E plans to operate the AUs such that extracted water is applied to an AU adjacent or near the extraction location

Water Board Comment #4g:

Propose a monitoring plan to measure soil nitrogen and nitrogen concentrations of the anticipated irrigation water.

Response to Comment #4g:

Monitoring will be conducted according to standard agricultural practices, and focus on documenting the total mass of nitrogen applied [(irrigation flow rate x time x nitrate concentration)/area], and the mass of nitrogen removed from the system through crop harvest (total yield per acre x nitrogen content in crop removed). Monitoring will consist of periodic samples of the combined extraction water used for irrigation and representative samples of plant tissue during crop harvest to estimate nitrogen uptake by plants.

Crop harvest can be easily tracked by weighing bales of hay (or net weight of truckloads of hay) at each harvest. In the case of grains, the total wagonloads or truckloads of grain removed can be readily weighed to determine the mass harvested. Nitrogen content of the harvested material can also be readily tracked by submitting representative samples of the hay or grain harvested by field to a laboratory for analysis. Tracking crop yield by field is a very common agricultural practice and tracking nutrient content of feed stocks is relatively common, especially for larger livestock producers. If any other forms of fertilizer are applied that contain nitrogen, these rates will be approximated as part of monitoring.

Water Board Comment #4h:

Propose a plan to assess each land treatment unit and propose contingency measures if nitrate applications or soil nitrogen concentrations exceed agronomic rates.

Response to Comment #4h:

The AUs will be operated in a similar fashion to other agricultural fields in California which will include irrigation at rates great enough to meet crop water demand and irrigating enough such that salinity issues do not begin to adversely affect crop growth. If irrigation with groundwater containing nitrate exceeds crop demand some draining of nitrate to the water table may occur; however, the groundwater affected by drained irrigation water will be mostly captured by remedial pumping, reapplied to the AU, and treated over time. Again the AUs are expected to reduce nitrogen levels in soils and groundwater over time even if there are temporary periods when the agronomic rates are exceeded.

The net result of land application of groundwater containing nitrate-N and crop harvest is expected to reduce the total nitrogen mass in the aquifer and soil system over time. Groundwater under OU2 can be monitored for nitrate concentrations. If such concentrations are observed to have an increasing trend beyond the first few years of operation (as described earlier and noted in Figure A-5), the overall fertilizer and irrigation program will be adjusted. The precise details of which wells to monitor, monitoring frequency and the like are proposed to be developed during the final design stage, when the final number and geometry of the AUs are defined.

Water Board Comment #5a:

Describe all known sources of contamination, when and how each of these sources was remediated, and their disposition with confirmation analytical data.

Response to Comment #5a:

See below for responses to comments 5a and 5b.

Water Board Comment #5b:

Provide information to support that soil sources are no longer a continuing threat to groundwater.

Response to Comment #5a and 5b:

These responses to Comments #5a and 5b provide additional details of known sources of contamination and investigations performed to assess the nature and extent of contamination in those areas. The scope and dates of remediation performed by PG&E at and in the vicinity of those sources are also provided. Analytical results for samples collected in these areas are summarized. The references cited in these responses provide more details of work performed at the areas considered to be known sources of contamination.

Source Area Investigations

On 29 December 1987, the Water Board issued Cleanup and Abatement Order No. 6-87-160, ordering PG&E to investigate, clean up, and abate the groundwater and soil contamination at the Hinkley Compressor Station Site. In response to the Water Board's Cleanup and Abatement Order, PG&E conducted site investigation and sampling activities to characterize source areas at the Compressor Station, assess site hydrogeologic conditions, and determine the extent of the Cr(VI) in soil and groundwater. A site characterization and FS were completed in 1988 by Ecology and Environment, Inc.

Source area investigation locations are listed in Appendix A-Table 4. Appendix A-Table 4 includes a brief description of each investigation, including a summary of the investigation activities, results, and disposition for each site. The locations of areas of previous investigation are shown on Figure A-6. Initial soil investigations focused on three locations known as Areas A, B, and C (shown on Figure A-6) where blowdown from cooling towers and/or sludge containing Cr(VI) were discharged to the soil. Subsequent investigations were conducted in areas where:

- Wastewater or sludge containing chromium were discharged;
- Process water containing chromium came in contact with soil;
- Chromium-containing chemicals were stored; and
- Soil investigations were also performed when chemical sheds, cooling towers, or other structures were demolished.

From 1988 through 2002, the regulatory objective for soil remediation was to excavate and remove soils containing total chromium [Cr(T)] in excess of 500 mg/kg. Although the established total threshold limit concentration for Cr(T) under hazardous waste classification was 2,500 mg/kg, PG&E and the Water Board agreed upon a lower action level of 500 mg/kg to provide an additional level of protection of the environment (Ecology and Environment, Inc., 1991).

In 2003, the regulatory objective for soil remediation was updated to excavate and remove soils containing Cr(T) and Cr(VI) concentrations above the USEPA Region 9 industrial soil preliminary remediation goals, which are 450 mg/kg for Cr(T) and 64 mg/kg for Cr(VI) (USEPA, 2002).

As summarized in Appendix A-Table 4, between 1998 and 2008, PG&E performed numerous major investigations and removal actions for soil at or near known source areas. Those known source areas, considered the primary release points of Cr(VI) to soil, include the former evaporation ponds and Areas A, B, and C (Appendix A-Table 4). These areas are shown on Figure A-6.

For purposes of the groundwater remedy design, it seems reasonable to conclude that there is not a significant ongoing vadose zone source for the following reasons. The concentrations of Cr(T) and Cr(VI) still present in the aquifer are highest below these known sources of contamination or immediately downgradient; indicating that the primary sources/areas of contamination have been identified. Further, the highest concentrations in the groundwater are found in the deeper zone (i.e. 9,030 μg/L Cr(VI) found at SA-MW05D in August 2010), not the shallow subsurface, indicating that leaching from the vadose zone (if it is occurring at all) is not the primary driver of groundwater concentrations. In short, no conclusive evidence of a continuing source to groundwater is observed.

As described in Addendum #3, once a final remedy alternative is selected, the subsequent detailed design process will incorporate sufficient flexibility to respond to future plume configuration changes. The use of in-situ treatment in the source area is intended to address any residual impacts below the water table. PG&E will continue groundwater monitoring for assessing remedy performance. If significant increases to known groundwater contamination in the shallowest layer of the aquifer in the source area are observed in the future (which would indicate an ongoing vadose zone source), PG&E will propose additional steps to investigate the source of those contributions.

Water Board Comment #5c:

If soil sources are a continuing threat to groundwater, describe how these sources will be addressed.

Response to Comment #5c:

As noted in the Response to Comments #5a and #b, PG&E will continue groundwater monitoring for assessing remedy performance. At the current time there is no evidence of a continuing vadose zone source that would impact the overall design of the groundwater remedy. If significant contributions to known groundwater contamination occur in the future (especially those that will impact performance or duration of the selected remedy), PG&E will propose additional steps to investigate those contributions, including investigation of possible contributions from known sources of contamination.

Water Board Comment #6a:

Provide information on bio-fouling related to IRZ operation and potential impacts to aquifer, including ability of IRZs to remain functional.

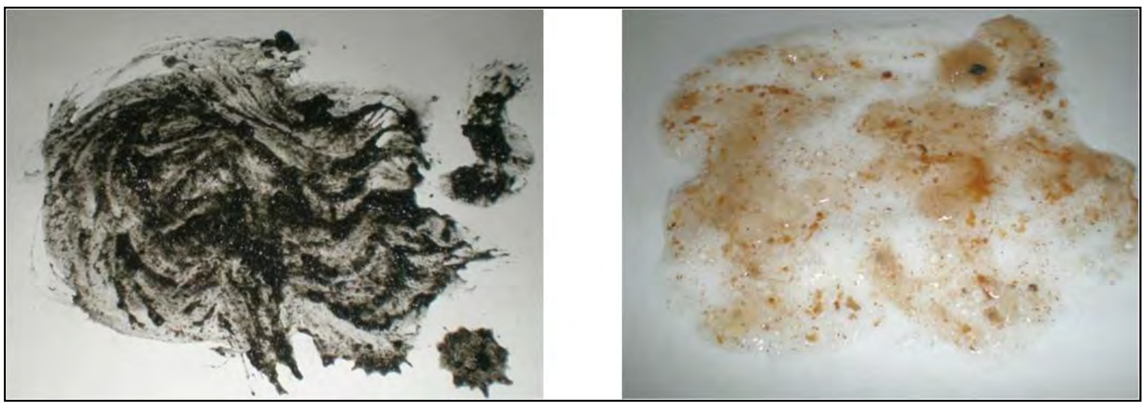
Response to Comment #6a:

Fouling can affect the ability of injection wells to accept water, resulting in decreased reagent distribution over time. If allowed to persist, decreased reagent distribution could potentially lead to decreased Cr(VI) treatment. For example, after several months of operation, water levels increased in several injection wells in the Central Area IRZ, indicating fouling of the well screen, filter pack, and potentially a small radius around the injection points in the aquifer. Eventually, target recirculation flowrates could not be maintained. This experience has led to the development of several key strategies to control the fouling of wells and sustain functionality of the IRZs. These strategies include:

- Rotating the operation of injection wells;
- Modifying the frequency of IRZ injections;
- Rehabilitating wells; and
- Careful IRZ well placement.

Well Fouling Occurrence and Effect on IRZ Operation

Fouling occurs as a result of the generation of biomass and/or formation mineral precipitates caused by organic carbon injections. Photograph 1 shows pictures of fouling deposits. The picture on the left shows black mineral deposits, likely iron sulfide minerals formed through the generation of ferrous iron from iron reduction and sulfide from sulfate reduction. The picture on the right shows biological fouling deposits, likely comprised of microbial biomass and extracellular polysaccharides.



Photograph 1. Mineral and Biological Fouling Deposits shown on the left and right, respectively

In addition to the direct fouling caused by organic carbon substrates, reinjection of extracted treated groundwater containing soluble organic carbon and dissolved, reduced metals can also cause fouling. Well performance deterioration can be caused by deposition of iron and manganese oxides formed by the oxidation and precipitation of dissolved, reduced iron and manganese in the recirculated groundwater. This effect was observed in both the Central Area and Source Area IRZs when organic carbon or reduced, dissolved metals were extracted and reinjected.

Ability to Maintain IRZ Functionality

The fouling of injection wells over time can limit the achievable injection rates and, therefore, reagent distribution and Cr(VI) treatment in the IRZs. Fouling of wells is controlled to sustain functionality of the IRZs by rotating the operation of injection wells, modifying the frequency of IRZ injections, and rehabilitating wells. In addition, avoidance of extraction of treated groundwater containing organic carbon and elevated concentrations of dissolved metals for reinjection, is a key consideration for IRZ extraction well placement.

Rotating Operation of Injection Wells

Based on data collected during the past several years of operations, the injectability of wells that have fouled can sometimes improve by ceasing to inject organic carbon for several months. The IRZs are designed with some redundancy and a reliance on stored reducing capacity such that the injection well locations can be rotated allowing continued injection to maintain treatment while wells recover.

Injection Frequency

Adjustment of the frequency of injections (e.g., injections twice per week rather than daily) has also been found to improve and maintain well performance. Water levels tend to increase quickly following injections, potentially as a result of gas generation by microbial respiration immediately following the supply of organic carbon. Appropriately timed injections allow water levels to relax in between injections. As a result, wells can operate for longer periods before fouling when operated at a reduced injection frequency.

Well Rehabilitation

In cases where wells become fouled and cannot be operated at sufficient flowrates, wells can be rehabilitated, removing fouling deposits and restoring well performance. Well rehabilitation methods employed to date have included both mechanical rehabilitation and chemical rehabilitation using hydrochloric acid as well as a combination of phosphoric acid and bioacid dispersant.

Chemical rehabilitation with phosphoric acid and bioacid dispersant has been the most effective method of well rehabilitation, although results have varied with location. Chemical rehabilitation has been very effective in the Source Area, and less effective in the Central Area. After chemical rehabilitation in several Source Area wells, recirculation rates were restored to levels comparable to initial operations and maintained for several months. In the Central Area, injection rates were greatly improved immediately following rehabilitation, but began to deteriorate within one month.

Additional work needs to be done to evaluate how to rehabilitate wells that do not improve with current rehabilitation techniques. Additional rehabilitation steps, such as surging and jetting, or using higher concentrations or different mixtures of rehabilitation chemicals will be evaluated and may be employed in an effort to remove additional fouling deposits. Ultimately, if injection wells cannot be rehabilitated to improve well performance, well replacement may also be considered to maintain functionality of the IRZs in areas that require continued treatment.

Injection and Extraction Well Placement

Operational data to date demonstrate the importance of placing extraction wells in locations where they will not extract treated water that contains organic carbon or dissolved metals. The extraction of organic carbon or dissolved, reduced metals rapidly fouls injection wells and limits system performance. The Central Area recirculation well configuration was changed from a dipole configuration to a configuration with fewer extraction wells in the middle of the IRZ line in 2009 to overcome the well fouling and recirculation challenges caused by extraction of organic carbon and dissolved, reduced metals. Expanded IRZ systems well networks for the comprehensive Site remedy will also be designed to prevent the extraction of organic carbon and dissolved, reduced metals.

Potential Impacts to the Aquifer

Well fouling is not expected to significantly impact the hydraulic properties of the aquifer. The majority of biofouling occurs on the well screen, within the filter pack, and in a small radius around the injection points. Any impact on hydraulic conductivity as a result of well fouling would be limited to the immediate vicinity of the well location. Data to date has not indicated that fouling has caused a significant reduction in hydraulic conductivity or caused changes in groundwater flow direction. The ability to regain well performance to levels comparable to startup following well rehabilitation in both the Central Area and Source Area IRZs is evidence that the fouling deposits are limited to the well screen, filter pack, and aquifer in the immediate vicinity of the well that would have been affected by rehabilitation activities.

Water Board Comment #6b:

Provide data on impacts from more aggressive in-situ remediation (closer well spacing, chemical reductants), including from by-product generation and biofouling.

Response to Comment #6b:

Closer Well Spacing

Operation of IRZs using closer well spacing may increase treatment effectiveness in areas where reagent distribution has been a challenge due to aquifer heterogeneities, as discussed in Response to Comment #3e. Decreased wells spacing would increase the number of locations where byproducts are generated, meaning byproducts would be generated over a larger area. However, with closer well spacing the concentration of organic carbon required to achieve lateral coverage could decrease and the concentrations of byproducts generated would be expected to decrease proportionally. Reducing carbon concentrations would result in tradeoffs; the longevity of the reducing zones would decrease and the timeframe for downgradient treatment would increase.

Based on operational data collected to date, decreased well spacing would improve treatment effectiveness and is being considered in areas where lateral distribution has been difficult to achieve due to aquifer heterogeneities.

Chemical Reductants

The comparison of byproduct generation for chemical versus organic carbon substrates was provided above in Response to Comment #1d. To summarize, both chemical and organic carbon substrates will generate dissolved arsenic, manganese, and iron, with the potential exception of ZVI. Reaction endproducts such as sulfur species and counter ions may be additional byproducts of chemical reductants.

Injection well fouling is a potential issue for both organic carbon and chemical reductants. As discussed above in Response to Comment #6a, organic carbon substrates cause fouling through the generation of biomass and/or the formation of mineral precipitates. Chemical reductants cause fouling through the formation of mineral precipitates. Chemical reductants are more likely to cause fouling and injection well clogging than organic carbon substrates. As discussed in Response to Comment #1d, sulfide and ferrous iron based reagents may oxidize to elemental sulfur and ferric iron precipitates, respectively, (Fruchter, 2002, EPA, 2000) which can limit injectability much more rapidly than the gradual build up of fouling materials with organic carbon substrates.

Water Board Comment #6c:

Provide quantitative data on the magnitude of significant and unavoidable impacts between alternatives for TDS and byproduct increases in the aquifer.

Response to Comment #6c:

PG&E previously estimated the mass of salts (i.e., total dissolved solids [TDS]) that could affect groundwater beneath the DVD LTU sub-surface irrigation system. The estimate was based on Site-specific data and included computer modeling with various input parameters such as the estimated infiltration rate for water percolating through the vadose zone beneath the farm and the expected concentration of TDS in the percolating water. This information is contained in ROWD submittals by PG&E in 2003 and 2004 in support of the Waste Discharge Requirements for the DVD (Board Order No. R6V-2004-0034).

The Water Board order for DVD operations (R6V-2004-0034) requires both vadose zone (lysimeters) and groundwater monitoring to measure TDS concentrations and compare data to the modeling predictions. In general, the modeling results appear to have over-estimated the salt concentrations that would be expected in the water percolating through the vadoze zone associated with farming on the DVD. Specifically, TDS concentrations in pore water collected from lysimeters at 20 feet bgs are substantially less than predicted by the model. On average, TDS concentrations in groundwater beneath the DVD have not increased as a result of PG&E's farming operations.

Most areas within the boundaries of the current chromium plume were historically used for irrigated agriculture. Much of the Hinkley Valley to the east of the chromium plume is currently farmed. The AU farming proposed as part of the final remedy is substantially less in total acreage than the amount of existing farming in the valley. The AU farming proposed by PG&E as part of the final remedy is not significant in consideration of the amount of existing farming by others.

The highest TDS concentrations currently noted in groundwater are typically in areas of current or historic dairy operations. Areas previously used for irrigated agriculture, such as the former East LTU and the Ranch LTU, are much lower in TDS with concentrations typically ranging from approximately 700 to 1,400 mg/L. TDS concentrations in groundwater to the east of the chromium plume (down-gradient of existing farming by others) typically range from about 1,000 to 1,400 mg/L.

The southern part of the chromium plume, such as the South Central Re-Injection Area (SCRIA), TDS concentrations are relatively low ranging from approximately 500 to 800 mg/L. These southern areas, which were also historically farmed including the East LTU and the compressor station property, do not appear to contain elevated TDS concentrations compared to the areas further to the north.

The upper aquifer groundwater system in some areas of the Hinkley Valley includes an upper (A1) and lower (A2) zone. The two zones are separated by a confining clay layer (CCL - the brown clay). TDS concentrations in the A1 zone are substantially higher than in the A2 zone, where TDS concentrations typically range from 400 to 800 mg/L. These data suggest that while historical and existing farming operations have affected the shallow groundwater, the affects have not extended to the deeper portions of the aquifer.

These empirical Site data suggest three key things. First, the computer modeling appears to over-predict the concentration of TDS that can be expected in groundwater as a result of irrigated agriculture. The reasons for the over-prediction are not clear, but may be associated with uncertainty associated with how TDS moves (or does not move) through the vadose zone and the capillary fringe and how the TDS mixes once the percolating liquids reach the groundwater. PG&E recommends that computer modeling not be used as a primary tool to predict TDS concentrations that may occur in groundwater as a result of final remedy AU operations.

Second, once irrigated agriculture is stopped, TDS concentrations in groundwater become stable and eventually decline. The decline is likely because the percolation of water containing TDS stops, and groundwater containing relatively low concentrations of TDS flows into the area from the upgradient side. Specific to the Hinkley Valley, the upgradient groundwater recharge is from the Mojave River to the south. The Mojave River groundwater contains very low concentrations of TDS, typically about 300 to 400 mg/L. As this lower TDS groundwater from the Mojave River flows from south to north through the Hinkley Valley, it mixes with the higher TDS groundwater beneath the areas used for irrigated agriculture. This affect is seen in groundwater beneath the SCRIA and to the south towards the compressor station where TDS concentrations typically range from about 400 to 800 mg/L.

Third, although the upper portion of the upper aquifer (A1 zone) may be affected by TDS concentrations ranging from about 1,200 to 1,400 mg/L with some areas affected by dairy operations as high as 4,000 mg/L, the deeper portions of the upper aquifer (A2 zone) have remained largely unaffected. As agriculture activity is implemented under the final remedy, the A2 zone is expected to contain TDS ranging from about 300 to 700 mg/L. The A2 zone is a primary source of groundwater for agriculture in much of the Hinkley Valley. The overall effect of TDS on the upper aquifer will be considerably less than the maximum concentrations observed in the A1 zone groundwater. The overall effect of TDS on the Upper Aquifer (i.e., the A1 and A2 zone) will be considerably less than the maximum concentrations observed in the A1 zone groundwater, and on a whole the groundwater in the Hinkley Valley is expected to remain below drinking water standards for TDS for agricultural and domestic use.

In conclusion, TDS concentrations in the A1 zone of the Upper Aquifer are expected to increase as a result of AU operations associated with the final remedy. The TDS increase cannot be reasonably or accurately predicted using computer modeling. Empirical Site data in areas previously used for irrigated agriculture suggest TDS concentrations will increase to approximately 1,200 to 1,400 mg/L in the areas used for farming. These TDS effects are expected to be limited to the upper portion of the upper aquifer (A1 zone). Groundwater in the Hinkley Valley in the deeper portions of the upper aquifer (A2) zone is expected to remain relatively low, mostly unaffected by the agriculture activities. Once AU operations stop as the remedy is completed, recharging groundwater from the Mojave River to the south will reduce TDS concentrations in the A1 zone groundwater. The overall affects of agriculture associated with the final remedy is not expected to result in adverse impacts to beneficial uses of the groundwater either during or following implementation of the final remedy. The agricultural activities proposed in the final remedy are consistent with other land use in the Hinkley Valley and the acreage of farming proposed as a component of the Site cleanup is not significant compared to the acreage of land currently farmed by others in the Hinkley Valley.

In-Situ Byproducts

The generation of anaerobic IRZs for treatment of Cr(VI) in groundwater results in the dissolution of a small fraction of naturally-occurring aquifer soil minerals, termed "in-situ by-products," including dissolved manganese, iron, and arsenic. Remedial alternative 3, 4, 4A, 4B, and 4C-1 through 4C-4 include IRZs within OU-1. The generation of in-situ byproducts is expected to occur within OU-1 for these alternatives.

Within the IRZ, the generation of byproducts can be controlled through total organic carbon (TOC) loading. As a result, the applied TOC loading can be adjusted to ensure lower byproduct formation. This control mechanism results in a tradeoff between maximizing the area of treatment and the storage of Cr(VI) reducing capacity (i.e., creation, through TOC loading, of aquifer soil minerals reactive toward dissolved Cr(VI) over the long-term) and minimizing the generation and migration of by-products.

In general, lower concentrations of organic carbon will be applied in the northern section of OU-1, i.e. the north SCRIA and Central Area, to minimize generation and migration of in-situ byproducts. In this northern portion of OU-1, there may be an increase in manganese concentrations, in the range of 5 to 10 mg/L, as reduced, treated water is generated in the vicinity of injection locations and migrates downgradient. Arsenic concentrations are not expected to increase significantly in the northern portion of OU-1. Data to date demonstrates only slight increases in arsenic concentrations in this area, with a maximum increase to 25 μg/L in isolated areas on the western side.

In the southern portion of the Site, higher TOC concentrations may be injected to treat higher Cr(VI) concentrations in groundwater present in this area, and in-situ byproduct concentrations may be higher in areas surrounding injection locations. To date, the maximum increase in dissolved manganese concentration reported was 15 mg/L; the maximum increase in dissolved arsenic concentrations was 250 μg/L.

Following the completion of in-situ organic carbon injections, byproduct concentrations are expected to decrease toward baseline. The time for recovery to baseline conditions may vary, likely on the order of months to years within the effected zone.

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APPENDIX A - TABLE I
Quarterly Irrigation vs. Winter-Only Treatment Flows per Agricultural Unit
Pacific Gas and Electric Company
San Francisco, California

Quarter	Flow Rates (gpm)	DVD LTU	Gorman AU	Cottrell AU	Bell AU	South AU	Yang AU	Ranch AU	West AU	Total "Winter-Only" Treatment Flow (gpm)
1st Quarter (Winter)	Total Flow	700	457	252	504	252	252	252	160	**1608**
	Irrigated	260	192	102	203	102	101	101	110	
	Winter Only Treatment System	**440**	**265**	**150**	**301**	**150**	**151**	**151**	**0**	
2nd Quarter (Spring)	Total Flow	700	457	252	504	252	252	252	160	**100**
	Irrigated	600	457	252	504	252	252	252	160	
	Winter Only Treatment System	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Quarter	Flow Rates (gpm)	DVD LTU	Gorman AU	Cottrell AU	Bell AU	South AU	Yang AU	Ranch AU	West AU	**Total "Winter-Only" Treatment Flow (gpm)**
3rd Quarter (Summer)	Total Flow	700	457	252	504	252	252	252	160	**96**
	Irrigated	700	438	239	478	237	239	240	160	
	Winter Only Treatment System	**0**	**19**	**13**	**26**	**13**	**13**	**12**	**0**	
4th Quarter (Fall)	Total Flow	700	457	252	504	252	252	252	160	**1247**
	Irrigated	520	211	114	231	117	116	113	110	
	Winter Only Treatment System	**180**	**246**	**138**	**273**	**135**	**136**	**139**	**0**	

APPENDIX A - TABLE 2
Influent Water Quality
Winter Water Treatment and Disposal
Pacific Gas and Electric Company
Hinkley California

Flow Rates[1]			
Pivot	**Winter**	**Weighted Flow[1]**	**Representative Wells**
Gorman	265	23%	G-1R, GR-2R, G-5R
Cottrell	150	13%	C-1, C-2, C-3, C-4
Yang	151	13%	MW-24A2, MW-41S
Ranch	150	13%	MW-10, MW-22A1, MW-22A2
Bell	301	26%	CA-MW-510S, CA-MW-411S
West	150	13%	MW-28A, MW-45A, MW-101S
Total Flow Rate	**1166**	100%	

Source: Table 1
[1] gpm
Representative wells = wells used to estimate water quality by well

Analyte	Gorman mix	Cottrell mix	Yang	Ranch	Bell	West	Treatment influent	Units
Cr total dissolved, µg/L	4.1	3.4	6.9	35.2	24.0	24.1	**16.1**	**µg/L**
Cr hex, µg/L	4.3	2.9	5.2	26.3	24.8	24.5	**15.0**	**µg/L**
Nitrate, mg/L	7.8	19.1	15.0	19.8	16.0	10.3	**14.2**	**mg/L**
Sulfate, mg/L	376	706	284	398	281	266	**371**	**mg/L**
pH	7.4	7.4	0.0	0.0	7.1	0.0	**7.3**	**pH**
Arsenic, µg/L	1.7	3.0	1.0	0.0	1.7	ND <1	**2.0**	**µg/L**
Iron, mg/L	0.0	1.6	0.0	0.0	0.0	0.0	**1.6**	**mg/L**
Manganese, mg/L	0.0	0.1	0.0	0.0	ND <0.57	0.0	**0.1**	**mg/L**
Nitrite, mg/L	0.0	0.9	0.0	0.0	0.0	0.0	**0.9**	**mg/L**
Analyte	**Gorman mix**	**Cottrell mix**	**Yang**	**Ranch**	**Bell**	**West**	**Treatment influent**	**Units**
TDS, mg/L	828	1516	1170	1367	0	1790	**1268**	**mg/L**

µg/L = micrograms per liter
mg/L = milligrams per liter
TDS = total dissolved so total dissolved solids
Notes:
1. For those water sources with missing analyte concentrations, total flow was assumed as the sum of the flows from the wells with data.
2. NDs not used

APPENDIX A - TABLE 3
WINTER WATER TREATMENT AND DISPOSAL TECHNOLOGY SCREENING MATRIX, ALTERNATIVE 4C-3
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

General Response Actions	Remedial Technology Types	Process Options	Descriptions	Primary Screening Comments	Pass Preliminary Screen?	Effectiveness(1)	Ease of Implementability(2)	Relative Cost	Screening Comment	Retain?
Ex-Situ Processes for Treating Water Extracted in Winter During Low AU Water Demand	Ex-Situ Biological Treatment	Anaerobic bioreactor (membrane biofilm reactor [MBfR])	Contaminants and electron donors are combined in a bioreactor to stimulate anaerobic biodegradation or redox changes. The MBfR process uses hydrogen as the electron donor, to develop a biofilm of indigenous bacteria on hollow filter membranes in an ex-situ reactor. As groundwater is moved through the reactor, the Cr(VI) that comes in contact with the biofilm serve as electron acceptors, and is reduced.	May be applicable to reduce Cr(VI) but not currently implemented at full scale at any known Cr(VI) remediation project.	Yes	• Achieve Background • Restore Beneficial Use • Containment	Low	Moderate capital cost, moderate O&M cost.	Potentially viable technology for lower Cr(VI) concentration pending further bench/pilot studies. Technology still in development and has not yet been implemented in full scale for Cr(VI) remediation. Full-scale implementability can not be confirmed. Therefore, not retained for winter water treatment.	No
		Agricultural application (land application)	Plants and soil with their associated rhizospheric (root zone) microorganisms are used to remove, degrade, or contain chemical contaminants in groundwater applied for irrigation. Reduction of Cr(VI) through interaction with electron donors in soil and organic matter; uptake and reduction by plant roots; adsorption onto colloids and organic matter followed by microbial reduction; complexation with organic functional groups involved in reduction. Technology could be implemented to treat winter flowrate that is not treated at primary agricultural units by installing dedicated winter-only agricultural units that are planted with a crop active only in the winter (e.g. winter oats). These dedicated winter agricultural units are only active in the winter; and are wound down as water demand at primary agricultural units increases seasonally. A winter-only crop requires significantly more acrea to treat the equivalent volume as the primary agricultural unit, which are planted with a mix crops.	Existing site experience with technology. Potential component of Cr(VI) winter treatment.	Yes	• Achieve Background • Restore Beneficial Use • Containment • Productive Use	Low	Low to moderate capital cost with low O&M cost.	Viable technology that is implementable with low/moderate costs. Agricultural land application technology has been highly effective in treating plume groundwater at site. May generate TDS/nitrate condition in groundwater that may require management. Dedicated winter agricultural units require large areas to achieve required treatment using crops that are only active in the winter. Total dedicated winter agricultural unit area required is estimated at 500-670 acres, which would likely require purchasing property.	Yes, pending space constraints.
	Ex-situ Physical/ Chemical Treatment	Reduction Coagulation Filtration (RCF)	In this process, ferrous sulfate is added to water; ferrous oxidizes to ferric while reducing hexavalent chromium to trivalent chromium; trivalent chromium co-precipitates with ferric hydroxide. Solid particles are isolated/removed by granular media, bag filters, cartridge filters or membranes. The driving force is either gravity or pressure across the filtration medium.	Potential component of ex-situ Cr(VI) treatment system.	Yes	• Achieve Background • Restore Beneficial Use • Containment	Low	Moderate to high capital cost, moderate to high O&M cost.	Potentially viable technology. Requires pilot testing to evaluate and identify key design and operating criteria (chemical dose, hydraulic retention time, need for aeration, removal efficiency, filter run times, waste materials). Produces solid and liquid waste streams. Solids include sludge that would require collection, dewatering, hauling and disposal. Liquid waste stream includes filter backwash water that can be processed and returned to the head of the treatment plant. Requires operator attention to consistently meet the background hexavalent chromium concentrations. Can be implemented as a supporting process if sufficient acreage is not available to fully treat winter-extracted water using only agricultural treatment.	Yes
		Reverse osmosis (RO) membranes	Single-pass RO membranes can reject or remove between 70-90 percent of hexavalent chromium, depending on the type and configuration of RO membrane. However, approximately 25-50 percent of the RO feed water may be brine or reject stream that requires special handling and disposal. The RO brine stream may concentrate the feedwater constituents (hexavalent chromium, metals, organics) by 2-4 times.	Potential component of ex-situ Cr(VI) treatment system. RO membranes can get fouled or scaled by sparingly-soluble salts such as calcium carbonate, barium sulfate, strontium sulfate, silica etc. Hinkley groundwater has high concentrations of sulfate which could impact the RO recoveries (ratio of product water to feed water).	Yes	• Achieve Background • Restore Beneficial Use • Containment	Low	High capital cost, high O&M cost.	RO requires elaborate pre-treatment to remove foulants. RO will generate significant quantities of brine that require special handling and disposal. Requires pilot testing to determine brine volume and characteristics. RO will require lot of energy and operator attention (add to O&M costs).	No
		Strong base anion (SBA) exchange	Hexavalent chromium from aqueous phase is removed by exchange with another ion on the SBA resin. Run times (or time between resin regenerations) are driven by sulfate concentrations. Sulfate concentrations in Hinkley groundwater is high (>300 mg/L) and will limit the run times to short durations.	Has been used to remove Cr(VI) from groundwater.	No	Not feasible for Hinkley groundwater	Low	High capital cost, high O&M cost.	Short run times can lead to large quantities of spent brine which will require special handling and disposal. Potential for "chromatographic peaking" of nitrate. In chromatographic peaking, concentrations of nitrate in the effluent can be substantially higher than in the influent water.	No
		Weak base anion (WBA) exchange	Hexavalent chromium from aqueous phase is removed by exchange with another ion on the WBA resin or reduction to trivalent chromium. Requires pH reduction to 6.0 for effective removal. Run lengths (or time between resin replacements) is dictated by several factors including co-occurring ions concentrations, temperature, resin type etc. Spent resin is disposed to a landfill.	Has been used to remove Cr(VI) from liquids. Potential ex-situ Cr(VI) treatment method for consideration.	Yes	• Achieve Background • Restore Beneficial Use • Containment	Low	Moderate capital cost, moderate-high O&M cost (O&M cost is dictated by the resin replacement frequency)	Potential component of ex-situ treatment, although effectiveness of ion exchange with site groundwater has not been evaluated at bench/pilot scale; effect of potential competing ions on treatment effectiveness and cost, as well as potential byproducts from resin use, remains to be determined. Would require extensive pilot-scale testing to confirm technical effectiveness and implementability. WBA resins were shown to release harmful by-products such as formaldehyde from reactions with resin matrix. WBA resins also accumulate other constituents such as radionuclides (uranium) which would require special handling and disposal of the spent resin material.	Yes (used for Contingency Plan)
Treated Winter Water Disposal	Discharge into Groundwater	Evaporation ponds	Surface impoundments are used to contain treated groundwater until it evaporates or disposed of by another means.	Possible option for management of water, though treated water would mostly accumulate during the winter, when ambient evaporation rates are low. This would result in large volumes of treated water stored on-site for months. Stored treated water would likely require disposal via irrigation, infiltration, or injection in addition to evaporation after the winter.	Yes	Water management mechanism, see screening comments.	Low	Moderate to high capital cost for new ponds.	Space requirements to allow fall/winter-stored water to evaporate in the summer. Otherwise, stored treated water would require additional disposal measures, like injection wells (in which case water should be injected directly and not temporarily stored), infiltration (with large space requirements and possibility of groundwater mounding) or agricultural reuse (in which case water should be reused in the winter via dedicated winter AUs and not temporarily stored). The large space requirements render technology unattractive; not retained for further evaluation.	No
		Injection wells	Groundwater is injected into on-Site wells.	Existing site experience with technology. Potential application at this Site. May help flush the groundwater and enhance movement.	Yes	Delivery mechanism, see screening comments.	High	Depends on approach.	Approach is a good option for recirculating treated water and for managing containment of plume.	Yes

NOTES
(1) Effectiveness is evaluated for each process option in terms of four criteria components: achieving background, restoring beneficial use, containment, and productive use. The main effectiveness criteria component(s) addressed by each particular process option is/are listed.
(2) Ease of implementability is evaluated in this table for the specific process option on a stand-alone basis (i.e., the discrete technology element). Table 6-4 evaluates the Ease of Implementability for the combined alternatives, which may include one or more discrete process options.
High - Alternative easy to implement.
Medium - Alternative moderately difficult to implement.
Low - Alternative difficult to implement.

APPENDIX A - TABLE 4
Summary of Source Area Soil Chromium Sampling and Excavation from 1988-2008
Pacific Gas & Electric Company, Hinkley, California

Date	Source Investigation Area	Description of Investigation Area	Documentation	Chromium Results Prior to Remedial Action	Remedial Action and Confirmation Sampling	Status & Disposition
1988-2004	Compressor Station Area A	Area A consists primarily of former unlined ditch that was used to convey wastewater to the former unlined ponds used to contain wastewater with chromium (1952 to 1966) and phosphate (1967 to 1972). Remediated area is 306 feet by 26 feet. Most of the chromium contamination was limited to (1) stained soils a few inches thick and not exposed at the surface along the base of a former unlined ditch that transported cooling wastewater containing Cr(VI) from the cooling towers to the unlined ponds, and (2) near-surface staining adjacent to an oil-water separator. The stained soil for the oil/water separator was removed and contained (E&E, 1988a). See Oil/Water Separator below for additional sampling (2003).	Ecology and Environment, Inc. 1988a. *Hinkley Compressor Station Groundwater Remediation Project Site Repor*t. October 14. __________. 1988b. *Hinkley Compressor Station, Groundwater Remediation Project, Feasibility Study*. October 14. __________. 1991. *Hinkley Compressor Station Soil and Groundwater Remediation Project Work Plan*. May. California Industrial Hygiene Services. 1992. *Results of Soil Assessment & Industrial Hygiene Monitoring to Determine Potential Hazards Associated with Soil Excavation Activities (Area A)*. December. PG&E. 1993. *Draft Soil Remediation Project Confirmation and Analysis Report*. Technical and Ecological Services.	**October 1988** Soil samples from surface, two soil borings, and three trenches cut across former cooling water discharge ditch: • Cr(T) 560 to 3,840 mg/kg from 0 to 2 feet bgs • Cr(VI) ND to 10.2 mg/kg at 2 feet bgs; sampled at horizon identified as base of former ditch	**1992** • In October 1992, soil was excavated 6 to 18 inches bgs (with deeper localized areas) to remove discolored soil and/or elevated chromium sample results. • Confirmation field XRF Cr(T) samples were collected over the entire gridded area with results ranging from ND to 330 mg/kg . XRF results were consistent with laboratory Cr(T) results for soil samples collected during remediation.	The 1988 feasibility study shows the predominant form of chromium for on-site soil is Cr(III) and not Cr(VI), that there is negligible potential under current site conditions for leaching chromium into groundwater, and that chromium originally disposed of at the site is stable and remains in the upper soil horizon in the Cr(III) state. Area A soil was removal to less than the established PRG of 500 mg/kg for Cr(T) occurred in October 1992 (306 feet by 26 feet). Approximately 750 cubic yards of soil were removed. A portion of the excavated soil was incorporated into a nonleachable emulsified asphalt base and used to pave areas at the compressor station.
1988	Compressor Station Area B	Area B is located north of the unlined ponds and is bound on the east and west by dirt roadways. Area B is south of Community Boulevard. Four borings were drilled at this site (two at 30 feet bgs and two at 15 feet bgs). Borehole B-21 was later completed as well MW-15. No Cr(VI) was detected in soil samples for this site. Cr(T) concentrations is soil samples were less than 30 mg/kg.	Ecology and Environment, Inc., 1988a. *Hinkley Compressor Station Groundwater Remediation Project Site Report.* October 14. __________.1988b. *Hinkley Compressor Station, Groundwater Remediation Project, Feasibility Study*. October 14.	**October 1988** Soil samples from four borings advanced to a maximum depth of 30 feet bgs; • Cr(T) 30 mg/kg at 0.5 foot bgs • Cr(T) 3.5 to 13.7 mg/kg at 15 feet bgs • Cr(T)19.5 mg/kg at 30 feet bgs	**1988** No removal action required. • Cr(VI) not detected in any soils samples • Cr(T) concentrations ranged from ND to 30 mg/kg	The 1988 feasibility study shows the predominant form of chromium in soil is Cr(III) and not Cr(VI), that there is negligible potential under current site conditions for leaching chromium into groundwater, and that chromium originally disposed of at the site is stable and remains in the upper soil horizon in the Cr(III) state. In 1988, soil sampling results show that no remediation is necessary for Area B. • Cr(VI) not detected in any soils samples • Cr(T) concentrations ranged from ND to 30 mg/kg
1988-2004	Compressor Station Area C	Area C consisted of a former unlined bermed pond that measured 520 feet long by 70 feet wide. Surficial soil staining was associated with elevated Cr(T) concentrations (E&E, 1988a).	Ecology and Environment, Inc. 1988a. *Hinkley Compressor Station Groundwater Remediation Project Site Report.* October 14. __________. 1988b. *Hinkley Compressor Station, Groundwater Remediation Project, Feasibility Study.* October 14. __________. 1991. *Hinkley Compressor Station Soil and Groundwater Remediation Project Work Plan.* May. PG&E. 1993. *Draft Soil Remediation Project Confirmation and Analysis Report.* Technical and Ecological Services.	**October 1988** Soil samples from four shallow soil borings: • Cr(T) 169 to 3,540 mg/kg at 0 feet bgs • Cr(T) 1,140 to 4,730 mg/kg at 0.5 foot bgs • Cr(T) 702 mg/kg at 1.5 feet bgs; Cr(T) 1,840 mg/kg at 3 feet bgs	**1993** • In October 1992, soil was excavated from 18 to 24 inches bgs (with deep localized areas) to remove discolored soil and/or previous elevated chromium sample results. • Confirmation field XRF Cr(T) samples were collected over the entire gridded area and results ranged from ND to 370 mg/kg . XRF results were consistent to laboratory Cr(T) results for soil samples collected during remediation.	The 1988, Feasibility Study shows the predominant form of chromium in soil is Cr(III) and not Cr(VI), that there is negligible potential under current site conditions for leaching chromium into groundwater, and that chromium originally disposed of at the site is stable and remains in the upper soil horizon in the Cr(III) state. Area C soil removal to less than the established PRG of 500 mg/kg for Cr(T) occurred in October 1992 (520 feet by 70 feet). Approximately 7,700 cubic yards of soil were removed.
1991 and 1993 2003 - Previous Investigation Summary	Lined Storage Ponds 2, 3, 4, and 5	The lined evaporation ponds (1 through 7), in the northern portion of the site, received cooling water for storage and evaporation. The ponds were constructed in the mid-1960s with a double liner system consisting of: 12 to 14 inches native soil cover, an upper liner (20 mil PVC), a sand bed leachate collection system, and a lower clay liner.	Brown and Caldwell. 1991. *Storage Ponds Soil Sampling,* December. __________. 1993. *Storage Ponds Soil Sampling.* April. CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September.	**1991 & 1993** Sludge and soils sample results from Ponds 2, 3, 4 and 5: • Cr(T) ranged from 5.1 to 760 mg/kg • Cr(VI) all samples were below detection limits of 0.5, 0.4, and 0.4 mg/kg • All samples were below the chromium leachability STLC results of 5.0 mg/L	The soil excavated from the dried ponds shown to be nonhazardous and was used to build large Pond 8.	Sludge and soil within Ponds 2, 3, 4, and 5 • Cr(VI) is below detection limits • Cr(T) ranged from 5.1 to 760 mg/kg • Chromium STLC results were not hazardous and were below 5 mg/L Soil excavated from the dried ponds was used to build the large Pond 8.

Date	Source Investigation Area	Description of Investigation Area	Documentation	Chromium Results Prior to Remedial Action	Remedial Action and Confirmation Sampling	Status & Disposition
		In 1988, PG&E planned on constructing a large pond (pond 8) to supplement the existing seven ponds. Subsequently, each of the seven ponds were taken out of service and updated. In 1991 and 1993, lined ponds 2, 3, 4, and 5 were taken out of service and allowed to dry. The native soil cover (12 to 14 inches) and overlying sludge were collected and analyzed for pH, conductivity, and Title 22 metals.				
1995-1997 2003 - Previous Investigation Summary	Former Debris Area	In response to employee concerns regarding a potential former debris area south of the site, three trenches were excavated to a maximum depth of 12 feet bgs covering the length and width of a former debris area.	PG&E. 1996a. Letter from Darrell Klingman/PG&E to Ken Carter/California Regional Water Quality Board. "Results of Subsurface Investigation of the Historic Waste Disposal Area." January 22. __________. 1996b. *Work Plan Soil Excavation and Remediation, PG&E Hinkley Compressor Station*. March. __________. 1997. Letter from Darrell Klingman/PG&E to Ken Carter/California Regional Water Quality Board. "Results of Soil Excavation and Remediation of the Historic Waste Disposal Area." February 6. CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September.	**1995** Sample three exploratory soil trenches: • Cr(VI) all sample results were below the detection limit of 0.1 mg/kg. • Cr(T) ranged from 8 to 1,900 mg/kg with maximum concentrations at 2 ft bgs	**1996** Approximately 50 cubic yards of soil were removed from three trenches and transported to a Class I landfill. Confirmation soil samples collected from the sides and bottom of the trenches: • Cr(VI) ND to 0.8 mg/kg • Cr(T) 2 mg/kg to 18 mg/kg	In 1996, 50 cubic yards of soil were removed from three trenches and transported to a Class I landfill.
March 2001 2003 - Previous Investigation Summary	Rental Compressor Area (south of Area A)	Upon removal of a rental compressor, located to the south of Area A, soil samples were collected from 0 to 3 feet bgs and were analyzed for Cr(VI) and Cr(T).	ChromaLab. 2001. *Laboratory Data Report*. March 12. CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September.		Confirmation soil sample results from ChromaLab 2001: • Cr(T) 3.1 to 110 mg/kg • Cr(VI) all samples were below detection limit of 0.2 mg/kg	No further action was taken because all Cr(T) concentrations are below 500 mg/kg.
January 2002	Former Cooling Towers A & B	Cooling towers A & B were used to cool heated water treated with Cr(VI) (1952 - 1966) and phosphate (1967-1972) to prevent corrosion of equipment.	BC Laboratories. 2002. *Laboratory Data Report*. January. CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September.	In 2002, cooling towers A and B were dismantled and soil samples near and under the former cooling towers were collected and analyzed with the California Waste Extraction Test to determine the soluble fraction of chromium in soil and assess the possibility of Cr(VI) leaching into groundwater.	Confirmation soil samples tested by STLC methods for Cr(VI)* by BC Laboratories 2002: • Cooling Tower A - Cr(VI) STLC concentrations ranged from 1.5 to 5.7 mg/L • Cooling Tower B - Cr(VI) STLC concentrations ranged from nondetect to 0.20 mg/L *NOTE: No Cr(T) data were available in lab data from BC Laboratories.	No further action was taken because average soil concentration were below the STLC limit for Cr(VI) of 5.0 mg/L.
October 2002 2003 - Previous Investigation Summary	P-Unit Area Chemical Shed	In 2002, a former chemical shed was dismantled in the P-Unit Area, situated near the center of the site. Soil samples were collected from 0 to 6 feet bgs for Cr(VI) and Cr(T).	Severn Trent Laboratories. 2002. *Laboratory Data Report, Submission#2002-10-0392*. October. CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September.	**2002** • Cr(T) 2.9 to 1,200 mg/kg with maximum concentration at 0.75 foot bgs • Cr(VI) non detect to 460 mg/kg with maximum concentration 0.75 foot bgs	No information available.	In the summer of 2003, approximately 60 cubic yards of soil were removed and transported to a Class I landfill.
1988 and 2003	Former Oil/Water Separator (Area A) and Installation of Fiber Optic Line	In 2003, before laying a fiber optic line in Area A, from the former oil/water separator to the current clubhouse, soil samples were collected from up to 5 feet bgs.	Ecology and Environment, Inc. 1988. *Hinkley Compressor Station Groundwater Remediation Project Site Report*. October 14. Severn Trent Laboratories. 2003. *Laboratory Data Report, Submission#2003-01-0547*.	**1988** The stained soil for the oil/water separator was removed and contained. Volume of soil removed is unknown.	**2003** • Cr(T) 1.8 to 9.9 mg/kg with maximum concentration at 1 foot bgs • Cr(VI) not detected above 0.2 mg/kg	No further action was taken because all soil samples were below established PRG for Cr(T) of 500 mg/kg.

Date	Source Investigation Area	Description of Investigation Area	Documentation	Chromium Results Prior to Remedial Action	Remedial Action and Confirmation Sampling	Status & Disposition
			January. CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September.	**2003** Soil sampling from 0 to 5 feet bgs for safety screening prior to installation of fiber optic line.		
February 2004 and January 2005	Surge Tank	The surge tank, constructed in 1951, is 15 feet, 4 inches wide by 32 feet, 9 inches long. The tank is an integral part of a closed-loop jacket water-cooling system. The tank received hot water from the water jackets of the gas compressor engines. The hot water is pumped from the tank to the heat exchangers before returning to the water jackets. During historical operations, the water from the engine cooling jacket would empty into the surge tank when a compressor engine was shut down.	CH2M HILL. 2003. *Additional Soil Sampling at the PG&E Compressor Station, Hinkley, California*. September. __________. 2004. *Soil Chromium Characterization Results and Removal Action Plan at PG&E Compressor Station, Hinkley Monitoring Program, Hinkley, California*. February. __________. 2005. *Surge Tank Removal Action Completion Report, PG&E Hinkley, California*. January 28.	**2003** Recommended investigation of Surge Tank area **2004** Collect 19 surface soil and shallow soil sampling at 10 locations for Cr(T) and Cr(VI) • Cr(T) 24 to 750 mg/kg, maximum concentration occurred at the surface (0 ft bgs) • Cr(VI) 7.9 to 15 mg/kg **2005** Approximately 14.5 cubic yards of chromium contaminated soil was excavated from areas adjacent to the surge tank to up to 2 feet bgs. Excavation was conducted in three phases - August 2004 (2 cubic yards), October 2004 (12 cubic yards), and January 2005 (0.4 cubic yard).Asbestos abatement activities were also successfully performed on November 3 and 4, 2004.	**August 2004** (20 samples) • Cr(VI) results were below industrial soil USEPA PRGs. • Cr(T) results were below PRGs for 14 of 20 samples. Localized excavation was conducted at six locations with approval from Water Board. **October 2004** (15 samples) • Cr(VI) results were below industrial soil USEPA PRGs. • Cr(T) results for 13 of 15 samples were below PRGs. Localized excavation recommended for two locations (see January 2005 for excavation results). **January 2005** Localized excavation at two locations was conducted. Confirmation results at 2 feet bgs during the October 2004 indicated that Cr(VI) and Cr(T) results were below PRGs; therefore, no additional confirmation sampling was performed in January 2005.	No further action because confirmation results are below established USEPA 2002 Region 9 industrial soil PRGs of Cr(VI) 64 mg/kg and Cr(T) 450 mg/kg.
Unknown	Leachfields, Sump, and Associated Pipelines	Unknown usage of leachfields, sump, and associated piping.	Unknown if any investigation has been conducted or if an investigation is warranted.	Unknown if any investigation has been conducted or if an investigation is warranted.	Unknown if any investigation has been conducted or if an investigation is warranted.	Unknown
2006 and 2008	Property 14 -Debris Area	Property 14 (APN # 0488-112-53-0000) is a 40-acre parcel located southwest of the Hinkley Compressor Station. This parcel is largely covered by native vegetation and slopes gently toward the Mojave River. There are several undeveloped roads crossing the parcel (CH2M HILL, 2008). According to PG&E staff, debris from the Hinkley Compressor Station was disposed of in shallow trenches on Property 14 from approximately 1952 to the mid-1970s. Samples were analyzed for asbestos, organic, and metals.	CH2M HILL. 2006. *Geophysical Investigation Phase 2 Work Plan of PG&E Property 14 Southwest of Hinkley Compressor Station, Hinkley, California*. April. __________. 2008. *PG&E Property 14 Site Investigation, Data Summary Report, Hinkley, California*. November.	**2006** Site visit, interviews with PG&E employees, materials potentially containing asbestos were collected for asbestos analysis and geophysical survey was conducted to identify geophysical anomalies that could identify areas of potential burial. **2008** Twenty-five potholes were excavated in areas were geophysical anomalies were identified in 2006.	**2006** Site investigation found some debris on the ground including non-friable asbestos-containing materials. Five areas of geophysical anomalies were identified indicating areas of potential buried waste. **2008** Of 25 potholes excavated only two potholes contain a significant amount of debris. According to Stantec, Pothole (PH-09) contained asbestos-containing materials & non-hazardous trash; the other pothole (PH-10) contained a solid piece of greenish-white material with hazardous levels of zinc (5,120 mg/kg) at approximately 2 feet bgs.	Site does not appear to have chromium contamination and does not appear to be associated with wastewater disposal. No further investigation required.
2008	Concrete Pipelines Investigation and Removal	Concrete pipelines (12-inch in diameter) were encountered during installation of the subsurface infrastructure associate with the Source Area *in situ* remediation system. Historic photographs indicate that these concrete pipelines were present prior to	Stantec. 2008. *Investigation and Removal of Historic Concrete Piping Discovered During In Situ Remediation System*. September.	**2008** Soil samples were collected every 200 feet and at junctions and valves per Water Board requirements. Analytical results for 59 soil samples show chromium	Concrete pipes (with and without visible green staining) and a small area of green soil (2 ft by 2 ft) was removed and transported to Kettleman Hills landfill for disposal.	Visual observations during pipe removal confirm chromium was not released from the piping except for a small 2 ft by 2 ft area of green stained soil. All Cr(T) and Cr(VI) soil sampling results were less than unrestricted residential PRGS

Date	Source Investigation Area	Description of Investigation Area	Documentation	Chromium Results Prior to Remedial Action	Remedial Action and Confirmation Sampling	Status & Disposition
		construction of the compressor station in the 1950's. It appears the pipelines were used for irrigating agricultural fields. When piping was initially discovered, the pipe interior at a few locations was visibly green and samples indicated the presence of chromium.		concentrations: • Cr(T) 2.58 to 188 mg/kg • Cr(VI) <0.040 to 3.5 mg/kg • All Cr(T) and Cr(VI) less than unrestricted residential PRGS of 210 mg/kg and 30 mg/kg, respectively.		of 210 mg/kg and 30 mg/kg, respectively.

Abbreviations

Cr(VI) = hexavalent chromium.
Cr(T) = total chromium.
Cr(III) = trivalent chromium.
ND = nondetect.
USEPA = United States Environmental Protection Agency.
PRG = preliminary remediation goals.
STLC = soluble threshold limit concentration.
XRF = X-ray fluorescence.

APPENDIX A - TABLE 5
Summary of Site Locations, Acreage, and Number of Test Pits
Pacific Gas and Electric Company
San Francisco, California

Site	Approximate Acreage	Number of Test Pits	General Location
Ranch LTU	120	8	North of Hwy 58 across from the intersection of Fairview Road
Site 5 LTU	80	8	Southeast corner of Fairview Road intersection with SR 58
East LTU	35	5	South of Hwy 58, northwest corner of Community and Summerset Road intersection

Laboratory results for nitrogen in shallow surface soil samples (composite of upper 18 inches) were very low to low (less than 11 mg/kg) throughout all test pits, except in test pits R4 and E4, where levels were high (64 and 33mg/kg, respectively). The R4 sample was from the Ranch where manure has been applied for crop cultivation, and the E4 sample was from the former East LTU.

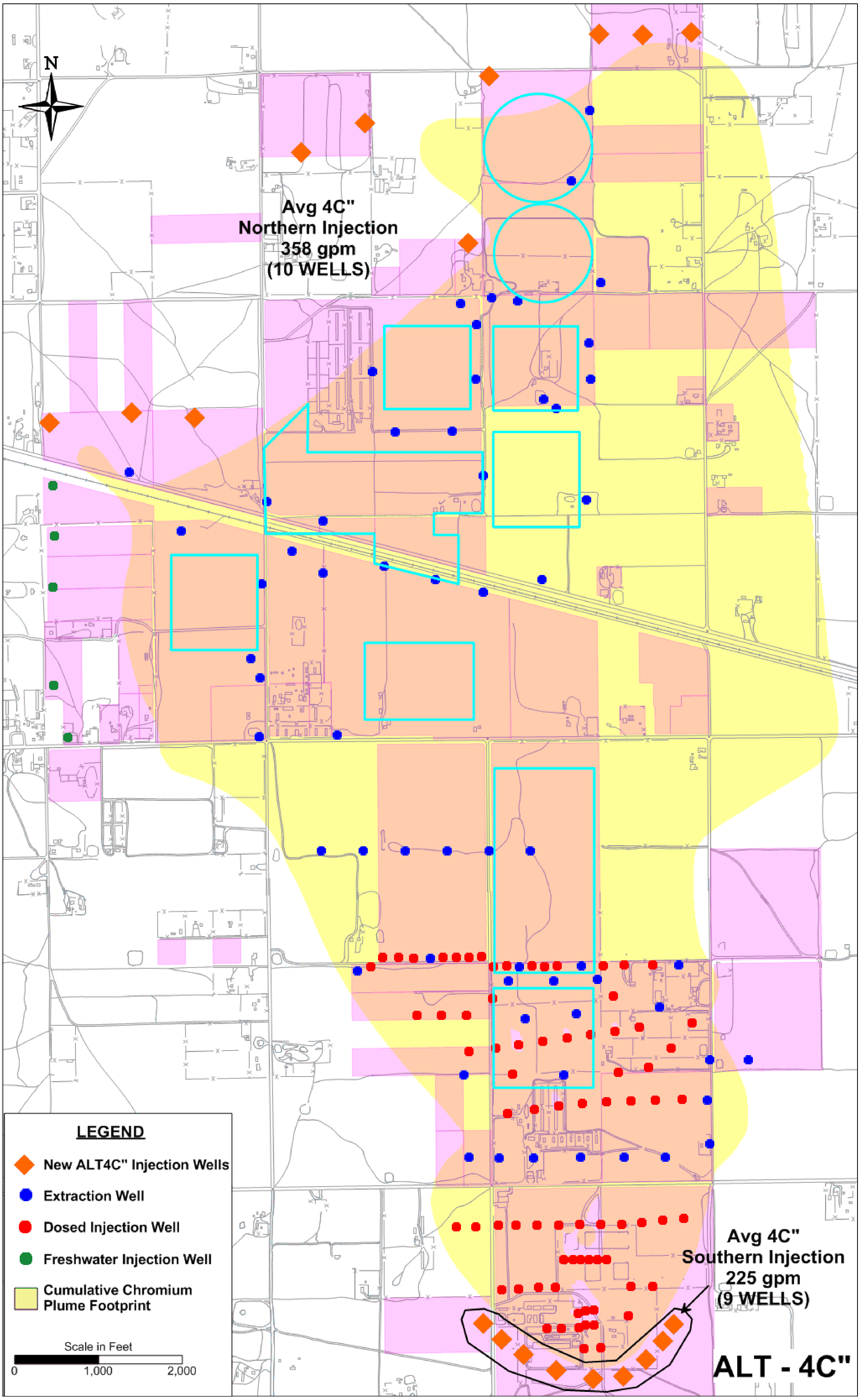
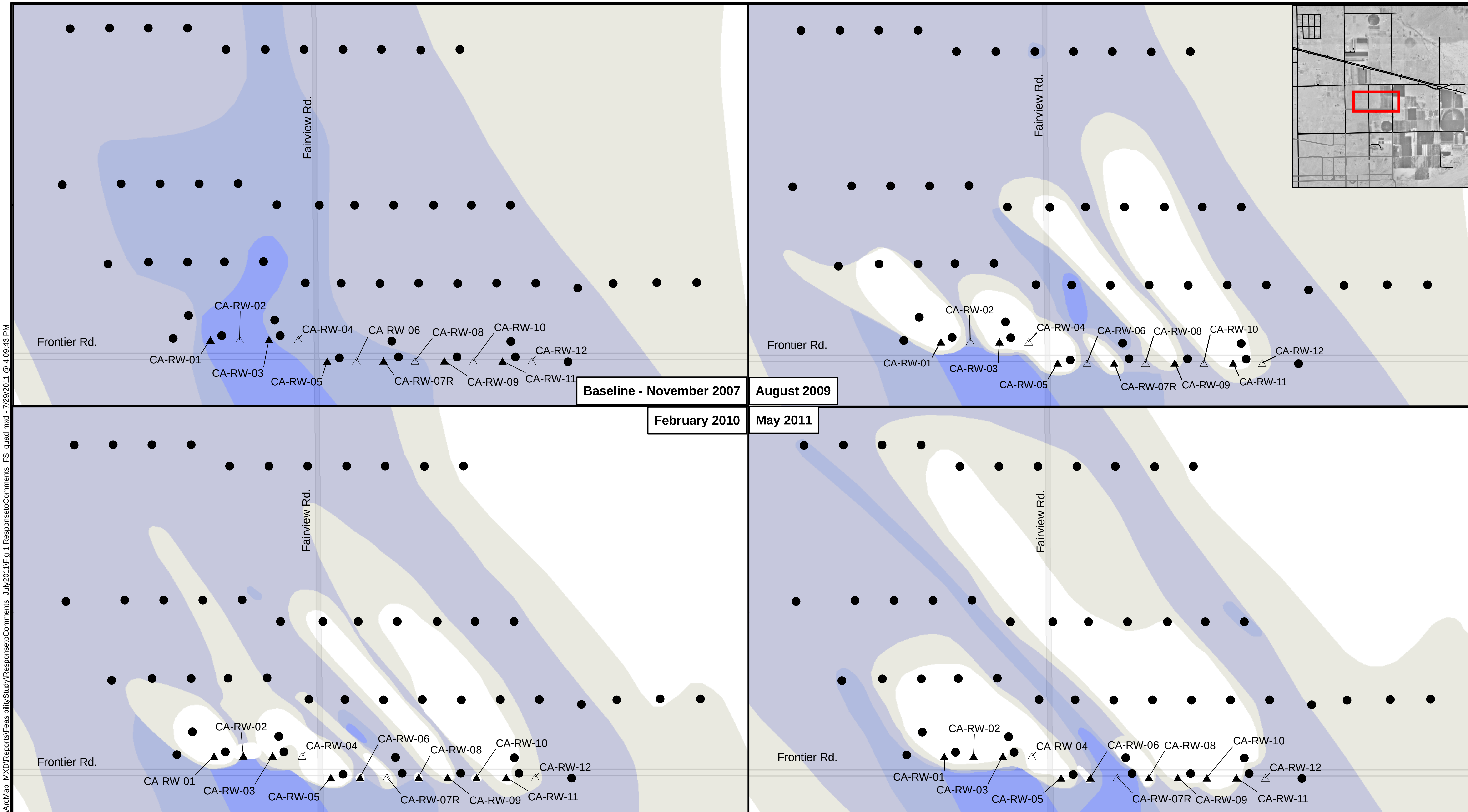


FIGURE A-1
Injection Wells
Draft Alternative 4C"
Feasibility Study Addendum 3
Pacific Gas & Electric Company
Hinkley, California



Program Manager Lisa Cope
Project Manager Jenifer Beatty
Task Manager Margy Gentile
Technical Review Frank Lenzo

ARCADIS

100 Montgomery Street, Suite 300
San Francisco, California 94104
Tel: 415 374 2744
Fax: 415 374 2745
www.arcadis-us.com

Legend

- Chromium Concentrations Less Than 3.1 µg/L
- Chromium Concentrations Between 3.1 to 10 µg/L
- Chromium Concentrations Between 10 and 50 µg/L
- Chromium Concentrations Between 50 and 100 µg/L
- Chromium Concentrations Between 100 and 500 µg/L
- ● Monitoring Well
- △ IRZ Extraction Well
- ▲ IRZ Injection Well

Note: µg/L - micrograms per liter

N

0 480 960 Feet

Central Area

Current Remediation Status - Central Area IRZ Shallow Unit of the Upper Aquifer

Response to Comments on Feasibility Study
Pacific Gas and Electric Company
Hinkley, California

Project Number RC000699.0044
Date 7/29/2011
Figure A-2

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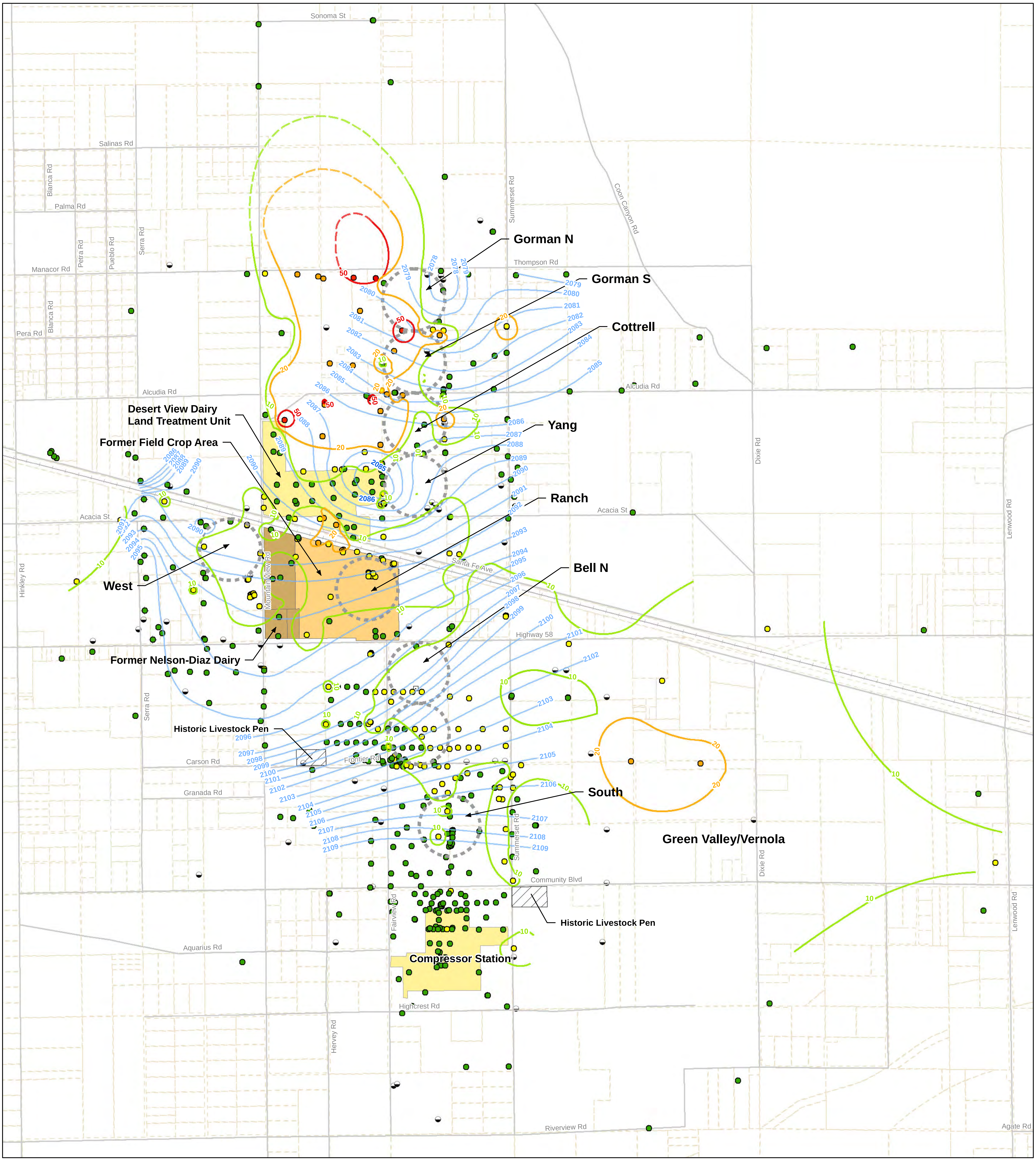

LEGEND

Nitrate as Nitrogen Concentrations (milligrams per liter [mg/L])

Contours

- 10
- 20
- 50

Potentiometric Elevation Contours from Upper Aquifer Monitoring Well Data, April 2011 (feet above MSL, 1 ft interval)

Agricultural Treatment Units

Nitrate as Nitrogen (mg/L)

- 0 - 10
- 10 - 20
- 20 - 50
- >50

N

0 500 1,000 2,000
Feet

FIGURE A-4
AVERAGE NITRATE AS NITROGEN CONCENTRATIONS PORTION OF HINKLEY VALLEY

SITE-WIDE GROUNDWATER MONITORING PROGRAM
PACIFIC GAS & ELECTRIC CO. COMPRESSOR STATION
HINKLEY, CALIFORNIA

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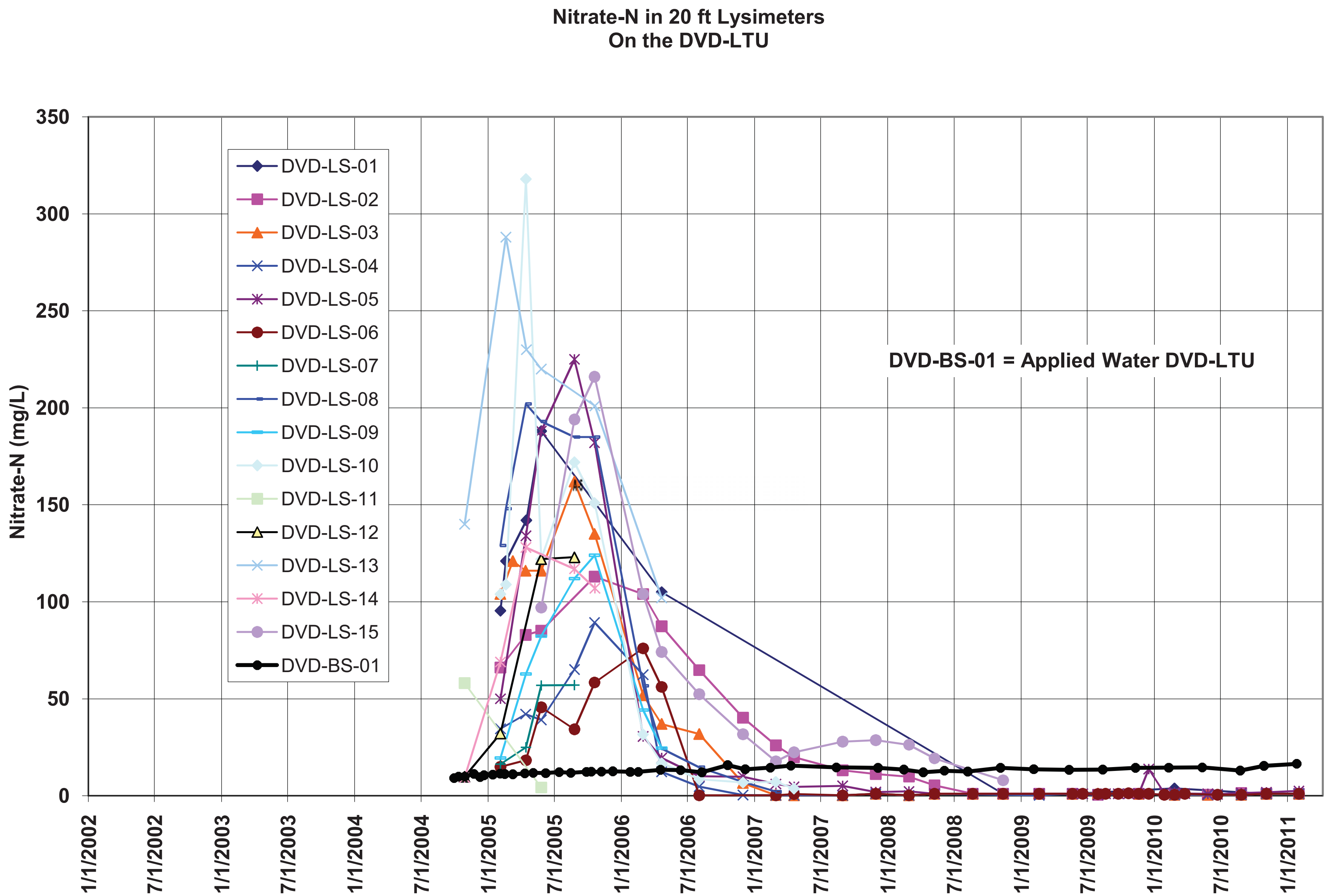
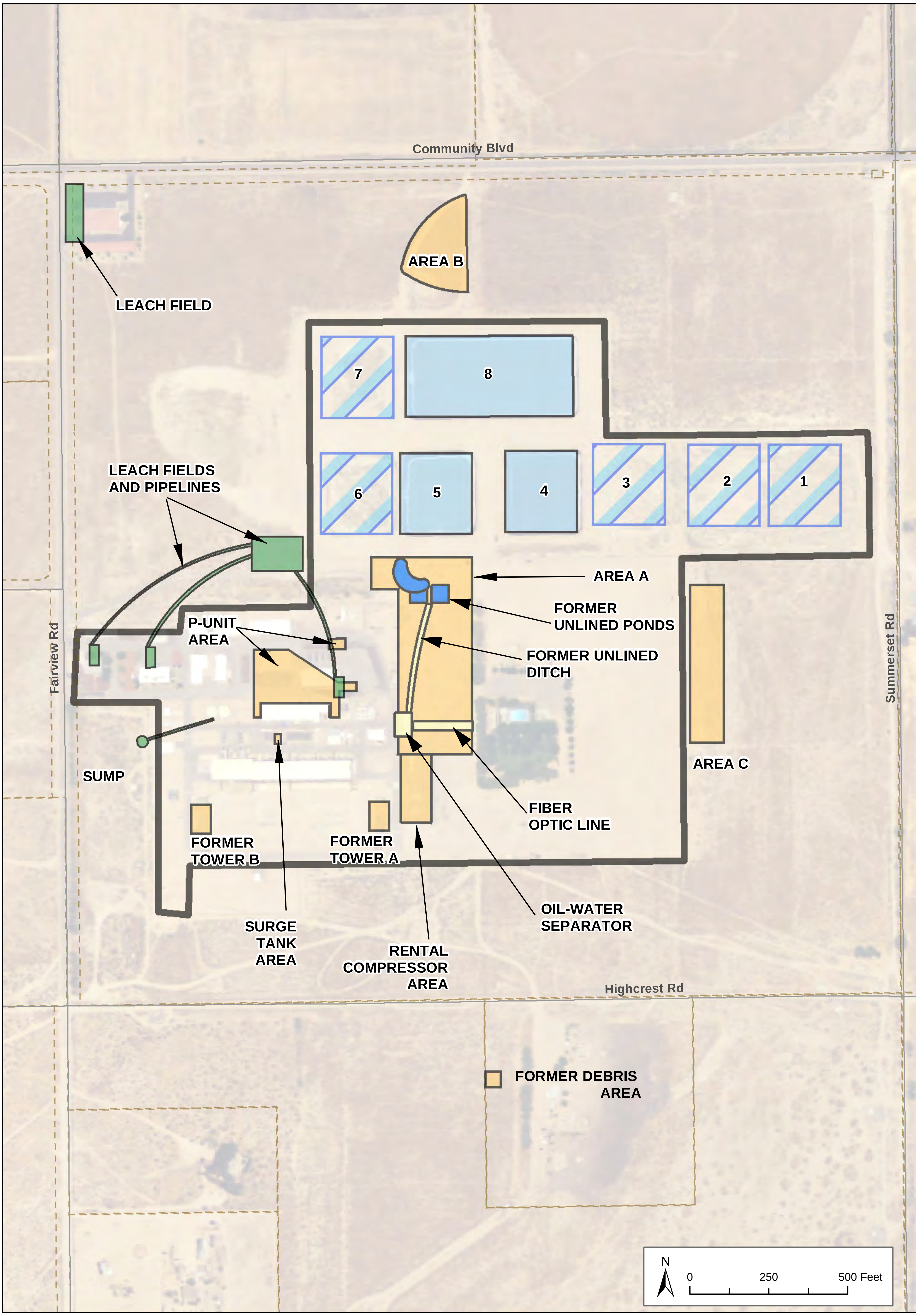


FIGURE A-5
NITRATE-N CONCENTRATIONS IN 20-FOOT LYSIMETER SAMPLES
SITE-WIDE GROUNDWATER MONITORING PROGRAM
PACIFIC GAS & ELECTRIC CO. COMPRESSOR STATION HINKLEY, CALIFORNIA



LEGEND
- Existing Lined Evaporation Pond
- Former Lined Evaporation Pond
- Former Unlined Evaporation Pond
- Investigation, Remedial Action Completed

Leica Geosystems Geospatial Image, July 26, 2007

FIGURE A-6
PREVIOUS SOIL INVESTIGATION AND REMEDIATION AREAS, 1988 THROUGH 2005
PACIFIC GAS AND ELECTRIC CO. COMPRESSOR STATION
HINKLEY, CALIFORNIA

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Appendix A - Attachment A

Evaporation Pond Sizing Rough Estimate for Alt 5 flow rates

Assumed Pond Size

272.5	acre	Alter acreage required to get zero stored water at end of Septembe
11870100	ft^2	

	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Reference
days in month	31	28	31	30	31	30	31	31	30	31	30	31	
gpm from AU for storage	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	From Alt 5 treatment system flow
Reference ET (in) for evap rate	2.29	2.89	5.33	7.08	9.13	10.05	9.92	8.86	6.96	4.86	2.78	1.98	CIMIS #134 Barstow Eto, 1999-2009

Pond Evaporation Estimates

	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Reference
Precipitation, (in.) [INFLOW]	0.34	0.81	0.43	0.30	0.11	0.09	0.38	0.43	0.82	0.25	0.43	0.38	Kc calcd;CIMIS Barstow (#134), 1999-2009 Avg. by month
AU water (in.) [INFLOW]	6.03	5.45	6.03	5.84	6.03	5.84	6.03	6.03	5.84	6.03	5.84	6.03	From Alt 5 treatment system flow
Water from last month (in.) [INFLOW]	8.87	12.84	16.06	16.93	15.63	12.19	7.56	3.56	0.72	0.00	1.18	4.54	
Evaporation, (in.) [OUTFLOW]	2.40	3.03	5.60	7.43	9.59	10.55	10.42	9.30	7.31	5.10	2.92	2.08	equals ref ET (CIMIS #134 Barstow Eto, 1999-2009) + 5%, per Smesrud
Water at end of month (in.)	12.84	16.06	16.93	15.63	12.19	7.56	3.56	0.72	0.00	1.18	4.54	8.87	Fixed September end-of-month to zero - start October empty
									7.38				
									0.07				

Minimum pond area required:	272.50	acre
Contingency for storms, etc.:	20%	
Rough Design Estimate pond area:	**327**	**acre**
Minimum pond height:	17	inches
Required freeboard height:	12	inches
Rough Design Estimate pond height:	**29**	**inches**

Assumptions

For rough sizing only

Evaporation = 1.05*reference ET (rule of thumb)

Precipitation inflow estimates for a standard farming year, does not estimate higher interval storms (e.g. 5-year, 10-year, 100-year storms)

Appendix A - Attachment B
Evaporation Pond Sizing Rough Estimate for Alt 4C-3 flow rates

Assumed Pond Size

212.5 acre   Alter acreage required to get zero stored water at end of September
9256500 ft^2

	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Reference
days in month	31	28	31	30	31	30	31	31	30	31	30	31	
gpm from AU for storage	1608	1608	1608	177	177	177	98	98	98	1244	1244	1244	From Alt 4C-3 treatment system flow
Reference ET (in) for evap rate	2.29	2.89	5.33	7.08	9.13	10.05	9.92	8.86	6.96	4.86	2.78	1.98	CIMIS #134 Barstow Eto, 1999-2009

Pond Evaporation Estimates

	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Reference
Precipitation, (in.) [INFLOW]	0.34	0.81	0.43	0.30	0.11	0.09	0.38	0.43	0.82	0.25	0.43	0.38	Kc calcd;CIMIS Barstow (#134), 1999-2009 Avg. by month
AU water (in.) [INFLOW]	12.44	11.24	12.44	1.33	1.37	1.33	0.76	0.76	0.73	9.62	9.31	9.62	From Alt 4C-3 treatment system flow
Water from last month (in.) [INFLOW]	19.53	29.90	38.91	46.19	40.38	32.27	23.13	13.86	5.74	0.00	4.78	11.60	
Evaporation, (in.) [OUTFLOW]	2.40	3.03	5.60	7.43	9.59	10.55	10.42	9.30	7.31	5.10	2.92	2.08	equals ref ET (CIMIS #134 Barstow Eto, 1999-2009) + 5%, per Smesrud
Water at end of month (in.)	29.90	38.91	46.19	40.38	32.27	23.13	13.86	5.74	0.00	4.78	11.60	19.53	Fixed September end-of-month to zero - start October empty

Minimum pond area required:	212.50	acre
Contingency for storms, etc.:	20%	
Rough Design Estimate pond area:	**255**	**acre**
Minimum pond height:	46	inches
Required freeboard height:	12	inches
Rough Design Estimate pond height:	**58**	**inches**

Assumptions
For rough sizing only
Evaporation = 1.05*reference ET (rule of thumb)
Precipitation inflow estimates for a standard farming year, does not estimate higher interval storms (e.g. 5-year, 10-year, 100-year storms)

APPENDIX B

Groundwater Modeling Particle Tracks for Alternatives 4B, 4C-1, 4C-2, 4C-3, and 4C-4

APPENDIX B

Groundwater Modeling Particle Tracks for Alternatives 4B, 4C-1, 4C-2, 4C-3, and 4C-4

Introduction

The existing strategy for plume containment in the northern and central areas of the Hinkley compressor station site includes groundwater extraction and land (agricultural) treatment. Pilot-scale testing at the Desert View Dairy (DVD) Land Treatment Unit (LTU) and the Gorman Agricultural Unit (AU) indicates that a remediation strategy that includes groundwater extraction and treatment can be effective and efficient if implemented on a larger scale, and therefore is an integral part of most of the alternatives being considered in the Feasibility Study (FS) Addendum #3.

The principal means of rapidly achieving hydraulic control of impacted groundwater and preventing further migration at many contamination sites is “pump and treat,” which typically uses extraction wells and, at some sites, injection wells, to capture (contain) the area targeted for cleanup. The hydraulic capture zone for a groundwater extraction well field can be defined as “the region that contributes the ground water extracted by the extraction well(s). It is a function of the drawdown due to pumping and the background (i.e., without remedy pumping) hydraulic gradient” (U.S. Environmental Protection Agency, “A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems—Final Project Report,” January 2008). Mass removal will result from hydraulic containment (via groundwater extraction and treatment), and can be enhanced by optimizing extraction well pumping rates periodically as the remedy progresses.

Hydraulic containment is achieved by pumping the extraction wells at rates sufficient to cause all contaminated groundwater within the target volume to flow towards the extraction wells. For the purposes of the FS, the target capture zone at the Hinkley site is considered to be the 3.1 μg/L Cr(VI) plume boundary for the First Quarter of 2010. However, groundwater modeling to evaluate plume capture was conducted using 3.1/3.2 μg/L Cr(VI)/Cr(T) plume boundary for the First Quarter of 2011, which is larger than the 3.1 μg/L Cr(VI) plume boundary for the First Quarter of 2010. Conclusions regarding plume capture are made based on comparison to the First Quarter 2011 plume outline, and thus also addresses the First Quarter 2010 plume.. If hydraulic containment of the target volume is achieved and maintained, the groundwater within the target volume will eventually be captured by the extraction wells, preventing further migration of chromium-impacted groundwater to areas outside of the target volume.

In simple aquifer systems (e.g., one water-bearing unit with a constant, unidirectional hydraulic gradient), algebraic solutions can be used to estimate the zone of hydraulic containment (i.e., the capture zone) for an extraction well field. However, the hydrogeologic system in the Hinkley area is too complex for a simple algebraic solution to estimate capture zones, and requires numerical groundwater flow modeling with particle tracking to evaluate the cumulative effects of the existing and proposed extraction wells, surrounding agricultural supply wells, layered aquifer system, multiple sources of groundwater recharge, and temporal variability in pumping and recharge rates.

Method

The forecasted effectiveness of plume containment resulting from different groundwater extraction well configurations considered in FS Addendum #3 was evaluated using a numerical groundwater flow model developed specifically for the site. A discussion of model construction and assumptions is presented in Appendix G. The level of detail considered in the groundwater flow modeling presented herein is appropriate for evaluation of the remedial alternatives currently under consideration. However, it is anticipated that additional modeling will likely be conducted during remedial design of the selected remedial alternative to incorporate new hydrogeologic data collected since the First Quarter of 2011. During the remedial design phase, details regarding the number, locations, screened intervals, capacities, and operating schedule for the extraction wells, injection wells, and agricultural supply wells for the selected remedy may be reevaluated and optimized using new data.

All of the alternatives considered in FS Addendum #3 include the operation of existing and potential new groundwater extraction wells to improve hydraulic containment of the Hinkley chromium plume; Alternative 4C-3 also includes injection wells to reinject some of the groundwater that is extracted (and treated) during the winter months. The groundwater flow model was used to estimate the extent of hydraulic containment provided by each extraction well configuration. The extent of hydraulic containment provided by a particular pumping configuration is influenced by changes in hydrologic conditions in the Hinkley area, including groundwater recharge beneath irrigated agricultural fields and seasonal pumping from agricultural supply wells in the Hinkley Valley. Therefore, forecasted capture zones will expand and contract over time due to seasonal and long-term fluctuations in groundwater levels, pumping rates, and recharge rates, even if the pumping rates from the proposed extraction wells were to remain constant. Impacts of these fluctuations were considered in the model by incorporating quarterly (3-month-long) "stress periods" into each simulation, and applying particle-tracking software to trace the forecasted pathways of simulated groundwater "particles" over time, starting at the plume boundary. Extraction and agricultural supply pumping rates are assumed to adjust in accordance with AU capacity and agronomic demand each quarter of the year (starting with winter, followed by spring, summer, and fall); the quarterly pumping rates input to the model are based on the different assumptions for each alternative, which change from season to season.

Particle tracking was used to determine which portions of the plume are forecasted to be hydraulically contained during the first several years of each remedial alternative. Growth of the hydraulic capture zones is expected for the first few years following commencement of pumping under each alternative, in response to increasing groundwater level drawdown. After 2 to 4 years of pumping, the capture zones under each remedial alternative are forecasted to achieve their typical full-scale dimensions, with minor fluctuations related to temporal hydrologic stresses (discussed above). Changes to the capture zones may also occur in response to anticipated future optimization of the extraction and treatment systems under each alternative (as described in main text of FS Addendum #3). Figures were developed showing forecasted particle tracks and estimated summer and winter zones of hydraulic control for each alternative during the first four simulated years following implementation, while effects of remedy implementation would still be developing and capture zones would be in or near the end of the "growth" phase. Specifically, figures are provided that show conditions at the end of the first 15 months of the simulation period (in March after 1 year of modeled pumping), and at

51 months into the simulation period (in March of simulation year 5). March (end of winter) groundwater levels are shown on these figures because that is the when simulated water-level drawdown and zones of hydraulic control are generally the smallest (pumping rates are smaller and irrigation return flows are larger than during other seasons). Therefore, the modeling figures illustrate conservatively small drawdown compared to the three other seasons.

Modeling Results

Model-forecasted groundwater levels and zones of hydraulic control in the upper aquifer after approximately 1 and 4 years of pumping under Alternative 4B and the Alternative 4C variants (Alternatives 4C-1, 4C-2, 4C-3, and 4C-4) are shown on Figures B1 through B-10. A summary of the features and comparison of the differences between each of these remedial alternatives is provided in Table B-1. Also shown on Figures B1 through B-10 are simulated groundwater pathlines (particle tracks), indicating the forecasted direction and distance of groundwater migration from the First Quarter 2011 plume boundary. Arrow heads on the particle tracks indicate groundwater movement occurring each year. Note that the particle tracks commonly deviate from a straight line between the arrow heads (each arrow head represents 1 year of simulated groundwater movement). These deviations are a result of the simulated changes in pumping rates from quarter to quarter, which cause particle tracks in some areas to shift direction somewhat during the course of a year of simulated flow. However, the directions of forecasted particle movement are dominated by the average annual pumping rate assumed for each alternative, and the net direction of groundwater movement is from the First Quarter 2011 plume boundary toward the extraction wells.

The target zone for capture (First Quarter 2010 and 2011 plume outlines) is forecasted to be captured by Alternatives 4B and each of the Alternative 4C variants. The assumed quarterly changes in pumping rates (in response to changes in agricultural unit capacity and agronomic demand) are not projected to result in overall loss of any part of the plume under these alternatives. By the fifth simulated year of pumping, the zones of hydraulic control in winter and summer are forecasted to be much larger than the First Quarter 2011 plume, indicating a capture zone conservatively large compared to the known plume boundaries. Results for each of the particle tracking simulations are shown on Figures B-1 through B-10. Relevant quantitative metrics for the simulation results are summarized in Table B-2, including:

- Forecasted extent of hydraulic control downgradient of the target zone—this metric is an indicator of the “excess” hydraulic control forecasted to occur north (downgradient) of the target zone for capture. The values provided on Table B-2 for this metric are the minimum distances between the First Quarter 2011 plume boundary and the estimated summer and winter extents of hydraulic control, which occur well beyond the plume boundary to the north and northwest under most of the alternatives.
- Forecasted drawdown in the area of the northern agricultural units—this metric is an indicator of the magnitude of the projected impacts of the proposed agricultural pumping on groundwater levels, and how drawdown is expected to evolve over time. The values provided on Table B-2 for this metric are the projected increases in depth to groundwater level after 15 and 51 months of pumping under each remedial alternative, compared to Second Quarter 2011 groundwater levels at the site, shown on Figure B-11.

Inspection of Table B-1 and Figures B-1 through B-10 indicates that the alternatives considered (Alternative 4B and the Alternative 4C variants) are forecasted to draw down groundwater levels sufficiently to achieve hydraulic control and capture of the target zone. Forecasted drawdown ranges from approximately 5 feet to 20 feet after 15 months of pumping, and 15 feet to more than 50 feet after 51 months of pumping. Forecasted drawdown is smallest under Alternative 4B, and increases progressively under Alternatives 4C-1 through 4C-4, which corresponds with increasing pumping rates and number of agricultural units assumed. The model results suggest that the proposed pumping rates under Alternative 4C-4 may not be sustainable at all extraction wells, as they may draw down groundwater levels to the base of the upper aquifer. If that occurs, pumping rates will be adjusted at the extraction wells to maintain plume capture.

During the second through fifth years of implementation, most of the remedial alternatives are projected to create capture zones that significantly exceed the extents of the target zone. By summer of the fifth year, most of the proposed remedial alternatives are forecasted to achieve hydraulic control of groundwater to distances of 3,600 feet (Alternative 4B) to 6,400 feet (Alternative 4C-4) beyond (downgradient from) the First Quarter 2011 plume boundary. However, under Alternative 4C-3 the extent of hydraulic capture in the north during winter is limited by the assumed locations of proposed injection wells, which are simulated to reinject a portion of the groundwater extracted from beneath agricultural units during the winter months, following ex situ treatment to remove chromium (see Section 5 of FS Addendum #3 for additional description of this alternative).

Conclusions

The modeling results indicate year-round hydraulic capture of the target capture zone under each of the alternative pumping scenarios considered (by summer of the year following remedy implementation). Both the extents of hydraulic control and the particle tracks shown on Figures B-1 through B-10 indicate that capture of the target zone is forecasted to be maintained during both the summer (maximum) and winter (minimum). During the first 5 years of implementation of most of the alternatives, the zones of hydraulic control are forecasted to expand substantially and to cover similar areas, significantly exceeding the First Quarter 2011 plume outline. The exception is Alternative 4C-3, which assumes reinjection of most of the groundwater extracted during winter (following treatment at an ex situ treatment plant), and is forecasted to have a smaller winter capture zone than the other alternatives by year 5.

The extents of hydraulic control achieved by each alternative generally increase from Alternative 4B through Alternative 4C-4, with increasing numbers of agricultural units and net annualized extraction rates. However, all of these alternatives provide significant “excess” capture beyond the First Quarter 2011 plume boundary (with the exception of Alternative 4C-3 during winter, as noted above). Because the larger average year-round pumping rates of Alternative 4C-4 aren’t necessary to achieve capture of the First Quarter 2011 plume boundary, the excess net extraction under Alternative 4C-4 could result in unnecessary drawdown of the water table over a broader area compared to Alternatives 4B and 4C-2. The excess pumping rate net withdrawal may increase drawdown in the area to unacceptable levels and have a negative impact on other water users in the Hinkley area, including increased pumping lifts resulting in greater costs to pump groundwater

TABLE B-1
ALTERNATIVE 4 VARIATIONS COMPARISON
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

Major Item	Alternative 4 (per FS)	Alternative 4A (Addendum #1)	Alternative 4B (Addendum #2)	Alternative 4C-1 (Addendum #3)	Alternative 4C-2 (Addendum #3)	Alternative 4C-3 (Addendum #3)	Alternative 4C-4 (Addendum #3)
AU Pivots[1]	3	5	5	9	9	9	25
Agricultural Treatment Capacity	840/950 gpm[Note 2,3,4]	1270 gpm[Note 2,3,4]	1270 gpm[Note 2,3]	1830/1530 gpm[Note 2,3,5,6]	2041.5/2041.5/2041.5/1687.5 gpm[Note 2,3,5,6]	2829/2829/2829/2325 gpm[Note 2,3,5,6]	2829/2829/2829/2325 gpm[Note 2,3,5,6]
Fresh Water Injection	40 gpm	80 gpm	80 gpm	80 gpm	80 gpm	80 gpm	80 gpm
Central Area IRZ Dosed Injection	150/0 gpm[Note 3,5]	140/140/140/0 gpm[Note 3,5]	140/140/140/0 gpm[Note 3,5]	140/140/140/0 gpm[Note 3,6]	140/140/140/0 gpm[Note 3,6]	140/140/140/0 gpm[Note 3,6]	140/140/140/0 gpm[Note 3,6]
SCRIA IRZ Dosed Injection	195/0 gpm[Note 23,5]	195/195/255/170 gpm[Note 3,5]	195/195/255/170 gpm[Note 3,5]	195/195/255/170 gpm[Note 3,6]	195/195/255/170 gpm[Note 3,6]	195/195/255/170 gpm[Note 3,6]	195/195/255/170 gpm[Note 3,6]
Source Area IRZ Dosed Injection	125/0 gpm[Note 3,5]	150/0/0/0 gpm[Note 3,5]	150/0/0/0 gpm[Note 3,5]	150/0/0/0 gpm[Note 3,6]	150/0/0/0 gpm[Note 3,6]	150/0/0/0 gpm[Note 3,6]	150/0/0/0 gpm[Note 3,6]
Ex-Situ Treated Injection	---	---	---	---	---	787.5/787.5/787.5/637.5 gpm[Note 2]	---
Primary Differences Between Alternatives							
1. Central Area IRZ	Current horizontal length for the recirculation IRZ, with supplemental SCRIA injection points to the east	Increase the width by 100 percent over the current length, expanding to the east and west to intercept a greater portion of the plume	***No change compared to Alternative 4A***	***No change compared to Alternative 4B***	***No change compared to Alternative 4B***	***No change compared to Alternative 4B***	***No change compared to Alternative 4B***
2. Operation of IRZ Components (SCRIA, Source Area, and Central Area)	5 years	20 years (intermittent, low concentration carbon amendment continues beyond 20 years - see text for description)	***No change compared to Alternative 4A***	SCRIA no longer receiving extraction from north of Highway 58 in initial buildout as in Alternative 4B. New extraction wells located in the SCRIA provide 110 gpm for dosed injection (as well as 150 gpm for the South SCRIA Pivot). All other well optimizations remain the same as Alternative 4B.	***No change compared to Alternative 4C-1***	***No change compared to Alternative 4C-1***	***No change compared to Alternative 4C-1***
3. Plume Containment and Treatment via GW Extraction	950 gallons per minute (gpm) average annual withdrawal, 840 gpm of which is sent to AUs, and 110 gpm is sent to the SCRIA (while IRZ is in operation)	Increase the amount of withdrawal above Alternative 4 by 430 gpm (to a total of 1,380 gpm total). The increased withdrawal all goes to support AU expansion. After year 10, an additional 60 gpm is pumped and sent to the SCRIA.	After year 10, 2 of the original extraction wells to support the new AUs are shut down, and the same flow (total of 100 gpm) is extracted from 12 new extraction wells located in the plume toe (10 in the vicinity of the existing SCRIA and DVD AU extraction wells, and 2 in the vicinity of the Gorman AU extraction wells), and redirects this flow to the new AUs.	Increase the amount of initial withdrawal above Alternative 4B by 560 gpm (to a total of 1,830 gpm total when all AUs are in operation). The increased withdrawal all goes to support AU expansion. This alternative supports 4 more AU pivots than Alternative 4B for a total of 9 AU pivots, not including the DVD LTU. After 20 years, the 2 Bell pivots (not included in Alternative 4B) and associated extraction wells are turned off and total flow is reduced to 1,530 gpm. Well optimizations occur at year 10 and year 20 to further address areas of lingering mass, redirecting up to 155 gpm to AUs and SCRIA dosed injections.	Increase the amount of initial withdrawal above Alternative 4C-1 by 211.5 gpm (to a total of 2,041.5 gpm total when all AUs are in operation). The increased withdrawal goes to support winter crops. All other well optimizations remain the same as Alternative 4C-1.	Increase the amount of initial withdrawal above Alternative 4C-2 by 787.5 gpm (to a total of 2,829 gpm total when all AUs are in operation) and pump continuously throughout the year. The increased withdrawal beyond Alt 4C-2 is treated ex-situ. Chemical reduction / precipitation ex-situ treatment treats excess winter flow that is not supported by the AUs. Cost estimates assume two plants (one that treats approximately 1,200 gpm* derived generally north of Hwy 58 and second plant that treats approximately 450 gpm* (reduced to 150 gpm at year 20) derived generally south of Hwy 58). (Note: * not annualized) All other well optimizations remain the same as Alternative 4C-1.	Increase the amount of initial withdrawal above Alternative 4C-2 by 788 gpm (to a total of 2,829 gpm total when all AUs are in operation) and pump continuously throughout the year. This alternative adds 16 pivots above Alternative 4C-2 for a total of 25 pivots. New pivots are used to support excess winter flows in lieu of an ex-situ treatment plant. All other well optimizations remain the same as Alternative 4C-1.
4. Duration of GW Extraction	Until background concentrations are achieved	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***	***No change compared to Alternative 4***
Estimated Timeframe of Alternative to Reach: [Note 7]							
50 µg/L	6 years	6 years	6 years	6 years	6 years	4 years	3 years
80% mass removal	13 years	10 years	10 years	8 years	7 years	6 years	6 years
3.1 µg/L	150 years	75 years	40 years	40 years	39 years	36 years	29 years
1.2 µg/L	220 years	130 years	95 years	95 years	90 years	85 years	75 years

Notes:
1. Excludes the DVD Land Treatment Unit (LTU), which will be operated for all alternatives shown through all optimizations. Flow for the DVD LTU is included in the agricultural treatment capacity of each alternative.
2. Flows are annualized and based on initial build-out. Treatment capacity includes DVD LTU
3. Flows by each major item are separated by optimization using "/"; Alternative 4 has one optimization at 5 years; Alternative 4A, Alternative 4B, and the Alternative 4C series have optimizations at 5, 10, and 20 years.
4. Under Alternative 4, 840 gpm is applied to Agricultural Units in initial buildout, then once IRZs are shut down at year 5, the flow from the SCRIA IRZ extraction is sent to the Agricultural Units for a total of 950 gpm applied to AUs.
5. Under Alternatives 4C-1, 4C-2, and 4C-3, the agricultural treatment capacity is reduced at year 20 when the 2 Bell pivots are shut down. Under Alternative 4C-4, the agricultural treatment capacity is reduced at year 20 when the 2 Bell pivots and 3 additional winter-only pivots treating excess flow from the Bell extraction wells are shut down.
6. Estimated IRZ recirculation flows (i.e., the water is both extracted and injected) are shown. For Alternatives 4C-1, 4C-2, 4C-3 and 4C-4, a portion of the water extracted for SCRIA IRZ dosed injection is extracted from wells that also support AUs.
7. Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedial Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation. Durations rounded to whole years.

TABLE B2
Results of Particle Tracking Simulations
Groundwater Modeling Particle Tracks for Alternatives 4B, 4C-1, 4C-2, 4C-3, and 4C-4

Remedial Alternative	Primary Features	Forecasted Extent of Hydraulic Control Downgradient of First Quarter 2011 Plume Boundary[a] (feet)		Forecasted Drawdown in Area of Northern Agricultural Units[b] (feet)	
		Year 2 (winter/summer)	Year 5 (winter/summer)[a]	Year 2	Year 5
Alternative 4B	Number of agricultural units[c]: 5 Initial agricultural treatment capacity[d]: 1,270 gpm[e] Ex-situ treated injection[f]: 0 gpm	0/1,800	3,200/3,600	5	15
Alternative 4C-1	Number of agricultural units[c]: 9 Initial agricultural treatment capacity[d]: 1,830 gpm Ex-situ treated injection[f]: 0 gpm	1,000/2,000	4,000/4,400	6	20
Alternative 4C-2	Number of agricultural units[c]: 9 Initial agricultural treatment capacity[d]: 2,041 gpm Ex-situ treated injection[f]: 0 gpm	1,400/2,400	4,400/4,700	10	30
Alternative 4C-3	Number of agricultural units[c]: 9 Initial agricultural treatment capacity[d]: 2,829 gpm Ex-situ treated injection[f]: 780 gpm	0/1,400	0/3,000	15	40
Alternative 4C-4	Number of agricultural units[c]: 25 Initial agricultural treatment capacity[d]: 2,829 gpm Ex-situ treated injection[f]: 0 gpm	1,600/3,000	6,000/6,400	20	>50[g]

Notes:

[a] Estimated as the minimum distance between the northern (downgradient) boundary of First Quarter 2011 plume to forecasted winter and summer extents of hydraulic control shown on Figures B1 through B10, in years 2 and 5 following implementation of each remedial alternative.

[b] Calculated by subtracting the forecasted groundwater elevations in the area between the Desert View Dairy Land Treatment Unit (DVD LTU) and the Gorman Agricultural Unit for each alternative (Figures B1 through B10) from recently measured (Second Quarter 2011) groundwater elevations (Figure B11).

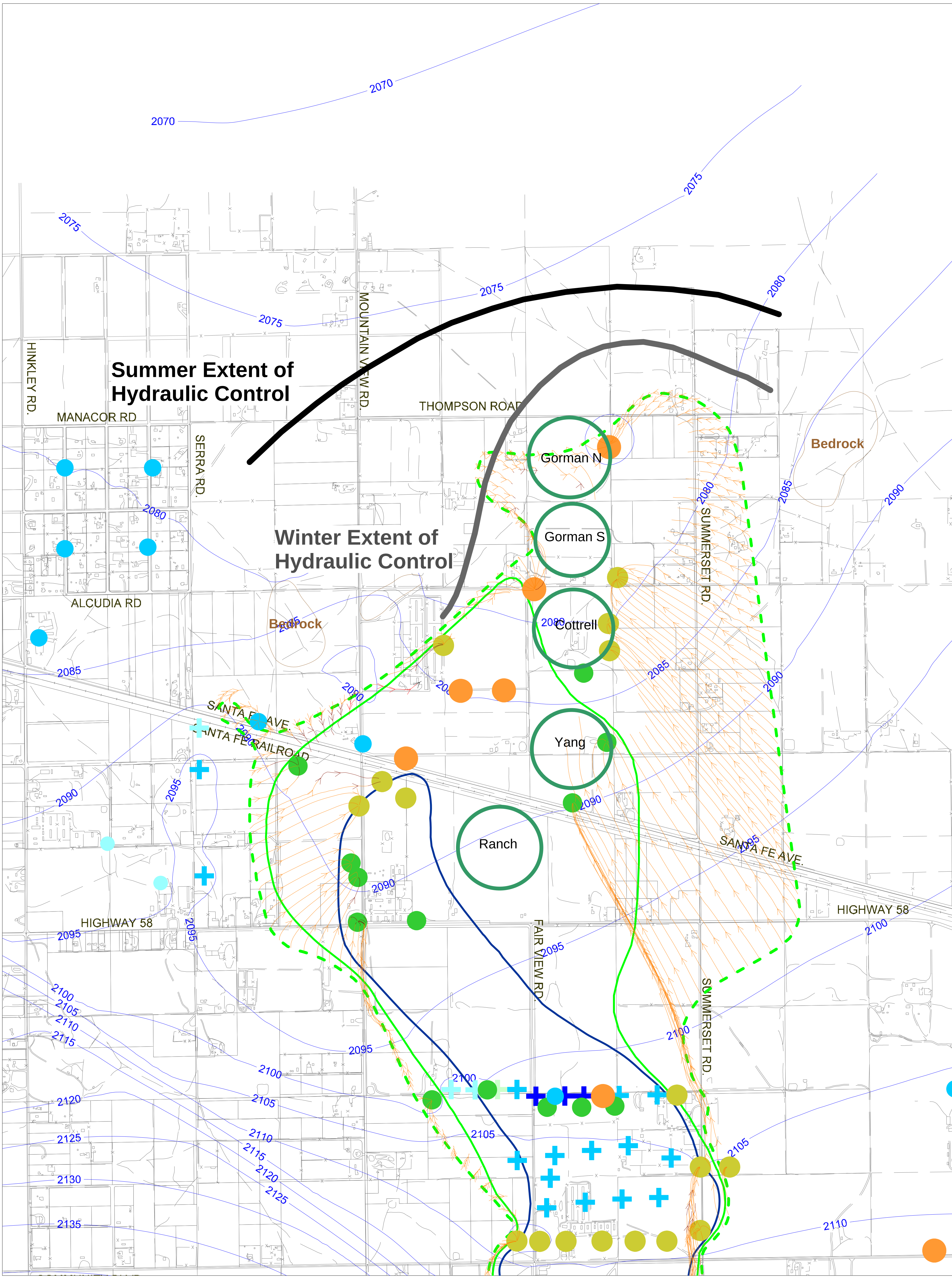
[c] Not including the DVD LTU.

[d] Proposed annualized extraction rate for application to agricultural units and DVD LTU.

[e] Gallons per minute.

[f] This includes groundwater extracted during winter, treated via an ex situ process to remove chromium, and reinjected via injection wells (included only under Alternative 4C-3), rather than applied to agricultural units as proposed under Alternatives 4B, 4C-1, 4C-2, and 4C-4.

[g] Forecasted drawdown is significantly more variable in the area of the northern agricultural units under Alternative 4C-4 (ranging from 50 to 80 feet) than under the other alternatives, particularly in the vicinity of the proposed and existing extraction wells.



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4B includes 5 ag. pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 2.
3. Extent of hydraulic control is shown for winter and summer, year 2.

N

0 feet 1000 feet 2000 feet

Figure B-1
Alternative 4B
Winter, Year 2, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

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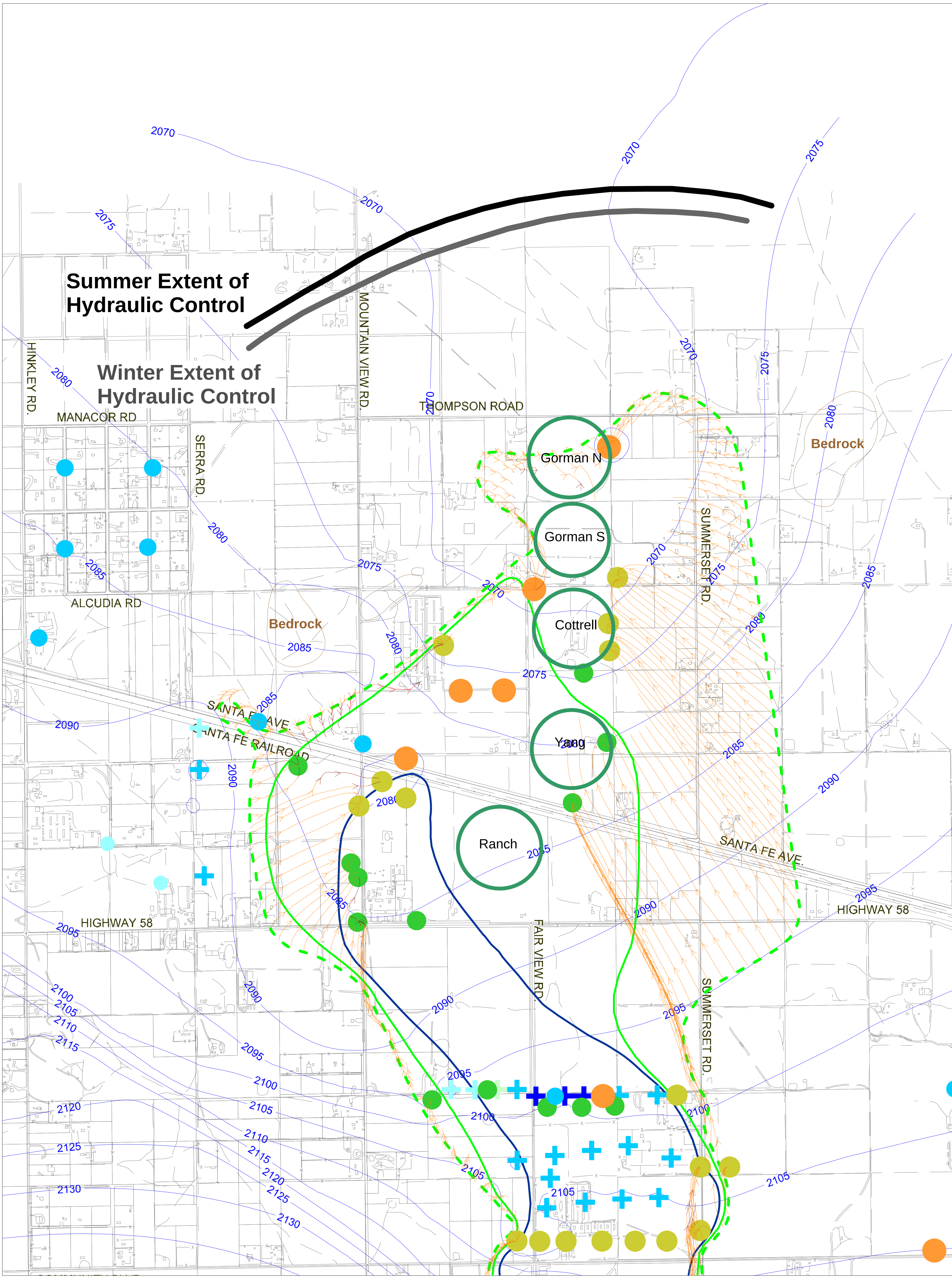

LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 μg/L
- 10 μg/L
- 50 μg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4B includes 5 ag. pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

N

0 feet 1000 feet 2000 feet

Figure B-2
Alternative 4B
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

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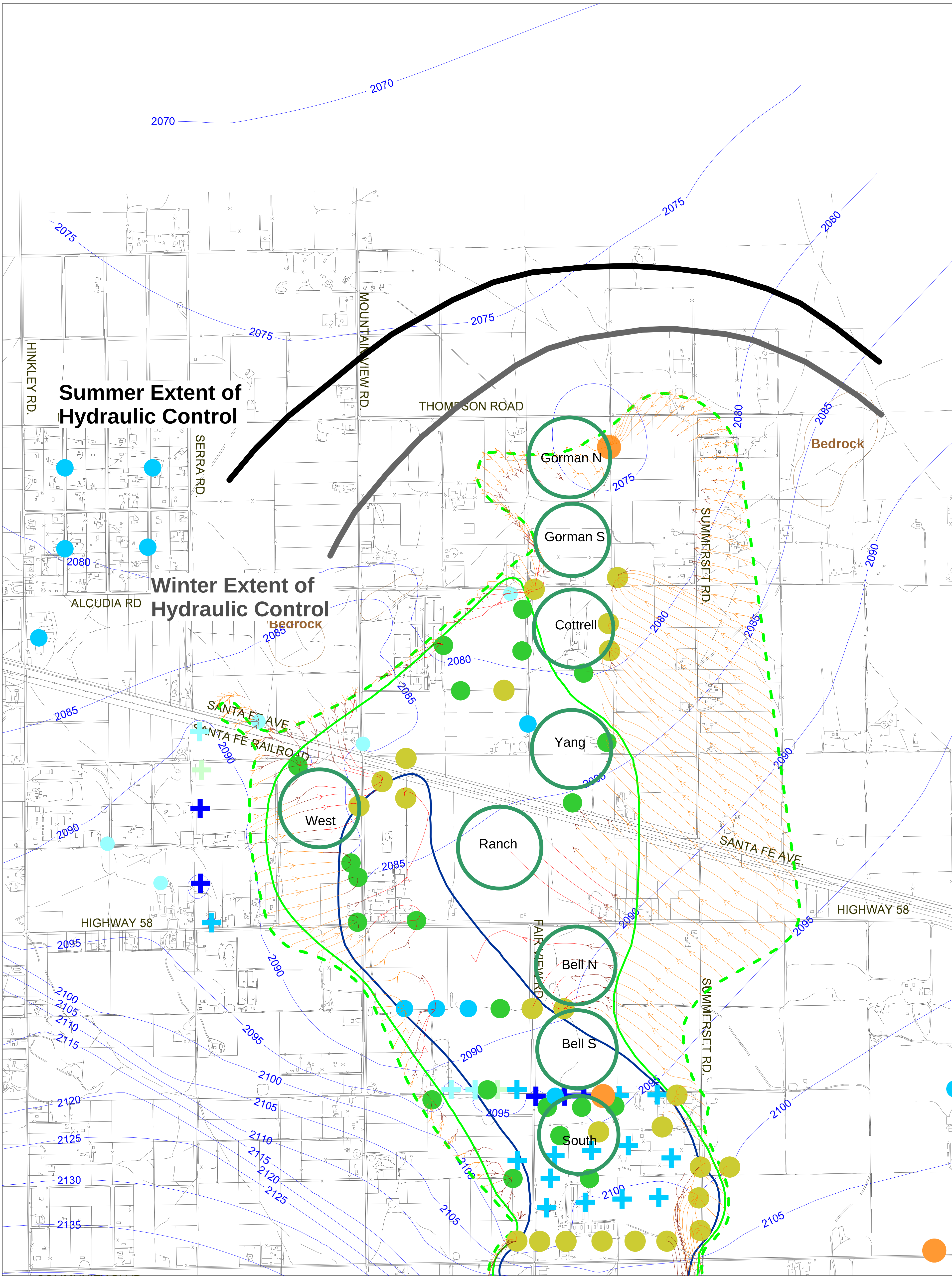

LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell, South
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 2 (after 5 quarters of operation)
3. Extent of hydraulic control is shown for winter and summer, year 2.

N

0 feet 1000 feet 2000 feet

Figure B-3
Alternative 4C-1
Winter, Year 2, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

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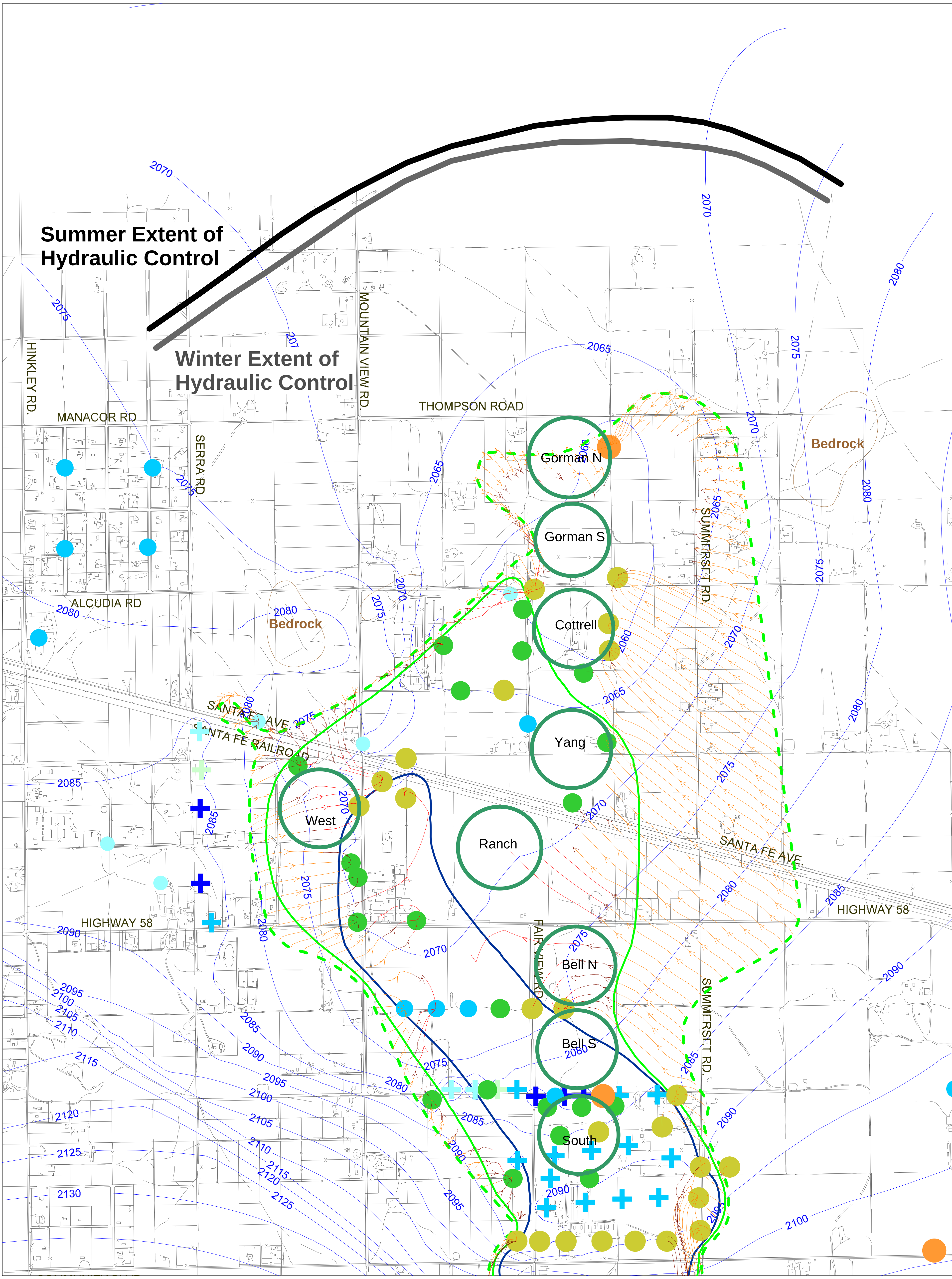

LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell, South
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

0 feet 1000 feet 2000 feet

Figure B-4
Alternative 4C-1
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

CH2MHILL

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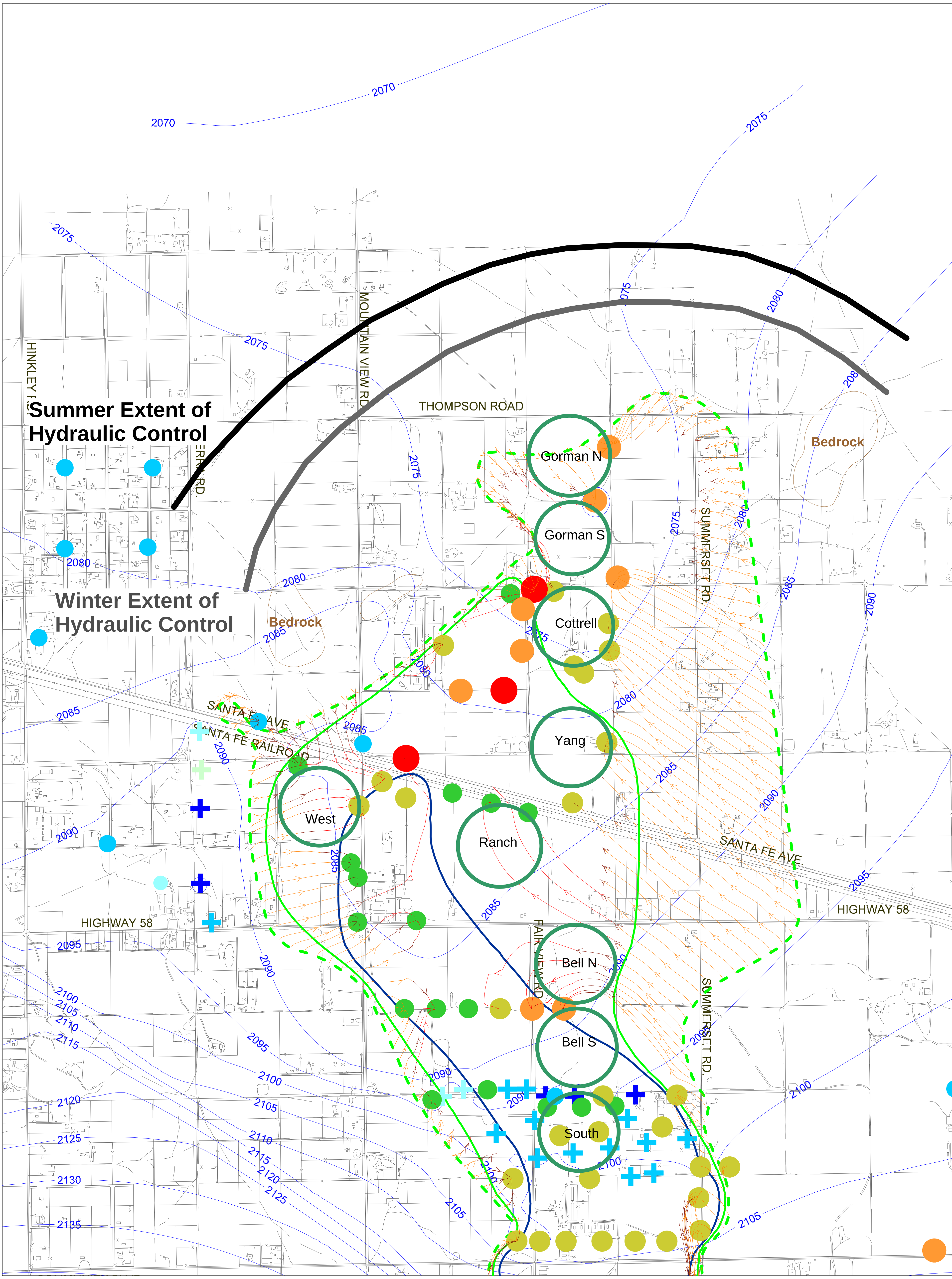


LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell, South
2. Model used quarterly time steps. Groundwater elevations and pumping rtes are from the winter quarter of year 2 (after 5 quarters of operation).
3. Alt. 4C' uses two-crop rotation at all ag. areas except DVD-LTU due to incompatibility with irrigation infrastructure. This increases fall and winter pumping rates.
4. The extent of hydraulic control is shown for winter and summer, year 2.

N

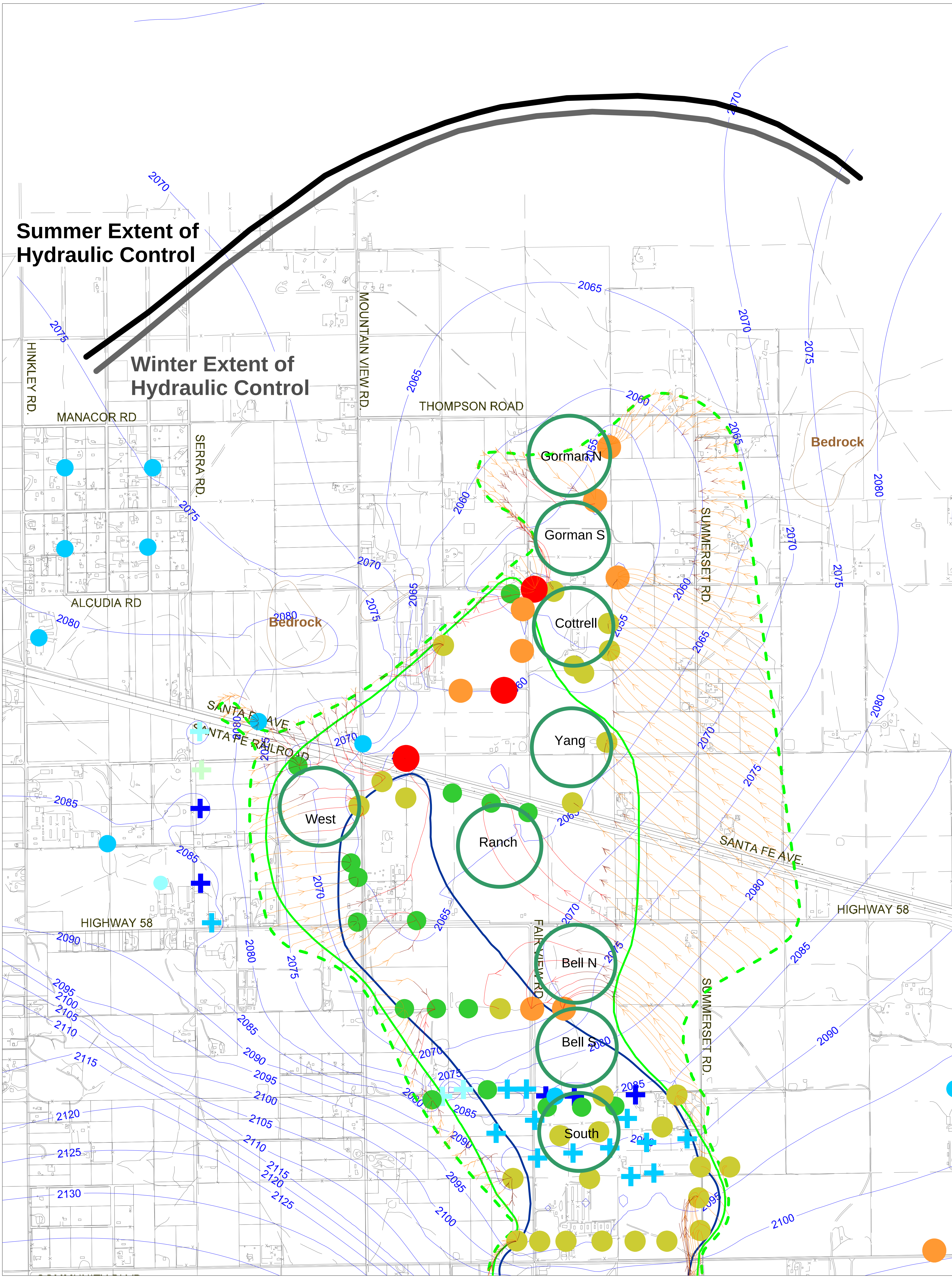
0 feet 1000 feet 2000 feet

Figure B-5
Alternative 4C-2
Winter, Year 2, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

CH2MHILL

ES082411032322RDD_B-5



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell, South
2. Model used quarterly time steps. Groundwater elevations and pumping rtes are from the winter quarter of year 5.
3. Alt. 4C' uses two-crop rotation at all ag. areas except DVD-LTU due to incompatibility with irrigation infrastructure. This increases fall and winter pumping rates.
4. The extent of hydraulic control is shown for winter and summer, year 5.

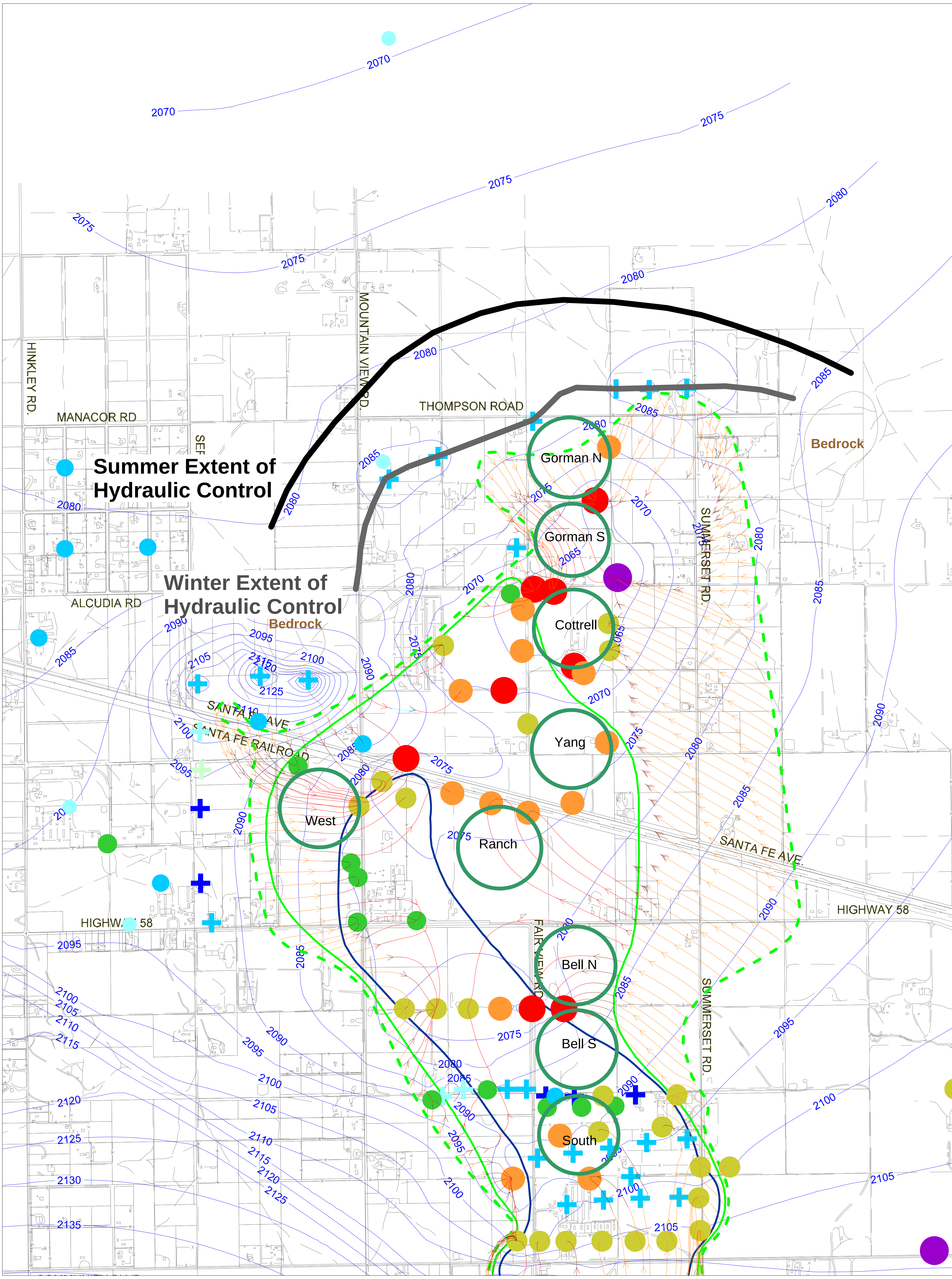
0 feet 1000 feet 2000 feet

Figure B-6
Alternative 4C-2
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

CH2MHILL

ES082411032322RDD_B-6



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour
Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C" includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell and South.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 2 (after 5 quarters of operation)
3. Extent of hydraulic control is shown for winter and summer, year 2.

0 feet 1000 feet 2000 feet

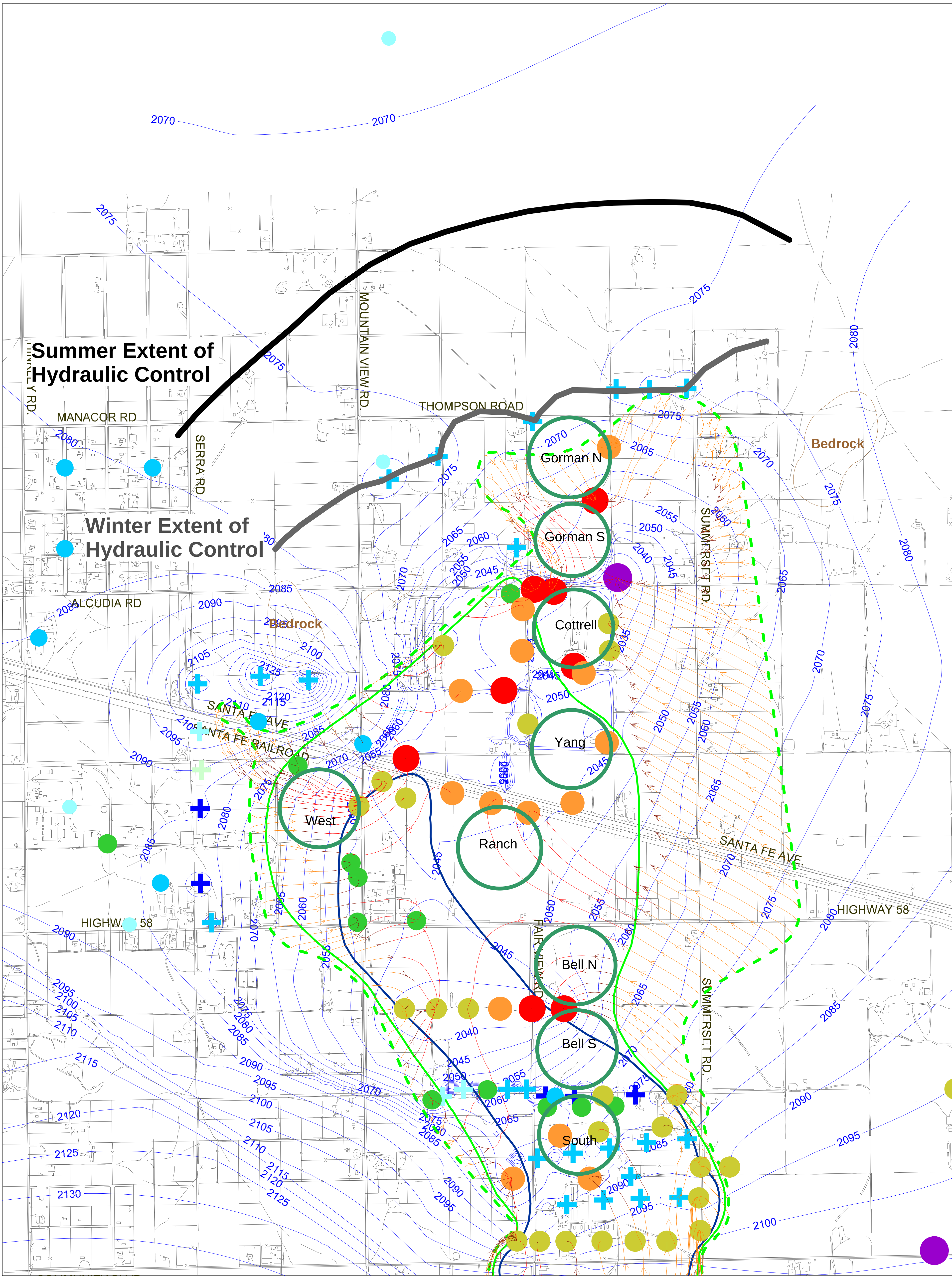
N

Figure B-7
Alternative 4C-3
Winter, Year 2, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

CH2MHILL

ES082411032322RDD_B-7



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 μg/L
- 10 μg/L
- 50 μg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

Notes:
1. Alt. 4C" includes 9 ag. pivots 2x Gorman, Cottrell, Yang, Ranch, West, 2X Bell and South.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

N

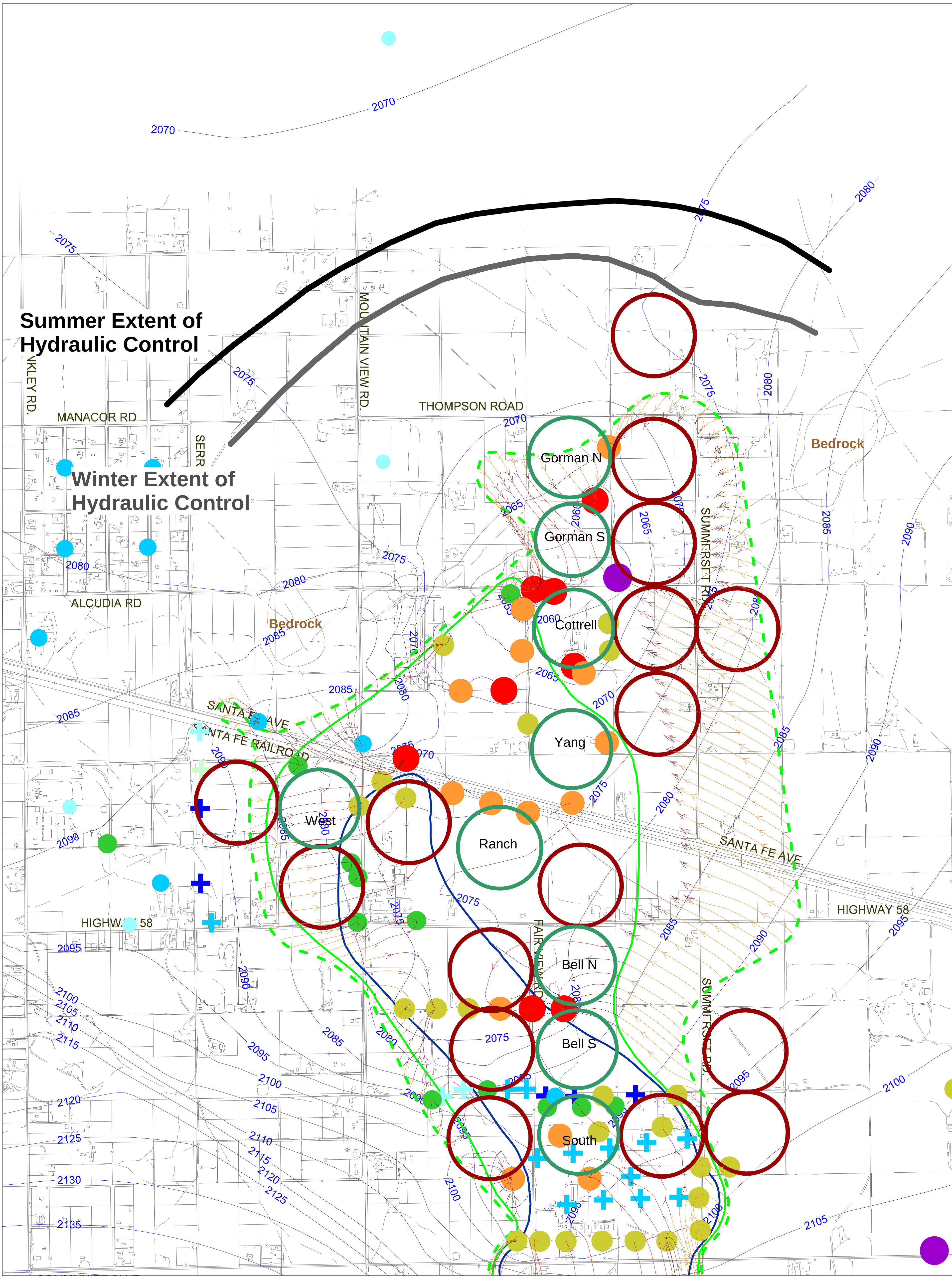
0 feet 1000 feet 2000 feet

Figure B-8
Alternative 4C-3
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

CH2MHILL

ES082411032322RDD_B-8



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

"Winter" Only Ag. Pivot

Notes:
1. Alt. 4C"Ag includes 9 full-time ag. pivots and 16 fall & winter-only pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 2 (after 5 quarters operation).
3. Extent of hydraulic control is shown for winter and summer, year 2.

N

0 feet 1000 feet 2000 feet

Figure B-9
Alternative 4C-4
Winter, Year 2, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA

Aug. 23, 2011

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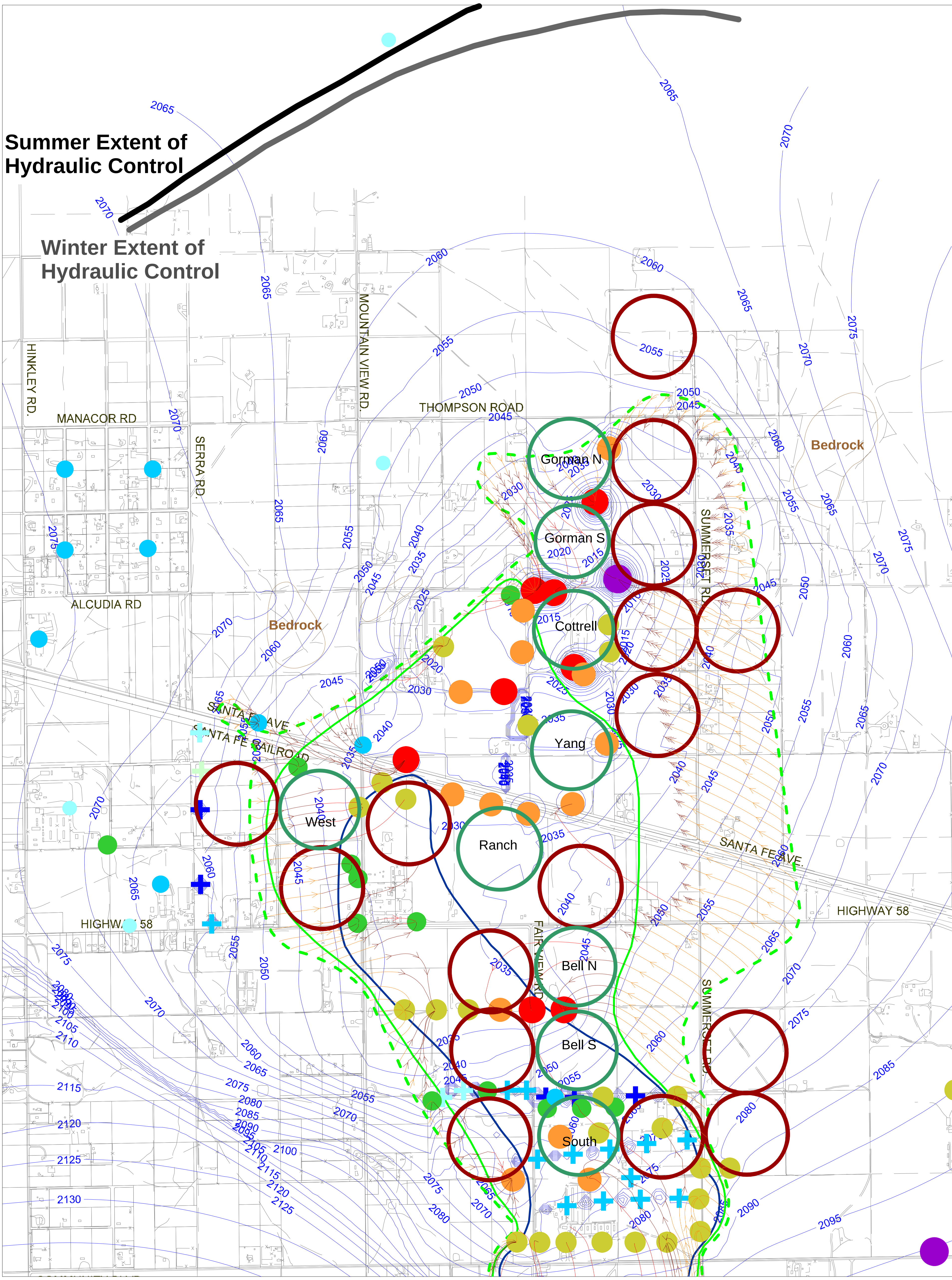


LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

2094 Simulated Groundwater Head Contour
Layer 1, 5 ft interval

Particle Traces, Arrows at 1 yr interval
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layer 5

Approximate Extent of Hydraulic Control
- Winter
- Summer

Pumping Rate (gpm) (negative = injection)
- 0.1 to 5
- 5 to 10
- 10 to 25
- 25 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- -30 to -20
- -20 to -10
- -10 to -5
- -5 to -0.1

Ag. Pivot

"Winter" Only Ag. Pivot

Notes:
1. Alt. 4C" includes 9 full-time ag. pivots and 16 fall & winter-only pivots.
2. Model used quarterly time steps. Groundwater elevations and pumpng rates are from the winter quarter of year 5.
3. Extent of hydraulic control is shown for winter and summer, year 5.

N

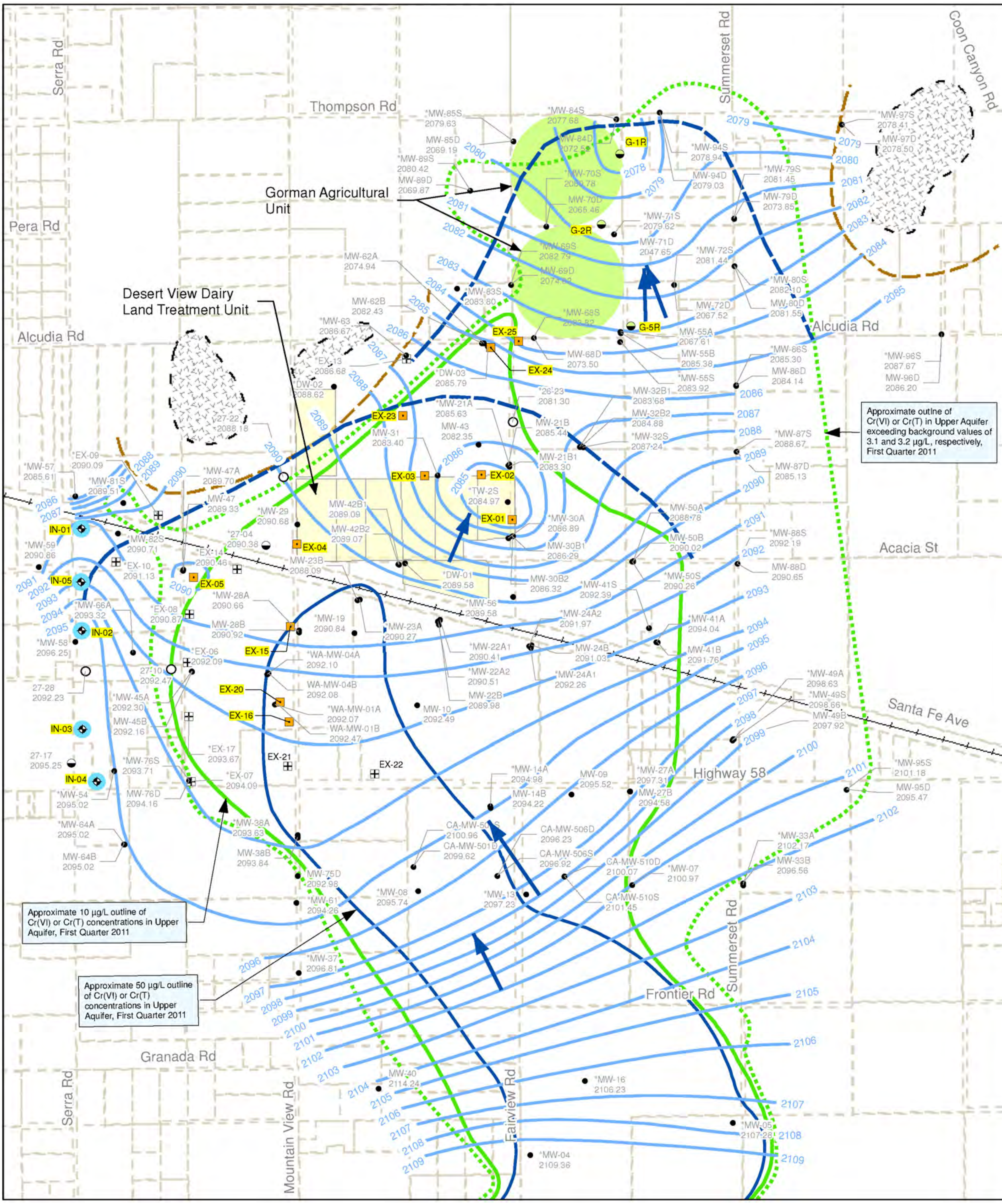
0 feet 1000 feet 2000 feet

Figure B-10
Alternative 4C-4
Winter, Year 5, Groundwater Elevation, Extent of Hydraulic Control, and 5 Year Particle Tracks

PG&E COMPRESSOR STATION, HINKLEY, CA
Aug. 23, 2011

CH2MHILL

ES082411032322RDD_B-10



LEGEND

- Monitoring Well
- Agricultural Supply Well
- Groundwater Extraction Well (active wells highlighted)
- Freshwater Injection Well (active wells highlighted)
- Multi-use Test Well, or Inactive Extraction/Injection Well
- Other Supply Well
- 2093.10 Groundwater elevation (feet above MSL)
- General Flow Direction In Upper Aquifer
- Estimated Zone of Hydraulic Control based on April 2011 water level measurements
- Approximate Limit of Saturated Alluvium Upper Aquifer
- DVD LTU Irrigation Fields
- Active Agricultural Units
- Bedrock Exposed at Ground Surface

Notes:

1) Groundwater elevation contours represent the hydraulic gradient in the shallow zone of the upper aquifer. The shallow wells of nested completions (wells designated "A" or "S") were preferentially used for contouring. In all cases, the screened interval of the well was taken into account, and data from deeper wells were given less weight for contouring.
2) Most groundwater elevations were measured April 25, 2011. See Table C-1 for dates.
3) * = Monitoring well used for contouring.

N

0 600 1,200

Feet

FIGURE B-11
Groundwater Elevations and Capture Zone in Upper Aquifer, April 2011

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APPENDIX C

Groundwater Modeling Results for Alternatives 4C-1, 4C-2, 4C-3, and 4C-4

Imagine the result

Pacific Gas & Electric Company

Appendix C –Solute Transport Modeling Results for Remedial Alternatives 4C-1, 4C-2, 4C-3 and 4C-4

Pacific Gas & Electric
Hinkley, California

September 2011

1. Development of Additional Remedial Alternative Transport Scenarios

Four alternative remedial scenarios (4C-1 through 4C-4) were developed and simulated using a solute transport model to respond to the Water Quality Control Board, Lahontan Region's (LRWQCB's) request to evaluate additional remedial alternative scenarios. The objective is to identify remedy improvements to reduce the remediation timeline and achieve year-round hydraulic control of the plume relative to Remedial Alternative 4B, which was described in detail in Feasibility Study (FS) Addendum #2, submitted to the LRWQCB on March 3, 2011.

1.1 Overview

Remedial alternatives 4C-1 through 4C-4 have the following elements in common with Remedial Alternative 4B:

- in-situ treatment (i.e., Source Area, Central Area, and the South Central Reinjection Area (SCRIA) In-situ Reactive Zones (IRZs)) focused in the core area of the plume, south of Highway 58, to aggressively reduce concentrations of hexavalent chromium (Cr[VI]) in groundwater;

- hydraulic containment and treatment in the northern, distal portion of the plume via groundwater extraction and discharge to agricultural units (AUs) in the northern portion of the site and the Desert View Dairy Land Treatment Unit (DVD LTU); and

- injection of 80 gallons per minute (gpm) of fresh water to enhance hydraulic containment in the northwest.

Alternatives 4C-1 through 4C-4 have additional groundwater extraction and AUs south of Highway 58.

To evaluate options to further improve hydraulic control across the site, winter crops and associated increased extraction rates during the winter were added to alternative 4C-1 to create alternative 4C-2. As requested by the LRWQCB, alternatives 4C-3 and 4C-4 assume that the higher summer extraction rates for the AUs are maintained year-round (i.e., there is no reduction in groundwater extraction rates during the winter months when higher precipitation and lower evapotranspiration rates reduce agronomic demand) to assess the effectiveness in maintaining constant, high extraction rates in further improving hydraulic control.

1.2 Solute Transport Model

The solute transport model used to evaluate the additional remedial alternatives was developed during preparation of the FS and is discussed in detail in Appendix G along with the groundwater flow model. The solute transport model was utilized to simulate the migration and fate of Cr(VI) detected in the groundwater under the various remedial scenarios. The model was developed using separate model layers to simulate the upper and lower portions of the Upper Aquifer Unit, Model Layer 1, and Model Layer 3, as shown below:

- Model layer 1 represents the upper portion of the Upper Aquifer Unit.
- Model layer 2 represents the discontinuous Brown Clay.
- Model layer 3 represents the lower portion of the Upper Aquifer Unit.
- Model layer 4 represents the Blue Clay.

The solute transport model was run for a period of 100 years for each of the four additional alternatives using the February 2010 plume extent (the plume extent used to evaluate previous remedial alternatives in the FS and Addendum #2) and the first quarter 2011 plume extent as starting points (i.e., time zero). Based on the simulated solute transport modeling results at years 5, 10, and 20, the pumping schedule was modified to optimize the remediation of Cr(VI) impacted groundwater.

2. Remedial Alternative Scenario Descriptions and Results

The following sections provide a detailed description of each remedial alternative and a summary of the results.

2.1 Alternative 4C-1: In-Situ and Enhanced Agricultural Treatment - One Crop

The simulation for Alternative 4C-1 was designed as a containment and in-situ remediation scenario. It represents proposed annual extraction and irrigation for a one-crop scenario (such as alfalfa) where water is applied at agronomic rates resulting in maximum pumping in the summer months and reduced pumping rates during the winter months. The goal of Alternative 4C-1 is to enhance hydraulic capture over Alternative 4B (Haley & Aldrich, 2010) and to reduce the remediation timeframe under a one-crop scenario.

The elements operated in Remedial Alternative 4C-1 are shown in Figure C-1. There are five AUs (six pivots) and the DVD LTU north of Highway 58 and two AUs (three pivots) south of Highway 58. The net extraction to the pivots located to the north of Highway 58 is 1,380 gpm. The net extraction to the pivots located to the south of Highway 58 is 450 gpm. In addition to extraction for the irrigation pivots, 195 gpm of extraction is also simulated to support the proposed in-situ remediation injection wells located in the Southern SCRIA area. Two recirculation areas including extraction and in-situ remediation wells were simulated in the Central Area and the Source Area. Lastly, the Northwest Injection wells are operating at 80 gpm designed to prevent western plume migration in the northern portion of the plume. All of the simulated injection wells, with the exception of the Northwest Injection wells, were simulated as carbon amended injection wells designed to remediate the chromium impacted groundwater. The majority of the carbon amended injection wells were oscillated quarterly to minimize the development of hydraulic dead zones and to improve distribution of carbon throughout the Upper Aquifer.

2.1.1 Remedial System Optimizations

The solute transport model was run for a period of 100 years using the February 2010 plume extent (referred to as Alt 4C-1) and the first quarter 2011 plume extent (referred to as Alt 4C-1 1Q11) as starting points (i.e., time zero). Based on the simulated solute transport modeling results, the pumping schedule was altered to optimize the remediation of Cr(VI) impacted groundwater.

System optimizations are detailed in Table 5 and shown on Figures 5A and 5B of Addendum #3 (the main report). After 5 years of simulated transport, several SCRIA Injection wells were turned off in treated areas, the six Source Area extraction wells are converted to carbon amended injection wells, and the southern Source Area injection wells are turned off. The remaining Source Area injection wells are supplied by the southern SCRIA extraction wells.

After 10 years of simulated transport, three carbon amended injection wells are added to the southern portion of the plume to address areas of lingering Cr(VI) concentrations. In the north, 15 extraction wells were added to address areas of low hydraulic gradient to improve remediation timeframes. To maintain flow balance in the north with the addition of new extraction wells, extraction rates are reduced from the Cottrell and Yang AUs.

After 20 years of simulated transport, south of Highway 58 the eastern SCRIA extraction wells are turned off, the Central Area recirculation is turned off, and the Bell extraction and irrigation pivots are turned off. The reason for turning off these various elements was that the solute transport model indicated that these areas were remediated, and the Bell extraction was turned off to enhance the hydraulic gradients to the north to improve the remediation timeframe. North of Highway 58, the net extraction was reallocated to better address the areas of lingering Cr(VI) concentrations.

2.1.2 Results

The modeling results at 0, 10, 20, 40, 60, and 100 years in simulated Model Layers 1, 2 and 3 for remedial alternative 4C-1 are provided in Attachment C-1. Model results suggest that Cr(VI) affected groundwater does not migrate downward into Model Layer 4.

With respect to the February 2010 plume delineation, the solute transport model indicates that the area of the initial 50 parts per billion (ppb) plume contour will be reduced by 99% within 6 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 40 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 95 years. The results are further summarized in Table C-1 which provides a comparison of the results for remedial alternative 4C-1 to previous Remedial Alternative 4B and subsequent versions of the alternative 4C-1 (i.e., 4C-2 through 4C-4).

The same pumping scenario for Alternative 4C-1 was applied to the first quarter 2011 (Alt 4C-1 1Q11) plume delineation. The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 6 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 34 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 80 years. The difference in the remediation timeframe between the February 2010 plume and the first quarter 2011 plume is due to the differences in the extent of the shallow and deep plumes, as well as differences is peak concentrations. In first quarter 2011, the plume is smaller in the deeper portion of the upper aquifer and the extent of the 50 ppb contour is smaller in the upper portion of the upper aquifer. The results are further summarized in Table C-2.

2.2 Alternative 4C-2: In-Situ and Enhanced Agricultural Treatment – Two Crops

The simulation for Alternative 4C-2 was designed as a containment and in-situ remediation scenario that represents proposed annual extraction and irrigation based on a two-crop pattern. The objective of this remedial scenario is to evaluate the effectiveness of increasing winter groundwater extraction rates to irrigate winter crops on improving hydraulic control and reducing remediation timeframe relative to Alt 4C-1. The elements operated in Remedial Alternative 4C-1 are shown in Figure C-2. The active AUs in this scenario are the same as those in Alternative 4C-1.The two-crop AU assumption is applied to the Gorman pivots, Cottrell pivot, Yang pivot, Ranch pivot, Bell pivots, and Southern SCRIA pivot. The West pivot and DVD LTU are not increased in this scenario. The West pivot is not increased because it is already scheduled to handle more irrigation than a normal pivot, and would need to be designed with two crop operation to handle 110 gpm in the winter, so it is not practical to increase winter rates again. The DVD LTU is not increased because it cannot be tilled for winter crops due to the subsurface irrigation infrastructure. When averaged over an annual basis, the two-crop scenario results in an approximate rate increase of 18% over the one-crop scenario at the individual adjusted AUs.

In this alternative, the net annual average extraction to the pivots located to the north of Highway 58 is 1,510 gpm. The net extraction to the pivots located to the south of Highway 58 is 531 gpm. In addition to extraction for the irrigation pivots, 195 gpm of extraction is also simulated to support the proposed in-situ remediation injection wells located in the Southern SCRIA area. The remaining remediation elements are the same as those in Alternative 4C-1.

2.2.1 Remedial System Optimizations

The solute transport model was run for a period of 100 years. Based on the simulated solute transport modeling results, the pumping schedule was altered to optimize the remediation of Cr(VI) impacted groundwater. System optimizations are detailed in Table 6 and shown on Figures 7A and 7B of the main report. After 5 years of simulated transport, several SCRIA Injection wells were turned off in treated areas, the six Source Area extraction wells are converted to carbon amended injection wells, and the southern Source Area injection wells are turned off. The remaining Source Area injection wells are supplied by the southern SCRIA extraction wells.

After 10 years of simulated transport, three carbon amended injection wells are added to the southern portion of the plume to address areas of lingering Cr(VI) concentrations. In the north, 15 extraction wells were added to address areas of low hydraulic gradient to improve remediation timeframes. To maintain flow balance in the north with the addition of new extraction wells, extraction rates are reduced from the Cottrell and Yang AUs.

After 20 years of simulated transport, south of Highway 58, the eastern SCRIA extraction wells are turned off, the Central Area recirculation is turned off, and the Bell extraction and irrigation pivots are turned off. The reason for turning off these various elements was that the solute transport model indicated that these areas were remediated, and the Bell extraction was turned off to enhance the hydraulic gradients to the north to improve the remediation timeframe. North of Highway 58, the net extraction was reallocated to better address the areas of lingering Cr(VI) concentrations.

2.2.2 Results

The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 5.5 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 39 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 90 years. These results are further summarized in Table C-1. The solute transport modeling results for Alternative 4C-2 for Model Layers 1, 2, and 3 at simulated time periods of 0, 10, 20, 40, 60, and 100 years, for years when plume remains, are presented in the figures included in Attachment C-2. No simulated Cr(VI) concentrations migrate down into Model Layer 4.

The same pumping scenario for Alternative 4C-2 was applied to the first quarter 2011 (1Q11) plume delineation. The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 5.5 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 32 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 75 years. The difference in the remediation timeframe between the February 2010 plume and the first quarter 2011 plume is due to the differences in the extent of the shallow and deep plumes, as well as differences is peak concentrations. In first quarter 2011, the plume is smaller in the deeper portion of the upper aquifer and the extent of the 50 ppb contour is smaller in the upper portion of the upper aquifer. The results are further summarized in Table C-2. The 1Q11 solute transport modeling results for Alternative 4C-2 for Model Layers 1, 2, and 3at simulated time periods of 0, 10, 20, 40, 60, and 100 years are presented in figures included in Attachment C-2. No simulated Cr(VI) concentrations migrate down into Model Layer 4.

2.3 Alternative 4C-3: In Situ and Enhanced Agricultural Treatment - Two Crops; Winter Ex-Situ Treatment and Reinjection to Support Continuous Pumping

The simulation for Alternative 4C-3 with treated injection was designed as a containment and in-situ remediation scenario that represents proposed annual extraction based on full-year summer extraction rates. The goal of Alternative 4C-3 is to further enhance hydraulic capture and to reduce the remediation timeframe by extracting at the maximum summer rate for the entire year and adding to hydraulic control by injecting the excess treated water along the plume periphery.

The elements operated in Remedial Alternative 4-1 are shown in Figure C-3.The active AUs in this scenario are the same as those for Alternatives 4C-1 and 4C-2. The AUs and the DVD LTU are run at full-year summer extraction rates. In this alternative, the net annual average extraction associated with AUs north of Highway 58 is 2,072 gpm. The net extraction associated with AUs south of Highway 58 is 756 gpm. In addition to extraction for the irrigation pivots, 195 gpm of extraction is also simulated for the proposed in-situ remediation injection wells located in the Southern SCRIA area. Two recirculation areas including extraction and in-situ remediation wells were simulated in the Central Area and the Source Area. The final area of pumping is the Northwest Injection wells operating at 80 gpm designed to prevent western plume migration in the northern portion of the plume. The carbon amended injection wells were oscillated quarterly to minimize the development of hydraulic dead zones and to improve distribution of carbon throughout the Upper Aquifer. The extracted water that is not applied to the AUs as irrigation is injected both south and north of the plume extent. All of the simulated injection wells, with the exception of the Northwest Injection wells and the ex-situ treatment injection wells, were simulated as carbon amended injection wells to remediate the chromium impacted groundwater.

2.3.1 Remediation System Optimizations

The solute transport model was run for a period of 100 years. The flow optimization pattern is kept consistent with Alternative 4C-1. During the full solute transport period, the majority of the AUs remain active.

System optimizations are detailed in Table 7 and shown on Figures 9A and 9B of the main report. After 5 years of simulated transport, several SCRIA Injection wells were turned off in treated areas, the six Source Area extraction wells are converted to carbon amended injection wells, and the southern Source Area injection wells are turned off. The remaining Source Area injection wells are supplied by the southern SCRIA extraction wells.

After 10 years of simulated transport, three carbon amended injection wells are added to the southern portion of the plume to address areas of lingering Cr(VI) concentrations. In the north, 15 extraction wells were added to address areas of low hydraulic gradient to improve remediation timeframes. To maintain flow balance in the north with the addition of new extraction wells, extraction rates are reduced from the Cottrell and Yang AUs.

After 20 years of simulated transport, south of Highway 58, the eastern SCRIA extraction wells are turned off, the Central Area recirculation is turned off, and the Bell extraction and irrigation pivots are turned off. The reason for turning off these various elements was that the solute transport model indicated that these areas were remediated, and the Bell extraction was turned off to enhance the hydraulic gradients to the north to improve the remediation timeframe. North of Highway 58, the net extraction was reallocated to better address the areas of lingering Cr(VI) concentrations.

2.3.2 Results

The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 4 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 36 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 85 years. The results are further summarized in Table C-1. The solute transport modeling results for Alternative 4C-3 for Model Layers 1, 2, and 3 at simulated time periods of 0, 10, 20, 40, 60, and 100 years are presented in figures included in Attachment C-3. No simulated Cr(VI) concentrations migrate down into Model Layer 4.

The same pumping scenario for Alternative 4C-3 was applied to the first quarter 2011 (1Q11) plume delineation. The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 5.5 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 31 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 75 years. The difference in the remediation timeframe between the February 2010 plume and the first quarter 2011 plume is due to the differences in the extent of the shallow and deep plumes, as well as differences is peak concentrations. In first quarter 2011, the plume is smaller in the deeper portion of the upper aquifer and the extent of the 50 ppb contour is smaller in the upper portion of the upper aquifer. The results are further summarized in Table C-2 The 1Q11 solute transport modeling results for Alternative 4C-3 for Model Layers 1, 2, and 3at simulated time periods of 0, 10, 20, 40, 60, and 100 years are presented in figures included in Attachment C-3. No simulated Cr(VI) concentrations migrate down into model layer 4. The actual groundwater pumping rates may need to be adjusted during operation if long-term drawdown reduces sustainable yields from wells.

2.4 Alternative 4C-4: In Situ and Enhanced Agricultural Treatment - Two Crops; Additional Agricultural Units to Support Continuous Pumping

The simulation for Alternative 4C-4 was designed as a containment and in-situ remediation scenario that represents proposed annual extraction based on full-year summer extraction rates. The excess water that is extracted and cannot be applied as irrigation to the existing pivots is applied to 16 new winter agricultural pivots located throughout the site and vicinity. The goal of Alternative 4C-4 is to further enhance hydraulic capture and to reduce the remediation timeframe by extracting at the maximum summer rate for the entire year.

The elements operated in Remedial Alternative 4-1 are shown in Figure C-4.The active AUs in this scenario are the same as those in the previous versions of alternative 4C, but with 16 new AUs added in the winter to accommodate the excess water.

In this alternative, the net annual average extraction associated with the AUs located to the north of Highway 58 is 2,072 gpm. The net extraction associated with the AUs located to the south of Highway 58 is 756 gpm. In addition to extraction for the irrigation pivots, 195 gpm of extraction is also simulated to support the proposed in-situ remediation injection wells located in the Southern SCRIA area. Two recirculation areas including extraction and in-situ remediation wells were simulated in the Central Area and the Source Area. The final area of pumping is the Northwest Injection wells operating at 80 gpm designed to prevent western plume migration in the northern portion of the plume. All of the simulated injection wells, with the exception of the Northwest Injection wells, were simulated as carbon amended injection wells designed to remediate the chromium impacted groundwater. The majority of the carbon amended injection wells were oscillated quarterly to minimize the development of hydraulic dead zones and to improve distribution of carbon throughout the Upper Aquifer. The excess extracted water that cannot be applied as irrigation is applied as recharge to 16 new winter agricultural pivots located from north of the Gorman pivots to the SCRIA area.

2.4.1 Remediation System Optimizations

The solute transport model was run for a period of 100 years. During the full solute transport period, the majority of the AUs remain active. System optimizations are detailed in Table 8 and shown on Figures 11A and 11B of the main report. The flow optimization pattern is kept consistent with Alternative 4C-1. After 5 years of simulated transport, several SCRIA Injection wells were turned off in treated areas, the six Source Area extraction wells are converted to carbon amended injection wells, and the southern Source Area injection wells are turned off. The remaining Source Area injection wells are supplied by the southern SCRIA extraction wells.

After 10 years of simulated transport, three carbon amended injection wells are added to the southern portion of the plume to address areas of lingering Cr(VI) concentrations. In the north, 15 extraction wells were added to address areas of low hydraulic gradient to improve remediation timeframes. To maintain flow balance in the north with the addition of new extraction wells, extraction rates are reduced from the Cottrell and Yang AUs.

After 20 years of simulated transport, south of Highway 58, the eastern SCRIA extraction wells are turned off, the Central Area recirculation is turned off, and the Bell extraction and irrigation pivots are turned off. These elements were turned off as the solute transport model indicated that areas were remediated. The Bell extraction was turned off to enhance the hydraulic gradients to the north to improve the remediation timeframe. North of Highway 58, the net extraction was reallocated to better address the areas of lingering Cr(VI) concentrations.

2.4.2 Results

The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 3 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 29 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 75 years. The results are further summarized in Table C-1. The solute transport modeling results for Alternative 4C-4 for Model Layers 1, 2, and 3at simulated time periods of 0, 10, 20, 40, 60, and 100 years are presented in figure included in Attachment C-4. No simulated Cr(VI) concentrations migrate down into Model Layer 4.

The same pumping scenario for Alternative 4C-4 was applied to the first quarter 2011 (1Q11) plume delineation. The solute transport model indicates that the area of the initial 50 ppb plume contour will be reduced by 99% within 5.5 years. The area of the initial 3.1 ppb plume contour will be reduced by 99% within 29 years. The area of the initial 1.2 ppb plume contour will be reduced by 99% within 70 years. The difference in the remediation timeframe between the February 2010 plume and the first quarter 2011 plume is due to the differences in the extent of the shallow and deep plumes, as well as differences is peak concentrations. In first quarter 2011, the plume is smaller in the deeper portion of the upper aquifer and the extent of the 50 ppb contour is smaller in the upper portion of the upper aquifer. The results are further summarized in Table C-2. The 1Q11 solute transport modeling results for Alternative 4C-4 for Model Layers 1, 2, and 3at simulated time periods of 0, 10, 20, 40, 60, and 100 years are included in Attachment C-4. No simulated Cr(VI) concentrations migrate down into Model Layer 4. The actual groundwater pumping rates may need to be adjusted during operation if long-term drawdown reduces sustainable yields from wells.

Table C-1
Summary of Solute Transport Results
Remedial Alternatives 4B, 4C-1, 4C-2, 4C-3, 4C-4
February 2010 Plume Extent

Pacific Gas and Electric Company
Hinkley, California

Remedial Alaternative	Estimated Time to Reach 99% Reduction of Select Concentration Levels Footprints (years)					
	50 µg/L		3.1 µg/L		1.2 µg/L	
	Layer 1	Layer 3	Layer 1	Layer 3	Layer 1	Layer 3
4B	6	6	40	37	95	65
4C-1	6	4.5	40	31	95	45
4C-2	5.5	4	39	30	90	41
4C-3	4	3	36	28	85	40
4C-4	3	2.5	29	28	75	38

Note:

µg/L = micrograms per liter

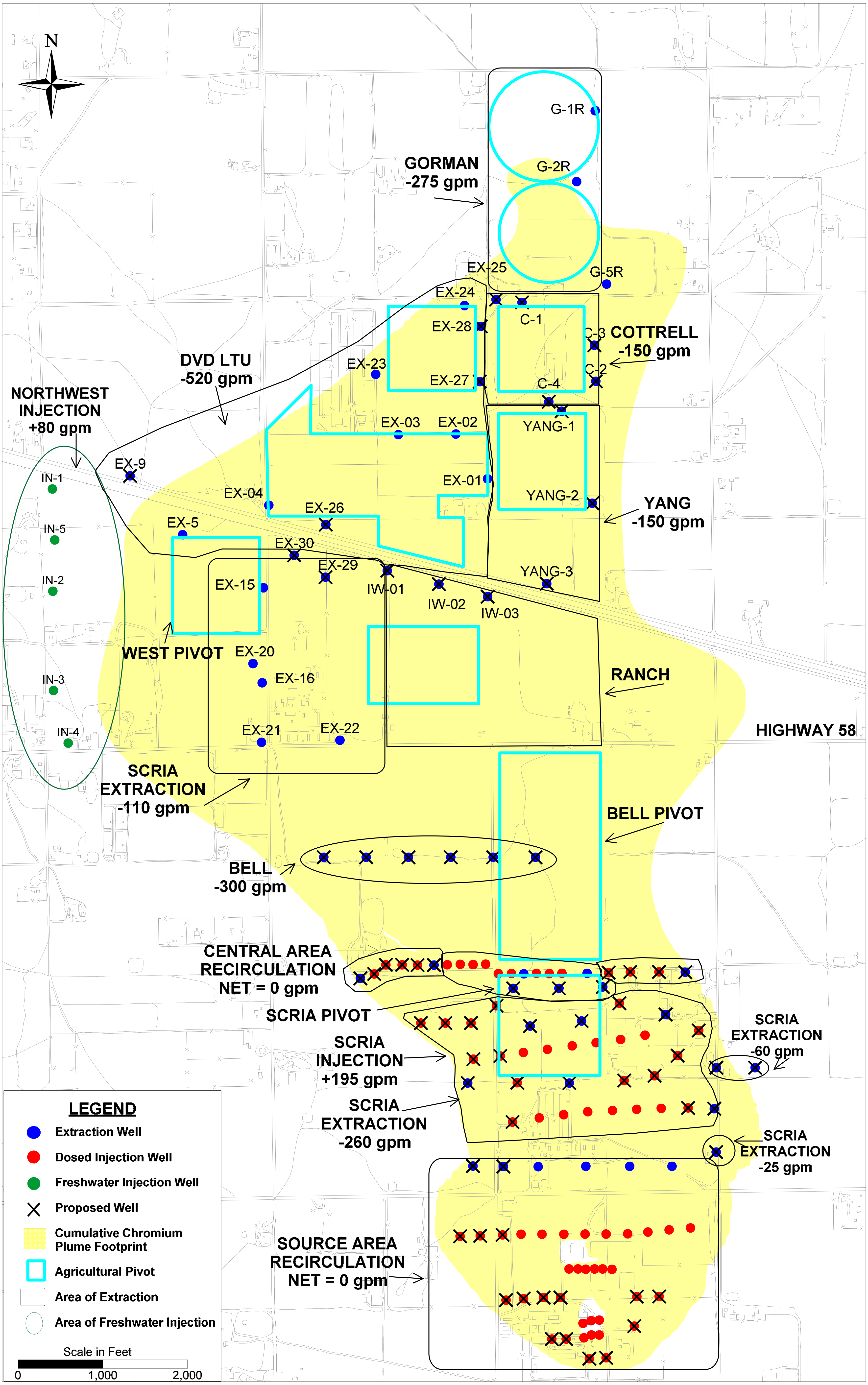
Table C-2
Summary of Solute Transport Results
Remedial Alternatives 4B, 4C-1, 4C-2, 4C-3, 4C-4
First Quarter 2011 Plume Extent

Pacific Gas and Electric Company
Hinkley, California

Alternative	Estimated Time to Reach 99% Reduction of Select Concentration Levels Footprints (years)					
	50 μg/L		3.1 μg/L		1.2 μg/L	
	Layer 1	Layer 3	Layer 1	Layer 3	Layer 1	Layer 3
4B	6	6	34	37	80	65
4C-1	6	5	32	34	80	50
4C-2	5.5	4.5	30	32	75	45
4C-3	5.5	3	28	31	75	45
4C-4	5.5	3	24	29	70	38

Note:

μg/L = micrograms per liter

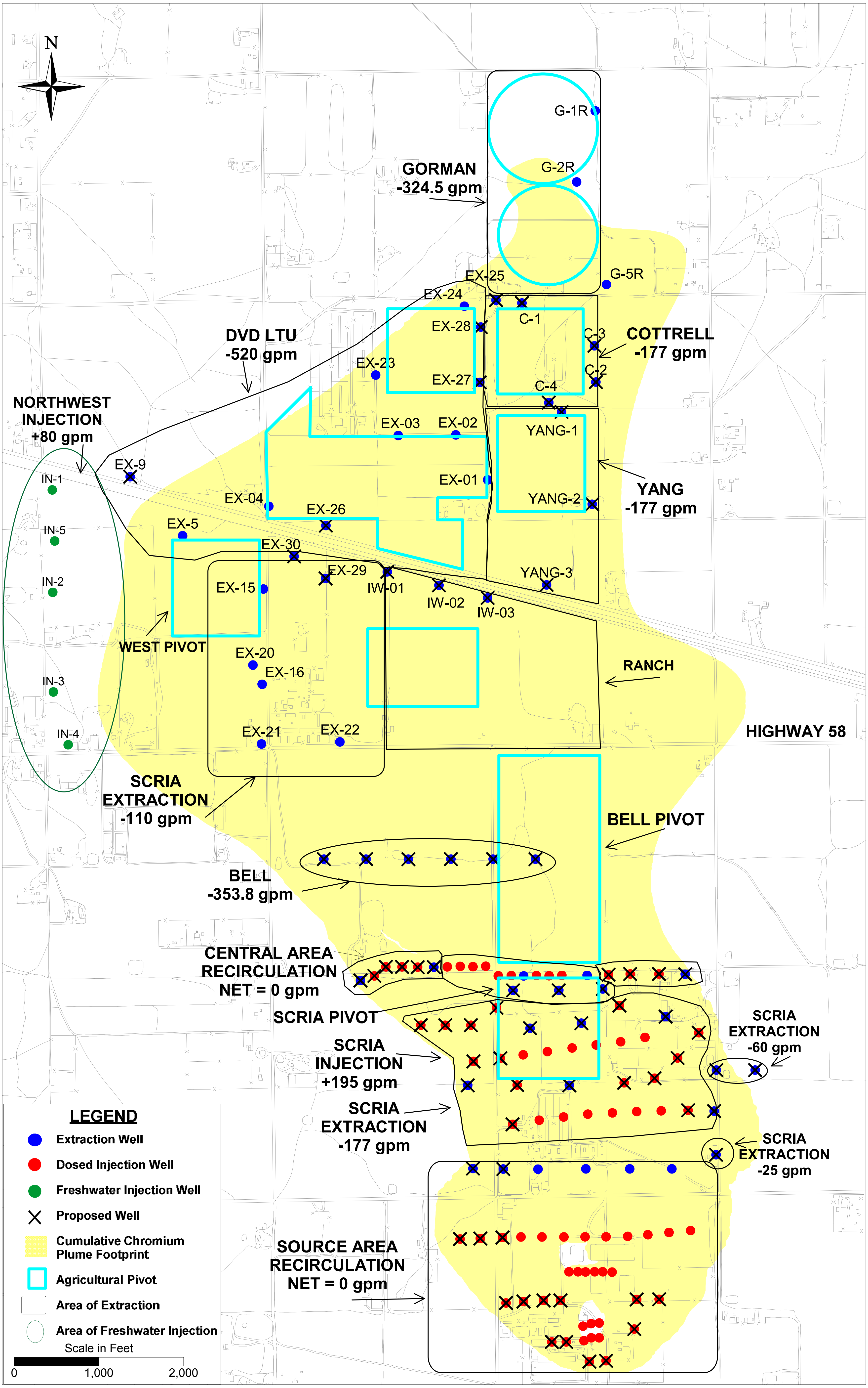


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIAL FLOW DISTRIBUTION
ALTERNATIVE 4C-1

ARCADIS

FIGURE
C-1

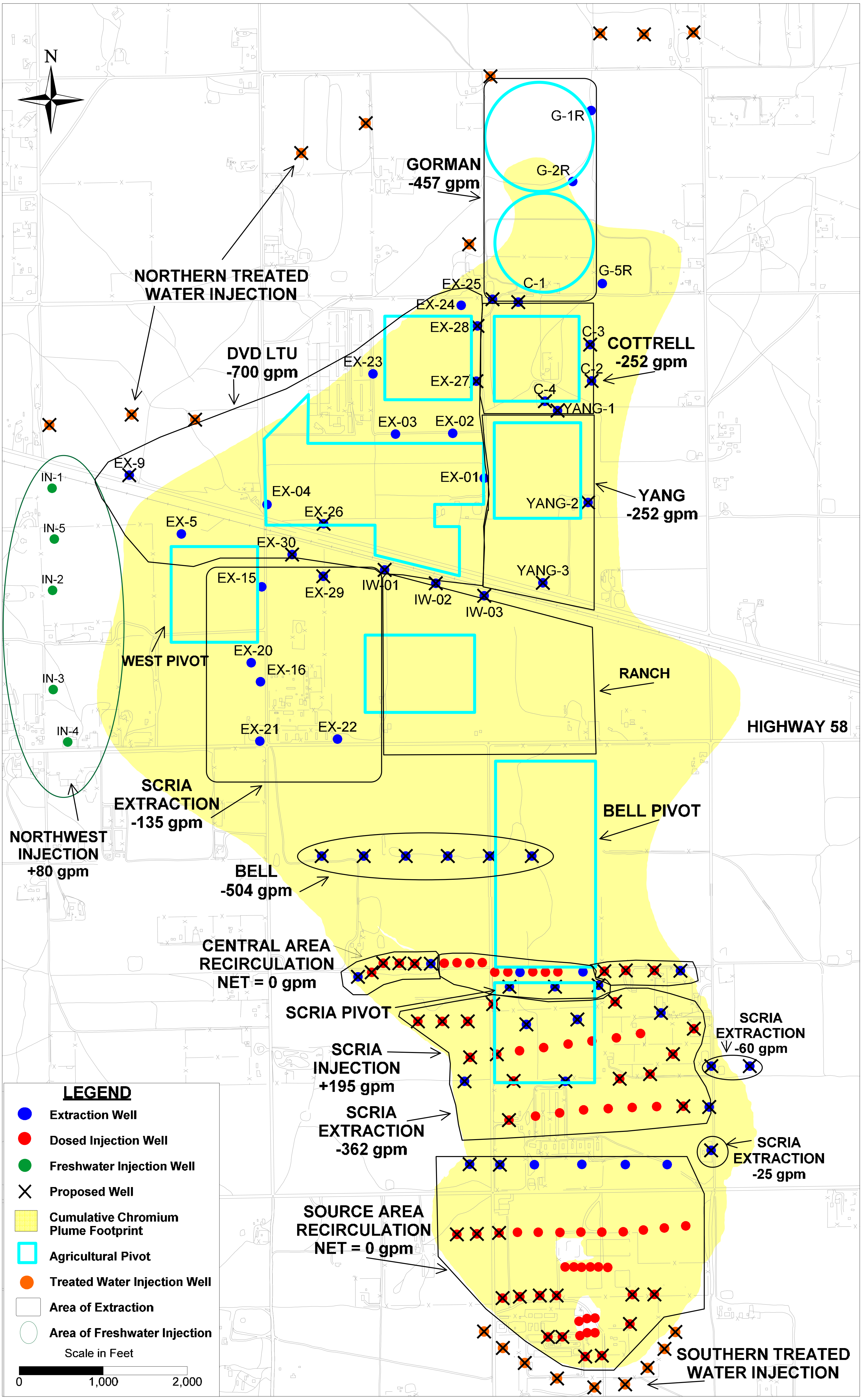


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIAL FLOW DISTRIBUTION
ALTERNATIVE 4C-2

ARCADIS

FIGURE
C-2



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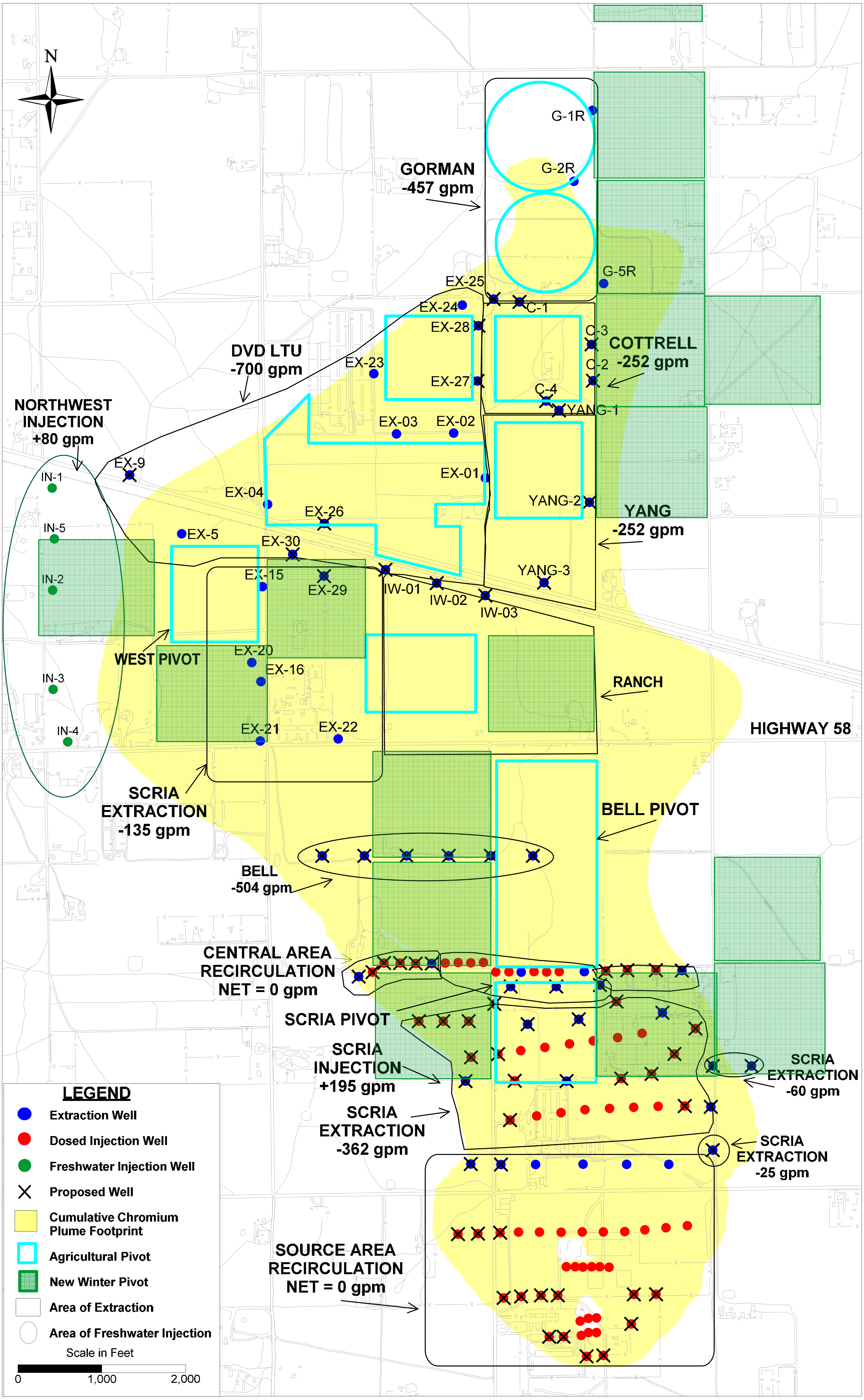
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIAL FLOW DISTRIBUTION
ALTERNATIVE 4C-3

ARCADIS

FIGURE
C-3



PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIAL FLOW DISTRIBUTION
ALTERNATIVE 4C-4

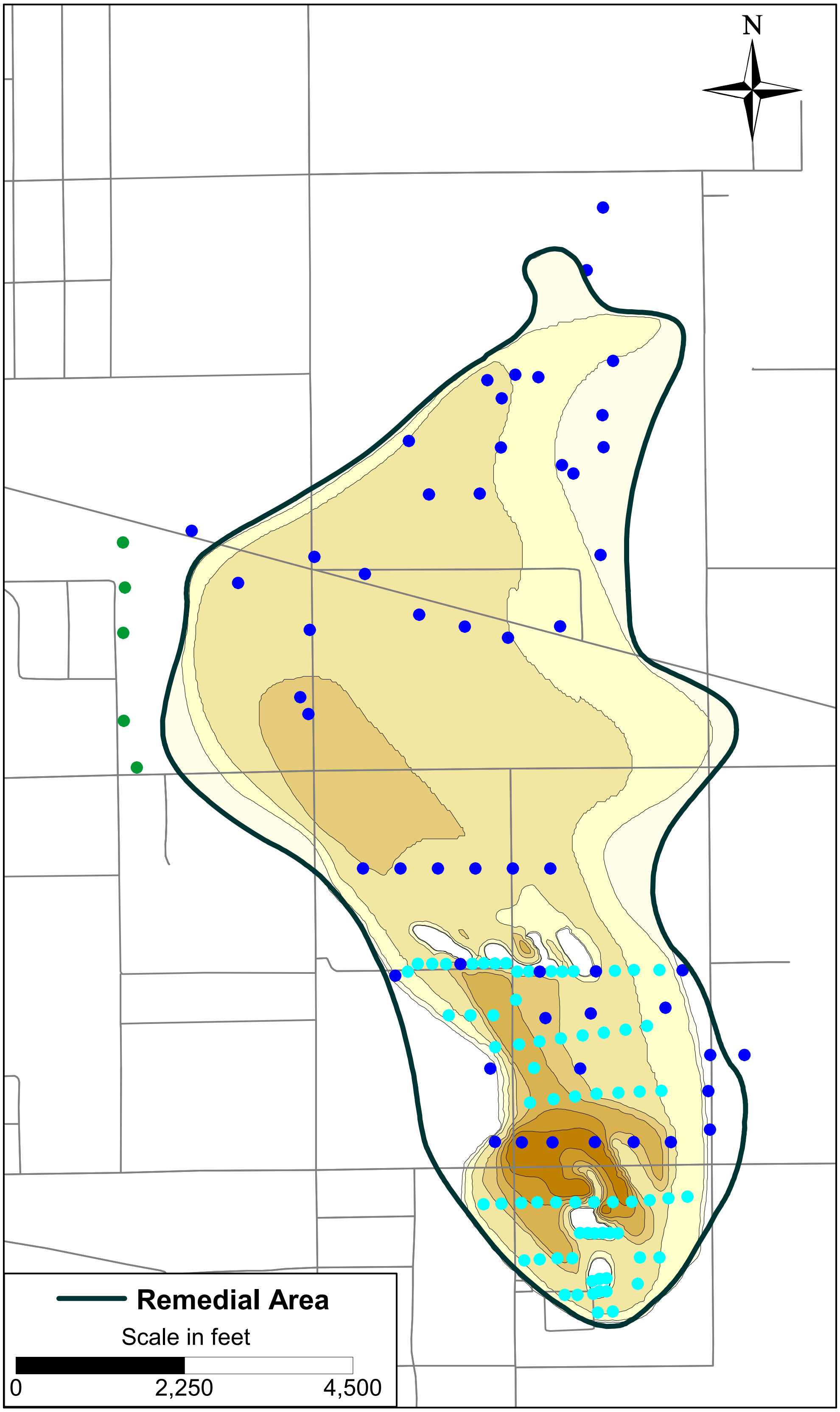
ARCADIS

FIGURE
C-4

ARCADIS

Attachment C-1

Solute Transport Results for
Alternative 4C-1



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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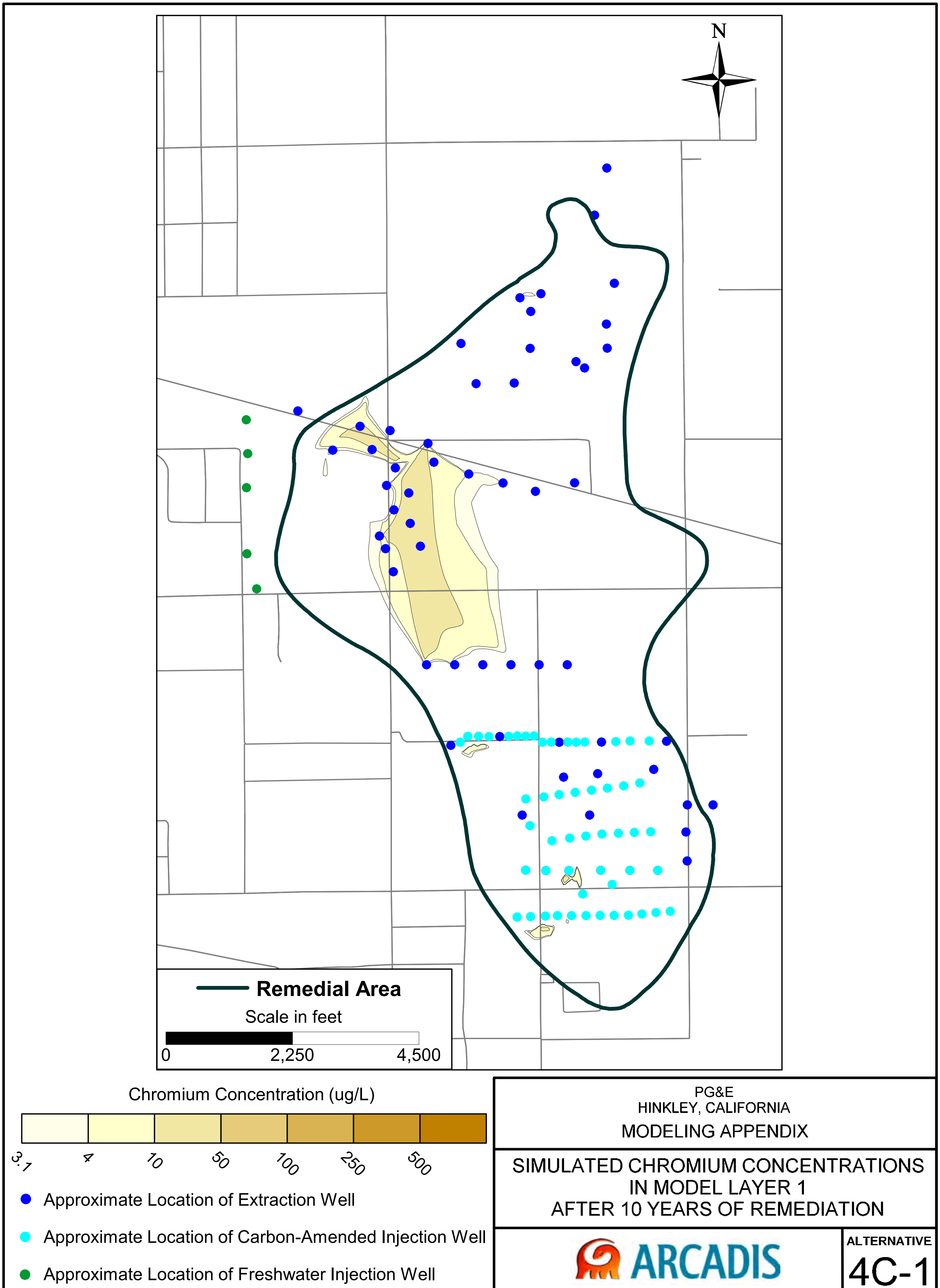
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-1



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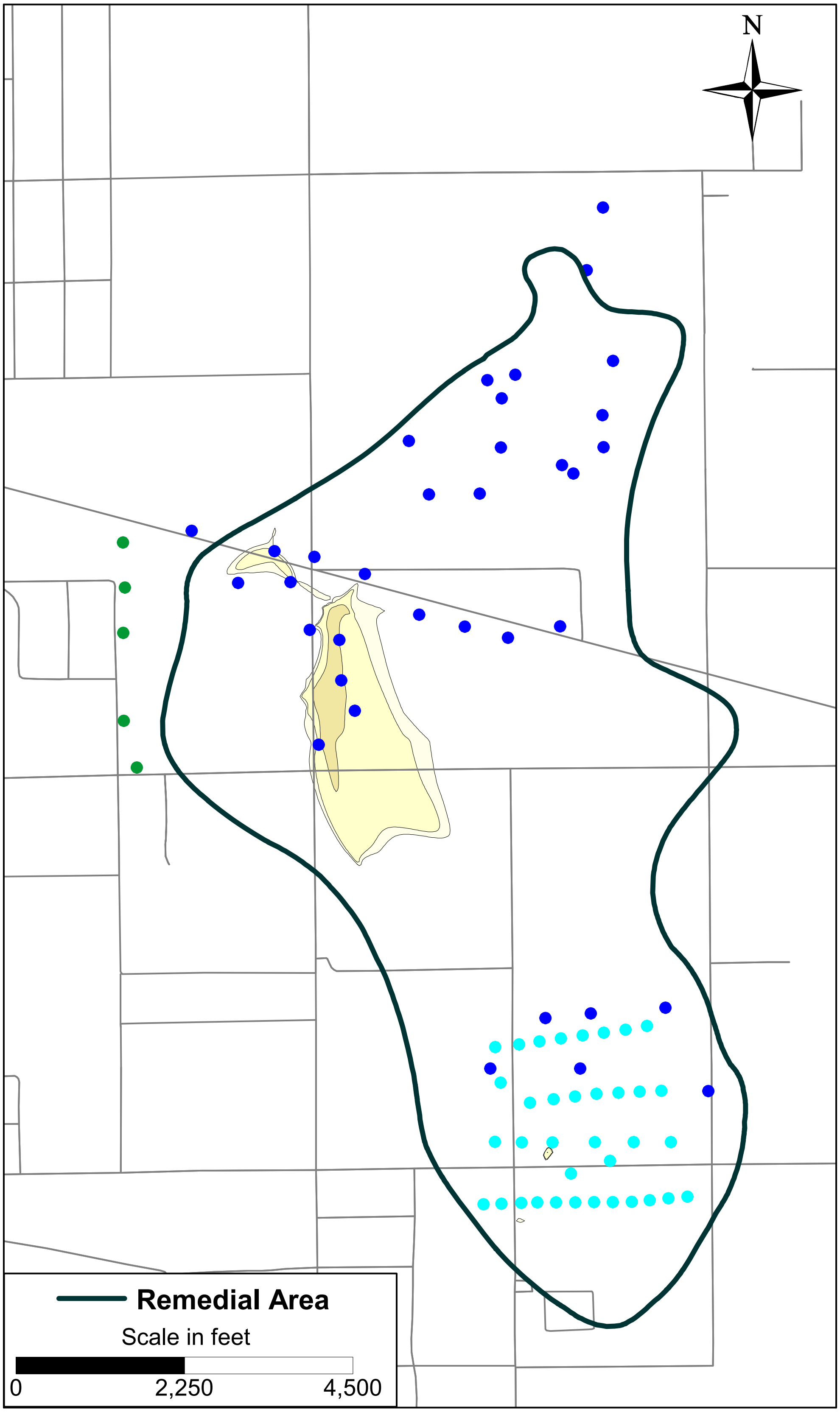
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1 AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE 4C-1



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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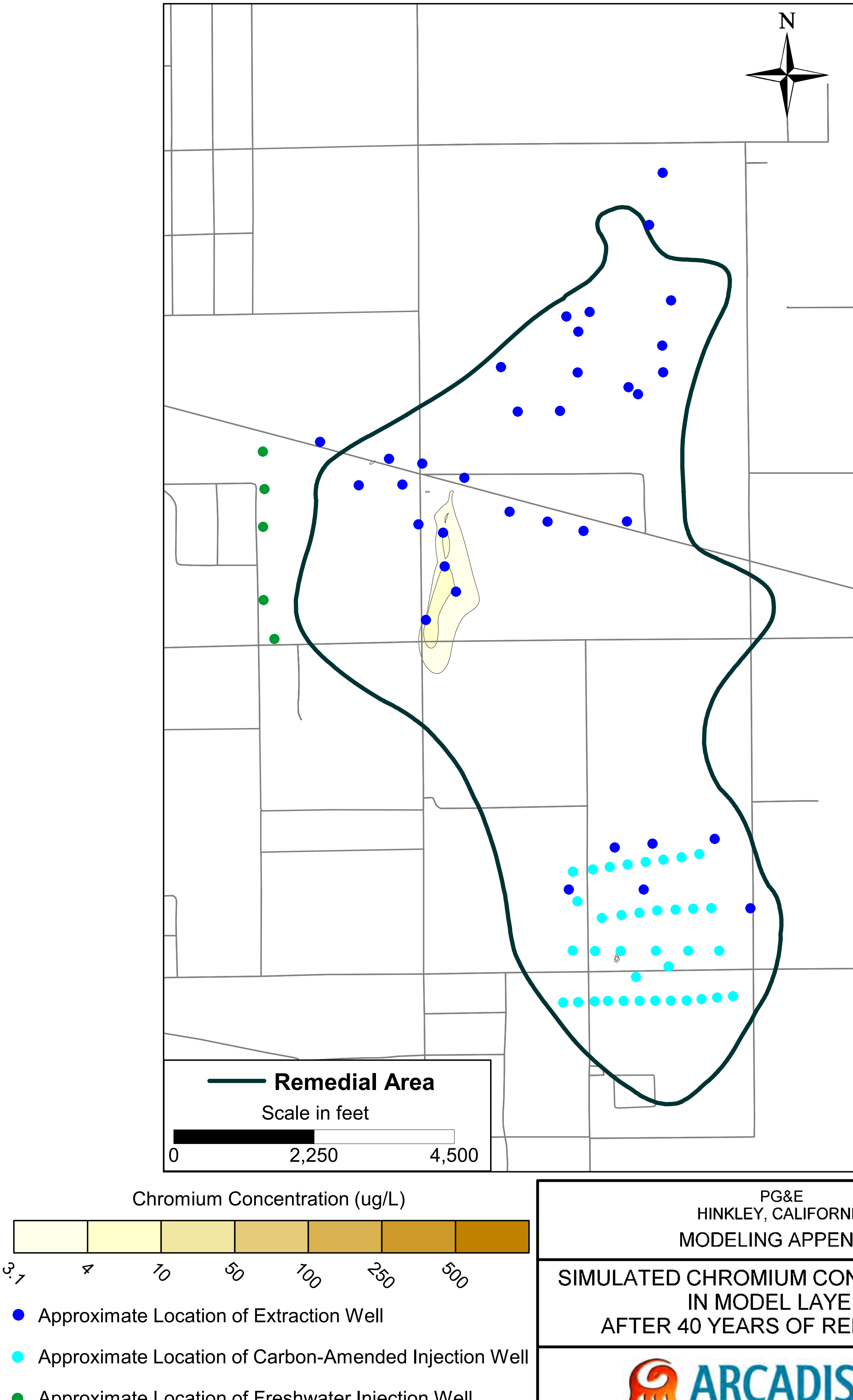
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



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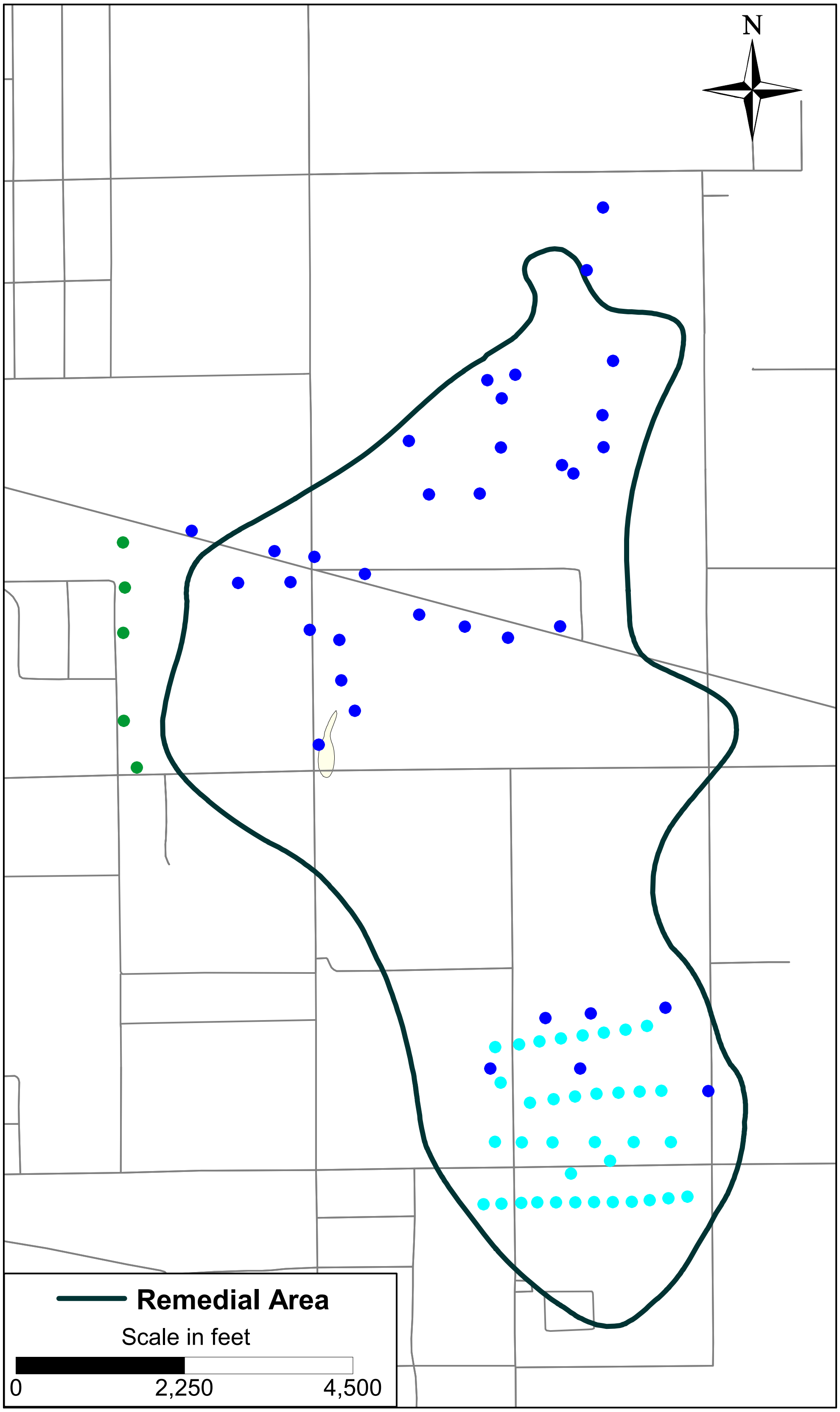
HINKLEY, CALIFORNIA
MODELING APPENDIX

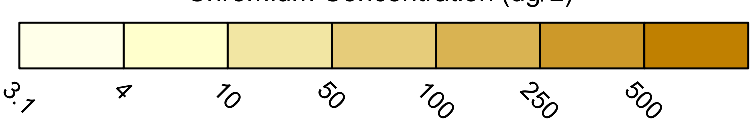
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)



- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

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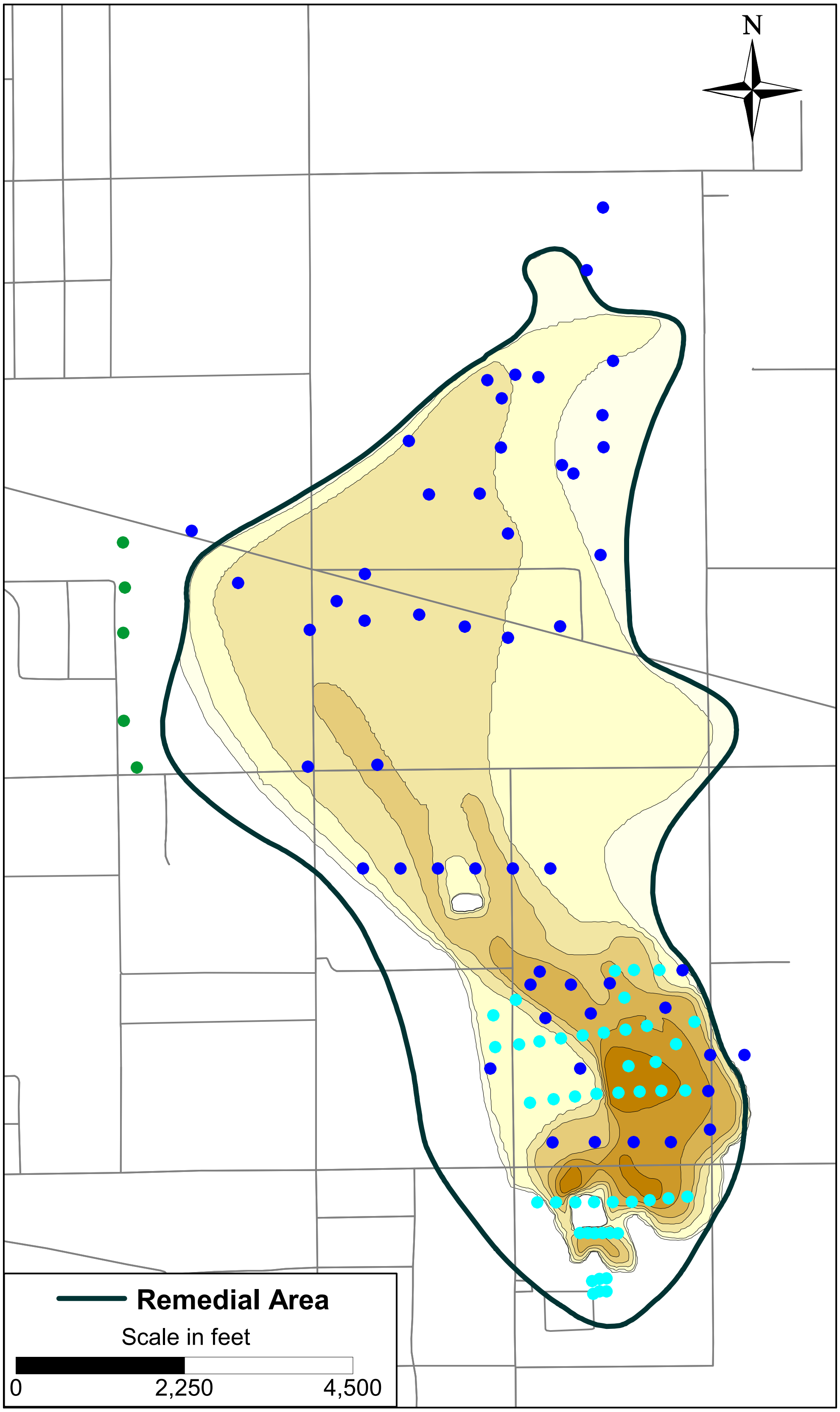
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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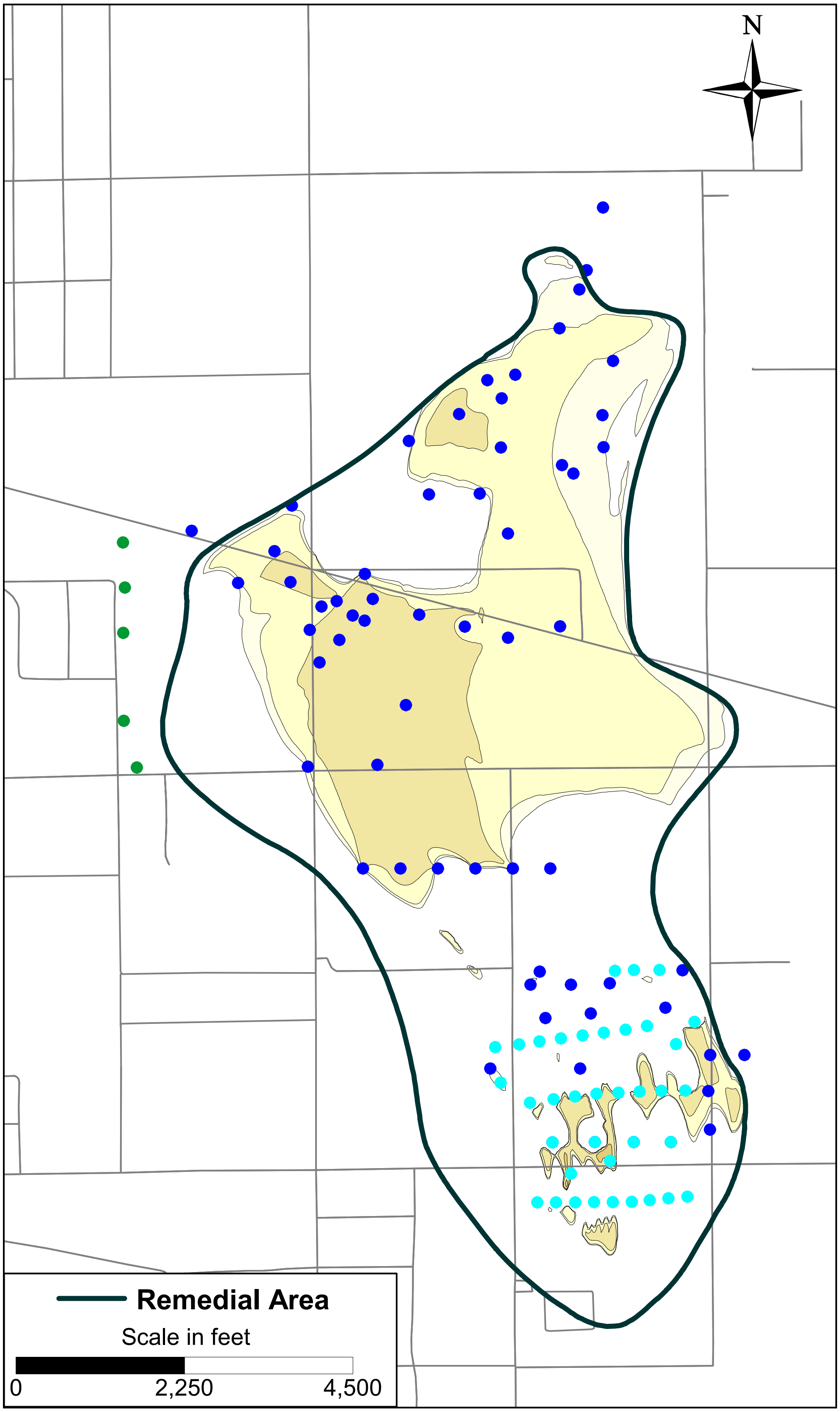
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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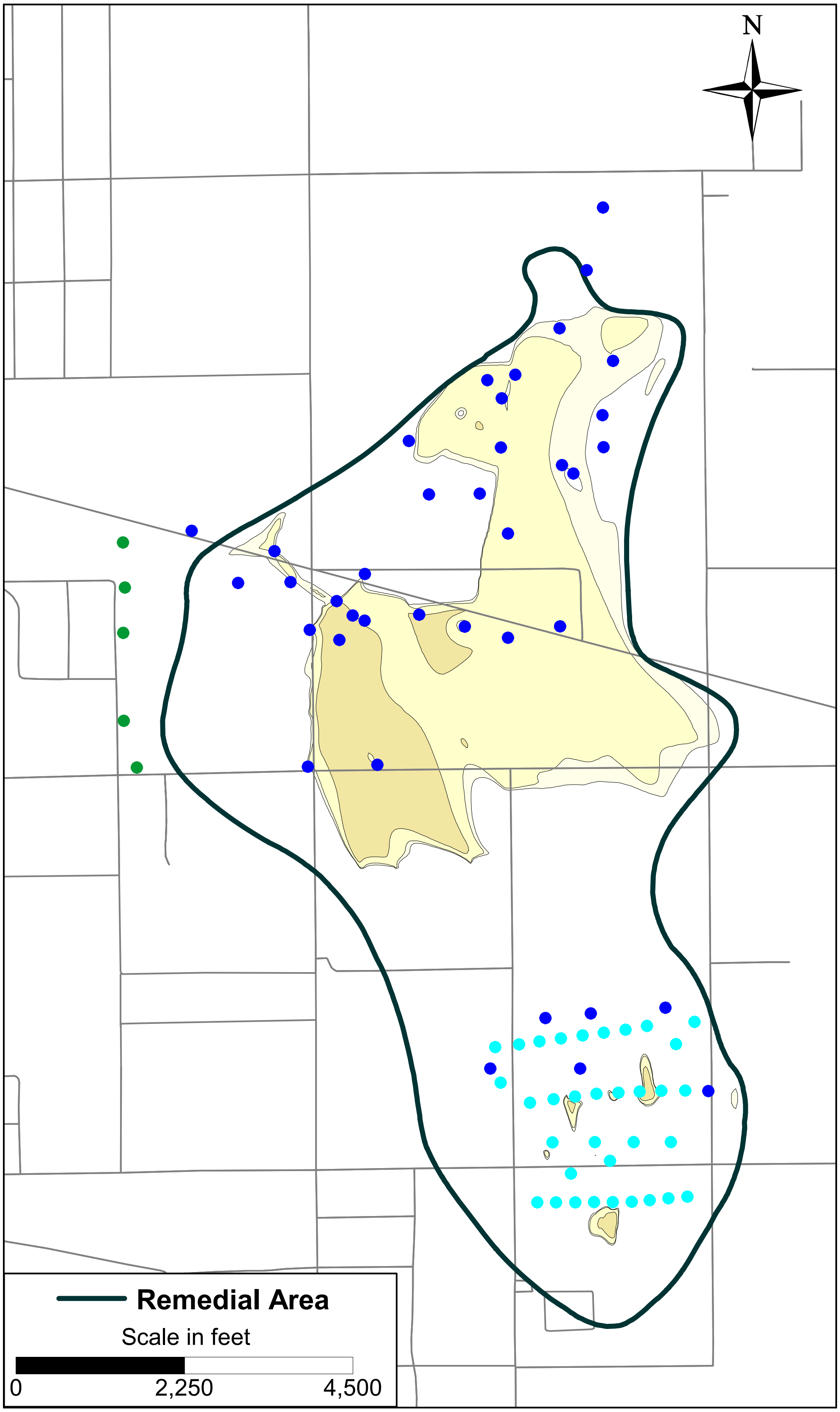
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE

4C-1



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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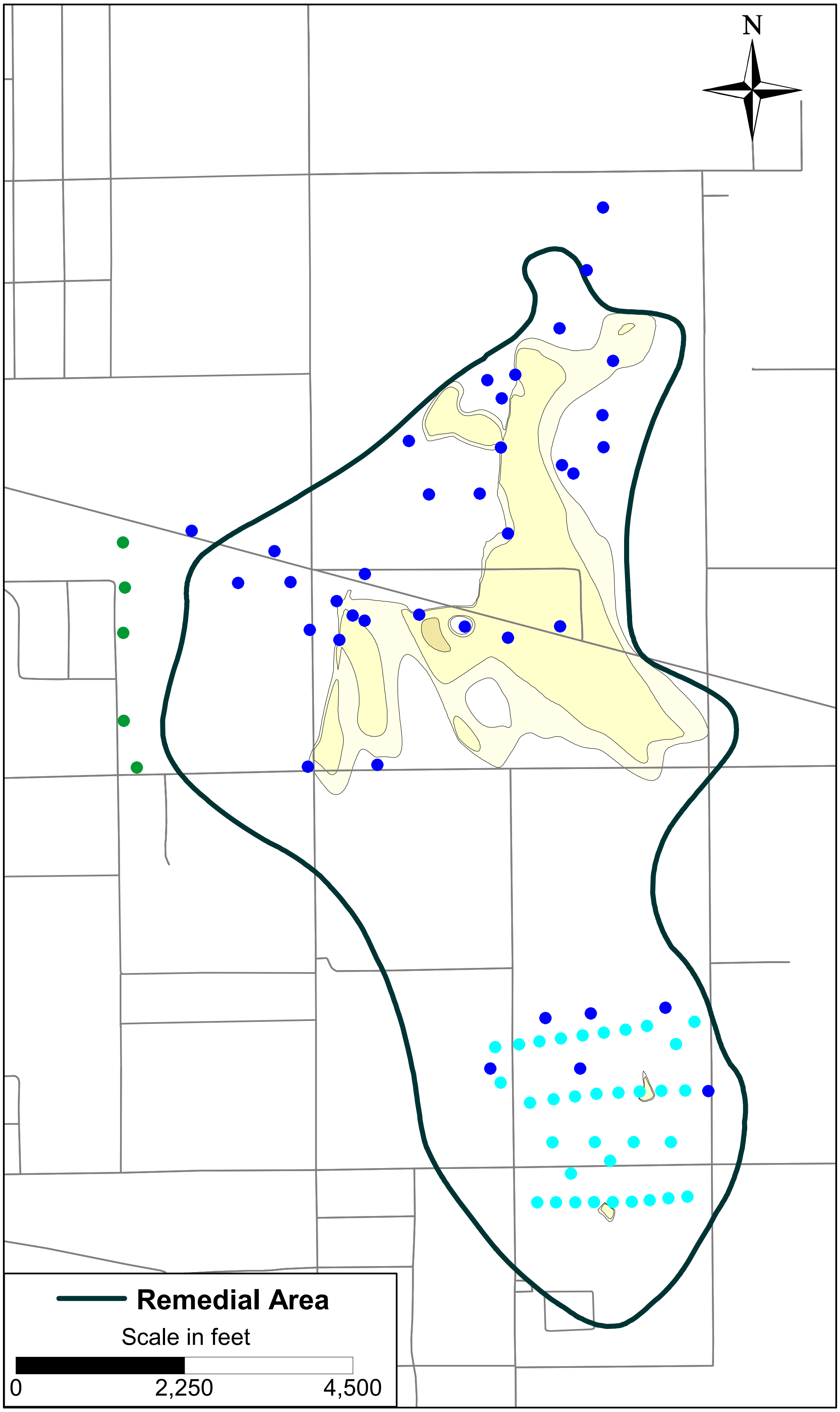
HINKLEY, CALIFORNIA
MODELING APPENDIX

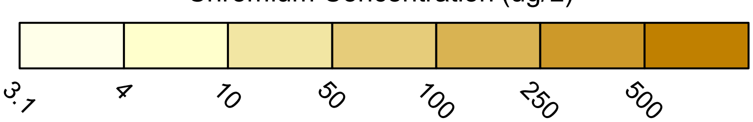
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)



- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

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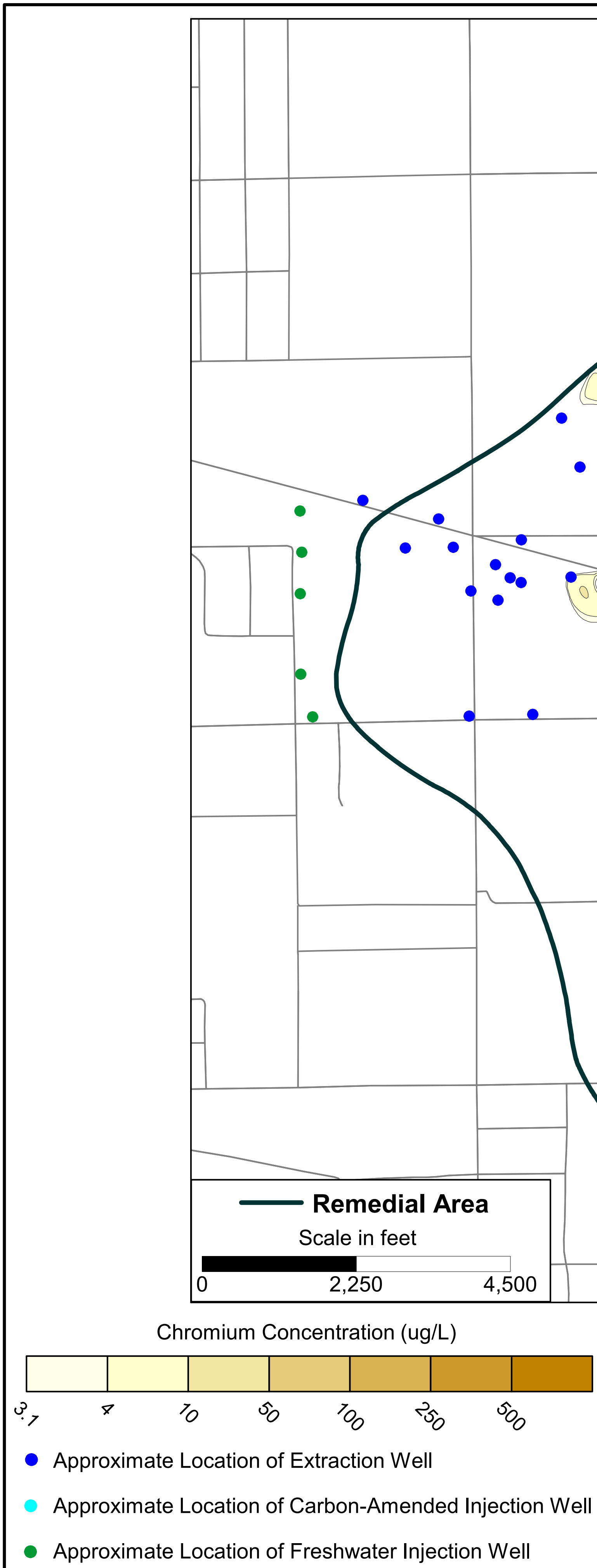
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



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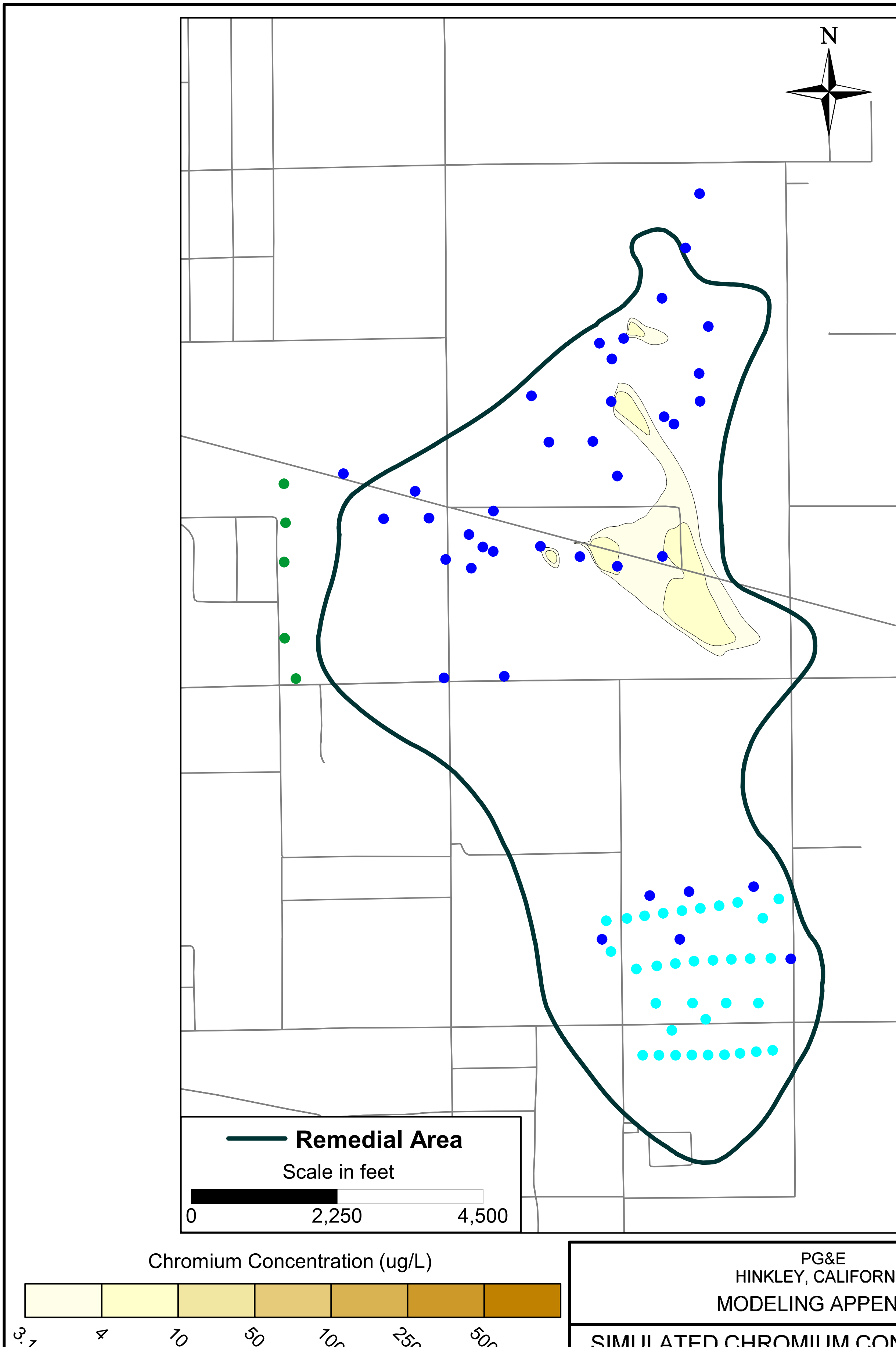
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 2 AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE 4C-1



Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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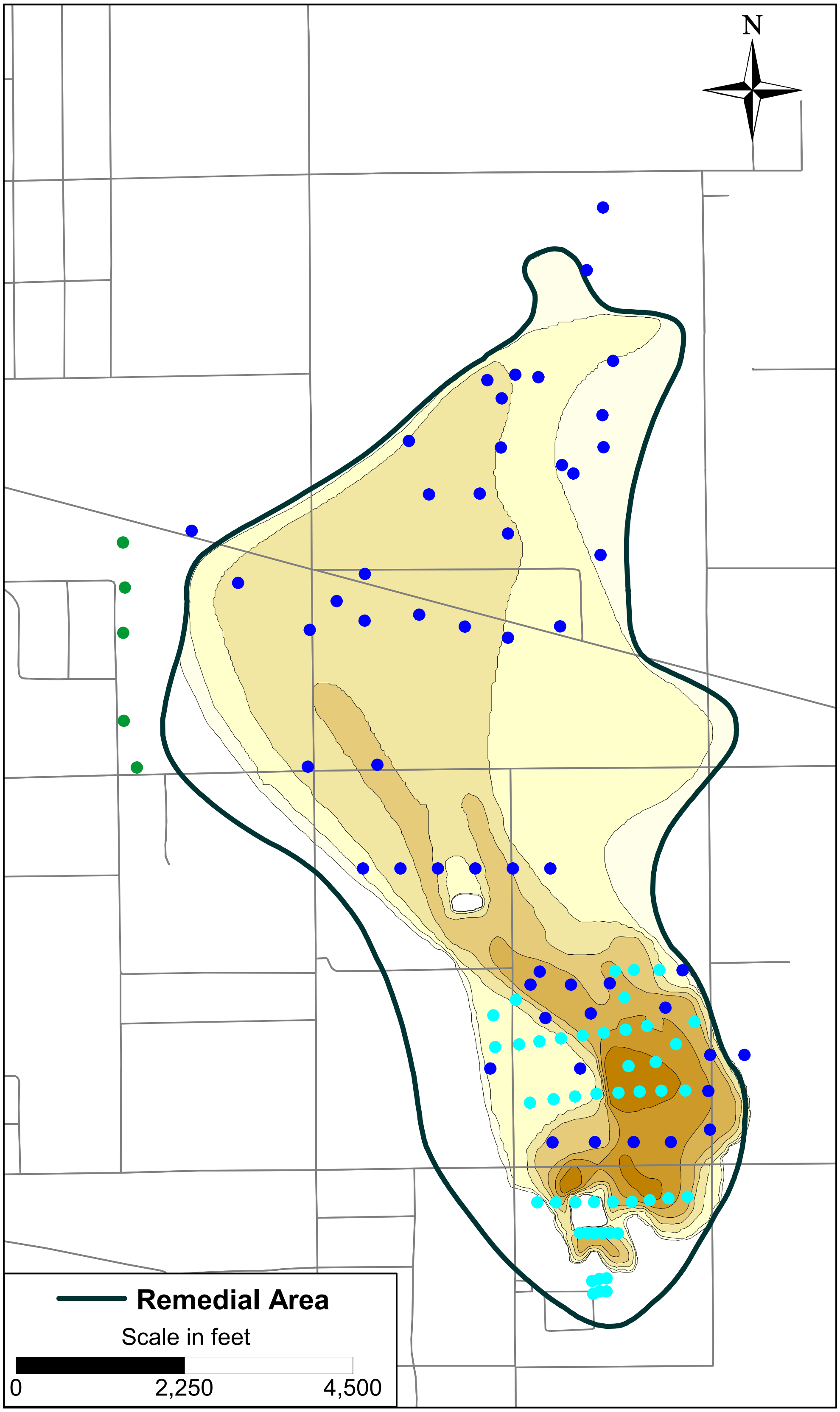
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 2 AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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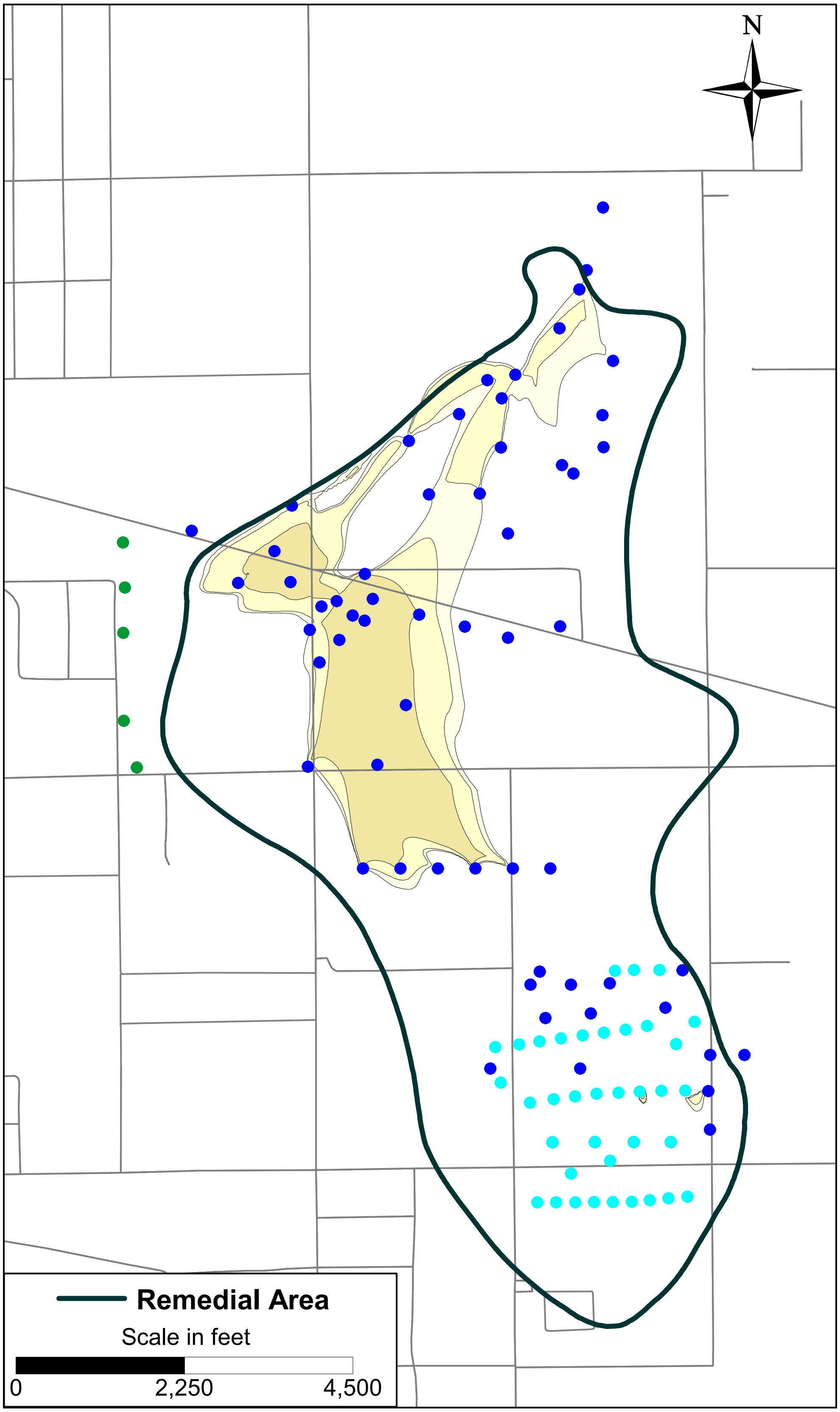
MODELING APPENDIX

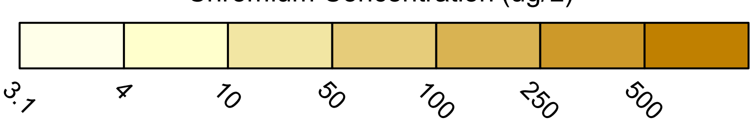
INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)



- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

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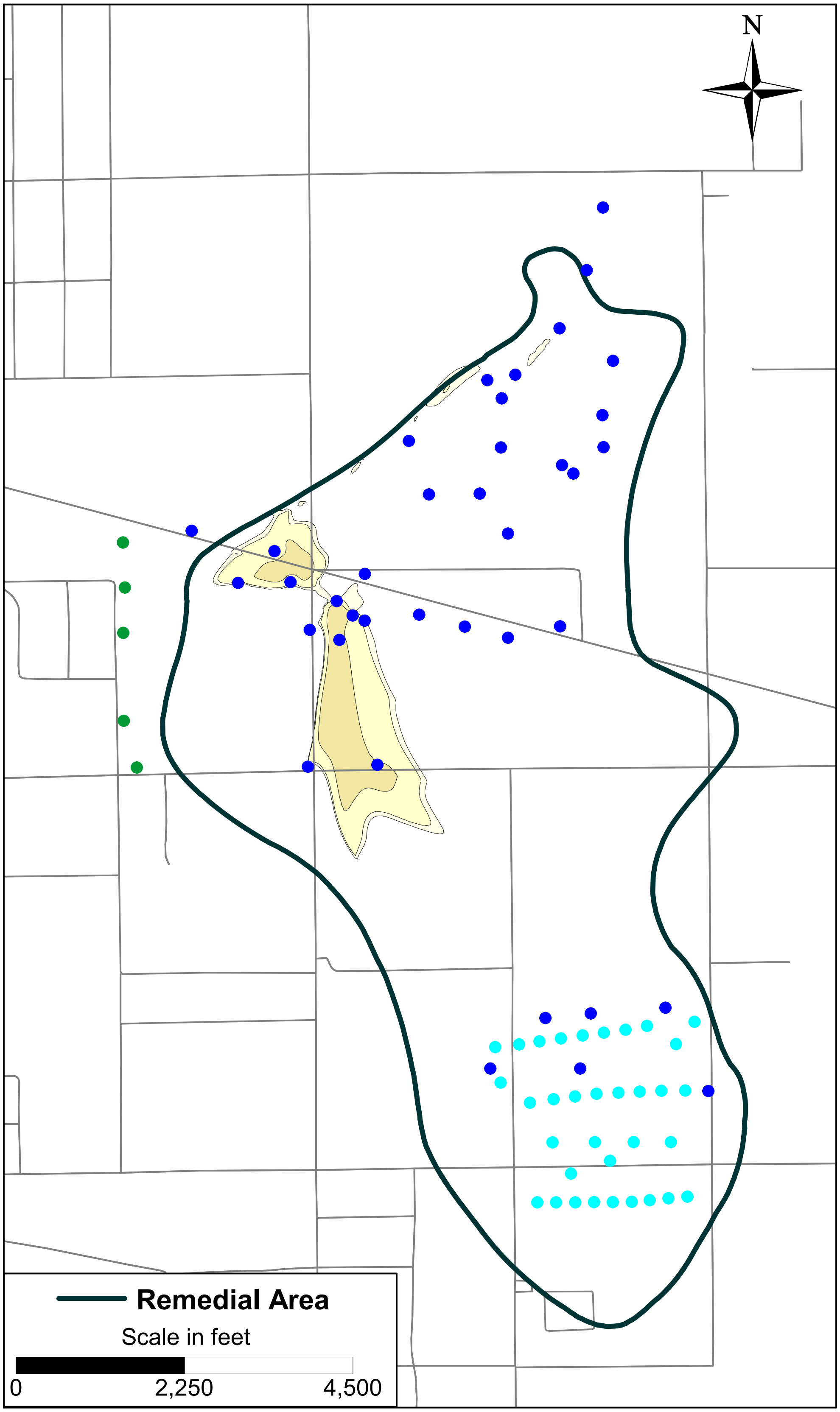
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

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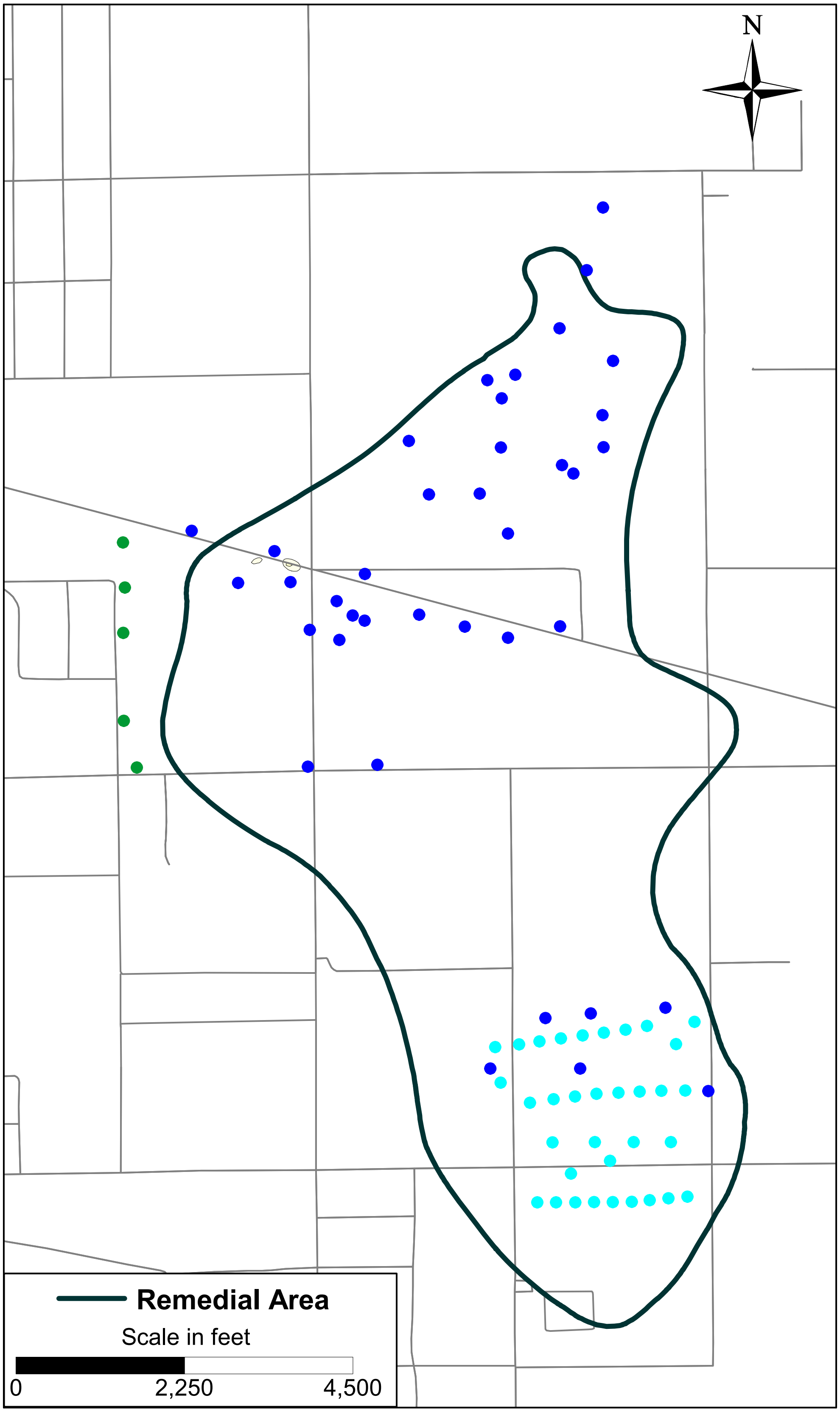
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

ARCADIS

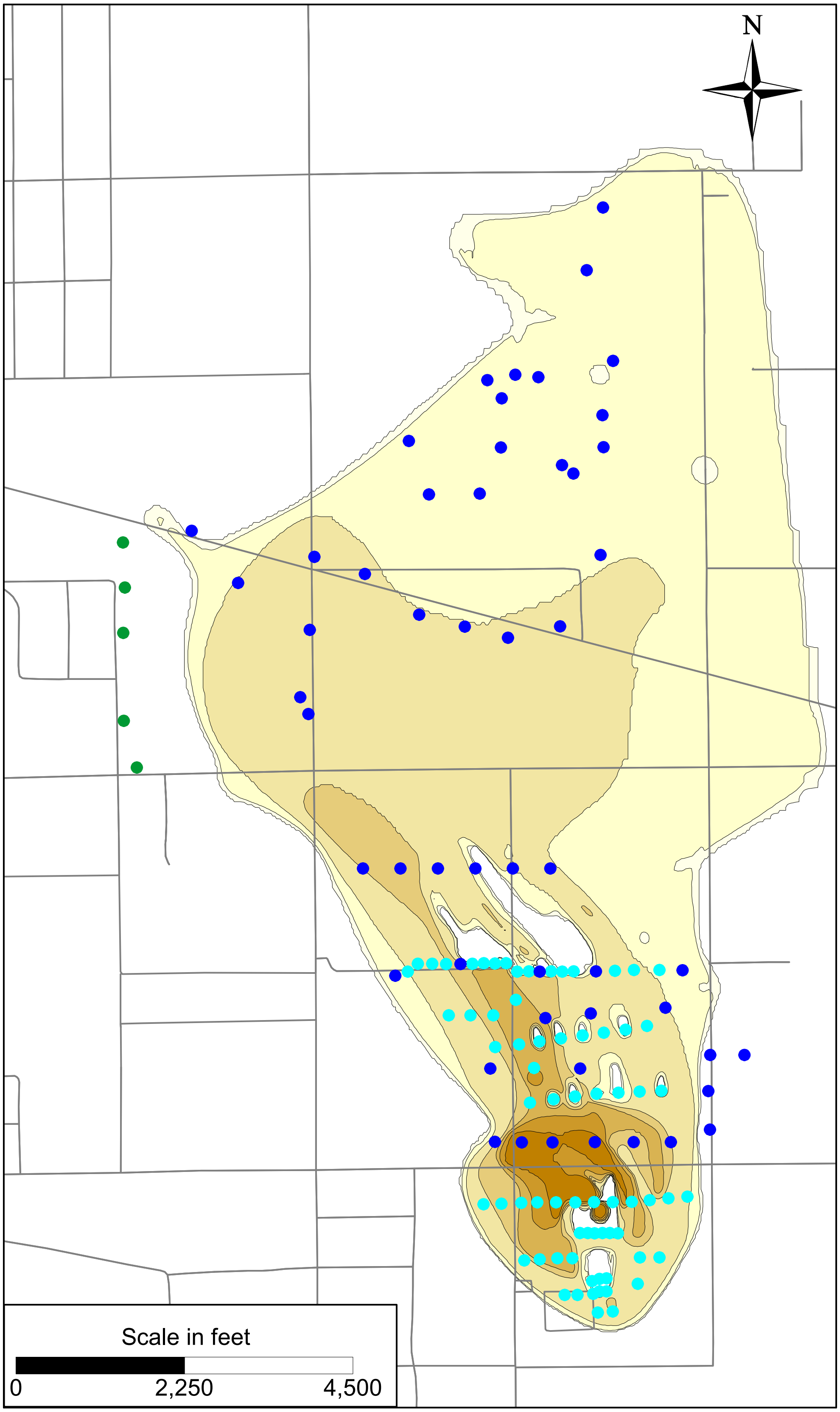
ALTERNATIVE

4C-1

ARCADIS

Attachment C-1

1Q11 Figures



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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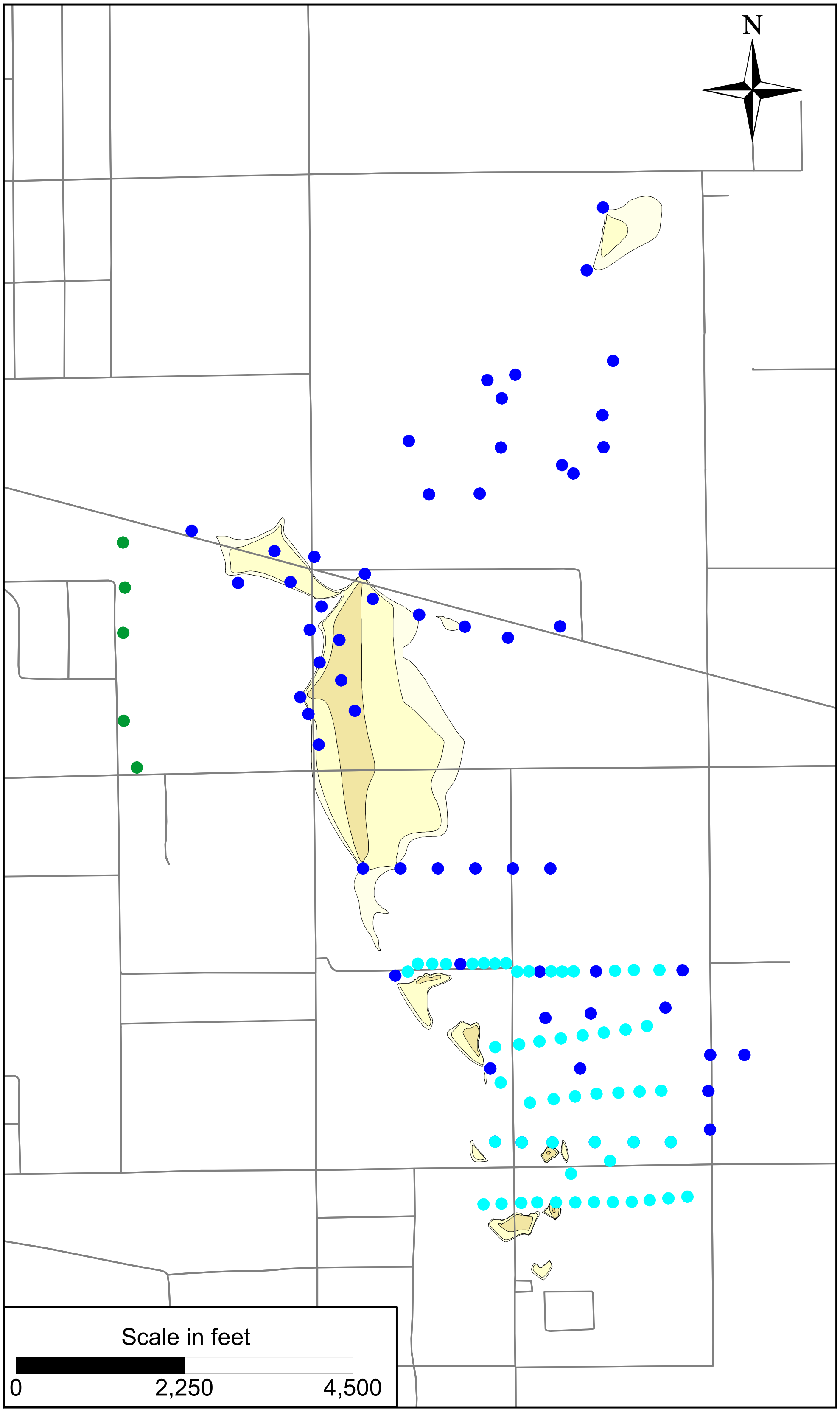
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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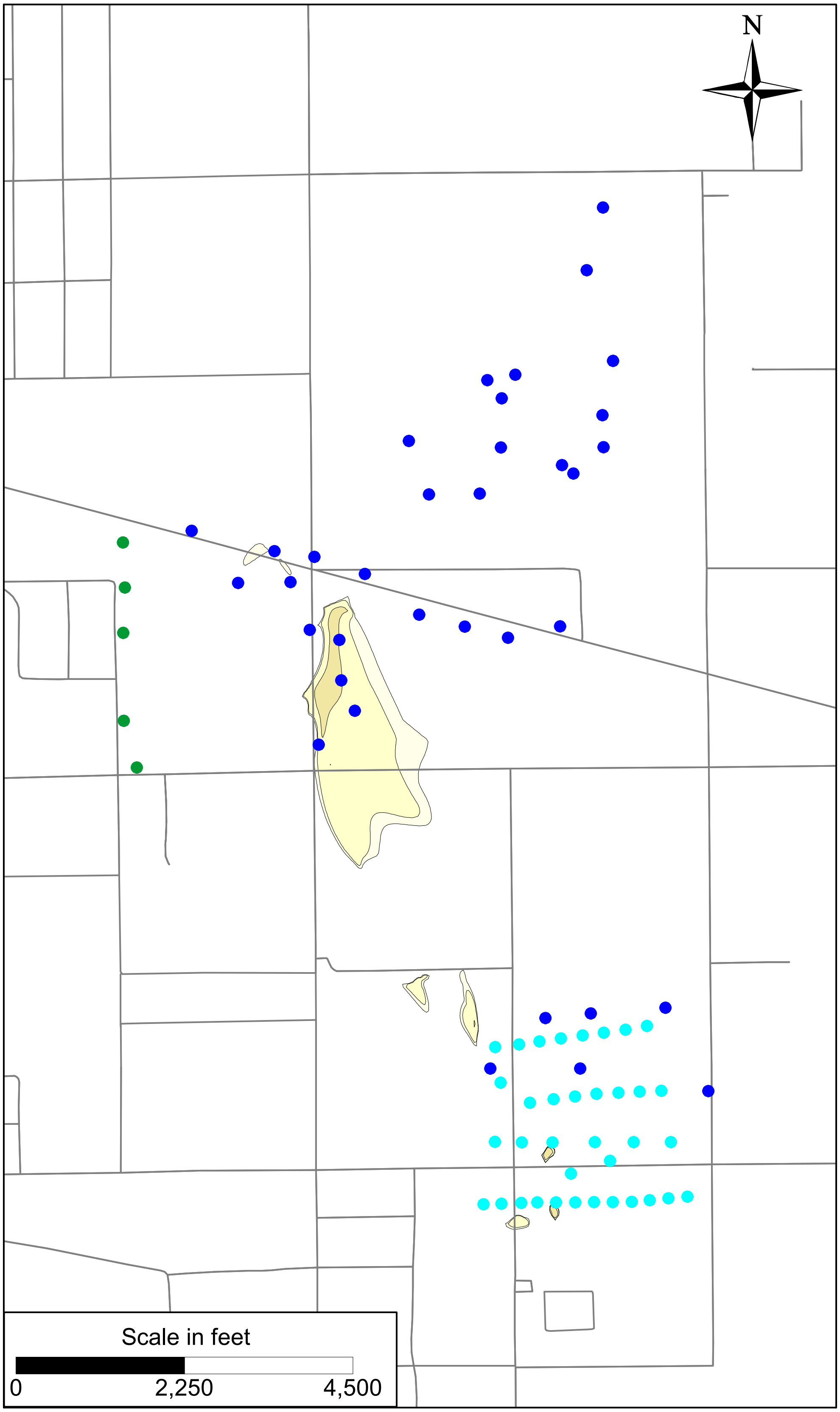
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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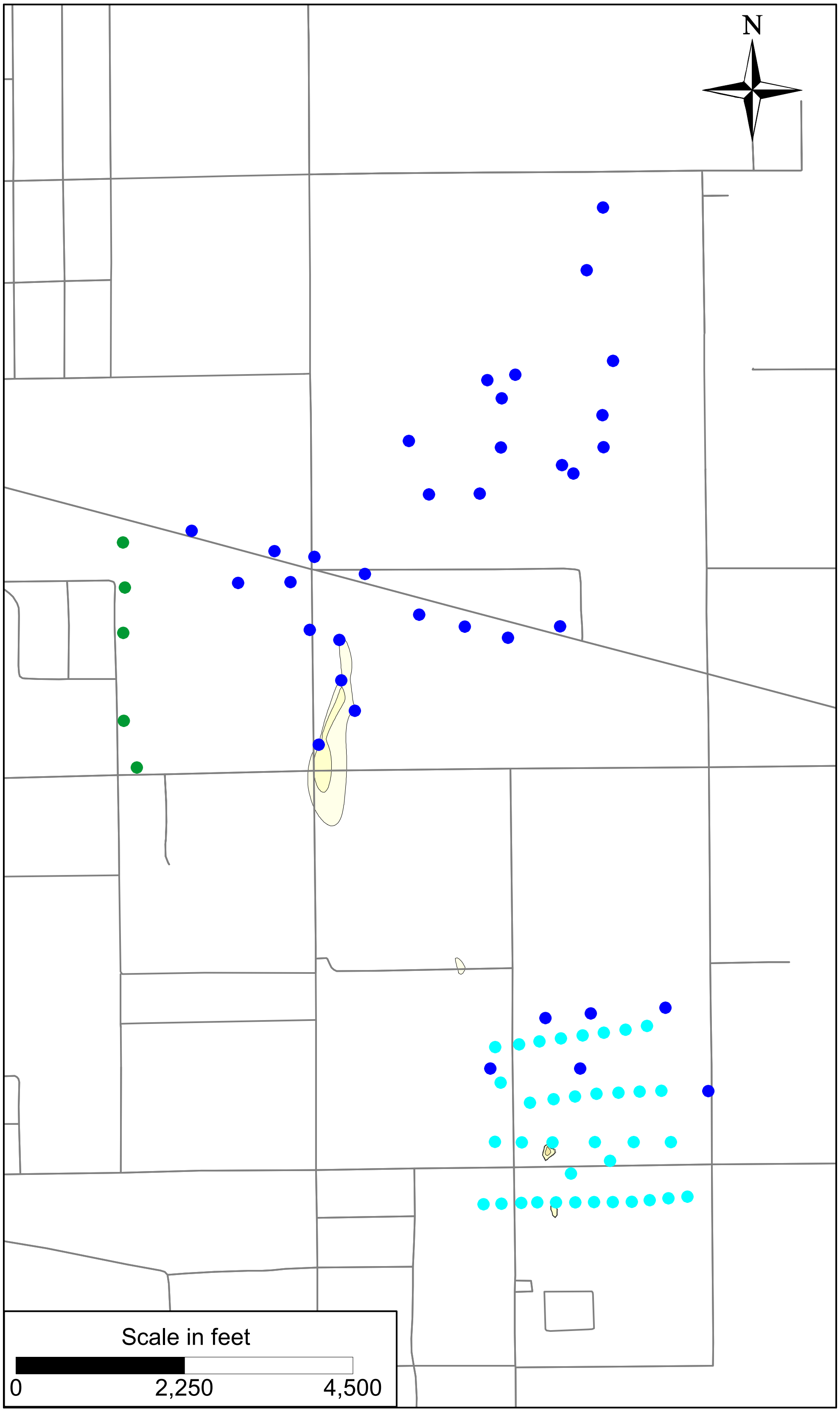
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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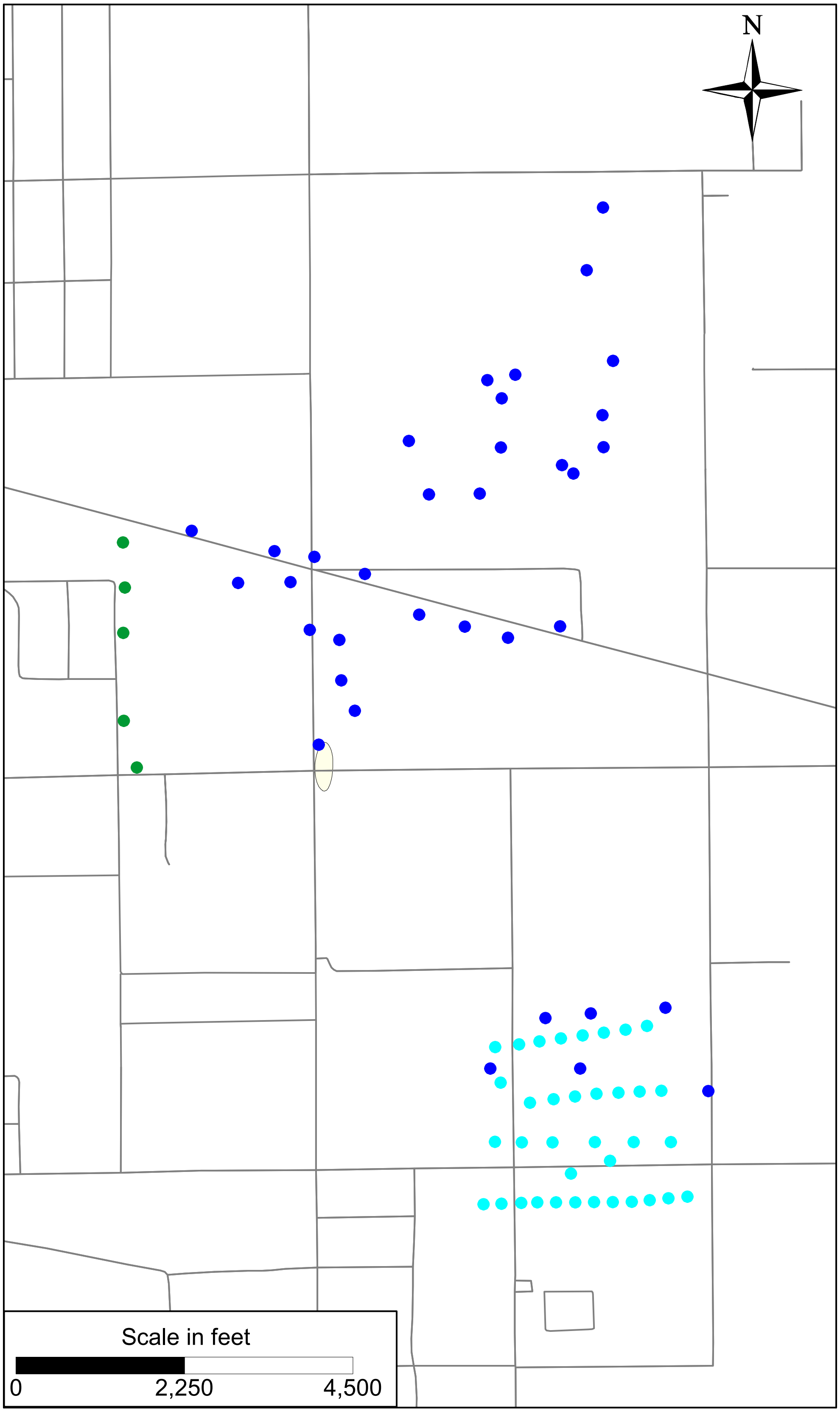
HINKLEY, CALIFORNIA
MODELING APPENDIX

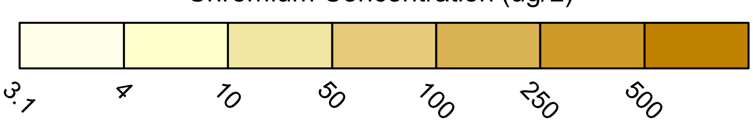
SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1 AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)



Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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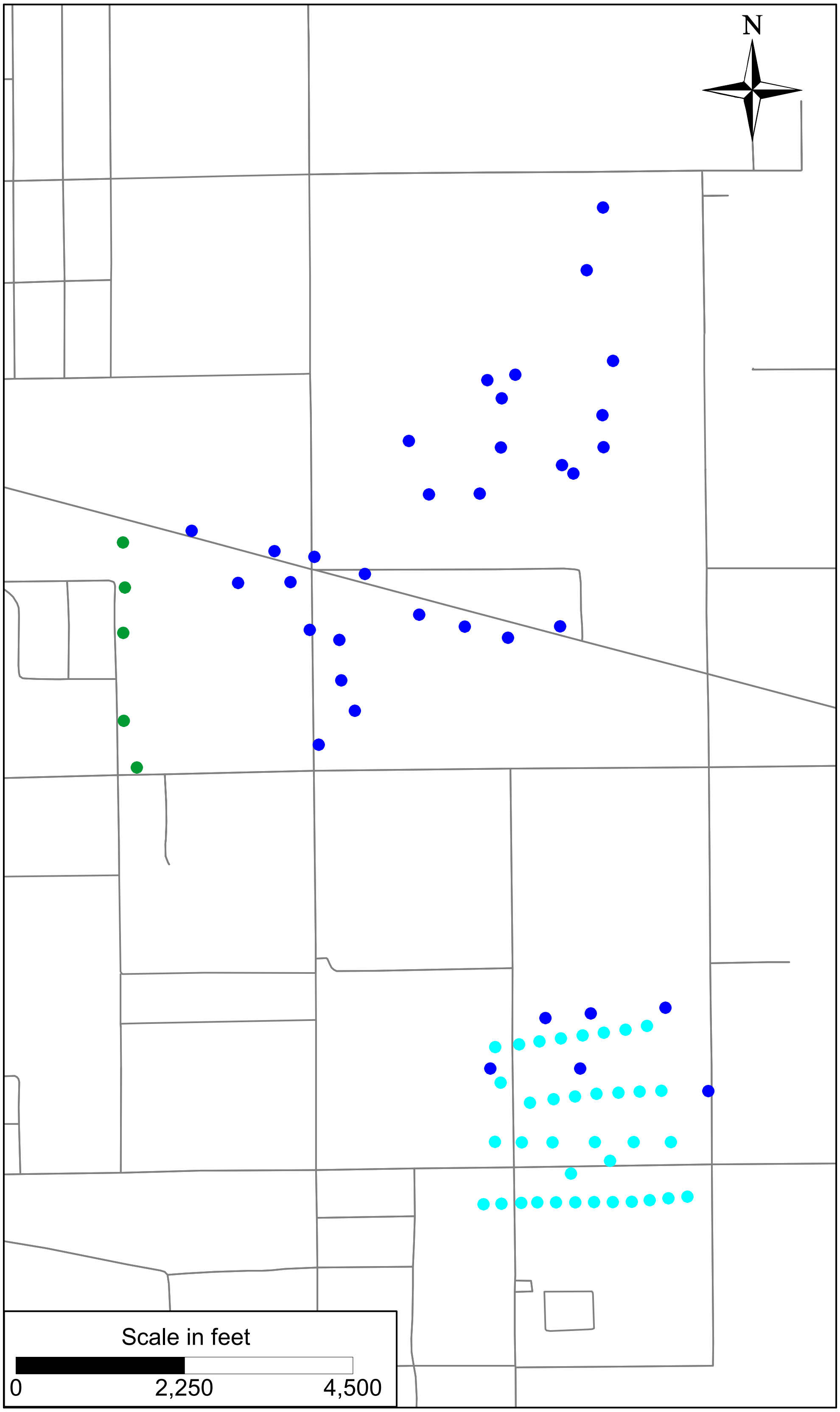
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1	4	10	50	100	250	500

- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

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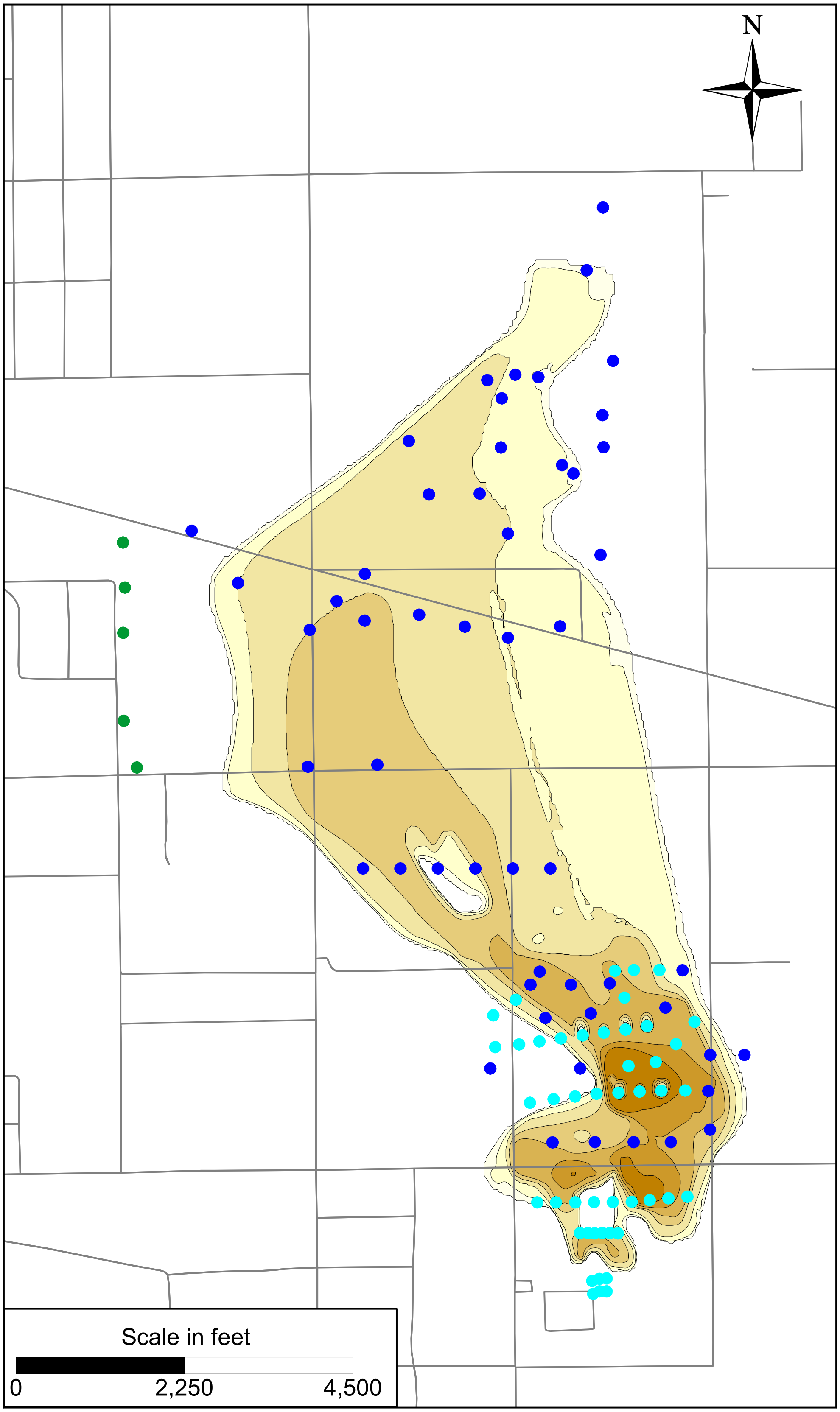
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

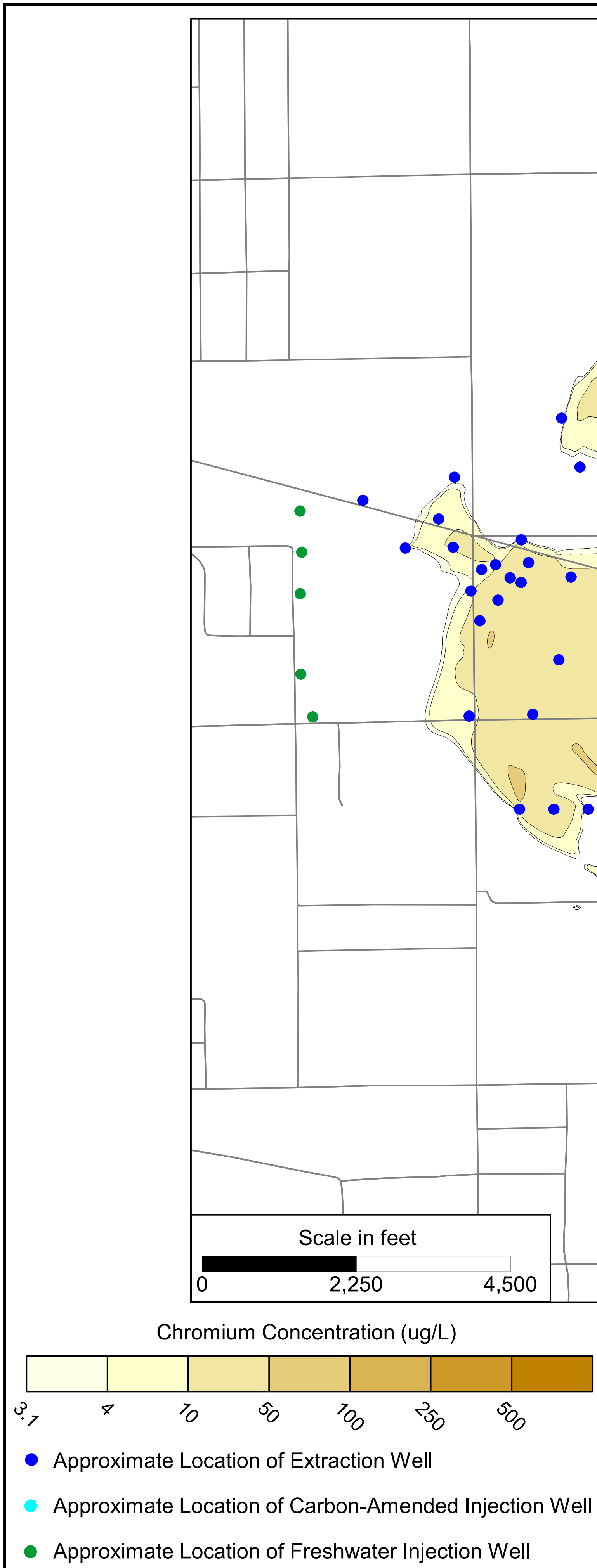
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-1
1Q11



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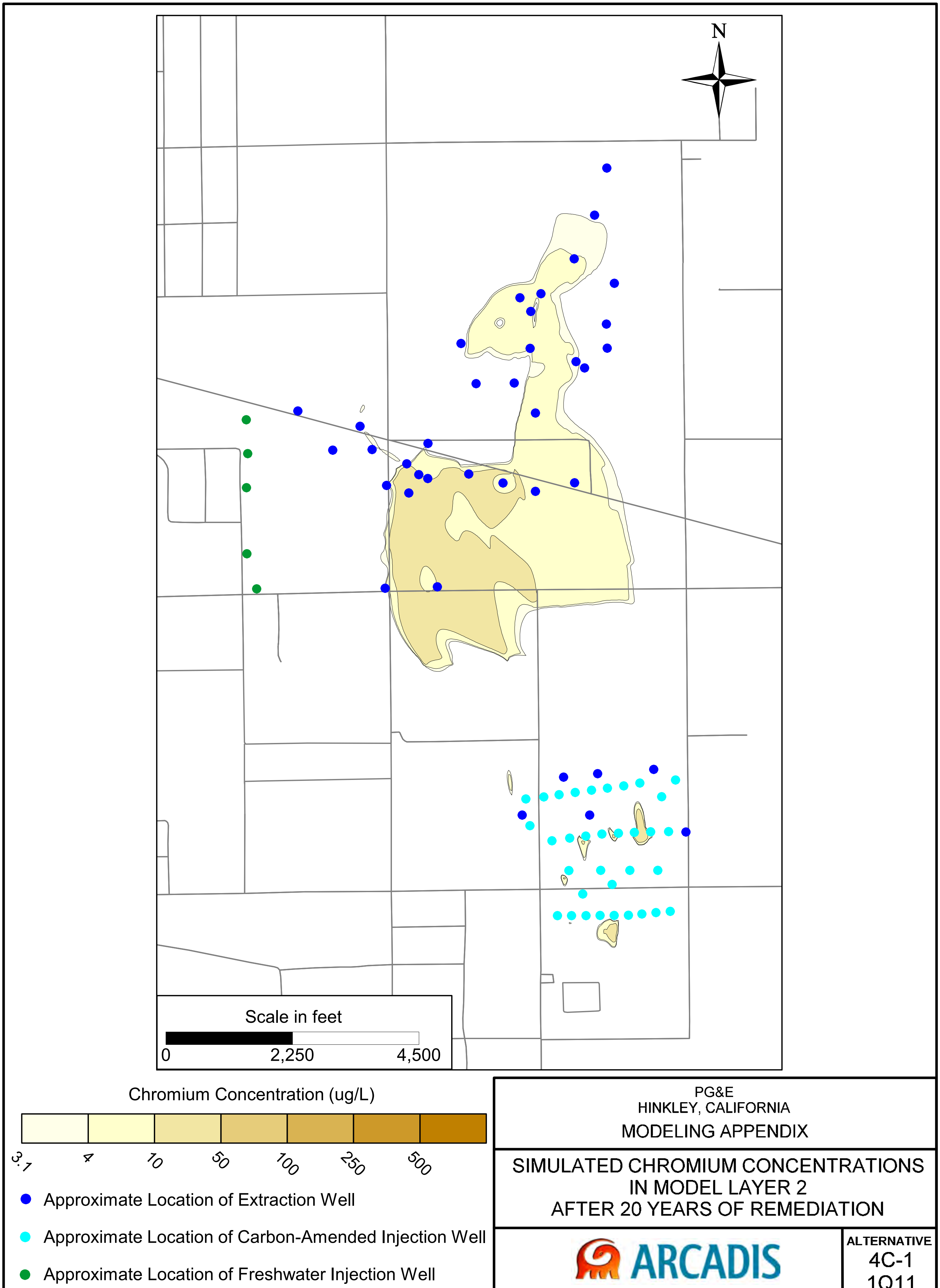
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



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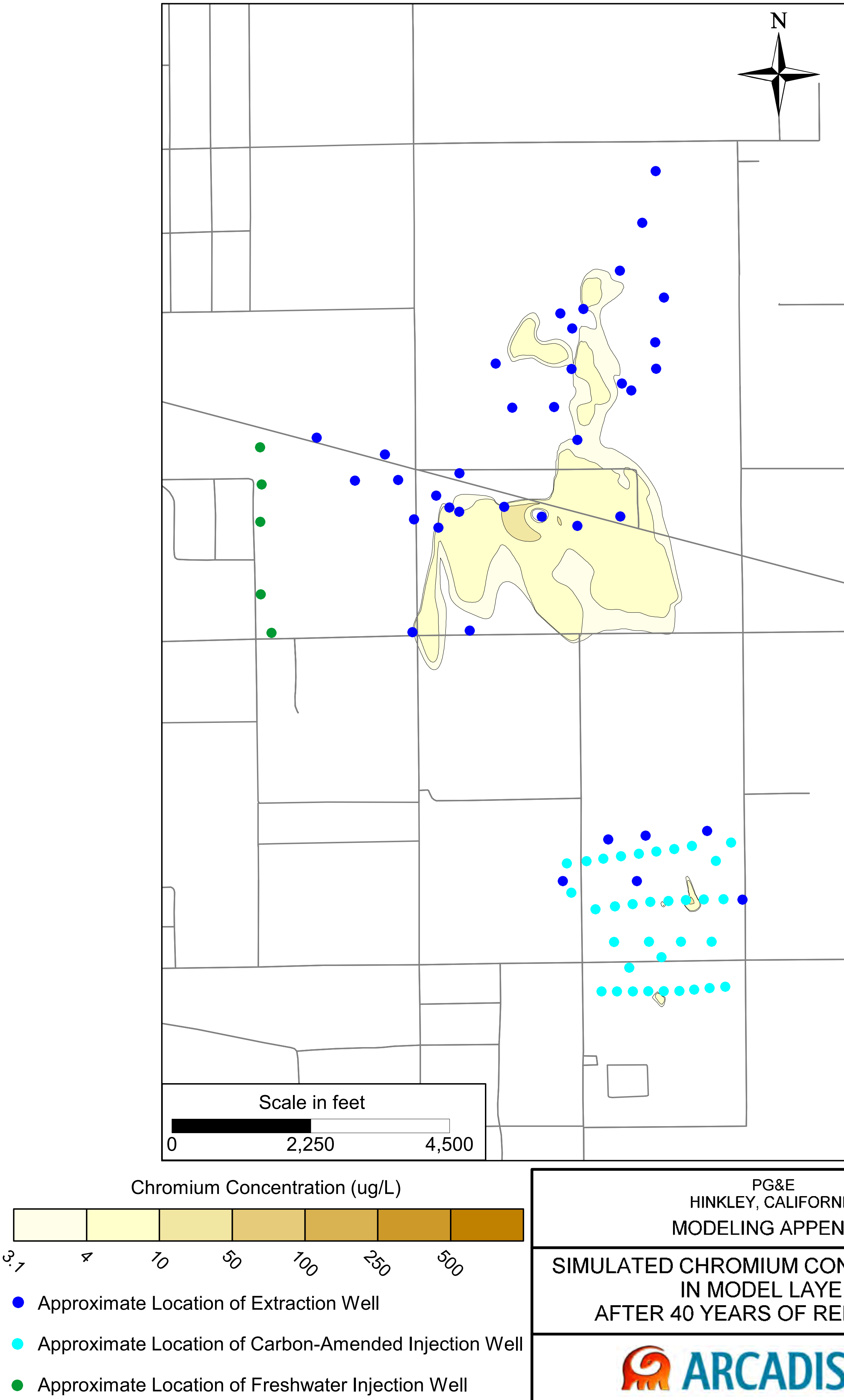
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 2 AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11

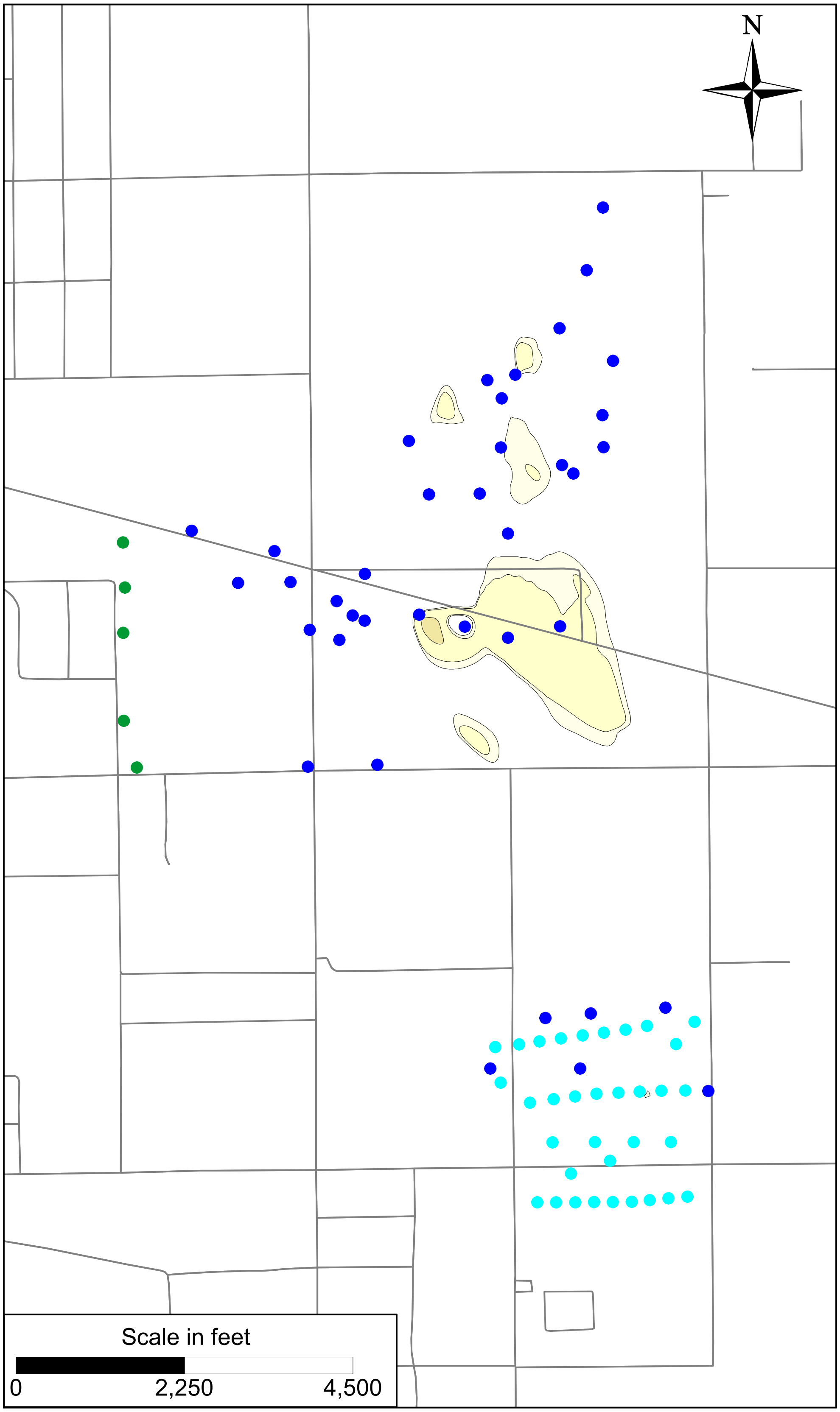


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

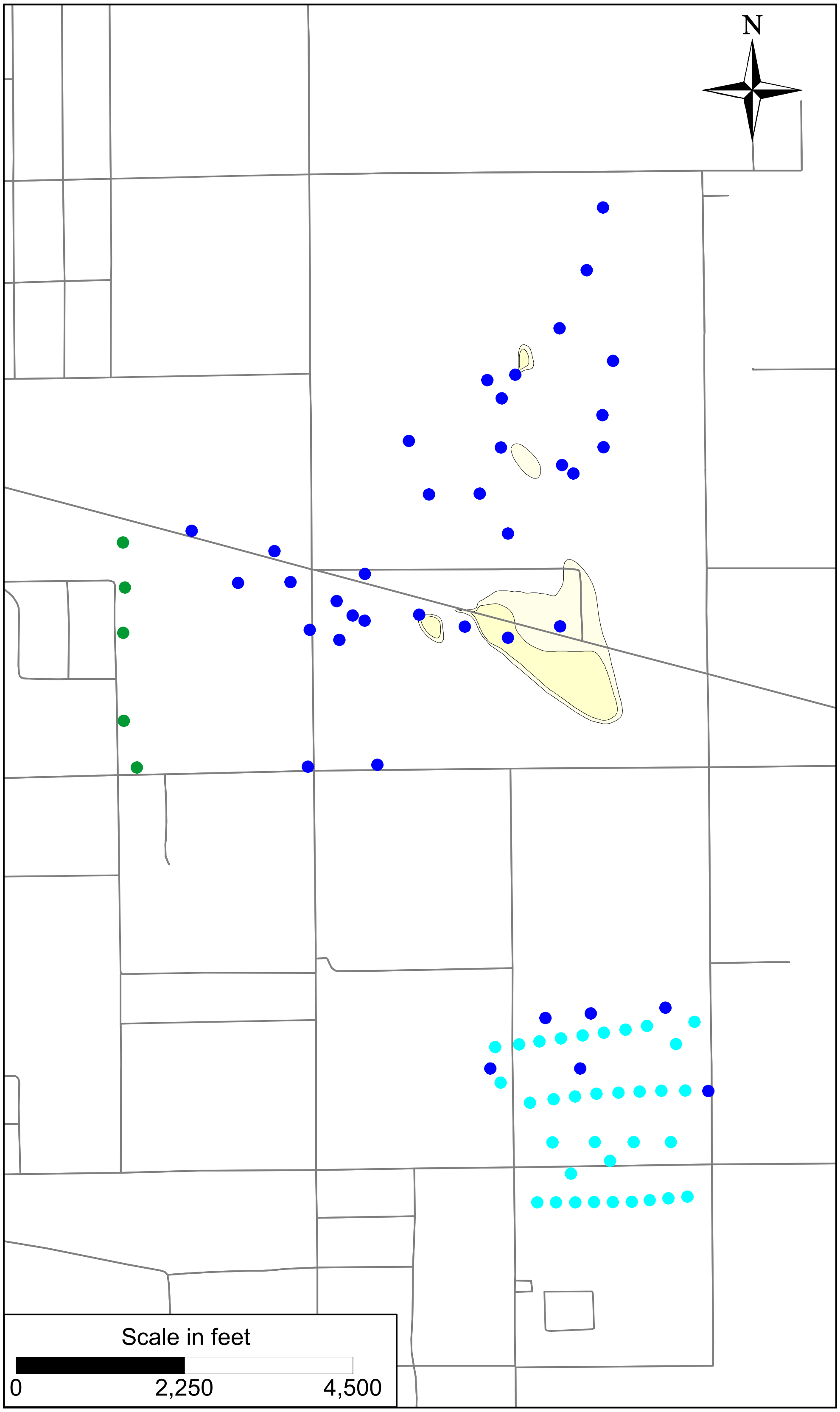
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

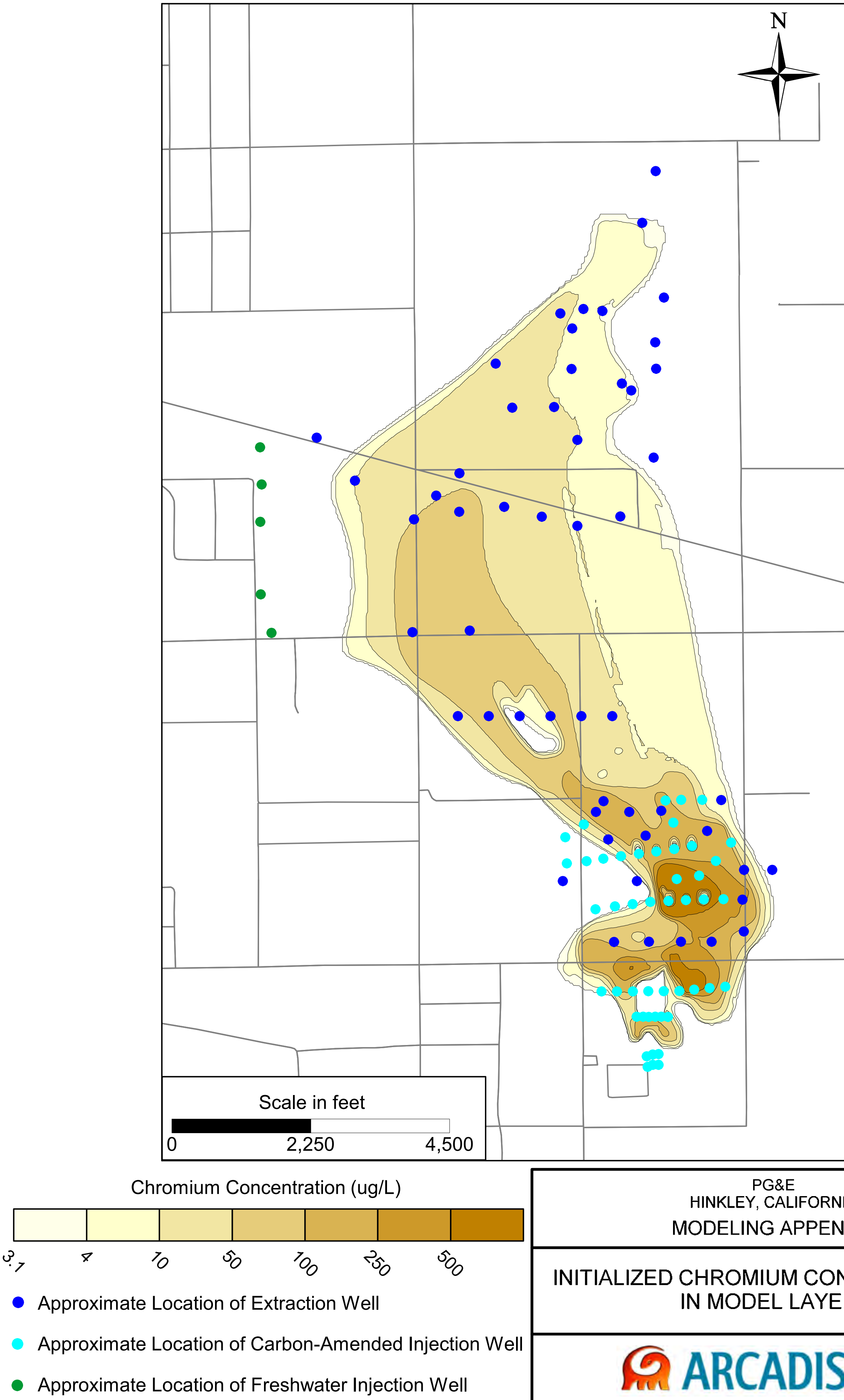
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11

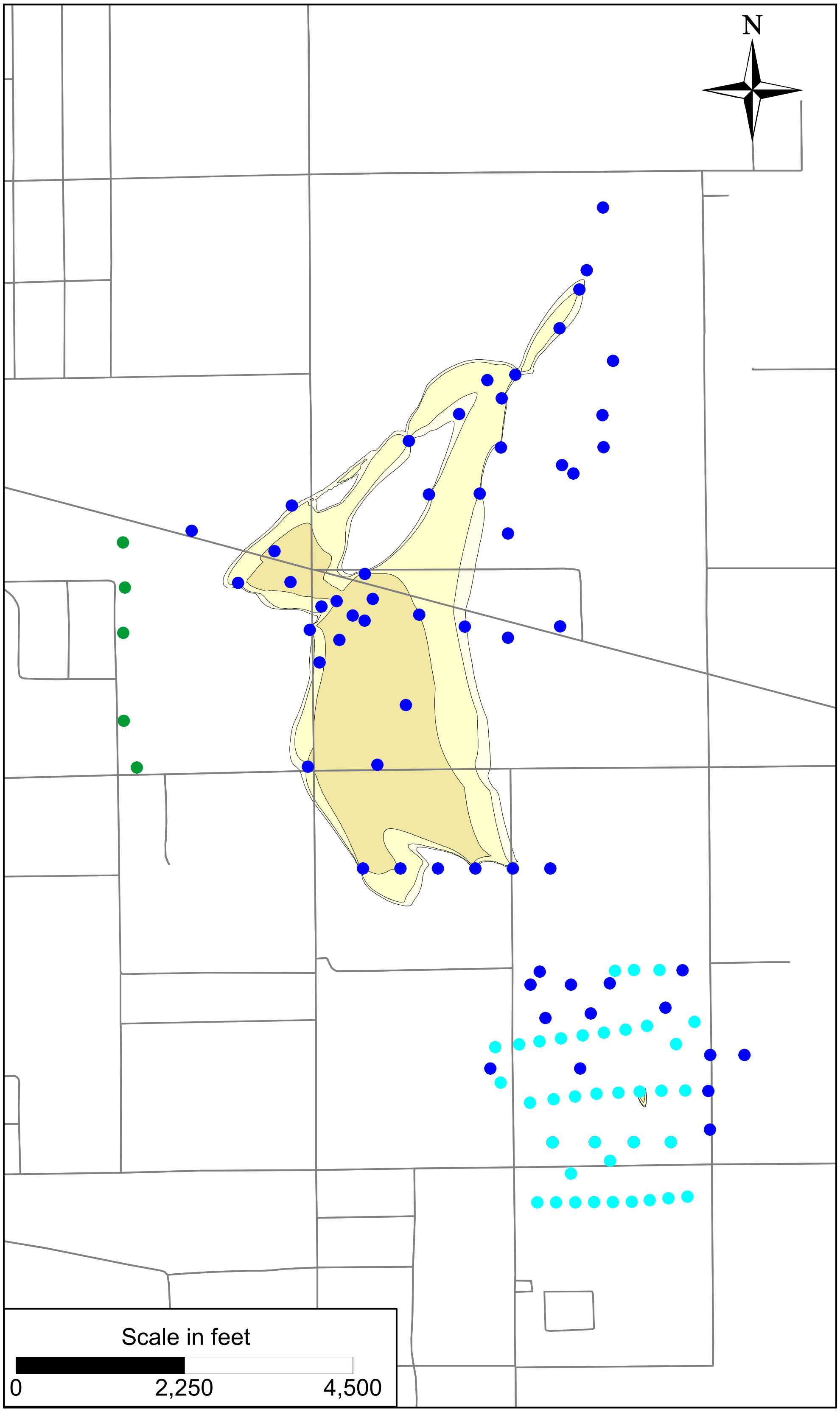


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

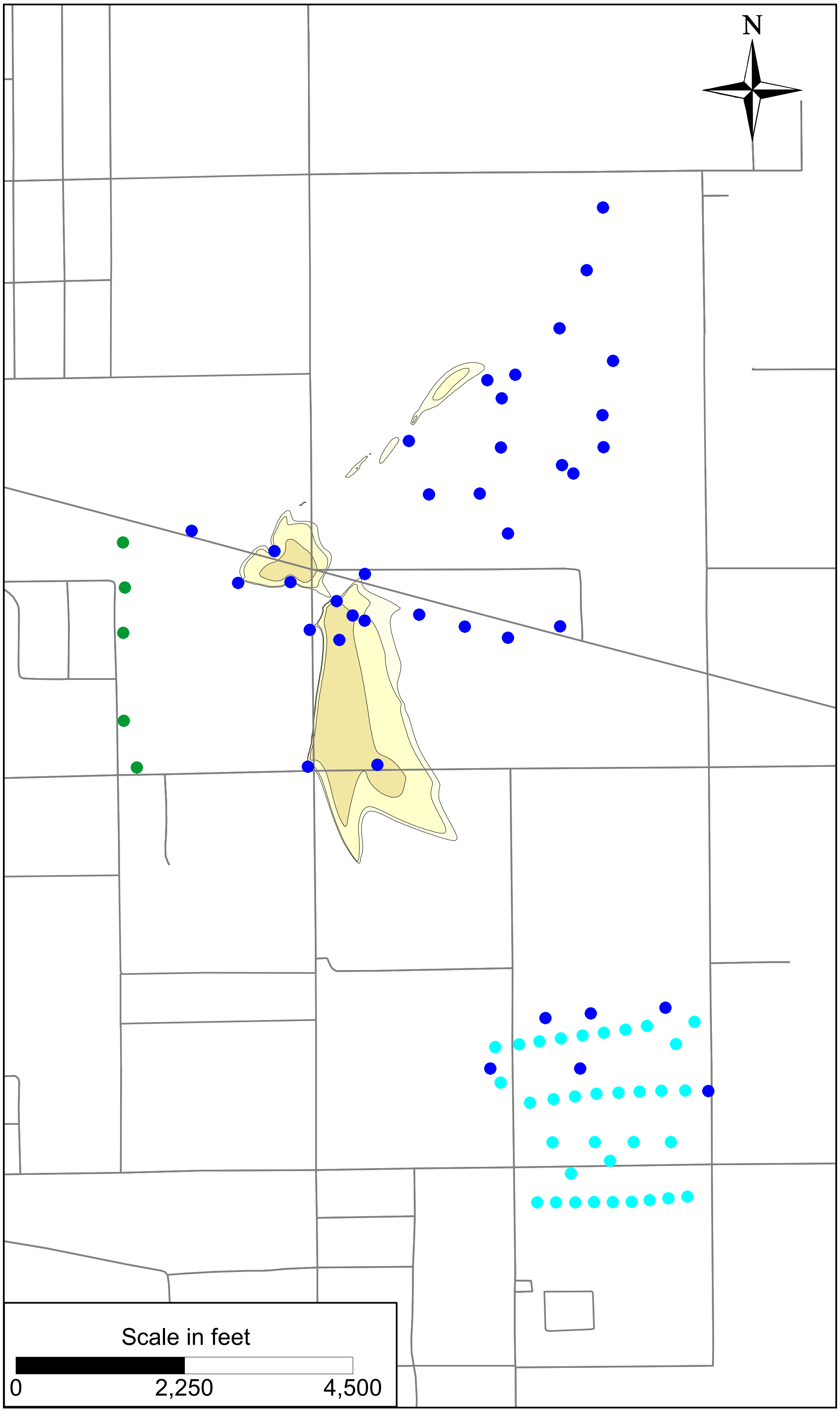
PG&E
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

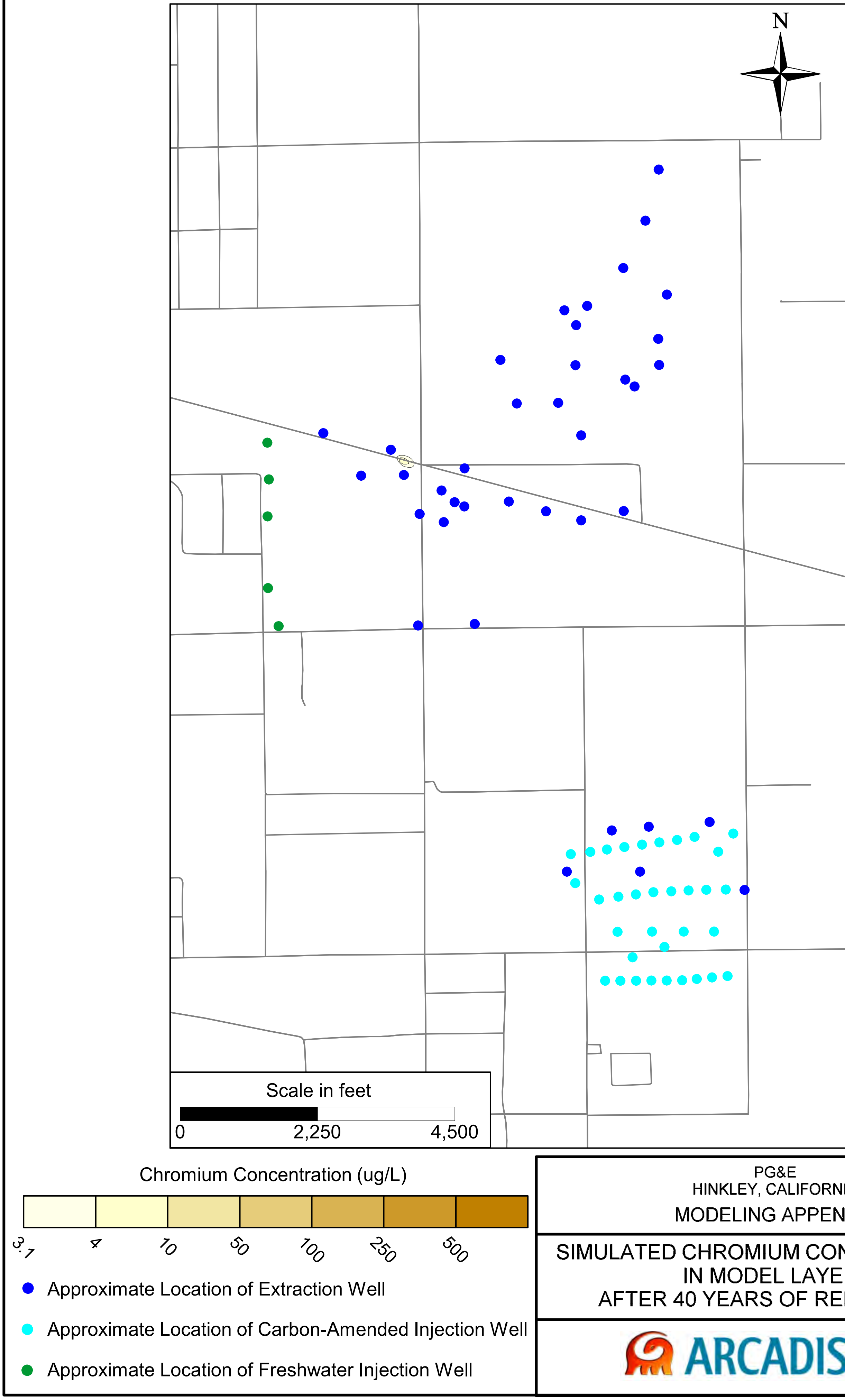
PG&E
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-1
1Q11



PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3 AFTER 40 YEARS OF REMEDIATION

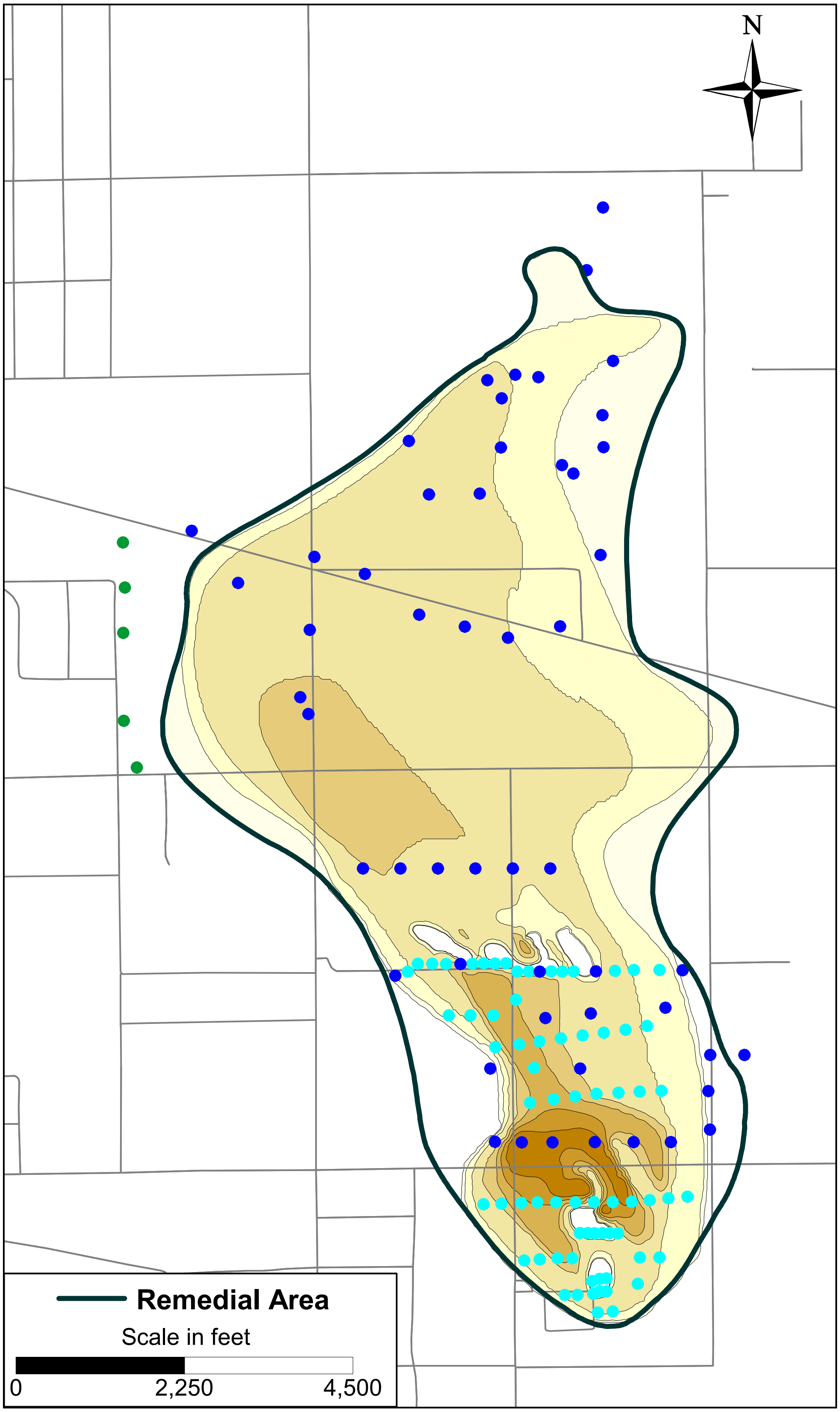
ARCADIS

ALTERNATIVE
4C-1
1Q11

ARCADIS

Attachment C-2

Solute Transport Results for
Alternative 4C-2



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

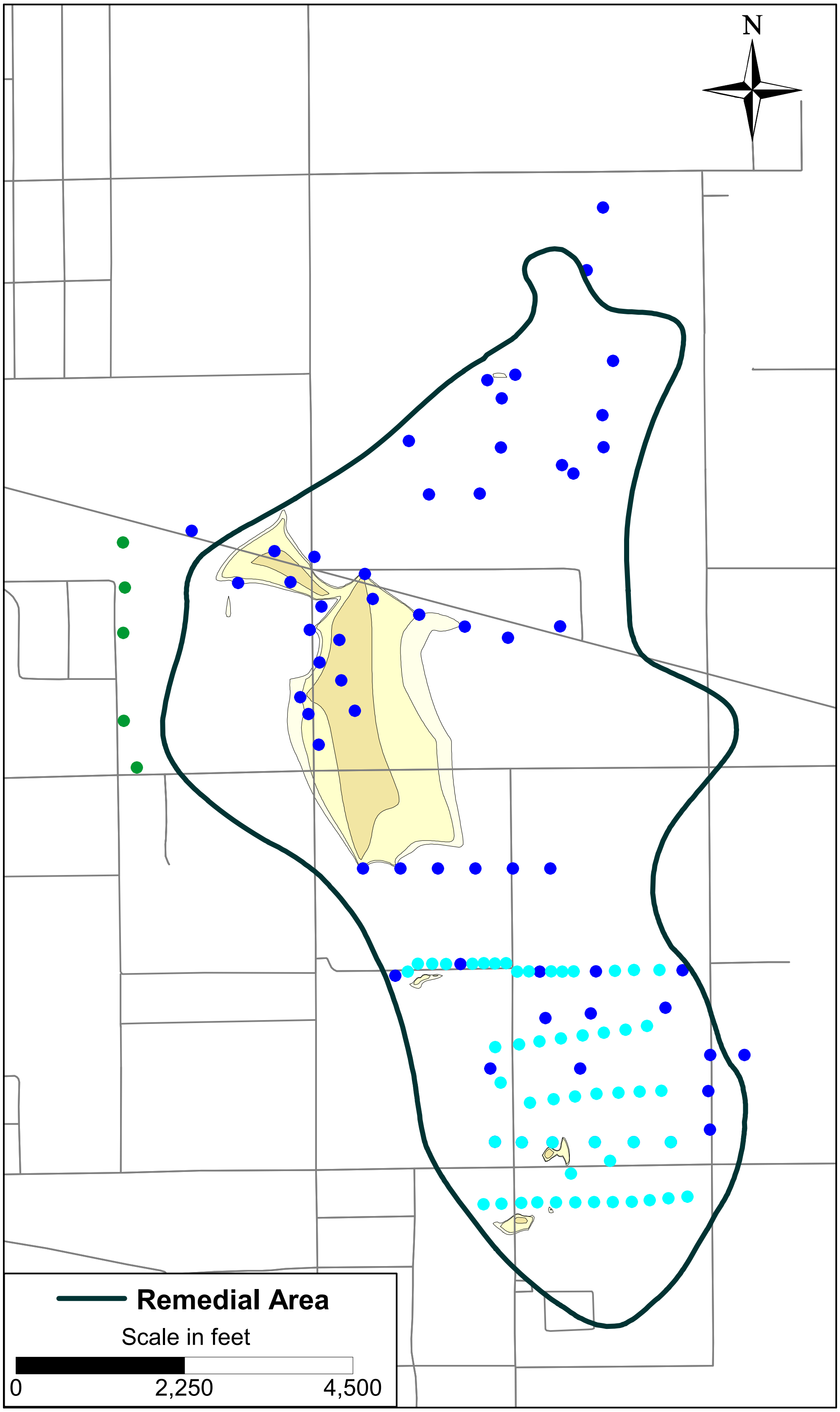
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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HINKLEY, CALIFORNIA

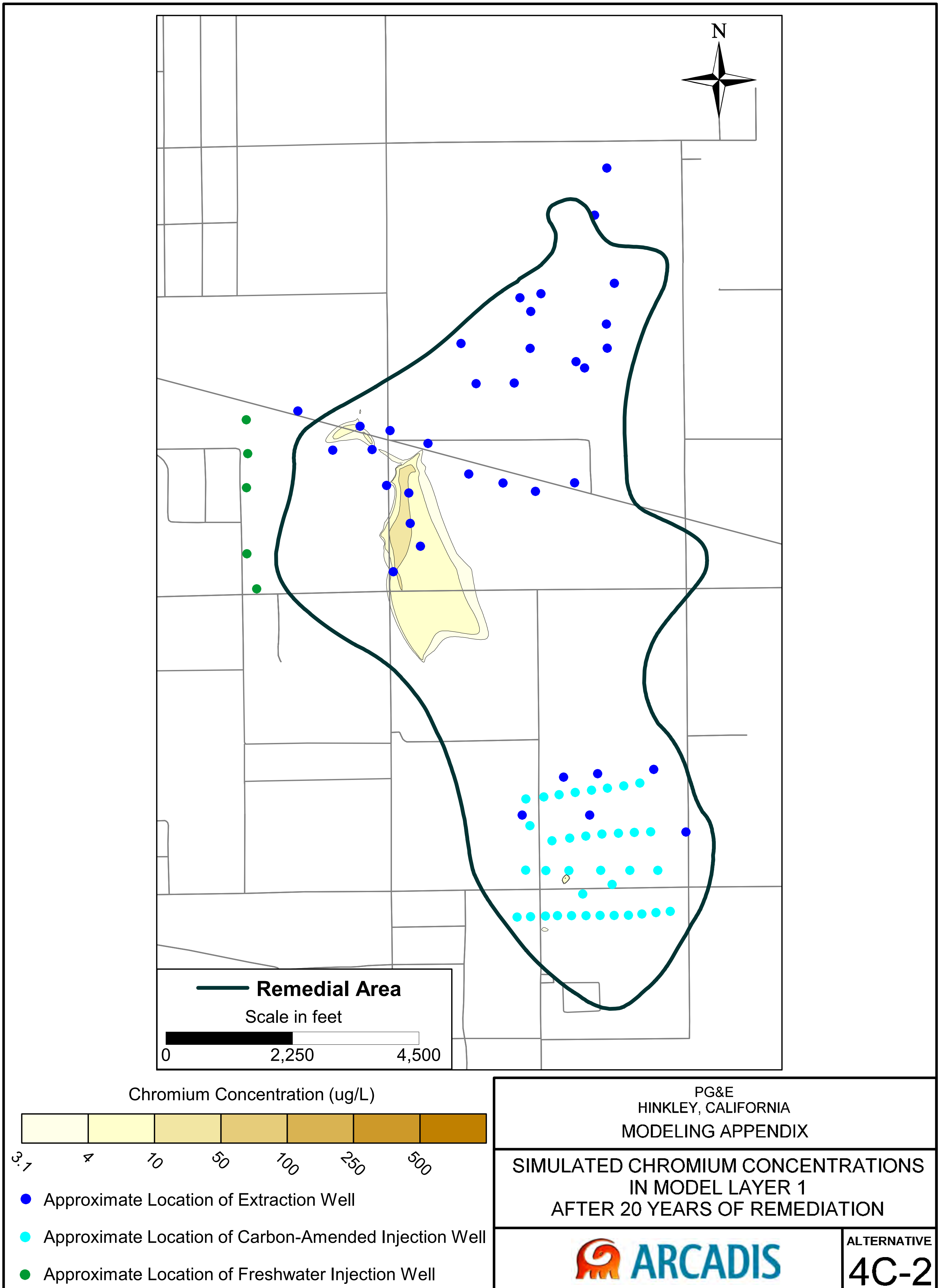
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE

4C-2

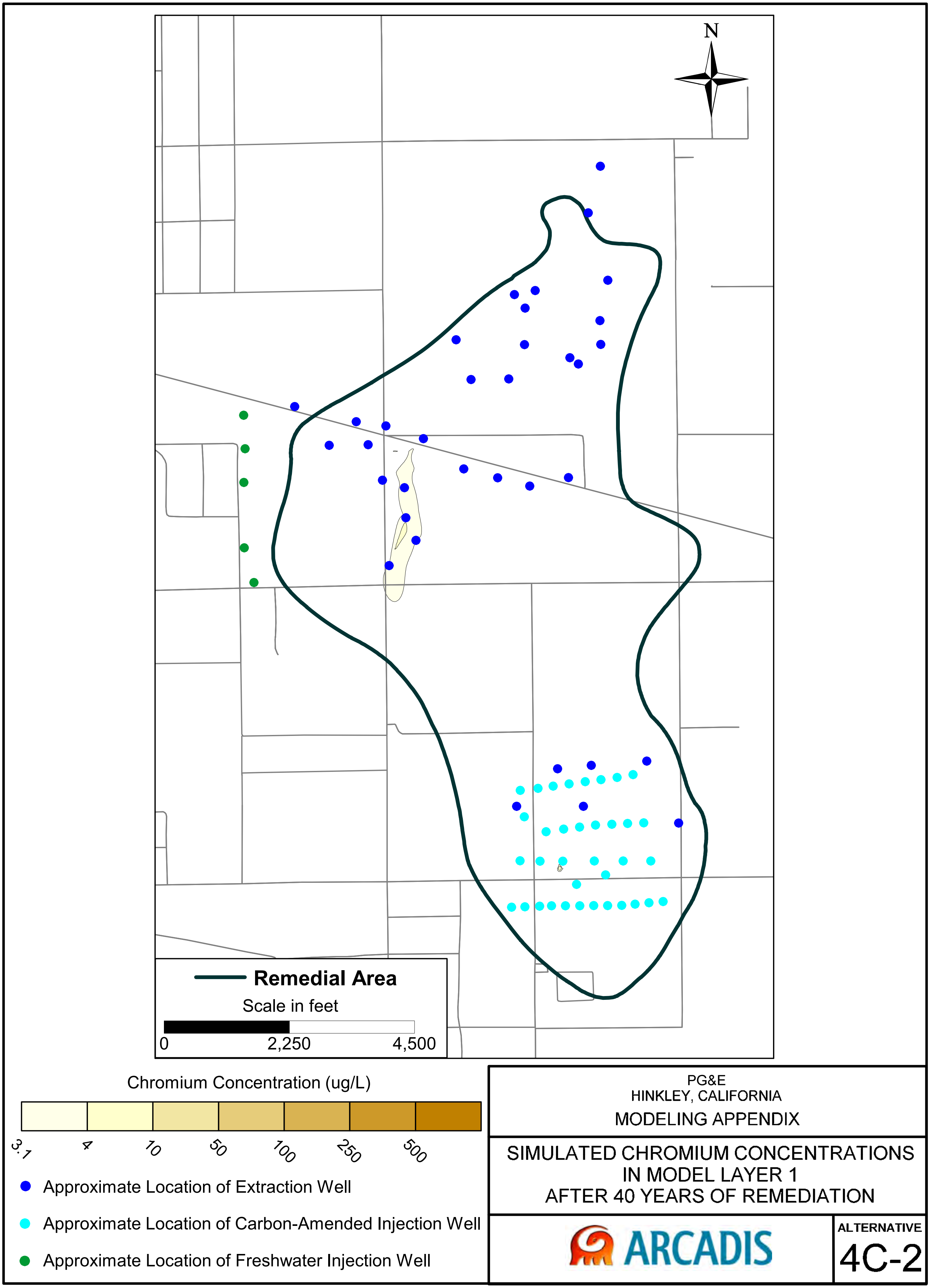


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1 AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2

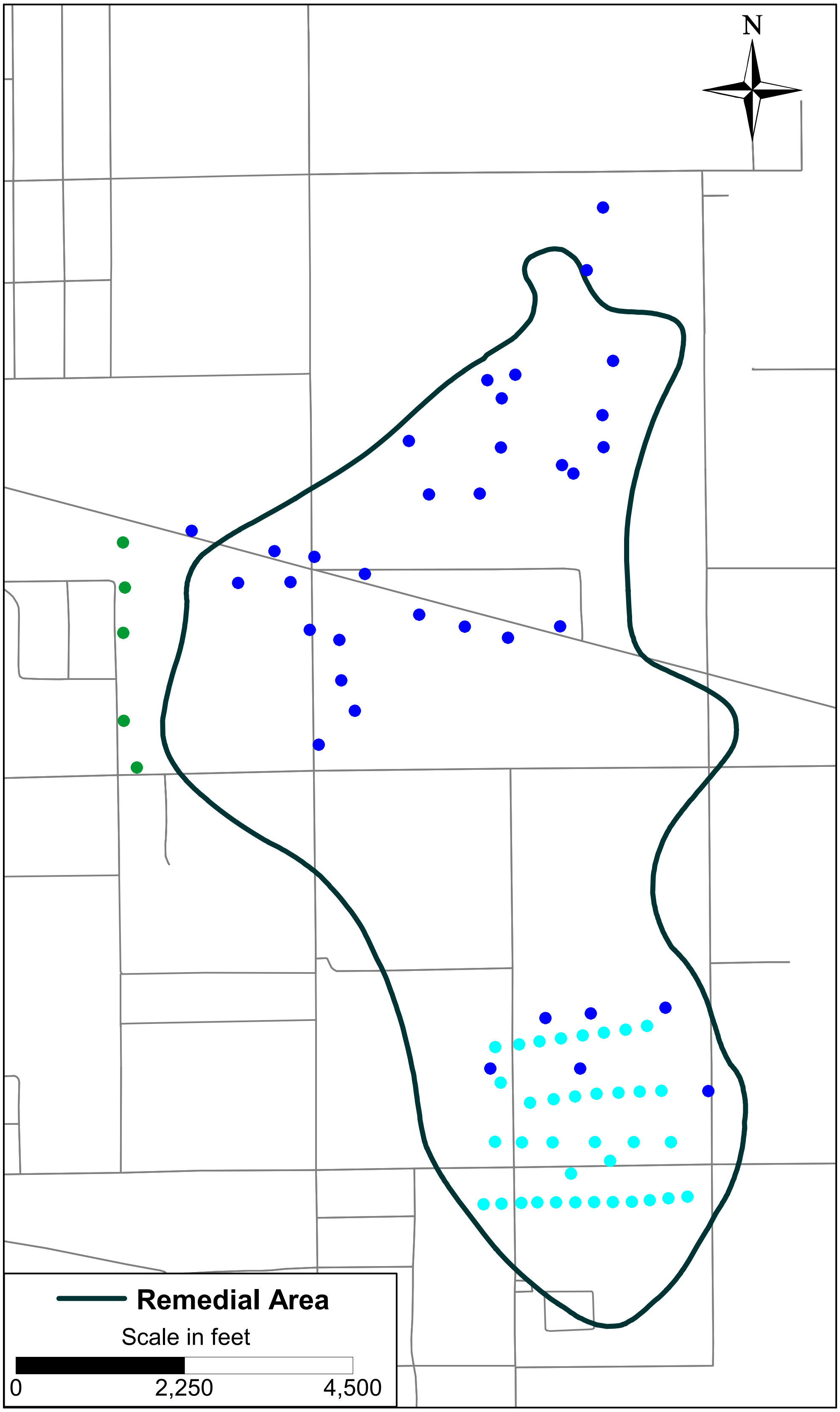


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

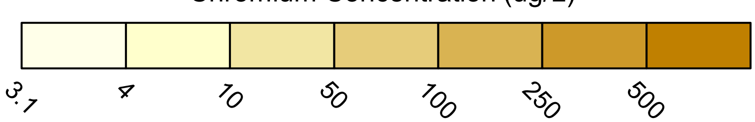
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)



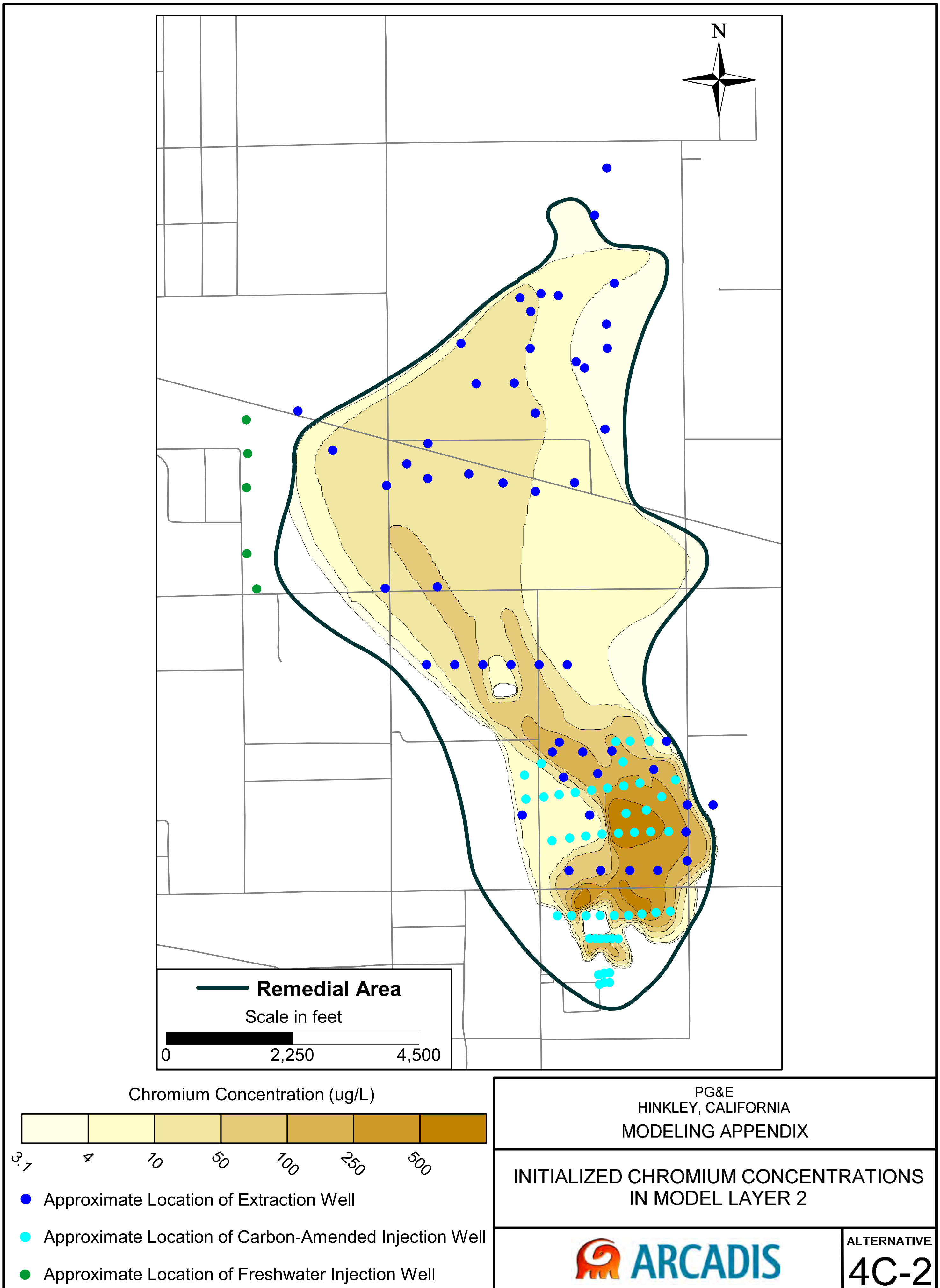
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2

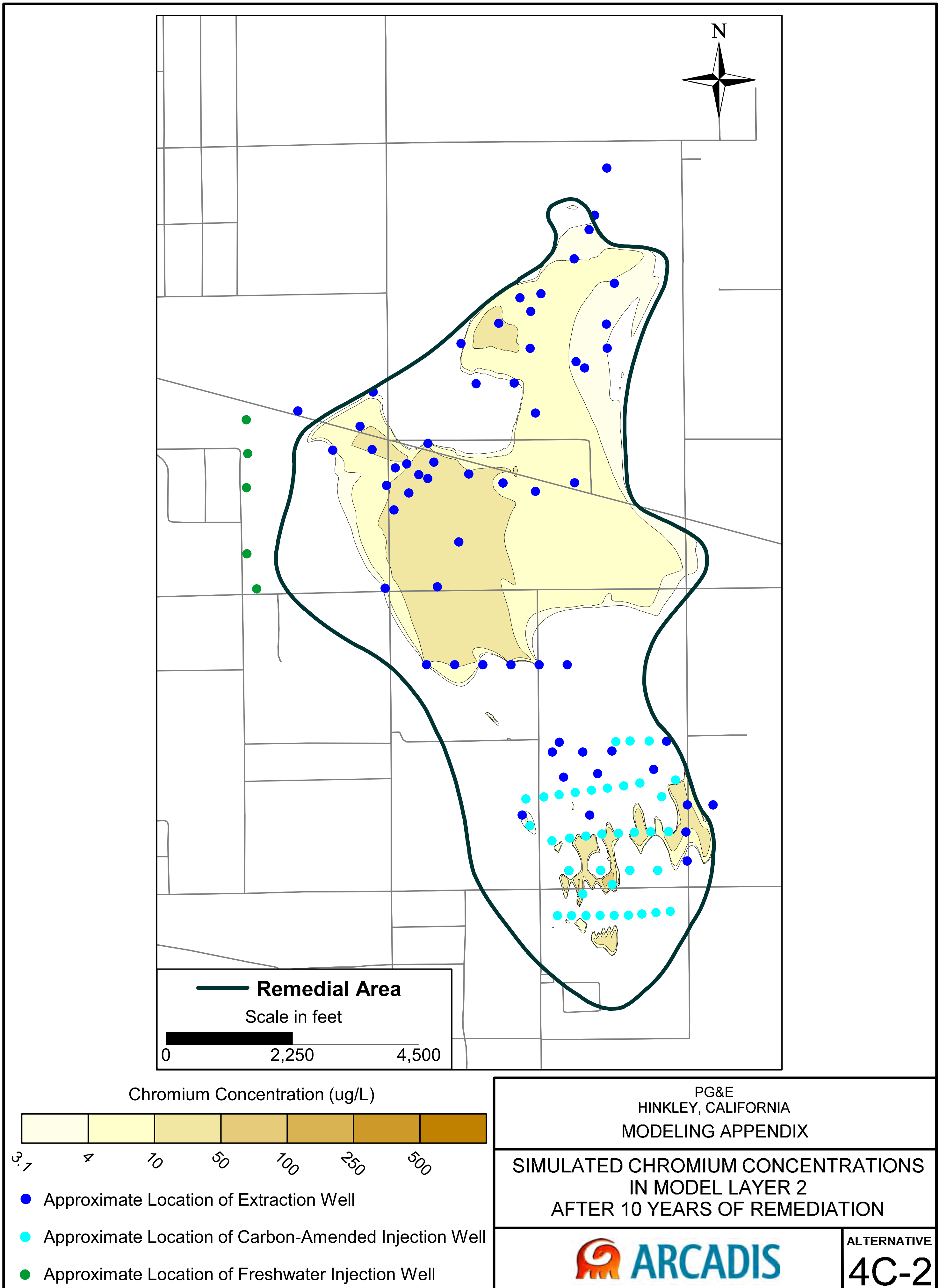


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-2

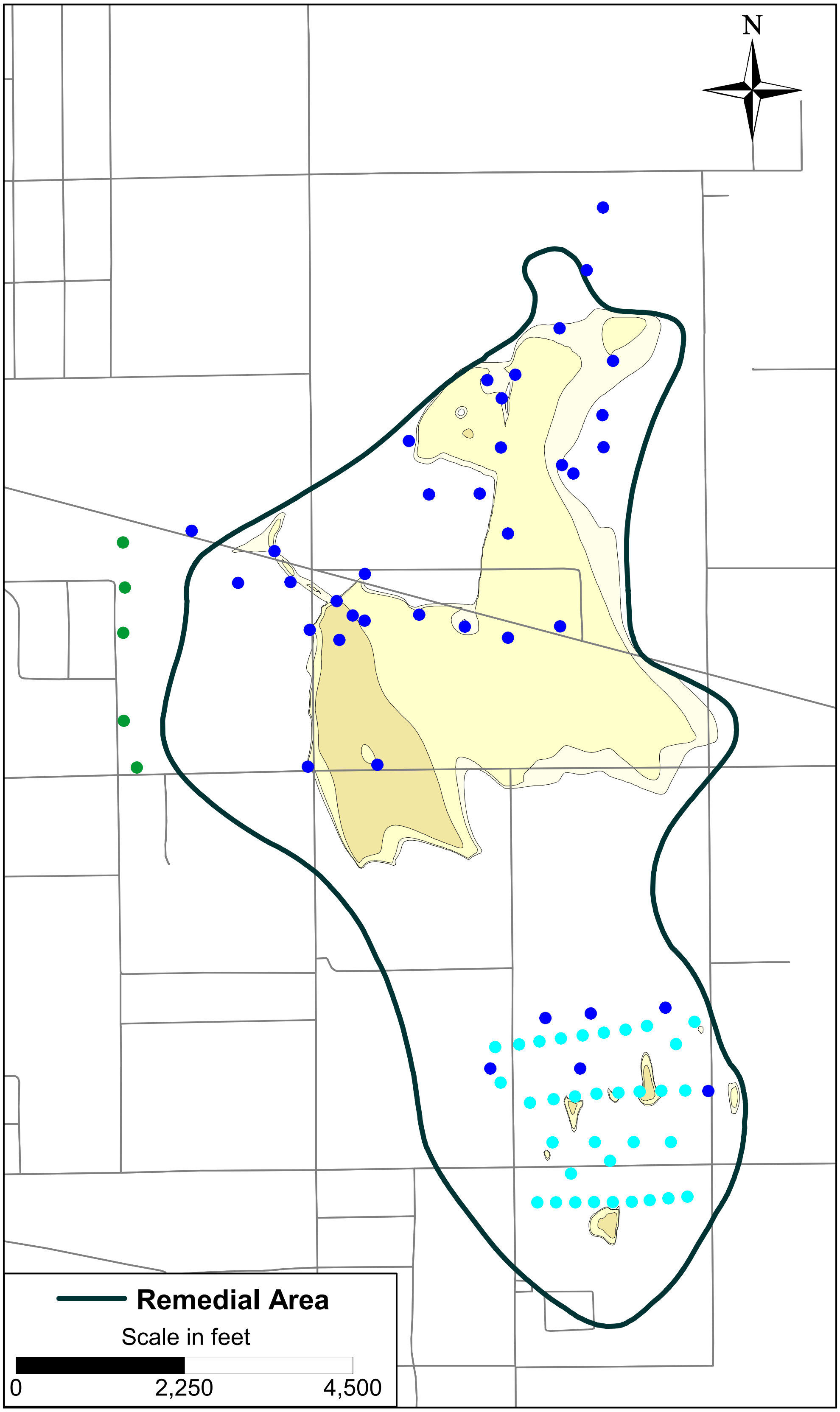


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

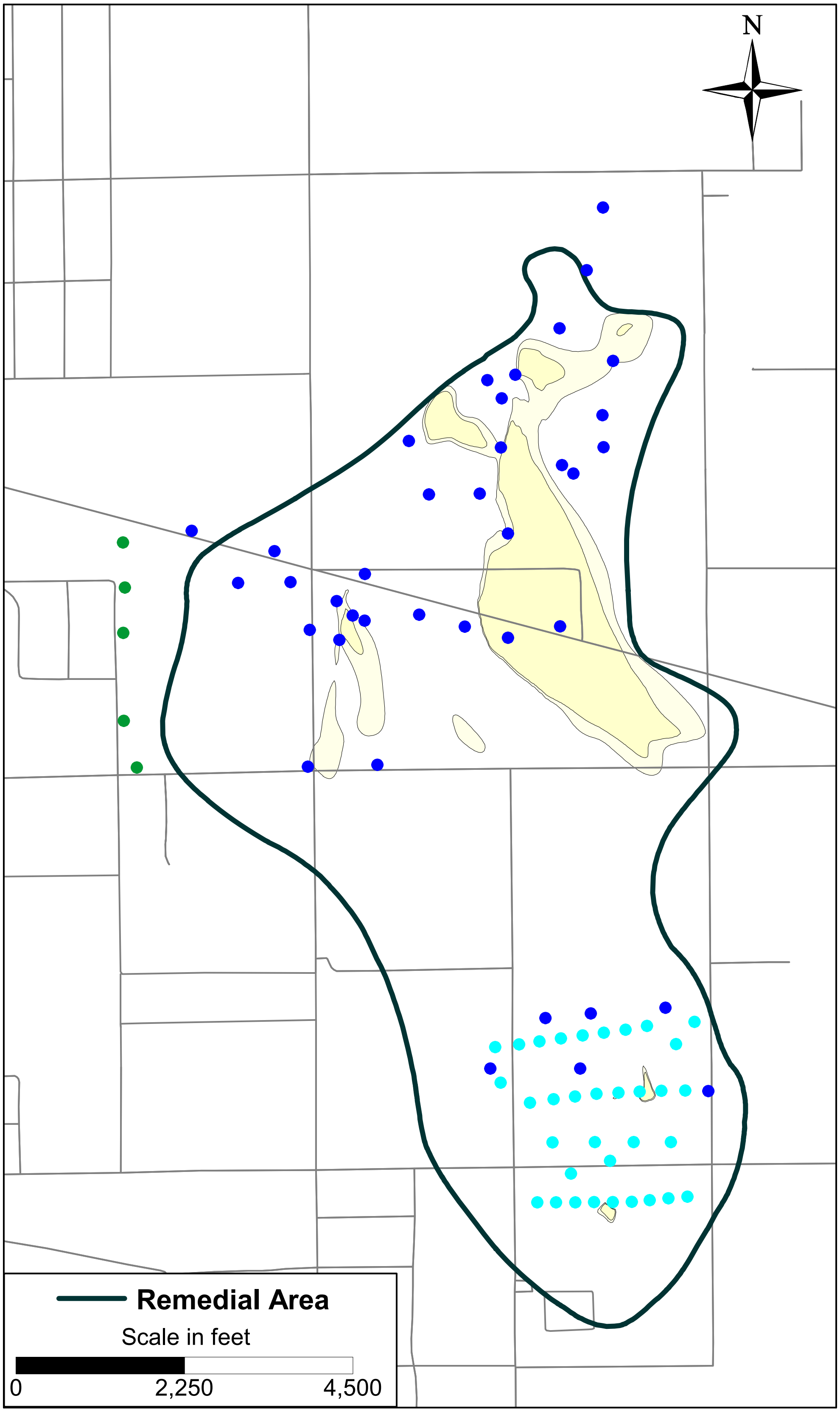
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

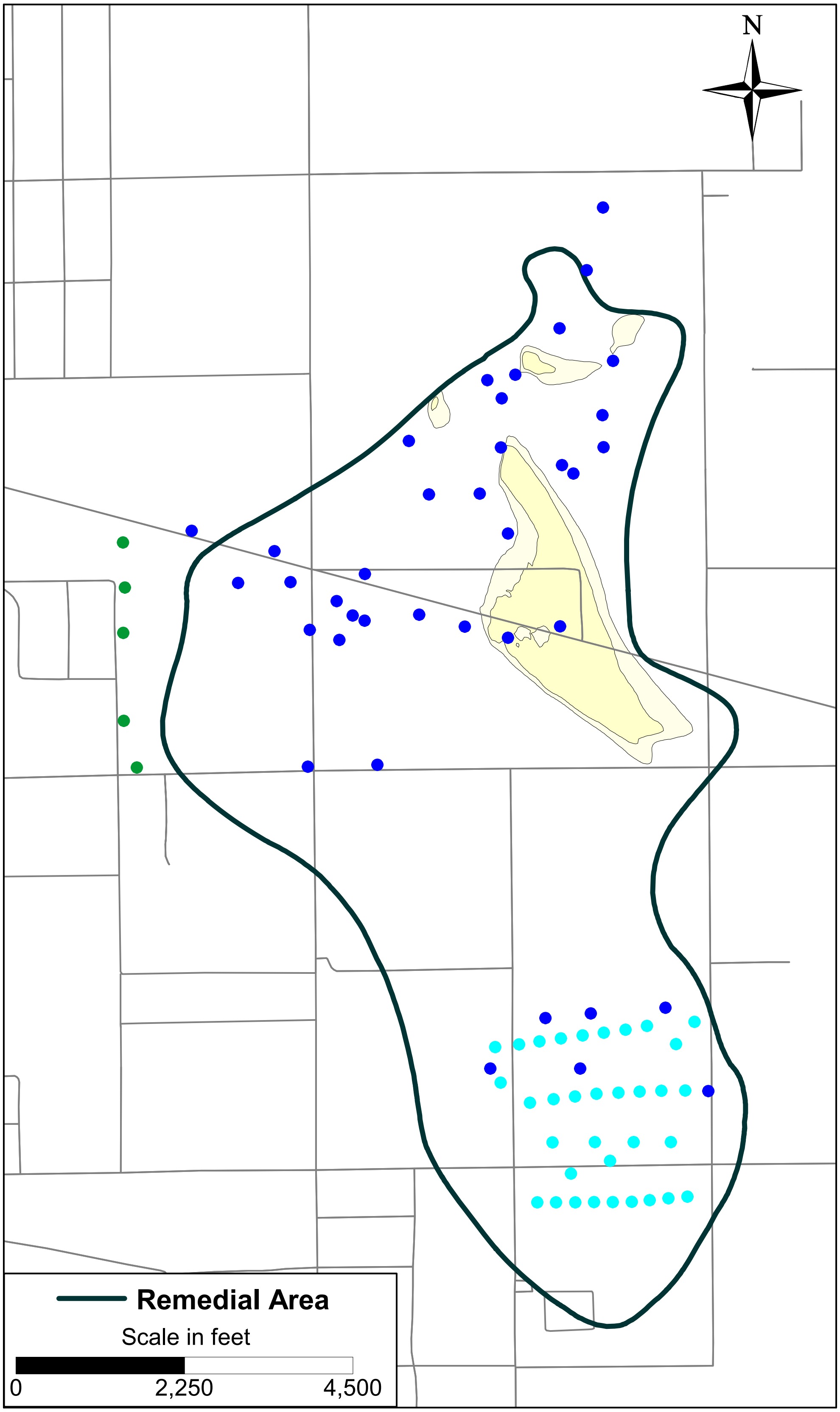
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

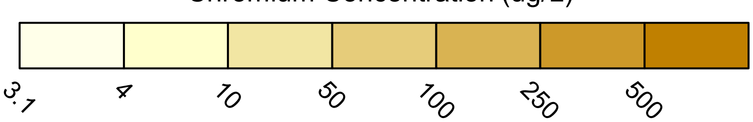
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)



● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

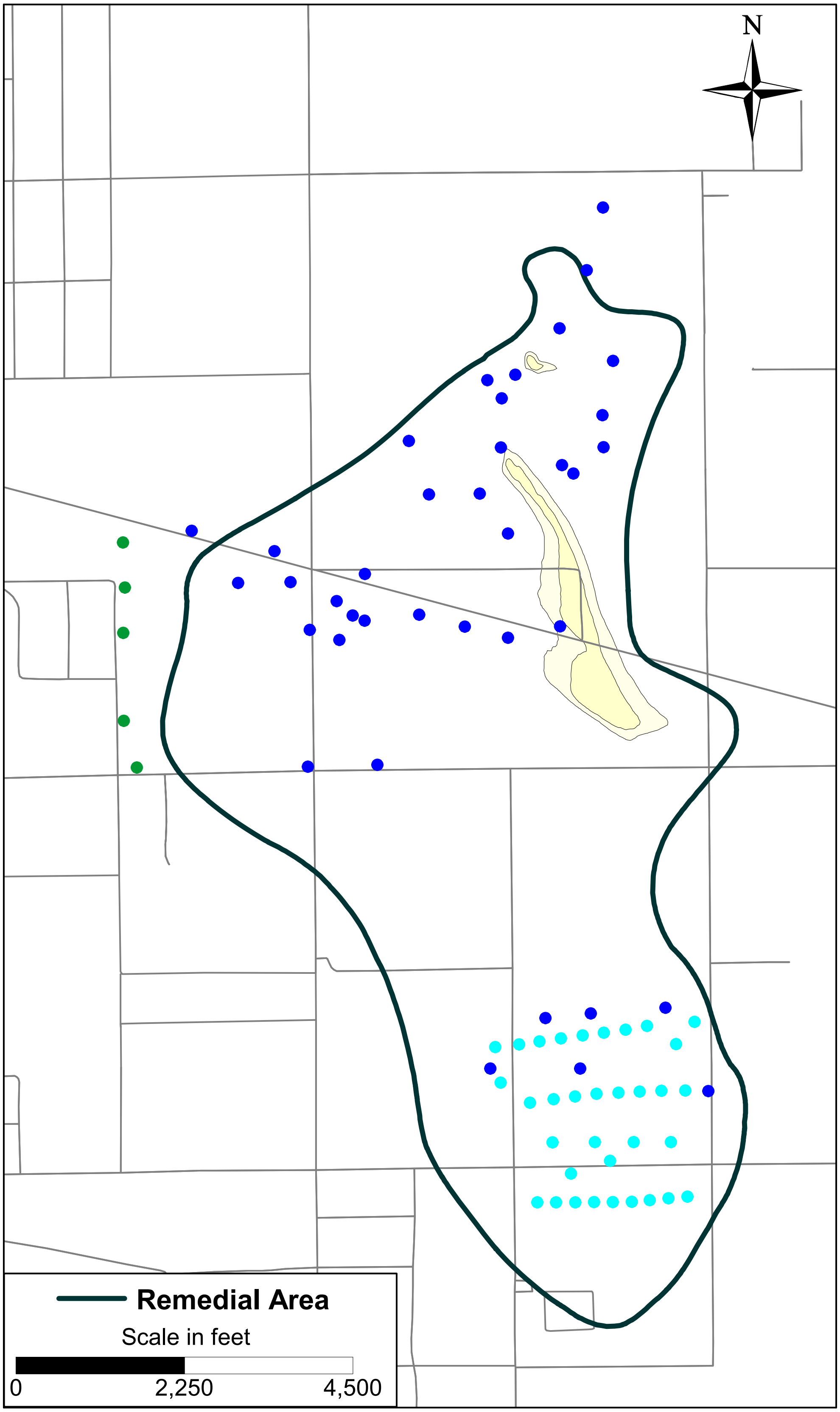
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

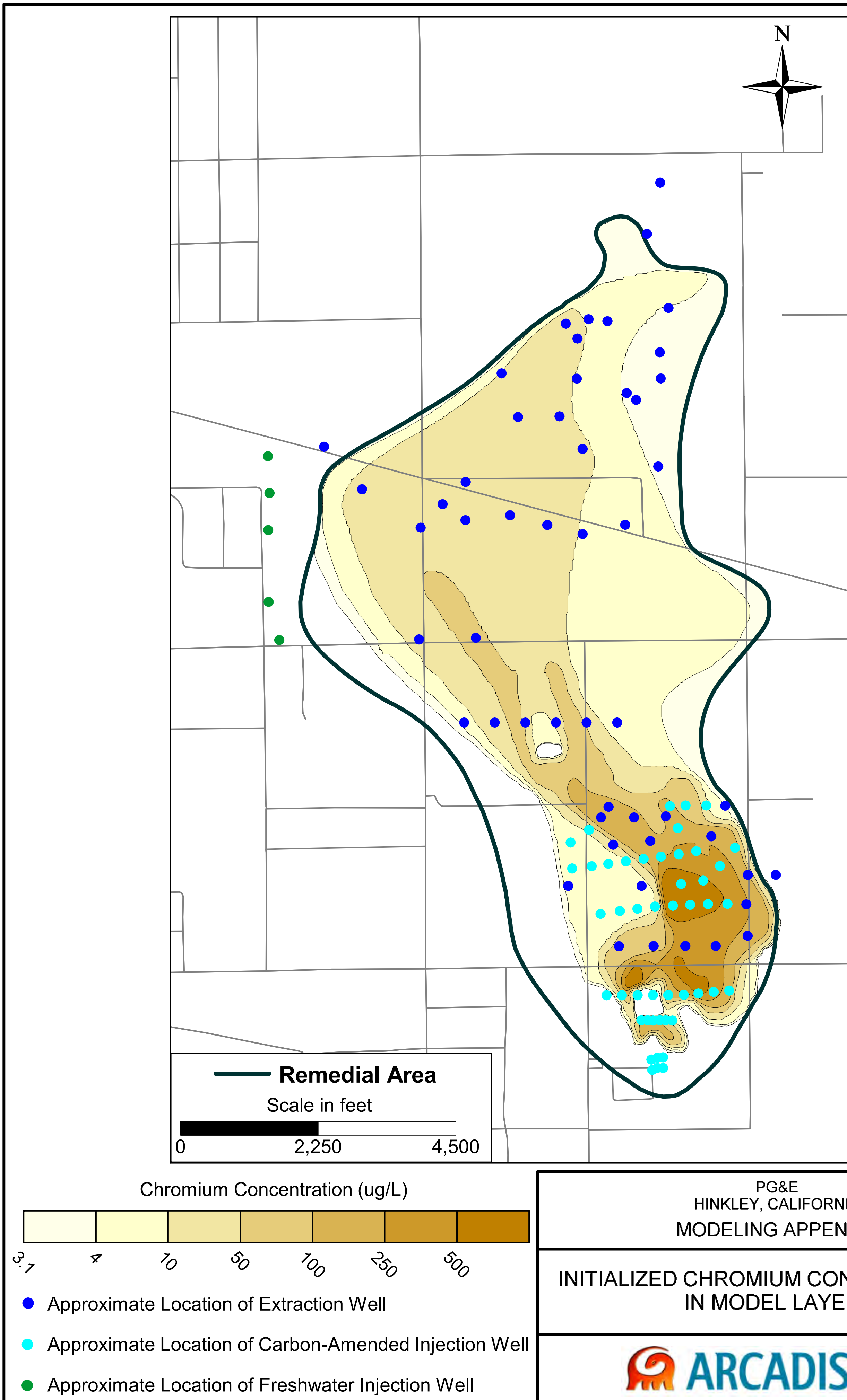
PG&E
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2

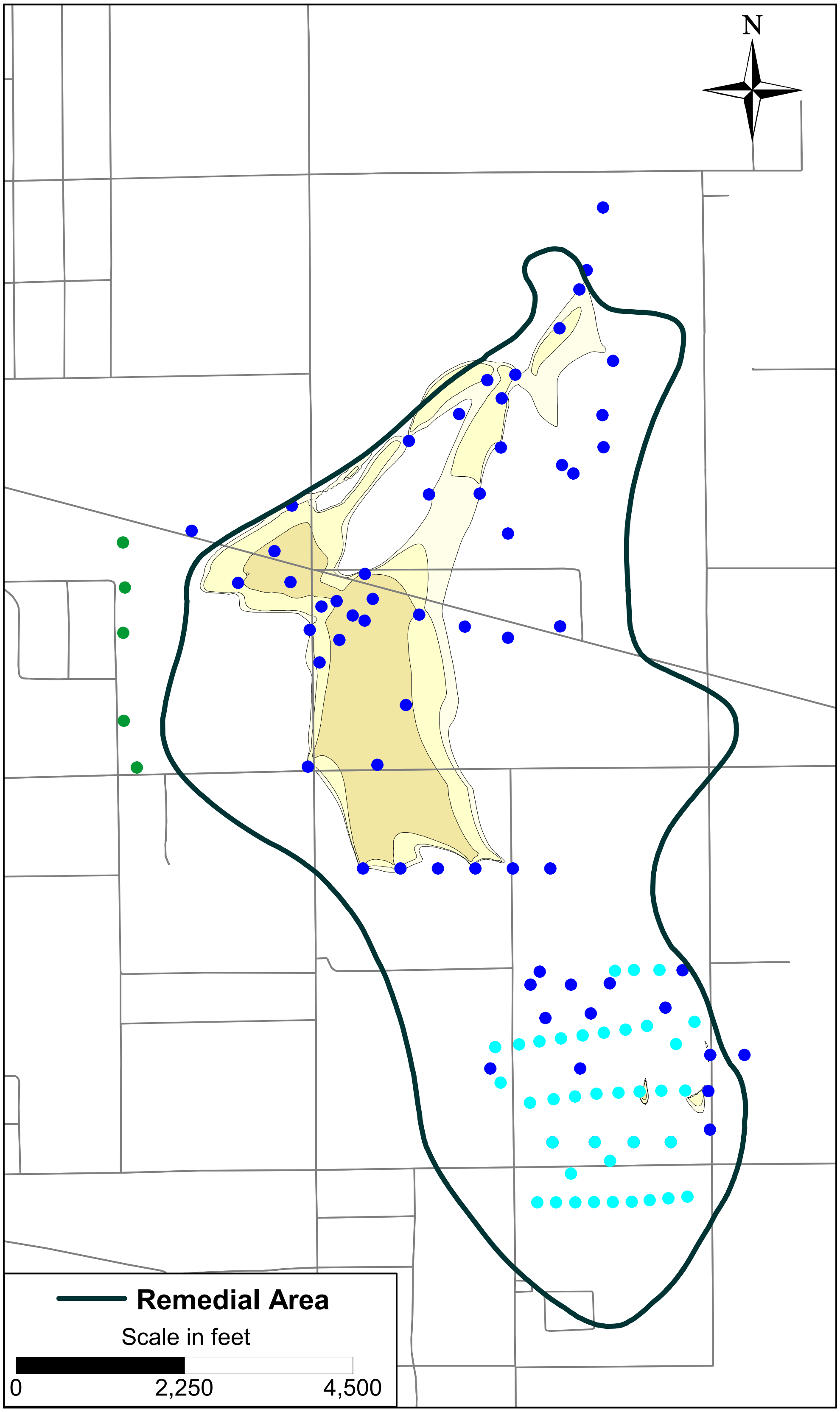


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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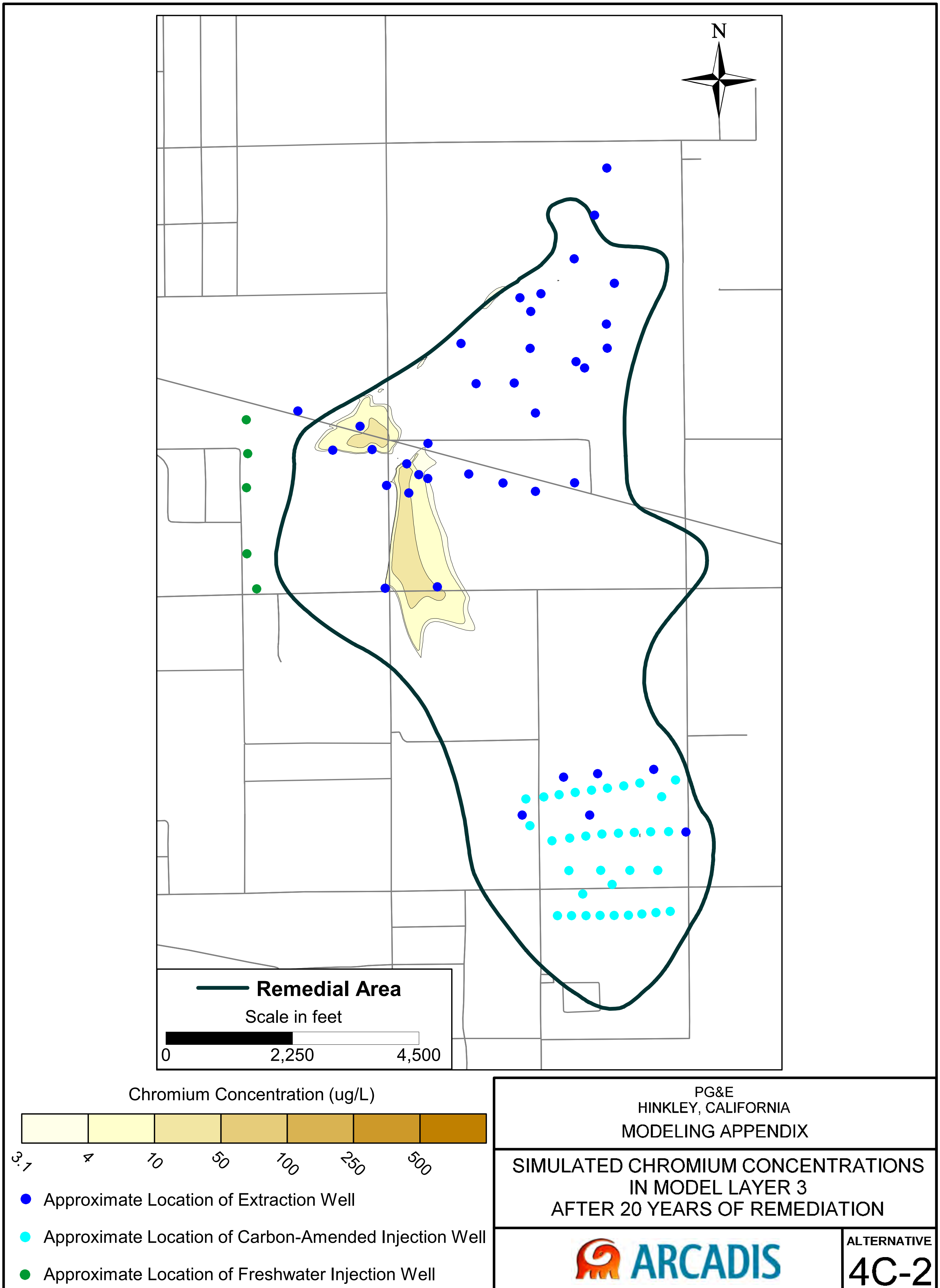
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2

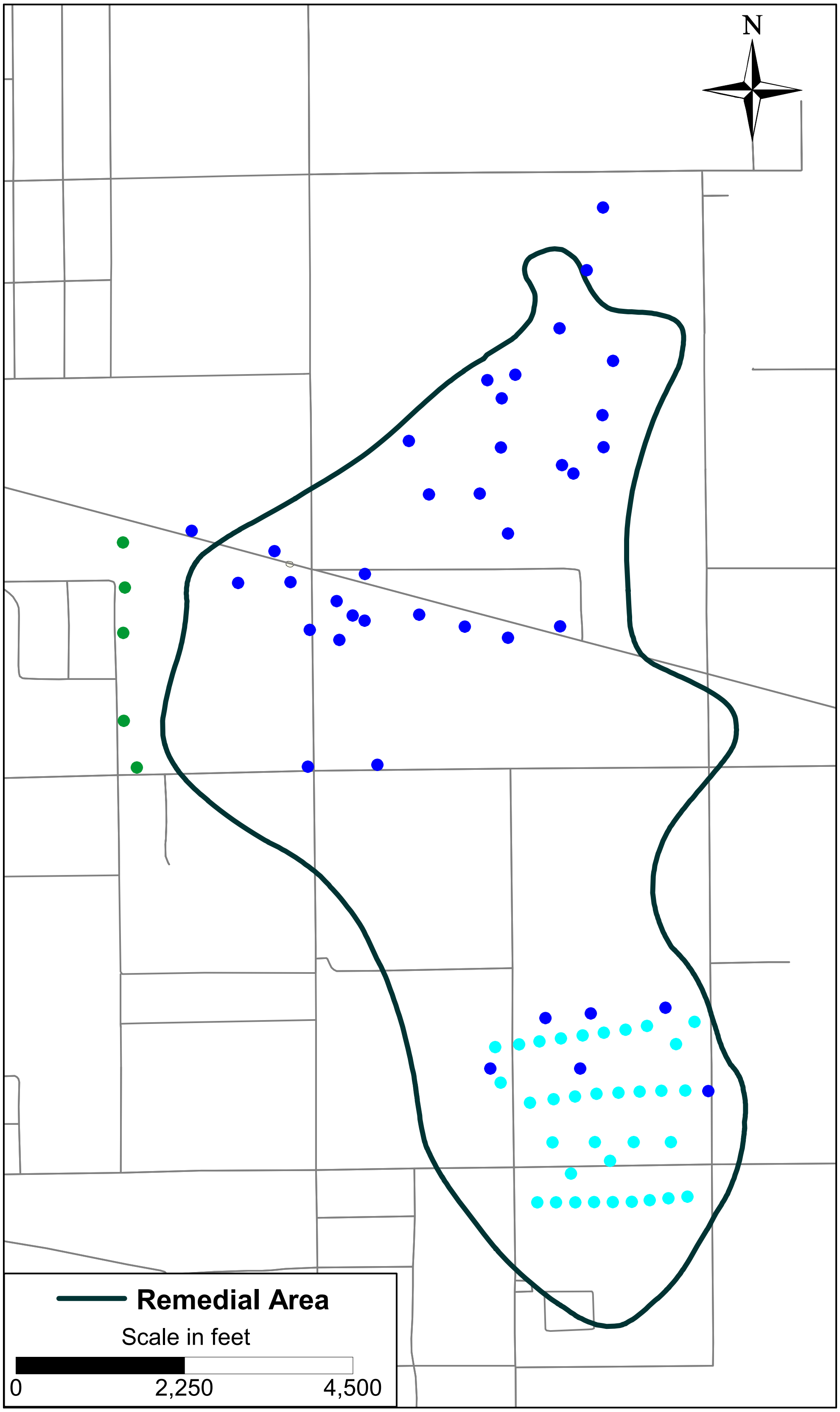


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

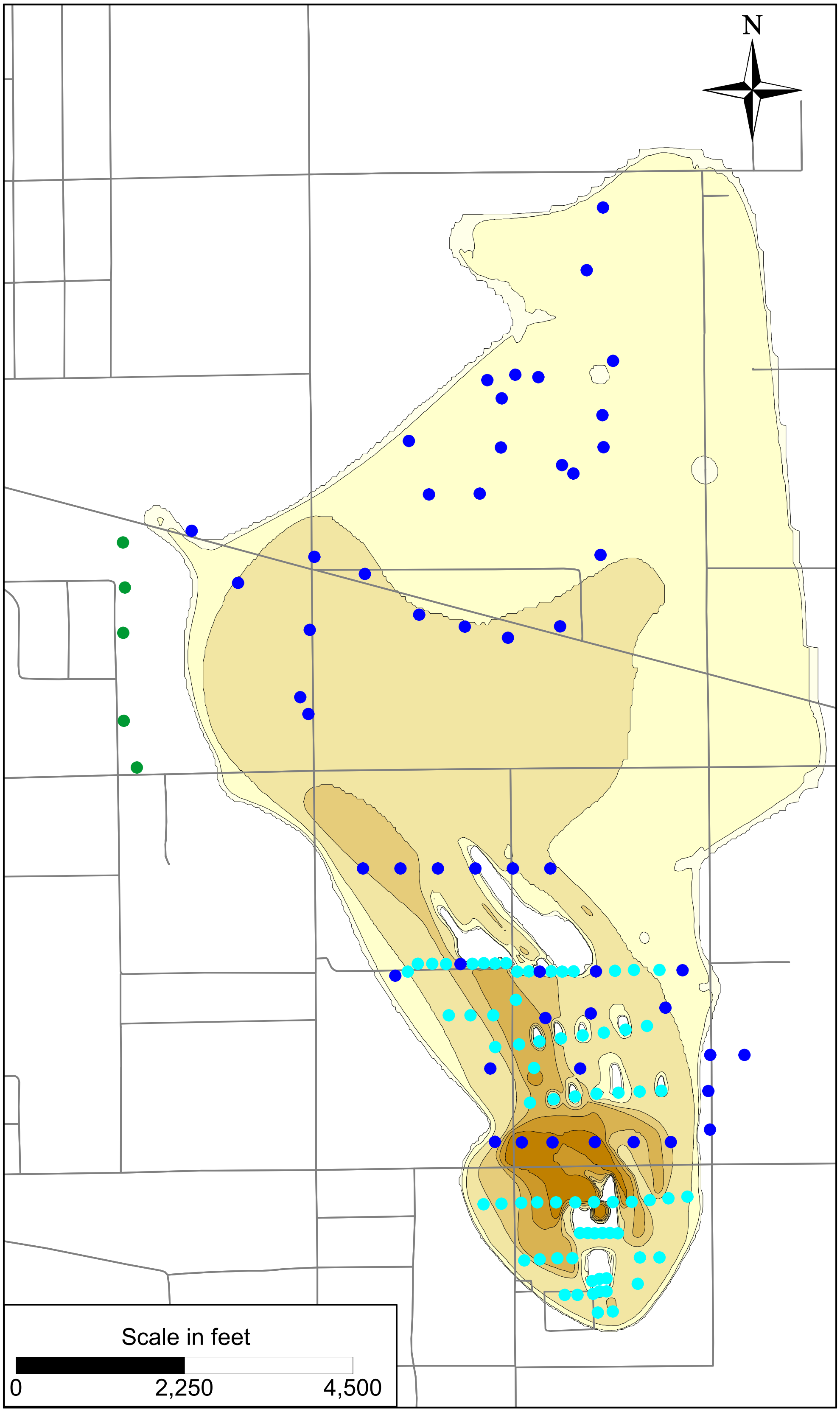
ARCADIS

ALTERNATIVE
4C-2

ARCADIS

Attachment C-2

1Q11 Figures



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

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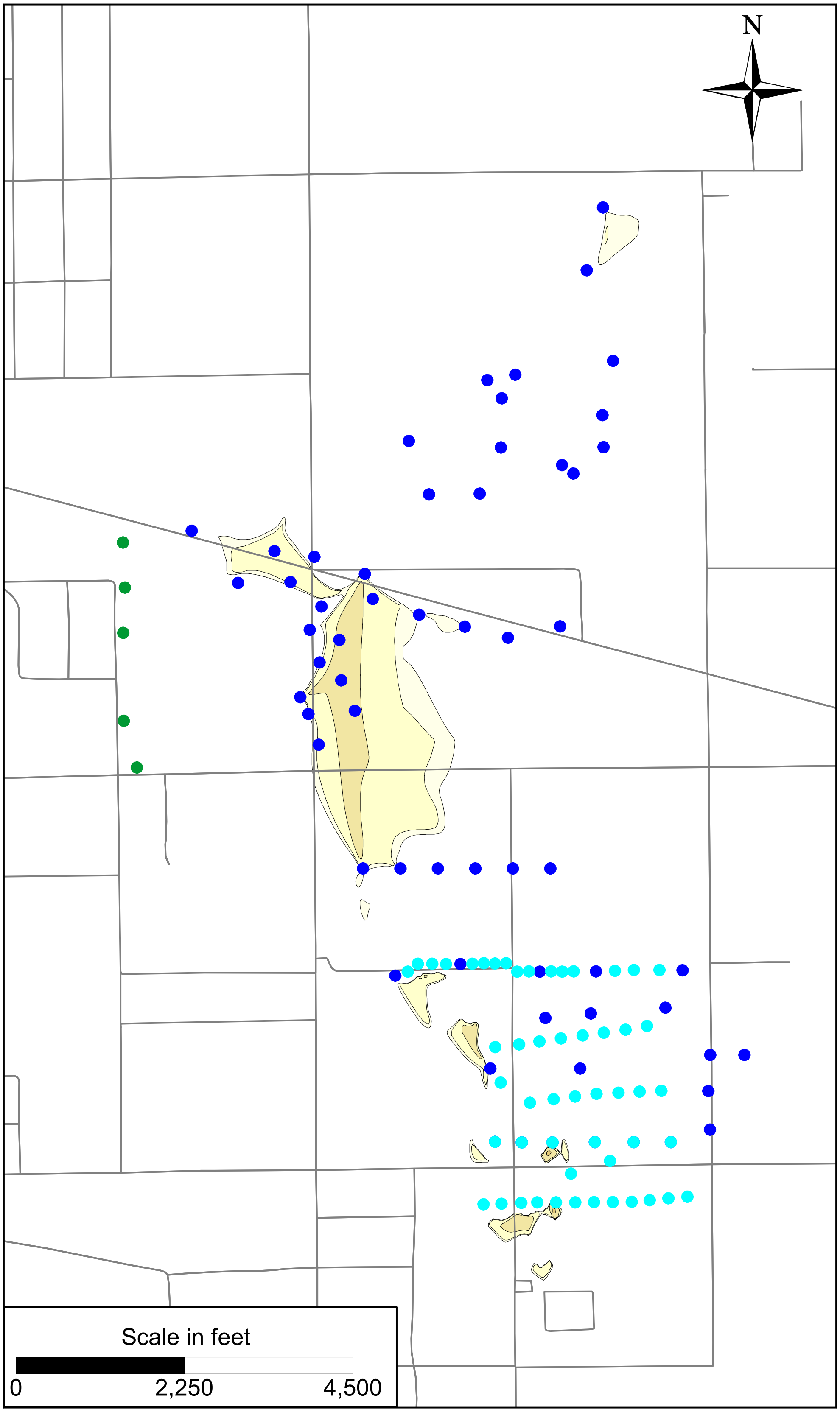
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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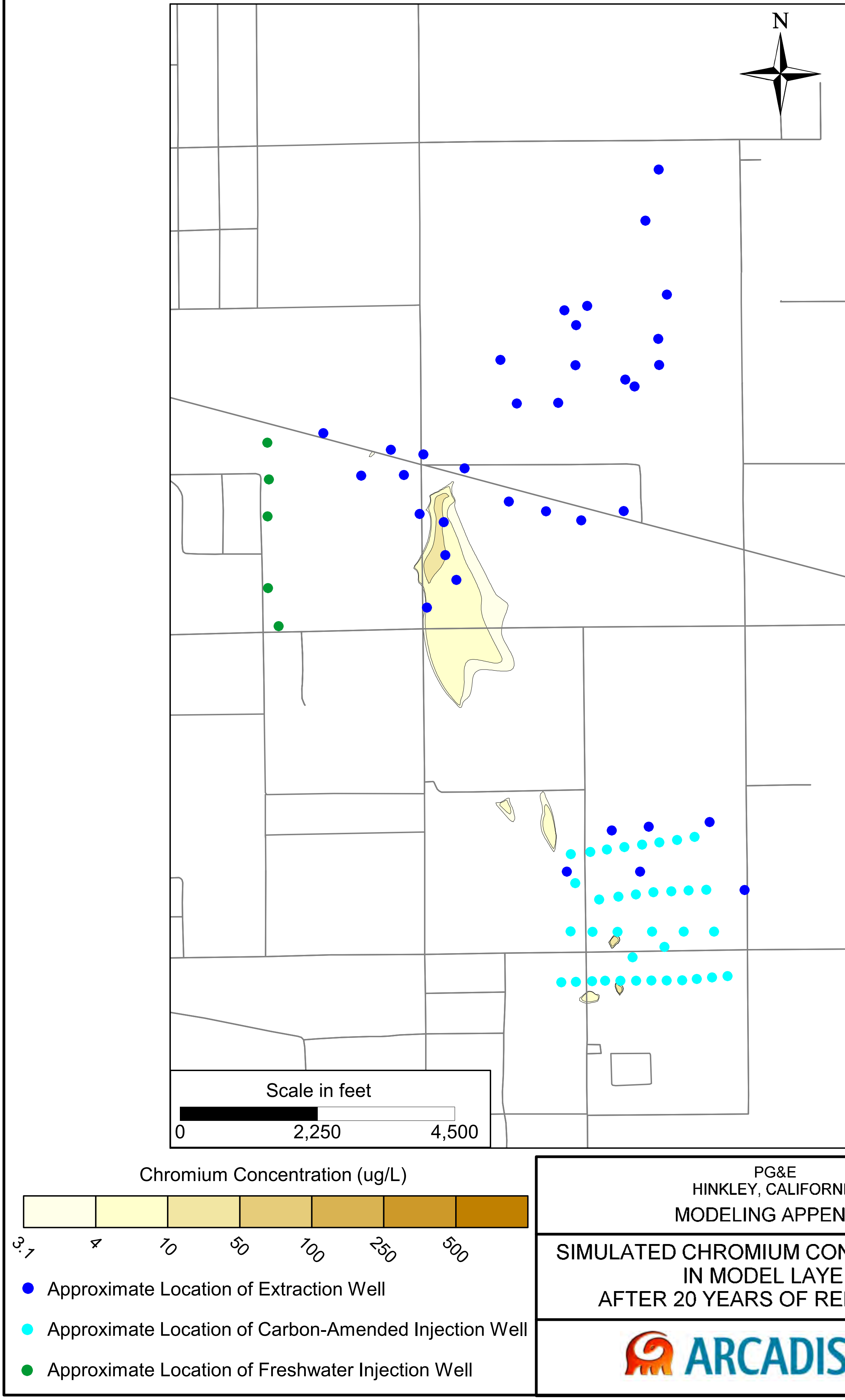
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11

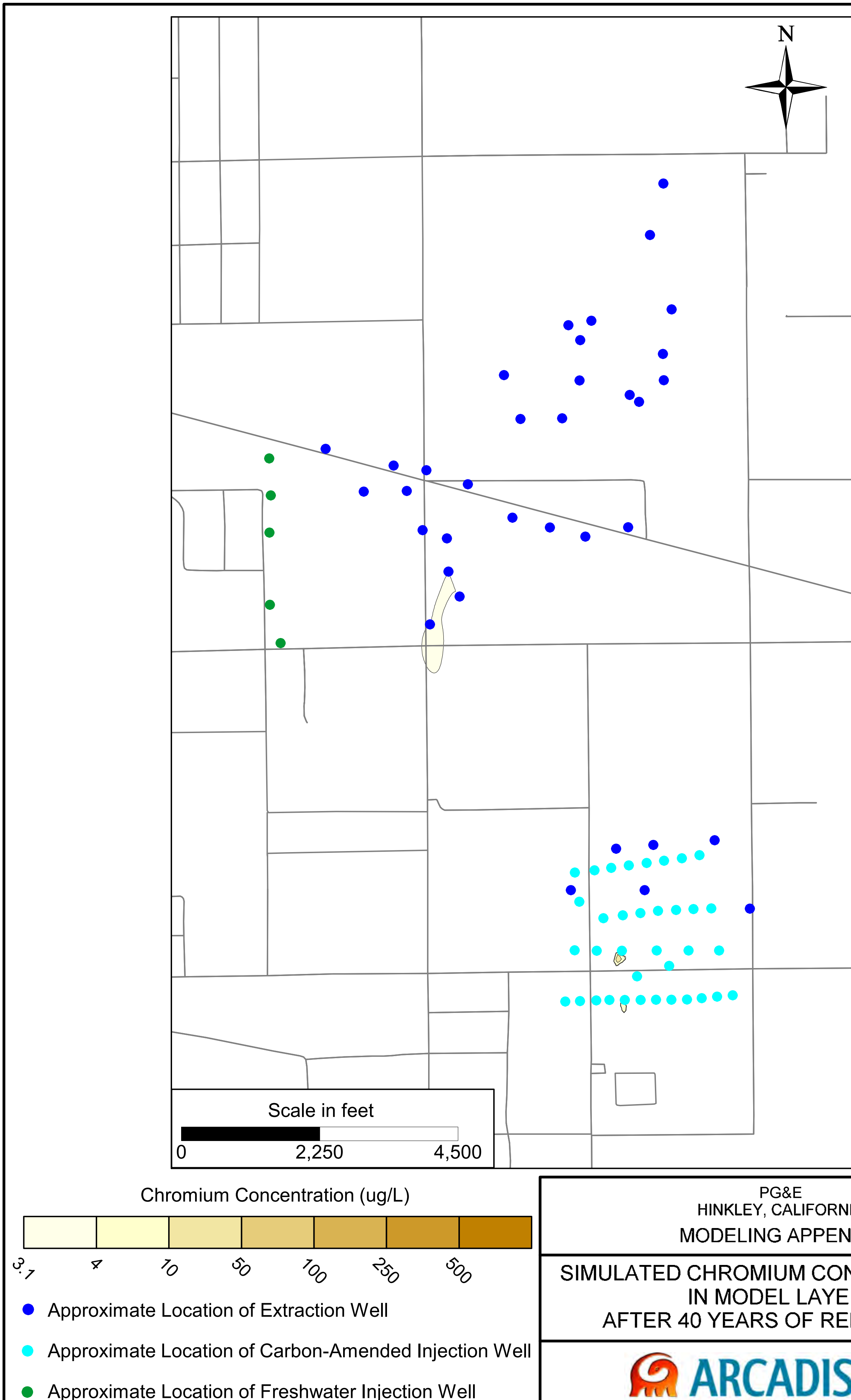


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



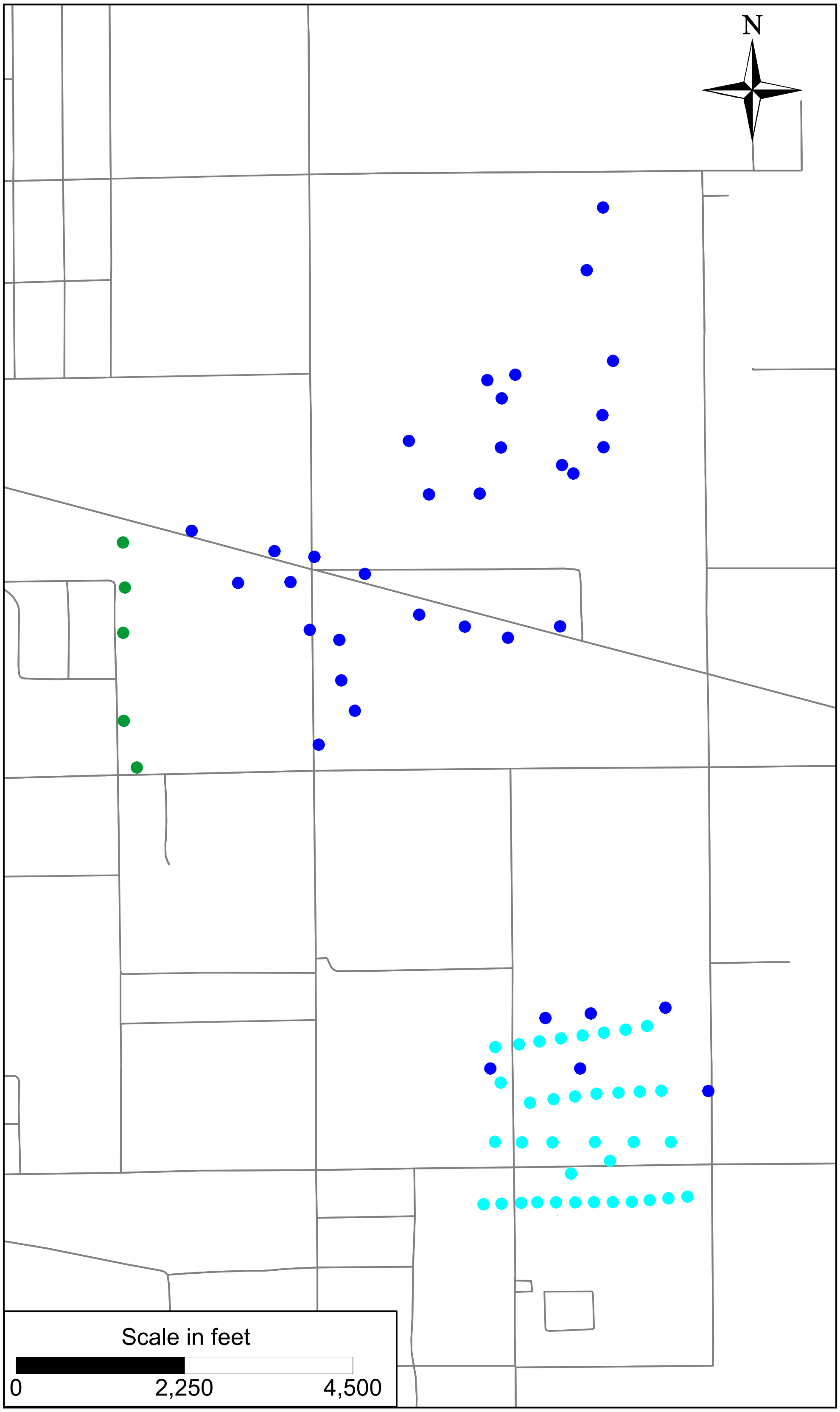
PG&E
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

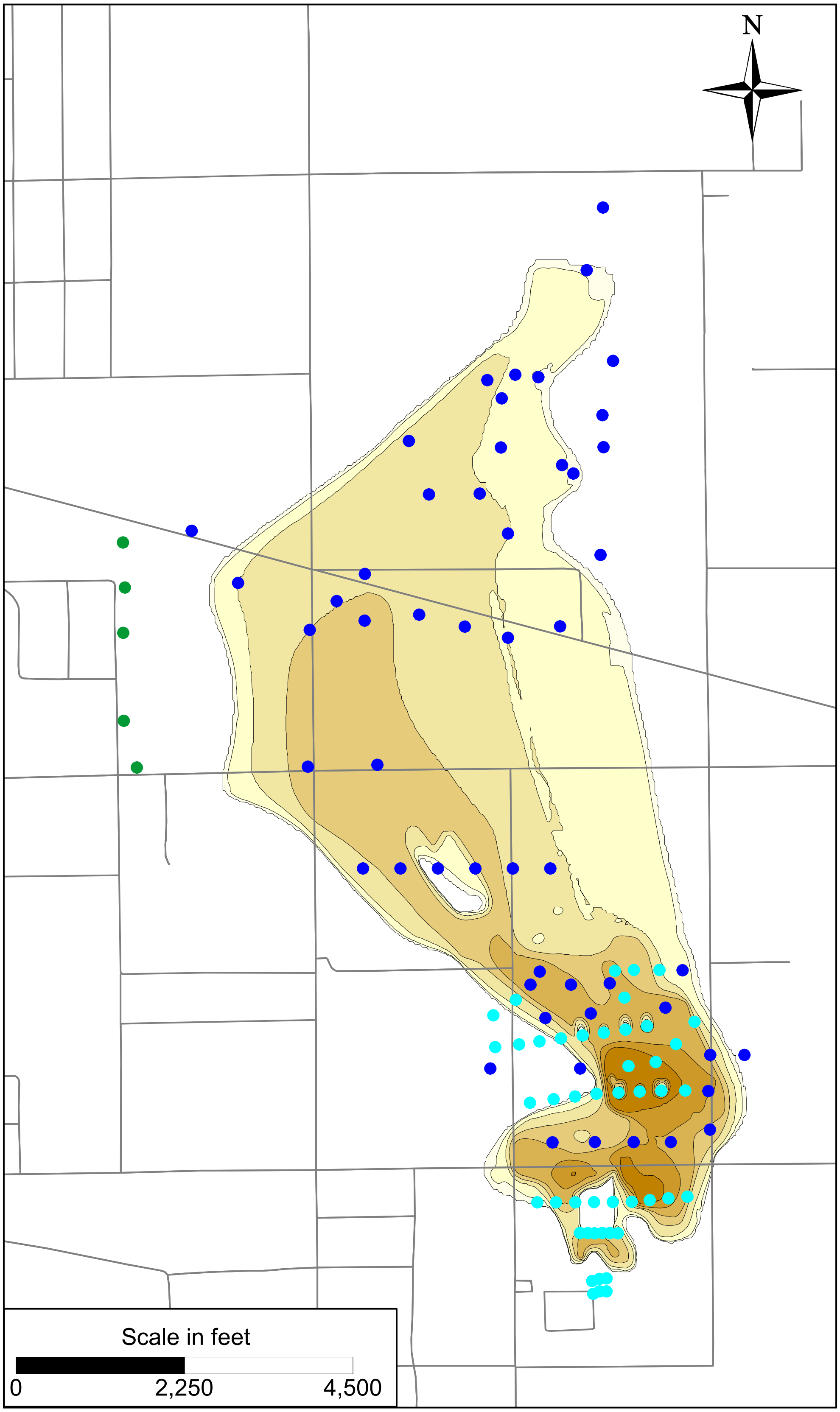
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

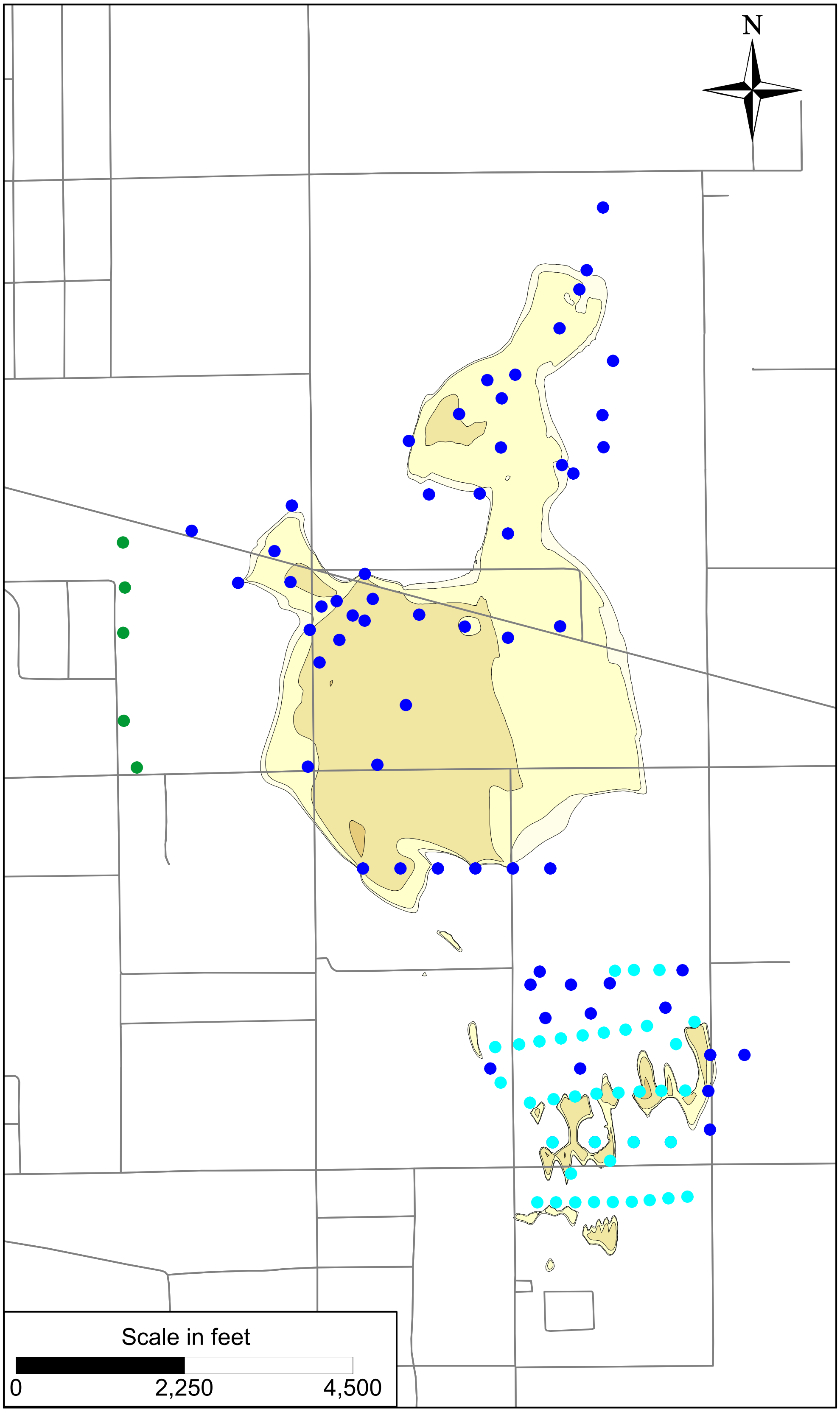
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

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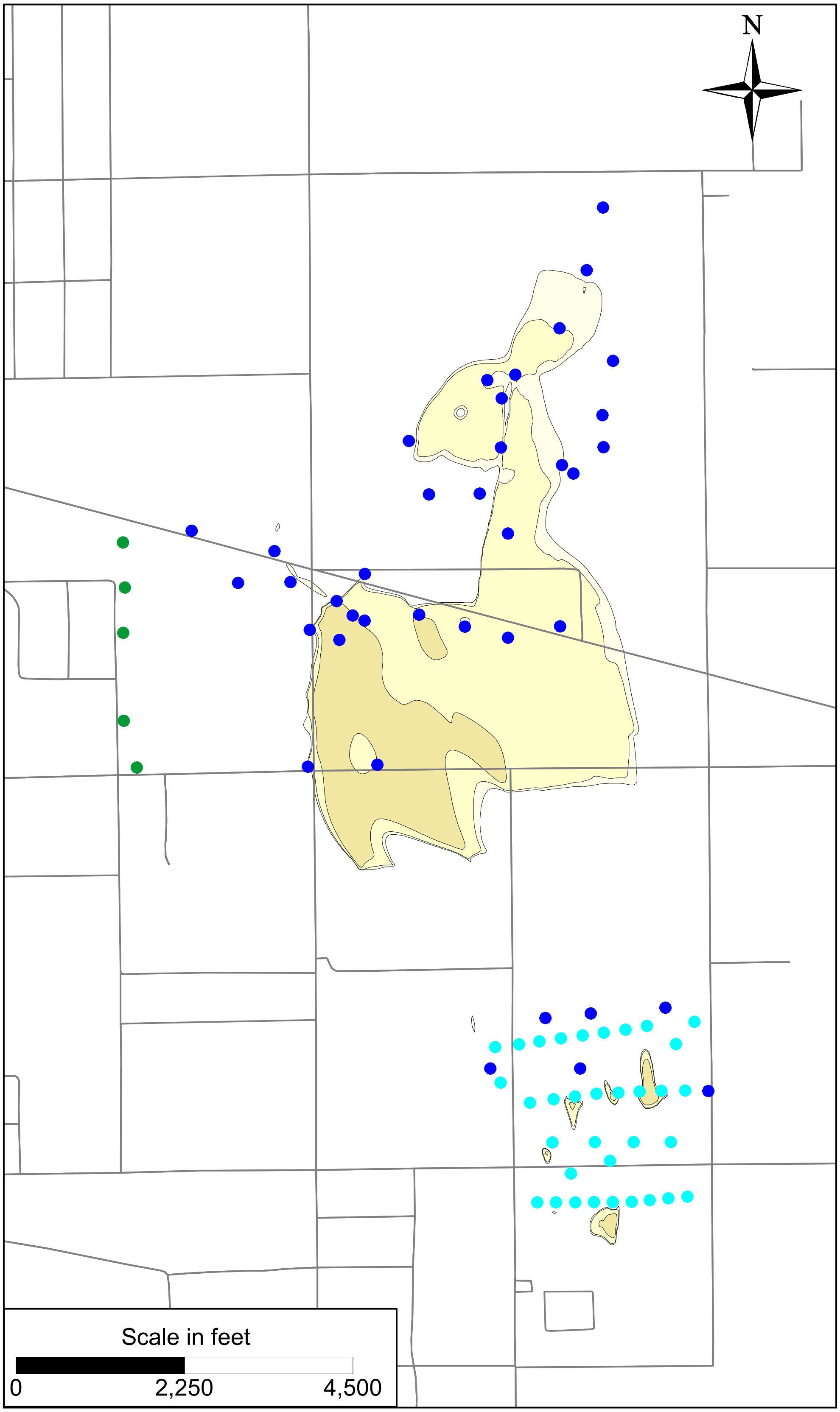
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

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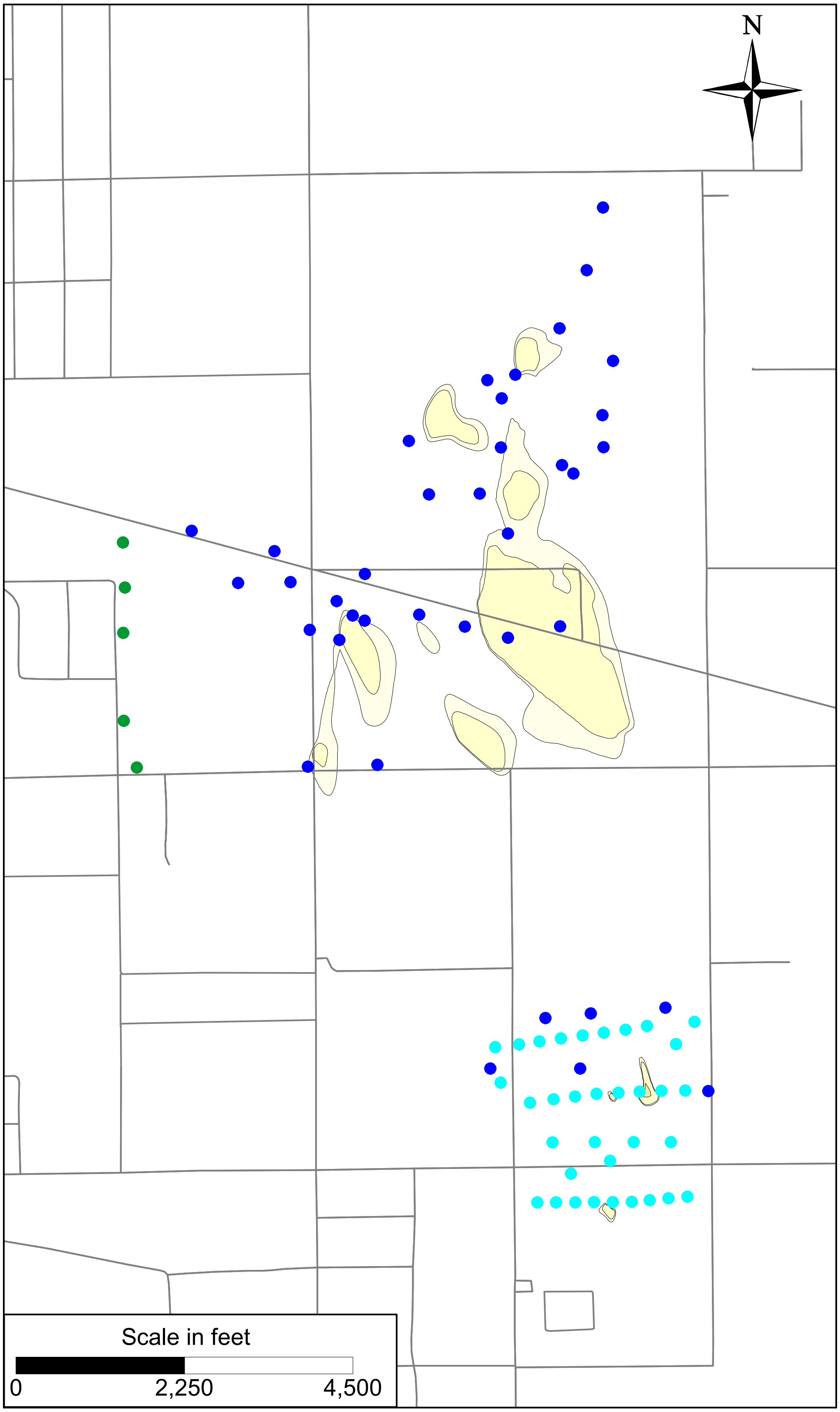
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

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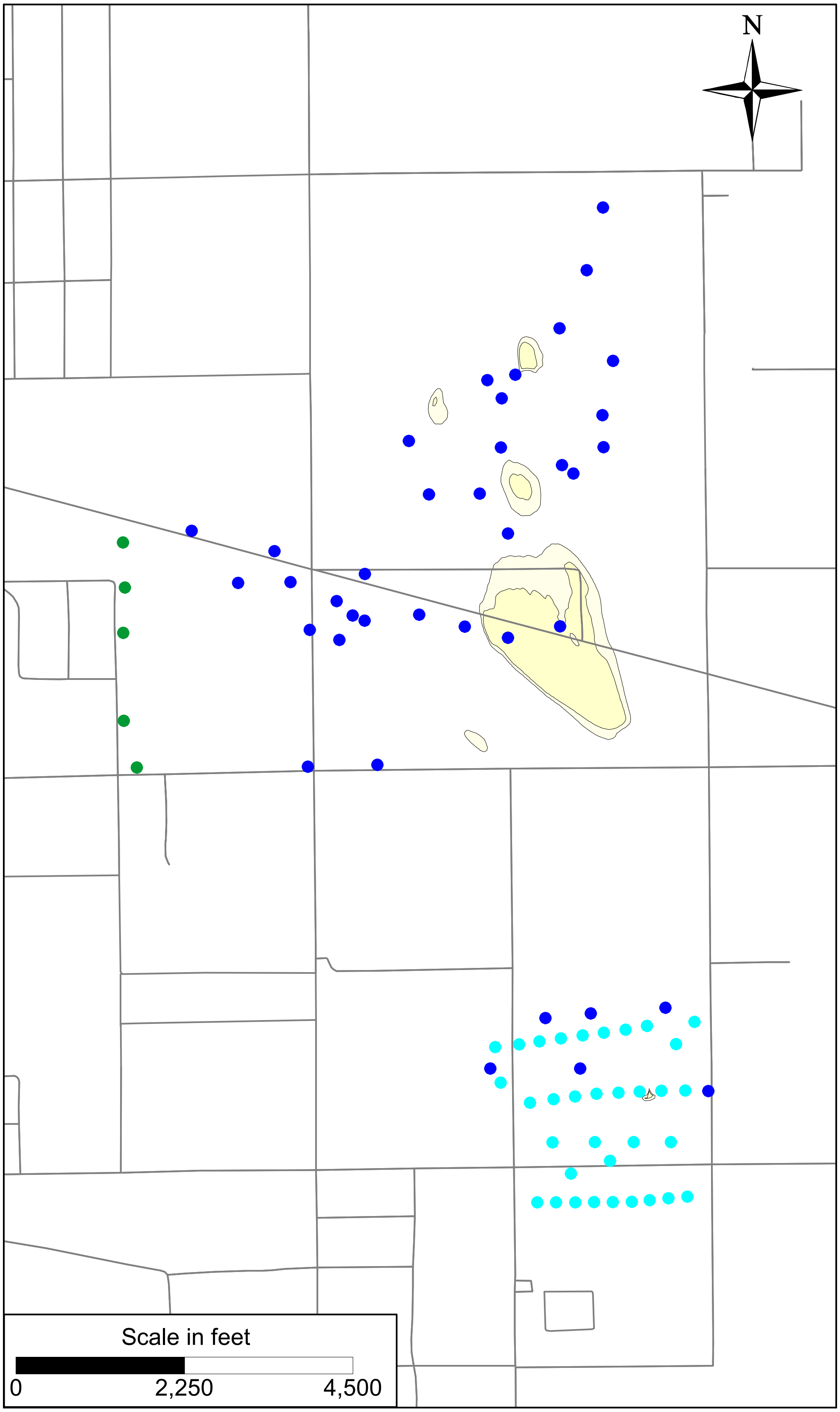
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

- Approximate Location of Extraction Well
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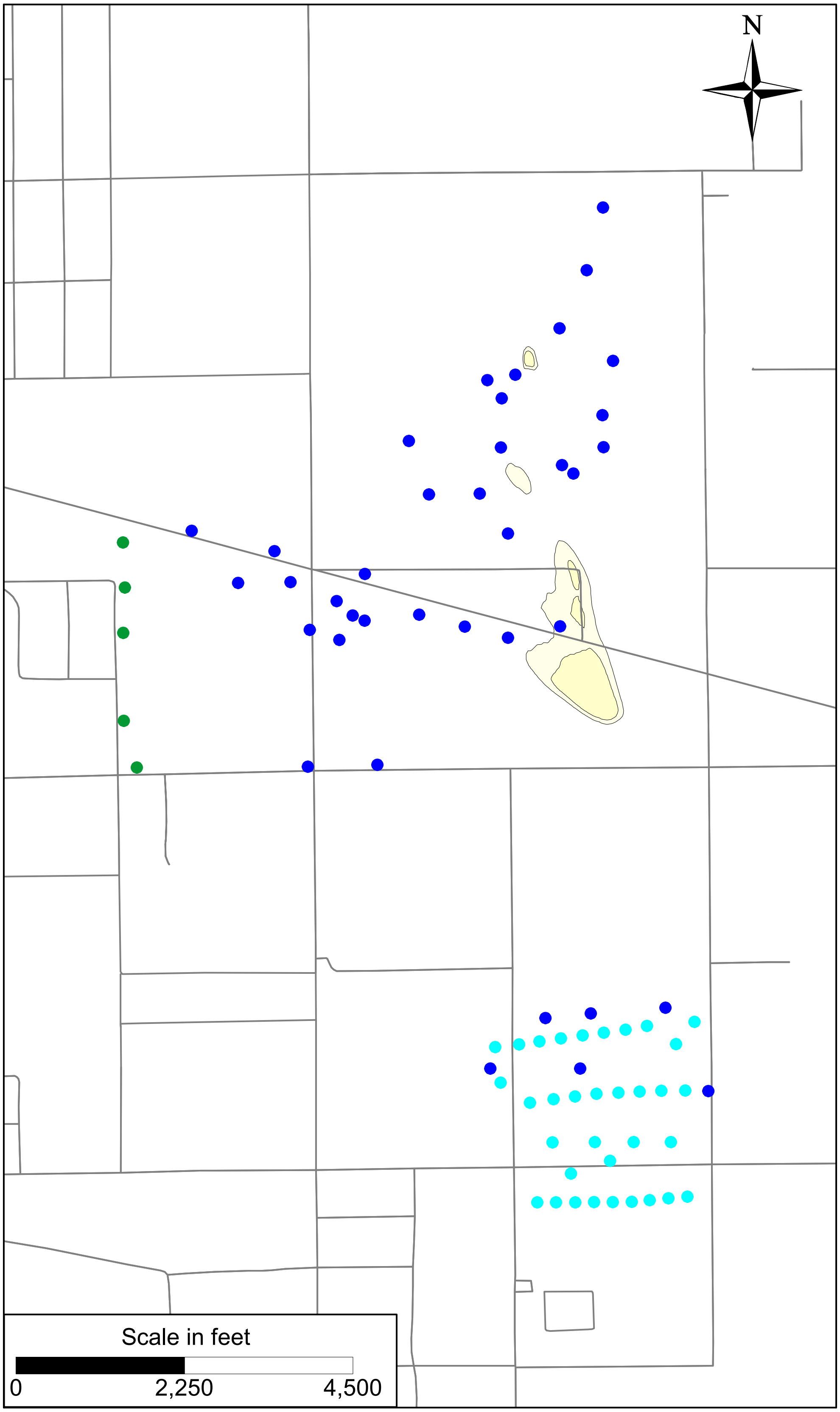
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

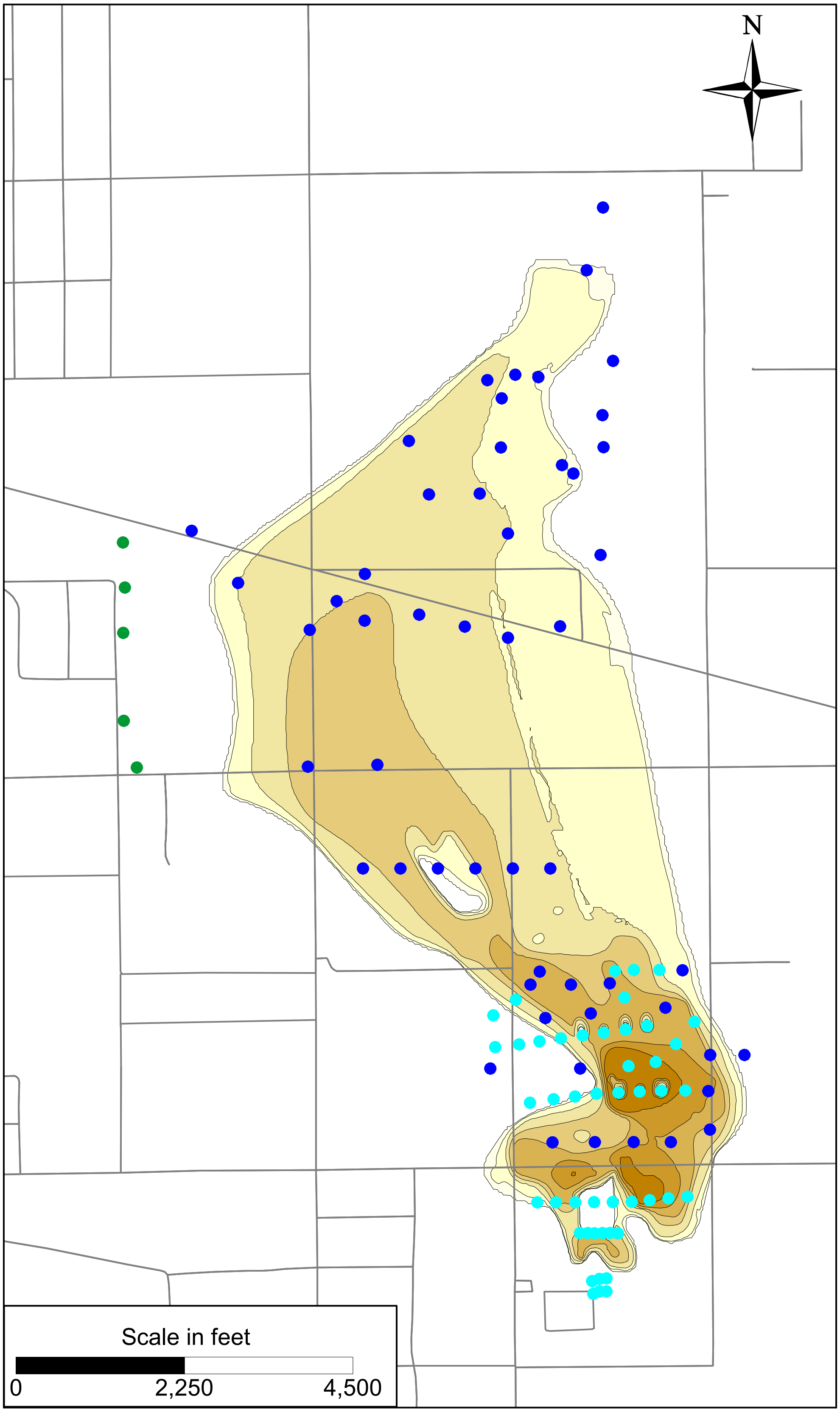
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

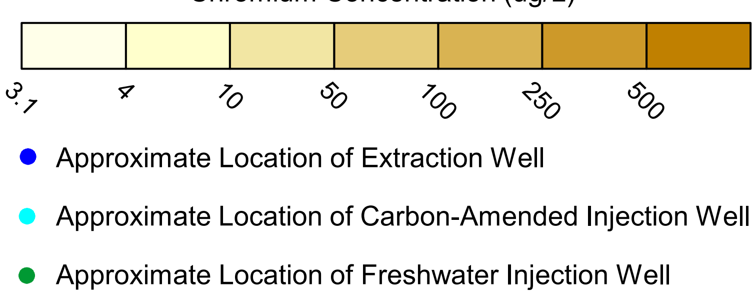
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

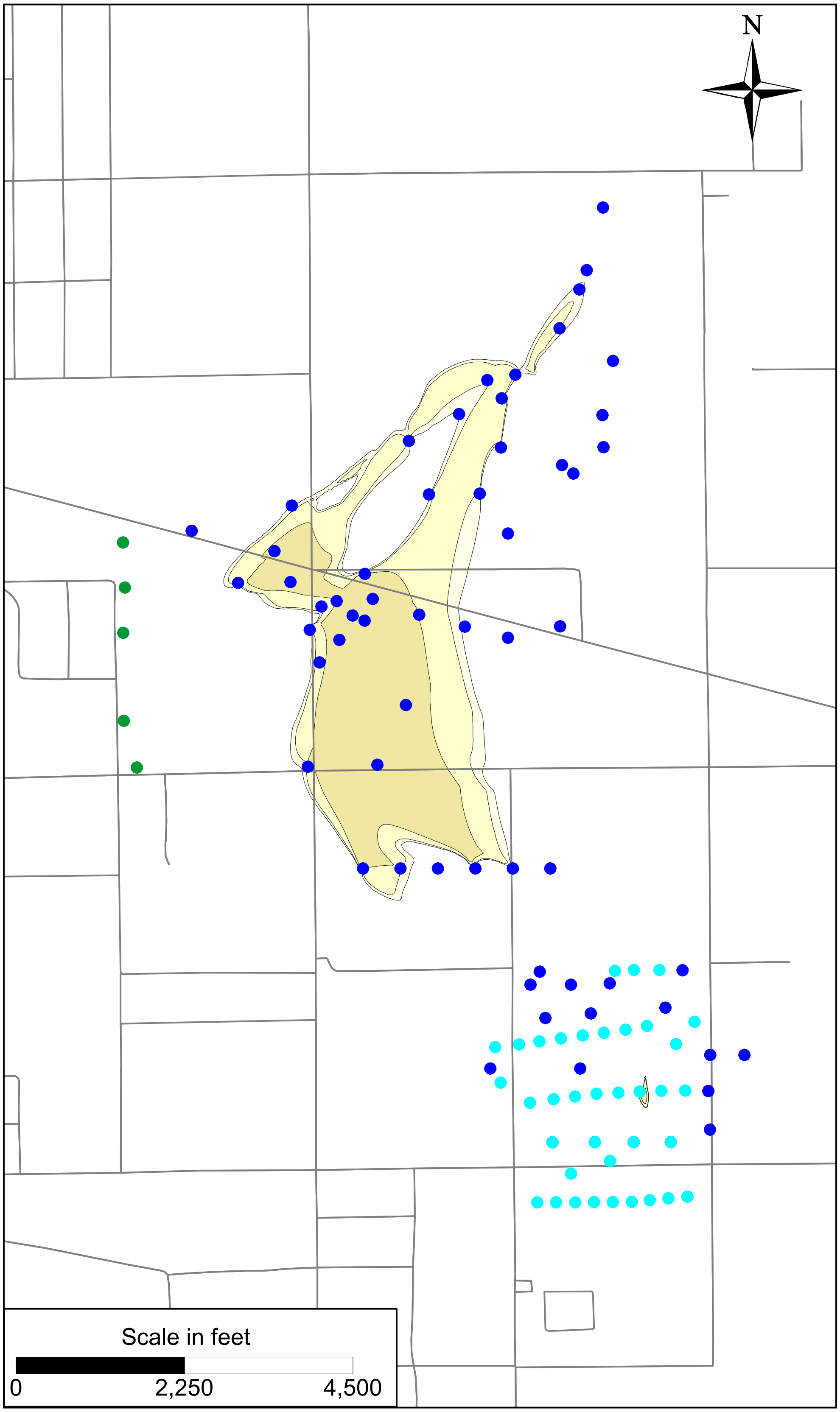


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

- Approximate Location of Extraction Well
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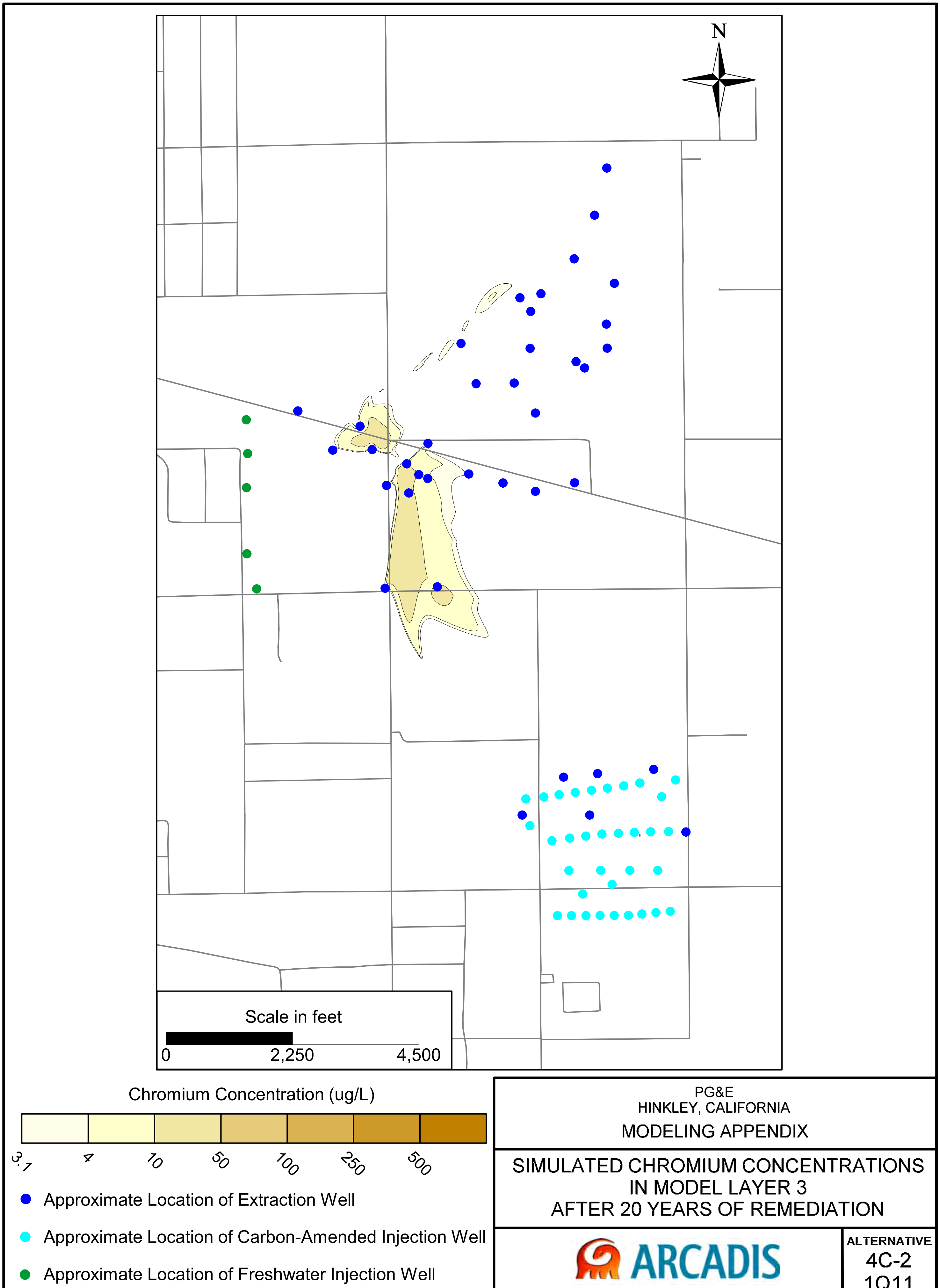
PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11

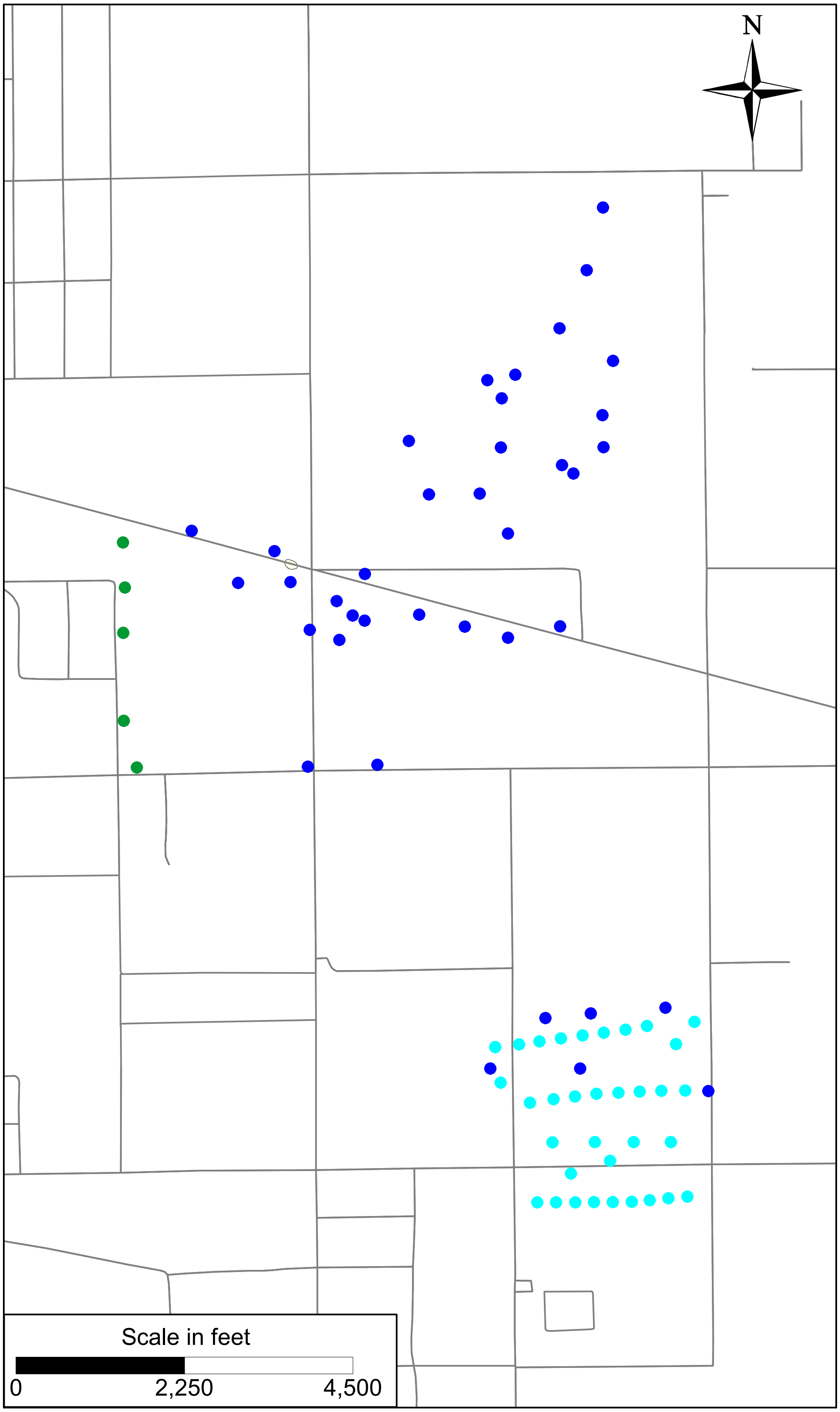


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-2
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

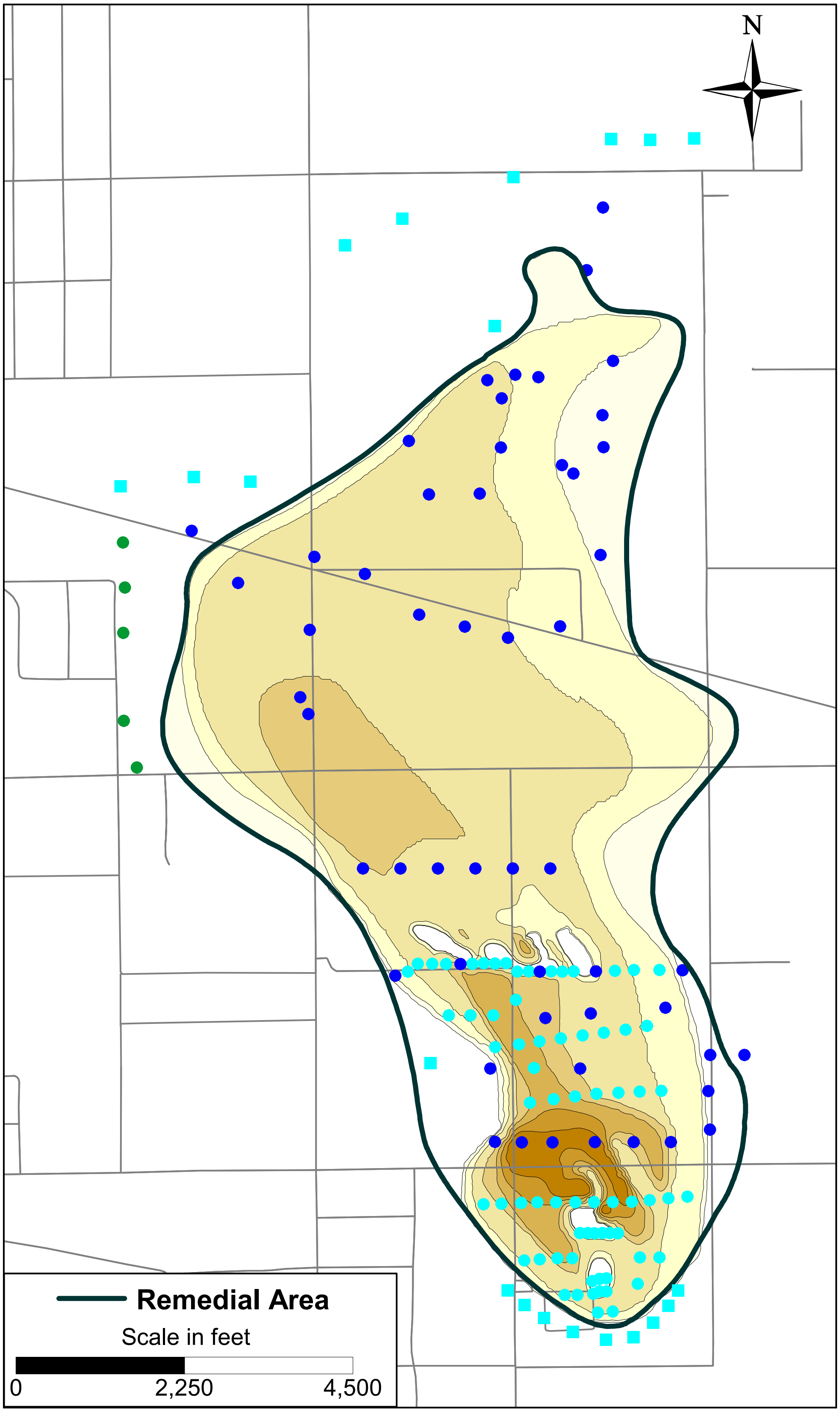
ARCADIS

ALTERNATIVE
4C-2
1Q11

ARCADIS

Attachment C-3

Solute Transport Results for
Alternative 4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

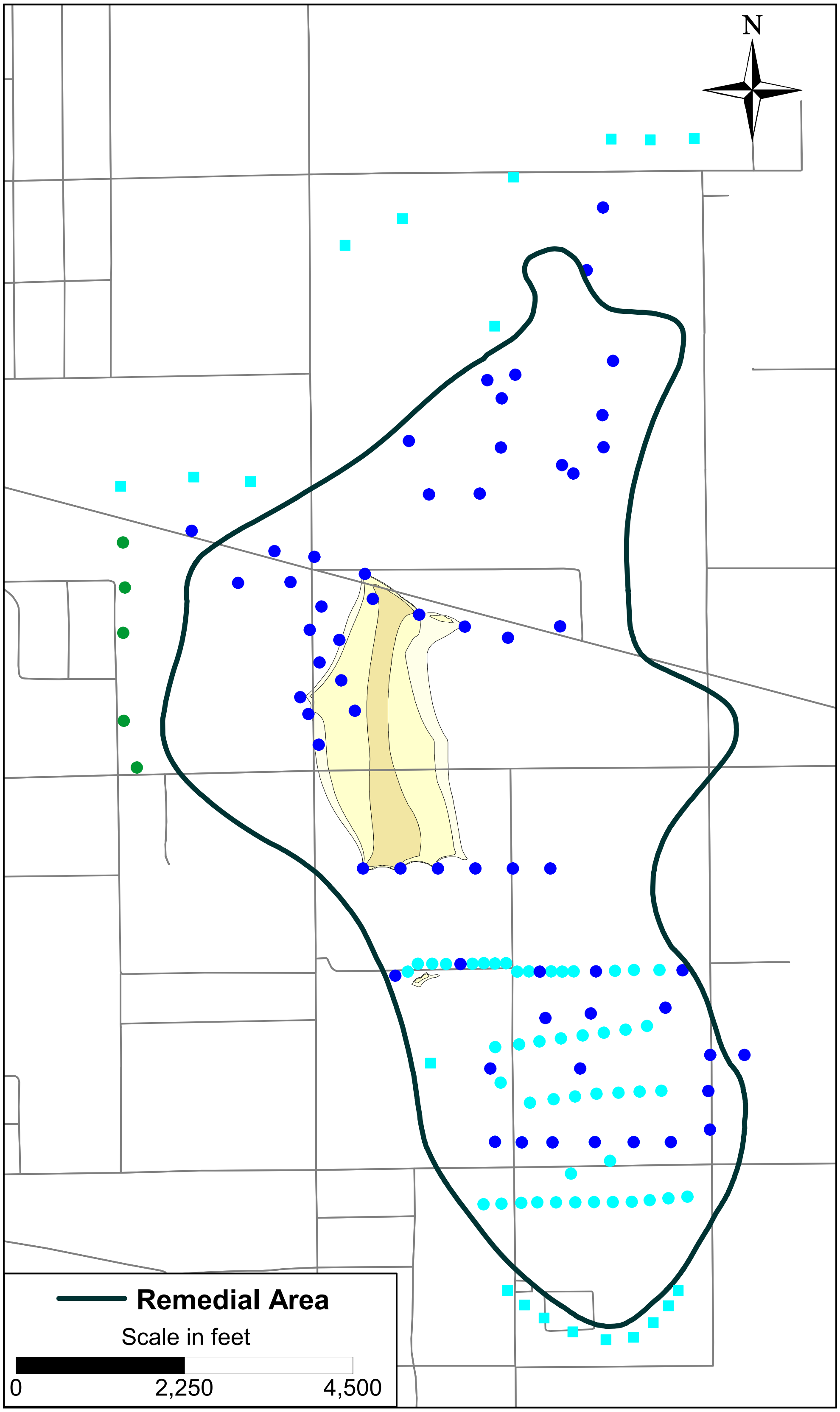
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

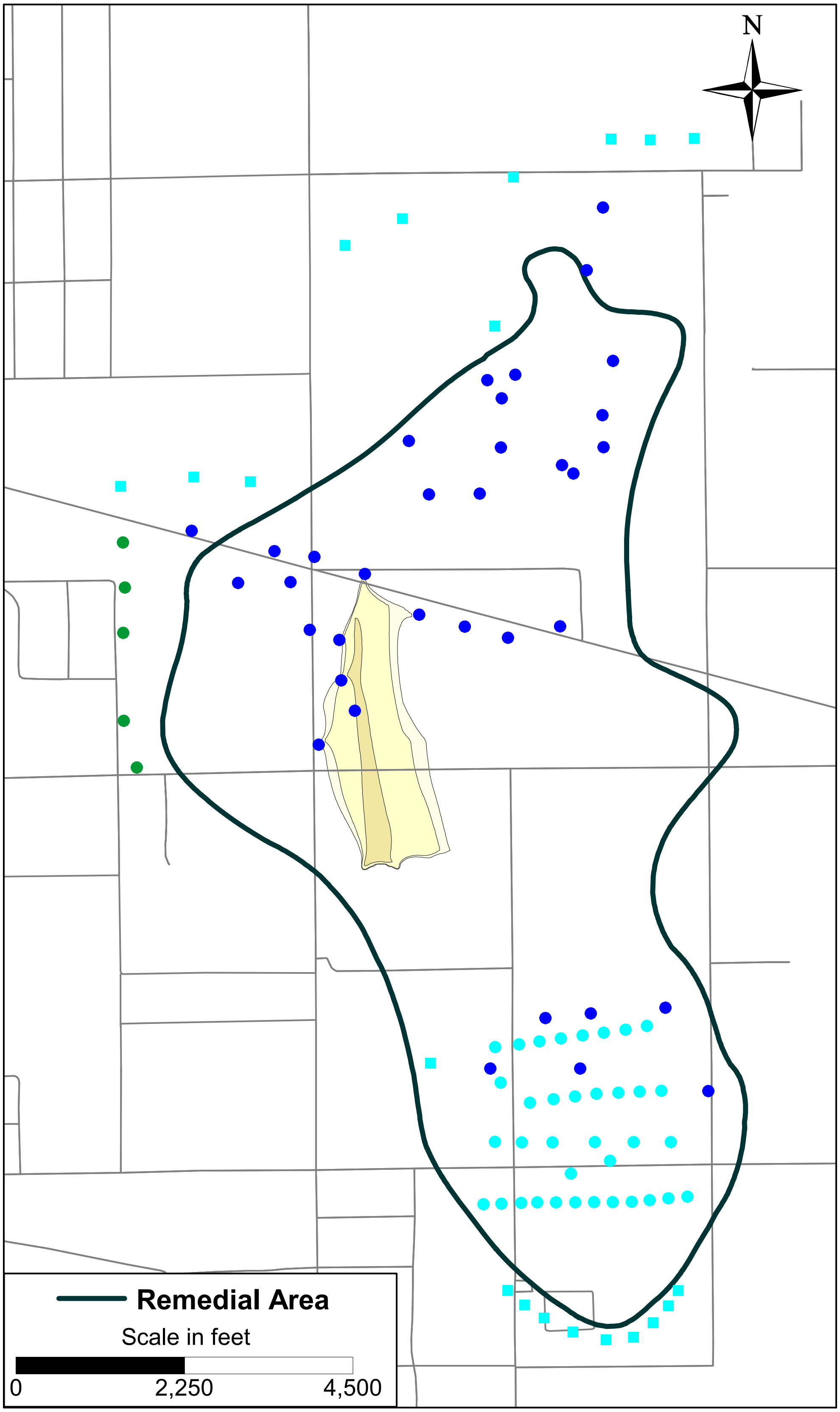
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

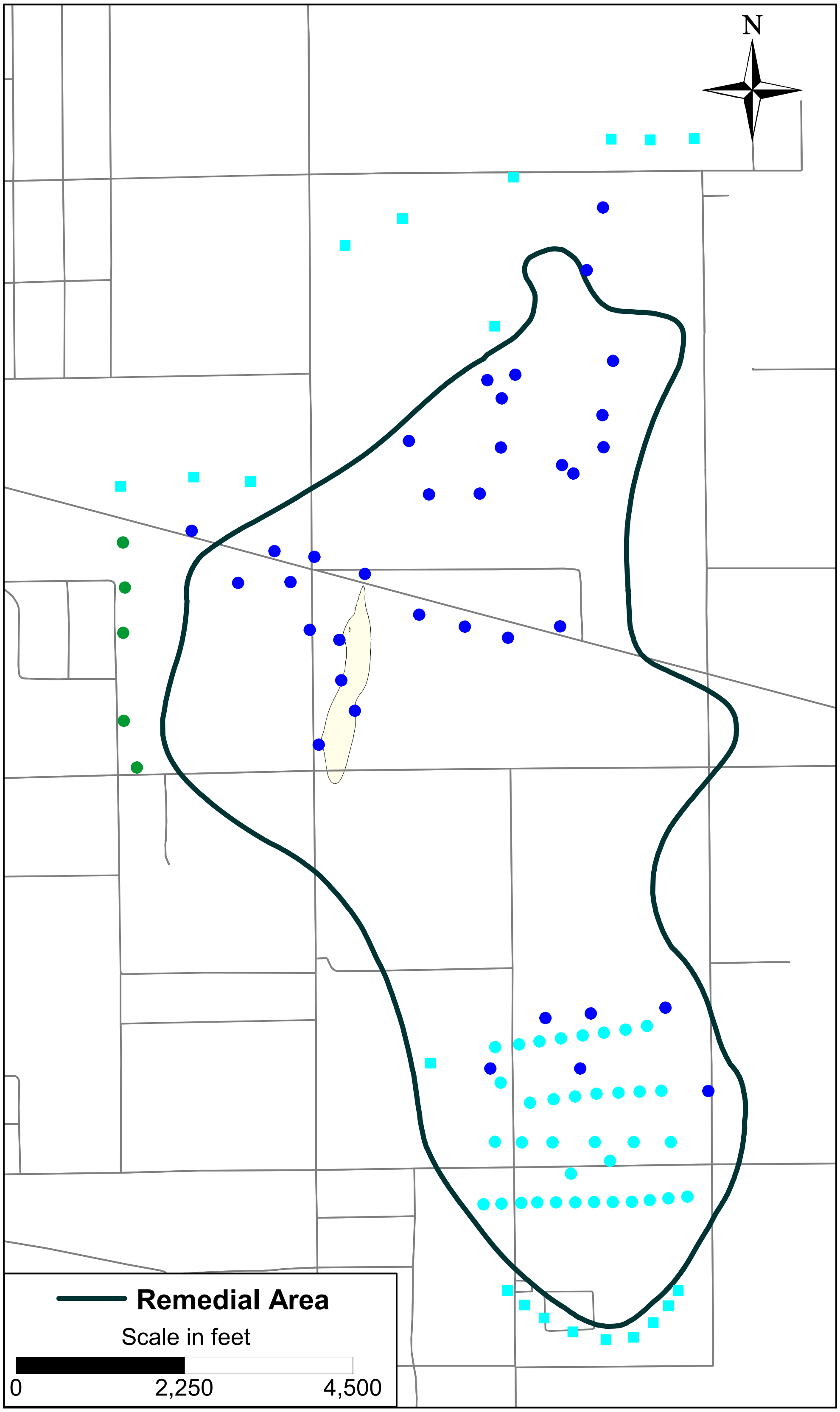
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

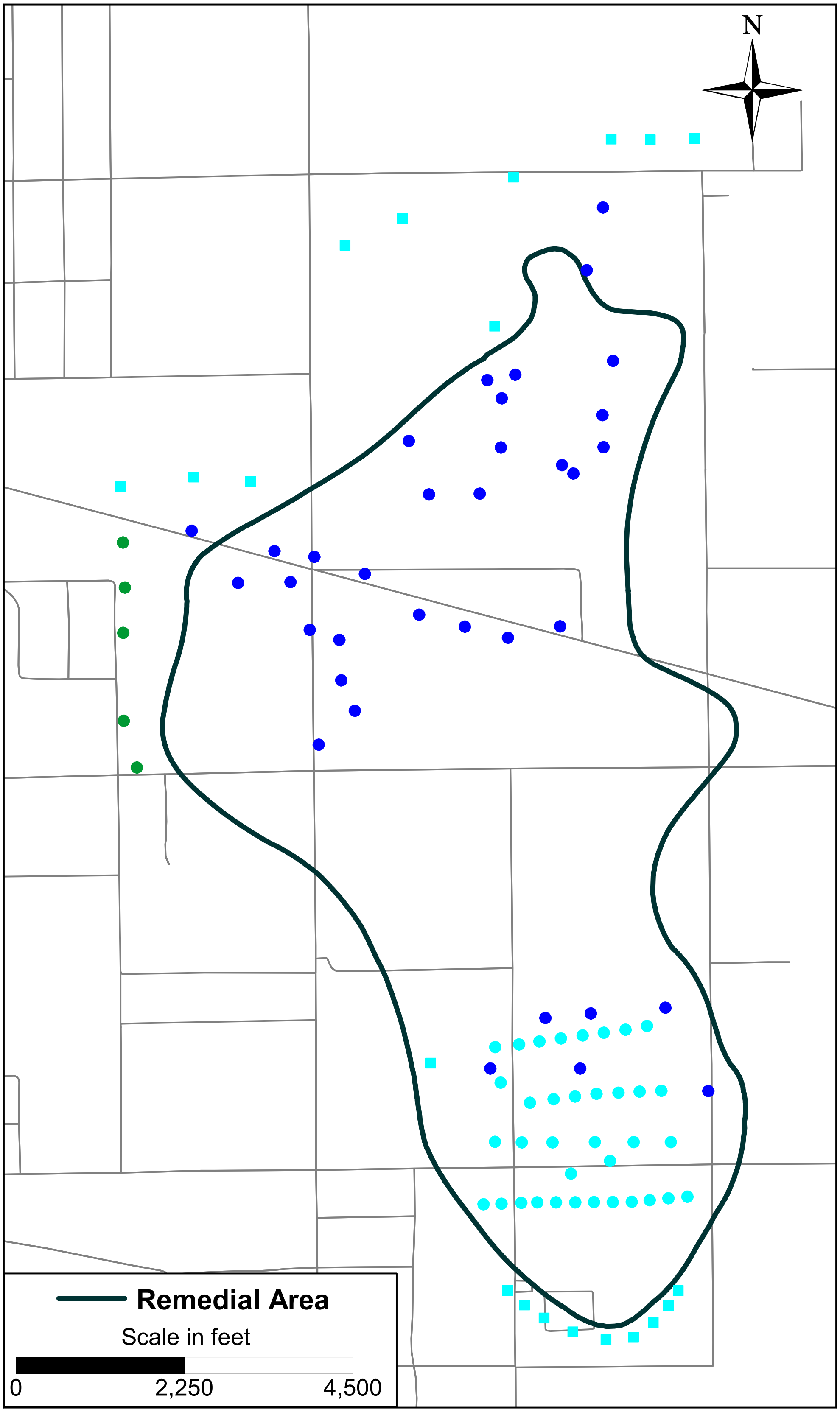
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1 AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE 4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

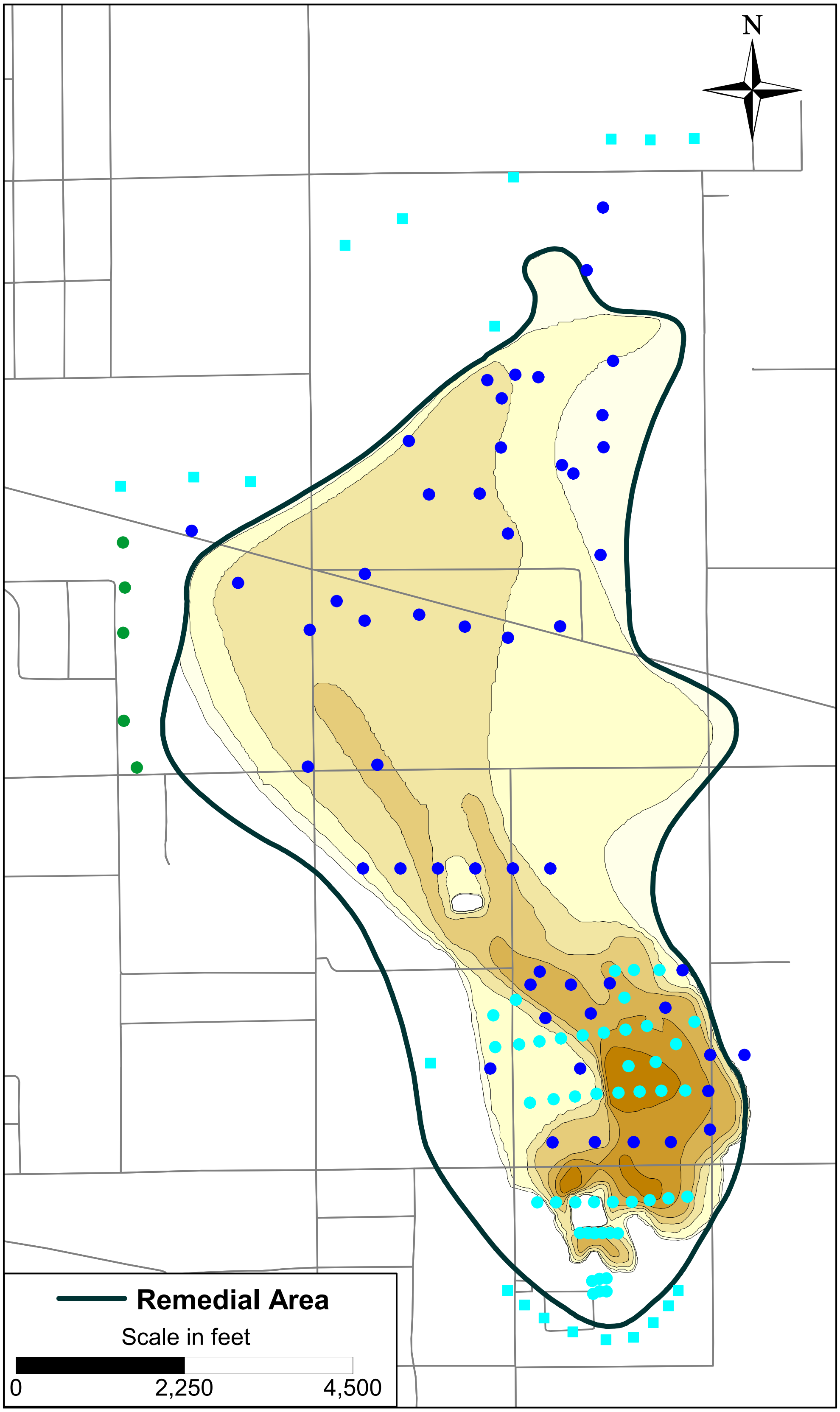
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA

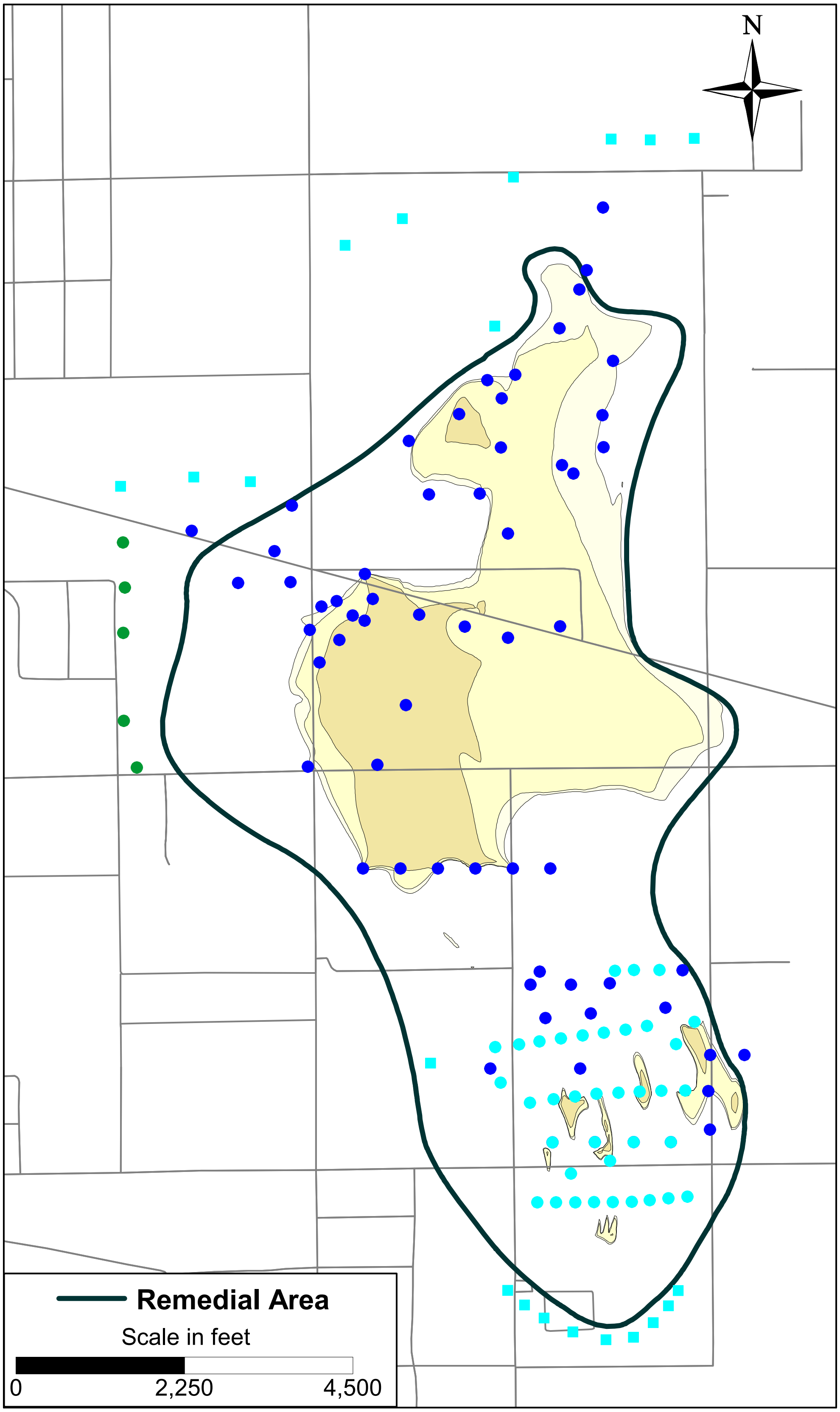
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2

ARCADIS

ALTERNATIVE

4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

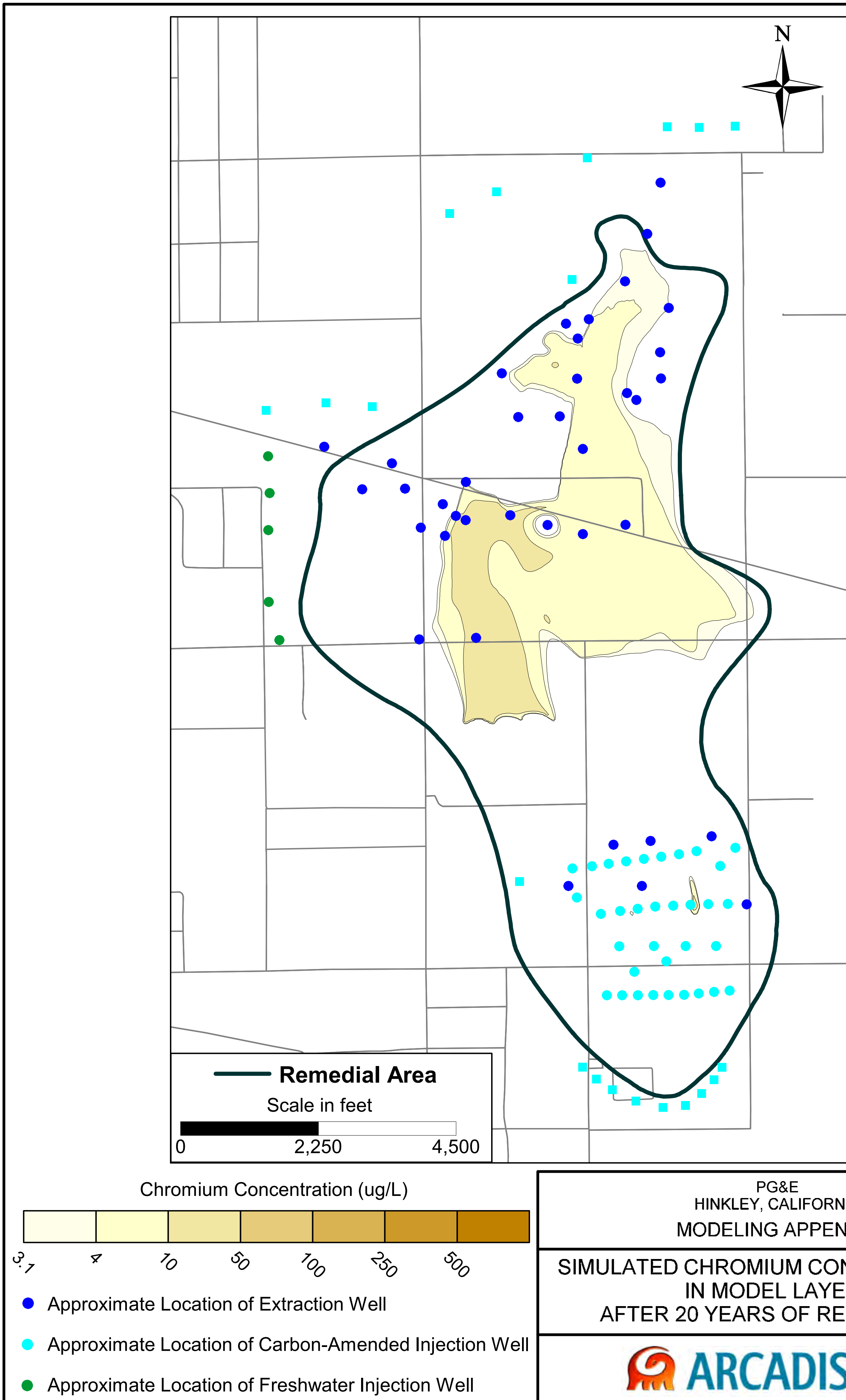
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3

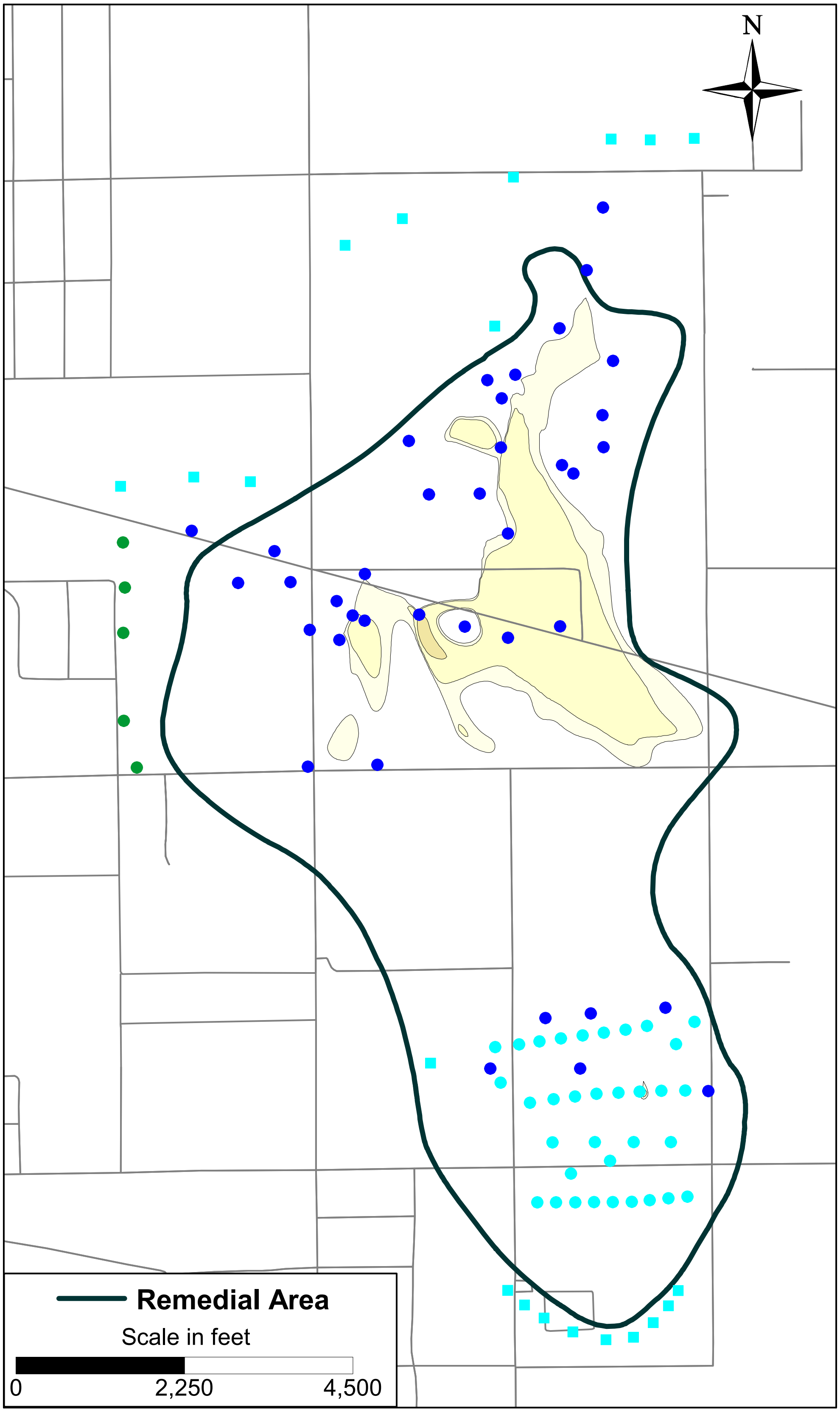


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

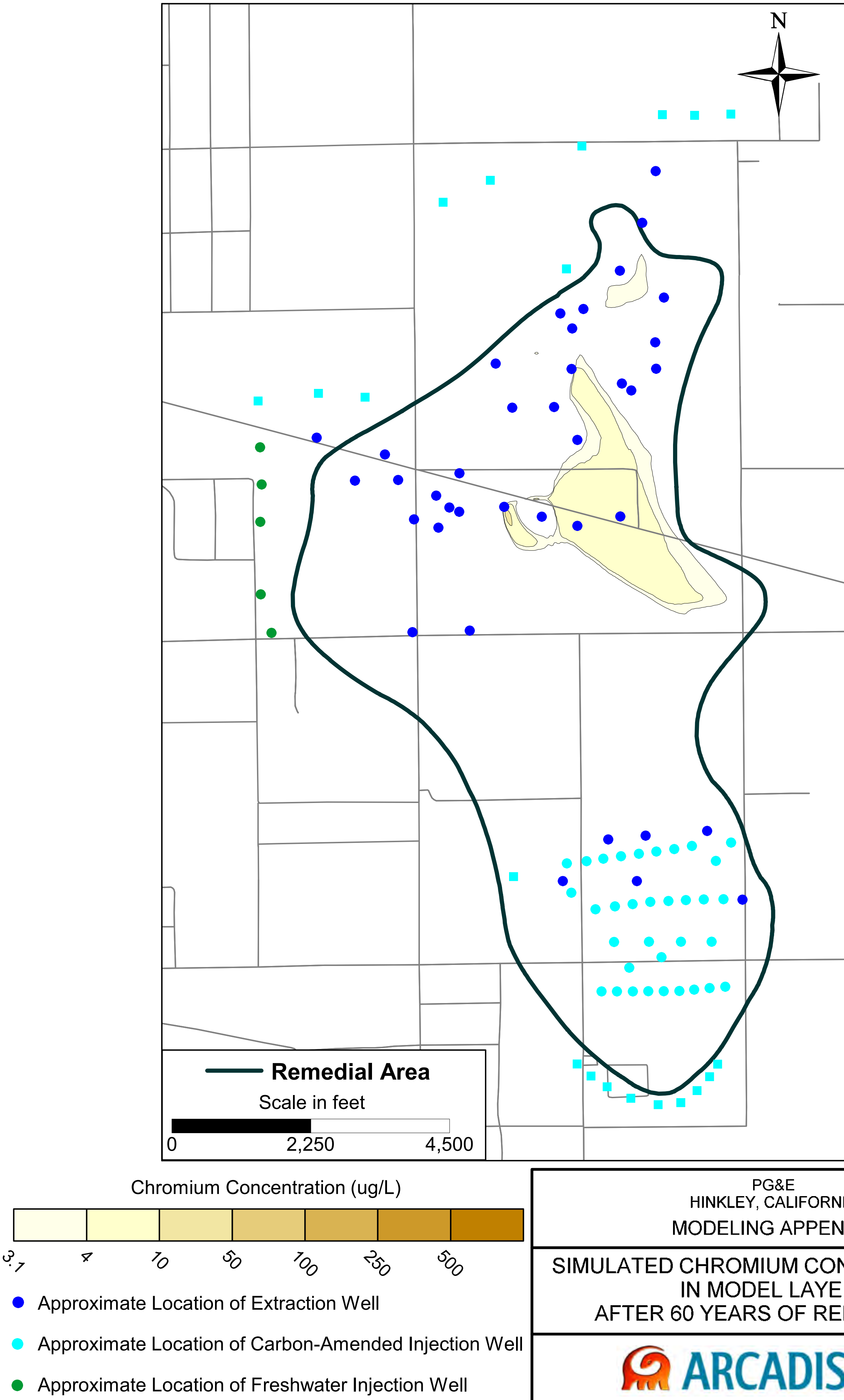
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3

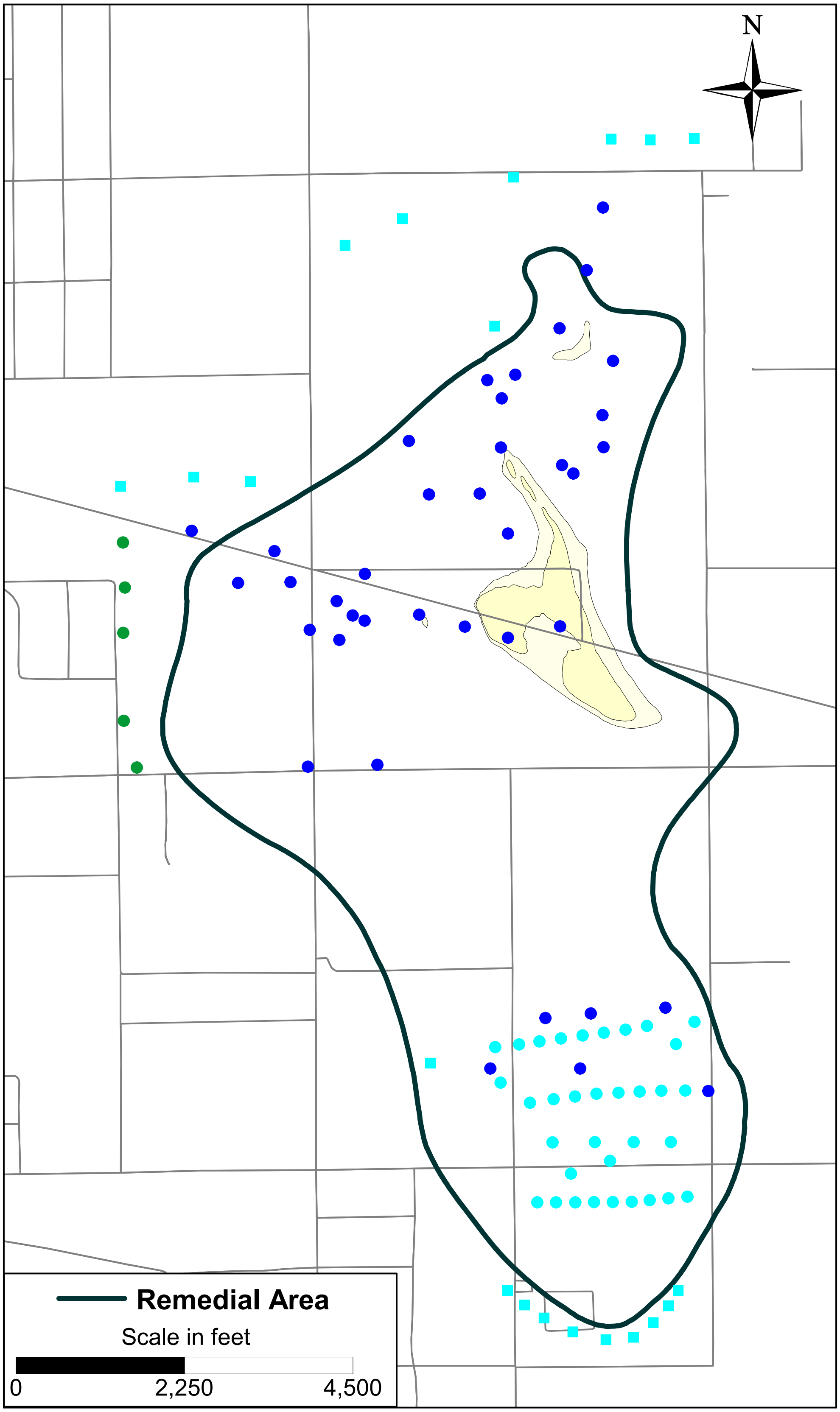


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

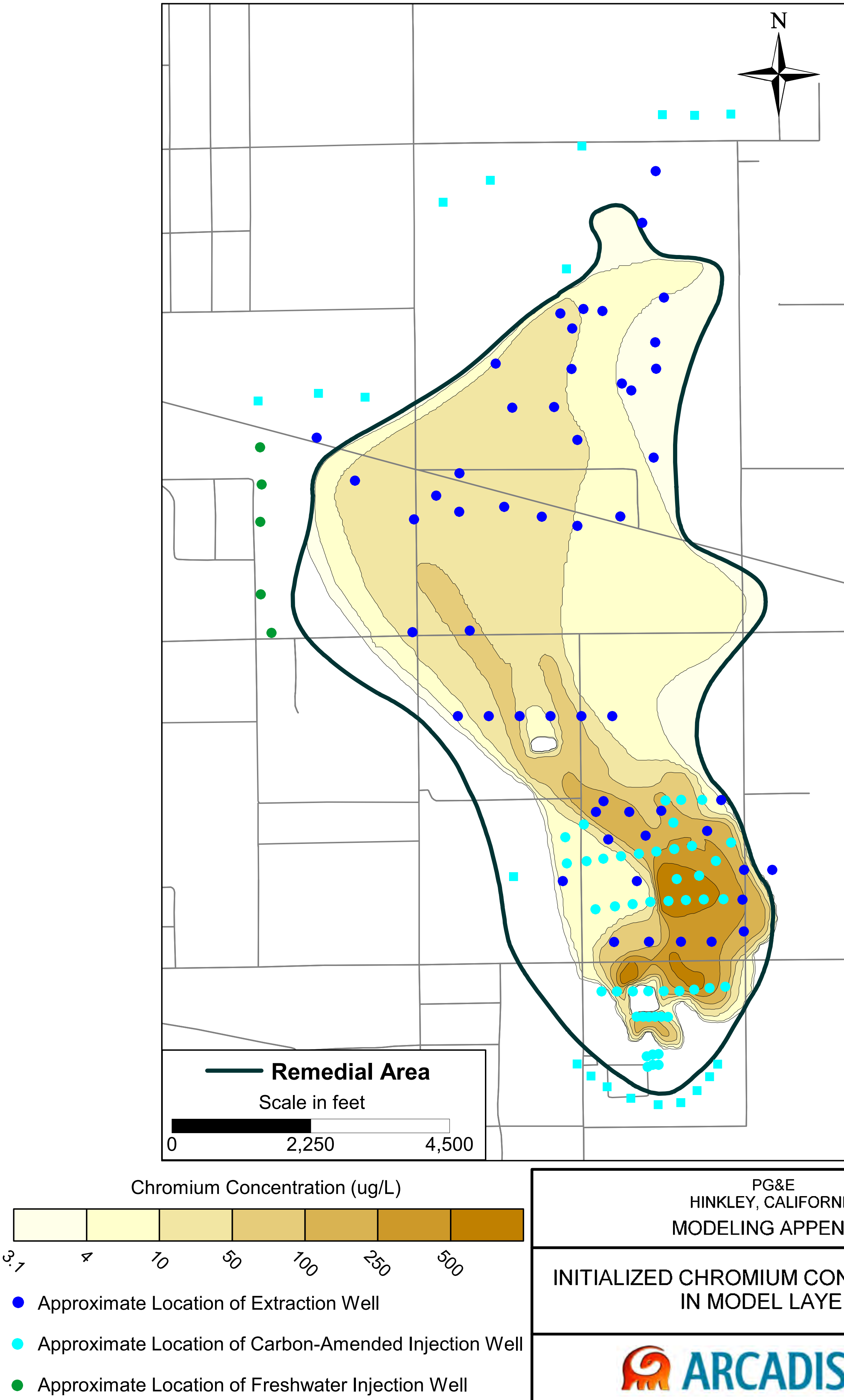
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



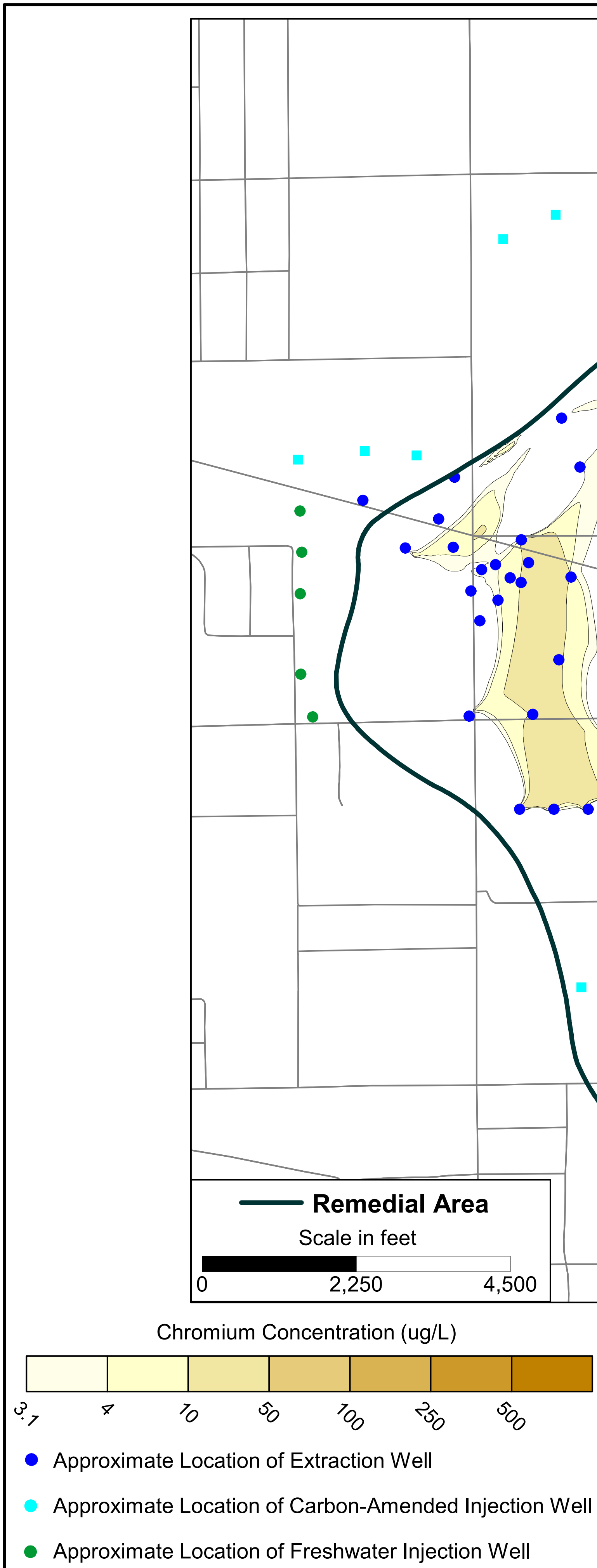
PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE

4C-3

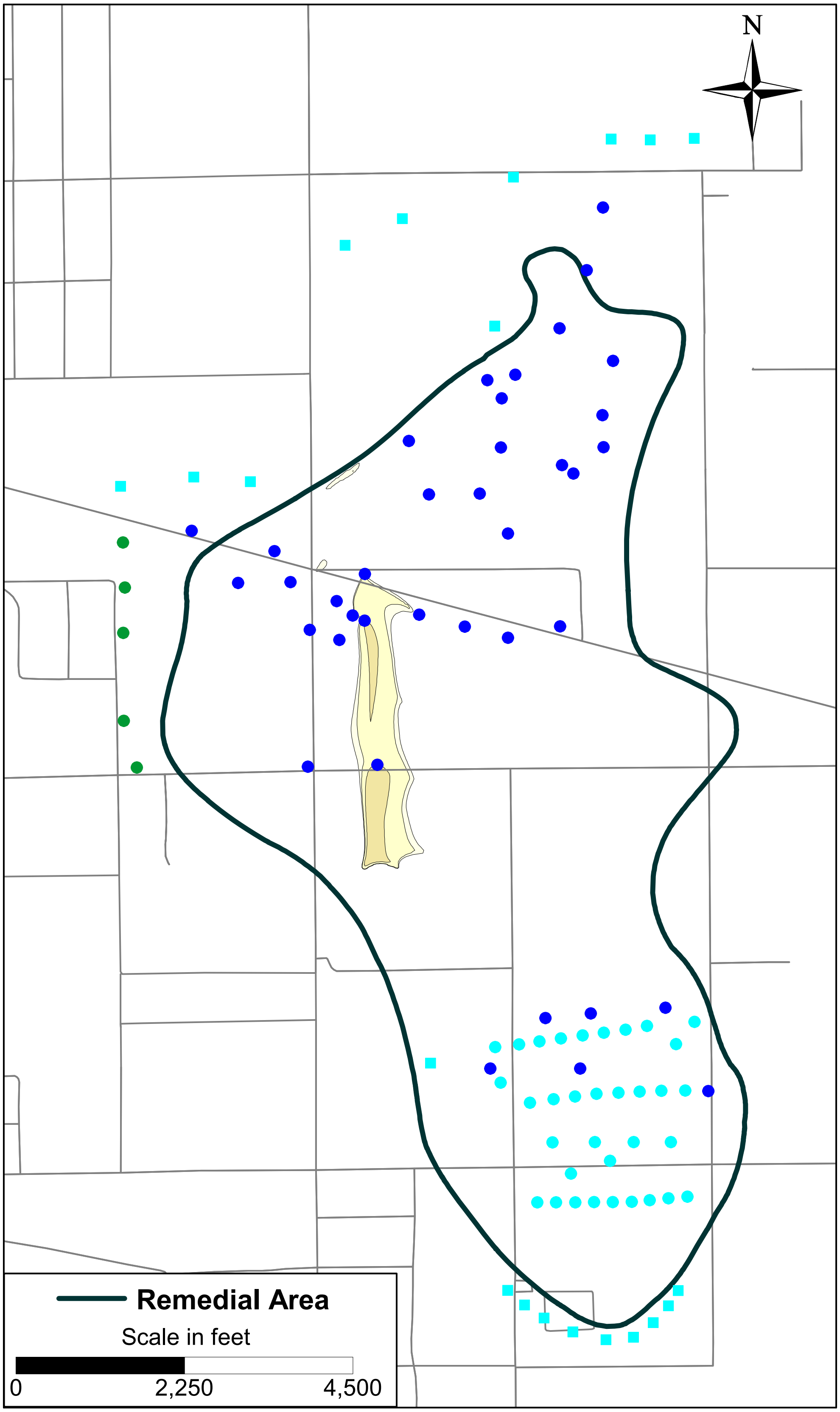


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

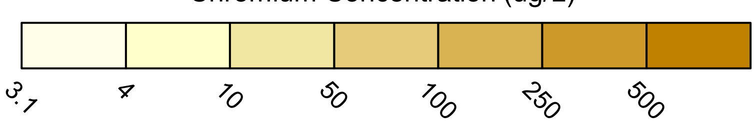
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)



● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

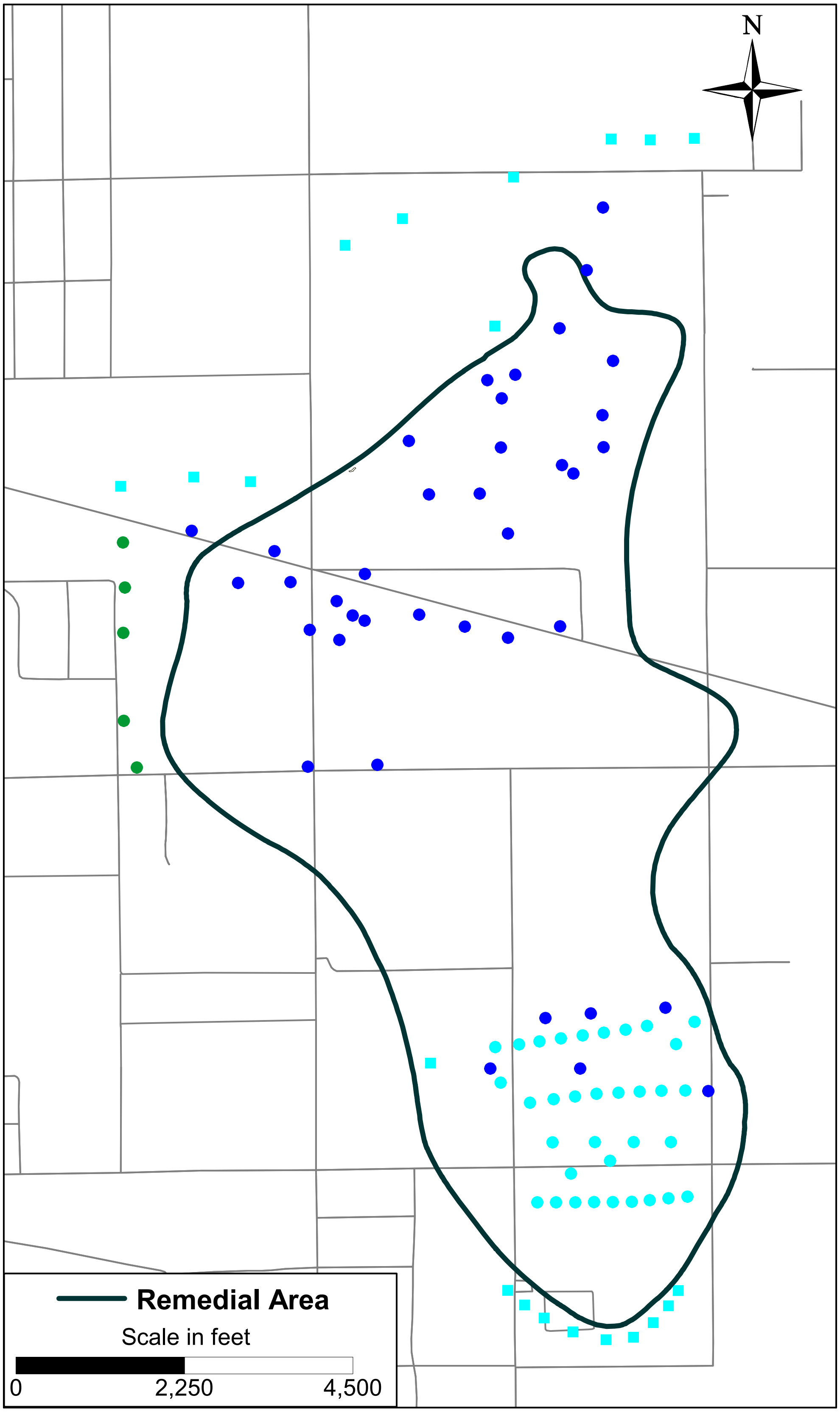
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3 AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

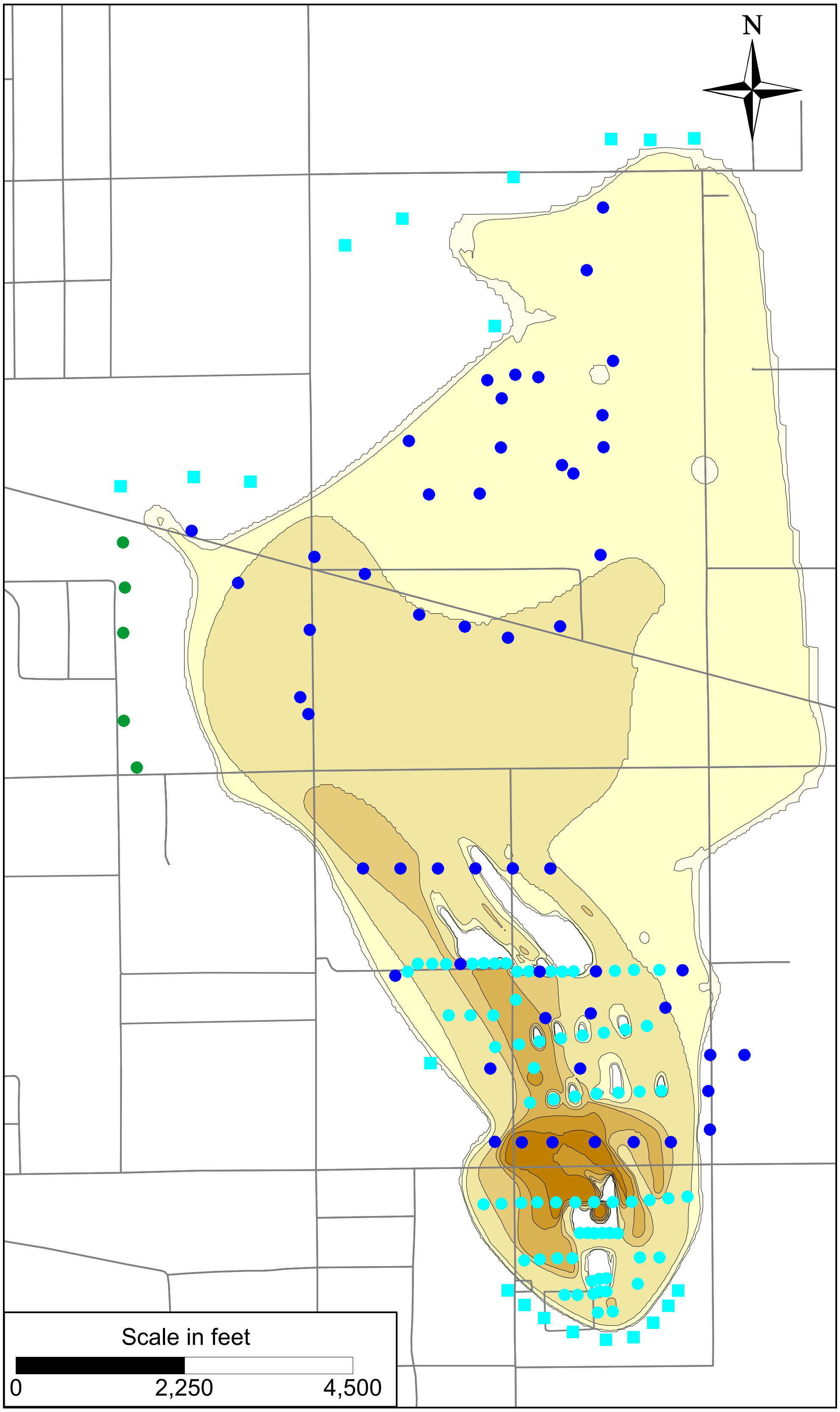
ARCADIS

ALTERNATIVE
4C-3

ARCADIS

Attachment C-3

1Q11 Figures



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

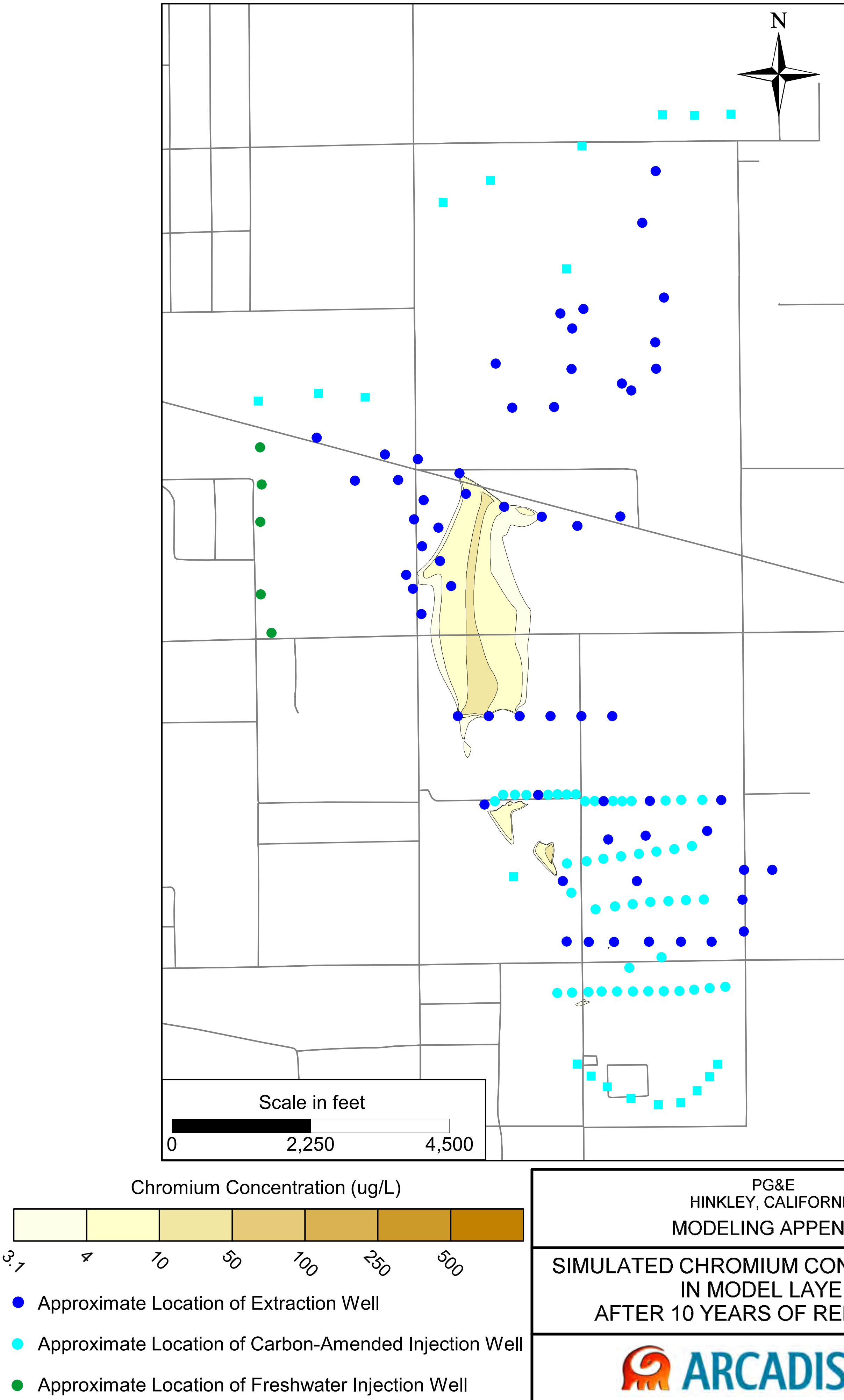
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-3
1Q11

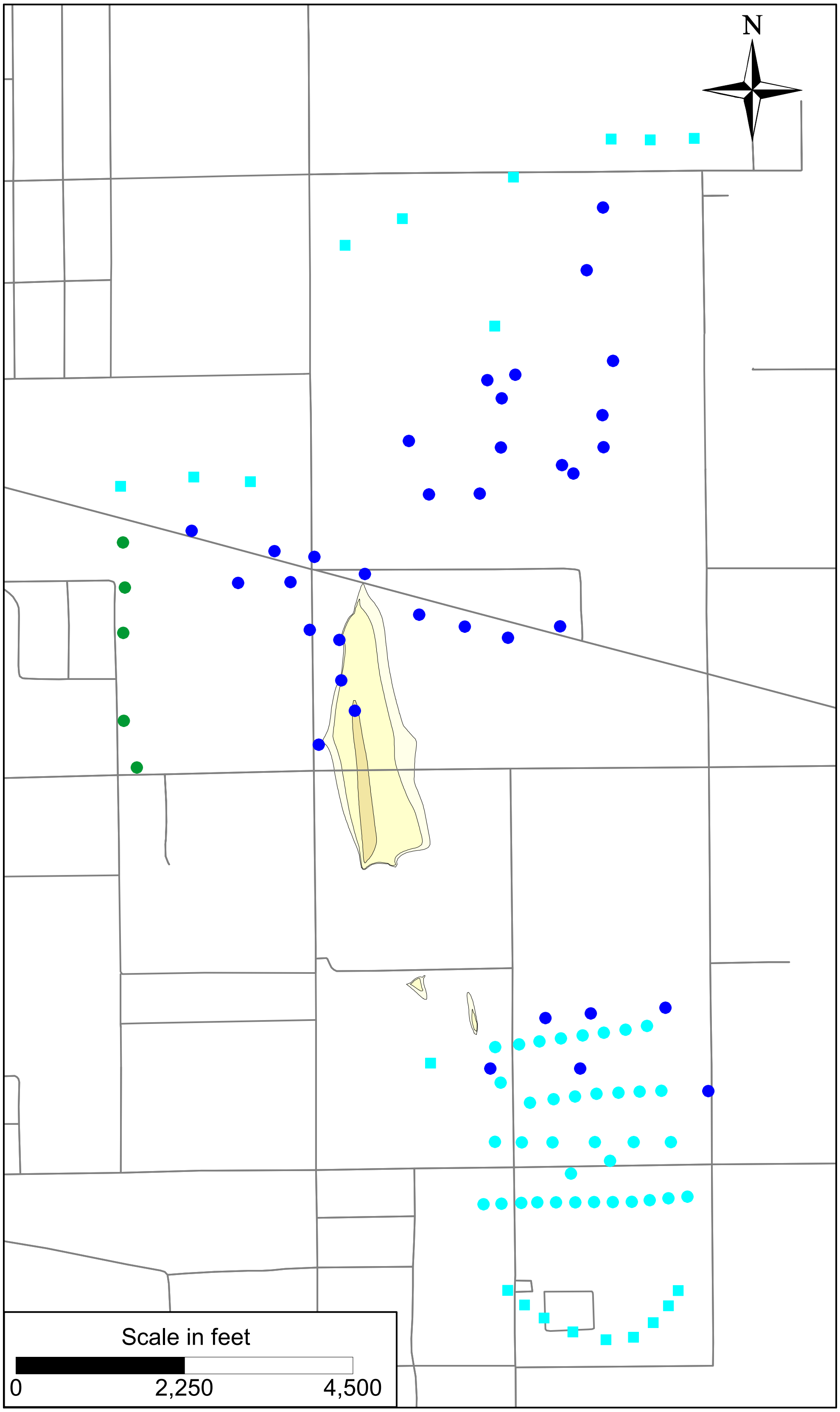


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

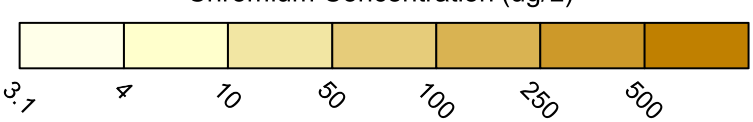
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)



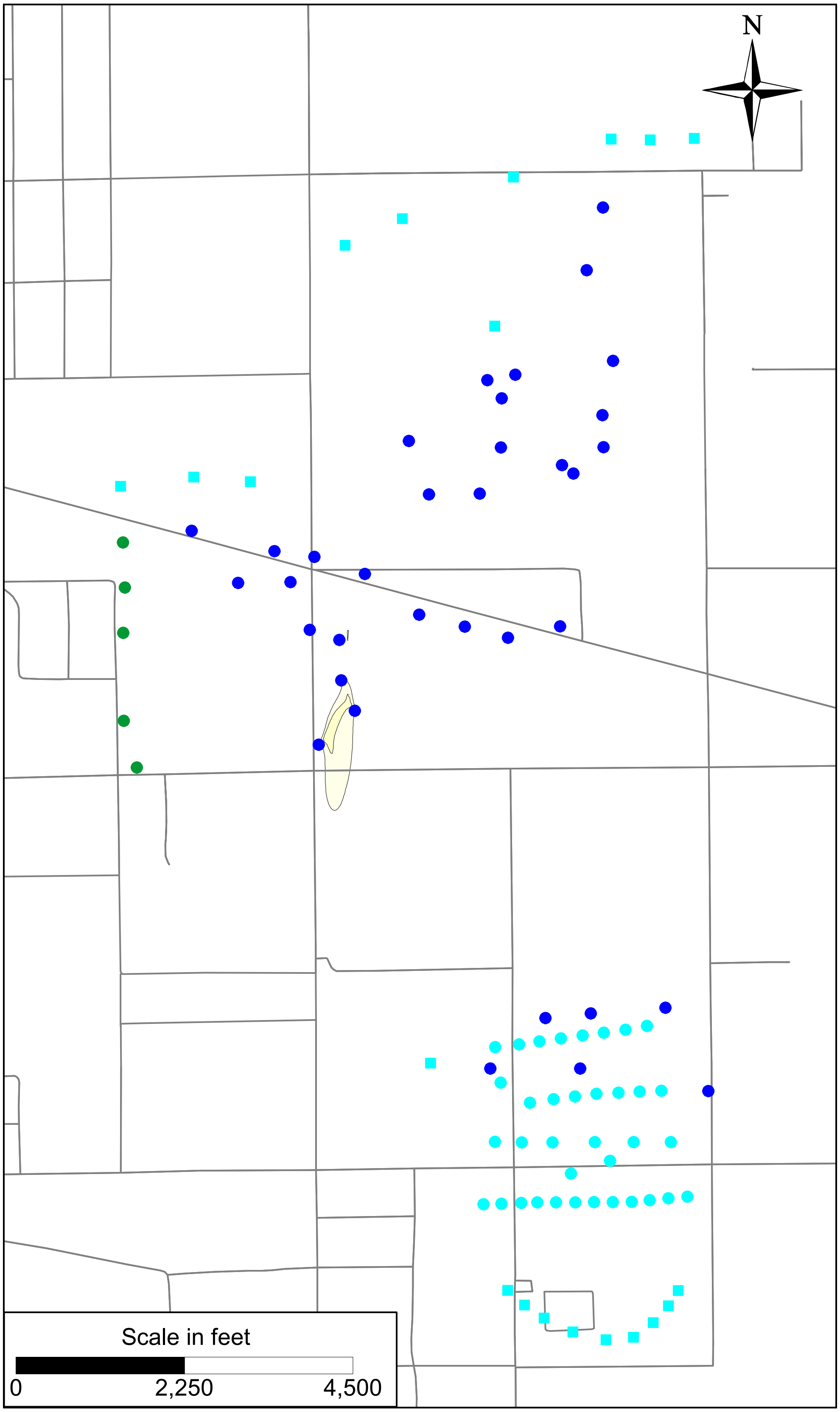
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

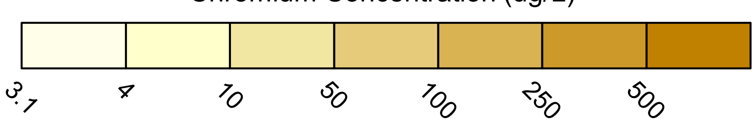
SIMULATED CHROMIUM CONCENTRATIONS IN MODEL LAYER 1 AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)



● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

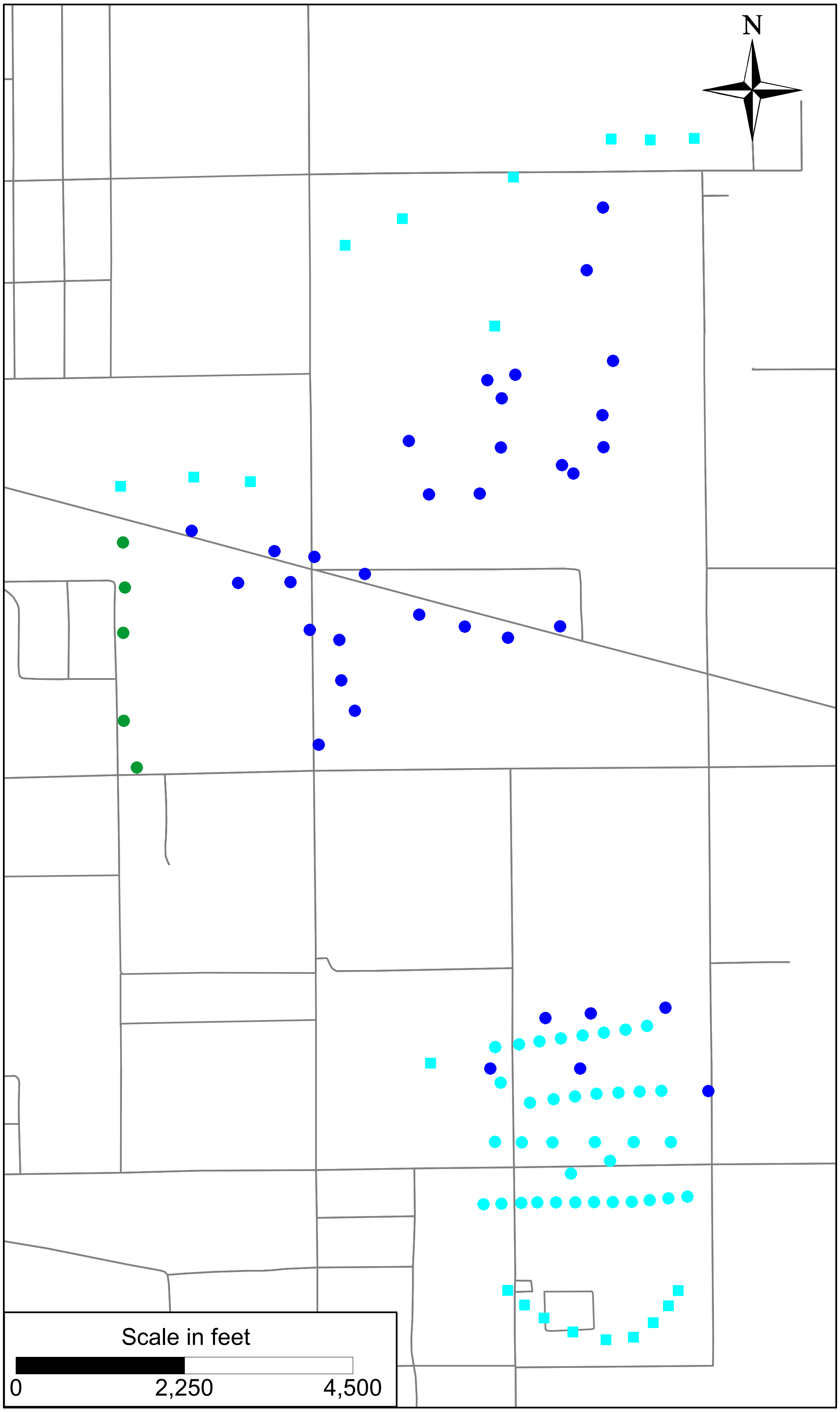
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

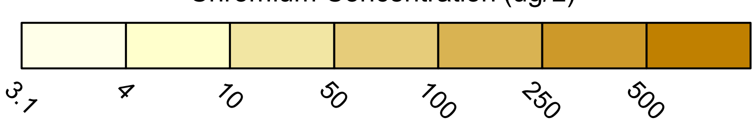
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)



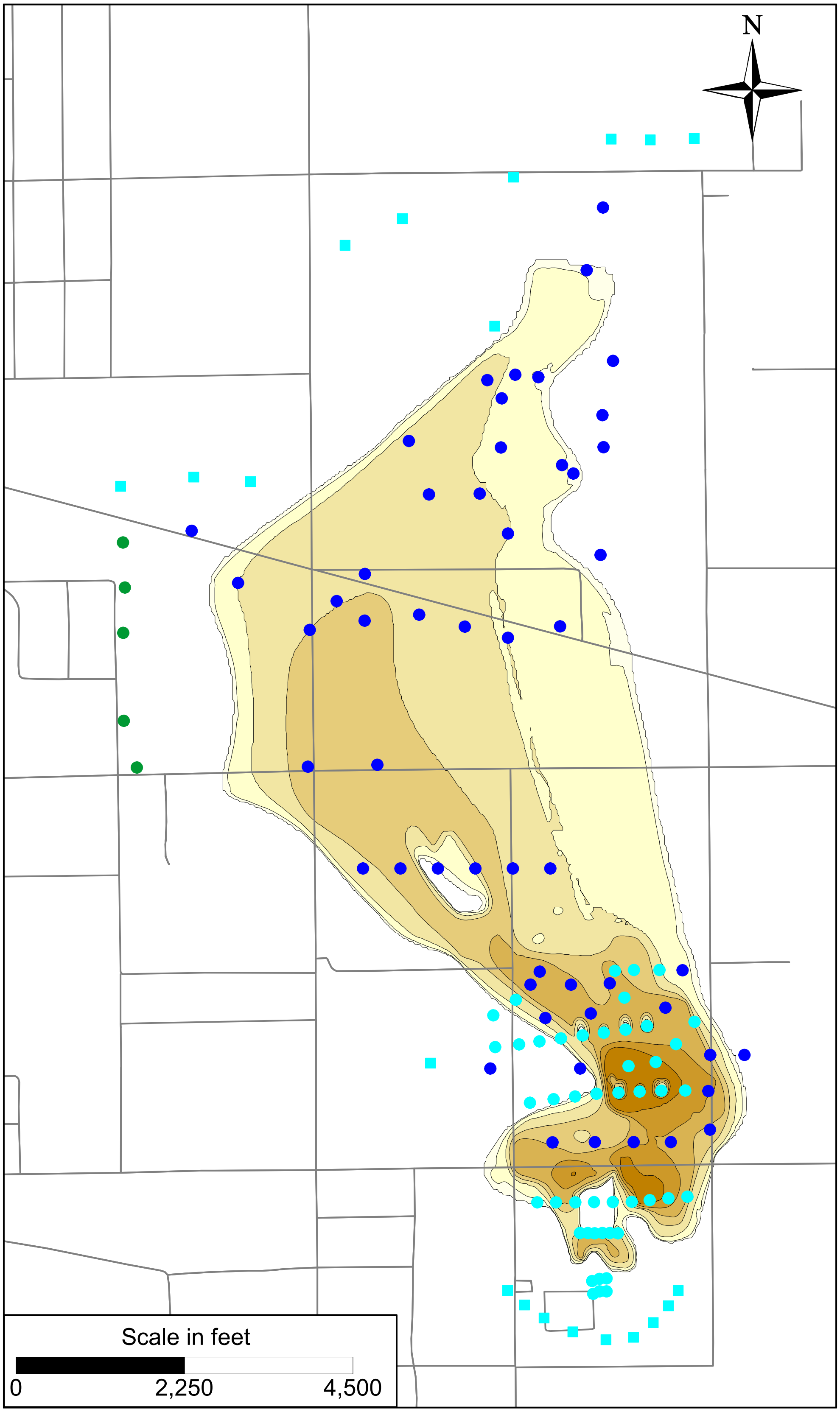
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

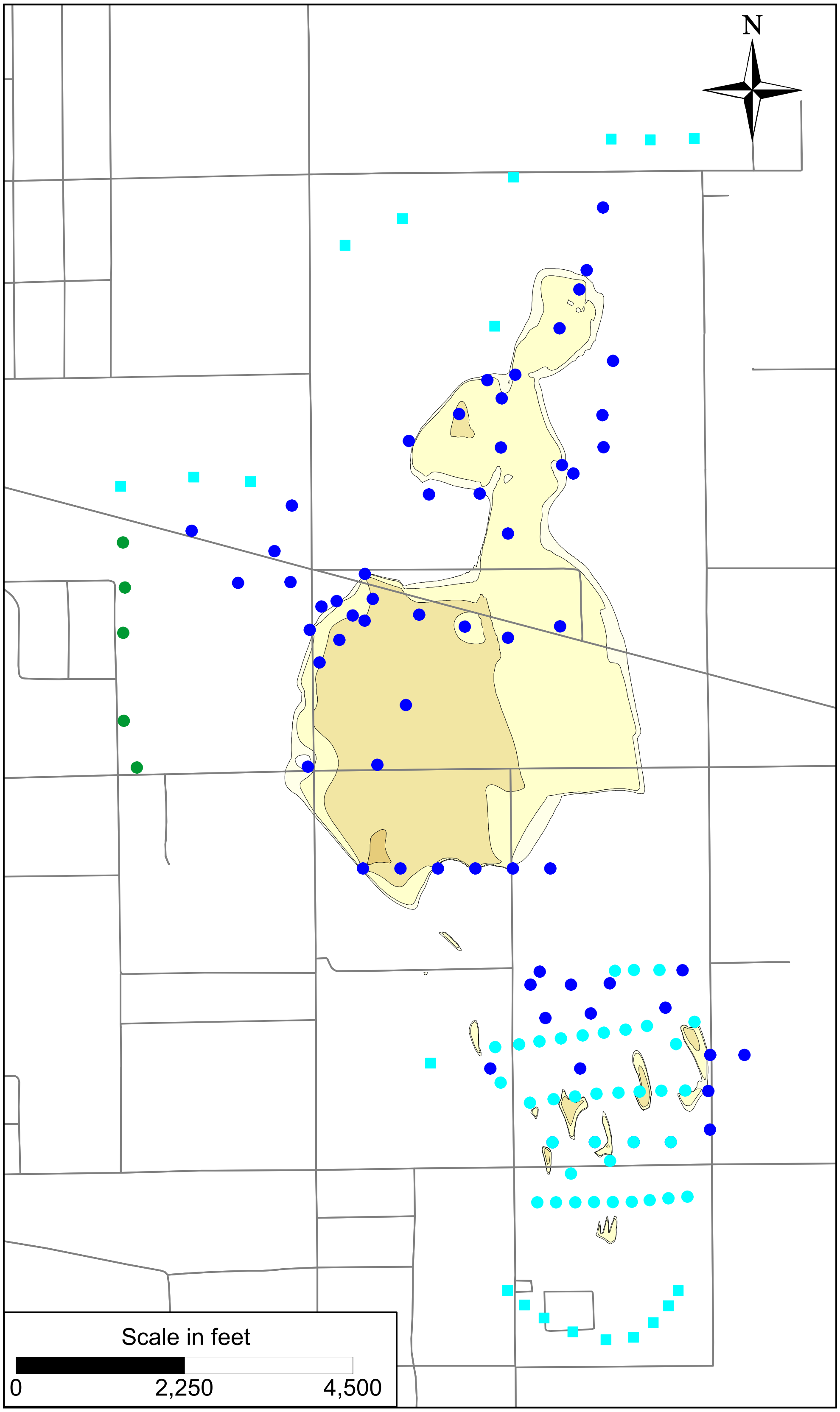
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

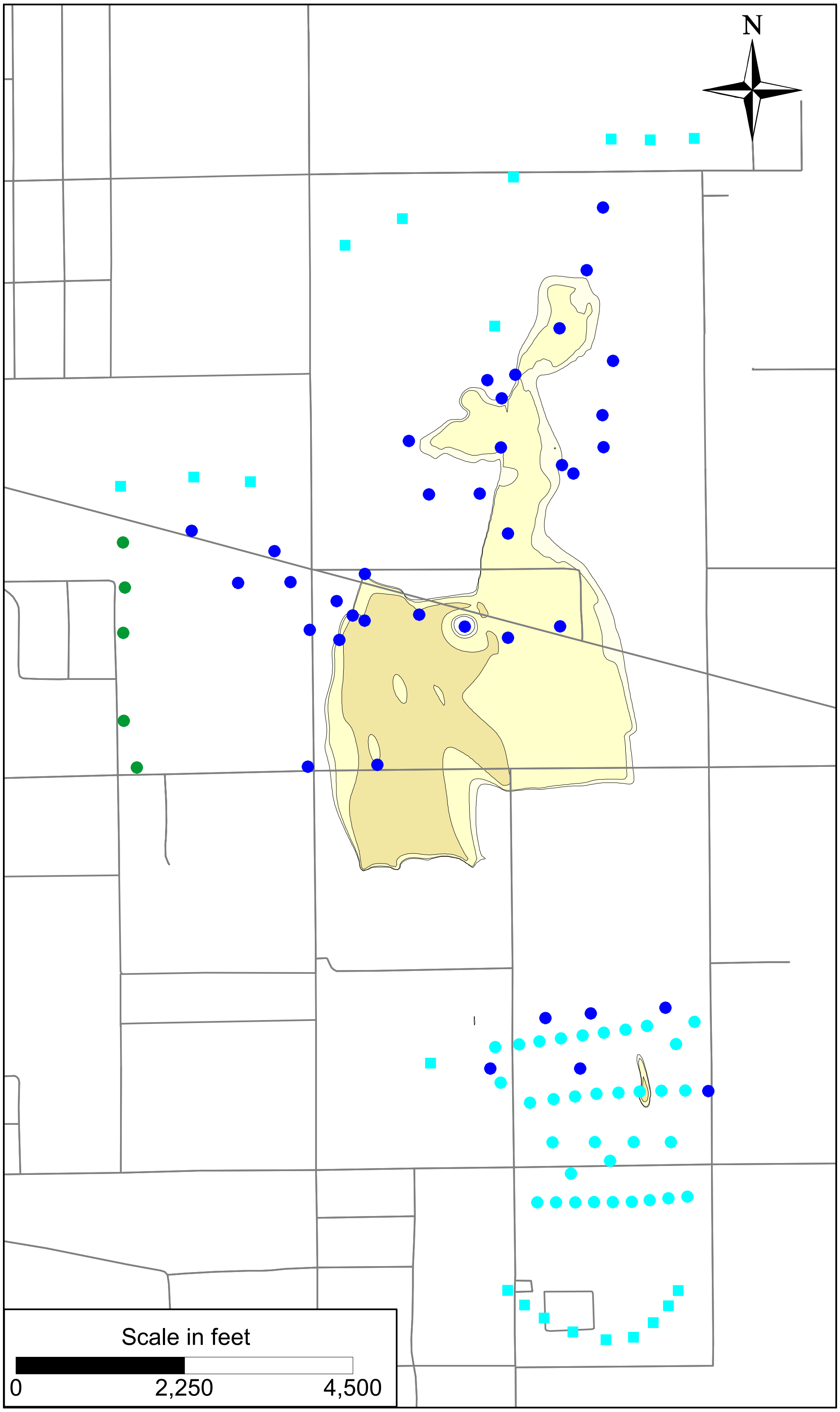
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

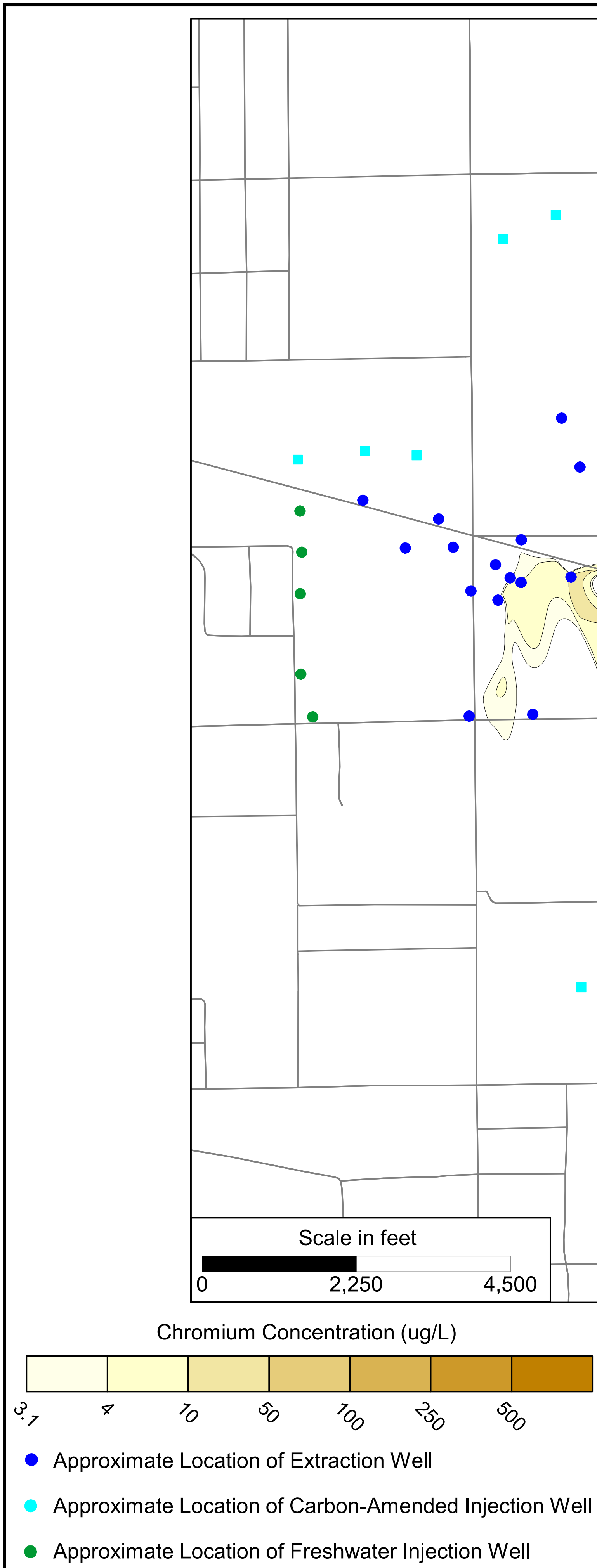
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11

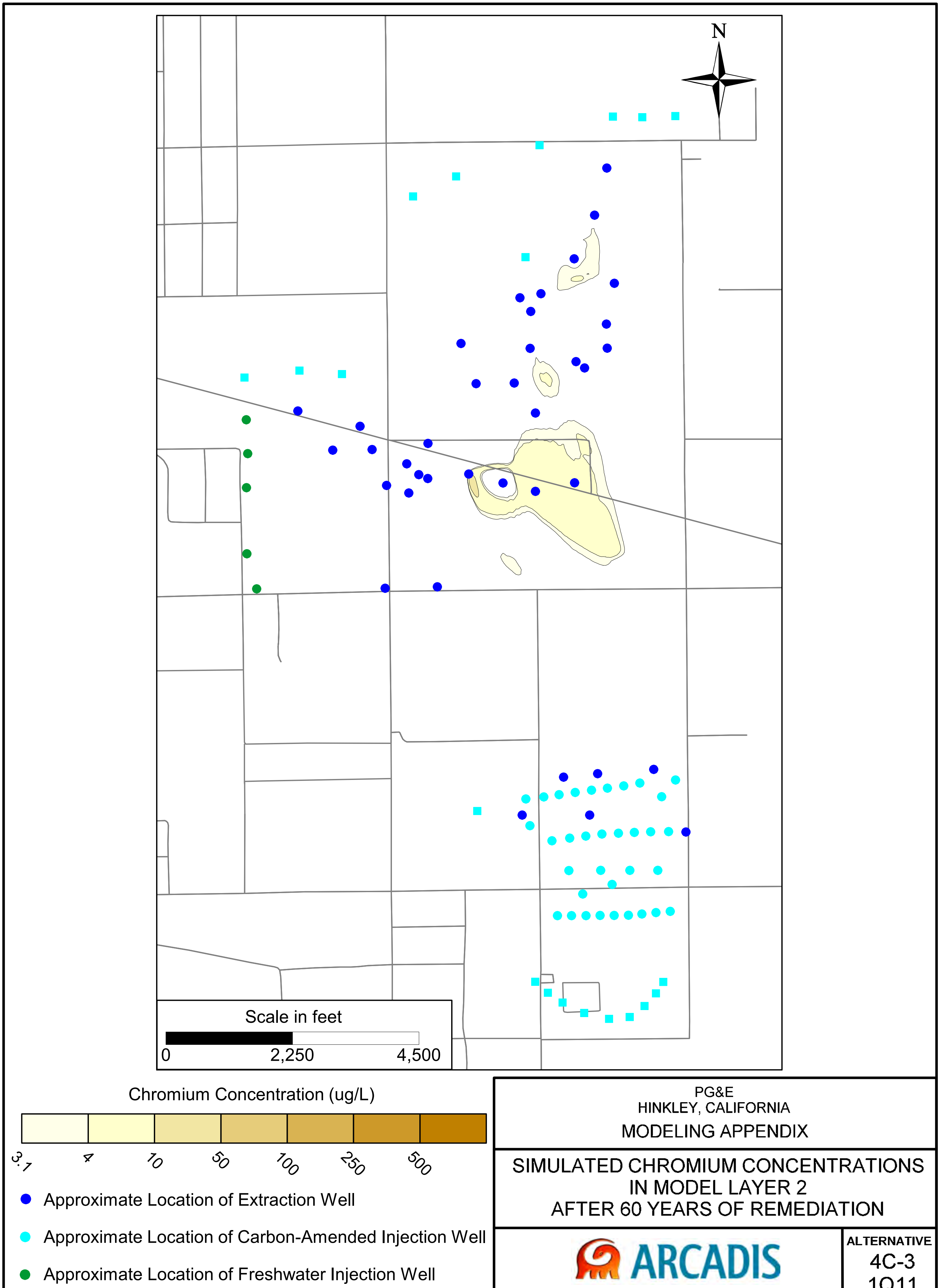


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11

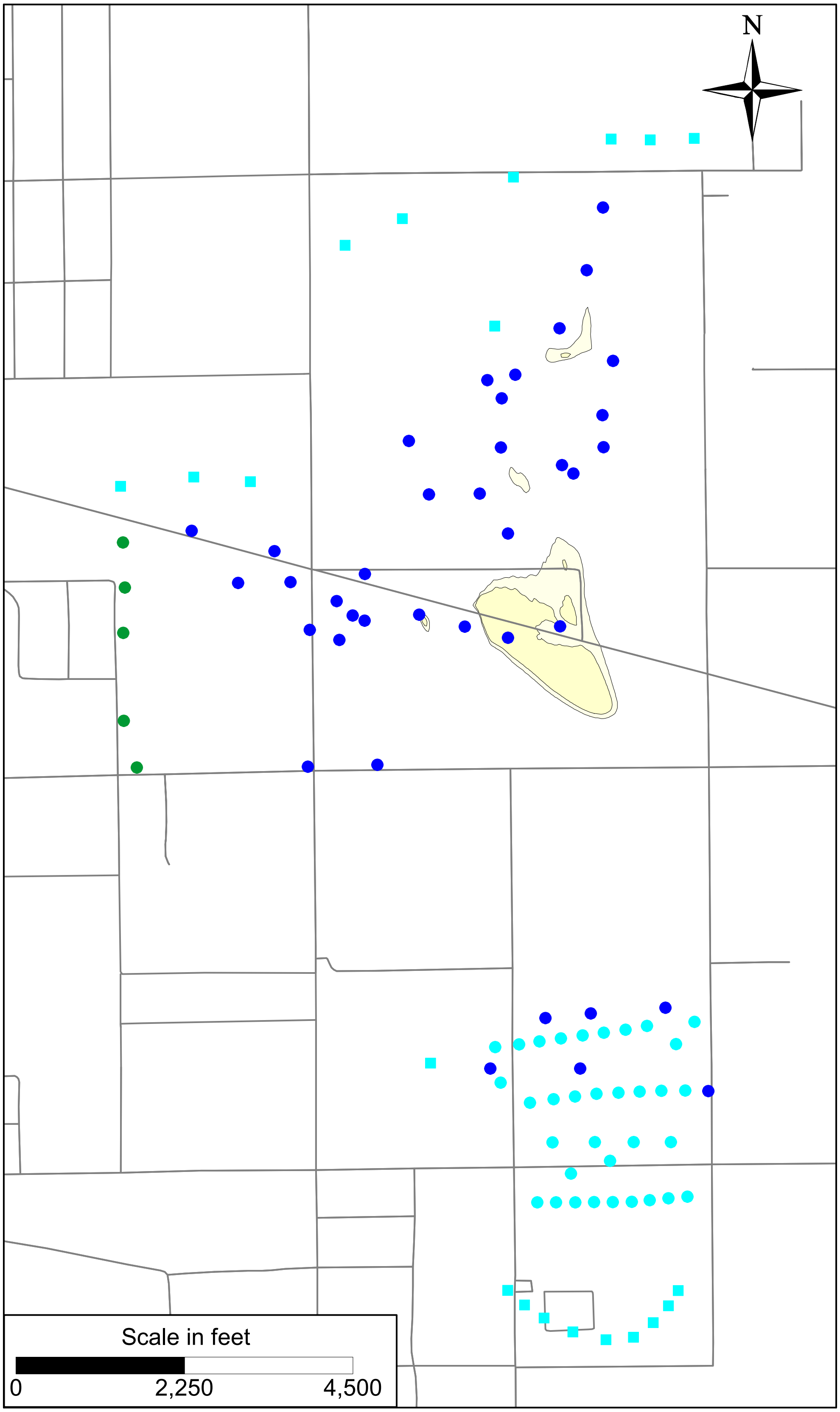


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

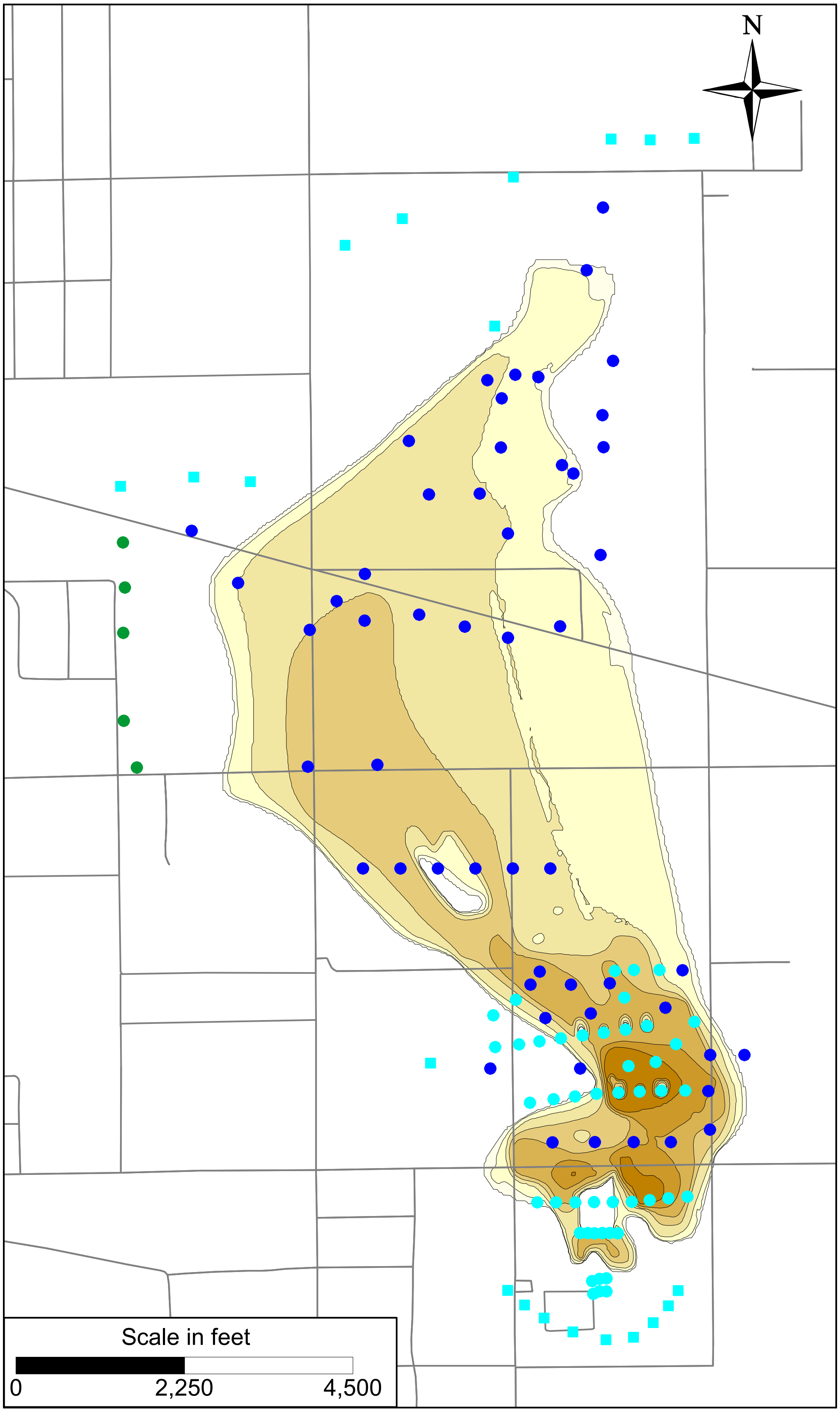
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

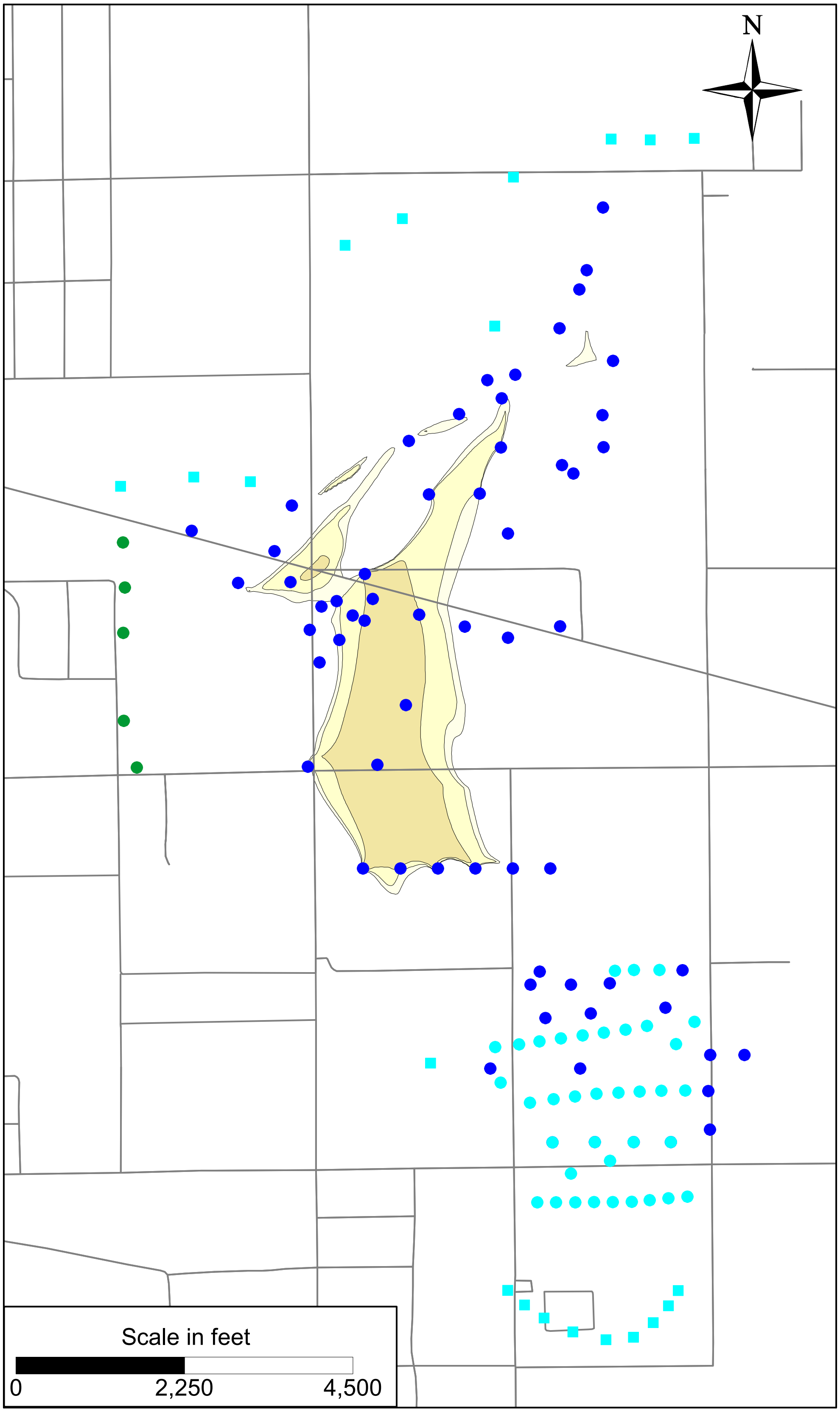
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

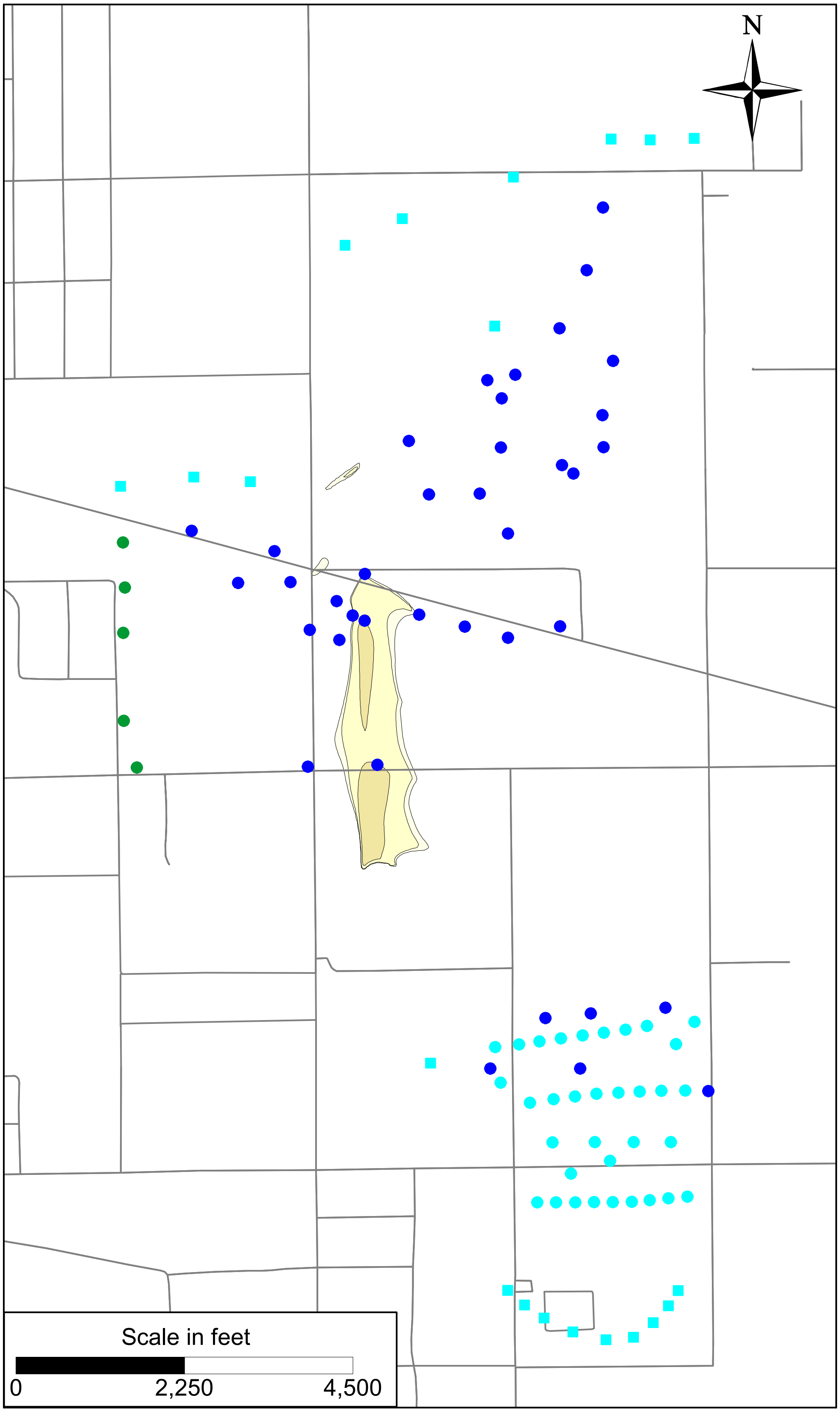
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

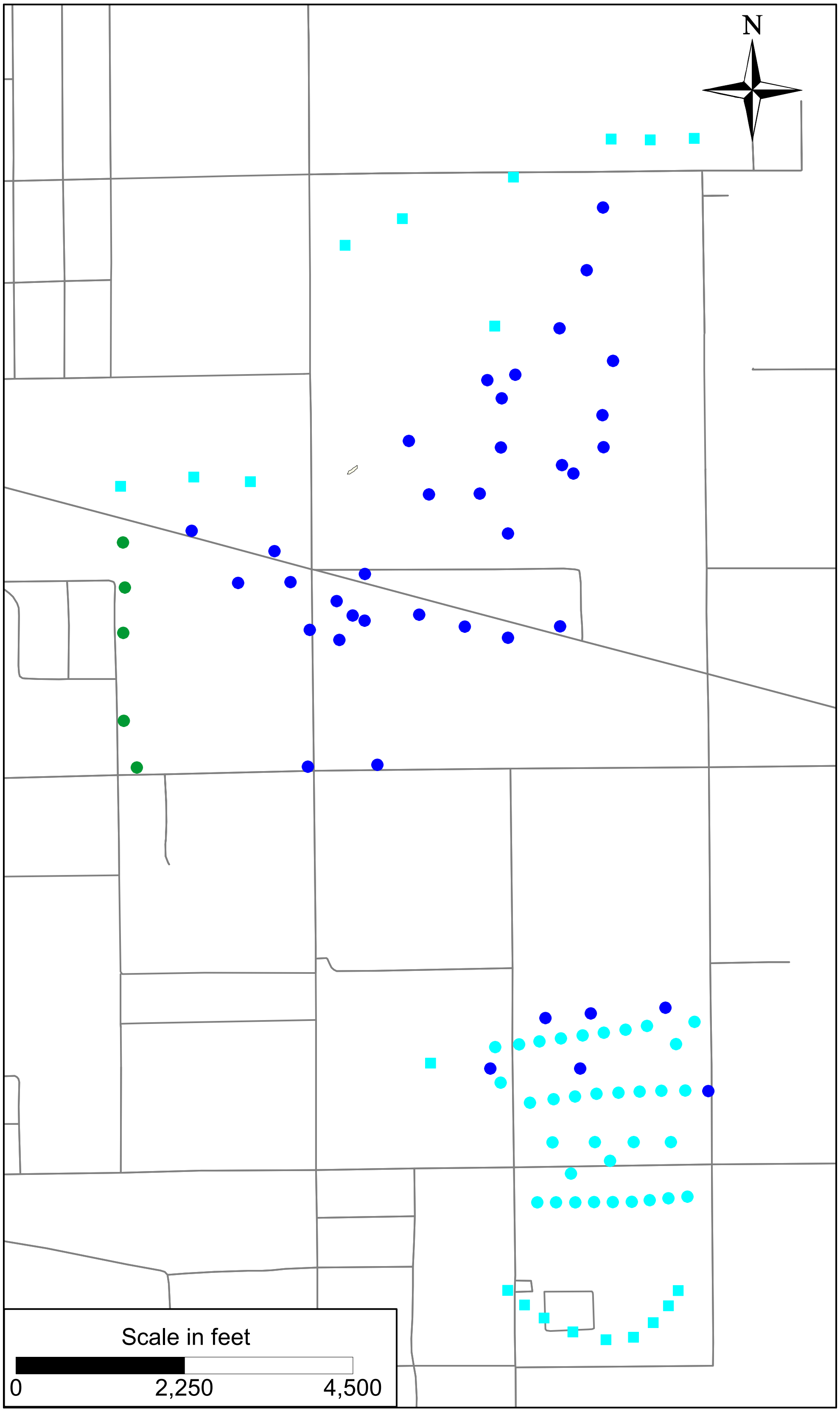
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-3
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

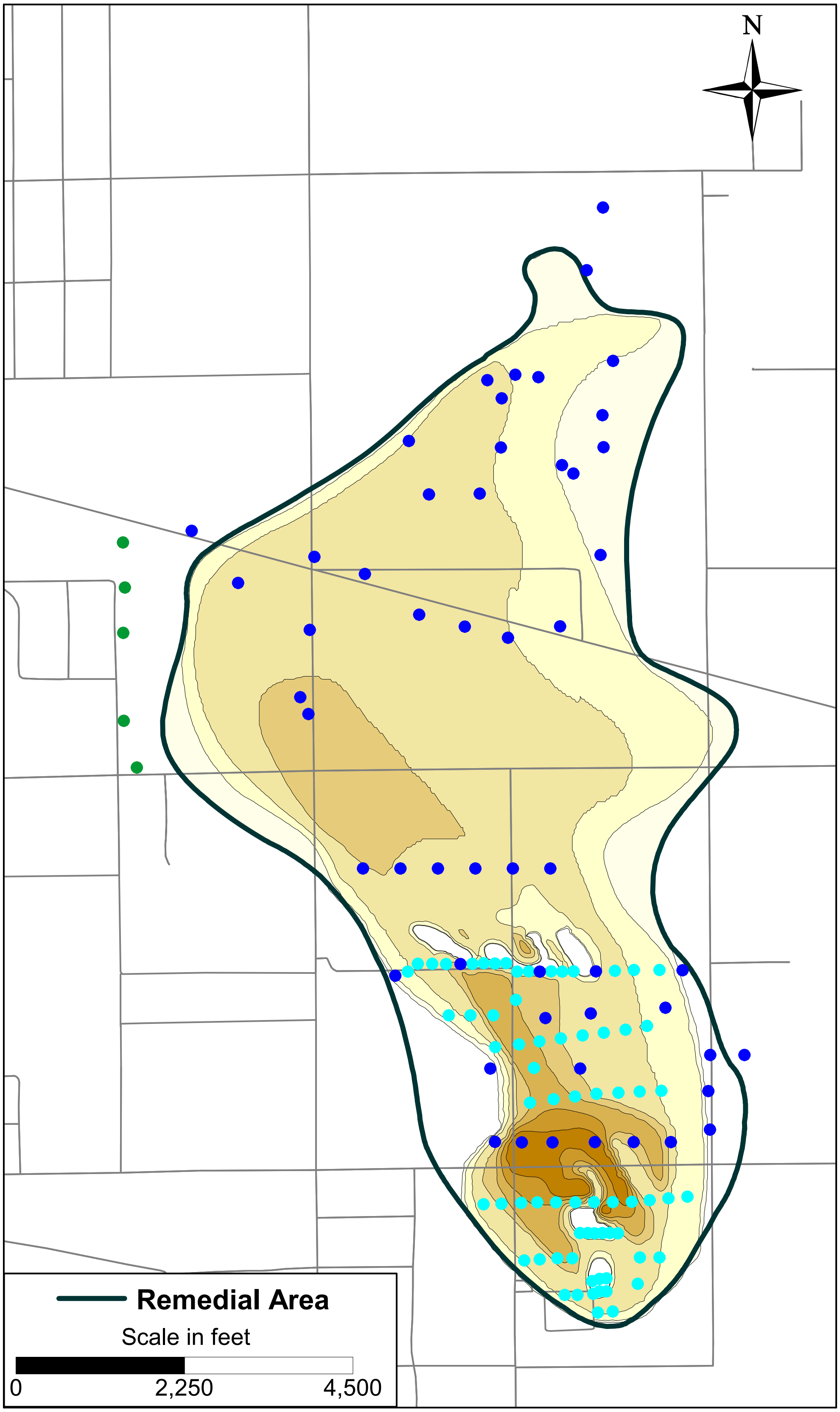
ARCADIS

ALTERNATIVE
4C-3
1Q11

ARCADIS

Attachment C-4

Solute Transport Results for Alternative 4C-4



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

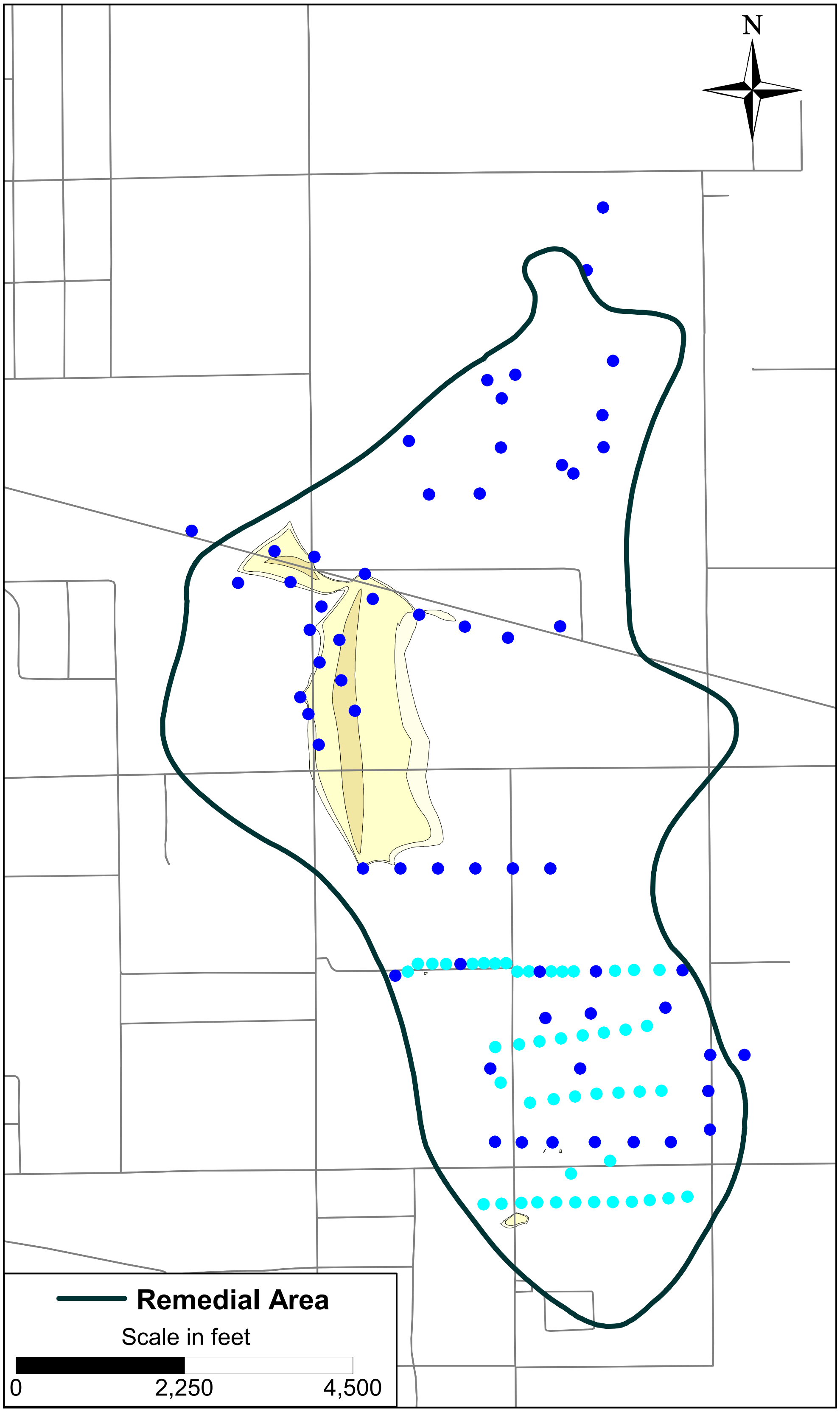
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

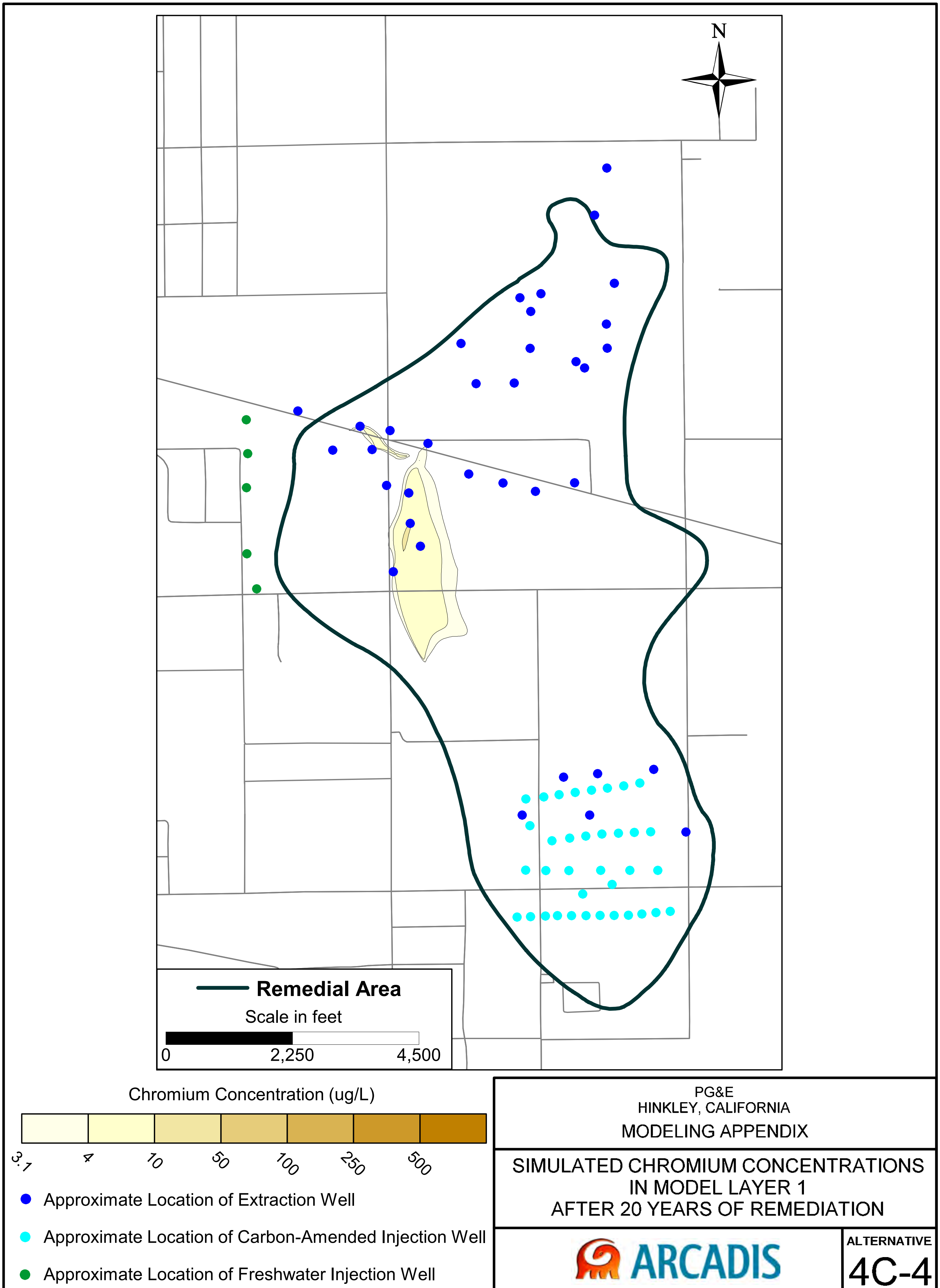
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4

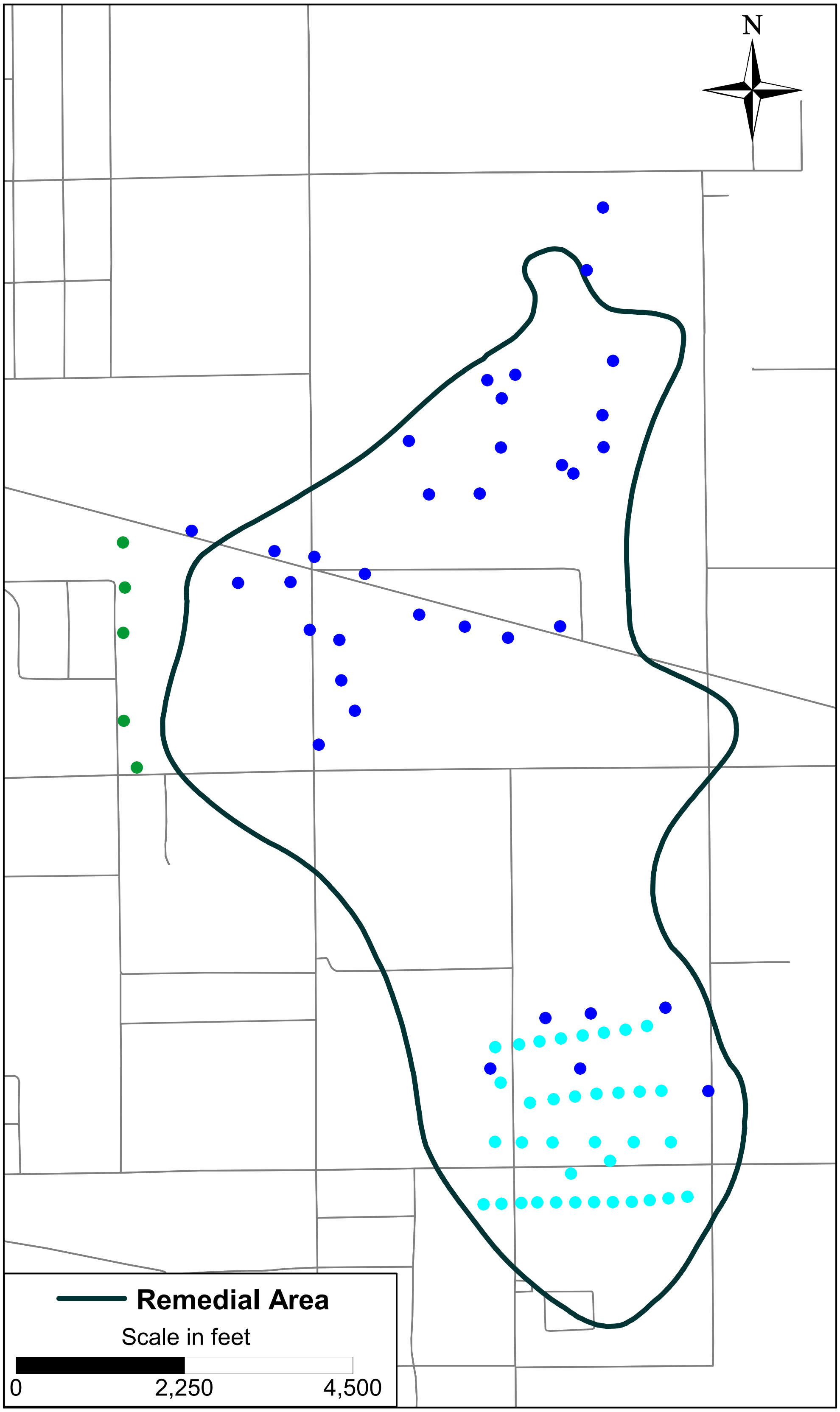


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

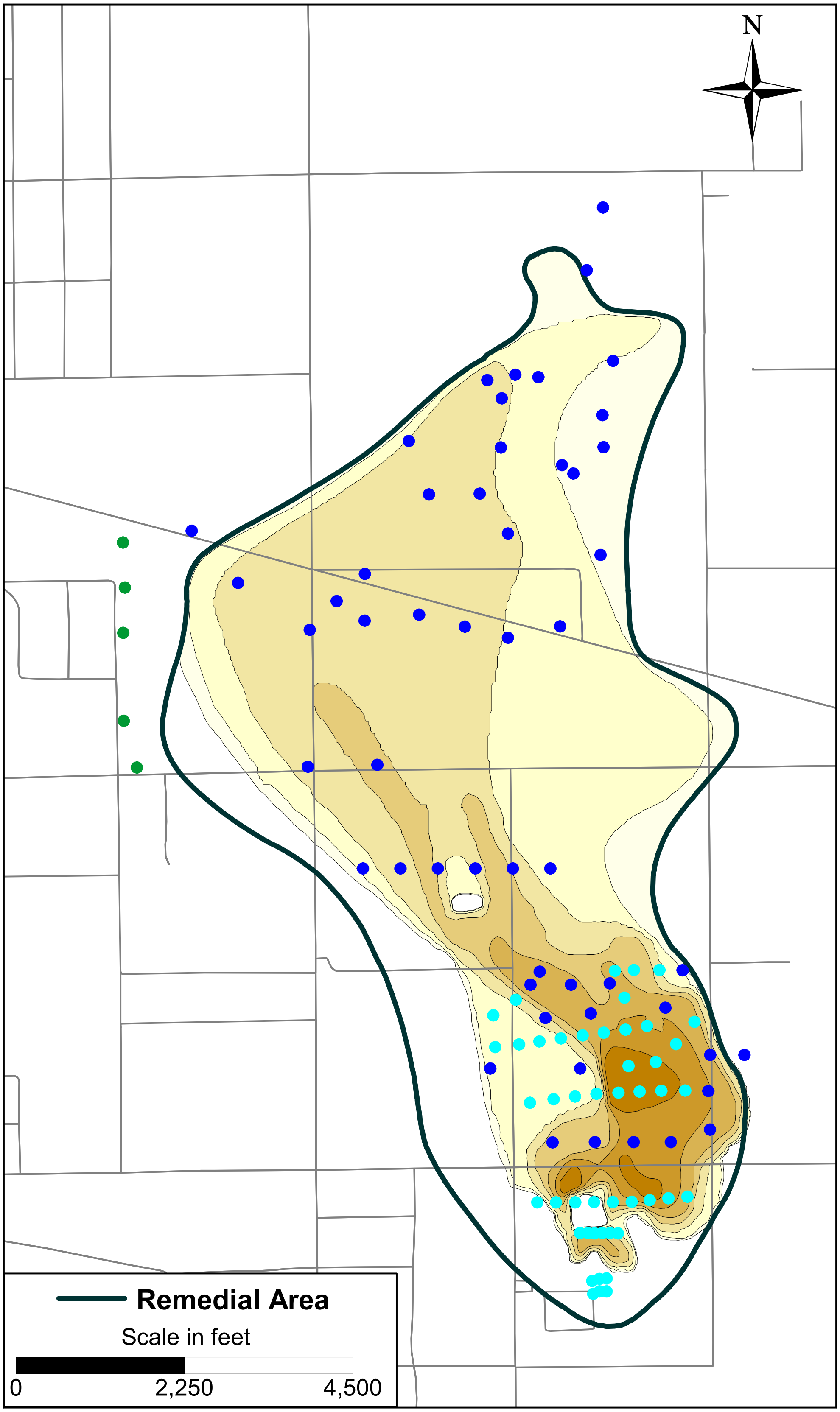
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

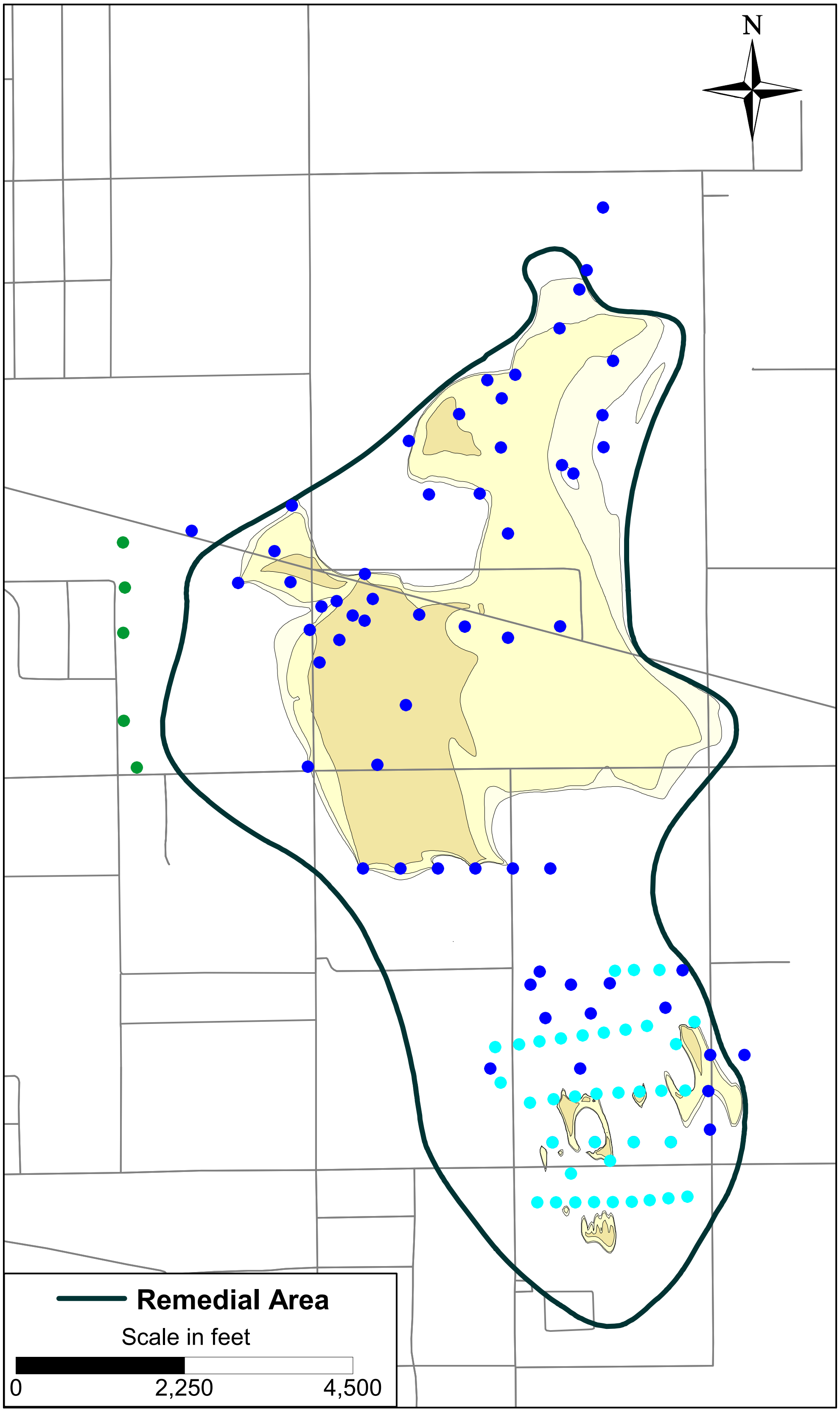
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

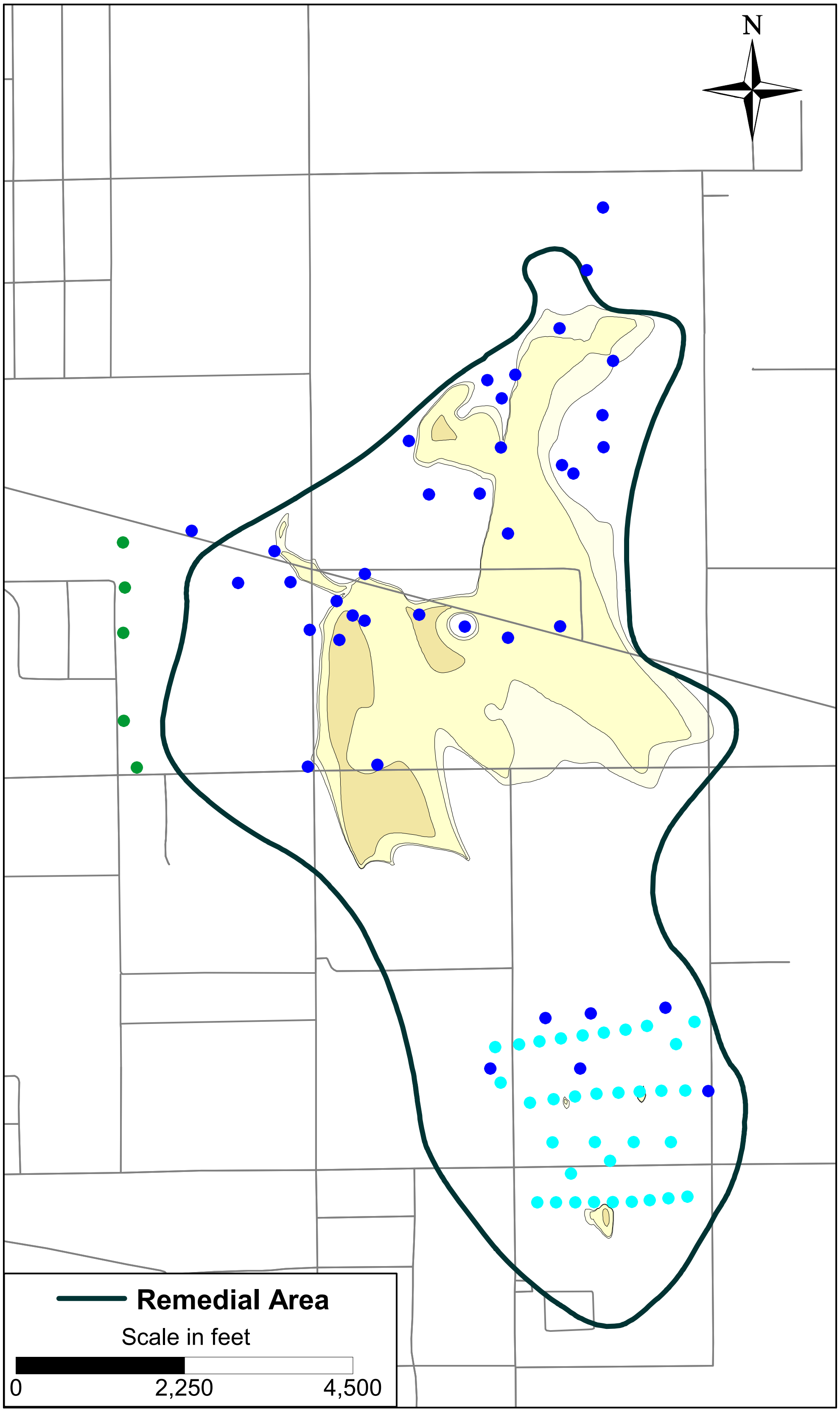
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA

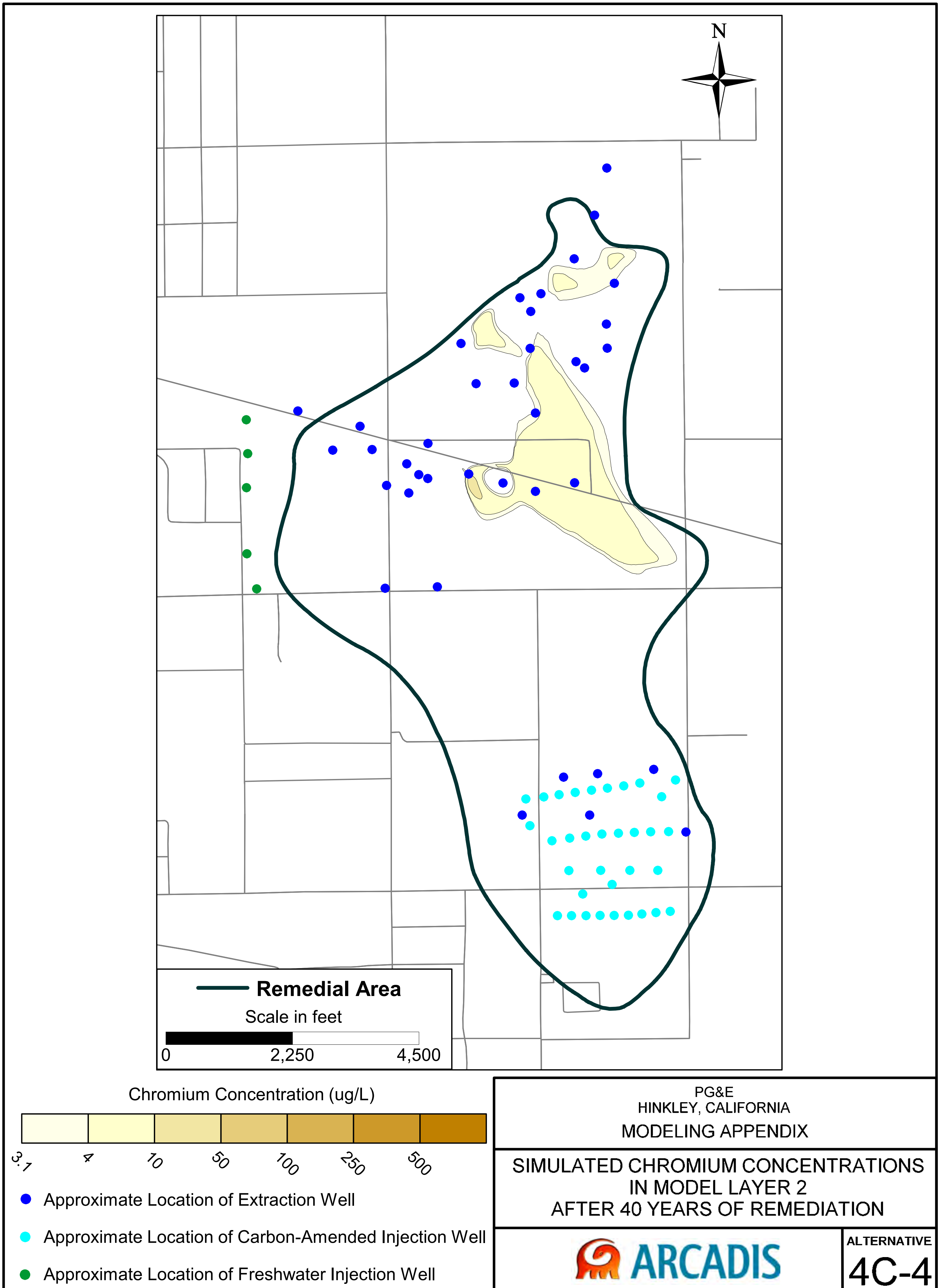
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE

4C-4

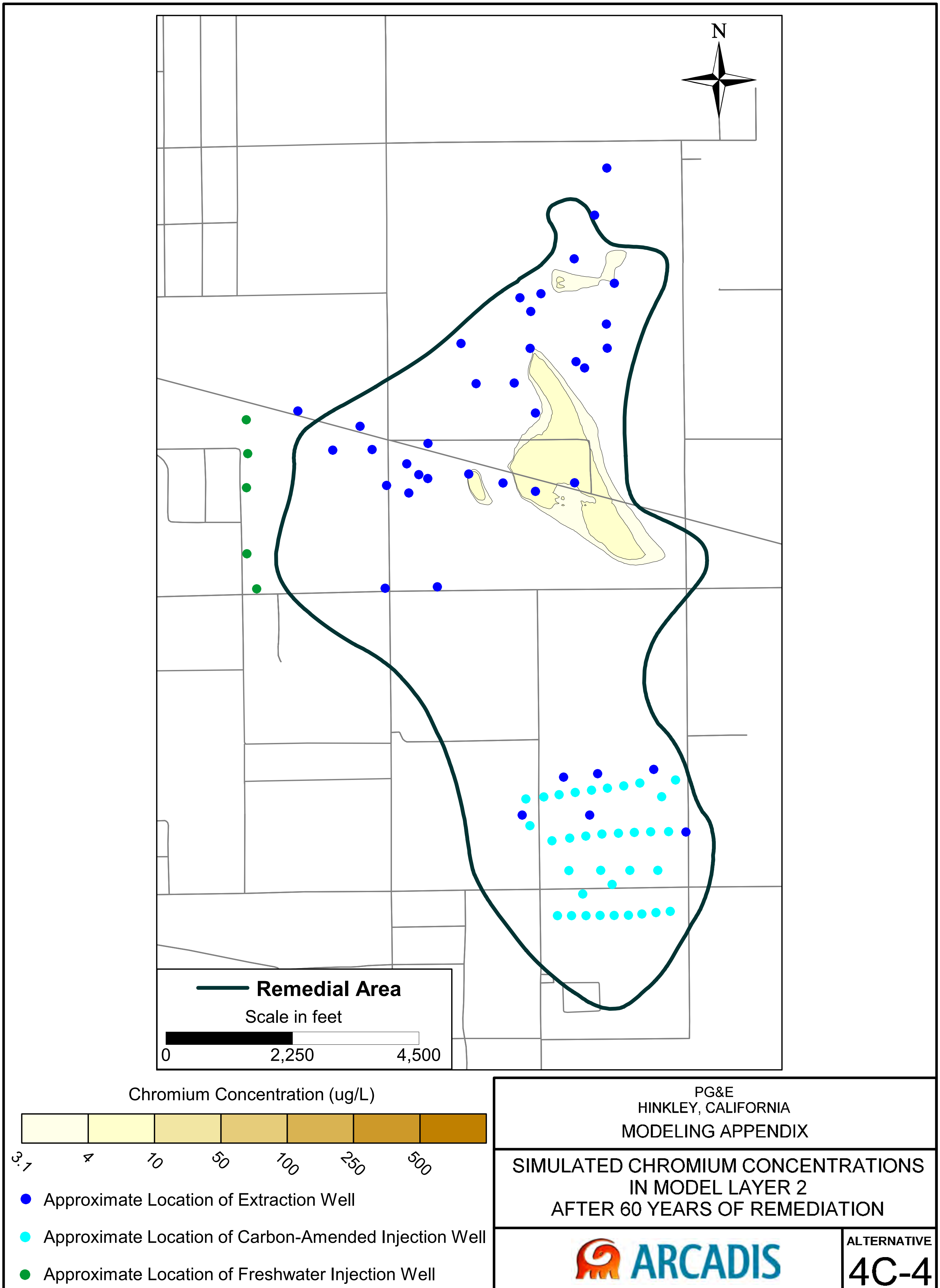


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4

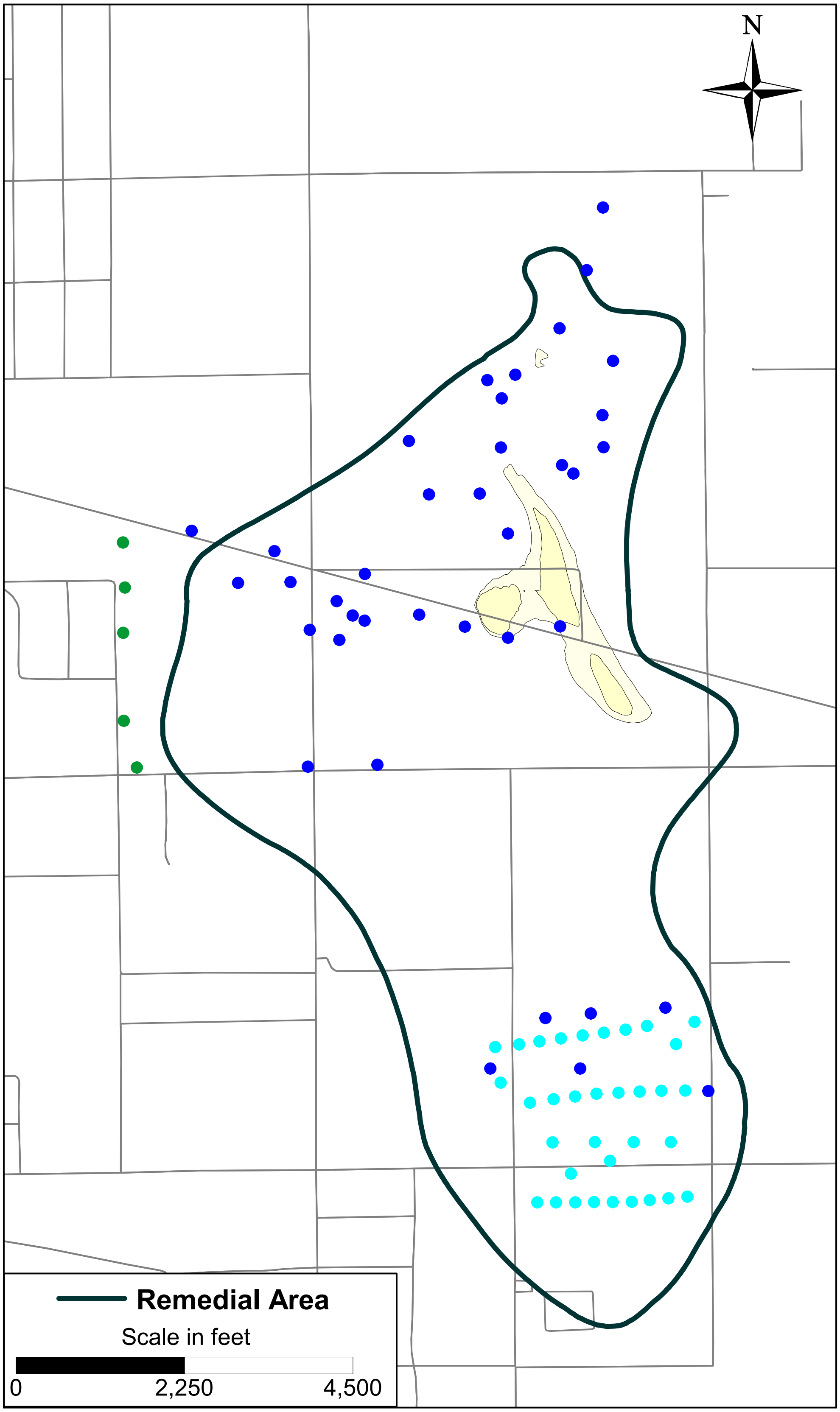


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

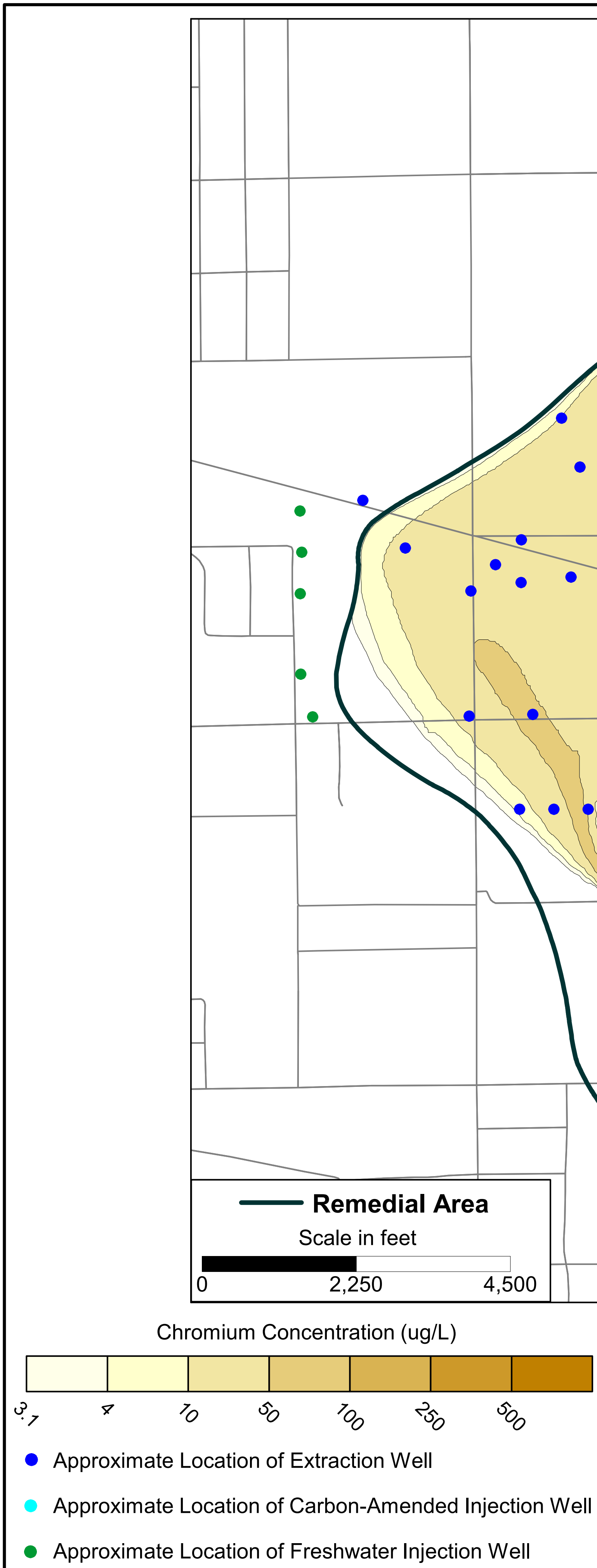
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4

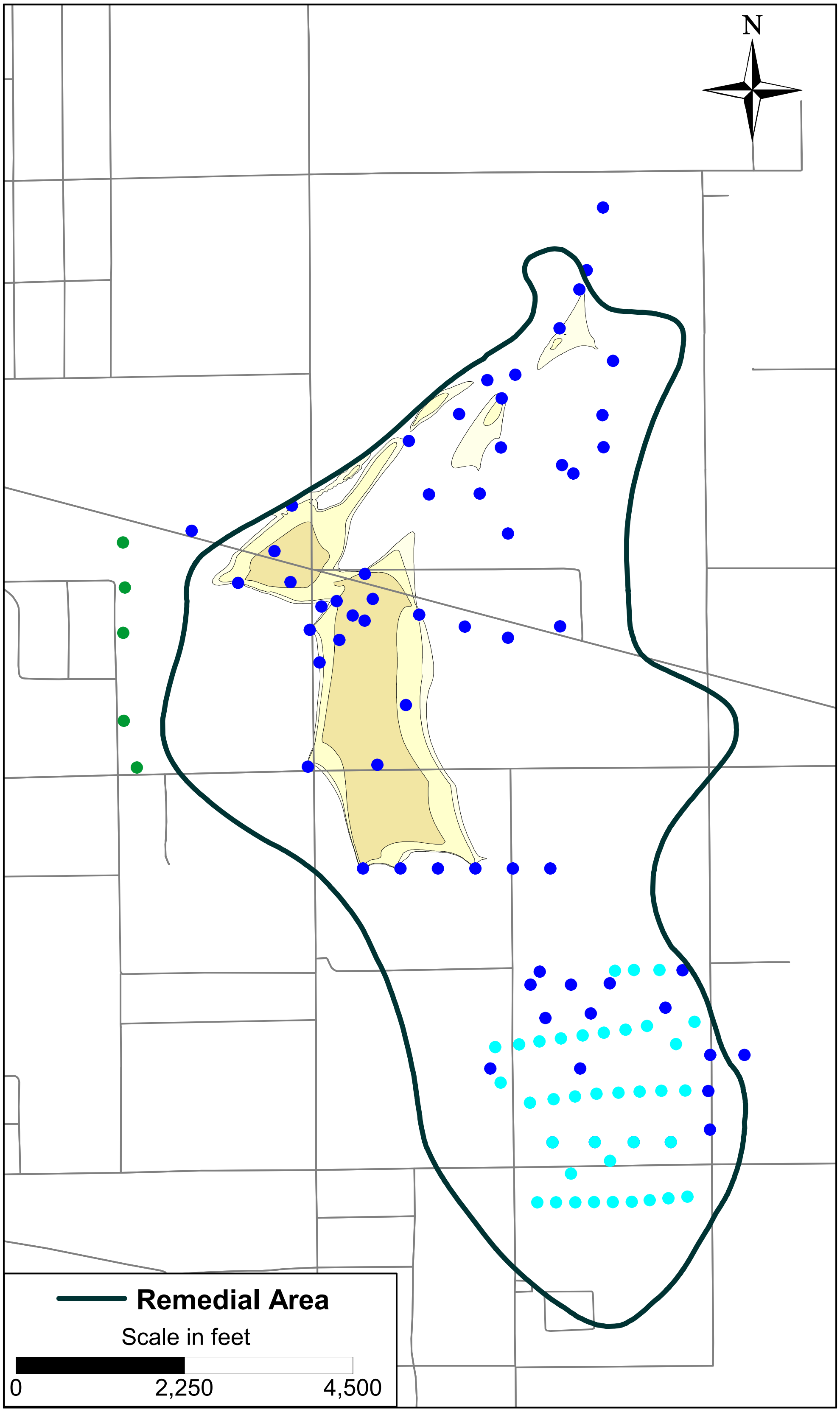


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

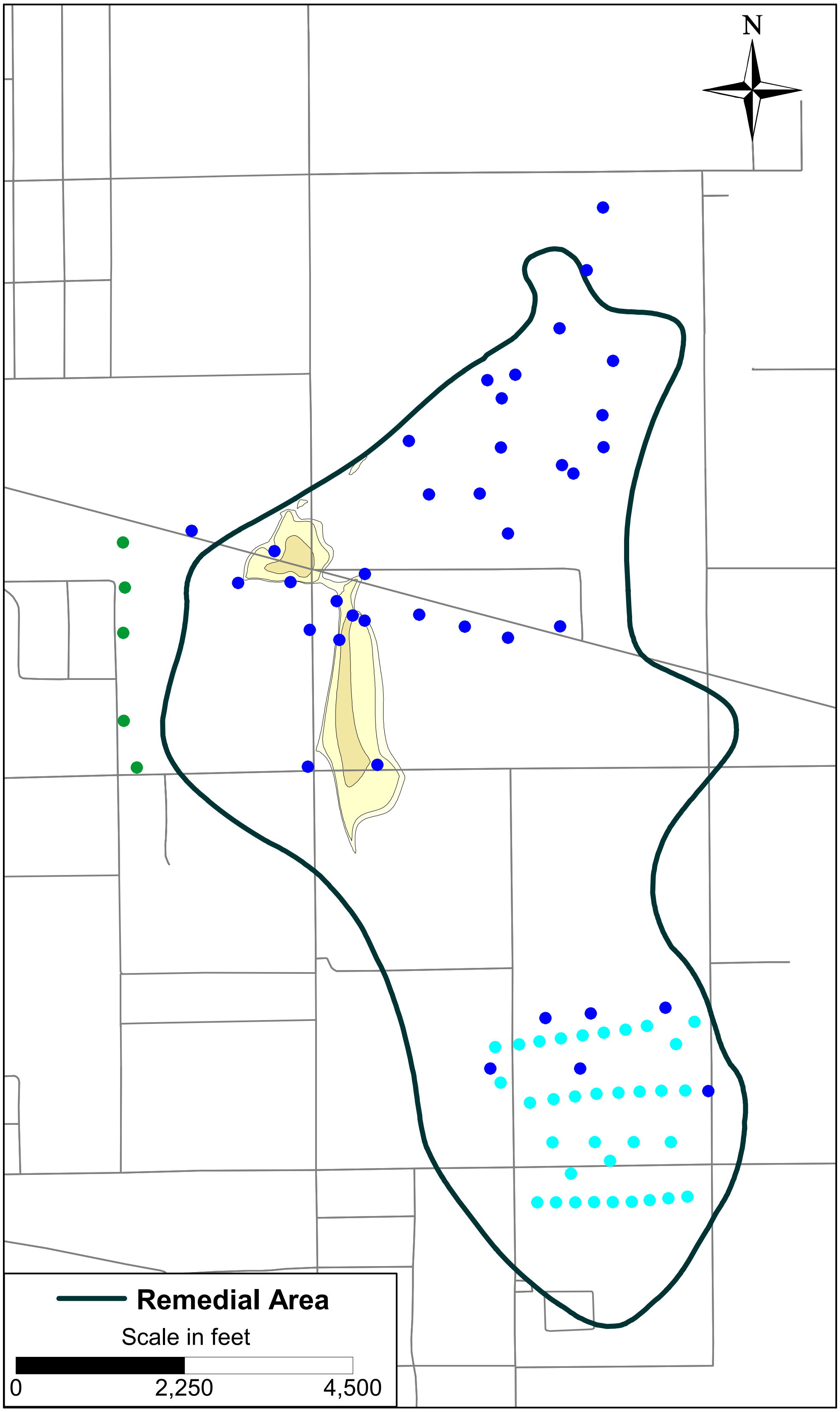
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

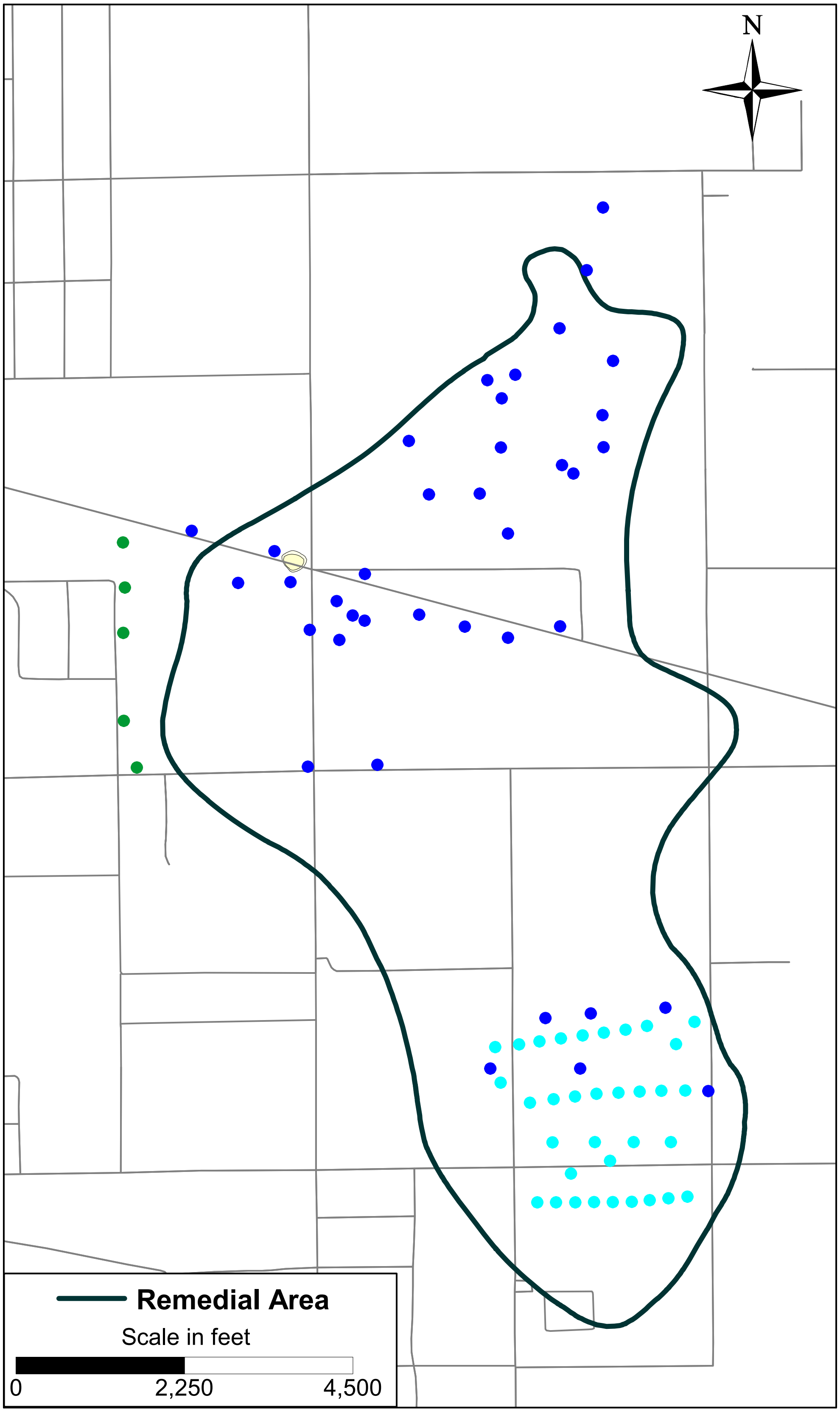
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

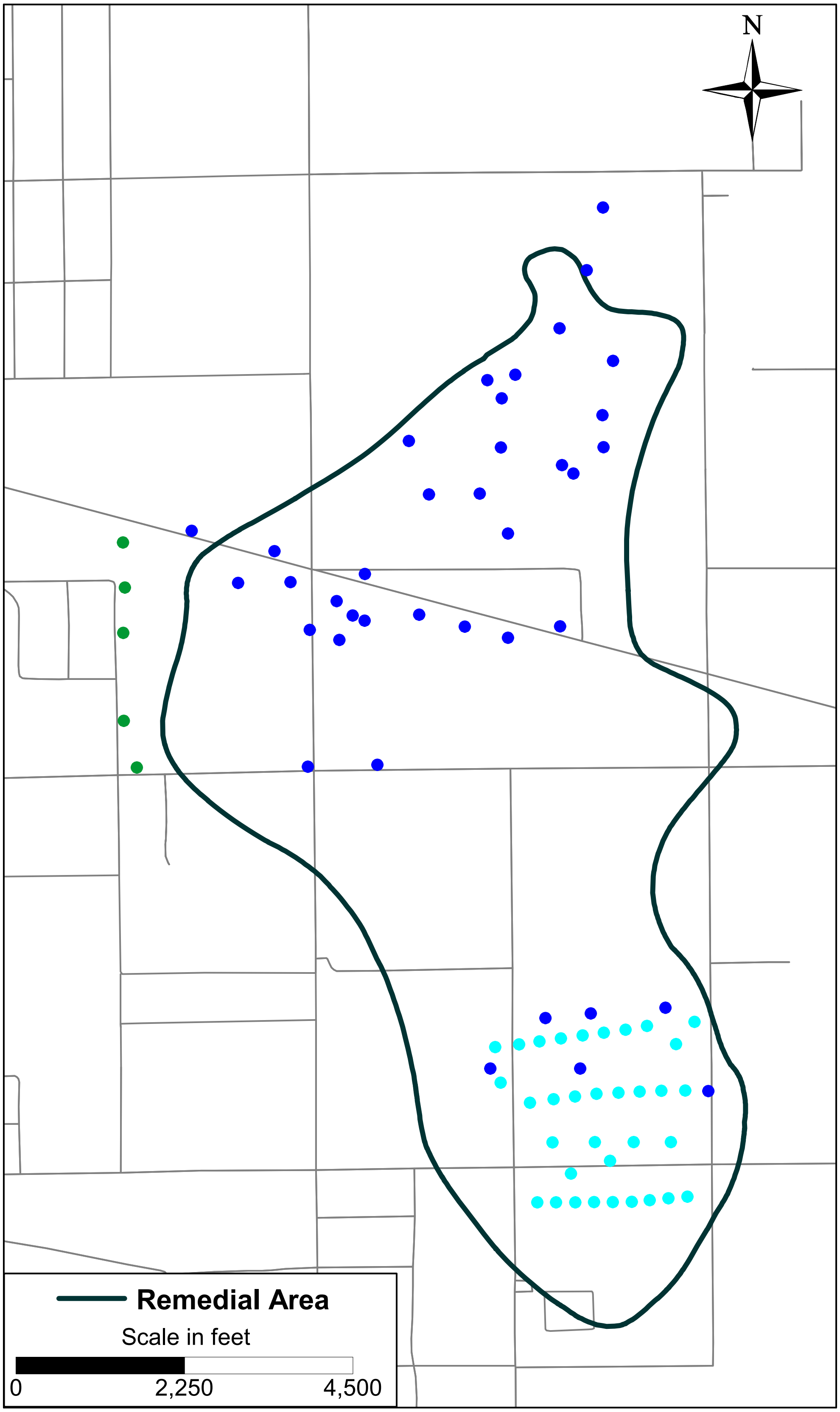
● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 60 YEARS OF REMEDIATION

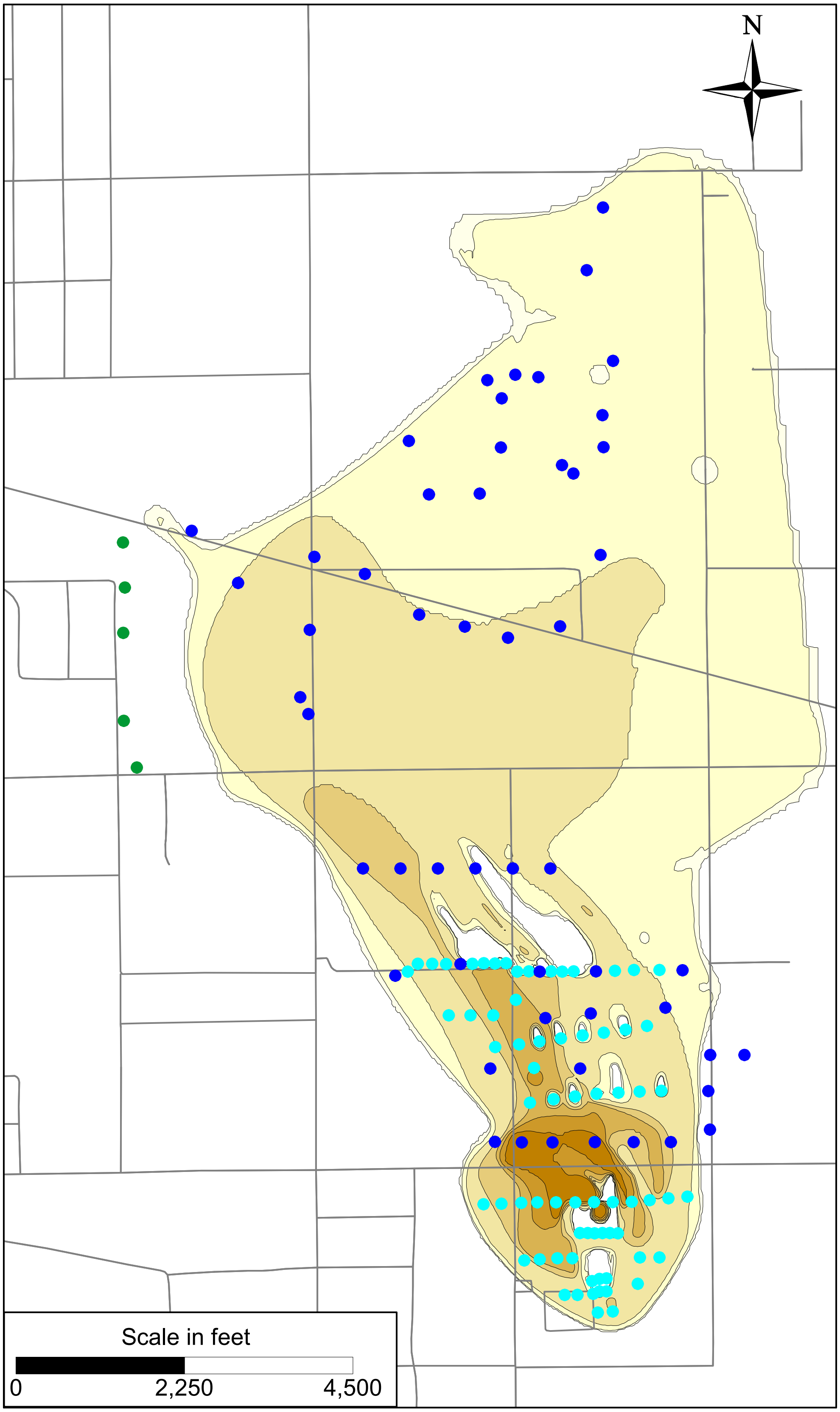
ARCADIS

ALTERNATIVE
4C-4

ARCADIS

Attachment C-4

1Q11 Figures



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

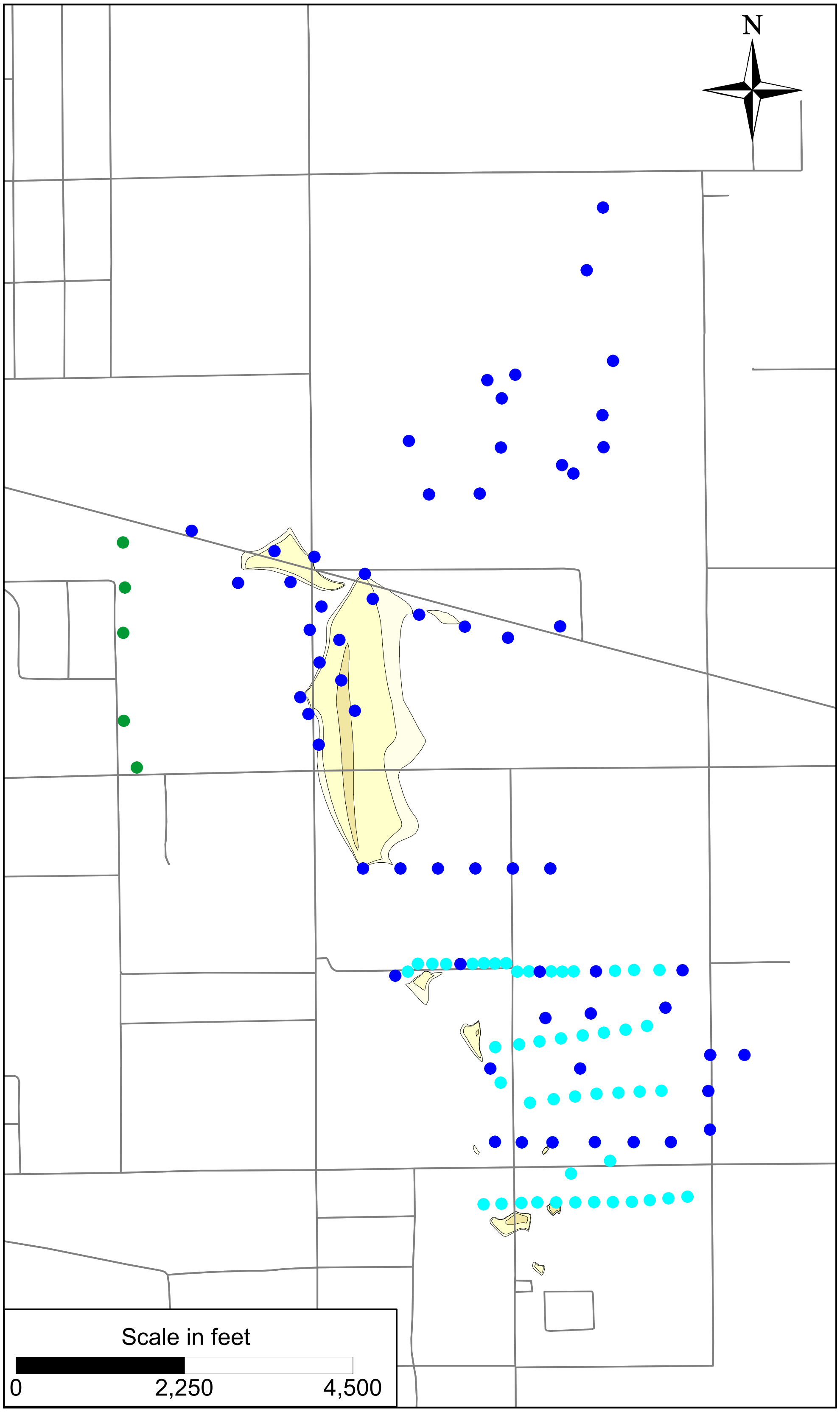
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

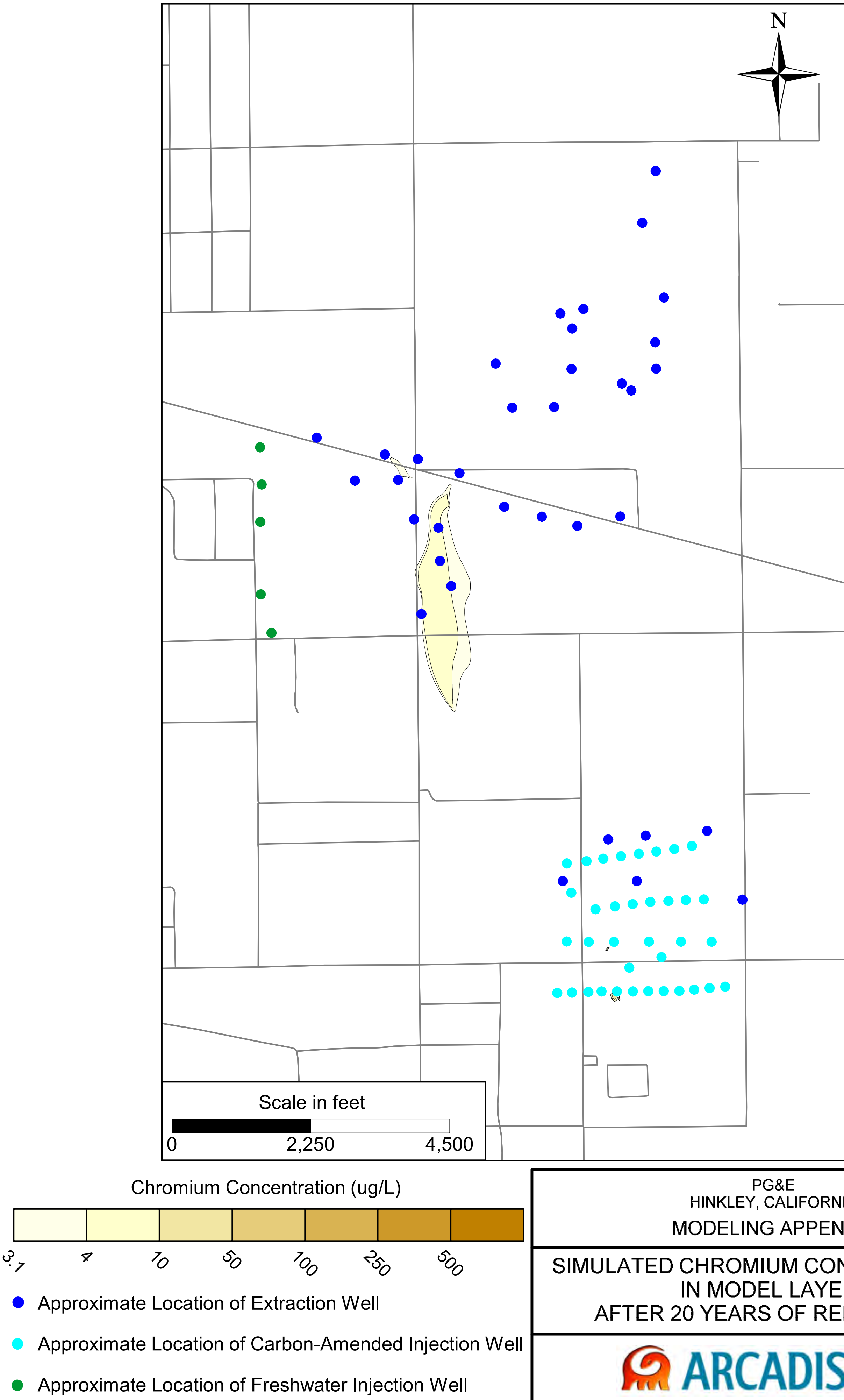
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11

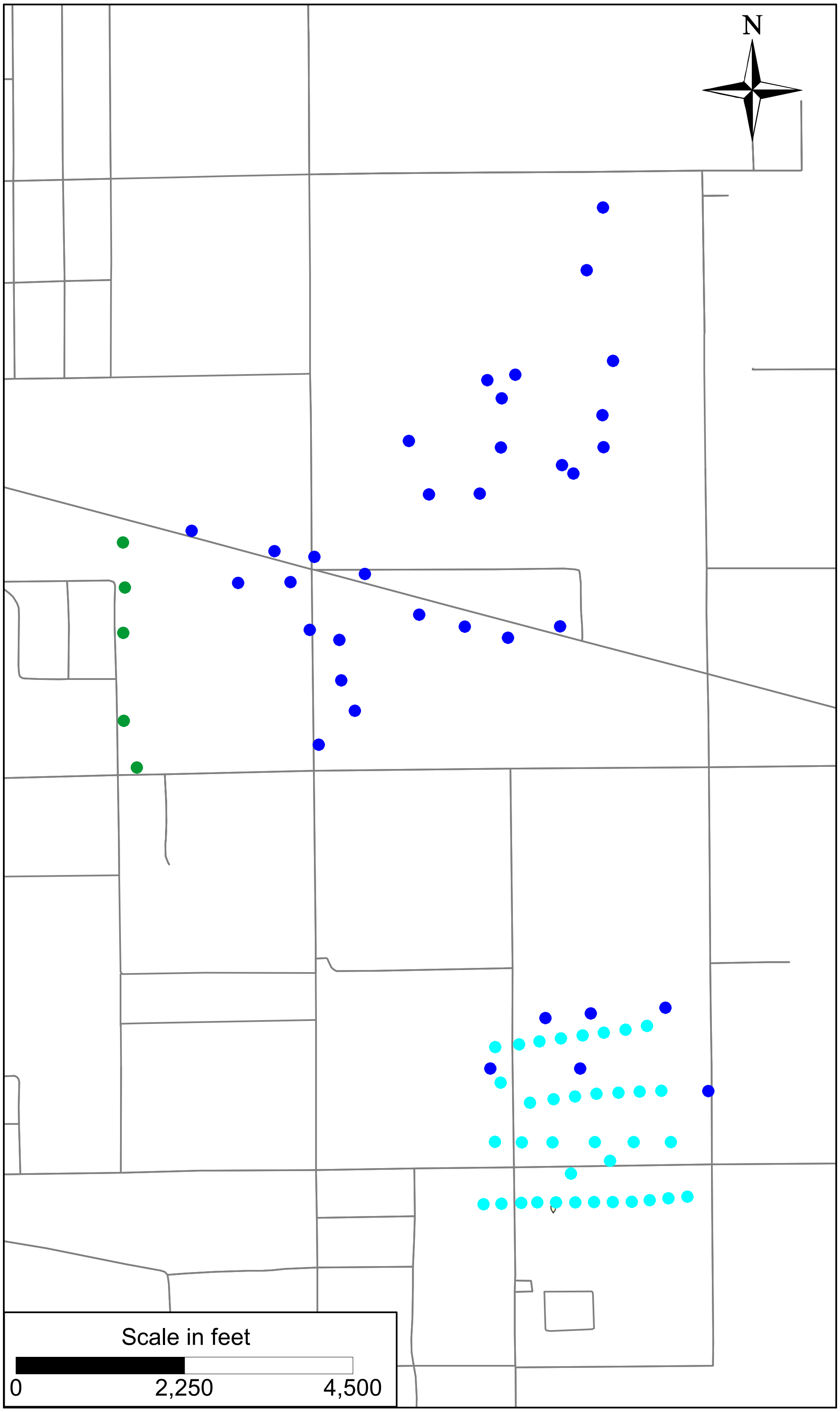


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

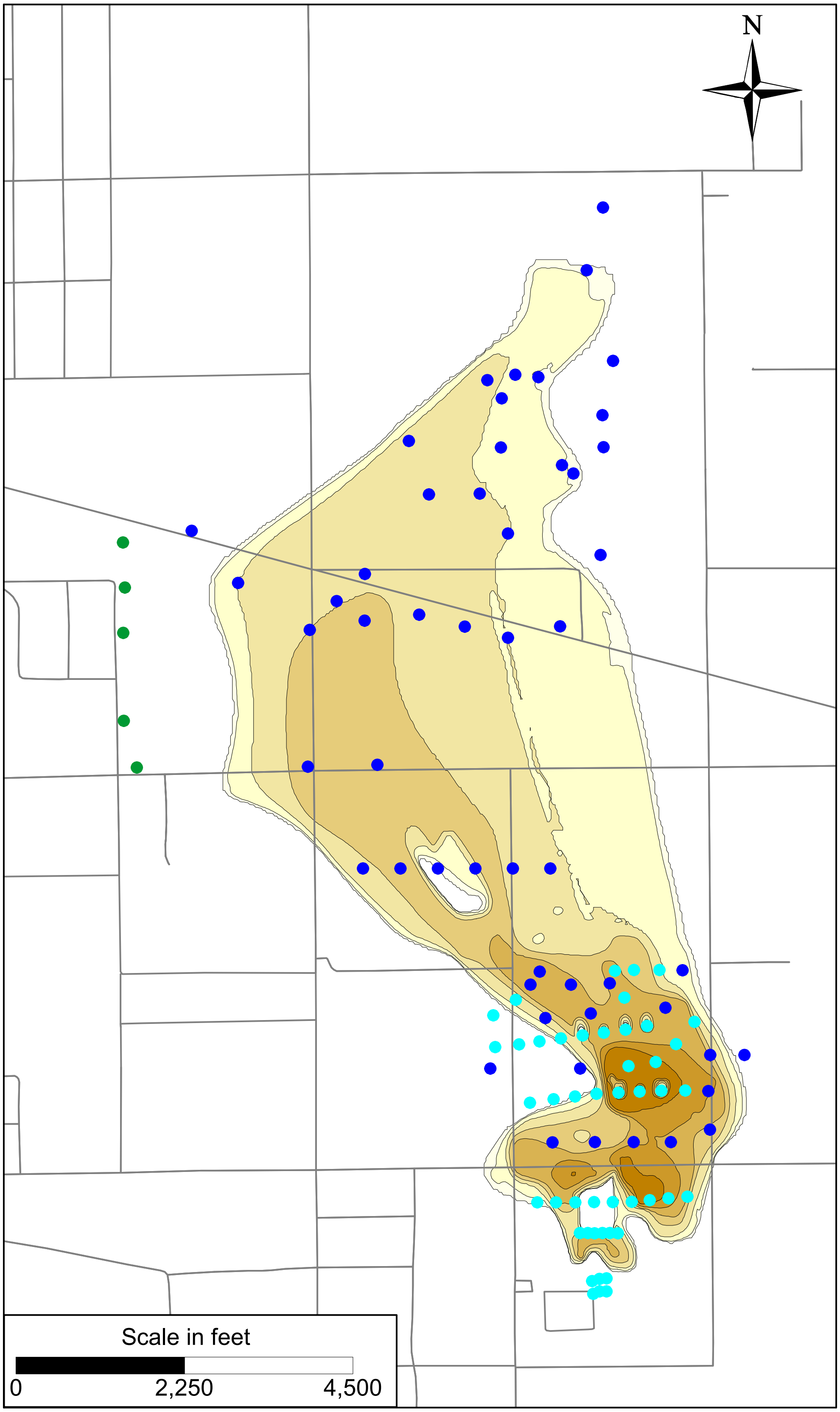
PG&E
HINKLEY, CALIFORNIA

MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 1
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1	4	10	50	100	250	500

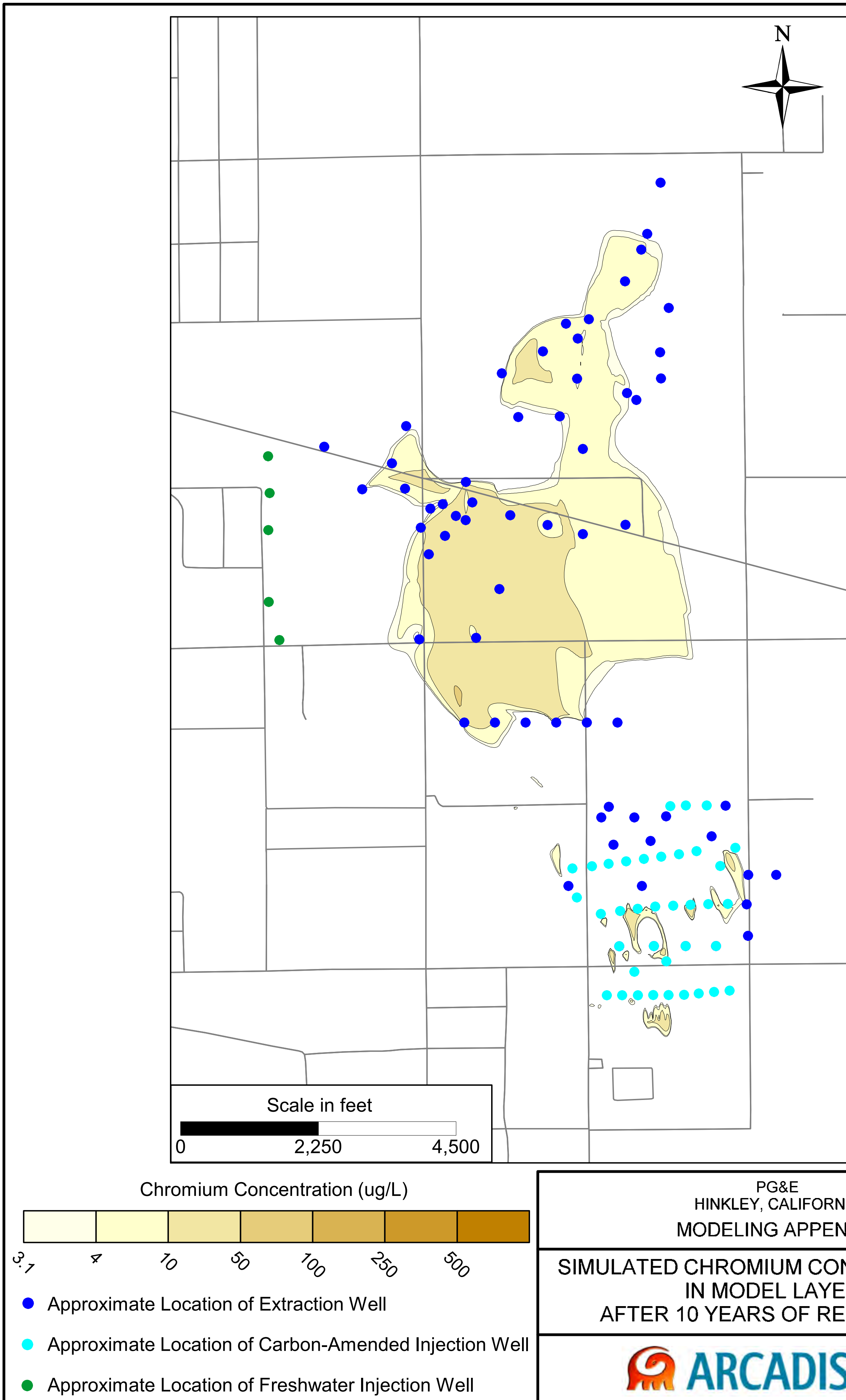
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 2

ARCADIS

ALTERNATIVE
4C-4
1Q11

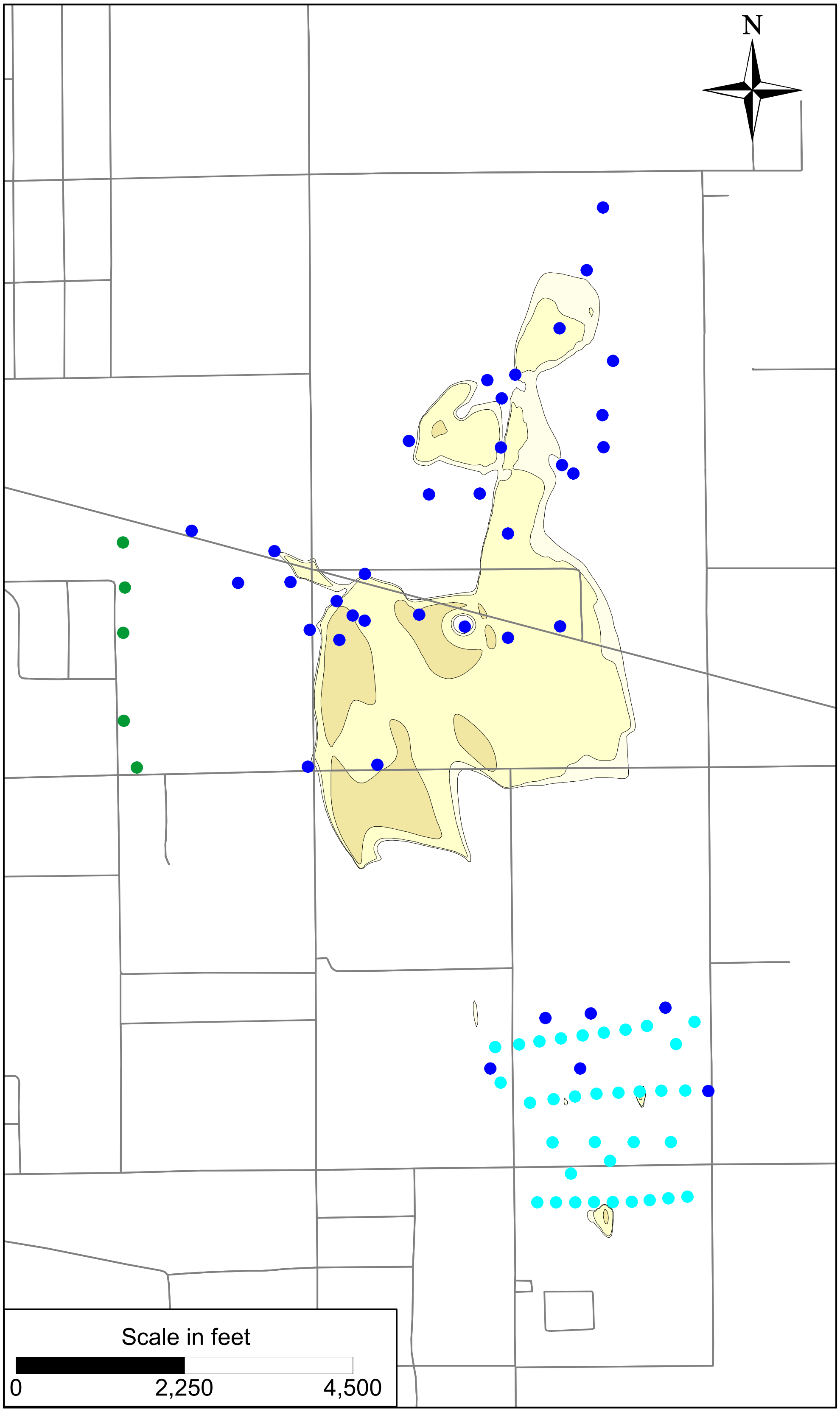


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

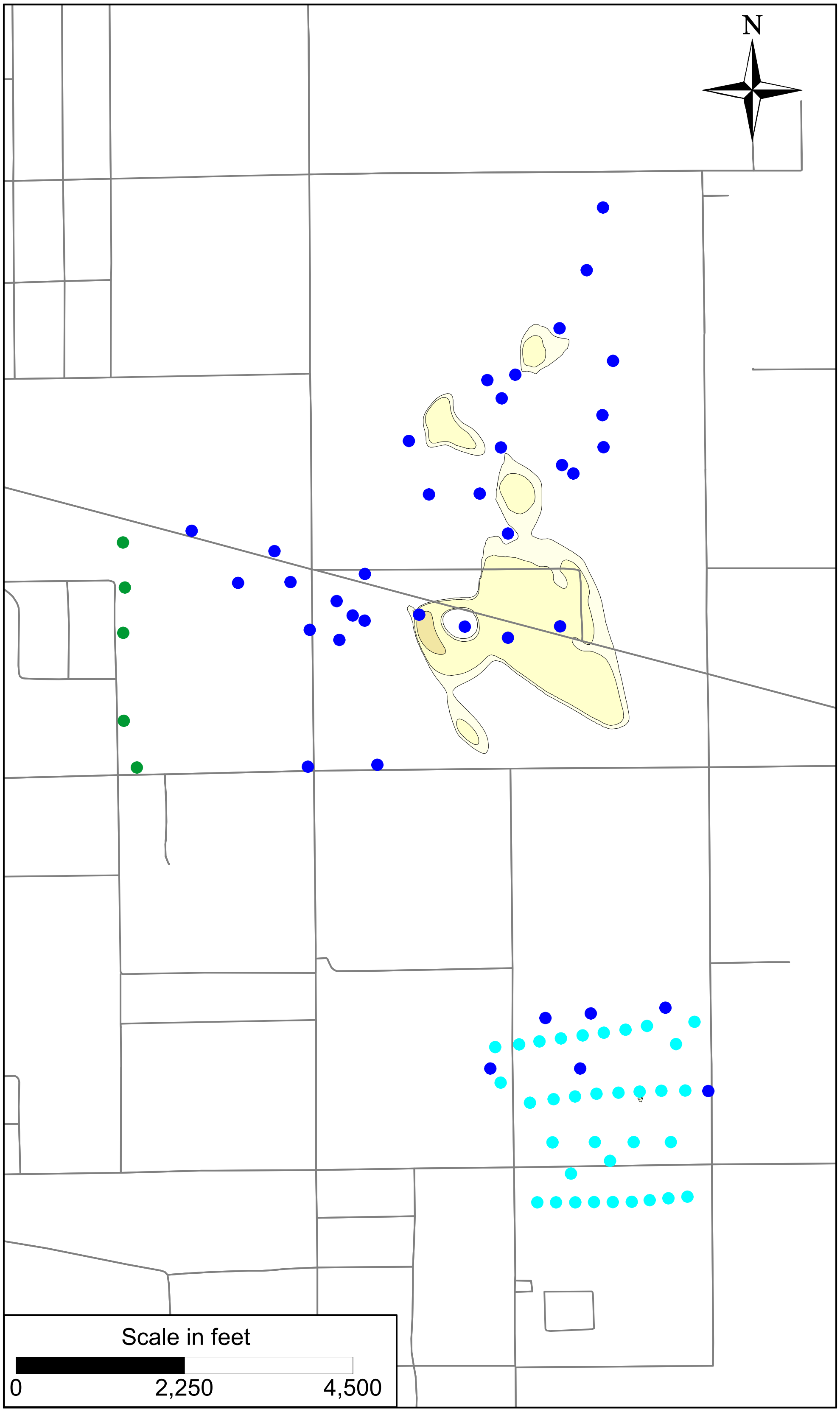
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1 | 4 | 10 | 50 | 100 | 250 | 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

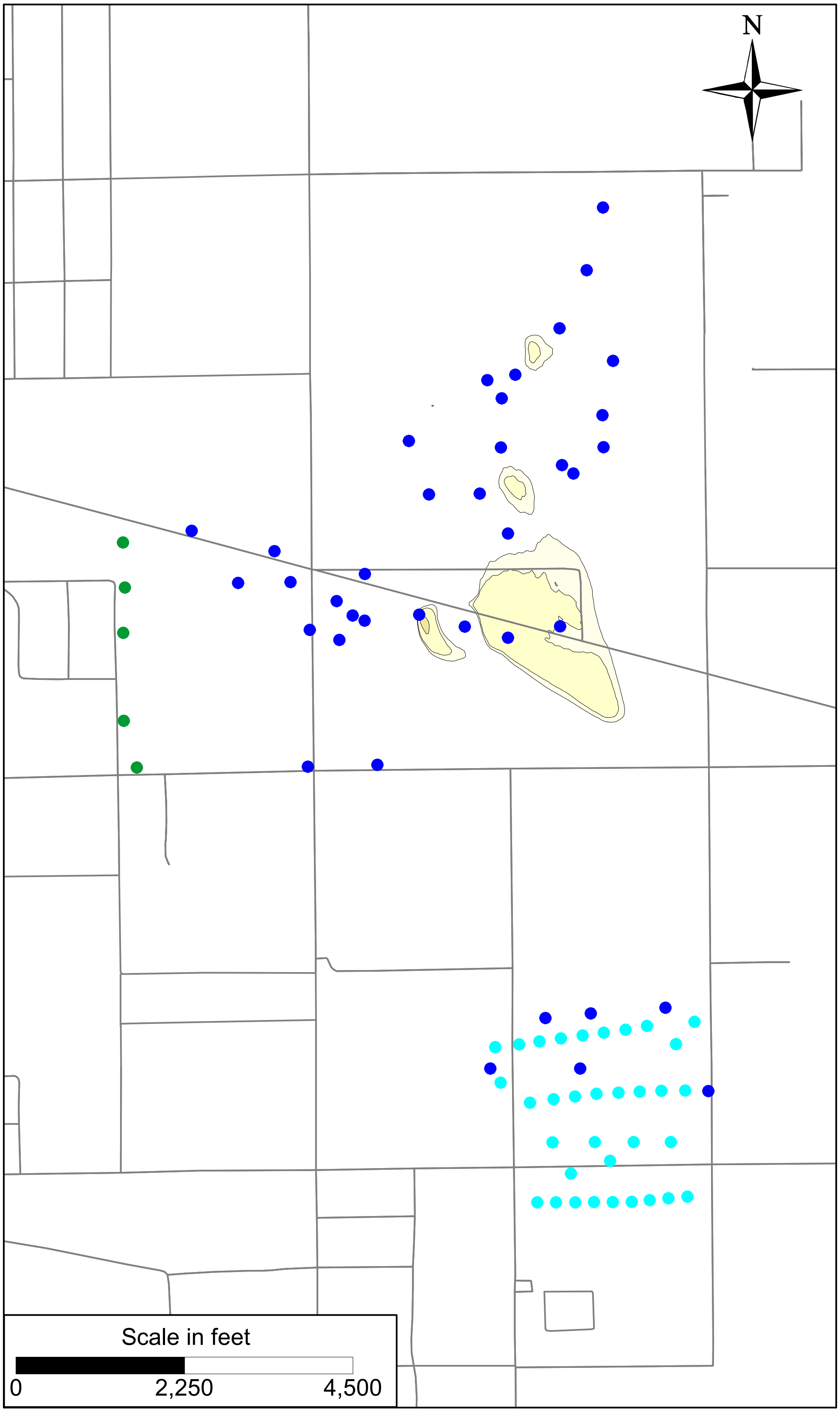
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1, 4, 10, 50, 100, 250, 500

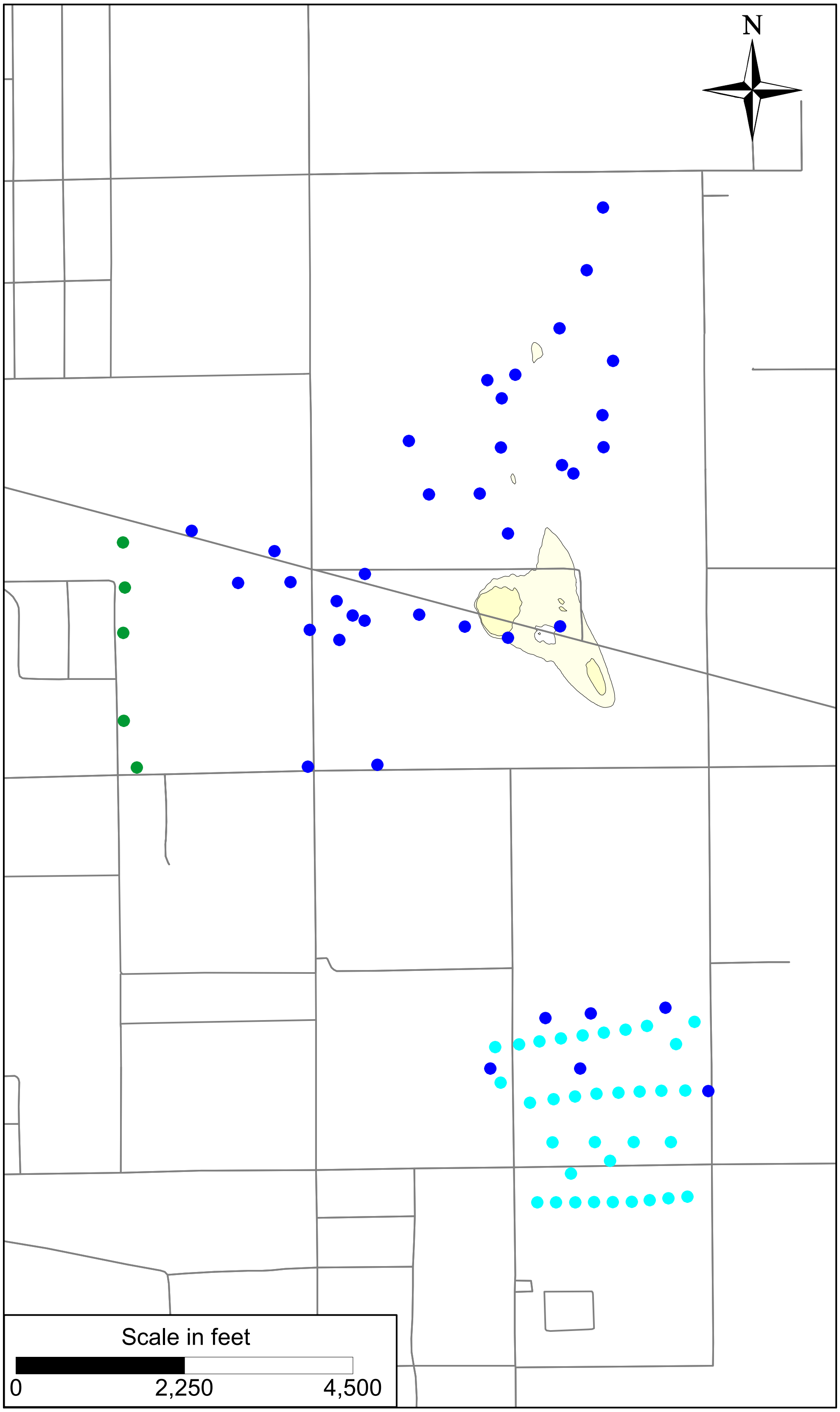
- Approximate Location of Extraction Well
- Approximate Location of Carbon-Amended Injection Well
- Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 60 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA

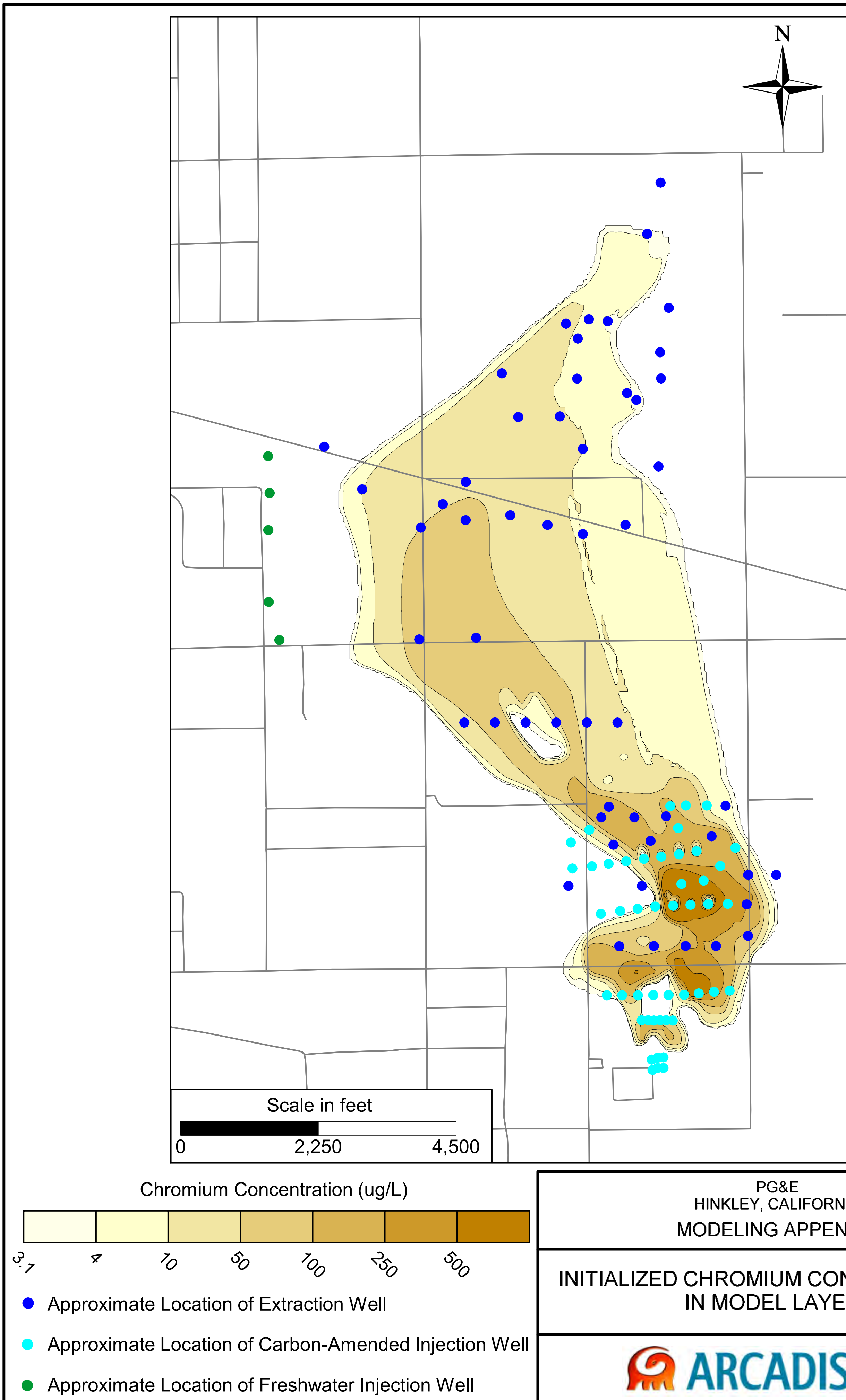
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 2
AFTER 100 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE

4C-4
1Q11

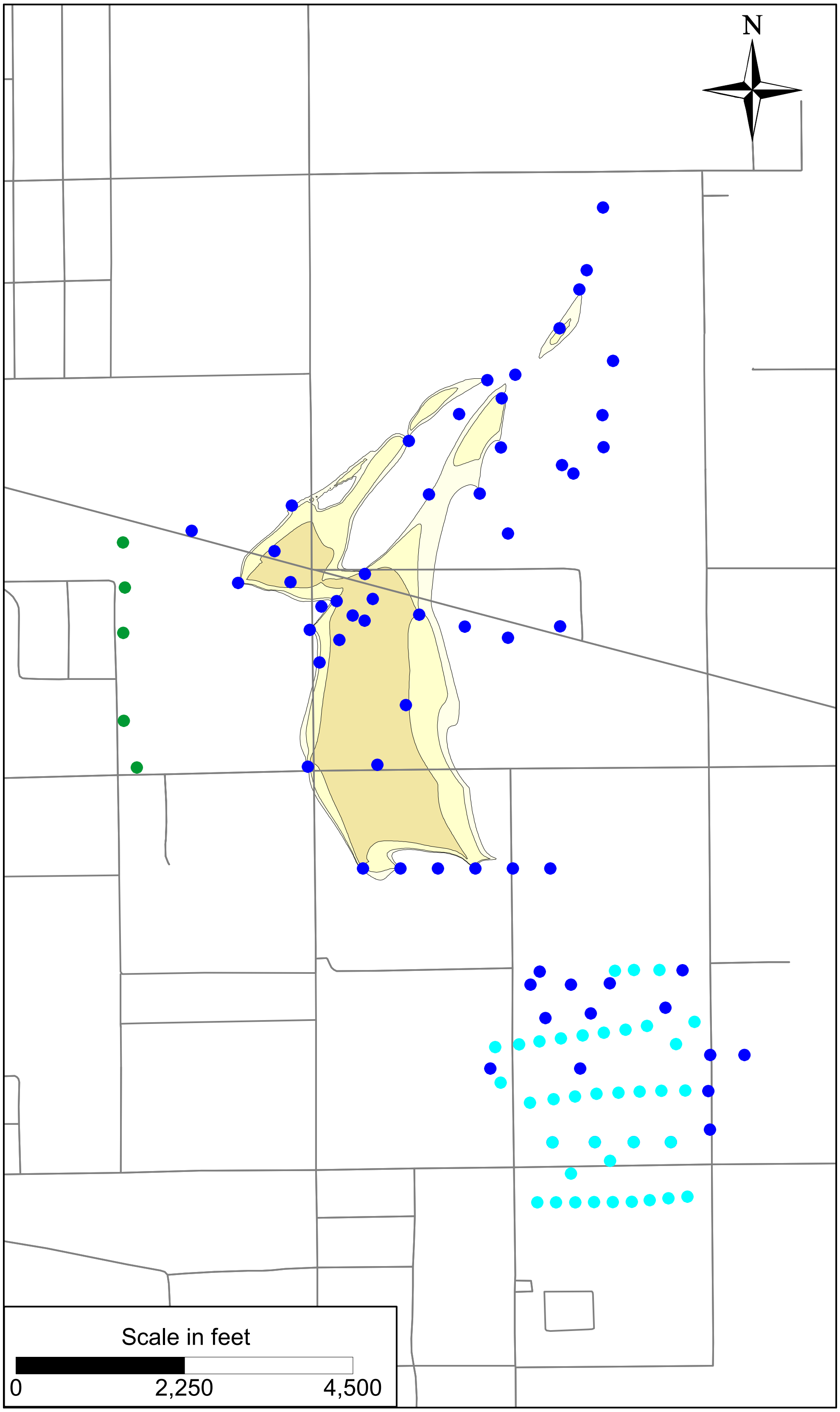


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

INITIALIZED CHROMIUM CONCENTRATIONS IN MODEL LAYER 3

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)

3.1 4 10 50 100 250 500

Approximate Location of Extraction Well

Approximate Location of Carbon-Amended Injection Well

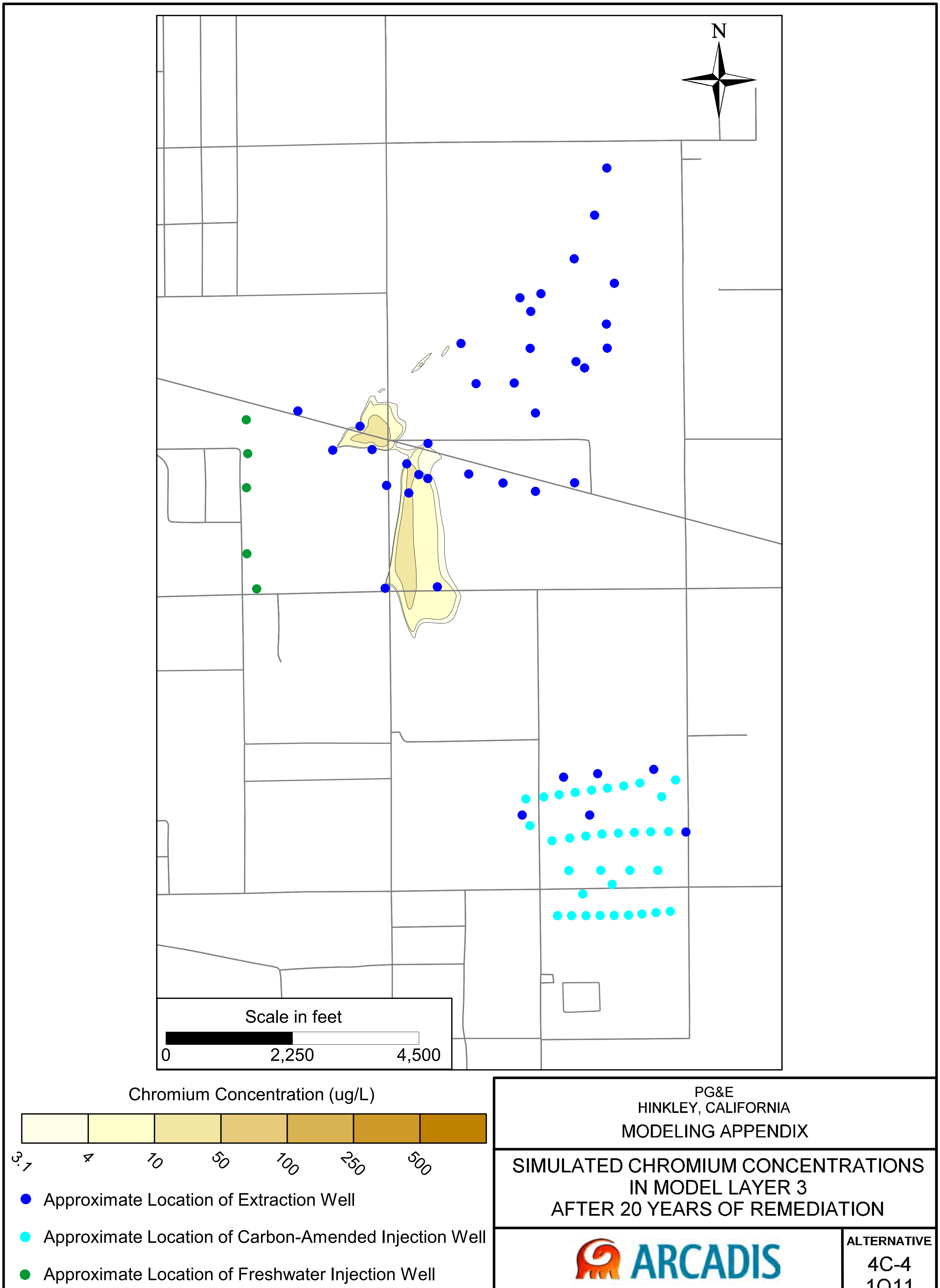
Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 10 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11

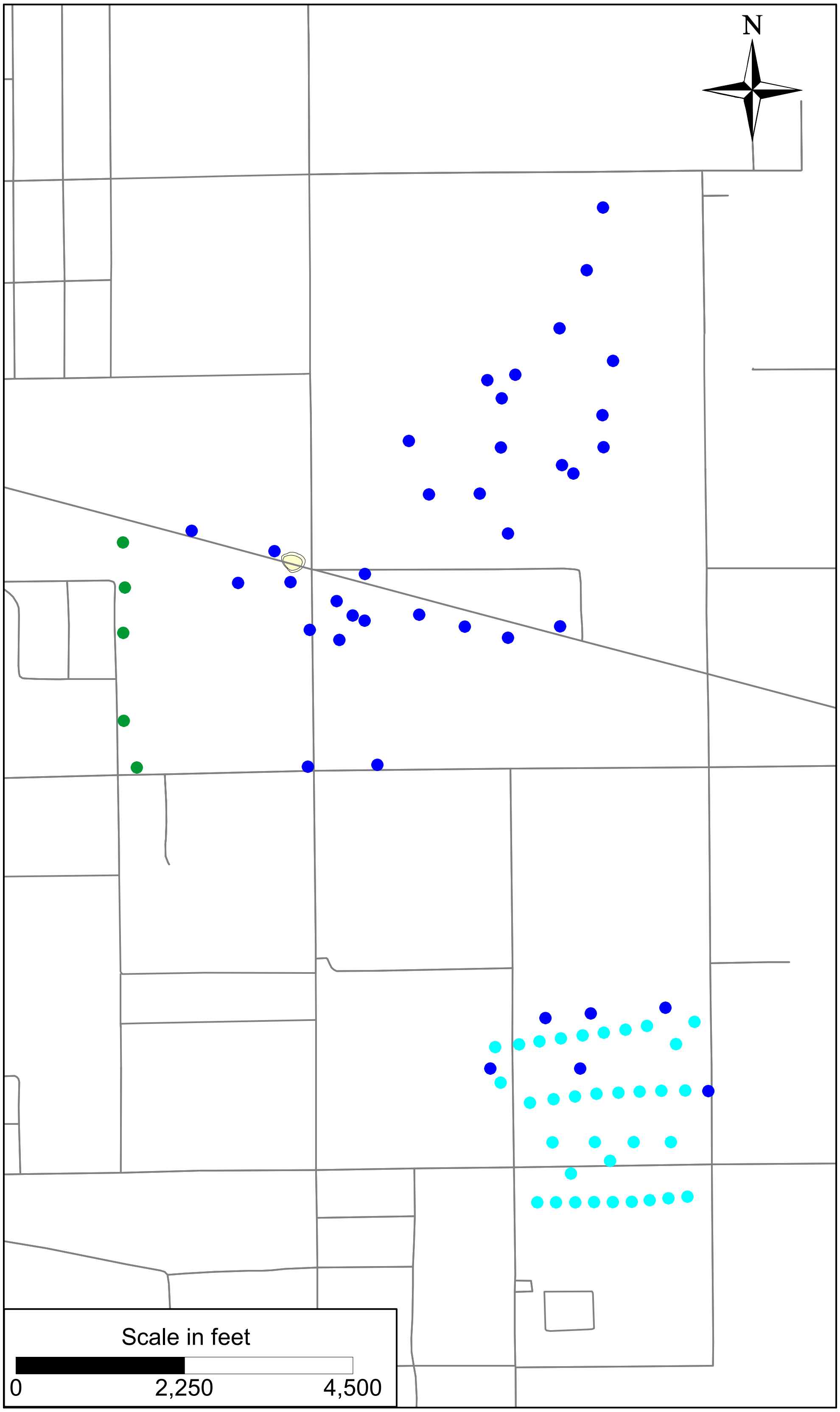


PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

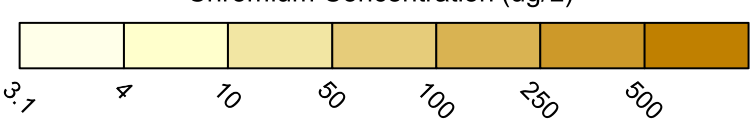
SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 20 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11



Chromium Concentration (ug/L)



● Approximate Location of Extraction Well

● Approximate Location of Carbon-Amended Injection Well

● Approximate Location of Freshwater Injection Well

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

SIMULATED CHROMIUM CONCENTRATIONS
IN MODEL LAYER 3
AFTER 40 YEARS OF REMEDIATION

ARCADIS

ALTERNATIVE
4C-4
1Q11

Appendix D

Detailed Costing Backup for Alternatives presented in the FS, Addendum #1 and Addendum #2

Alternative 2: Containment

Hinkley Feasibility Study

Table 1: Northwest Freshwater Injection at 40 gpm

Table 2: Scaled O&M Costs per Injection Well and Extraction Well

Table 3: Groundwater Monitoring Program - Current

Table 4: Groundwater Monitoring Program - 75% of Current Program

Table 5: Alt 2 - Northern Extraction

Table 6: SCRIA Extraction at 110 gpm

Table 7: Agricultural Unit Modifications

Table 8: New Agricultural Unit

Table 9: Agricultural Unit O&M Backup

Table 10: Alt 2 - Land Acquisition

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 40 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.04	Project Management	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.05	Electricity	16,561 - 16,561	KWH	$0.12 $0.18	$1,987 - $2,981	$2,484	1, 2
1.06							
				SUBTOTAL (BARE):	**$142,707 - $143,701**	**$143,204**	
				CONTINGENCY (10%):	**$14,271 - $14,370**	**$14,320**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,978 - $158,071**	**$157,524**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch Extraction	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific **TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection	$ 143,204	$ 14,320	$ 157,524
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 143,204**	**$ 14,320**	**$ 157,524**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 40 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 30-Aug-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 382,000	$ 38,200	$ 420,200
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS

	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch Extraction	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific				
TOTAL:	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 286,500	$ 28,650	$ 315,150
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 2 - Northern Extraction		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$59,240. - $59,240.	$59,240 - $59,240	$59,240	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$59,240 - $59,240***	***$59,240***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$59,240. - $59,240.	$59,240 - $59,240	$59,240	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$29,620. - $29,620.	$29,620 - $29,620	$29,620	1, 3
				Construction Monitoring and Site Security Subtotal:	***$98,860 - $98,860***	***$98,860***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	1 - 1	EA	$73,000. - $73,000.	$73,000 - $73,000	$73,000	1, 4
6.02	Well Completion	1 - 1	EA	$53,000. - $53,000.	$53,000 - $53,000	$53,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	5,830 - 5,830	LF	$80. - $80.	$466,400 - $466,400	$466,400	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$592,400 - $592,400***	***$592,400***	
				SUBTOTAL (BARE):	**$750,500 - $750,500**	**$750,500**	
				CONTINGENCY (20%):	**$150,100 - $150,100**	**$150,100**	
				TOTAL ESTIMATED CAPITAL COST:	**$900,600 - $900,600**	**$900,600**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1, 7
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.05	Electricity	51,752 - 51,752	KWH	$0.12 - $0.18	$6,210 - $9,315	$7,763	1, 8
				SUBTOTAL (BARE):	**$75,490 - $78,595**	**$77,043**	
				CONTINGENCY (10%):	**$7,549 - $7,860**	**$7,704**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$83,039 - $86,455**	**$84,747**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 750,500	$ 150,100	$ 900,600
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 750,500**	**$ 150,100**	**$ 900,600**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction		$ 77,043	$ 7,704	$ 84,747
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 77,043**	**$ 7,704**	**$ 84,747**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 2 - Northern Extraction		Date: 30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5%General Contractor markup)+$7K General Contractor Labor+$9K development - 180 foot, 8-inch diamter well
5	Per Contractor bid: $25.5K downhole+ $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 existing + 1 new extraction well; O&M for Gorman Extraction wells covered in a separate cost estimate sheet
8	250 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 110 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	4 - 4	EA	$12,320 - $12,320	$49,280 - $49,280	$49,280	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$64,745 - $67,477**	**$66,111**	
				CONTINGENCY (10%):	**$6,474 - $6,748**	**$6,611**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$71,219 - $74,225**	**$72,722**	

CAPITAL COSTS

	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch Extraction	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific **TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 66,111	$ 6,611	$ 72,722
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 66,111**	**$ 6,611**	**$ 72,722**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	4 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit Modifications		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$16,000 - $16,000*	*$16,000*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	*$24,000 - $24,000*	*$24,000*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$160,000 - $160,000*	*$160,000*	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units	100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection	0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection	0.0%	$ -	$ -	$ -
Source Area IRZ / Injection	0.0%	$ -	$ -	$ -
Non-Specific				
TOTAL:	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K per pivot

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
New Agricultural Unit		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$410,588 - $410,588	$410,588 - $410,588	$410,588	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$410,588 - $410,588***	***$410,588***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$80,700. - $80,700.	$80,700 - $80,700	$80,700	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$80,700 - $80,700***	***$80,700***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$136,862.5 - $136,862.5	$136,863 - $136,863	$136,863	1, 3
3.02	Construction Management	1 - 1	LS	$273,725. - $273,725.	$273,725 - $273,725	$273,725	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$410,588 - $410,588***	***$410,588***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	1 - 1	LS	$73,200. - $73,200.	$73,200 - $73,200	$73,200	1
4.02	AU Building Construction	1 - 1	LS	$556,000. - $556,000.	$556,000 - $556,000	$556,000	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$906,000. - $906,000.	$906,000 - $906,000	$906,000	1
4.04	Electrical	1 - 1	LS	$262,000. - $262,000.	$262,000 - $262,000	$262,000	1
4.05	Vaults	1 - 1	LS	$243,600. - $243,600.	$243,600 - $243,600	$243,600	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$688,950. - $688,950.	$688,950 - $688,950	$688,950	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$2,737,250 - $2,737,250***	***$2,737,250***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$3,689,125 - $3,689,125**	**$3,689,125**	
				CONTINGENCY (20%):	**$737,825 - $737,825**	**$737,825**	
				TOTAL ESTIMATED CAPITAL COST:	**$4,426,950 - $4,426,950**	**$4,426,950**	

Use 50% of 400 gpm/80 Acre AU for new 200 gpm AU:	**$2,213,475**
Use 33% of 400 gpm/80 Acre AU for each new 150 gpm AU:	**$1,460,894**
Use 75% of 400 gpm/80 Acre AU for new 200 gpm AU:	**$3,320,213**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST

Agricultural Unit O&M Backup

Hinkley Feasibility Study

Project Number: 36385

Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS: FARMER-OPERATED CASE

											CALCULATED			CALCULATED			CALCULATED		
Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			4			3			3			6		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head			840 gpm at 100 ft head			950 gpm at 100 ft head			1270 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations																			
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000	405	$ 100	$ 40,533	420	$ 100	$ 42,000	520	$ 100	$ 52,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000	1	$ 10,267	$ 10,267	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000	1	$ 6,160	$ 6,160	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220
Electrical Power																			
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471	173,885	$ 0.15	$ 26,083	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services																			
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	89,000	$ 89,000
Parts/repairs																			
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000	2	$ 1,283,333	$ 25,667	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000
Subtotal				$ 287,709			$ 319,104			$ 418,802			$ 290,578			$ 308,347			$ 447,186
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880	10	$ 290,578	$ 29,058	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719
GRAND TOTAL				$ 316,480			$ 351,015			$ 460,682			$ 319,636			$ 339,181			$ 491,904

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
9	Controls/lights operated at 1.5 kW.
10	Five (5) pivot motors operated for 800 gpm and 840 gpm applications; six (6) pivot motors operated for 950 gpm and 1,100 gpm applications; eight (8) pivot motors operated for 1,270 and 1,400 gpm applications. Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 2 - Land Acquisition		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
					Land Acquisition Costs Subtotal: ***$320,000 - $320,000***	***$320,000***	
					SUBTOTAL (BARE): $320,000 - $320,000	**$320,000**	
					CONTINGENCY (0%): $0 - $0	**$0**	
					TOTAL ESTIMATED CAPITAL COST: $320,000 - $320,000	**$320,000**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for the third agricultural unit.

Alternative 3: Plume-Wide In-Situ Treatment

Hinkley Feasibility Study

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 40 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.04	Project Management	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.05	Electricity	16,561 - 16,561	KWH	$0.12 $0.18	$1,987 - $2,981	$2,484	1, 2
1.06							
				SUBTOTAL (BARE):	**$142,707 - $143,701**	**$143,204**	
				CONTINGENCY (10%):	**$14,271 - $14,370**	**$14,320**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,978 - $158,071**	**$157,524**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection		$ 143,204	$ 14,320	$ 157,524
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 143,204**	**$ 14,320**	**$ 157,524**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 40 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 30-Aug-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
GMP Including BCMP	$ 382,000	$ 38,200	$ 420,200
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 191,000	$ 19,100	$ 210,100
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 - Northern Extraction		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$110,920. - $110,920.	$110,920 - $110,920	$110,920	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$110,920 - $110,920***	***$110,920***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$110,920. - $110,920.	$110,920 - $110,920	$110,920	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$55,460. - $55,460.	$55,460 - $55,460	$55,460	1, 3
				Construction Monitoring and Site Security Subtotal:	***$176,380 - $176,380***	***$176,380***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	1 - 1	EA	$73,000. - $73,000.	$73,000 - $73,000	$73,000	1, 4
6.02	Well Completion	1 - 1	EA	$53,000. - $53,000.	$53,000 - $53,000	$53,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	12,290 - 12,290	LF	$80. - $80.	$983,200 - $983,200	$983,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$1,109,200 - $1,109,200***	***$1,109,200***	
				SUBTOTAL (BARE):	**$1,396,500 - $1,396,500**	**$1,396,500**	
				CONTINGENCY (20%):	**$279,300 - $279,300**	**$279,300**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,675,800 - $1,675,800**	**$1,675,800**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1, 7
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.05	Electricity	62,102 - 62,102	KWH	$0.12 - $0.18	$7,452 - $11,178	$9,315	1, 8
				SUBTOTAL (BARE):	**$76,732 - $80,458**	**$78,595**	
				CONTINGENCY (10%):	**$7,673 - $8,046**	**$7,860**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$84,405 - $88,504**	**$86,455**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 1,396,500	$ 279,300	$ 1,675,800
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 1,396,500**	**$ 279,300**	**$ 1,675,800**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 78,595	$ 7,860	$ 86,455
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 78,595**	**$ 7,860**	**$ 86,455**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 - Northern Extraction		Date: 30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) + $7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	Piping ties 4 Northern Extraction + 3 Gorman Extraction wells together; $/lf includes piping + conduit + pullboxes
7	3 existing + 1 new extraction well; O&M for Gorman Extraction wells covered in a separate cost estimate sheet
8	300 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 110 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	4 - 4	EA	$12,320 - $12,320	$49,280 - $49,280	$49,280	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$64,745 - $67,477**	**$66,111**	
				CONTINGENCY (10%):	**$6,474 - $6,748**	**$6,611**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$71,219 - $74,225**	**$72,722**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 66,111	$ 6,611	$ 72,722
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 66,111**	**$ 6,611**	**$ 72,722**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	4 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (0-5 years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$418,160. - $418,160.	$418,160. - $418,160.	$418,160	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	***$418,160 - $418,160***	***$418,160***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$418,160. - $418,160.	$418,160. - $418,160.	$418,160	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$209,080. - $209,080.	$209,080. - $209,080.	$209,080	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	***$637,240 - $637,240***	***$637,240***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0. - $0.	$0	1
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0. - $0.	$0	1
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1
6.04	Influent Piping	0 - 0	LF	$80. - $80.	$0. - $0.	$0	1
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	26,170 - 26,170	LF	$80. - $80.	$2,093,600. - $2,093,600.	$2,093,600	1, 4
6.07	Injection Wells	18 - 18	EA	$116,000. - $116,000.	$2,088,000. - $2,088,000.	$2,088,000	1, 5
6.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$4,181,600 - $4,181,600***	***$4,181,600***	
				SUBTOTAL (BARE):	**$5,237,000 - $5,237,000**	**$5,237,000**	
				CONTINGENCY (20%):	**$1,047,400 - $1,047,400**	**$1,047,400**	
				TOTAL ESTIMATED CAPITAL COST:	**$6,284,400 - $6,284,400**	**$6,284,400**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	0.0%	$ -
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	27.8%	$ 1,745,667
Southeast and East Plume Fringe	33.3%	$ 2,094,800
Southern Plume Fringe	38.9%	$ 2,443,933
Southwest Plume Fringe	0.0%	$ -
	100.0%	$ 6,284,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (0-5 years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	71,417 - 71,417	KWH	$0.12 - $0.18	$8,570 - $12,855	$10,713	1, 6
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	50,717 - 50,717	KWH	$0.12 - $0.18	$6,086 - $9,129	$7,607	1, 7
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
3.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
3.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
3.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	5 - 5	WELL	$24,600. - $24,600.	$123,000 - $123,000	$123,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	6 - 6	WELL	$24,600. - $24,600.	$147,600 - $147,600	$147,600	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	7 - 7	WELL	$24,600. - $24,600.	$172,200 - $172,200	$172,200	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$613,696 - $621,024**	**$617,360**	
				CONTINGENCY (10%):	**$61,370 - $62,102**	**$61,736**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$675,066 - $683,126**	**$679,096**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 3 (0-5 years) - Piping & Wells Module		**Date:**	**30-Aug-10**

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		27.8%	$ 1,454,722	$ 290,944	$ 1,745,667
Southeast and East Plume Fringe		33.3%	$ 1,745,667	$ 349,133	$ 2,094,800
Southern Plume Fringe		38.9%	$ 2,036,611	$ 407,322	$ 2,443,933
Southwest Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 5,237,000**	**$ 1,047,400**	**$ 6,284,400**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
SCRIA Extraction		$ -	$ -	$ -
DVD Extraction		$ 69,993	$ 6,999	$ 76,992
Ranch or Other Extraction		$ -	$ -	$ -
Gorman Extraction		$ 54,567	$ 5,457	$ 60,024
Northern Plume Fringe		$ 133,000	$ 13,300	$ 146,300
Southeast and East Plume Fringe		$ 167,600	$ 16,760	$ 184,360
Southern Plume Fringe		$ 192,200	$ 19,220	$ 211,420
Southwest Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 617,360**	**$ 61,736**	**$ 679,096**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	$/lf includes piping + conduit + pullboxes
5	Per 2009 work: Well installation: $54K + $7K + $9K (development) + $18K downhole equip + $28K wellhead mech/elect - 130 foot, 8-inch diameter well
6	345 gpm @ 100' head
7	245 gpm @ 100' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 3 (5-10 years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$146,000. - $146,000.	$146,000. - $146,000.	$146,000	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	***$146,000 - $146,000***	***$146,000***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$146,000. - $146,000.	$146,000. - $146,000.	$146,000	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$73,000. - $73,000.	$73,000. - $73,000.	$73,000	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	***$229,000 - $229,000***	***$229,000***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0. - $0.	$0	1
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0. - $0.	$0	1
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1
6.04	Influent Piping	0 - 0	LF	$80. - $80.	$0. - $0.	$0	1
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	2,300 - 2,300	LF	$80. - $80.	$184,000. - $184,000.	$184,000	1, 4
6.07	Injection Wells	11 - 11	EA	$116,000. - $116,000.	$1,276,000. - $1,276,000.	$1,276,000	1, 5
6.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$1,460,000 - $1,460,000***	***$1,460,000***	
				SUBTOTAL (BARE):	**$1,835,000 - $1,835,000**	**$1,835,000**	
				CONTINGENCY (20%):	**$367,000 - $367,000**	**$367,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,202,000 - $2,202,000**	**$2,202,000**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	0.0%	$ -
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	0.0%	$ -
Southeast and East Plume Fringe	63.6%	$ 1,401,273
Southern Plume Fringe	36.4%	$ 800,727
Southwest Plume Fringe	0.0%	$ -
	100.0%	$ 2,202,000

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (5-10 years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	71,417 - 71,417	KWH	$0.12 - $0.18	$8,570 - $12,855	$10,713	1, 6
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	
2.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	50,717 - 50,717	KWH	$0.12 - $0.18	$6,086 - $9,129	$7,607	1, 7
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
3.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
3.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
3.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	5 - 5	WELL	$24,600. - $24,600.	$123,000 - $123,000	$123,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	9 - 9	WELL	$24,600. - $24,600.	$221,400 - $221,400	$221,400	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	11 - 11	WELL	$24,600. - $24,600.	$270,600 - $270,600	$270,600	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$785,896 - $793,224**	**$789,560**	
				CONTINGENCY (10%):	**$78,590 - $79,322**	**$78,956**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$864,486 - $872,546**	**$868,516**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 3 (5-10 years) - Piping & Wells Module		**Date:**	**30-Aug-10**

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		63.6%	$ 1,167,727	$ 233,545	$ 1,401,273
Southern Plume Fringe		36.4%	$ 667,273	$ 133,455	$ 800,727
Southwest Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 1,835,000**	**$ 367,000**	**$ 2,202,000**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ -	$ -	$ -
DVD Extraction	$ 69,993	$ 6,999	$ 76,992
Ranch or Other Extraction	$ -	$ -	$ -
Gorman Extraction	$ 54,567	$ 5,457	$ 60,024
Northern Plume Fringe	$ 133,000	$ 13,300	$ 146,300
Southeast and East Plume Fringe	$ 241,400	$ 24,140	$ 265,540
Southern Plume Fringe	$ 290,600	$ 29,060	$ 319,660
Southwest Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 789,560**	**$ 78,956**	**$ 868,516**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	$/lf includes piping + conduit + pullboxes
5	Per 2009 work: Well installation: $54K + $7K + $9K (development) + $18K downhole equip + $28K wellhead mech/elect - 130 foot, 8-inch diameter well
6	345 gpm @ 100' head
7	245 gpm @ 100' head

ALTERNATIVE 3: TABLE 9
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility {űdzŘȅ*	Project Number: 36385
Alt 3 (10+ years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	71,417 - 71,417	KWH	$0.12 - $0.18	$8,570 - $12,855	$10,713	1, 2
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	50,717 - 50,717	KWH	$0.12 - $0.18	$6,086 - $9,129	$7,607	1, 3
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
3.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
3.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
3.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	5 - 5	WELL	$24,600. - $24,600.	$123,000 - $123,000	$123,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	6 - 6	WELL	$24,600. - $24,600.	$147,600 - $147,600	$147,600	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	11 - 11	WELL	$24,600. - $24,600.	$270,600 - $270,600	$270,600	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$712,096 - $719,424**	**$715,760**	
				CONTINGENCY (10%):	**$71,210 - $71,942**	**$71,576**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$783,306 - $791,366**	**$787,336**	

OPINION OF PROBABLE COST	*Hinkleƨ Feasibility {ǘdzŘƨ*	Project Number: 36385
Alt 3 (10+ years) - Piping & Wells Module		Date: 30-Aug-10

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Southwest Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ -	$ -	$ -
DVD Extraction		$ 69,993	$ 6,999	$ 76,992
Ranch or Other Extraction		$ -	$ -	$ -
Gorman Extraction		$ 54,567	$ 5,457	$ 60,024
Northern Plume Fringe		$ 133,000	$ 13,300	$ 146,300
Southeast and East Plume Fringe		$ 167,600	$ 16,760	$ 184,360
Southern Plume Fringe		$ 290,600	$ 29,060	$ 319,660
Southwest Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 715,760**	**$ 71,576**	**$ 787,336**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	345 gpm @ 100' head
3	245 gpm @ 100' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 3 (0-5 years)		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1
5.03	Injection Wells - Shallow	34 - 34	EA	$20,000. - $25,000.	$680,000. - $850,000.	$765,000	1
5.04	Injection Wells - Dual Screen	20 - 20	EA	$30,000. - $40,000.	$600,000. - $800,000.	$700,000	1
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	1 - 1	LS	$87,500. - $162,500.	$87,500. - $162,500.	$125,000	1
5.11	IRZ Well Head/Downhole Completion	54 - 54	EA	$12,000. - $14,500.	$648,000. - $783,000.	$715,500	1, 2
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	11,750 - 11,750	LF	$75. - $100.	$881,250. - $1,175,000.	$1,028,125	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$1,000,000. - $1,000,000.	$1,000,000. - $1,000,000.	$1,000,000	1, 3
5.18	Road Crossing - Directional Drill	1 - 1	LS	$75,000. - $110,000.	$75,000. - $110,000.	$92,500	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$4,646,750 - $5,790,500***	***$5,218,625***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$5,202,339 - $6,571,614**	**$5,886,977**	
				CONTINGENCY (20%):	**$1,040,468 - $1,314,323**	**$1,177,395**	
				TOTAL ESTIMATED CAPITAL COST:	**$6,242,807 - $7,885,937**	**$7,064,372**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Plume Fringe	0.0%	$ -
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	19.2%	$ 1,353,685
SCRIA / Dosed Injection	29.9%	$ 2,115,069
Source Area IRZ / Injection	50.9%	$ 3,595,618
	100.0%	$ 7,064,372

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (0-5 years)		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	18,546 - 18,546	GAL	$5. - $6.	$92,728. - $111,274.	$102,001	1, 4
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$109,200. - $202,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	1
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	365,000 - 365,000	KWH	$0.12 - $0.18	$43,800. - $65,700.	$54,750	1
3.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
4.03	Biological / Chemical Consumables	59,009 - 59,009	GAL	$5. - $6.	$295,044. - $354,052.	$324,548	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	1 - 1	LS	$109,200. - $202,800.	$109,200. - $202,800.	$156,000	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	547,500 - 547,500	KWH	$0.12 - $0.18	$65,700. - $98,550.	$82,125	1
5.03	Biological / Chemical Consumables	37,091 - 37,091	GAL	$5. - $6.	$185,456. - $222,547.	$204,002	1, 7
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	1 - 1	LS	$163,800. - $304,200.	$163,800. - $304,200.	$234,000	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	27,818 - 27,818	GAL	$5. - $6.	$139,092. - $166,910.	$153,001	1, 8
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	26,132 - 26,132	GAL	$5. - $6.	$130,662. - $156,795.	$143,728	1, 9
				SUBTOTAL (BARE):	**$2,112,005 - $3,246,134**	**$2,679,070**	
				CONTINGENCY (10%):	**$211,200 - $324,613**	**$267,907**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$2,323,205 - $3,570,748**	**$2,946,977**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		19.2%	$ 1,128,070	$ 225,614	$ 1,353,685
SCRIA / Dosed Injection		29.9%	$ 1,762,558	$ 352,512	$ 2,115,069
Source Area IRZ / Injection		50.9%	$ 2,996,348	$ 599,270	$ 3,595,618
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 5,886,977**	**$ 1,177,395**	**$ 7,064,372**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ 102,001	$ 10,200	$ 112,201
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 834,807	$ 83,481	$ 918,288
SCRIA / Dosed Injection		$ 584,991	$ 58,499	$ 643,490
Source Area IRZ / Injection		$ 860,542	$ 86,054	$ 946,596
Southeast and East Plume Fringe		$ 153,001	$ 15,300	$ 168,301
Southern Plume Fringe		$ 143,728	$ 14,373	$ 158,101
	TOTAL:	**$ 2,679,070**	**$ 267,907**	**$ 2,946,977**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number:	36385
Alt 3 (0-5 years)		Date:	30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Includes 20 wells within the SCRIA Injection area, and 34 wells within the Source Area IRZ/Injection
3	Modifications to deepen wells in existing IRZ system
4	110 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
5	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	350 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	220 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
8	165 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
9	155 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (5-10 years)		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$180,000 - $240,000***	***$210,000***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$35,000. - $60,000.	$35,000. - $60,000.	$47,500	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$35,000 - $60,000***	***$47,500***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1
5.04	Injection Wells - Dual Screen	30 - 30	EA	$30,000. - $40,000.	$900,000. - $1,200,000.	$1,050,000	1, 2
5.05	Carbon Storage Tank (Double Wall Steel Tank)	1 - 1	EA	$56,000. - $104,000.	$56,000. - $104,000.	$80,000	1
5.06	Building(s) (Modified Shipping Containers)	1 - 1	LS	$31,500. - $58,500.	$31,500. - $58,500.	$45,000	1
5.07	Chemical Feed Pumps	1 - 1	EA	$3,500. - $6,500.	$3,500. - $6,500.	$5,000	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$30,000. - $40,000.	$30,000. - $40,000.	$35,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$40,000. - $60,000.	$40,000. - $60,000.	$50,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	1 - 1	LS	$87,500. - $162,500.	$87,500. - $162,500.	$125,000	1
5.11	IRZ Well Head/Downhole Completion	30 - 30	EA	$12,000. - $14,500.	$360,000. - $435,000.	$397,500	1, 2
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	10,400 - 10,400	LF	$75. - $100.	$780,000. - $1,040,000.	$910,000	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$60,000. - $80,000.	$60,000. - $80,000.	$70,000	1
5.16	Electrical Installation	1 - 1	LS	$90,000. - $110,000.	$90,000. - $110,000.	$100,000	1
5.17	Central Area Modifications	0 - 0	LS	$1,000,000. - $1,000,000.	$0. - $0.	$0	1
5.18	Road Crossing - Directional Drill	0 - 0	LS	$75,000. - $110,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$2,558,500 - $3,476,500***	***$3,017,500***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$3,279,089 - $4,457,614**	**$3,868,352**	
				CONTINGENCY (20%):	**$655,818 - $891,523**	**$773,670**	
				TOTAL ESTIMATED CAPITAL COST:	**$3,934,907 - $5,349,137**	**$4,642,022**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	100.0%	$ 4,642,022
	Northern Plume Fringe	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	0.0%	$ -
	Source Area IRZ / Injection	0.0%	$ -
		100.0%	$ 4,642,022

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 3 (5-10 years)		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	Northern Plume Fringe						
1.01	Biological / Chemical Consumables	18,546 - 18,546	GAL	$5. - $6.	$92,728. - $111,274.	$102,001	1, 3
2.00	Northern Injection						
2.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
2.02	Electricity	292,000 - 365,000	KWH	$0.12 - $0.18	$35,040. - $65,700.	$50,370	1
2.03	Biological / Chemical Consumables	62,381 - 62,381	GAL	$5. - $6.	$311,903. - $374,284.	$343,093	1, 4
2.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
2.05	Routine / General Maintenance	1 - 1	LS	$109,200. - $202,800.	$98,280. - $182,520.	$140,400	1
2.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	Central Area IRZ						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	365,000 - 365,000	KWH	$0.12 - $0.18	$43,800. - $65,700.	$54,750	1
3.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	SCRIA Injection						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
4.03	Biological / Chemical Consumables	11,802 - 11,802	GAL	$5. - $6.	$59,009. - $70,810.	$64,910	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	1 - 1	LS	$109,200. - $202,800.	$109,200. - $202,800.	$156,000	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	Source Area Injection and/or Recirc						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
5.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
5.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$13,255.2 - $24,616.8	$0. - $0.	$0	1
5.05	Routine / General Maintenance	0 - 0	LS	$163,800. - $304,200.	$0. - $0.	$0	1
5.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$50,578.5 - $93,931.5	$0. - $0.	$0	1
5.07	Compliance - Permits, etc.	0 - 0	LS	$34,456.8 - $63,991.2	$0. - $0.	$0	1
6.00	Southeast and East Plume Fringe						
6.01	Biological / Chemical Consumables	34,562 - 34,562	GAL	$5. - $6.	$172,811. - $207,373.	$190,092	1, 7
7.00	Southern Plume Fringe						
7.01	Biological / Chemical Consumables	41,306 - 41,306	GAL	$5. - $6.	$206,530. - $247,837.	$227,184	1, 8
				SUBTOTAL (BARE):	$1,827,873 - $2,742,552	$2,285,213	
				CONTINGENCY (10%):	$182,787 - $274,255	$228,521	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	$2,010,661 - $3,016,807	$2,513,734	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		100.0%	$ 3,868,352	$ 773,670	$ 4,642,022
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 3,868,352**	**$ 773,670**	**$ 4,642,022**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ 102,001	$ 10,200	$ 112,201
Northern Injection	$ 605,776	$ 60,578	$ 666,354
Central Area IRZ / Injection	$ 834,807	$ 83,481	$ 918,288
SCRIA / Dosed Injection	$ 325,353	$ 32,535	$ 357,888
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ 190,092	$ 19,009	$ 209,102
Southern Plume Fringe	$ 227,184	$ 22,718	$ 249,902
TOTAL:	**$ 2,285,213**	**$ 228,521**	**$ 2,513,734**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (5-10 years)		Date: 30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Includes 30 wells within the Northern Injection area.
3	110 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
4	370 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
5	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, deliverd
6	70 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	205 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
8	245 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 3 (10-15 years)		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	0 - 0	LS	$21,939. - $27,347.	$0. - $0.	$0	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	*$65,150 - $101,267*	*$83,209*	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	5 - 5	EA	$15,000. - $20,000.	$75,000. - $100,000.	$87,500	1
2.02							
				Performance Monitoring Well Installation Subtotal:	*$75,000 - $100,000*	*$87,500*	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$35,000. - $60,000.	$35,000. - $60,000.	$47,500	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	*$35,000 - $60,000*	*$47,500*	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$35,000. - $60,000.	$35,000. - $60,000.	$47,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	*$35,000 - $60,000*	*$47,500*	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1
5.04	Injection Wells - Dual Screen	19 - 19	EA	$30,000. - $40,000.	$570,000. - $760,000.	$665,000	1
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	0 - 0	LS	$30,000. - $40,000.	$0. - $0.	$0	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$40,000. - $60,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	19 - 19	EA	$12,000. - $14,500.	$228,000. - $275,500.	$251,750	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	4,750 - 4,750	LF	$75. - $100.	$356,250. - $475,000.	$415,625	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	0 - 0	LS	$100,000. - $150,000.	$0. - $0.	$0	1
5.14	Equipment Installation	0 - 0	LS	$20,000. - $30,000.	$0. - $0.	$0	1
5.15	Mechanical Installation	0 - 0	LS	$60,000. - $80,000.	$0. - $0.	$0	1
5.16	Electrical Installation	0 - 0	LS	$90,000. - $110,000.	$0. - $0.	$0	1
5.17	Central Area Modifications	0 - 0	LS	$1,000,000. - $1,000,000.	$0. - $0.	$0	1
5.18	Road Crossing - Directional Drill	0 - 0	LS	$75,000. - $110,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	*$1,154,250 - $1,510,500*	*$1,332,375*	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	*$75,000 - $100,000*	*$87,500*	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	*$1,000 - $2,000*	*$1,500*	
				SUBTOTAL (BARE):	**$1,440,400 - $1,933,767**	**$1,687,084**	
				CONTINGENCY (20%):	**$288,080 - $386,753**	**$337,417**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,728,480 - $2,320,520**	**$2,024,500**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	100.0%	$ 2,024,500
	Northern Plume Fringe	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	0.0%	$ -
	Source Area IRZ / Injection	0.0%	$ -
		100.0%	$ 2,024,500

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 3 (10-15 years)		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	18,546 - 18,546	GAL	$5. - $6.	$92,728. - $111,274.	$102,001	1, 2
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0.75 - 0.75	YR	$35,000. - $65,000.	$26,250. - $48,750.	$37,500	1
2.02	Electricity	292,000 - 365,000	KWH	$0.12 - $0.18	$35,040. - $65,700.	$50,370	1
2.03	Biological / Chemical Consumables	80,083 - 80,083	GAL	$5. - $6.	$400,416. - $480,499.	$440,458	1, 3
2.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
2.05	Routine / General Maintenance	0.8 - 0.8	LS	$109,200. - $202,800.	$87,360. - $162,240.	$124,800	1
2.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
4.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
4.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
4.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
4.05	Routine / General Maintenance	0 - 0	LS	$109,200. - $202,800.	$0. - $0.	$0	1
4.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$29,771. - $55,289.	$0. - $0.	$0	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
5.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
5.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$13,255.2 - $24,616.8	$0. - $0.	$0	1
5.05	Routine / General Maintenance	0 - 0	LS	$163,800. - $304,200.	$0. - $0.	$0	1
5.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$50,578.5 - $93,931.5	$0. - $0.	$0	1
5.07	Compliance - Permits, etc.	0 - 0	LS	$34,456.8 - $63,991.2	$0. - $0.	$0	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	28,661 - 28,661	GAL	$5. - $6.	$143,307. - $171,968.	$157,638	1, 4
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	41,306 - 41,306	GAL	$5. - $6.	$206,530. - $247,837.	$227,184	1, 5
				SUBTOTAL (BARE):	**$1,006,971 - $1,316,755**	**$1,161,863**	
				CONTINGENCY (10%):	**$100,697 - $131,675**	**$116,186**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,107,668 - $1,448,430**	**$1,278,049**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe	0.0%	$ -	$ -	$ -
Northern Injection	100.0%	$ 1,687,084	$ 337,417	$ 2,024,500
Central Area IRZ / Injection	0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection	0.0%	$ -	$ -	$ -
Source Area IRZ / Injection	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific — **TOTAL:**	**100%**	**$ 1,687,084**	**$ 337,417**	**$ 2,024,500**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ 102,001	$ 10,200	$ 112,201
Northern Injection	$ 675,041	$ 67,504	$ 742,545
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ 157,638	$ 15,764	$ 173,401
Southern Plume Fringe	$ 227,184	$ 22,718	$ 249,902
TOTAL:	**$ 1,161,863**	**$ 116,186**	**$ 1,278,049**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (10-15 years)		Date: 30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	110 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
3	475 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
4	170 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
5	245 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 3 (15+ years)		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
	ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS						
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	18,546 - 18,546	GAL	$5. - $6.	$92,728. - $111,274.	$102,001	1, 2
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0.531 - 0.531	YR	$35,000. - $65,000.	$18,585. - $34,515.	$26,550	1
2.02	Electricity	292,000 - 365,000	KWH	$0.12 - $0.18	$35,040. - $65,700.	$50,370	1
2.03	Biological / Chemical Consumables	41,306 - 41,306	GAL	$5. - $6.	$206,530. - $247,837.	$227,184	1, 3
2.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
2.05	Routine / General Maintenance	0.8 - 0.8	LS	$109,200. - $202,800.	$87,360. - $162,240.	$124,800	1
2.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	0.531 - 0.531	YR	$35,000. - $65,000.	$18,585. - $34,515.	$26,550	1
4.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
4.03	Biological / Chemical Consumables	21,918 - 21,918	GAL	$5. - $6.	$109,588. - $131,505.	$120,546	1, 4
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.8 - 0.8	LS	$109,200. - $202,800.	$87,360. - $162,240.	$124,800	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0.531 - 0.531	YR	$140,000. - $260,000.	$74,340. - $138,060.	$106,200	1
5.02	Electricity	547,500 - 547,500	KWH	$0.12 - $0.18	$65,700. - $98,550.	$82,125	1, 5
5.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.8 - 0.8	LS	$163,800. - $304,200.	$131,040. - $243,360.	$187,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	28,661 - 28,661	GAL	$5. - $6.	$143,307. - $171,968.	$157,638	1, 7
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	41,306 - 41,306	GAL	$5. - $6.	$206,530. - $247,837.	$227,184	1, 8
				SUBTOTAL (BARE):	**$1,512,731 - $2,232,560**	**$1,872,646**	
				CONTINGENCY (10%):	**$151,273 - $223,256**	**$187,265**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,664,004 - $2,455,816**	**$2,059,910**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe		$ 102,001	$ 10,200	$ 112,201
Northern Injection		$ 450,817	$ 45,082	$ 495,898
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ 326,339	$ 32,634	$ 358,973
Source Area IRZ / Injection		$ 608,668	$ 60,867	$ 669,535
Southeast and East Plume Fringe		$ 157,638	$ 15,764	$ 173,401
Southern Plume Fringe		$ 227,184	$ 22,718	$ 249,902
	TOTAL:	**$ 1,872,646**	**$ 187,265**	**$ 2,059,910**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 3 (15+ years)		**Date: 30-Aug-10**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	110 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
3	245 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
4	130 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
5	Derived at Compressor Station
6	100 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	170 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
8	245 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 3 - Land Acquisition		**Date:**	**30-Aug-10**

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition	10 - 10	AC	$2,000. - $2,000.	$20,000 - $20,000	$20,000	1, 2
				Land Acquisition Costs Subtotal:	***$20,000 - $20,000***	***$20,000***	
				SUBTOTAL (BARE):	**$20,000 - $20,000**	**$20,000**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$20,000 - $20,000**	**$20,000**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for an easement.

Alternative 4: Core In-Situ Treatment and Beneficial Agricultural Use

Hinkley Feasibility Study

Table 1: Northwest Freshwater Injection at 40 gpm

Table 2: Scaled O&M Costs per Injection Well and Extraction Well

Table 3: Groundwater Monitoring Program - Current

Table 4: Groundwater Monitoring Program - 50% of Current Program

Table 5: Alt 4 - Northern Extraction

Table 6: SCRIA Extraction at 110 gpm

Table 7: Supplemental SCRIA Extraction

Table 8: Alt 4 (0-5 years)

Table 9: Agricultural Unit Modifications

Table 10: New Agricultural Unit

Table 11: Agricultural Unit O&M Backup

Table 12: Alt 4 - Land Acquisition

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 40 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.04	Project Management	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.05	Electricity	16,561 - 16,561	KWH	$0.12 $0.18	$1,987 - $2,981	$2,484	1, 2
1.06							
				SUBTOTAL (BARE):	**$142,707 - $143,701**	**$143,204**	
				CONTINGENCY (10%):	**$14,271 - $14,370**	**$14,320**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,978 - $158,071**	**$157,524**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection	$ 143,204	$ 14,320	$ 157,524
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 143,204**	**$ 14,320**	**$ 157,524**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 40 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 30-Aug-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 382,000	$ 38,200	$ 420,200
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 191,000	$ 19,100	$ 210,100
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4 - Northern Extraction		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$72,760. - $72,760.	$72,760 - $72,760	$72,760	1, 2
	Design and Contractor Bidding / Procurement Subtotal:				*$72,760 - $72,760*	*$72,760*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$72,760. - $72,760.	$72,760 - $72,760	$72,760	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$36,380. - $36,380.	$36,380 - $36,380	$36,380	1, 3
	Construction Monitoring and Site Security Subtotal:				*$119,140 - $119,140*	*$119,140*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	1 - 1	EA	$73,000. - $73,000.	$73,000 - $73,000	$73,000	1, 4
6.02	Well Completion	1 - 1	EA	$53,000. - $53,000.	$53,000 - $53,000	$53,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	7,520 - 7,520	LF	$80. - $80.	$601,600 - $601,600	$601,600	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
	Systems / Equipment Install / Field Labor Subtotal:				*$727,600 - $727,600*	*$727,600*	
	SUBTOTAL (BARE):				**$919,500 - $919,500**	**$919,500**	
	CONTINGENCY (20%):				**$183,900 - $183,900**	**$183,900**	
	TOTAL ESTIMATED CAPITAL COST:				**$1,103,400 - $1,103,400**	**$1,103,400**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1, 7
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.05	Electricity	51,752 - 51,752	KWH	$0.12 - $0.18	$6,210 - $9,315	$7,763	1, 8
	SUBTOTAL (BARE):				**$75,490 - $78,595**	**$77,043**	
	CONTINGENCY (10%):				**$7,549 - $7,860**	**$7,704**	
	TOTAL ESTIMATED ANNUAL O&M COSTS:				**$83,039 - $86,455**	**$84,747**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 919,500	$ 183,900	$ 1,103,400
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 919,500**	**$ 183,900**	**$ 1,103,400**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 77,043	$ 7,704	$ 84,747
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 77,043**	**$ 7,704**	**$ 84,747**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4 - Northern Extraction		Date: 30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup)+$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 existing + 1 new extraction well; O&M for Gorman Extraction wells covered in a separate cost estimate sheet
8	250 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 110 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	4 - 4	EA	$12,320 - $12,320	$49,280 - $49,280	$49,280	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$64,745 - $67,477**	**$66,111**	
				CONTINGENCY (10%):	**$6,474 - $6,748**	**$6,611**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$71,219 - $74,225**	**$72,722**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 66,111	$ 6,611	$ 72,722
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 66,111**	**$ 6,611**	**$ 72,722**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	4 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4 - Supplemental SCRIA Extraction		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1
1.02	Electricity	17,596 - 17,596	KWH	$0.12 - $0.18	$2,111 - $3,167	$2,639	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$49,071 - $50,127**	**$49,599**	
				CONTINGENCY (10%):	**$4,907 - $5,013**	**$4,960**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$53,979 - $55,140**	**$54,559**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 49,599	$ 4,960	$ 54,559
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 49,599**	**$ 4,960**	**$ 54,559**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells (to East of SCRIA Injection area); 85 gpm total @ 100' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4 (0-5 years)		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $10,000.	$50,000. - $10,000.	$30,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $10,000***	***$30,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	3 - 3	EA	$20,000. - $25,000.	$60,000. - $75,000.	$67,500	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	9 - 9	EA	$20,000. - $25,000.	$180,000. - $225,000.	$202,500	1, 2
5.04	Injection Wells - Dual Screen	26 - 26	EA	$30,000. - $40,000.	$780,000. - $1,040,000.	$910,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	1 - 1	LS	$87,500. - $162,500.	$87,500. - $162,500.	$125,000	1
5.11	IRZ Well Head/Downhole Completion	41 - 41	EA	$12,000. - $14,500.	$492,000. - $594,500.	$543,250	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	18,400 - 18,400	LF	$75. - $100.	$1,380,000. - $1,840,000.	$1,610,000	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$1,000,000. - $1,000,000.	$1,000,000. - $1,000,000.	$1,000,000	1, 4
5.18	Road Crossing - Surface Cut	1 - 1	LS	$75,000. - $110,000.	$75,000. - $110,000.	$92,500	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$4,819,500 - $6,077,000***	***$5,448,250***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$5,375,089 - $6,768,114**	**$6,071,602**	
				CONTINGENCY (20%):	**$1,075,018 - $1,353,623**	**$1,214,320**	
				TOTAL ESTIMATED CAPITAL COST:	**$6,450,107 - $8,121,737**	**$7,285,922**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	18.4%	$ 1,337,296
SCRIA / Dosed Injection	64.5%	$ 4,698,720
Source Area IRZ / Injection	17.2%	$ 1,249,906
	100.0%	$ 7,285,922

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4 (0-5 years)		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	365,000 - 365,000	KWH	$0.12 - $0.18	$43,800. - $65,700.	$54,750	1
3.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	410,625 - 410,625	KWH	$0.12 - $0.18	$49,275. - $73,913.	$61,594	1, 7
5.03	Biological / Chemical Consumables	21,075 - 21,075	GAL	$5. - $6.	$105,373. - $126,447.	$115,910	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,508,702 - $2,508,274**	**$2,008,488**	
				CONTINGENCY (10%):	**$150,870 - $250,827**	**$200,849**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,659,573 - $2,759,101**	**$2,209,337**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		18.4%	$ 1,114,413	$ 222,883	$ 1,337,296
SCRIA / Dosed Injection		64.5%	$ 3,915,600	$ 783,120	$ 4,698,720
Source Area IRZ / Injection		17.2%	$ 1,041,588	$ 208,318	$ 1,249,906
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,071,602**	**$ 1,214,320**	**$ 7,285,922**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 834,807	$ 83,481	$ 918,288
SCRIA / Dosed Injection		$ 433,463	$ 43,346	$ 476,809
Source Area IRZ / Injection		$ 740,219	$ 74,022	$ 814,241
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 2,008,488**	**$ 200,849**	**$ 2,209,337**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4 (0-5 years)		Date: 30-Aug-10

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, deliverec
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, deliverec
7	Derived at Compressor Station
8	125 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, deliverec

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit Modifications		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$16,000 - $16,000***	***$16,000***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	***$24,000 - $24,000***	***$24,000***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$160,000 - $160,000***	***$160,000***	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Agricultural Units	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K per pivot

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
New Agricultural Unit		**Date: 30-Aug-10**

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$410,588 - $410,588	$410,588 - $410,588	$410,588	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
	Design and Contractor Bidding / Procurement Subtotal:				***$410,588 - $410,588***	***$410,588***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$80,700. - $80,700.	$80,700 - $80,700	$80,700	1
2.02							
	Mobilization/Demobilization/Site Prep/General Conditions Subtotal:				***$80,700 - $80,700***	***$80,700***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$136,862.5 - $136,862.5	$136,863 - $136,863	$136,863	1, 3
3.02	Construction Management	1 - 1	LS	$273,725. - $273,725.	$273,725 - $273,725	$273,725	1, 4
3.03							
	Construction Monitoring and Site Security Subtotal:				***$410,588 - $410,588***	***$410,588***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	1 - 1	LS	$73,200. - $73,200.	$73,200 - $73,200	$73,200	1
4.02	AU Building Construction	1 - 1	LS	$556,000. - $556,000.	$556,000 - $556,000	$556,000	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$906,000. - $906,000.	$906,000 - $906,000	$906,000	1
4.04	Electrical	1 - 1	LS	$262,000. - $262,000.	$262,000 - $262,000	$262,000	1
4.05	Vaults	1 - 1	LS	$243,600. - $243,600.	$243,600 - $243,600	$243,600	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$688,950. - $688,950.	$688,950 - $688,950	$688,950	1
4.08							
	Systems / Equipment Install / Field Labor Subtotal:				***$2,737,250 - $2,737,250***	***$2,737,250***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
	Permits and Regulatory Compliance Subtotal:				***$50,000 - $50,000***	***$50,000***	
	SUBTOTAL (BARE):				**$3,689,125 - $3,689,125**	**$3,689,125**	
	CONTINGENCY (20%):				**$737,825 - $737,825**	**$737,825**	
	TOTAL ESTIMATED CAPITAL COST:				**$4,426,950 - $4,426,950**	**$4,426,950**	

Use 50% of 400 gpm/80 Acre AU for new 200 gpm AU:	**$2,213,475**
Use 33% of 400 gpm/80 Acre AU for each new 150 gpm AU:	**$1,460,894**
Use 75% of 400 gpm/80 Acre AU for new 200 gpm AU:	**$3,320,213**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST

Agricultural Unit O&M Backup

Hinkley Feasibility Study

Project Number: 36385

Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS: FARMER-OPERATED CASE

Equipment/Process Name	Unit of Measure	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost
Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			4		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head		
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000
Electrical Power										
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**

Equipment/Process Name	Unit of Measure	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost
		CALCULATED			CALCULATED			CALCULATED		
Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			6		
Application Rate and Pressure		840 gpm at 100 ft head			950 gpm at 100 ft head			1270 gpm at 100 ft head		
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	405	$ 100	$ 40,533	420	$ 100	$ 42,000	520	$ 100	$ 52,000
Health & safety training/monitoring	ea	1	$ 10,267	$ 10,267	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700
Other expenses	ea	1	$ 6,160	$ 6,160	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220
Electrical Power										
Pump Water from Aquifer to AUs	kW-hr	173,885	$ 0.15	$ 26,083	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	89,000	$ 89,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,283,333	$ 25,667	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000
Subtotal				**$ 290,578**			**$ 308,347**			**$ 447,186**
Contingency on Materials/Services	percent	10	$ 290,578	$ 29,058	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719
GRAND TOTAL				**$ 319,636**			**$ 339,181**			**$ 491,904**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
9	Controls/lights operated at 1.5 kW.
10	Five (5) pivot motors operated for 800 gpm and 840 gpm applications; six (6) pivot motors operated for 950 gpm and 1,100 gpm applications; eight (8) pivot motors operated for 1,270 and 1,400 gpm applications. Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4 - Land Acquisition		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition	8.8 - 8.8	AC	$2,000. - $2,000.	$17,600 - $17,600	$17,600	1, 2
1.02	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
				Land Acquisition Costs Subtotal:	***$337,600 - $337,600***	***$337,600***	
				SUBTOTAL (BARE):	**$337,600 - $337,600**	**$337,600**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$337,600 - $337,600**	**$337,600**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for an easement.
3	Property will be used for the third agricultural unit.

Alternative 4A: Aggressive In-Situ Treatment and Beneficial Agricultural Use

Hinkley Feasibility Study - Addendum #1

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 80 gpm		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northwest Freshwater Injection		$ 135,688	$ 13,569	$ 149,257
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 30-Aug-10

Injection Well Cost Estimate

Description	Quantity Low		Quantity High	Units	Unit Cost Low		Unit Cost High	Midpoint Cost		Notes
Routine - Monthly injection well backwashing - Labor	24	-	144	HRS	$70	-	$70	$	5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	-	12	MO	$500	-	$500	$	3,500	estimate
Routine - Weekly injection well inspection - Labor	26	-	26	HRS	$70	-	$70	$	1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	-	52	WKS	$50	-	$50	$	2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	-	15	HRS	$70	-	$70	$	1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	-	0.5	LS	$500	-	$500	$	250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	-	1.5	DAYS	$3,000	-	$3,000	$	4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	-	1	YR	$5,000	-	$5,000	$	5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
								$	**24,600**	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low		Quantity High	Units	Unit Cost Low		Unit Cost High	Midpoint Cost		Notes
Routine - Weekly extraction well inspection - Labor	26	-	26	HRS	$70		$70	$	1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	-	52	WKS	$50		$50	$	2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	-	1	YR	$2,500		$2,500	$	2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	-	1	YR	$2,500		$2,500	$	2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	-	7.5	HRS	$70	-	$70	$	525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	-	0.25	LS	$500	-	$500	$	125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	-	0.75	DAYS	$3,000	-	$3,000	$	2,250	3 days/well, $3,000/day (every 4 years)
								$	**12,320**	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)							$ XX		A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 382,000	$ 38,200	$ 420,200
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 286,500	$ 28,650	$ 315,150
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 191,000	$ 19,100	$ 210,100
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A - Northern Extraction		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$174,104. - $174,104.	$174,104 - $174,104	$174,104	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$174,104 - $174,104***	***$174,104***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$174,104. - $174,104.	$174,104 - $174,104	$174,104	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$87,052. - $87,052.	$87,052 - $87,052	$87,052	1, 3
				Construction Monitoring and Site Security Subtotal:	***$271,156 - $271,156***	***$271,156***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	13 - 13	EA	$73,000. - $73,000.	$949,000 - $949,000	$949,000	1, 4
6.02	Well Completion	5 - 5	EA	$53,000. - $53,000.	$265,000 - $265,000	$265,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	6,588 - 6,588	LF	$80. - $80.	$527,040 - $527,040	$527,040	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$1,741,040 - $1,741,040***	***$1,741,040***	
				SUBTOTAL (BARE):	**$2,186,300 - $2,186,300**	**$2,186,300**	
				CONTINGENCY (20%):	**$437,260 - $437,260**	**$437,260**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,623,560 - $2,623,560**	**$2,623,560**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	7
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$0 - $0**	**$0**	
				CONTINGENCY (10%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$0 - $0**	**$0**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 2,186,300	$ 437,260	$ 2,623,560
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,186,300**	**$ 437,260**	**$ 2,623,560**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ -	$ -	$ -
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ -**	**$ -**	**$ -**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A - Northern Extraction		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 110 gpm (5 wells)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	5 - 5	EA	$12,320 - $12,320	$61,600 - $61,600	$61,600	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$77,065 - $79,797**	**$78,431**	
				CONTINGENCY (10%):	**$7,706 - $7,980**	**$7,843**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$84,771 - $87,777**	**$86,274**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 78,431	$ 7,843	$ 86,274
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 78,431**	**$ 7,843**	**$ 86,274**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	5 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Supplemental SCRIA Extraction		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1
1.02	Electricity	17,596 - 17,596	KWH	$0.12 - $0.18	$2,111 - $3,167	$2,639	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$49,071 - $50,127**	**$49,599**	
				CONTINGENCY (10%):	**$4,907 - $5,013**	**$4,960**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$53,979 - $55,140**	**$54,559**	

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 49,599	$ 4,960	$ 54,559
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 49,599**	**$ 4,960**	**$ 54,559**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells (to East of SCRIA Injection area); 85 gpm total @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction (60 gpm)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$49,480. - $49,480.	$49,480 - $49,480	$49,480	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$49,480 - $49,480***	***$49,480***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$49,480. - $49,480.	$49,480 - $49,480	$49,480	1, 2
5.02	Project Management through Startup	1 - 1	LS	$24,740. - $24,740.	$24,740 - $24,740	$24,740	1, 3
				Construction Monitoring and Site Security Subtotal:	***$74,220 - $74,220***	***$74,220***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	1,460 - 1,460	LF	$80. - $80.	$116,800 - $116,800	$116,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$494,800 - $494,800***	***$494,800***	
				SUBTOTAL (BARE):	**$618,500 - $618,500**	**$618,500**	
				CONTINGENCY (20%):	**$123,700 - $123,700**	**$123,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$742,200 - $742,200**	**$742,200**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
				SUBTOTAL (BARE):	**$49,941 - $51,431**	**$50,686**	
				CONTINGENCY (10%):	**$4,994 - $5,143**	**$5,069**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 618,500	$ 123,700	$ 742,200
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 618,500**	**$ 123,700**	**$ 742,200**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 50,686	$ 5,069	$ 55,755
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction (60 gpm)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 170 gpm for low dose		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	8 - 8	EA	$12,320 - $12,320	$98,560 - $98,560	$98,560	1
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$127,006 - $131,229**	**$129,117**	
				CONTINGENCY (10%):	**$12,701 - $13,123**	**$12,912**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$139,706 - $144,352**	**$142,029**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 129,117	$ 12,912	$ 142,029
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 129,117**	**$ 12,912**	**$ 142,029**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	170 gpm total @200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$180,000 - $240,000***	***$210,000***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	12 - 12	EA	$30,000. - $40,000.	$360,000. - $480,000.	$420,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	40 - 40	EA	$30,000. - $40,000.	$1,200,000. - $1,600,000.	$1,400,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	52 - 52	EA	$12,000. - $14,500.	$624,000. - $754,000.	$689,000	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	22,634 - 22,634	LF	$75. - $100.	$1,697,550. - $2,263,400.	$1,980,475	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	4 - 4	LS	$20,000. - $20,000.	$80,000. - $80,000.	$80,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	***$5,136,550 - $6,587,400***	***$5,861,975***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$5,872,139 - $7,608,514**	**$6,740,327**	
				CONTINGENCY (20%):	**$1,174,428 - $1,521,703**	**$1,348,065**	
				TOTAL ESTIMATED CAPITAL COST:	**$7,046,567 - $9,130,217**	**$8,088,392**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	25.7%	$ 2,077,153
	SCRIA / Dosed Injection	36.2%	$ 2,927,479
	Source Area IRZ / Injection	38.1%	$ 3,083,759
		100.0%	$ 8,088,392

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	302,930 - 302,930	KWH	$0.12 - $0.18	$36,352. - $54,527.	$45,440	1, 7
5.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,507,024 - $2,501,964**	**$2,004,494**	
				CONTINGENCY (10%):	**$150,702 - $250,196**	**$200,449**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,657,727 - $2,752,160**	**$2,204,943**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		25.7%	$ 1,730,961	$ 346,192	$ 2,077,153
SCRIA / Dosed Injection		36.2%	$ 2,439,566	$ 487,913	$ 2,927,479
Source Area IRZ / Injection		38.1%	$ 2,569,800	$ 513,960	$ 3,083,759
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,740,327**	**$ 1,348,065**	**$ 8,088,392**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection		$ 747,246	$ 74,725	$ 821,971
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 2,004,494**	**$ 200,449**	**$ 2,204,943**

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (0-5 years)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	Derived at Compressor Station
8	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 4A (5-10 years)		**Date: 31-Jan-11**

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$42,500 - $49,500***	***$46,000***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$25,000. - $50,000.	$25,000. - $50,000.	$37,500	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$25,000 - $50,000***	***$37,500***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$50,000 - $50,000***	***$50,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	6 - 6	LS	$3,000. - $3,000.	$18,000. - $18,000.	$18,000	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$190,000 - $224,000***	***$207,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$10,000. - $15,000.	$10,000. - $15,000.	$12,500	1
6.02							
				Treatment System Startup Subtotal:	***$10,000 - $15,000***	***$12,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$318,500 - $390,500**	**$354,500**	
				CONTINGENCY (20%):	**$63,700 - $78,100**	**$70,900**	
				TOTAL ESTIMATED CAPITAL COST:	**$382,200 - $468,600**	**$425,400**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	83.7%	$ 356,104
Source Area IRZ / Injection	16.3%	$ 69,296
	100.0%	$ 425,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	4,364 - 4,364	KWH	$0.12 - $0.18	$524. - $785.	$655	1
4.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	4,145 - 4,145	KWH	$0.12 - $0.18	$497. - $746.	$622	1
5.03	Biological / Chemical Consumables	16,017 - 16,017	GAL	$5. - $6.	$80,083. - $96,100.	$88,092	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,344,226 - $2,295,700**	**$1,819,963**	
				CONTINGENCY (10%):	**$134,423 - $229,570**	**$181,996**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,478,648 - $2,525,269**	**$2,001,959**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe	0.0%	$ -	$ -	$ -
Northern Injection	0.0%	$ -	$ -	$ -
Central Area IRZ / Injection	0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection	83.7%	$ 296,753	$ 59,351	$ 356,104
Source Area IRZ / Injection	16.3%	$ 57,747	$ 11,549	$ 69,296
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific **TOTAL:**	**100%**	**$ 354,500**	**$ 70,900**	**$ 425,400**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 346,026	$ 34,603	$ 380,628
Source Area IRZ / Injection	$ 651,428	$ 65,143	$ 716,571
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,819,963**	**$ 181,996**	**$ 2,001,959**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (10-20 years)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$87,089 - $128,614***	***$107,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$100,000 - $150,000***	***$125,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$28,000. - $52,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	6 - 6	EA	$12,000. - $14,500.	$72,000. - $87,000.	$79,500	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	2,480 - 2,480	LF	$75. - $100.	$186,000. - $248,000.	$217,000	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$565,000 - $721,000***	***$643,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	***$25,000 - $30,000***	***$27,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$828,089 - $1,131,614**	**$979,852**	
				CONTINGENCY (20%):	**$165,618 - $226,323**	**$195,970**	
				TOTAL ESTIMATED CAPITAL COST:	**$993,707 - $1,357,937**	**$1,175,822**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	72.1%	$ 848,241
Source Area IRZ / Injection	27.9%	$ 327,581
	100.0%	$ 1,175,822

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (10-20 years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	5,455 - 5,455	KWH	$0.12 - $0.18	$655. - $982.	$818	1
4.03	Biological / Chemical Consumables	22,761 - 22,761	GAL	$5. - $6.	$113,803. - $136,563.	$125,183	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
5.02	Electricity	5,236 - 5,236	KWH	$0.12 - $0.18	$628. - $943.	$785	1
5.03	Biological / Chemical Consumables	20,232 - 20,232	GAL	$5. - $6.	$101,158. - $121,389.	$111,274	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$25,200. - $46,800.	$23,940. - $44,460.	$34,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,109,902 - $1,827,196**	**$1,468,549**	
				CONTINGENCY (10%):	**$110,990 - $182,720**	**$146,855**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,220,892 - $2,009,915**	**$1,615,403**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		72.1%	$ 706,868	$ 141,374	$ 848,241
Source Area IRZ / Injection		27.9%	$ 272,984	$ 54,597	$ 327,581
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 979,852**	**$ 195,970**	**$ 1,175,822**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 378,644	$ 37,864	$ 416,508
Source Area IRZ / Injection	$ 267,396	$ 26,740	$ 294,136
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,468,549**	**$ 146,855**	**$ 1,615,403**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (10-20 years)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	245 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (20+ years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit Modifications		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	Design and Contractor Bidding / Procurement						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
	Design and Contractor Bidding / Procurement Subtotal:				$16,000 - $16,000	$16,000	
5.00	Construction Monitoring and Site Security						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
	Construction Monitoring and Site Security Subtotal:				$24,000 - $24,000	$24,000	
6.00	Systems / Equipment Install / Field Labor						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
	Systems / Equipment Install / Field Labor Subtotal:				$160,000 - $160,000	$160,000	
	SUBTOTAL (BARE):				$200,000 - $200,000	$200,000	
	CONTINGENCY (20%):				$40,000 - $40,000	$40,000	
	TOTAL ESTIMATED CAPITAL COST:				$240,000 - $240,000	$240,000	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	TOTAL:	100%	$ 200,000	$ 40,000	$ 240,000

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	$ -	$ -	$ -

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K per pivot

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
New Agricultural Unit (Revised)		Date: 31-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$901,332 - $1,026,332**	**$963,832**	
				CONTINGENCY (20%):	**$180,266 - $205,266**	**$192,766**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST

Agricultural Unit O&M Backup

Hinkley Feasibility Study

Project Number: 36385

Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS: FARMER-OPERATED CASE

											CALCULATED			CALCULATED			CALCULATED		
Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			4			3			3			6		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head			840 gpm at 100 ft head			950 gpm at 100 ft head			1270 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations																			
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000	405	$ 100	$ 40,533	420	$ 100	$ 42,000	520	$ 100	$ 52,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000	1	$ 10,267	$ 10,267	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000	1	$ 6,160	$ 6,160	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220
Electrical Power																			
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471	173,885	$ 0.15	$ 26,083	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services																			
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	89,000	$ 89,000
Parts/repairs																			
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000	2	$ 1,283,333	$ 25,667	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**			**$ 290,578**			**$ 308,347**			**$ 447,186**
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880	10	$ 290,578	$ 29,058	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**			**$ 319,636**			**$ 339,181**			**$ 491,904**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
9	Controls/lights operated at 1.5 kW.
10	Five (5) pivot motors operated for 800 gpm and 840 gpm applications; six (6) pivot motors operated for 950 gpm and 1,100 gpm applications; eight (8) pivot motors operated for 1,270 and 1,400 gpm applications. Each pivot motor operated at 6 kW.
11	Electrical rate varies from \$0.12/kW-hr to \$0.18/kW-hr. Average electrical rate is \$0.15/kW-hr.

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4a - Land Acquisition		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.03	Land Acquisition	26.3 - 26.3	AC	$2,000. - $2,000.	$52,600 - $52,600	$52,600	1, 4
				Land Acquisition Costs Subtotal:	***$1,012,600 - $1,012,600***	***$1,012,600***	
				SUBTOTAL (BARE):	**$1,012,600 - $1,012,600**	**$1,012,600**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,012,600 - $1,012,600**	**$1,012,600**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for two agricultural units.
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for an easement.

Alternative 4B: Aggressive In-situ Treatment and Beneficial Agricultural Use with Targeted Pumping

Hinkley Feasibility Study - Addendum #2

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 80 gpm		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection		$ 135,688	$ 13,569	$ 149,257
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 30-Aug-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: ол-!uƎ-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
GMP Including BCMP		$ 382,000	$ 38,200	$ 420,200
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 0л-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 286,500	$ 28,650	$ 315,150
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 01-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS

	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch Extraction	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific				
TOTAL:	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 191,000	$ 19,100	$ 210,100
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A - Northern Extraction		Date: 0M-Jan-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$174,104. - $174,104.	$174,104 - $174,104	$174,104	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$174,104 - $174,104***	***$174,104***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$174,104. - $174,104.	$174,104 - $174,104	$174,104	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$87,052. - $87,052.	$87,052 - $87,052	$87,052	1, 3
				Construction Monitoring and Site Security Subtotal:	***$271,156 - $271,156***	***$271,156***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	13 - 13	EA	$73,000. - $73,000.	$949,000 - $949,000	$949,000	1, 4
6.02	Well Completion	5 - 5	EA	$53,000. - $53,000.	$265,000 - $265,000	$265,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	6,588 - 6,588	LF	$80. - $80.	$527,040 - $527,040	$527,040	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$1,741,040 - $1,741,040***	***$1,741,040***	
				SUBTOTAL (BARE):	**$2,186,300 - $2,186,300**	**$2,186,300**	
				CONTINGENCY (20%):	**$437,260 - $437,260**	**$437,260**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,623,560 - $2,623,560**	**$2,623,560**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	7
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$0 - $0**	**$0**	
				CONTINGENCY (10%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$0 - $0**	**$0**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 2,186,300	$ 437,260	$ 2,623,560
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,186,300**	**$ 437,260**	**$ 2,623,560**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ -	$ -	$ -
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ -**	**$ -**	**$ -**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 4A - Northern Extraction		**Date: 31-Jan-11**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4B - Northern Extraction (10 yrs)		Date: 3-Mar-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$225,260. - $225,260.	$225,260 - $225,260	$225,260	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$225,260 - $225,260***	***$225,260***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$225,260. - $225,260.	$225,260 - $225,260	$225,260	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$112,630. - $112,630.	$112,630 - $112,630	$112,630	1, 3
				Construction Monitoring and Site Security Subtotal:	***$347,890 - $347,890***	***$347,890***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	12 - 12	EA	$53,000. - $53,000.	$636,000 - $636,000	$636,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	9,070 - 9,070	LF	$80. - $80.	$725,600 - $725,600	$725,600	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
6.08	Pressure Boosting System	1 - 1	EA	$15,000. - $15,000.	$15,000 - $15,000	$15,000	1, 7
				Systems / Equipment Install / Field Labor Subtotal:	***$2,252,600 - $2,252,600***	***$2,252,600***	
				SUBTOTAL (BARE):	**$2,825,750 - $2,825,750**	**$2,825,750**	
				CONTINGENCY (20%):	**$565,150 - $565,150**	**$565,150**	
				TOTAL ESTIMATED CAPITAL COST:	**$3,390,900 - $3,390,900**	**$3,390,900**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	8
1.02	Scaled Operating Cost (per off-site AU extraction well)	12 - 12	WELL	$7,285. - $7,285.	$87,420 - $87,420	$87,420	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	9
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	7, 8
				SUBTOTAL (BARE):	**$91,420 - $91,420**	**$91,420**	
				CONTINGENCY (10%):	**$9,142 - $9,142**	**$9,142**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$100,562 - $100,562**	**$100,562**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 2,825,750	$ 565,150	$ 3,390,900
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,825,750**	**$ 565,150**	**$ 3,390,900**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction		$ 91,420	$ 9,142	$ 100,562
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 91,420**	**$ 9,142**	**$ 100,562**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4B - Northern Extraction (10 yrs)		Date: 3-Mar-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.
8	O&M costs not already covered under AU O&M estimate
9	O&M costs already covered under AU O&M estimate

ALTERNATIVE 4B: TABLE 8
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 110 gpm (5 wells)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	5 - 5	EA	$12,320 - $12,320	$61,600 - $61,600	$61,600	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$77,065 - $79,797**	**$78,431**	
				CONTINGENCY (10%):	**$7,706 - $7,980**	**$7,843**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$84,771 - $87,777**	**$86,274**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 78,431	$ 7,843	$ 86,274
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 78,431**	**$ 7,843**	**$ 86,274**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	5 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Supplemental SCRIA Extraction		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1
1.02	Electricity	17,596 - 17,596	KWH	$0.12 - $0.18	$2,111 - $3,167	$2,639	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$49,071 - $50,127**	**$49,599**	
				CONTINGENCY (10%):	**$4,907 - $5,013**	**$4,960**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$53,979 - $55,140**	**$54,559**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 49,599	$ 4,960	$ 54,559
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 49,599**	**$ 4,960**	**$ 54,559**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells (to East of SCRIA Injection area); 85 gpm total @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction (60 gpm)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$49,480. - $49,480.	$49,480 - $49,480	$49,480	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$49,480 - $49,480***	***$49,480***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$49,480. - $49,480.	$49,480 - $49,480	$49,480	1, 2
5.02	Project Management through Startup	1 - 1	LS	$24,740. - $24,740.	$24,740 - $24,740	$24,740	1, 3
				Construction Monitoring and Site Security Subtotal:	***$74,220 - $74,220***	***$74,220***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	1,460 - 1,460	LF	$80. - $80.	$116,800 - $116,800	$116,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$494,800 - $494,800***	***$494,800***	
				SUBTOTAL (BARE):	**$618,500 - $618,500**	**$618,500**	
				CONTINGENCY (20%):	**$123,700 - $123,700**	**$123,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$742,200 - $742,200**	**$742,200**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
				SUBTOTAL (BARE):	**$49,941 - $51,431**	**$50,686**	
				CONTINGENCY (10%):	**$4,994 - $5,143**	**$5,069**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 618,500	$ 123,700	$ 742,200
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 618,500**	**$ 123,700**	**$ 742,200**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
SCRIA Extraction	$ 50,686	$ 5,069	$ 55,755
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction (60 gpm)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 170 gpm for low dose		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	8 - 8	EA	$12,320 - $12,320	$98,560 - $98,560	$98,560	1
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$127,006 - $131,229**	**$129,117**	
				CONTINGENCY (10%):	**$12,701 - $13,123**	**$12,912**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$139,706 - $144,352**	**$142,029**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 129,117	$ 12,912	$ 142,029
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 129,117**	**$ 12,912**	**$ 142,029**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	170 gpm total @ 200' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (0-5 years)		Date: 31-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	Design and Contractor Bidding / Procurement						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	*$204,589 - $269,114*	*$236,852*	
2.00	Performance Monitoring Well Installation						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	*$180,000 - $240,000*	*$210,000*	
3.00	Mobilization/Demobilization/Site Prep/General Conditions						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	*$50,000 - $100,000*	*$75,000*	
4.00	Construction Monitoring and Site Security						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	*$225,000 - $310,000*	*$267,500*	
5.00	Systems / Equipment Install / Field Labor						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	12 - 12	EA	$30,000. - $40,000.	$360,000. - $480,000.	$420,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	40 - 40	EA	$30,000. - $40,000.	$1,200,000. - $1,600,000.	$1,400,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	52 - 52	EA	$12,000. - $14,500.	$624,000. - $754,000.	$689,000	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	22,634 - 22,634	LF	$75. - $100.	$1,697,550. - $2,263,400.	$1,980,475	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	4 - 4	LS	$20,000. - $20,000.	$80,000. - $80,000.	$80,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	*$5,136,550 - $6,587,400*	*$5,861,975*	
6.00	Treatment System Startup						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	*$75,000 - $100,000*	*$87,500*	
7.00	Permits and Regulatory Compliance						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	*$1,000 - $2,000*	*$1,500*	
				SUBTOTAL (BARE):	**$5,872,139 - $7,608,514**	**$6,740,327**	
				CONTINGENCY (20%):	**$1,174,428 - $1,521,703**	**$1,348,065**	
				TOTAL ESTIMATED CAPITAL COST:	**$7,046,567 - $9,130,217**	**$8,088,392**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	25.7%	$ 2,077,153
	SCRIA / Dosed Injection	36.2%	$ 2,927,479
	Source Area IRZ / Injection	38.1%	$ 3,083,759
		100.0%	$ 8,088,392

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (0-5 years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	302,930 - 302,930	KWH	$0.12 - $0.18	$36,352. - $54,527.	$45,440	1, 7
5.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,507,024 - $2,501,964**	**$2,004,494**	
				CONTINGENCY (10%):	**$150,702 - $250,196**	**$200,449**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,657,727 - $2,752,160**	**$2,204,943**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		25.7%	$ 1,730,961	$ 346,192	$ 2,077,153
SCRIA / Dosed Injection		36.2%	$ 2,439,566	$ 487,913	$ 2,927,479
Source Area IRZ / Injection		38.1%	$ 2,569,800	$ 513,960	$ 3,083,759
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,740,327**	**$ 1,348,065**	**$ 8,088,392**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection	$ 747,246	$ 74,725	$ 821,971
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 2,004,494**	**$ 200,449**	**$ 2,204,943**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	Derived at Compressor Station
8	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (5-10 years)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
	Design and Contractor Bidding / Procurement Subtotal:				***$42,500 - $49,500***	***$46,000***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
	Performance Monitoring Well Installation Subtotal:				***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$25,000. - $50,000.	$25,000. - $50,000.	$37,500	1
3.02							
	Mobilization/Demobilization/Site Prep/General Conditions Subtotal:				***$25,000 - $50,000***	***$37,500***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
	Construction Monitoring and Site Security Subtotal:				***$50,000 - $50,000***	***$50,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	6 - 6	LS	$3,000. - $3,000.	$18,000. - $18,000.	$18,000	1
5.19							
	Systems / Equipment Install / Field Labor Subtotal:				***$190,000 - $224,000***	***$207,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$10,000. - $15,000.	$10,000. - $15,000.	$12,500	1
6.02							
	Treatment System Startup Subtotal:				***$10,000 - $15,000***	***$12,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
	Permits and Regulatory Compliance Subtotal:				***$1,000 - $2,000***	***$1,500***	
	SUBTOTAL (BARE):				**$318,500 - $390,500**	**$354,500**	
	CONTINGENCY (20%):				**$63,700 - $78,100**	**$70,900**	
	TOTAL ESTIMATED CAPITAL COST:				**$382,200 - $468,600**	**$425,400**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	83.7%	$ 356,104
	Source Area IRZ / Injection	16.3%	$ 69,296
		100.0%	$ 425,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 0M-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	4,364 - 4,364	KWH	$0.12 - $0.18	$524. - $785.	$655	1
4.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	4,145 - 4,145	KWH	$0.12 - $0.18	$497. - $746.	$622	1
5.03	Biological / Chemical Consumables	16,017 - 16,017	GAL	$5. - $6.	$80,083. - $96,100.	$88,092	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,344,226 - $2,295,700**	**$1,819,963**	
				CONTINGENCY (10%):	**$134,423 - $229,570**	**$181,996**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,478,648 - $2,525,269**	**$2,001,959**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		83.7%	$ 296,753	$ 59,351	$ 356,104
Source Area IRZ / Injection		16.3%	$ 57,747	$ 11,549	$ 69,296
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 354,500**	**$ 70,900**	**$ 425,400**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 346,026	$ 34,603	$ 380,628
Source Area IRZ / Injection		$ 651,428	$ 65,143	$ 716,571
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 1,819,963**	**$ 181,996**	**$ 2,001,959**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 0M-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (10-20 years)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	*$87,089 - $128,614*	*$107,852*	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	*$0 - $0*	*$0*	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	*$50,000 - $100,000*	*$75,000*	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	*$100,000 - $150,000*	*$125,000*	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$28,000. - $52,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	6 - 6	EA	$12,000. - $14,500.	$72,000. - $87,000.	$79,500	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	2,480 - 2,480	LF	$75. - $100.	$186,000. - $248,000.	$217,000	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	*$565,000 - $721,000*	*$643,000*	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	*$25,000 - $30,000*	*$27,500*	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	*$1,000 - $2,000*	*$1,500*	
				SUBTOTAL (BARE):	**$828,089 - $1,131,614**	**$979,852**	
				CONTINGENCY (20%):	**$165,618 - $226,323**	**$195,970**	
				TOTAL ESTIMATED CAPITAL COST:	**$993,707 - $1,357,937**	**$1,175,822**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	72.1%	$ 848,241
	Source Area IRZ / Injection	27.9%	$ 327,581
		100.0%	$ 1,175,822

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (10-20 years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	5,455 - 5,455	KWH	$0.12 - $0.18	$655. - $982.	$818	1
4.03	Biological / Chemical Consumables	22,761 - 22,761	GAL	$5. - $6.	$113,803. - $136,563.	$125,183	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
5.02	Electricity	5,236 - 5,236	KWH	$0.12 - $0.18	$628. - $943.	$785	1
5.03	Biological / Chemical Consumables	20,232 - 20,232	GAL	$5. - $6.	$101,158. - $121,389.	$111,274	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$25,200. - $46,800.	$23,940. - $44,460.	$34,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,109,902 - $1,827,196**	**$1,468,549**	
				CONTINGENCY (10%):	**$110,990 - $182,720**	**$146,855**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,220,892 - $2,009,915**	**$1,615,403**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe	0.0%	$ -	$ -	$ -
Northern Injection	0.0%	$ -	$ -	$ -
Central Area IRZ / Injection	0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection	72.1%	$ 706,868	$ 141,374	$ 848,241
Source Area IRZ / Injection	27.9%	$ 272,984	$ 54,597	$ 327,581
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific **TOTAL:**	**100%**	**$ 979,852**	**$ 195,970**	**$ 1,175,822**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 378,644	$ 37,864	$ 416,508
Source Area IRZ / Injection	$ 267,396	$ 26,740	$ 294,136
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,468,549**	**$ 146,855**	**$ 1,615,403**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (10-20 years)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	245 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (20+ years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST Agricultural Unit Modifications	*Hinkley Feasibility Study*	Project Number: 36385 Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$16,000 - $16,000***	***$16,000***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	***$24,000 - $24,000***	***$24,000***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$160,000 - $160,000***	***$160,000***	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K per pivot

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
New Agricultural Unit (Revised)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$901,332 - $1,026,332**	**$963,832**	
				CONTINGENCY (20%):	**$180,266 - $205,266**	**$192,766**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST

Agricultural Unit O&M Backup

Hinkley Feasibility Study

Project Number: 36385

Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS: FARMER-OPERATED CASE

Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			4		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000
Electrical Power										
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**

		CALCULATED			CALCULATED			CALCULATED		
Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			6		
Application Rate and Pressure		840 gpm at 100 ft head			950 gpm at 100 ft head			1270 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	405	$ 100	$ 40,533	420	$ 100	$ 42,000	520	$ 100	$ 52,000
Health & safety training/monitoring	ea	1	$ 10,267	$ 10,267	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700
Other expenses	ea	1	$ 6,160	$ 6,160	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220
Electrical Power										
Pump Water from Aquifer to AUs	kW-hr	173,885	$ 0.15	$ 26,083	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	89,000	$ 89,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,283,333	$ 25,667	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000
Subtotal				**$ 290,578**			**$ 308,347**			**$ 447,186**
Contingency on Materials/Services	percent	10	$ 290,578	$ 29,058	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719
GRAND TOTAL				**$ 319,636**			**$ 339,181**			**$ 491,904**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
9	Controls/lights operated at 1.5 kW.
10	Five (5) pivot motors operated for 800 gpm and 840 gpm applications; six (6) pivot motors operated for 950 gpm and 1,100 gpm applications; eight (8) pivot motors operated for 1,270 and 1,400 gpm applications. Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4a - Land Acquisition		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.03	Land Acquisition	26.3 - 26.3	AC	$2,000. - $2,000.	$52,600 - $52,600	$52,600	1, 4
				Land Acquisition Costs Subtotal:	***$1,012,600 - $1,012,600***	***$1,012,600***	
				SUBTOTAL (BARE):	**$1,012,600 - $1,012,600**	**$1,012,600**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,012,600 - $1,012,600**	**$1,012,600**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for two agricultural units.
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for an easement.

Alternative 5: Plume-Wide Pump and Treat

Hinkley Feasibility Study

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 40 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.04	Project Management	1 - 1	YR	$15,000 - $15,000	$15,000 - $15,000	$15,000	1
1.05	Electricity	16,561 - 16,561	KWH	$0.12 $0.18	$1,987 - $2,981	$2,484	1, 2
1.06							
				SUBTOTAL (BARE):	**$142,707 - $143,701**	**$143,204**	
				CONTINGENCY (10%):	**$14,271 - $14,370**	**$14,320**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,978 - $158,071**	**$157,524**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection		$ 143,204	$ 14,320	$ 157,524
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 143,204**	**$ 14,320**	**$ 157,524**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 40 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 30-Aug-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS

	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch Extraction	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific — **TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 382,000	$ 38,200	$ 420,200
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 191,000	$ 19,100	$ 210,100
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 5 - Northern Extraction		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$110,920. - $110,920.	$110,920 - $110,920	$110,920	1, 2
	Design and Contractor Bidding / Procurement Subtotal:				*$110,920 - $110,920*	*$110,920*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$110,920. - $110,920.	$110,920 - $110,920	$110,920	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$55,460. - $55,460.	$55,460 - $55,460	$55,460	1, 3
	Construction Monitoring and Site Security Subtotal:				*$176,380 - $176,380*	*$176,380*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	1 - 1	EA	$73,000. - $73,000.	$73,000 - $73,000	$73,000	1, 4
6.02	Well Completion	1 - 1	EA	$53,000. - $53,000.	$53,000 - $53,000	$53,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	12,290 - 12,290	LF	$80. - $80.	$983,200 - $983,200	$983,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
	Systems / Equipment Install / Field Labor Subtotal:				*$1,109,200 - $1,109,200*	*$1,109,200*	
	SUBTOTAL (BARE):				**$1,396,500 - $1,396,500**	**$1,396,500**	
	CONTINGENCY (20%):				**$279,300 - $279,300**	**$279,300**	
	TOTAL ESTIMATED CAPITAL COST:				**$1,675,800 - $1,675,800**	**$1,675,800**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1, 7
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
1.05	Electricity	51,752 - 51,752	KWH	$0.12 - $0.18	$6,210 - $9,315	$7,763	1, 8
	SUBTOTAL (BARE):				**$75,490 - $78,595**	**$77,043**	
	CONTINGENCY (10%):				**$7,549 - $7,860**	**$7,704**	
	TOTAL ESTIMATED ANNUAL O&M COSTS:				**$83,039 - $86,455**	**$84,747**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction	100.0%	$ 1,396,500	$ 279,300	$ 1,675,800
Gorman Extraction	0.0%	$ -	$ -	$ -
Central Area IRZ / Injection	0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection	0.0%	$ -	$ -	$ -
Source Area IRZ / Injection	0.0%	$ -	$ -	$ -
Non-Specific — **TOTAL:**	**100%**	**$ 1,396,500**	**$ 279,300**	**$ 1,675,800**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 77,043	$ 7,704	$ 84,747
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 77,043**	**$ 7,704**	**$ 84,747**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 5 - Northern Extraction		**Date: 30-Aug-10**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 existing + 1 new extraction well; O&M for Gorman Extraction wells covered in a separate cost estimate sheet
8	250 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 110 gpm		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	4 - 4	EA	$12,320 - $12,320	$49,280 - $49,280	$49,280	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$64,745 - $67,477**	**$66,111**	
				CONTINGENCY (10%):	**$6,474 - $6,748**	**$6,611**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$71,219 - $74,225**	**$72,722**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 66,111	$ 6,611	$ 72,722
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 66,111**	**$ 6,611**	**$ 72,722**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	4 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	Hinkley Feasibility {ύdzŘè	Project Number: 36385
Alt 5 (0-10 years) - Piping & Wells Module		Date: ол-!uƎ-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$1,047,480. - $1,047,480.	$1,047,480. - $1,047,480.	$1,047,480	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	*$1,047,480 - $1,047,480*	*$1,047,480*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$1,047,480. - $1,047,480.	$1,047,480. - $1,047,480.	$1,047,480	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$523,740. - $523,740.	$523,740. - $523,740.	$523,740	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	*$1,581,220 - $1,581,220*	*$1,581,220*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	6 - 6	EA	$73,000. - $73,000.	$438,000. - $438,000.	$438,000	1, 4
6.02	Well Completion	8 - 8	EA	$53,000. - $53,000.	$424,000. - $424,000.	$424,000	1, 5
6.03	Well Rehab	2 - 2	EA	$9,000. - $9,000.	$18,000. - $18,000.	$18,000	1, 6
6.04	Influent Piping	15,670 - 15,670	LF	$80. - $80.	$1,253,600. - $1,253,600.	$1,253,600	1, 7
6.05	Bore & Jack	1 - 1	LS	$570,000. - $570,000.	$570,000. - $570,000.	$570,000	1
6.06	Effluent Piping	37,690 - 37,690	LF	$80. - $80.	$3,015,200. - $3,015,200.	$3,015,200	1, 8
6.07	Injection Wells	41 - 41	EA	$116,000. - $116,000.	$4,756,000. - $4,756,000.	$4,756,000	1, 9
6.08							
				Systems / Equipment Install / Field Labor Subtotal:	*$10,474,800 - $10,474,800*	*$10,474,800*	
				SUBTOTAL (BARE):	**$13,103,500 - $13,103,500**	**$13,103,500**	
				CONTINGENCY (20%):	**$2,620,700 - $2,620,700**	**$2,620,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$15,724,200 - $15,724,200**	**$15,724,200**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	20.4%	$ 3,202,844
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	9.7%	$ 1,526,995
Southeast and East Plume Fringe	42.7%	$ 6,718,776
Southern Plume Fringe	21.4%	$ 3,359,388
Southwest Plume Fringe	5.8%	$ 916,197
	100.0%	$ 15,724,200

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 5 (0-10 years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	50,717 - 50,717	KWH	$0.12 - $0.18	$6,086 - $9,129	$7,607	1, 10
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	40,366 - 40,366	KWH	$0.12 - $0.18	$4,844 - $7,266	$6,055	1, 11
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	8 - 8	WELL	$12,320. - $12,320.	$98,560 - $98,560	$98,560	1
3.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.05	Electricity	41,401 - 41,401	KWH	$0.12 - $0.18	$4,968 - $7,452	$6,210	1, 12
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	5 - 5	WELL	$24,600. - $24,600.	$123,000 - $123,000	$123,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	22 - 22	WELL	$24,600. - $24,600.	$541,200 - $541,200	$541,200	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	11 - 11	WELL	$24,600. - $24,600.	$270,600 - $270,600	$270,600	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	3 - 3	WELL	$24,600. - $24,600.	$73,800 - $73,800	$73,800	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
7.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$1,299,298 - $1,307,247**	**$1,303,273**	
				CONTINGENCY (10%):	**$129,930 - $130,725**	**$130,327**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,429,228 - $1,437,972**	**$1,433,600**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 5 (0-10 years) - Piping & Wells Module		**Date:**	**30-Aug-10**

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		20.4%	$ 2,669,037	$ 533,807	$ 3,202,844
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		9.7%	$ 1,272,496	$ 254,499	$ 1,526,995
Southeast and East Plume Fringe		42.7%	$ 5,598,980	$ 1,119,796	$ 6,718,776
Southern Plume Fringe		21.4%	$ 2,799,490	$ 559,898	$ 3,359,388
Southwest Plume Fringe		5.8%	$ 763,497	$ 152,699	$ 916,197
Non-Specific	**TOTAL:**	**100%**	**$ 13,103,500**	**$ 2,620,700**	**$ 15,724,200**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
SCRIA Extraction	$ -	$ -	$ -
DVD Extraction	$ 66,887	$ 6,689	$ 73,576
Ranch or Other Extraction	$ 114,770	$ 11,477	$ 126,247
Gorman Extraction	$ 53,015	$ 5,301	$ 58,316
Northern Plume Fringe	$ 133,000	$ 13,300	$ 146,300
Southeast and East Plume Fringe	$ 561,200	$ 56,120	$ 617,320
Southern Plume Fringe	$ 290,600	$ 29,060	$ 319,660
Southwest Plume Fringe	$ 83,800	$ 8,380	$ 92,180
TOTAL:	**$ 1,303,273**	**$ 130,327**	**$ 1,433,600**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	Per 2009 Well Installation: Development + analytical cost/well
7	$/lf includes piping + conduit + pullboxes
8	$/lf includes piping + conduit + pullboxes
9	Per 2009 work: Well installation: $54K + $7K + $9K (development) + $18K downhole equip + $28K wellhead mech/elect - 130 foot, 8-inch diameter well
10	245 gpm @ 100' head
11	195 gpm @ 100' head
12	200 gpm @ 100' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 5 (10-15 years) - Piping & Wells Module		Date: 30-Aug-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$44,360. - $44,360.	$44,360. - $44,360.	$44,360	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	***$44,360 - $44,360***	***$44,360***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$44,360. - $44,360.	$44,360. - $44,360.	$44,360	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$22,180. - $22,180.	$22,180. - $22,180.	$22,180	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	***$76,540 - $76,540***	***$76,540***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000. - $219,000.	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000. - $159,000.	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1
6.04	Influent Piping	820 - 820	LF	$80. - $80.	$65,600. - $65,600.	$65,600	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0. - $0.	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0. - $0.	$0	1
6.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$443,600 - $443,600***	***$443,600***	
				SUBTOTAL (BARE):	**$564,500 - $564,500**	**$564,500**	
				CONTINGENCY (20%):	**$112,900 - $112,900**	**$112,900**	
				TOTAL ESTIMATED CAPITAL COST:	**$677,400 - $677,400**	**$677,400**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	100.0%	$ 677,400
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	0.0%	$ -
Southeast and East Plume Fringe	0.0%	$ -
Southern Plume Fringe	0.0%	$ -
Southwest Plume Fringe	0.0%	$ -
	100.0%	$ 677,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 5 (10-15 years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	**ITEM**	**ESTIMATED QUANTITY RANGE**	**UNIT**	**UNIT PRICE RANGE**	**ESTIMATED COST RANGE**	**MIDPOINT COST**	**NOTE NO.**
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	50,717 - 50,717	KWH	$0.12 - $0.18	$6,086 - $9,129	$7,607	1, 7
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	40,366 - 40,366	KWH	$0.12 - $0.18	$4,844 - $7,266	$6,055	1, 8
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	8 - 8	WELL	$12,320. - $12,320.	$98,560 - $98,560	$98,560	1
3.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.05	Electricity	41,401 - 41,401	KWH	$0.12 - $0.18	$4,968 - $7,452	$6,210	1, 9
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	5 - 5	WELL	$24,600. - $24,600.	$123,000 - $123,000	$123,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	22 - 22	WELL	$24,600. - $24,600.	$541,200 - $541,200	$541,200	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	11 - 11	WELL	$24,600. - $24,600.	$270,600 - $270,600	$270,600	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	3 - 3	WELL	$24,600. - $24,600.	$73,800 - $73,800	$73,800	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
7.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$1,299,298 - $1,307,247**	**$1,303,273**	
				CONTINGENCY (10%):	**$129,930 - $130,725**	**$130,327**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,429,228 - $1,437,972**	**$1,433,600**	

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 5 (10-15 years) - Piping & Wells Module		Date: 30-Aug-10

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		100.0%	$ 564,500	$ 112,900	$ 677,400
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Southwest Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 564,500**	**$ 112,900**	**$ 677,400**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ -	$ -	$ -
DVD Extraction		$ 66,887	$ 6,689	$ 73,576
Ranch or Other Extraction		$ 114,770	$ 11,477	$ 126,247
Gorman Extraction		$ 53,015	$ 5,301	$ 58,316
Northern Plume Fringe		$ 133,000	$ 13,300	$ 146,300
Southeast and East Plume Fringe		$ 561,200	$ 56,120	$ 617,320
Southern Plume Fringe		$ 290,600	$ 29,060	$ 319,660
Southwest Plume Fringe		$ 83,800	$ 8,380	$ 92,180
	TOTAL:	**$ 1,303,273**	**$ 130,327**	**$ 1,433,600**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid:$25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	245 gpm @ 100' head
8	195 gpm @ 100' head
9	200 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility {ʹdzȒȅ*	Project Number: 36385
Alt 5 (15+ years) - Piping & Wells Module		Date: 0Л-!uƎ-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$58,240. - $58,240.	$58,240. - $58,240.	$58,240	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	***$58,240 - $58,240***	***$58,240***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$58,240. - $58,240.	$58,240. - $58,240.	$58,240	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$29,120. - $29,120.	$29,120. - $29,120.	$29,120	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	***$97,360 - $97,360***	***$97,360***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	4 - 4	EA	$73,000. - $73,000.	$292,000. - $292,000.	$292,000	1, 4
6.02	Well Completion	4 - 4	EA	$53,000. - $53,000.	$212,000. - $212,000.	$212,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1
6.04	Influent Piping	980 - 980	LF	$80. - $80.	$78,400. - $78,400.	$78,400	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0. - $0.	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0. - $0.	$0	1
6.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$582,400 - $582,400***	***$582,400***	
				SUBTOTAL (BARE):	**$738,000 - $738,000**	**$738,000**	
				CONTINGENCY (20%):	**$147,600 - $147,600**	**$147,600**	
				TOTAL ESTIMATED CAPITAL COST:	**$885,600 - $885,600**	**$885,600**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	SCRIA Extraction	0.0%	$ -
	DVD Extraction	0.0%	$ -
	Ranch or Other Extraction	100.0%	$ 885,600
	Gorman Extraction	0.0%	$ -
	Northern Plume Fringe	0.0%	$ -
	Southeast and East Plume Fringe	0.0%	$ -
	Southern Plume Fringe	0.0%	$ -
	Southwest Plume Fringe	0.0%	$ -
		100.0%	$ 885,600

ALTERNATIVE 5: TABLE 9
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 5 (15+ years) - Piping & Wells Module		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	4 - 4	WELL	$12,320. - $12,320.	$49,280 - $49,280	$49,280	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	50,717 - 50,717	KWH	$0.12 - $0.18	$6,086 - $9,129	$7,607	1, 7
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	40,366 - 40,366	KWH	$0.12 - $0.18	$4,844 - $7,266	$6,055	1, 8
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	8 - 8	WELL	$12,320. - $12,320.	$98,560 - $98,560	$98,560	1
3.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.05	Electricity	41,401 - 41,401	KWH	$0.12 - $0.18	$4,968 - $7,452	$6,210	1, 9
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	5 - 5	WELL	$24,600. - $24,600.	$123,000 - $123,000	$123,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	22 - 22	WELL	$24,600. - $24,600.	$541,200 - $541,200	$541,200	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	11 - 11	WELL	$24,600. - $24,600.	$270,600 - $270,600	$270,600	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	3 - 3	WELL	$24,600. - $24,600.	$73,800 - $73,800	$73,800	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
7.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$1,299,298 - $1,307,247**	**$1,303,273**	
				CONTINGENCY (10%):	**$129,930 - $130,725**	**$130,327**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,429,228 - $1,437,972**	**$1,433,600**	

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 5 (15+ years) - Piping & Wells Module		Date: 30-Aug-10

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		100.0%	$ 738,000	$ 147,600	$ 885,600
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Southwest Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 738,000**	**$ 147,600**	**$ 885,600**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ -	$ -	$ -
DVD Extraction	$ 66,887	$ 6,689	$ 73,576
Ranch or Other Extraction	$ 114,770	$ 11,477	$ 126,247
Gorman Extraction	$ 53,015	$ 5,301	$ 58,316
Northern Plume Fringe	$ 133,000	$ 13,300	$ 146,300
Southeast and East Plume Fringe	$ 561,200	$ 56,120	$ 617,320
Southern Plume Fringe	$ 290,600	$ 29,060	$ 319,660
Southwest Plume Fringe	$ 83,800	$ 8,380	$ 92,180
TOTAL:	**$ 1,303,273**	**$ 130,327**	**$ 1,433,600**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid:$25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	245 gpm @ 100' head
8	195 gpm @ 100' head
9	200 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Ex-Situ Treatment		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$602,482 - $602,482	$602,482 - $602,482	$602,482	1, 2
2.02	Bench / Pilot Scale Testing	1 - 1	LS	$50,000 - $50,000	$50,000. - $50,000.	$50,000	1
2.03							
				Design and Contractor Bidding / Procurement Subtotal:	***$652,482 - $652,482***	***$652,482***	
5.00	**Construction Monitoring and Site Security**						
5.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$351,448 - $351,448	$351,448 - $351,448	$351,448	1, 3
5.02	Construction Management	1 - 1	LS	$401,655 - $401,655	$401,655 - $401,655	$401,655	1, 4
5.03	Project Management through Startup	1 - 1	LS	$200,827 - $200,827	$200,827 - $200,827	$200,827	1, 5
5.04							
				Construction Monitoring and Site Security Subtotal:	***$602,482 - $602,482***	***$953,930***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Site Grading/Baserock	3,240 - 3,240	CY	$17 - $17	$55,080 - $55,080	$55,080	1
6.02	Utilities - Electrical	1 - 1	LS	$90,000 - $90,000	$90,000 - $90,000	$90,000	1
6.03	Utilities - Water	1 - 1	LS	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
6.04	Influent/Effluent Yard Piping	292 - 292	LF	$90 - $90	$26,244 - $26,244	$26,244	1
6.05	Concrete Slab	778 - 778	CY	$700 - $700	$544,320 - $544,320	$544,320	1
6.06	Receiving Tank	1 - 1	EA	$100,440 - $100,440	$100,440 - $100,440	$100,440	1
6.07	Batch Treatment Tanks	12 - 12	EA	$45,000 - $45,000	$540,000 - $540,000	$540,000	1
6.08	Ferrous Iron Tank	1 - 1	EA	$17,280 - $17,280	$17,280 - $17,280	$17,280	1
6.09	FE/NaOH/Sulfide Metering Pump/Tank System	4 - 4	EA	$15,120 - $15,120	$60,480 - $60,480	$60,480	1
6.10	Oxidation Reactors	1 - 1	EA	$54,000 - $54,000	$54,000 - $54,000	$54,000	1
6.11	Parkson Lamella Clarifier/Flocculent Mix Tank	1 - 1	EA	$108,000 - $108,000	$108,000 - $108,000	$108,000	1
6.12	Clarifier Effluent Tank	1 - 1	EA	$54,000 - $54,000	$54,000 - $54,000	$54,000	1
6.13	Blowers	4 - 4	EA	$15,000 - $15,000	$60,000 - $60,000	$60,000	1
6.14	Aeration Systems	24 - 24	EA	$5,000 - $5,000	$120,000 - $120,000	$120,000	1
6.15	Microfiltration 180 gpm	1 - 1	LS	$766,800 - $766,800	$766,800 - $766,800	$766,800	1
6.16	Sludge Thickening Tank w/Pump system	1 - 1	LS	$108,000 - $108,000	$108,000 - $108,000	$108,000	1
6.17	Treated Water Storage	4 - 4	LS	$40,000 - $40,000	$160,000 - $160,000	$160,000	1
6.18	Misc Pumps/mixers	11 - 11	EA	$19,440 - $19,440	$213,840 - $213,840	$213,840	1
6.19	Plant Process Valves/Misc Fittings & Equip	1 - 1	LS	$216,000 - $216,000	$216,000 - $216,000	$216,000	1
6.20	Plant Process Piping	1 1	LS	$247,000 - $247,000	$247,000 - $247,000	$247,000	1
6.21	Plant Electrical	1 1	LS	$247,000 - $247,000	$247,000 - $247,000	$247,000	1
6.22	Instrumentation	1 - 1	LS	$309,000 - $309,000	$309,000 - $309,000	$309,000	1
6.23	Fire Suppression	1 - 1	LS	$75,600 - $75,600	$75,600 - $75,600	$75,600	1
6.24	Roof	31,104 31,104	SF	$25 - $25	$777,600 - $777,600	$777,600	1
6.25	Lab Trailer & Furniture	1 - 1	LS	$35,000 - $35,000	$35,000 - $35,000	$35,000	1
6.26	Lab Equipment	1 - 1	LS	$25,000 - $25,000	$25,000 - $25,000	$25,000	1
6.27							
				Systems / Equipment Install / Field Labor Subtotal:	***$5,020,684 - $5,020,684***	***$5,020,684***	
11.00	**Permits and Regulatory Compliance**						
11.01	Local Permits	1 - 1	EA	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
11.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$1,304,964 - $1,304,964**	**$6,677,096**	
				CONTINGENCY (20%):	**$260,993 - $260,993**	**$1,335,419**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,565,957 - $1,565,957**	**$8,012,515**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Ex-Situ Treatment		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**General**						
1.01	Operations, Monitoring and Reporting	16,704 - 16,704	HR	$80. - $80.	$1,336,320 - $1,336,320	$1,336,320	1
1.02	Electricity	3,027,273 - 3,027,273	KWH	$0.12 - $0.18	$363,273 - $544,909	$454,091	1
1.03	Equipment Rental (tools, instruments)	12 - 12	MO	$500. - $500.	$6,000 - $6,000	$6,000	1
1.04	Forklift Rental	6 - 6	MO	$1,500. - $1,500.	$9,000 - $9,000	$9,000	1
1.05	Other (Office Supplies, transportation, comm., etc.)	12 - 12	MO	$2,500. - $2,500.	$30,000 - $30,000	$30,000	1
1.06	Sludge Disposal	720,000 - 720,000	LB	$0.36 - $0.36	$259,200 - $259,200	$259,200	1
1.07	10% fee on expenses	1 - 1	LS	$147,000. - $147,000.	$147,000 - $147,000	$147,000	1
2.00	**Chemicals**						
2.01	FeCl2 (35% Solution)	163,636 - 163,636	LB	$0.4 - $0.4	$65,454 - $65,454	$65,454	1
2.02	Filtration Polymer	5,482 - 5,482	LB	$5. - $5.	$27,410 - $27,410	$27,410	1
2.03	Dewatering Polymer	5,482 - 5,482	LB	$5. - $5.	$27,410 - $27,410	$27,410	1
2.04	Acid	225,000 - 225,000	LB	$0.09 - $0.09	$20,250 - $20,250	$20,250	1
2.05	Caustic	180,000 - 180,000	LB	$0.25 - $0.25	$45,000 - $45,000	$45,000	1
2.06	Anti-Scalant	572,728 - 572,728	LB	$2. - $2.	$1,145,456 - $1,145,456	$1,145,456	1
3.00	**Analytical**						
3.01	Supplies	1 - 1	LS	$120,000. - $120,000.	$120,000 - $120,000	$120,000	1
3.02	Consumables	1 - 1	LS	$40,000. - $40,000.	$40,000 - $40,000	$40,000	1
3.03	QC Samples	52 - 52	EA	$105. - $105.	$5,460 - $5,460	$5,460	1, 6
3.04	Other (Water Chemistry, Misc.)	52 - 52	WK	$200. - $200.	$10,400 - $10,400	$10,400	1
3.05	Lab Courier	52 - 52	TRIP	$130. - $130.	$6,760 - $6,760	$6,760	1
				SUBTOTAL (BARE):	**$3,664,393 - $3,846,030**	**$3,755,211**	
				CONTINGENCY (10%):	**$366,439 - $384,603**	**$375,521**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$4,030,832 - $4,230,632**	**$4,130,732**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Ex-Situ Treatment (Chem Precip)		100.0%	$ 6,677,096	$ 1,335,419	$ 8,012,515
Non-Specific	**TOTAL:**	**100%**	**$ 6,677,096**	**$ 1,335,419**	**$ 8,012,515**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Ex-Situ Treatment (Chem Precip)		$ 3,755,211	$ 375,521	$ 4,130,732
	TOTAL:	**$ 3,755,211**	**$ 375,521**	**$ 4,130,732**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	12% of total project capital cost
3	7% of total project capital cost
4	8% of total project capital cost
5	50% of Construction Management cost
6	Including operations, sampling; 1 Ops manager for 8 hours/day, 1 operator for 16 hours/day, 1 operator for 24 hours per day - weighted average OMI rate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 5 - Land Acquisition		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition	227 - 227	AC	$2,000. - $2,000.	$454,000 - $454,000	$454,000	1, 2
				Land Acquisition Costs Subtotal:	***$454,000 - $454,000***	***$454,000***	
				SUBTOTAL (BARE):	**$454,000 - $454,000**	**$454,000**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$454,000 - $454,000**	**$454,000**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for an easement.

Combined Alternative

Hinkley Feasibility Study - Addendum #1

OPINION OF PROBABLE COST Northwest Freshwater Injection at 80 gpm	*Hinkley Feasibility Study*	Project Number: 36385 Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection		$ 135,688	$ 13,569	$ 149,257
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Scaled O&M Costs per Injection Well and Extraction Well		**Date:**	**31-Jan-11**

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

Other costs not directly scalable:

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch Extraction	0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific **TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 382,000	$ 38,200	$ 420,200
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 286,500	$ 28,650	$ 315,150
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 191,000	$ 19,100	$ 210,100
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Combined Alternatives Scenario - Northern Extraction		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$174,104. - $174,104.	$174,104 - $174,104	$174,104	1, 2
	Design and Contractor Bidding / Procurement Subtotal:				***$174,104 - $174,104***	***$174,104***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$174,104. - $174,104.	$174,104 - $174,104	$174,104	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$87,052. - $87,052.	$87,052 - $87,052	$87,052	1, 3
	Construction Monitoring and Site Security Subtotal:				***$271,156 - $271,156***	***$271,156***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	13 - 13	EA	$73,000. - $73,000.	$949,000 - $949,000	$949,000	1, 4
6.02	Well Completion	5 - 5	EA	$53,000. - $53,000.	$265,000 - $265,000	$265,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	6,588 - 6,588	LF	$80. - $80.	$527,040 - $527,040	$527,040	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
	Systems / Equipment Install / Field Labor Subtotal:				***$1,741,040 - $1,741,040***	***$1,741,040***	
	SUBTOTAL (BARE):				**$2,186,300 - $2,186,300**	**$2,186,300**	
	CONTINGENCY (20%):				**$437,260 - $437,260**	**$437,260**	
	TOTAL ESTIMATED CAPITAL COST:				**$2,623,560 - $2,623,560**	**$2,623,560**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	7
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
	SUBTOTAL (BARE):				**$0 - $0**	**$0**	
	CONTINGENCY (10%):				**$0 - $0**	**$0**	
	TOTAL ESTIMATED ANNUAL O&M COSTS:				**$0 - $0**	**$0**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 2,186,300	$ 437,260	$ 2,623,560
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,186,300**	**$ 437,260**	**$ 2,623,560**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction		$ -	$ -	$ -
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ -**	**$ -**	**$ -**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Combined Alternatives Scenario - Northern Extraction		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
SCRIA Extraction at 110 gpm (5 wells)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	5 - 5	EA	$12,320 - $12,320	$61,600 - $61,600	$61,600	1
1.02	Electricity	45,541 - 45,541	KWH	$0.12 - $0.18	$5,465 - $8,197	$6,831	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$77,065 - $79,797**	**$78,431**	
				CONTINGENCY (10%):	**$7,706 - $7,980**	**$7,843**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$84,771 - $87,777**	**$86,274**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 78,431	$ 7,843	$ 86,274
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 78,431**	**$ 7,843**	**$ 86,274**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	5 SCRIA Wells; 110 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Supplemental SCRIA Extraction		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1
1.02	Electricity	17,596 - 17,596	KWH	$0.12 - $0.18	$2,111 - $3,167	$2,639	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$49,071 - $50,127**	**$49,599**	
				CONTINGENCY (10%):	**$4,907 - $5,013**	**$4,960**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$53,979 - $55,140**	**$54,559**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 49,599	$ 4,960	$ 54,559
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 49,599**	**$ 4,960**	**$ 54,559**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells (to East of SCRIA Injection area); 85 gpm total @ 100' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
DVD/SCRIA Extraction (60 gpm)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$49,480. - $49,480.	$49,480 - $49,480	$49,480	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$49,480 - $49,480***	***$49,480***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$49,480. - $49,480.	$49,480 - $49,480	$49,480	1, 2
5.02	Project Management through Startup	1 - 1	LS	$24,740. - $24,740.	$24,740 - $24,740	$24,740	1, 3
				Construction Monitoring and Site Security Subtotal:	***$74,220 - $74,220***	***$74,220***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	1,460 - 1,460	LF	$80. - $80.	$116,800 - $116,800	$116,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$494,800 - $494,800***	***$494,800***	
				SUBTOTAL (BARE):	**$618,500 - $618,500**	**$618,500**	
				CONTINGENCY (20%):	**$123,700 - $123,700**	**$123,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$742,200 - $742,200**	**$742,200**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
				SUBTOTAL (BARE):	**$49,941 - $51,431**	**$50,686**	
				CONTINGENCY (10%):	**$4,994 - $5,143**	**$5,069**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 618,500	$ 123,700	$ 742,200
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 618,500**	**$ 123,700**	**$ 742,200**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 50,686	$ 5,069	$ 55,755
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction (60 gpm)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 170 gpm for low dose		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	8 - 8	EA	$12,320 - $12,320	$98,560 - $98,560	$98,560	1
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$127,006 - $131,229**	**$129,117**	
				CONTINGENCY (10%):	**$12,701 - $13,123**	**$12,912**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$139,706 - $144,352**	**$142,029**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 129,117	$ 12,912	$ 142,029
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 129,117**	**$ 12,912**	**$ 142,029**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	170 gpm total @ 200' head

OPINION OF PROBABLE COST | ***Hinkley Feasibility Study*** | **Project Number: 36385**

Alt 6 (0-10 years) | **Date: 31-Jan-11**

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
	Design and Contractor Bidding / Procurement Subtotal:				***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
	Performance Monitoring Well Installation Subtotal:				***$180,000 - $240,000***	***$210,000***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
	Mobilization/Demobilization/Site Prep/General Conditions Subtotal:				***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
	Construction Monitoring and Site Security Subtotal:				***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	6 - 6	EA	$30,000. - $40,000.	$180,000. - $240,000.	$210,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	21 - 21	EA	$30,000. - $40,000.	$630,000. - $840,000.	$735,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	27 - 27	EA	$12,000. - $14,500.	$324,000. - $391,500.	$357,750	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	14,788 - 14,788	LF	$75. - $100.	$1,109,100. - $1,478,800.	$1,293,950	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	2 - 2	LS	$20,000. - $20,000.	$40,000. - $40,000.	$40,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
	Systems / Equipment Install / Field Labor Subtotal:				***$3,458,100 - $4,400,300***	***$3,929,200***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
	Treatment System Startup Subtotal:				***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
	Permits and Regulatory Compliance Subtotal:				***$1,000 - $2,000***	***$1,500***	
	SUBTOTAL (BARE):				**$4,193,689 - $5,421,414**	**$4,807,552**	
	CONTINGENCY (20%):				**$838,738 - $1,084,283**	**$961,510**	
	TOTAL ESTIMATED CAPITAL COST:				**$5,032,427 - $6,505,697**	**$5,769,062**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	41.5%	$ 2,394,426
	SCRIA / Dosed Injection	58.5%	$ 3,374,635
	Source Area IRZ / Injection	0.0%	$ -
		100.0%	$ 5,769,062

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 6 (0-10 years)		Date: 31-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
5.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
5.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$13,255.2 - $24,616.8	$0. - $0.	$0	1
5.05	Routine / General Maintenance	0 - 0	LS	$163,800. - $304,200.	$0. - $0.	$0	1
5.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$50,578.5 - $93,931.5	$0. - $0.	$0	1
5.07	Compliance - Permits, etc.	0 - 0	LS	$34,456.8 - $63,991.2	$0. - $0.	$0	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$950,325 - $1,564,170**	**$1,257,248**	
				CONTINGENCY (10%):	**$95,033 - $156,417**	**$125,725**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,045,358 - $1,720,587**	**$1,382,972**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		41.5%	$ 1,995,355	$ 399,071	$ 2,394,426
SCRIA / Dosed Injection		58.5%	$ 2,812,196	$ 562,439	$ 3,374,635
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 4,807,552**	**$ 961,510**	**$ 5,769,062**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 1,257,248**	**$ 125,725**	**$ 1,382,972**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:** 36385
Alt 6 (0-10 years)		**Date:** 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 6 (10-40 years)		Date: 31-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$87,089 - $128,614***	***$107,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $100,000.	$100,000. - $100,000.	$100,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$100,000 - $100,000***	***$100,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$28,000. - $52,000.	$28,000. - $52,000.	$40,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	3 - 3	EA	$12,000. - $14,500.	$36,000. - $43,500.	$39,750	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	1,460 - 1,460	LF	$75. - $100.	$109,500. - $146,000.	$127,750	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	1 - 1	LS	$20,000. - $20,000.	$20,000. - $20,000.	$20,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	***$410,500 - $527,500***	***$469,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	***$25,000 - $30,000***	***$27,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$673,589 - $888,114**	**$780,852**	
				CONTINGENCY (20%):	**$134,718 - $177,623**	**$156,170**	
				TOTAL ESTIMATED CAPITAL COST:	**$808,307 - $1,065,737**	**$937,022**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	100.0%	$ 937,022
	Source Area IRZ / Injection	0.0%	$ -
		100.0%	$ 937,022

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 6 (10-40 years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	11,127 - 11,127	KWH	$0.12 - $0.18	$1,335. - $2,003.	$1,669	1
4.03	Biological / Chemical Consumables	42,992 - 42,992	GAL	$5. - $6.	$214,960. - $257,952.	$236,456	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
5.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
5.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$13,255.2 - $24,616.8	$0. - $0.	$0	1
5.05	Routine / General Maintenance	0 - 0	LS	$163,800. - $304,200.	$0. - $0.	$0	1
5.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$50,578.5 - $93,931.5	$0. - $0.	$0	1
5.07	Compliance - Permits, etc.	0 - 0	LS	$34,456.8 - $63,991.2	$0. - $0.	$0	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,001,218 - $1,625,336**	**$1,313,277**	
				CONTINGENCY (10%):	**$100,122 - $162,534**	**$131,328**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,101,340 - $1,787,870**	**$1,444,605**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		100.0%	$ 780,852	$ 156,170	$ 937,022
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 780,852**	**$ 156,170**	**$ 937,022**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 490,768	$ 49,077	$ 539,845
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,313,277**	**$ 131,328**	**$ 1,444,605**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 6 (10-40 years)		Date: 31-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	255 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 6 (40-42 years)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	*$42,500 - $49,500*	*$46,000*	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	*$0 - $0*	*$0*	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	*$50,000 - $100,000*	*$75,000*	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	*$50,000 - $50,000*	*$50,000*	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	5 - 5	LS	$3,000. - $3,000.	$15,000. - $15,000.	$15,000	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	*$187,000 - $221,000*	*$204,000*	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	*$25,000 - $30,000*	*$27,500*	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	*$1,000 - $2,000*	*$1,500*	
				SUBTOTAL (BARE):	**$355,500 - $452,500**	**$404,000**	
				CONTINGENCY (20%):	**$71,100 - $90,500**	**$80,800**	
				TOTAL ESTIMATED CAPITAL COST:	**$426,600 - $543,000**	**$484,800**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	77.8%	$ 377,067
Source Area IRZ / Injection	22.2%	$ 107,733
	100.0%	$ 484,800

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 6 (40-42 years)		**Date:**	**31-Jan-11**

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	14,331 - 14,331	GAL	$5. - $6.	$71,653. - $85,984.	$78,819	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	14,331 - 14,331	GAL	$5. - $6.	$71,653. - $85,984.	$78,819	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	0 - 0	LS	$34,456.8 - $63,991.2	$0. - $0.	$0	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$680,491 - $1,169,278**	**$924,884**	
				CONTINGENCY (10%):	**$68,049 - $116,928**	**$92,488**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$748,540 - $1,286,205**	**$1,017,373**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		77.8%	$ 314,222	$ 62,844	$ 377,067
Source Area IRZ / Injection		22.2%	$ 89,778	$ 17,956	$ 107,733
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 404,000**	**$ 80,800**	**$ 484,800**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ 332,018	$ 33,202	$ 365,220
Source Area IRZ / Injection		$ 592,866	$ 59,287	$ 652,153
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 924,884**	**$ 92,488**	**$ 1,017,373**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 6 (40-42 years)		**Date: 31-Jan-11**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	170 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 6 (42+ years)		Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit Modifications		Date: 30-Aug-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$16,000 - $16,000***	***$16,000***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	***$24,000 - $24,000***	***$24,000***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$160,000 - $160,000***	***$160,000***	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K pei

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
New Agricultural Unit (Revised)		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$901,332 - $1,026,332**	**$963,832**	
				CONTINGENCY (20%):	**$180,266 - $205,266**	**$192,766**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit O&M Backup		Date: 30-Aug-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS: FARMER-OPERATED CASE

Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			4		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head		
Equipment/Process Name	Unit of Measure	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000
Electrical Power										
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				$ 287,709			$ 319,104			$ 418,802
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880
GRAND TOTAL				$ 316,480			$ 351,015			$ 460,682

		CALCULATED			CALCULATED			CALCULATED		
Farmer-Operated or Consultant-Operated		Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			6		
Application Rate and Pressure		840 gpm at 100 ft head			950 gpm at 100 ft head			1270 gpm at 100 ft head		
Equipment/Process Name	Unit of Measure	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost	Number Required	Unit Cost	Total Cost
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500
Labor to operate AUs	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	405	$ 100	$ 40,533	420	$ 100	$ 42,000	520	$ 100	$ 52,000
Health & safety training/monitoring	ea	1	$ 10,267	$ 10,267	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700
Other expenses	ea	1	$ 6,160	$ 6,160	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220
Electrical Power										
Pump Water from Aquifer to AUs	kW-hr	173,885	$ 0.15	$ 26,083	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	89,000	$ 89,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,283,333	$ 25,667	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000
Subtotal				$ 290,578			$ 308,347			$ 447,186
Contingency on Materials/Services	percent	10	$ 290,578	$ 29,058	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719
GRAND TOTAL				$ 319,636			$ 339,181			$ 491,904

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
9	Controls/lights operated at 1.5 kW.
10	Five (5) pivot motors operated for 800 gpm and 840 gpm applications; six (6) pivot motors operated for 950 gpm and 1,100 gpm applications; eight (8) pivot motors operated for 1,270 and 1,400 gpm applications. Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Combined Alternative - Land Acquisition		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition for Agricultural Application	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.03	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.04	Land Acquisition	21.3 - 21.3	AC	$8,000. - $8,000.	$170,400 - $170,400	$170,400	1, 3
				Land Acquisition Costs Subtotal:	***$1,130,400 - $1,130,400***	***$1,130,400***	
				SUBTOTAL (BARE):	**$1,130,400 - $1,130,400**	**$1,130,400**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,130,400 - $1,130,400**	**$1,130,400**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for two agricultural units.
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for an easement.

OPINION OF PROBABLE COST

Ex-Situ Treatment (200 gpm)

Hinkley Feasibility Study

Project Number: 36385

Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Project Workplan, Site Survey, and Design	1 - 1		$257,601 - $257,601	$257,601 - $257,601	$257,601	1, 2
2.02	Bench / Pilot Scale Testing	1 - 1	LS	$50,000. $50,000.	$50,000 - $50,000	$50,000	1
2.03							
				Design and Contractor Bidding / Procurement Subtotal:	*$307,601 - $307,601*	*$307,601*	
5.00	**Construction Monitoring and Site Security**						
5.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$150,267 - $150,267	$150,267 - $150,267	$150,267	1, 3
5.02	Construction Management	1 - 1	LS	$171,734 - $171,734	$171,734 - $171,734	$171,734	1, 4
5.03	Project Management through Startup	1 - 1	LS	$85,867 - $85,867	$85,867 - $85,867	$85,867	1, 5
5.04							
				Construction Monitoring and Site Security Subtotal:	*$407,868 - $407,868*	*$407,868*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Site Grading/Baserock	1395 - 1395	CY	$17. - $17.	$23,715 - $23,715	$23,715	1
6.02	Utilities - Electrical	1 - 1	LS	$90,000. - $90,000.	$90,000 - $90,000	$90,000	1
6.03	Utilities - Water	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Influent/Effluent Yard Piping	135 - 135	LF	$90. - $90.	$12,150 - $12,150	$12,150	1
6.05	Concrete Slab	334.8 - 334.8	CY	$700. - $700.	$234,360 - $234,360	$234,360	1
6.06	Receiving Tank	1 - 1	EA	$46,500. - $46,500.	$46,500 - $46,500	$46,500	1
6.07	Batch Treatment Tanks	3 - 3	EA	$45,000. - $45,000.	$135,000 - $135,000	$135,000	1
6.08	Ferrous Iron Tank	1 - 1	EA	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1
6.09	FE/NaOH/Sulfide Metering Pump/Tank System	4 - 4	EA	$7,000. - $7,000.	$28,000 - $28,000	$28,000	1
6.10	Oxidation Reactors	1 - 1	EA	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
6.11	Parkson Lamella Clarifier/Floculant Mix Tank	1 - 1	EA	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
6.12	Clarifier Effluent Tank	1 - 1	EA	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
6.13	Blowers	1 - 1	EA	$15,000. - $15,000.	$15,000 - $15,000	$15,000	1
6.14	Aeration Systems	6 - 6	EA	$5,000. - $5,000.	$30,000 - $30,000	$30,000	1
6.15	Microfiltration 180 gpm	1 - 1	LS	$330,150. - $330,150.	$330,150 - $330,150	$330,150	1
6.16	Sludge Thickening Tank w/Pump system	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
6.17	Treated Water Storage	2 - 2	LS	$40,000. - $40,000.	$80,000 - $80,000	$80,000	1
6.18	Misc Pumps/mixers	11 - 11	EA	$9,000. - $9,000.	$99,000 - $99,000	$99,000	1
6.19	Plant Process Valves/Misc Fittings & Equip	1 - 1	LS	$90,000. - $90,000.	$90,000 - $90,000	$90,000	1
6.20	Plant Process Piping	1 1	LS	$103,000. $103,000.	$103,000 $103,000	$103,000	1
6.21	Plant Electrical	1 1	LS	$103,000. $103,000.	$103,000 $103,000	$103,000	1
6.22	Instrumentation	1 - 1	LS	$129,000. - $129,000.	$129,000 - $129,000	$129,000	1
6.23	Fire Supression	1 - 1	LS	$35,000. - $35,000.	$35,000 - $35,000	$35,000	1
6.24	Roof	13392 - 13392	SF	$25. $25.	$334,800 - $334,800	$334,800	1
6.25	Lab Trailer & Furniture	1 - 1	LS	$35,000. - $35,000.	$35,000 - $35,000	$35,000	1
6.26	Lab Equipment	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
6.27							
				Systems / Equipment Install / Field Labor Subtotal:	*$2,146,675 - $2,146,675*	*$2,146,675*	
11.00	**Permits and Regulatory Compliance**						
11.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
11.02							
				Permits and Regulatory Compliance Subtotal:	*$50,000 - $50,000*	*$50,000*	
				SUBTOTAL (BARE):	**$2,912,144 - $2,912,144**	**$2,912,144**	
				CONTINGENCY (20%):	**$582,429 - $582,429**	**$582,429**	
				CAPITAL COST TOTAL:	**$3,494,573 - $3,494,573**	**$3,494,573**	

OPINION OF PROBABLE COST

Ex-Situ Treatment (200 gpm)

Hinkley Feasibility Study

Project Number: 36385

Date: 31-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**General**						
1.01	Operations, Monitoring and Reporting	12528 - 12528	HR	$80 - $80.	$1,002,240 - $1,002,240	$1,002,240	1
1.02	Electricity	740000 - 740000	KWH	$0.12 - $0.18	$88,800 - $133,200	$111,000	1
1.03	Equipment Rental (tools, instruments)	12 - 12	MO	$500. - $500.	$6,000 - $6,000	$6,000	1
1.04	Forklift Rental	6 - 6	MO	$1,500. - $1,500.	$9,000 - $9,000	$9,000	1
1.05	Other (Office Supplies, transportation, communications, etc.)	12 - 12	MO	$2,500. - $2,500.	$30,000 - $30,000	$30,000	1
1.06	Sludge Disposal	346000 - 346000	LB	$0.36 - $0.36	$124,560 - $124,560	$124,560	1
1.07	10% fee on expenses	1 - 1	LS	$147,000. - $147,000.	$147,000 - $147,000	$147,000	1
2.00	**Chemicals**						
2.01	$FeCl_2$	109967.4 - 109967	LB	$0.4 - $0.4	$43,987 - $43,987	$43,987	1
2.02	Filtration Polymer	1340 - 1340	LB	$5. - $5.	$6,700 - $6,700	$6,700	1
2.03	Dewatering Polymer	1340 - 1340	LB	$5. - $5.	$6,700 - $6,700	$6,700	1
2.04	Acid	48400 - 48400	LB	$0.09 - $0.09	$4,356 - $4,356	$4,356	1
2.05	Caustic	38720 - 38720	LB	$0.25 - $0.25	$9,680 - $9,680	$9,680	1
2.06	Anti-Scalant	123200 - 123200	LB	$2. - $2.	$246,400 - $246,400	$246,400	1
3.00	**Analytical**						
3.01	Supplies	1 - 1	LS	$120,000. $120,000.	$120,000 - $120,000	$120,000	1
3.02	Consumables	1 - 1	LS	$40,000. $40,000.	$40,000 - $40,000	$40,000	1
3.03	QC Samples	52 - 52	EA	$105. $105.	$5,460 - $5,460	$5,460	1, 6
3.04	Other (Water Chemistry, Misc.)	52 - 52	WK	$200. $200.	$10,400 - $10,400	$10,400	1
3.05	Lab Courier	52 - 52	TRIP	$130. - $130.	$6,760 - $6,760	$6,760	1
				SUBTOTAL (BARE):	**$1,908,043 - $1,952,443**	**$1,930,243**	
				CONTINGENCY(10%)	**$190,804 $195,244**	**$193,024**	
				TOTAL:	**$2,098,847 - $2,147,687**	**$2,123,267**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
				20%	
Ex-Situ Treatment (Chem Precip)		100%	$ 2,912,144	$ 582,429	$ 3,494,573
Non-Specific	**TOTAL:**	**100%**	**$ 2,912,144**	**$ 582,429**	**$ 3,494,573**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Ex-Situ Treatment (Chem Precip)		$ 1,930,243	$ 193,024	$ 2,123,267
	TOTAL:	**$ 1,930,243**	**$ 193,024**	**$ 2,123,267**

1	Costs based on Contractor Experience
2	12% of total project capital cost
3	7% of total project capital cost
4	8% of total project capital cost
5	50% of Construction Management cost
6	1 sample per week

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 6 (0-10 years)- Piping & Wells Module		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$280,648. - $280,648.	$280,648. - $280,648.	$280,648	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	***$280,648 - $280,648***	***$280,648***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$280,648. - $280,648.	$280,648. - $280,648.	$280,648	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$140,324. - $140,324.	$140,324. - $140,324.	$140,324	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	***$430,972 - $430,972***	***$430,972***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	7 - 7	EA	$73,000. - $73,000.	$511,000. - $511,000.	$511,000	1, 4
6.02	Well Completion	7 7	EA	$53,000. - $53,000.	$371,000. - $371,000.	$371,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1, 6
6.04	Influent Piping	4,506 - 4,506	LF	$80. - $80.	$360,480. - $360,480.	$360,480	1, 7
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	3,600 - 3,600	LF	$80. - $80.	$288,000. - $288,000.	$288,000	1, 8
6.07	Injection Wells	11 - 11	EA	$116,000. - $116,000.	$1,276,000. - $1,276,000.	$1,276,000	1, 9
6.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$2,806,480 - $2,806,480***	***$2,806,480***	
				SUBTOTAL (BARE):	**$3,518,100 - $3,518,100**	**$3,518,100**	
				CONTINGENCY (20%):	**$703,620 - $703,620**	**$703,620**	
				TOTAL ESTIMATED CAPITAL COST:	**$4,221,720 - $4,221,720**	**$4,221,720**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	0.0%	$ -
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	0.0%	$ -
Southeast and East Plume Fringe	0.0%	$ -
Southern Plume Fringe	0.0%	$ -
Ex-Situ Treatment (Chem Precip)	100.0%	$ 4,221,720
	100.0%	$ 4,221,720

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Extraction for Ex-Situ Treatment**						
1.01	Scaled Operating Cost (per injection well)	11 - 11	WELL	$24,600. - $24,600.	$270,600 - $270,600	$270,600	1
1.02	Scaled Operating Cost (per extraction well)	7 - 7	WELL	$12,320. - $12,320.	$86,240 - $86,240	$86,240	1
1.03	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000 - $260,000	$200,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	41,401 - 41,401	KWH	$0.12 - $0.18	$4,968 - $7,452	$6,210	1, 10
				SUBTOTAL (BARE):	**$506,808 - $629,292**	**$568,050**	
				CONTINGENCY (10%):	**$50,681 - $62,929**	**$56,805**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$557,489 - $692,221**	**$624,855**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number:	36385
Alt 6 (0-10 years) - Piping & Wells Module		Date:	31-Jan-11

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Ex-Situ Treatment (Chem Precip)		100.0%	$ 3,518,100	$ 703,620	$ 4,221,720
Non-Specific	**TOTAL:**	**100%**	**$ 3,518,100**	**$ 703,620**	**$ 4,221,720**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ -	$ -	$ -
DVD Extraction		$ -	$ -	$ -
Ranch or Other Extraction		$ -	$ -	$ -
Gorman Extraction		$ -	$ -	$ -
Northern Plume Fringe		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
Ex-Situ Treatment (Chem Precip)		$ 568,050	$ 56,805	$ 624,855
	TOTAL:	**$ 568,050**	**$ 56,805**	**$ 624,855**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid:$25.5K downhole + $27.5K Vault Mechanical/Electrical
6	Per 2009 Well Installation: Development + analytical cost/well
7	$/lf includes piping + conduit + pullboxes
8	$/lf includes piping + conduit + pullboxes
9	Per 2009 work: Well installation: $54K + $7K + $9K (development) + $18K downhole equip + $28K wellhead mech/elect - 130 foot, 8-inch diameter well
10	200 gpm @ 100' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 6 (10-40 years) - Piping & Wells Module		Date: 31-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	Design and Contractor Bidding / Procurement						
2.01	Engineering Final Design	1 - 1	LS	$39,100. - $39,100.	$39,100. - $39,100.	$39,100	1, 2
2.02							
	Design and Contractor Bidding / Procurement Subtotal:				*$39,100 - $39,100*	*$39,100*	
5.00	Construction Monitoring and Site Security						
5.01	Construction Management	1 - 1	LS	$39,100. - $39,100.	$39,100. - $39,100.	$39,100	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$19,550. - $19,550.	$19,550. - $19,550.	$19,550	1, 3
5.04							
	Construction Monitoring and Site Security Subtotal:				*$68,650 - $68,650*	*$68,650*	
6.00	Systems / Equipment Install / Field Labor						
6.01	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0. - $0.	$0	1, 4
6.02	Well Completion	0 0	EA	$53,000. - $53,000.	$0. - $0.	$0	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1, 6
6.04	Influent Piping	0 - 0	LF	$80. - $80.	$0. - $0.	$0	1, 7
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	500 - 500	LF	$80. - $80.	$40,000. - $40,000.	$40,000	1, 8
6.07	Injection Wells	3 - 3	EA	$116,000. - $116,000.	$348,000. - $348,000.	$348,000	1, 9
6.08	Convert Extraction Well to Injection Well	1 - 1	EA	$3,000. - $3,000.	$3,000. - $3,000.	$3,000	1, 9
	Systems / Equipment Install / Field Labor Subtotal:				*$391,000 - $391,000*	*$391,000*	
	SUBTOTAL (BARE):				**$498,750 - $498,750**	**$498,750**	
	CONTINGENCY (20%):				**$99,750 - $99,750**	**$99,750**	
	TOTAL ESTIMATED CAPITAL COST:				**$598,500 - $598,500**	**$598,500**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	0.0%	$ -
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	0.0%	$ -
Southeast and East Plume Fringe	0.0%	$ -
Southern Plume Fringe	0.0%	$ -
Ex-Situ Treatment (Chem Precip)	100.0%	$ 598,500
	100.0%	$ 598,500

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	Extraction for Ex-Situ Treatment						
1.01	Scaled Operating Cost (per injection well)	12 - 12	WELL	$24,600. - $24,600.	$295,200 - $295,200	$295,200	1
1.02	Scaled Operating Cost (per extraction well)	5 - 5	WELL	$12,320. - $12,320.	$61,600 - $61,600	$61,600	1
1.03	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000 - $260,000	$200,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	41,401 - 41,401	KWH	$0.12 - $0.18	$4,968 - $7,452	$6,210	1, 10
	SUBTOTAL (BARE):				**$506,768 - $629,252**	**$568,010**	
	CONTINGENCY (10%):				**$50,677 - $62,925**	**$56,801**	
	TOTAL ESTIMATED ANNUAL O&M COSTS:				**$557,445 - $692,177**	**$624,811**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 6 (10-40 years)- Piping & Wells Module		**Date:**	**31-Jan-11**

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Ex-Situ Treatment (Chem Precip)		100.0%	$ 498,750	$ 99,750	$ 598,500
Non-Specific	**TOTAL:**	**100%**	**$ 498,750**	**$ 99,750**	**$ 598,500**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
SCRIA Extraction		$ -	$ -	$ -
DVD Extraction		$ -	$ -	$ -
Ranch or Other Extraction		$ -	$ -	$ -
Gorman Extraction		$ -	$ -	$ -
Northern Plume Fringe		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
Ex-Situ Treatment (Chem Precip)		$ 568,010	$ 56,801	$ 624,811
	TOTAL:	**$ 568,010**	**$ 56,801**	**$ 624,811**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Contractor + 5% General Contractor markup) +$7K General Contractor Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Contractor bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	Per 2009 Well Installation: Development + analytical cost/well
7	$/lf includes piping + conduit + pullboxes
8	$/lf includes piping + conduit + pullboxes
9	Per 2009 work: Well installation: $54K + $7K + $9K (development) + $18K downhole equip + $28K wellhead mech/elect - 130 foot, 8-inch diameter well
10	200 gpm @ 100' head

Appendix E

Cost Estimate Details for Alternatives 4C-1, 4C-2, 4C-3, and 4C-4

APPENDIX E
COST ESTIMATE DETAILS FOR ALTERNATIVES 4C-1, 4C-2, 4C-3, and 4C-4

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LIST OF TABLES

See Addendum #3 for additional tables referenced herein

LIST OF FIGURES

See Addendum #3

LIST OF ATTACHMENTS

ACRONYMS AND ABREVIATIONS

AU	Agricultural Unit
DVD	Desert View Dairy
gpm	Gallons per Minute
IRZ	In-Situ Reactive Zone
kWh	Kilowatt Hour
O&M	Operations and Maintenance
RO	Remedial Objective
SCRIA	South Central Reinjection Area
mg/L	Milligrams per Liter

E.1 INTRODUCTION

This appendix presents cost estimate details associated with alternatives designated 4C-1 through -4 as presented in Addendum #3 to the "Feasibility Study, Pacific Gas and Electric Company Compressor Station, Hinkley, California" (FS) (Haley & Aldrich, 2010). The cost estimates were developed using United States Environmental Protection Agency guidance for preparation of Feasibility Studies (USEPA 2000) and have an approximate expected accuracy range of -30 percent to +50 percent. Quantities and unit costs were selected based on contractor experience both at the Hinkley Site and at other sites with similar impacts and subsurface conditions. These quantities and costs are used for comparative purposes only, as values may vary upon implementation of the initial buildout of the alternative, as well as optimizations performed during the life cycle of the remedy.

Costs were based on 2010/2011 values; future capital and operations and maintenance (O&M) costs were adjusted to derive net present value (NPV) using a discount rate of 3.17 percent, which accounts for inflation. A contingency (adder) of 20 percent was used on capital costs and a contingency of 10 percent was used on O&M costs, based on engineering judgment. Remedy durations to meet the key remedial objectives for each alternative were estimated through the use of fate and transport modeling simulations.

The following section outlines the cost estimate components and associated assumptions that are either common among alternatives or specific to particular alternatives. Tables E-1 and E-2 summarize costs by alternative and components. Additional costing details for each alternative are provided in Appendix E, Attachments 1 through 4 (APP E/ATT 1 through 4).

E.2 COMPONENTS AND ASSUMPTIONS

This section outlines the primary components of each cost estimate and the main assumptions that were used.

E.2.1 Common Components among Alternatives

Alternatives 4C-1 through -4 include some common components. Common components that are shared by at least two or more alternatives include:

- Northwest freshwater injection of 80 gallons per minute (gpm);
- Groundwater monitoring program;
- New agricultural units (AUs), AU modifications, and AU O&M; and
- Source Area, South Central Reinjection Area (SCRIA), and Central Area In-situ Reactive Zone (IRZ) treatment.

The northwest freshwater injection component is consistent among Alternatives 4C-1 through 4C-4. The component involves injecting fresh water into four or five injection wells located on the northwest corner of the Site. The cost estimate does not include treatment costs for arsenic via resin, as this treatment is anticipated to be temporary and water is extracted from an area upgradient of the Site.

The groundwater monitoring program used in Alternatives 4C-1 through -4 is assumed to be generally consistent with the monitoring program considered for the FS alternatives, which involves wells distributed throughout the Project Area and does not require additional capital costs (for consistency). It is anticipated that the program can be reduced to 75 percent or 50 percent of the base program based on reductions to the impacted area above background over the remedy duration. These percentages are applied to O&M costs associated with sample collection and laboratory analysis, data management, and reporting.

AUs are utilized in Alternatives 4C-1 through -4 to varying magnitudes as described in Addendum #3 to the FS. It is anticipated that new AUs associated with the remedy alternatives evaluated would be drag-drip style systems and as irrigation “pivots.” The AUs would be operated by farmers; technical consultants would be available to provide guidance on specific issues as necessary. In addition, AU O&M cost estimates were based on actual costs from operating the existing DVD LTU, as well as similar projects. Costs related to general oversight, health and safety training and monitoring, electrical power to pump water from aquifer to AUs, power for miscellaneous controls and lights, and other expenses were scaled off of these other applications based on anticipated application rates, pressures, and number and location of AUs. Parts and repairs were estimated at 3 percent of the capital cost, and a contingency on materials and services was estimated at 10 percent for costs relating to operations, electrical power, outside services (water quality monitoring and reporting), parts, and repairs.

In addition to AUs, a core element of the mass reduction in the source area and plume core (i.e., generally defined in Addendum #3 as Operable Unit #1) is the IRZ. For Alternatives 4C-1 through -4, these IRZ components are operated in the same manner. They undergo the same optimization over time and were assumed to operate for a period of 20 years, although some low dose application of IRZ is used in the SCRIA and Source Area after 20 years for the balance of the remedy duration to provide supplemental spot treatment.

Alternatives 4C-1 through -4 all utilize injection wells and/or extraction wells. The basis for scaled O&M costs per injection well and extraction well was kept similar for all alternatives. This estimate combined labor and expenses associated with inspections, backwashing (for injection wells only), redevelopment, and compliance sampling.

Consistent with the FS alternatives, the estimated time to reach *de minimis* area is defined as the time to achieve a reduction in Cr(VI) to the background value of 3.1 μg/L over 99 percent of the Remedial Area, based on fate and transport modeling performed by ARCADIS. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation (relevant to Alternative 1: No Action from the FS only).

Electricity is estimated to range from $0.12 to $0.18 per kWh; midpoint of $0.15 per kWh used for all cost estimate components.

Where unit cost and/or quantity ranges were identified for individual cost line items, the range midpoint was utilized in the cost estimates.

For alternatives that require it, land acquisition and easements were assumed to cost $8,000 per acre and $2,000 per acre, respectively. To provide consistency with the FS alternatives, cost estimates for Alternatives 4C-1 through -4 assume PG&E ownership of properties acquired as of the original FS date (i.e., properties acquired by PG&E since the FS that are also necessary for the buildout are included at the assumed rate in the cost estimates).

E.2.2 4C-1 In-Situ and Enhanced Agricultural Treatment-1 Crop Major Assumptions

Alternative 4C-1 expands AUs compared to Alternative 4, 4A, and 4B as presented in FS and Addendums #1 and #2 (see Table 9 from Addendum #3 summarizing the major remedy elements and differences between these Alternative 4 varieties). In summary, the major difference in AUs include three additional AU pivots south of Highway 58, and an AU pivot north of Highway 58 (the West Pivot). The AUs would be operated by farmers, with technical input provided by consultants as necessary. Table 5 from FS Addendum #3 provides a detailed breakdown of the Alternative 4C-1 components and the optimization process steps, which are relevant to the cost estimate. Figures 5A and 5B from FS Addendum #3 illustrates the approximate location of AUs and extraction wells used to support AU operation and IRZ treatment for Alternative 4C-1.

E.2.3 4C-2 In-Situ and Enhanced Agricultural Treatment-2 Crops Major Assumptions

Alternative 4C-2 uses the same AUs as Alternative 4C-1, except grows two crops (e.g., summer alfalfa and winter crops). As in Alternative 4C-1, it was assumed that the AUs would be operated by farmers, with technical input provided by consultants as necessary. Table 6 from FS Addendum #3 provides a detailed breakdown of the Alternative 4C-2 components and the optimization process steps, which are relevant to the cost estimate. Figures 7A and 7B from FS Addendum #3 illustrates the approximate location of AUs and extraction wells used to support AU operation and IRZ treatment for Alternative 4C-2.

E.2.4 4C-3 In-Situ and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment-Continuous Pumping Major Assumptions

Alternative 4C-3 uses the same AUs as Alternative 4C-1 and 4C-2, including growing two crops (e.g., summer alfalfa and winter crops). Alternative 4C-3 adds ex-situ water treatment for approximately 6 months of the year to augment treatment capacity in winter months when irrigation flows are typically lower for AUs, thereby maintaining peak summer withdrawal rates during the full year. Chemical precipitation was the assumed method of ex-situ treatment (similar to other alternatives in the FS and prior addenda that included ex-situ treatment). For this alternative buildout, one larger ex-situ plant was assumed in the cost estimates to treat flows generally north of Highway 58, with a second, smaller plant to treat lower flows derived generally south of Highway 58.

In addition, similar to Alternative 4C-1 and -2, Alternative 4C-3 assumes the AUs would be operated by farmers, with technical input provided by consultants as necessary.

Table 7 from FS Addendum #3 provides a detailed breakdown of the Alternative 4C-3 components and the optimization process steps, which are relevant to the cost estimate. Figures 9A and 9B from FS Addendum #3 illustrates the approximate location of AUs, extraction and injection wells used to support AU operation, IRZ treatment, and/or ex-situ treatment for Alternative 4C-3.

E.2.5 4C-4 In-Situ and Enhanced Agricultural Treatment-Continuous Pumping Major Assumptions

Alternative 4C-4 uses the same AUs as Alternative 4C-1 and 4C-2, including growing two crops (e.g., summer alfalfa and winter crops). However, Alternative 4C-4 adds 16 additional AUs (13 additional AUs operated after year 20) for approximately 6 months of the year to augment treatment capacity in winter months when irrigation flows are typically lower for AUs, thereby maintaining peak summer withdrawal rates during the full year. In addition, similar to Alternative 4C-1, -2, and -3, Alternative 4C-4 assumes that the AUs would be operated by farmers, with technical input provided by consultants as necessary.

Table 8 from FS Addendum #3 provides a detailed breakdown of the Alternative 4C-3 components and the optimization process steps, which are relevant to the cost estimate. Figures 11A and 11B from FS Addendum #3 illustrates the approximate location of AUs, extraction wells used to support AU operation and IRZ treatment for Alternative 4C-4.

REFERENCES

1. United States Environmental Protection Agency (USEPA)/Army Corps of Engineers. 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA 540-R-00-002, OSWER 9355.0-75. July.

2. Haley & Aldrich, Inc. 2010. Feasibility Study, Pacific Gas and Electric Company Compressor Station, Hinkley, California. 30 August.

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TABLE E-1
COST AND DURATION SUMMARY
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

	MCL Cr(T) 50 ug/L			Estimated Time to 80% Chromium Mass Removal	Maximum Background Cr(VI) 3.1 ug/L			Average Background Cr(VI) 1.2 ug/L		
Alternative	**Years***	**Non-Discounted Cost***	**NPV Cost***	**Years***	**Years***	**Non-Discounted Cost***	**NPV Cost***	**Years****	**Non-Discounted Cost***	**NPV Cost***
1: No Further Action	750-1000	$0M	$0M	>780	>1000	$0M	$0M	>1000	$0M	$0M
2: Containment	120	$123M	$35.3M	95	260	$258M	$36.0M	320	$316M	$36.0M
3: Plume-Wide In-Situ Treatment	8	$58.1M	$50.7M	10	110	$399M	$130M	180	$634M	$133M
4: Core In-Situ Treatment and Beneficial Agricultural Use	6	$28.9M	$27.2M	13	150	$154M	$50.2M	220	$215M	$50.4M
5: Plume-Wide Pump and Treat	50	$334M	$180M	37	140	$882M	$218M	210	$1.31B	$221M
4A: Aggressive In-Situ Treatment and Beneficial Agricultural Use	6	$36.1M	$34.0M	10	75	$142M	$78.7M	130	$203M	$81.5M
Combined Alternative	28	$173M	$121M	18	90	$295M	$151M	130	$340M	$153M
4B: Aggressive In-Situ Treatment and Beneficial Agricultural Use with Targeted Pumping	6	$36.1M	$34.0M	10	40	$109M	$75.9M	95	$176M	$84.9M
4C-1: In-Situ and Enhanced Agricultural Treatment - 1 crop	6	$53.2M	$50.2M	8	40	$148M	$106M	95	$221M	$116M
4C-2: In-Situ and Enhanced Agricultural Treatment - 2 crops	6	$54.0M	$50.9M	7	39	$150M	$108M	90	$220M	$118M
4C-3: In-Situ and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuous Pumping	4	$82.0M	$79.1M	6	36	$335M	$226M	85	$638M	$276M
4C-4: In-Situ and Enhanced Agricultural Treatment - Continuous Pumping	3	$64.3M	$63.2M	6	29	$193M	$148M	75	$314M	$173M

*Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedia Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation.
**Timeframe to reach 1.2 ug/L shown above, to the extent achieving this criteria is feasible, is based on modeling.
Unless otherwise noted, Non-Discounted and NPV costs in millions and refer to the capital and O&M cost for the duration to reach the criteria.

ug/L - micrograms per liter chromium
NPV = Net present value
$M = Millions of dollars
$B = Billions of dollars

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 2 - Containment														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	120	$ -	$ 4,851,770	$ 4,851,770	0	120	$ 18,902,938	$ 18,902,938
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	25	$ -	$ 7,180,314	$ 7,180,314	0	25	$ 10,505,000	$ 10,505,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	25	120	$ -	$ 4,321,416	$ 4,321,416	25	120	$ 29,939,250	$ 29,939,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (2)	$ 900,600	$ 84,747	0	120	$ 900,600	$ 2,610,217	$ 3,510,817	0	120	$ 10,169,642	$ 11,070,242
Extraction for AU Application	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	120	$ -	$ 2,239,855	$ 2,239,855	0	120	$ 8,726,680	$ 8,726,680
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	120	$ 240,000	$ -	$ 240,000	0	120	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU	$ 2,213,475	$ -	0	120	$ 2,213,475	$ -	$ 2,213,475	0	120	$ -	$ 2,213,475
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 339,181	0	120	$ -	$ 10,446,815	$ 10,446,815	0	120	$ 40,701,742	$ 40,701,742
Land Acquisition	Land Acquisition or Other	Initial	Alt 2 Land Acq	$ 320,000	$ -	0	120	$ 320,000	$ -	$ 320,000	0	120	$ -	$ 320,000
TOTAL				**$ 3,674,075**				**$ 3,674,075**	**$ 31,650,387**	**$ 35,324,462**			**$ 118,945,252**	**$ 122,619,327**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 3 - Plume-Wide In-Situ Treatment														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	8	$ -	$ 1,097,886	$ 1,097,886	0	8	$ 1,260,196	$ 1,260,196
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	8	$ -	$ 2,928,635	$ 2,928,635	0	8	$ 3,361,600	$ 3,361,600
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	Northern Extraction	Initial	Northern Extraction (3)	$ 1,675,800	$ 86,455	0	8	$ 1,675,800	$ 602,557	$ 2,278,357	0	8	$ 691,639	$ 2,367,439
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	8	$ -	$ 506,847	$ 506,847	0	8	$ 581,779	$ 581,779
Groundwater Extraction	DVD Extraction	Initial	Alt 3_PIPE-WELL (0 - 5)	$ -	$ 76,992	0	5	$ -	$ 350,895	$ 350,895	0	5	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 76,992	5	8	$ -	$ 185,709	$ 185,709	5	8	$ 230,976	$ 230,976
Groundwater Extraction	DVD Extraction	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 76,992	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	DVD Extraction	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 76,992	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	Gorman Extraction	Initial	Alt 3_PIPE-WELL (0 - 5)	$ -	$ 60,024	0	5	$ -	$ 273,564	$ 273,564	0	5	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 60,024	5	8	$ -	$ 144,782	$ 144,782	5	8	$ 180,073	$ 180,073
Groundwater Extraction	Gorman Extraction	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 60,024	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	Gorman Extraction	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 60,024	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Northern Injection	Initial	Alt #3_0 to 5 yrs	$ -	$ -	0	5	$ -	$ -	$ -	0	5	$ -	$ -
Dosed Injection	Northern Injection	Opt 1	Alt #3_5 to 10 yrs	$ 4,642,022	$ 666,354	5	8	$ 3,971,367	$ 1,607,287	$ 5,578,654	5	8	$ 1,999,062	$ 6,641,084
Dosed Injection	Northern Injection	Opt 2	Alt #3_10 to 15 yrs	$ 2,024,500	$ 742,545	0	0	$ -	$ -	$ -	0	0	$ -	$ 2,024,500
Dosed Injection	Northern Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 495,898	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Central Area IRZ / Injection	Initial	Alt #3_0 to 5 yrs	$ 1,353,685	$ 918,288	0	5	$ 1,353,685	$ 4,185,153	$ 5,538,838	0	5	$ 4,591,438	$ 5,945,123
Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 918,288	5	8	$ -	$ 2,214,965	$ 2,214,965	5	8	$ 2,754,863	$ 2,754,863
Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #3_15+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #3_0 to 5 yrs	$ 2,115,069	$ 643,490	0	5	$ 2,115,069	$ 2,932,746	$ 5,047,815	0	5	$ 3,217,450	$ 5,332,519
Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 357,888	5	8	$ -	$ 863,247	$ 863,247	5	8	$ 1,073,664	$ 1,073,664
Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 358,973	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Initial	Alt #3_0 to 5 yrs	$ 3,595,618	$ 946,596	0	5	$ 3,595,618	$ 4,314,169	$ 7,909,787	0	5	$ 4,732,978	$ 8,328,596
Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ -	5	8	$ -	$ -	$ -	5	8	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 669,535	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Northern Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 112,201	0	5	$ -	$ 511,362	$ 511,362	0	5	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 112,201	5	8	$ -	$ 270,635	$ 270,635	5	8	$ 336,603	$ 336,603
Dosed Injection	Northern Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 112,201	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Northern Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 112,201	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southeast and East Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 168,301	0	5	$ -	$ 767,043	$ 767,043	0	5	$ 841,506	$ 841,506
Dosed Injection	Southeast and East Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 209,102	5	8	$ -	$ 504,366	$ 504,366	5	8	$ 627,305	$ 627,305
Dosed Injection	Southeast and East Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 173,401	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southeast and East Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 173,401	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southern Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 158,101	0	5	$ -	$ 720,556	$ 720,556	0	5	$ 790,506	$ 790,506
Dosed Injection	Southern Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 249,902	5	8	$ -	$ 602,778	$ 602,778	5	8	$ 749,706	$ 749,706
Dosed Injection	Southern Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 249,902	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southern Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 249,902	0	0	$ -	$ -	$ -	0	0	$ -	$ -

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Dosed Injection	Northern Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 1,745,667	$ 146,300	0	5	$ 1,745,667	$ 666,771	$ 2,412,438	0	5	$ 731,500	$ 2,477,167
Dosed Injection	Northern Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 146,300	5	8	$ -	$ 352,884	$ 352,884	5	8	$ 438,900	$ 438,900
Dosed Injection	Northern Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 146,300	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Northern Plume Fringe	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 146,300	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southeast and East Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 2,094,800	$ 184,360	0	5	$ 2,094,800	$ 840,232	$ 2,935,032	0	5	$ 921,800	$ 3,016,600
Dosed Injection	Southeast and East Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ 1,401,273	$ 265,540	5	8	$ 1,198,824	$ 640,499	$ 1,839,323	5	8	$ 796,620	$ 2,197,893
Dosed Injection	Southeast and East Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 184,360	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southeast and East Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 173,401	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southern Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 2,443,933	$ 211,420	0	5	$ 2,443,933	$ 963,560	$ 3,407,493	0	5	$ 1,057,100	$ 3,501,033
Dosed Injection	Southern Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ 800,727	$ 319,660	5	8	$ 685,042	$ 771,039	$ 1,456,082	5	8	$ 958,980	$ 1,759,707
Dosed Injection	Southern Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 319,660	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Dosed Injection	Southern Plume Fringe	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 319,660	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Land Acquisition	Land Acquisition or Other	Initial	Alt 3 Land Acq	$ 20,000	$ -	0	8	$ 20,000	$ -	$ 20,000	0	8	$ -	$ 20,000
TOTAL				**$ 23,913,094**				**$ 20,899,805**	**$ 29,820,170**	**$ 50,719,975**			**$ 34,172,326**	**$ 58,085,420**

Alternative 4 - Core In-Site Treatment and Beneficial Agricultural Use

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Begin	End	O&M x No. of years	Total Capital & O&M
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	6	$ -	$ 848,553	$ 848,553	0	6	$ 945,147	$ 945,147
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	6	$ -	$ 2,263,534	$ 2,263,534	0	6	$ 2,521,200	$ 2,521,200
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4)	$ 1,103,400	$ 84,747	0	6	$ 1,103,400	$ 456,515	$ 1,559,915	0	6	$ 508,482	$ 1,611,882
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	6	$ -	$ 391,741	$ 391,741	0	6	$ 436,334	$ 436,334
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	6	$ -	$ 293,900	$ 293,900	0	6	$ 327,356	$ 327,356
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4_0 to 5 yrs	$ 1,337,296	$ 918,288	0	5	$ 1,337,296	$ 4,185,153	$ 5,522,449	0	5	$ 4,591,438	$ 5,928,734
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4_0 to 5 yrs	$ 4,698,720	$ 476,809	0	5	$ 4,698,720	$ 2,173,086	$ 6,871,806	0	5	$ 2,384,044	$ 7,082,764
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4_0 to 5 yrs	$ 1,249,906	$ 814,241	0	5	$ 1,249,906	$ 3,710,952	$ 4,960,858	0	5	$ 4,071,203	$ 5,321,109
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	5	$ 240,000	$ -	$ 240,000	0	5	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU	$ 2,213,475	$ -	0	5	$ 2,213,475	$ -	$ 2,213,475	0	5	$ -	$ 2,213,475
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 319,636	0	5	$ -	$ 1,456,759	$ 1,456,759	0	5	$ 1,598,178	$ 1,598,178
AU Application	Agricultural Units	Opt 1	AU O&M Summary	$ -	$ 339,181	5	6	$ -	$ 281,262	$ 281,262	5	6	$ 339,181	$ 339,181
Land Acquisition	Land Acquisition or Other	Initial	Alt 4 Land Acq	$ 337,600	$ -	0	6	$ 337,600	$ -	$ 337,600	0	6	$ -	$ 337,600
TOTAL				**$ 11,180,397**					**$ 16,061,455**	**$ 27,241,852**			**$ 17,722,563**	**$ 28,902,960**

OPINION OF PROBABLE COST | *Hinkley Feasibility Study Including Addendum #3* | *Costs to 50 ug/L* | **Project Number:** 36385

Cost Breakdown Detail by Component | **Date:** 13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4A - Aggressive Core In-Site Treatment and Beneficial Agricultural Use														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	6	$ -	$ 804,018	$ 804,018	0	6	$ 895,542	$ 895,542
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	6	$ -	$ 2,263,534	$ 2,263,534	0	6	$ 2,521,200	$ 2,521,200
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4A)	$ 2,623,560	$ -	0	6	$ 2,623,560	$ -	$ 2,623,560	0	6	$ -	$ 2,623,560
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	6	$ -	$ 464,743	$ 464,743	0	6	$ 517,646	$ 517,646
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	6	$ -	$ 293,900	$ 293,900	0	6	$ 327,356	$ 327,356
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extraction for low dose	$ -	$ 142,029	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	6	$ -	$ 750,261	$ 750,261	5	6	$ 904,760	$ 904,760
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	6	$ 304,656	$ 315,631	$ 620,287	5	6	$ 380,628	$ 736,732
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	6	$ 59,284	$ 594,208	$ 653,493	5	6	$ 716,571	$ 785,867
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 848,241	$ 416,508	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 327,581	$ 294,136	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	6	$ 240,000	$ -	$ 240,000	0	6	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	6	$ 3,469,796	$ -	$ 3,469,796	0	6	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	6	$ -	$ 2,649,789	$ 2,649,789	0	6	$ 2,951,425	$ 2,951,425
Land Acquisition	Land Acquisition or Other	Initial	Alt 4a Land Acq	$ 1,012,600	$ -	0	6	$ 1,012,600	$ -	$ 1,012,600	0	6	$ -	$ 1,012,600
TOTAL				**$ 17,777,770**				**$ 15,798,289**	**$ 18,185,251**	**$ 33,983,539**			**$ 20,239,844**	**$ 36,099,592**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number: 36385
Cost Breakdown Detail by Component			Date: 13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4B - Aggressive Core In-Site Treatment and Beneficial Agricultural Use with Targeted Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	6	$ -	$ 804,018	$ 804,018	0	6	$ 895,542	$ 895,542
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	6	$ -	$ 2,263,534	$ 2,263,534	0	6	$ 2,521,200	$ 2,521,200
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4A)	$ 2,623,560	$ -	0	6	$ 2,623,560	$ -	$ 2,623,560	0	6	$ -	$ 2,623,560
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4B at 10)	$ 3,390,900	$ 100,562	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	6	$ -	$ 464,743	$ 464,743	0	6	$ 517,646	$ 517,646
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	6	$ -	$ 293,900	$ 293,900	0	6	$ 327,356	$ 327,356
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extraction for low dose	$ -	$ 142,029	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	6	$ -	$ 750,261	$ 750,261	5	6	$ 904,760	$ 904,760
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	6	$ 304,656	$ 315,631	$ 620,287	5	6	$ 380,628	$ 736,732
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	6	$ 59,284	$ 594,208	$ 653,493	5	6	$ 716,571	$ 785,867
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 848,241	$ 416,508	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 327,581	$ 294,136	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	6	$ 240,000	$ -	$ 240,000	0	6	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	6	$ 3,469,796	$ -	$ 3,469,796	0	6	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	6	$ -	$ 2,649,789	$ 2,649,789	0	6	$ 2,951,425	$ 2,951,425
Land Acquisition	Land Acquisition or Other	Initial	Alt 4a Land Acq	$ 1,012,600	$ -	0	6	$ 1,012,600	$ -	$ 1,012,600	0	6	$ -	$ 1,012,600
TOTAL				**$ 21,168,670**				**$ 15,798,289**	**$ 18,185,251**	**$ 33,983,539**			**$ 20,239,844**	**$ 36,099,592**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study Including Addendum #3***	***Costs to 50 ug/L***	**Project Number:**	**36385**
Cost Breakdown Detail by Component			**Date:**	**13-Sep-11**

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4C-1 In-Situ and Enhanced Agricultural Treatment - 1 Crop														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	6	$ -	$ 804,018	$ 804,018	0	6	$ 895,542	$ 895,542
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	6	$ -	$ 2,263,534	$ 2,263,534	0	6	$ 2,521,200	$ 2,521,200
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	6	$ 4,417,800	$ 302,170	$ 4,719,970	0	6	$ 336,567	$ 4,754,367
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	6	$ 2,206,200	$ 129,501	$ 2,335,701	0	6	$ 144,243	$ 2,350,443
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extraction (4C at 10)	$ 3,195,300	$ 156,657	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	6	$ -	$ 350,017	$ 350,017	0	6	$ 389,861	$ 389,861
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	6	$ -	$ 750,261	$ 750,261	5	6	$ 904,760	$ 904,760
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	6	$ 304,656	$ 315,631	$ 620,287	5	6	$ 380,628	$ 736,732
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	6	$ 59,284	$ 594,208	$ 653,493	5	6	$ 716,571	$ 785,867
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	6	$ 240,000	$ -	$ 240,000	0	6	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	6	$ 8,096,191	$ -	$ 8,096,191	0	6	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 1,895,326	0	6	$ -	$ 10,209,741	$ 10,209,741	0	6	$ 11,371,953	$ 11,371,953
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 690,537	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C Land Acq	$ 1,052,000	$ -	0	6	$ 1,052,000	$ -	$ 1,052,000	0	6	$ -	$ 1,052,000
TOTAL				**$ 29,496,805**				**$ 24,464,524**	**$ 25,768,248**	**$ 50,232,772**			**$ 28,686,042**	**$ 53,212,025**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 4C-2 - In-Situ Treatment and Year-round Beneficial Agricultural Use														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	6	$ -	$ 804,018	$ 804,018	0	6	$ 895,542	$ 895,542
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	6	$ -	$ 2,263,534	$ 2,263,534	0	6	$ 2,521,200	$ 2,521,200
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	6	$ 4,417,800	$ 302,170	$ 4,719,970	0	6	$ 336,567	$ 4,754,367
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	6	$ 2,206,200	$ 129,501	$ 2,335,701	0	6	$ 144,243	$ 2,350,443
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extraction (4C at 10)	$ 3,195,300	$ 156,657	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	6	$ -	$ 350,017	$ 350,017	0	6	$ 389,861	$ 389,861
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	6	$ -	$ 750,261	$ 750,261	5	6	$ 904,760	$ 904,760
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	6	$ 304,656	$ 315,631	$ 620,287	5	6	$ 380,628	$ 736,732
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	6	$ 59,284	$ 594,208	$ 653,493	5	6	$ 716,571	$ 785,867
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	6	$ 240,000	$ -	$ 240,000	0	6	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	6	$ 8,096,191	$ -	$ 8,096,191	0	6	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 2,018,957	0	6	$ -	$ 10,875,716	$ 10,875,716	0	6	$ 12,113,739	$ 12,113,739
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 734,677	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C Land Acq	$ 1,052,000	$ -	0	6	$ 1,052,000	$ -	$ 1,052,000	0	6	$ -	$ 1,052,000
TOTAL				**$ 29,496,805**				**$ 24,464,524**	**$ 26,434,224**	**$ 50,898,747**			**$ 29,427,828**	**$ 53,953,811**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4C-3 - In-Situ Treatment and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuous Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	4	$ -	$ 552,555	$ 552,555	0	4	$ 597,028	$ 597,028
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	4	$ -	$ 1,555,596	$ 1,555,596	0	4	$ 1,680,800	$ 1,680,800
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	4	$ 4,417,800	$ 207,664	$ 4,625,464	0	4	$ 224,378	$ 4,642,178
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	4	$ 2,206,200	$ 88,999	$ 2,295,199	0	4	$ 96,162	$ 2,302,362
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extr (4C-3 at 10)	$ 2,939,700	$ 156,657	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	4	$ -	$ 240,547	$ 240,547	0	4	$ 259,907	$ 259,907
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	4	$ 2,077,153	$ 3,349,453	$ 5,426,606	0	4	$ 3,619,038	$ 5,696,191
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	4	$ 2,927,479	$ 1,770,361	$ 4,697,841	0	4	$ 1,912,851	$ 4,840,331
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	4	$ 3,083,759	$ 3,042,967	$ 6,126,727	0	4	$ 3,287,884	$ 6,371,644
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	4	$ 240,000	$ -	$ 240,000	0	4	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	4	$ 8,096,191	$ -	$ 8,096,191	0	4	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 2,018,957	0	4	$ -	$ 7,474,251	$ 7,474,251	0	4	$ 8,075,826	$ 8,075,826
AU Application	Agricultural Units	Opt 3	AU O&M Summary	$ -	$ 734,677	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C-3 Land Acq	$ 1,093,400	$ -	0	4	$ 1,093,400	$ -	$ 1,093,400	0	4	$ -	$ 1,093,400
Groundwater Extraction	DVD Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ -	$ 17,148	0	4	$ -	$ 63,483	$ 63,483	0	4	$ 68,592	$ 68,592
Groundwater Extraction	DVD Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 17,148	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	Gorman Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ -	$ 15,526	0	4	$ -	$ 57,477	$ 57,477	0	4	$ 62,103	$ 62,103
Groundwater Extraction	Gorman Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 15,526	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	Ranch or Other Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 256,087	$ 27,250	0	4	$ 256,087	$ 100,880	$ 356,967	0	4	$ 108,999	$ 365,086
Groundwater Extraction	Ranch or Other Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 22,126	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (1200 gpm)	$ 8,012,515	$ -	0	4	$ 8,012,515	$ -	$ 8,012,515	0	4	$ -	$ 8,012,515
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (450 gpm)	$ 5,086,428	$ -	0	4	$ 5,086,428	$ -	$ 5,086,428	0	4	$ -	$ 5,086,428
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A O&M (Alt 4C-3)	$ -	$ 4,061,665	0	4	$ -	$ 15,036,435	$ 15,036,435	0	4	$ 16,246,661	$ 16,246,661
Treated Injection	Northern Plume Fringe	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 3,749,137	$ 281,600	0	4	$ 3,749,137	$ 1,042,494	$ 4,791,631	0	4	$ 1,126,400	$ 4,875,537
Treated Injection	Northern Plume Fringe	Opt 1	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 281,600	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Treated Injection	Southern Plume Fringe	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 2,304,376	$ 265,540	0	4	$ 2,304,376	$ 983,039	$ 3,287,415	0	4	$ 1,062,160	$ 3,366,536
Treated Injection	Southern Plume Fringe	Opt 1	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 265,540	0	0	$ -	$ -	$ -	0	0	$ -	$ -
TOTAL				$ 48,691,148				$ 43,550,527	$ 35,566,199	$ 79,116,726			$ 38,428,790	$ 81,979,317

OPINION OF PROBABLE COST	Hinkley Feasibility Study Including Addendum #3	Costs to 50 ug/L	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 4C-4 - In-Situ and Enhanced Agricultural Treatment - Continuous Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	3	$ -	$ 420,814	$ 420,814	0	3	$ 447,771	$ 447,771
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	3	$ -	$ 1,184,708	$ 1,184,708	0	3	$ 1,260,600	$ 1,260,600
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C-4)	$ 5,834,400	$ 56,095	0	3	$ 5,834,400	$ 158,152	$ 5,992,552	0	3	$ 168,284	$ 6,002,684
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C-4)	$ 2,776,800	$ 24,041	0	3	$ 2,776,800	$ 67,780	$ 2,844,580	0	3	$ 72,122	$ 2,848,922
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extr (4C-3 at 10)	$ 2,939,700	$ 156,657	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	3	$ -	$ 183,195	$ 183,195	0	3	$ 194,931	$ 194,931
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	3	$ 2,077,153	$ 2,550,871	$ 4,628,024	0	3	$ 2,714,279	$ 4,791,432
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	3	$ 2,927,479	$ 1,348,269	$ 4,275,748	0	3	$ 1,434,638	$ 4,362,118
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	3	$ 3,083,759	$ 2,317,458	$ 5,401,218	0	3	$ 2,465,913	$ 5,549,673
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	3	$ 240,000	$ -	$ 240,000	0	3	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 26,601,771	$ -	0	3	$ 26,601,771	$ -	$ 26,601,771	0	3	$ -	$ 26,601,771
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 3,254,880	0	3	$ -	$ 9,176,781	$ 9,176,781	0	3	$ 9,764,640	$ 9,764,640
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 1,833,604	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C-4 Land Acq	$ 2,230,720	$ -	0	3	$ 2,230,720	$ -	$ 2,230,720	0	3	$ -	$ 2,230,720
TOTAL				**$ 50,912,705**				**$ 45,772,083**	**$ 17,408,029**	**$ 63,180,112**			**$ 18,523,177**	**$ 64,295,260**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 5 - Plume-Wide Pump and Treat														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	50	$ -	$ 3,925,427	$ 3,925,427	0	50	$ 7,876,224	$ 7,876,224
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	50	$ -	$ 3,458,834	$ 3,458,834	10	50	$ 8,404,000	$ 8,404,000
Groundwater Extraction	Northern Extraction	Initial	Northern Extraction (5)	$ 1,675,800	$ 84,747	0	50	$ 1,675,800	$ 2,111,851	$ 3,787,651	0	50	$ 4,237,351	$ 5,913,151
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	50	$ -	$ 1,812,202	$ 1,812,202	0	50	$ 3,636,117	$ 3,636,117
Groundwater Extraction	DVD Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ -	$ 73,576	0	10	$ -	$ 622,210	$ 622,210	0	10	$ 735,762	$ 735,762
Groundwater Extraction	DVD Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 73,576	10	15	$ -	$ 245,435	$ 245,435	10	15	$ 367,881	$ 367,881
Groundwater Extraction	DVD Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 73,576	15	50	$ -	$ 965,836	$ 965,836	15	50	$ 2,575,168	$ 2,575,168
Groundwater Extraction	Gorman Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ -	$ 58,316	0	10	$ -	$ 493,163	$ 493,163	0	10	$ 583,164	$ 583,164
Groundwater Extraction	Gorman Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 58,316	10	15	$ -	$ 194,531	$ 194,531	10	15	$ 291,582	$ 291,582
Groundwater Extraction	Gorman Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 58,316	15	50	$ -	$ 765,520	$ 765,520	15	50	$ 2,041,075	$ 2,041,075
Groundwater Extraction	Ranch or Other Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 3,202,844	$ 126,247	0	10	$ 3,202,844	$ 1,067,631	$ 4,270,475	0	10	$ 1,262,472	$ 4,465,316
Groundwater Extraction	Ranch or Other Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ 677,400	$ 126,247	10	15	$ 495,805	$ 421,134	$ 916,939	10	15	$ 631,236	$ 1,308,636
Groundwater Extraction	Ranch or Other Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ 885,600	$ 126,247	15	50	$ 554,544	$ 1,657,249	$ 2,211,793	15	50	$ 4,418,652	$ 5,304,252
Treated Injection	Northern Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 1,526,995	$ 146,300	0	10	$ 1,526,995	$ 1,237,211	$ 2,764,206	0	10	$ 1,463,000	$ 2,989,995
Treated Injection	Northern Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 146,300	10	15	$ -	$ 488,026	$ 488,026	10	15	$ 731,500	$ 731,500
Treated Injection	Northern Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 146,300	15	50	$ -	$ 1,920,482	$ 1,920,482	15	50	$ 5,120,500	$ 5,120,500
Treated Injection	Southeast and East Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 6,718,776	$ 617,320	0	10	$ 6,718,776	$ 5,220,473	$ 11,939,249	0	10	$ 6,173,200	$ 12,891,976
Treated Injection	Southeast and East Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 617,320	10	15	$ -	$ 2,059,248	$ 2,059,248	10	15	$ 3,086,600	$ 3,086,600
Treated Injection	Southeast and East Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 617,320	15	50	$ -	$ 8,103,567	$ 8,103,567	15	50	$ 21,606,200	$ 21,606,200
Treated Injection	Southern Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 3,359,388	$ 319,660	0	10	$ 3,359,388	$ 2,703,260	$ 6,062,648	0	10	$ 3,196,600	$ 6,555,988
Treated Injection	Southern Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 319,660	10	15	$ -	$ 1,066,318	$ 1,066,318	10	15	$ 1,598,300	$ 1,598,300
Treated Injection	Southern Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 319,660	15	50	$ -	$ 4,196,180	$ 4,196,180	15	50	$ 11,188,100	$ 11,188,100
Treated Injection	Southwest Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 916,197	$ 92,180	0	10	$ 916,197	$ 779,536	$ 1,695,733	0	10	$ 921,800	$ 1,837,997
Treated Injection	Southwest Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 92,180	10	15	$ -	$ 307,493	$ 307,493	10	15	$ 460,900	$ 460,900
Treated Injection	Southwest Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 92,180	15	50	$ -	$ 1,210,048	$ 1,210,048	15	50	$ 3,226,300	$ 3,226,300
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A	$ 8,012,515	$ 4,130,732	0	50	$ 8,012,515	$ 102,935,665	$ 110,948,180	0	50	$ 206,536,624	$ 214,549,139
Land Acquisition	Land Acquisition or Other	Initial	Alt 5 Land Acq	$ 454,000	$ -	0	50	$ 454,000	$ -	$ 454,000	0	50	$ -	$ 454,000
TOTAL				**$ 27,429,515**				**$ 26,916,864**	**$ 153,522,020**	**$ 180,438,885**			**$ 306,572,310**	**$ 334,001,825**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 50 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

						NPV to reach 50 ug/L Hexavalent Chromium*					Non-discounted Cash Flow to reach 50 ug/L Hexavalent Chromium*			
						Optimization					Optimization			
ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Begin	End	O&M x No. of years	Total Capital & O&M
Combined Alternative														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	28	$ -	$ 2,743,346	$ 2,743,346	0	28	$ 4,179,195	$ 4,179,195
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	28	$ -	$ 2,076,070	$ 2,076,070	15	28	$ 4,096,950	$ 4,096,950
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (Combined)	$ 2,623,560	$ -	0	28	$ 2,623,560	$ -	$ 2,623,560	0	28	$ -	$ 2,623,560
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	28	$ -	$ 1,585,724	$ 1,585,724	0	28	$ 2,415,681	$ 2,415,681
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	28	$ -	$ 1,002,800	$ 1,002,800	0	28	$ 1,527,659	$ 1,527,659
Groundwater Extraction	SCRIA Extraction	Initial	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	28	$ 543,234	$ 553,274	$ 1,096,507	10	28	$ 1,003,585	$ 1,745,785
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction for low dose	$ -	$ 142,029	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #6_0 to 10 yrs	$ 2,394,426	$ 904,760	0	10	$ 2,394,426	$ 7,651,254	$ 10,045,681	0	10	$ 9,047,595	$ 11,442,022
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #6_0 to 10 yrs	$ 3,374,635	$ 478,213	0	10	$ 3,374,635	$ 4,044,089	$ 7,418,724	0	10	$ 4,782,128	$ 8,156,763
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #6_10 to 40 yrs	$ -	$ 904,760	10	28	$ -	$ 8,978,243	$ 8,978,243	10	28	$ 16,285,671	$ 16,285,671
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #6_10 to 40 yrs	$ 937,022	$ 539,845	10	28	$ 685,828	$ 5,357,072	$ 6,042,900	10	28	$ 9,717,215	$ 10,654,236
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #6_40 to 42 yrs	$ -	$ -	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #6_40 to 42 yrs	$ 377,067	$ 365,220	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #6_40 to 42 yrs	$ 107,733	$ 652,153	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #6_42+ yrs	$ -	$ 88,342	0	0	$ -	$ -	$ -	0	0	$ -	$ -
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #6_42+ yrs	$ -	$ 38,842	0	0	$ -	$ -	$ -	0	0	$ -	$ -
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	28	$ 240,000	$ -	$ 240,000	0	28	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	28	$ 3,469,796	$ -	$ 3,469,796	0	28	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	28	$ -	$ 9,041,207	$ 9,041,207	0	28	$ 13,773,315	$ 13,773,315
Land Acquisition	Land Acquisition or Other	Initial	Alt 6 Land Acq	$ 1,130,400	$ -	0	28	$ 1,130,400	$ -	$ 1,130,400	0	28	$ -	$ 1,130,400
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (200 gpm)	$ 3,494,573	$ 2,123,267	0	28	$ 3,494,573	$ 39,025,693	$ 42,520,266	0	28	$ 59,451,483	$ 62,946,056
Groundwater Extraction & O&M for plant and treated injection	Ex-Situ Treatment (Chem Precip)	Initial	Alt 6_PIPE-WELL (0-10)	$ 4,221,720	$ 624,855	0	10	$ 4,221,720	$ 5,284,195	$ 9,505,915	0	10	$ 6,248,552	$ 10,470,272
Groundwater Extraction & O&M for plant and treated injection	Ex-Situ Treatment (Chem Precip)	Opt 1	Alt 6_PIPE-WELL (10-40)	$ 598,500	$ 624,811	10	28	$ 438,056	$ 6,200,219	$ 6,638,275	10	28	$ 11,246,602	$ 11,845,102
TOTAL				**$ 23,711,633**				**$ 22,616,229**	**$ 98,498,377**	**$ 121,114,606**			**$ 150,078,632**	**$ 173,305,465**

*Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedial Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation.

** Timeframe to reach 1.2 ug/L shown above, to the extent achieving this criteria is feasible, is based on modeling.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

						NPV to reach 3.1 ug/L Hexavalent Chromium*					Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium*			
						Optimization					Optimization			
ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 2 - Containment														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	260	$ -	$ 4,967,739	$ 4,967,739	0	260	$ 40,956,366	$ 40,956,366
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	25	$ -	$ 7,180,314	$ 7,180,314	0	25	$ 10,505,000	$ 10,505,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	25	260	$ -	$ 4,553,429	$ 4,553,429	25	260	$ 74,060,250	$ 74,060,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (2)	$ 900,600	$ 84,747	0	260	$ 900,600	$ 2,672,607	$ 3,573,207	0	260	$ 22,034,224	$ 22,934,824
Extraction for AU Application	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	260	$ -	$ 2,293,393	$ 2,293,393	0	260	$ 18,907,806	$ 18,907,806
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	260	$ 240,000	$ -	$ 240,000	0	260	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU	$ 2,213,475	$ -	0	260	$ 2,213,475	$ -	$ 2,213,475	0	260	$ -	$ 2,213,475
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 339,181	0	260	$ -	$ 10,696,519	$ 10,696,519	0	260	$ 88,187,108	$ 88,187,108
Land Acquisition	Land Acquisition or Other	Initial	Alt 2 Land Acq	$ 320,000	$ -	0	260	$ 320,000	$ -	$ 320,000	0	260	$ -	$ 320,000
TOTAL				**$ 3,674,075**				**$ 3,674,075**	**$ 32,364,003**	**$ 36,038,078**			**$ 254,650,754**	**$ 258,324,829**

OPINION OF PROBABLE COST	Hinkley Feasibility Study Including Addendum #3	Costs to 3.1 ug/L	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 3 - Plume-Wide In-Situ Treatment														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	110	$ -	$ 4,808,750	$ 4,808,750	0	110	$ 17,327,693	$ 17,327,693
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	110	$ -	$ 4,636,976	$ 4,636,976	10	110	$ 21,010,000	$ 21,010,000
Groundwater Extraction	Northern Extraction	Initial	Northern Extraction (3)	$ 1,675,800	$ 86,455	0	110	$ 1,675,800	$ 2,639,206	$ 4,315,006	0	110	$ 9,510,030	$ 11,185,830
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	110	$ -	$ 2,219,995	$ 2,219,995	0	110	$ 7,999,457	$ 7,999,457
Groundwater Extraction	DVD Extraction	Initial	Alt 3_PIPE-WELL (0 - 5)	$ -	$ 76,992	0	5	$ -	$ 350,895	$ 350,895	0	5	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 76,992	5	10	$ -	$ 300,200	$ 300,200	5	10	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 76,992	10	15	$ -	$ 256,828	$ 256,828	10	15	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 76,992	15	110	$ -	$ 1,442,407	$ 1,442,407	15	110	$ 7,314,225	$ 7,314,225
Groundwater Extraction	Gorman Extraction	Initial	Alt 3_PIPE-WELL (0 - 5)	$ -	$ 60,024	0	5	$ -	$ 273,564	$ 273,564	0	5	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 60,024	5	10	$ -	$ 234,041	$ 234,041	5	10	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 60,024	10	15	$ -	$ 200,228	$ 200,228	10	15	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 60,024	15	110	$ -	$ 1,124,527	$ 1,124,527	15	110	$ 5,702,302	$ 5,702,302
Dosed Injection	Northern Injection	Initial	Alt #3_0 to 5 yrs	$ -	$ -	0	5	$ -	$ -	$ -	0	5	$ -	$ -
Dosed Injection	Northern Injection	Opt 1	Alt #3_5 to 10 yrs	$ 4,642,022	$ 666,354	5	10	$ 3,971,367	$ 2,598,188	$ 6,569,555	5	10	$ 3,331,771	$ 7,973,792
Dosed Injection	Northern Injection	Opt 2	Alt #3_10 to 15 yrs	$ 2,024,500	$ 742,545	10	15	$ 1,481,779	$ 2,476,972	$ 3,958,751	10	15	$ 3,712,725	$ 5,737,225
Dosed Injection	Northern Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 495,898	15	110	$ -	$ 9,290,426	$ 9,290,426	15	110	$ 47,110,327	$ 47,110,327
Dosed Injection	Central Area IRZ / Injection	Initial	Alt #3_0 to 5 yrs	$ 1,353,685	$ 918,288	0	5	$ 1,353,685	$ 4,185,153	$ 5,538,838	0	5	$ 4,591,438	$ 5,945,123
Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 918,288	5	10	$ -	$ 3,580,504	$ 3,580,504	5	10	$ 4,591,438	$ 4,591,438
Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	10	15	$ -	$ -	$ -	10	15	$ -	$ -
Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #3_15+ yrs	$ -	$ -	15	110	$ -	$ -	$ -	15	110	$ -	$ -
Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #3_0 to 5 yrs	$ 2,115,069	$ 643,490	0	5	$ 2,115,069	$ 2,932,746	$ 5,047,815	0	5	$ 3,217,450	$ 5,332,519
Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 357,888	5	10	$ -	$ 1,395,444	$ 1,395,444	5	10	$ 1,789,439	$ 1,789,439
Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	10	15	$ -	$ -	$ -	10	15	$ -	$ -
Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 358,973	15	110	$ -	$ 6,725,201	$ 6,725,201	15	110	$ 34,102,463	$ 34,102,463
Dosed Injection	Source Area IRZ / Injection	Initial	Alt #3_0 to 5 yrs	$ 3,595,618	$ 946,596	0	5	$ 3,595,618	$ 4,314,169	$ 7,909,787	0	5	$ 4,732,978	$ 8,328,596
Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ -	5	10	$ -	$ -	$ -	5	10	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	10	15	$ -	$ -	$ -	10	15	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 669,535	15	110	$ -	$ 12,543,428	$ 12,543,428	15	110	$ 63,605,803	$ 63,605,803
Dosed Injection	Northern Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 112,201	0	5	$ -	$ 511,362	$ 511,362	0	5	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 112,201	5	10	$ -	$ 437,483	$ 437,483	5	10	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 112,201	10	15	$ -	$ 374,278	$ 374,278	10	15	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 112,201	15	110	$ -	$ 2,102,031	$ 2,102,031	15	110	$ 10,659,080	$ 10,659,080
Dosed Injection	Southeast and East Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 168,301	0	5	$ -	$ 767,043	$ 767,043	0	5	$ 841,506	$ 841,506
Dosed Injection	Southeast and East Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 209,102	5	10	$ -	$ 815,310	$ 815,310	5	10	$ 1,045,508	$ 1,045,508
Dosed Injection	Southeast and East Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 173,401	10	15	$ -	$ 578,430	$ 578,430	10	15	$ 867,007	$ 867,007
Dosed Injection	Southeast and East Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 173,401	15	110	$ -	$ 3,248,594	$ 3,248,594	15	110	$ 16,473,124	$ 16,473,124
Dosed Injection	Southern Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 158,101	0	5	$ -	$ 720,556	$ 720,556	0	5	$ 790,506	$ 790,506
Dosed Injection	Southern Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 249,902	5	10	$ -	$ 974,395	$ 974,395	5	10	$ 1,249,509	$ 1,249,509
Dosed Injection	Southern Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 249,902	10	15	$ -	$ 833,619	$ 833,619	10	15	$ 1,249,509	$ 1,249,509
Dosed Injection	Southern Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 249,902	15	110	$ -	$ 4,681,797	$ 4,681,797	15	110	$ 23,740,678	$ 23,740,678

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Dosed Injection	Northern Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 1,745,667	$ 146,300	0	5	$ 1,745,667	$ 666,771	$ 2,412,438	0	5	$ 731,500	$ 2,477,167
Dosed Injection	Northern Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 146,300	5	10	$ -	$ 570,440	$ 570,440	5	10	$ 731,500	$ 731,500
Dosed Injection	Northern Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 146,300	10	15	$ -	$ 488,026	$ 488,026	10	15	$ 731,500	$ 731,500
Dosed Injection	Northern Plume Fringe	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 146,300	15	110	$ -	$ 2,740,864	$ 2,740,864	15	110	$ 13,898,500	$ 13,898,500
Dosed Injection	Southeast and East Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 2,094,800	$ 184,360	0	5	$ 2,094,800	$ 840,232	$ 2,935,032	0	5	$ 921,800	$ 3,016,600
Dosed Injection	Southeast and East Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ 1,401,273	$ 265,540	5	10	$ 1,198,824	$ 1,035,370	$ 2,234,194	5	10	$ 1,327,700	$ 2,728,973
Dosed Injection	Southeast and East Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 184,360	10	15	$ -	$ 614,986	$ 614,986	10	15	$ 921,800	$ 921,800
Dosed Injection	Southeast and East Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 173,401	15	110	$ -	$ 3,248,594	$ 3,248,594	15	110	$ 16,473,124	$ 16,473,124
Dosed Injection	Southern Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 2,443,933	$ 211,420	0	5	$ 2,443,933	$ 963,560	$ 3,407,493	0	5	$ 1,057,100	$ 3,501,033
Dosed Injection	Southern Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ 800,727	$ 319,660	5	10	$ 685,042	$ 1,246,389	$ 1,931,432	5	10	$ 1,598,300	$ 2,399,027
Dosed Injection	Southern Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 319,660	10	15	$ -	$ 1,066,318	$ 1,066,318	10	15	$ 1,598,300	$ 1,598,300
Dosed Injection	Southern Plume Fringe	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 319,660	15	110	$ -	$ 5,988,684	$ 5,988,684	15	110	$ 30,367,700	$ 30,367,700
Land Acquisition	Land Acquisition or Other	Initial	Alt 3 Land Acq	$ 20,000	$ -	0	110	$ 20,000	$ -	$ 20,000	0	110	$ -	$ 20,000
TOTAL				**$ 23,913,094**				**$ 22,381,585**	**$ 107,598,472**	**$ 129,980,057**			**$ 374,865,044**	**$ 398,778,137**

Alternative 4 - Core In-Site Treatment and Beneficial Agricultural Use

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Begin	End	O&M x No. of years	Total Capital & O&M
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	150	$ -	$ 4,923,172	$ 4,923,172	0	150	$ 23,628,673	$ 23,628,673
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	150	$ -	$ 4,789,588	$ 4,789,588	10	150	$ 29,414,000	$ 29,414,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4)	$ 1,103,400	$ 84,747	0	150	$ 1,103,400	$ 2,648,630	$ 3,752,030	0	150	$ 12,712,052	$ 13,815,452
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	150	$ -	$ 2,272,818	$ 2,272,818	0	150	$ 10,908,350	$ 10,908,350
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	5	$ -	$ 248,657	$ 248,657	0	5	$ 272,796	$ 272,796
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4_0 to 5 yrs	$ 1,337,296	$ 918,288	0	5	$ 1,337,296	$ 4,185,153	$ 5,522,449	0	5	$ 4,591,438	$ 5,928,734
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4_0 to 5 yrs	$ 4,698,720	$ 476,809	0	5	$ 4,698,720	$ 2,173,086	$ 6,871,806	0	5	$ 2,384,044	$ 7,082,764
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4_0 to 5 yrs	$ 1,249,906	$ 814,241	0	5	$ 1,249,906	$ 3,710,952	$ 4,960,858	0	5	$ 4,071,203	$ 5,321,109
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	5	$ 240,000	$ -	$ 240,000	0	5	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU	$ 2,213,475	$ -	0	5	$ 2,213,475	$ -	$ 2,213,475	0	5	$ -	$ 2,213,475
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 319,636	0	5	$ -	$ 1,456,759	$ 1,456,759	0	5	$ 1,598,178	$ 1,598,178
AU Application	Agricultural Units	Opt 1	AU O&M Summary	$ -	$ 339,181	5	150	$ -	$ 9,054,718	$ 9,054,718	5	150	$ 49,181,272	$ 49,181,272
Land Acquisition	Land Acquisition or Other	Initial	Alt 4 Land Acq	$ 337,600	$ -	0	150	$ 337,600	$ -	$ 337,600	0	150	$ -	$ 337,600
TOTAL				**$ 11,180,397**					**$ 39,017,027**	**$ 50,197,424**			**$ 142,964,006**	**$ 154,144,403**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4A - Aggressive Core In-Site Treatment and Beneficial Agricultural Use														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	75	$ -	$ 4,255,140	$ 4,255,140	0	75	$ 11,194,273	$ 11,194,273
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	75	$ -	$ 1,960,689	$ 1,960,689	30	75	$ 9,454,500	$ 9,454,500
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4A)	$ 2,623,560	$ -	0	75	$ 2,623,560	$ -	$ 2,623,560	0	75	$ -	$ 2,623,560
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	20	$ -	$ 1,263,600	$ 1,263,600	0	20	$ 1,725,487	$ 1,725,487
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	20	$ -	$ 799,092	$ 799,092	0	20	$ 1,091,185	$ 1,091,185
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	20	$ 543,234	$ 345,102	$ 888,335	10	20	$ 557,547	$ 1,299,747
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extraction for low dose	$ -	$ 142,029	20	75	$ -	$ 1,968,880	$ 1,968,880	20	75	$ 7,811,598	$ 7,811,598
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 848,241	$ 416,508	10	20	$ 620,848	$ 2,578,035	$ 3,198,883	10	20	$ 4,165,083	$ 5,013,325
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 327,581	$ 294,136	10	20	$ 239,764	$ 1,820,593	$ 2,060,357	10	20	$ 2,941,356	$ 3,268,937
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	75	$ -	$ -	$ -	20	75	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	75	$ -	$ 1,224,643	$ 1,224,643	20	75	$ 4,858,812	$ 4,858,812
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	75	$ -	$ 538,448	$ 538,448	20	75	$ 2,136,312	$ 2,136,312
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	75	$ 240,000	$ -	$ 240,000	0	75	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	75	$ 3,469,796	$ -	$ 3,469,796	0	75	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	75	$ -	$ 14,023,606	$ 14,023,606	0	75	$ 36,892,807	$ 36,892,807
Land Acquisition	Land Acquisition or Other	Initial	Alt 4a Land Acq	$ 1,012,600	$ -	0	75	$ 1,012,600	$ -	$ 1,012,600	0	75	$ -	$ 1,012,600
TOTAL				**$ 17,777,770**				**$ 17,202,134**	**$ 61,515,303**	**$ 78,717,436**			**$ 123,941,318**	**$ 141,719,088**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4B - Aggressive Core In-Site Treatment and Beneficial Agricultural Use with Targeted Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	40	$ -	$ 3,357,164	$ 3,357,164	0	40	$ 5,970,279	$ 5,970,279
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	40	$ -	$ 696,663	$ 696,663	30	40	$ 2,101,000	$ 2,101,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4A)	$ 2,623,560	$ -	0	40	$ 2,623,560	$ -	$ 2,623,560	0	40	$ -	$ 2,623,560
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4B at 10)	$ 3,390,900	$ 100,562	10	40	$ 2,481,879	$ 1,411,472	$ 3,893,352	10	40	$ 3,016,860	$ 6,407,760
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	20	$ -	$ 1,263,600	$ 1,263,600	0	20	$ 1,725,487	$ 1,725,487
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	20	$ -	$ 799,092	$ 799,092	0	20	$ 1,091,185	$ 1,091,185
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	20	$ 543,234	$ 345,102	$ 888,335	10	20	$ 557,547	$ 1,299,747
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extraction for low dose	$ -	$ 142,029	20	40	$ -	$ 1,114,389	$ 1,114,389	20	40	$ 2,840,581	$ 2,840,581
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 848,241	$ 416,508	10	20	$ 620,848	$ 2,578,035	$ 3,198,883	10	20	$ 4,165,083	$ 5,013,325
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 327,581	$ 294,136	10	20	$ 239,764	$ 1,820,593	$ 2,060,357	10	20	$ 2,941,356	$ 3,268,937
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	40	$ -	$ -	$ -	20	40	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	40	$ -	$ 693,150	$ 693,150	20	40	$ 1,766,841	$ 1,766,841
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	40	$ -	$ 304,763	$ 304,763	20	40	$ 776,841	$ 776,841
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	40	$ 240,000	$ -	$ 240,000	0	40	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	40	$ 3,469,796	$ -	$ 3,469,796	0	40	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	40	$ -	$ 11,064,159	$ 11,064,159	0	40	$ 19,676,164	$ 19,676,164
Land Acquisition	Land Acquisition or Other	Initial	Alt 4a Land Acq	$ 1,012,600	$ -	0	40	$ 1,012,600	$ -	$ 1,012,600	0	40	$ -	$ 1,012,600
TOTAL				**$ 21,168,670**				**$ 19,684,013**	**$ 56,185,656**	**$ 75,869,669**			**$ 87,741,581**	**$ 108,910,251**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

						NPV to reach 3.1 ug/L Hexavalent Chromium*					Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium*			
						Optimization					Optimization			
ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4C-1 In-Situ and Enhanced Agricultural Treatment - 1 Crop														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	40	$ -	$ 3,357,164	$ 3,357,164	0	40	$ 5,970,279	$ 5,970,279
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	40	$ -	$ 696,663	$ 696,663	30	40	$ 2,101,000	$ 2,101,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	10	$ 4,417,800	$ 474,373	$ 4,892,173	0	10	$ 560,945	$ 4,978,745
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	40	$ 2,206,200	$ 540,731	$ 2,746,931	0	40	$ 961,620	$ 3,167,820
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extraction (4C at 10)	$ 3,195,300	$ 156,657	10	20	$ 2,338,715	$ 969,647	$ 3,308,362	10	20	$ 1,566,565	$ 4,761,865
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	40	$ -	$ 789,030	$ 789,030	20	40	$ 2,011,240	$ 2,011,240
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	40	$ -	$ 240,604	$ 240,604	20	40	$ 613,301	$ 613,301
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	40	$ -	$ -	$ -	20	40	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	40	$ -	$ 693,150	$ 693,150	20	40	$ 1,766,841	$ 1,766,841
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	40	$ -	$ 304,763	$ 304,763	20	40	$ 776,841	$ 776,841
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	40	$ 240,000	$ -	$ 240,000	0	40	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	40	$ 8,096,191	$ -	$ 8,096,191	0	40	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 1,895,326	0	20	$ -	$ 27,759,523	$ 27,759,523	0	20	$ 37,906,512	$ 37,906,512
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 690,537	20	40	$ -	$ 5,418,094	$ 5,418,094	20	40	$ 13,810,740	$ 13,810,740
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C Land Acq	$ 1,052,000	$ -	0	40	$ 1,052,000	$ -	$ 1,052,000	0	40	$ -	$ 1,052,000
TOTAL				**$ 29,496,805**				**$ 28,102,785**	**$ 77,676,617**	**$ 105,779,402**			**$ 118,121,763**	**$ 147,618,568**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 4C-2 - In-Situ Treatment and Year-round Beneficial Agricultural Use														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	39	$ -	$ 3,314,329	$ 3,314,329	0	39	$ 5,821,022	$ 5,821,022
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	39	$ -	$ 636,367	$ 636,367	30	39	$ 1,890,900	$ 1,890,900
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	10	$ 4,417,800	$ 474,373	$ 4,892,173	0	10	$ 560,945	$ 4,978,745
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	39	$ 2,206,200	$ 533,832	$ 2,740,032	0	39	$ 937,580	$ 3,143,780
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extraction (4C at 10)	$ 3,195,300	$ 156,657	10	20	$ 2,338,715	$ 969,647	$ 3,308,362	10	20	$ 1,566,565	$ 4,761,865
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	39	$ -	$ 760,170	$ 760,170	20	39	$ 1,910,678	$ 1,910,678
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	39	$ -	$ 231,804	$ 231,804	20	39	$ 582,636	$ 582,636
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	39	$ -	$ -	$ -	20	39	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	39	$ -	$ 667,797	$ 667,797	20	39	$ 1,678,499	$ 1,678,499
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	39	$ -	$ 293,615	$ 293,615	20	39	$ 737,999	$ 737,999
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	39	$ 240,000	$ -	$ 240,000	0	39	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	39	$ 8,096,191	$ -	$ 8,096,191	0	39	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 2,018,957	0	20	$ -	$ 29,570,260	$ 29,570,260	0	20	$ 40,379,130	$ 40,379,130
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 734,677	20	39	$ -	$ 5,553,580	$ 5,553,580	20	39	$ 13,958,857	$ 13,958,857
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C Land Acq	$ 1,052,000	$ -	0	39	$ 1,052,000	$ -	$ 1,052,000	0	39	$ -	$ 1,052,000
TOTAL				**$ 29,496,805**				**$ 28,102,785**	**$ 79,438,649**	**$ 107,541,434**			**$ 120,100,691**	**$ 149,597,496**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4C-3 - In-Situ Treatment and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuc														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	36	$ -	$ 3,177,504	$ 3,177,504	0	36	$ 5,373,251	$ 5,373,251
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	36	$ -	$ 8,945,560	$ 8,945,560	0	36	$ 15,127,200	$ 15,127,200
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	10	$ 4,417,800	$ 474,373	$ 4,892,173	0	10	$ 560,945	$ 4,978,745
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	36	$ 2,206,200	$ 511,794	$ 2,717,994	0	36	$ 865,458	$ 3,071,658
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extr (4C-3 at 10)	$ 2,939,700	$ 156,657	10	20	$ 2,151,636	$ 969,647	$ 3,121,282	10	20	$ 1,566,565	$ 4,506,265
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	36	$ -	$ 667,984	$ 667,984	20	36	$ 1,608,992	$ 1,608,992
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	36	$ -	$ 203,693	$ 203,693	20	36	$ 490,641	$ 490,641
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	36	$ -	$ -	$ -	20	36	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	36	$ -	$ 586,813	$ 586,813	20	36	$ 1,413,473	$ 1,413,473
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	36	$ -	$ 258,009	$ 258,009	20	36	$ 621,473	$ 621,473
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	36	$ 240,000	$ -	$ 240,000	0	36	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	36	$ 8,096,191	$ -	$ 8,096,191	0	36	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 2,018,957	0	20	$ -	$ 29,570,260	$ 29,570,260	0	20	$ 40,379,130	$ 40,379,130
AU Application	Agricultural Units	Opt 3	AU O&M Summary	$ -	$ 734,677	20	36	$ -	$ 4,880,095	$ 4,880,095	20	36	$ 11,754,827	$ 11,754,827
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C-3 Land Acq	$ 1,093,400	$ -	0	36	$ 1,093,400	$ -	$ 1,093,400	0	36	$ -	$ 1,093,400
Groundwater Extraction	DVD Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ -	$ 17,148	0	20	$ -	$ 251,156	$ 251,156	0	20	$ 342,962	$ 342,962
Groundwater Extraction	DVD Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 17,148	20	36	$ -	$ 113,906	$ 113,906	20	36	$ 274,369	$ 274,369
Groundwater Extraction	Gorman Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ -	$ 15,526	0	20	$ -	$ 227,394	$ 227,394	0	20	$ 310,514	$ 310,514
Groundwater Extraction	Gorman Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 15,526	20	36	$ -	$ 103,129	$ 103,129	20	36	$ 248,411	$ 248,411
Groundwater Extraction	Ranch or Other Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 256,087	$ 27,250	0	20	$ 256,087	$ 399,108	$ 655,195	0	20	$ 544,995	$ 801,082
Groundwater Extraction	Ranch or Other Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 22,126	20	36	$ -	$ 146,974	$ 146,974	20	36	$ 354,021	$ 354,021
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (1200 gpm)	$ 8,012,515	$ -	0	36	$ 8,012,515	$ -	$ 8,012,515	0	36	$ -	$ 8,012,515
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (450 gpm)	$ 5,086,428	$ -	0	36	$ 5,086,428	$ -	$ 5,086,428	0	36	$ -	$ 5,086,428
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A O&M (Alt 4C-3)	$ -	$ 4,061,665	0	36	$ -	$ 86,468,041	$ 86,468,041	0	36	$ 146,219,951	$ 146,219,951
Treated Injection	Northern Plume Fringe	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 3,749,137	$ 281,600	0	20	$ 3,749,137	$ 4,124,400	$ 7,873,538	0	20	$ 5,632,000	$ 9,381,137
Treated Injection	Northern Plume Fringe	Opt 1	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 281,600	20	36	$ -	$ 1,870,530	$ 1,870,530	20	36	$ 4,505,600	$ 4,505,600
Treated Injection	Southern Plume Fringe	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 2,304,376	$ 265,540	0	20	$ 2,304,376	$ 3,889,181	$ 6,193,557	0	20	$ 5,310,800	$ 7,615,176
Treated Injection	Southern Plume Fringe	Opt 1	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 265,540	20	36	$ -	$ 1,763,851	$ 1,763,851	20	36	$ 4,248,640	$ 4,248,640
TOTAL				$ 48,691,148				$ 47,365,649	$ 178,753,958	$ 226,119,607			$ 286,799,847	$ 335,490,996

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 4C-4 - In-Situ and Enhanced Agricultural Treatment - Continuous Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	29	$ -	$ 2,803,725	$ 2,803,725	0	29	$ 4,328,452	$ 4,328,452
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	29	$ -	$ 7,893,268	$ 7,893,268	0	29	$ 12,185,800	$ 12,185,800
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C-4)	$ 5,834,400	$ 56,095	0	10	$ 5,834,400	$ 474,373	$ 6,308,773	0	10	$ 560,945	$ 6,395,345
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C-4)	$ 2,776,800	$ 24,041	0	29	$ 2,776,800	$ 451,590	$ 3,228,390	0	29	$ 697,175	$ 3,473,975
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extr (4C-3 at 10)	$ 2,939,700	$ 156,657	10	20	$ 2,151,636	$ 969,647	$ 3,121,282	10	20	$ 1,566,565	$ 4,506,265
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	29	$ -	$ 416,150	$ 416,150	20	29	$ 905,058	$ 905,058
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	29	$ -	$ 126,899	$ 126,899	20	29	$ 275,986	$ 275,986
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	29	$ -	$ -	$ -	20	29	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	29	$ -	$ 365,581	$ 365,581	20	29	$ 795,078	$ 795,078
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	29	$ -	$ 160,738	$ 160,738	20	29	$ 349,578	$ 349,578
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	29	$ 240,000	$ -	$ 240,000	0	29	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 26,601,771	$ -	0	29	$ 26,601,771	$ -	$ 26,601,771	0	29	$ -	$ 26,601,771
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 3,254,880	0	20	$ -	$ 47,671,978	$ 47,671,978	0	20	$ 65,097,601	$ 65,097,601
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 1,833,604	20	29	$ -	$ 7,587,896	$ 7,587,896	20	29	$ 16,502,439	$ 16,502,439
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C-4 Land Acq	$ 2,230,720	$ -	0	29	$ 2,230,720	$ -	$ 2,230,720	0	29	$ -	$ 2,230,720
TOTAL				**$ 50,912,705**				**$ 49,587,205**	**$ 98,072,400**	**$ 147,659,606**			**$ 142,310,308**	**$ 193,223,013**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 5 - Plume-Wide Pump and Treat														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	140	$ -	$ 4,906,304	$ 4,906,304	0	140	$ 22,053,428	$ 22,053,428
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	140	$ -	$ 4,767,089	$ 4,767,089	10	140	$ 27,313,000	$ 27,313,000
Groundwater Extraction	Northern Extraction	Initial	Northern Extraction (5)	$ 1,675,800	$ 84,747	0	140	$ 1,675,800	$ 2,639,555	$ 4,315,355	0	140	$ 11,864,582	$ 13,540,382
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	140	$ -	$ 2,265,031	$ 2,265,031	0	140	$ 10,181,126	$ 10,181,126
Groundwater Extraction	DVD Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ -	$ 73,576	0	10	$ -	$ 622,210	$ 622,210	0	10	$ 735,762	$ 735,762
Groundwater Extraction	DVD Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 73,576	10	15	$ -	$ 245,435	$ 245,435	10	15	$ 367,881	$ 367,881
Groundwater Extraction	DVD Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 73,576	15	140	$ -	$ 1,423,982	$ 1,423,982	15	140	$ 9,197,029	$ 9,197,029
Groundwater Extraction	Gorman Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ -	$ 58,316	0	10	$ -	$ 493,163	$ 493,163	0	10	$ 583,164	$ 583,164
Groundwater Extraction	Gorman Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 58,316	10	15	$ -	$ 194,531	$ 194,531	10	15	$ 291,582	$ 291,582
Groundwater Extraction	Gorman Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 58,316	15	140	$ -	$ 1,128,647	$ 1,128,647	15	140	$ 7,289,554	$ 7,289,554
Groundwater Extraction	Ranch or Other Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 3,202,844	$ 126,247	0	10	$ 3,202,844	$ 1,067,631	$ 4,270,475	0	10	$ 1,262,472	$ 4,465,316
Groundwater Extraction	Ranch or Other Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ 677,400	$ 126,247	10	15	$ 495,805	$ 421,134	$ 916,939	10	15	$ 631,236	$ 1,308,636
Groundwater Extraction	Ranch or Other Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ 885,600	$ 126,247	15	140	$ 554,544	$ 2,443,368	$ 2,997,912	15	140	$ 15,780,901	$ 16,666,501
Treated Injection	Northern Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 1,526,995	$ 146,300	0	10	$ 1,526,995	$ 1,237,211	$ 2,764,206	0	10	$ 1,463,000	$ 2,989,995
Treated Injection	Northern Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 146,300	10	15	$ -	$ 488,026	$ 488,026	10	15	$ 731,500	$ 731,500
Treated Injection	Northern Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 146,300	15	140	$ -	$ 2,831,466	$ 2,831,466	15	140	$ 18,287,500	$ 18,287,500
Treated Injection	Southeast and East Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 6,718,776	$ 617,320	0	10	$ 6,718,776	$ 5,220,473	$ 11,939,249	0	10	$ 6,173,200	$ 12,891,976
Treated Injection	Southeast and East Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 617,320	10	15	$ -	$ 2,059,248	$ 2,059,248	10	15	$ 3,086,600	$ 3,086,600
Treated Injection	Southeast and East Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 617,320	15	140	$ -	$ 11,947,509	$ 11,947,509	15	140	$ 77,165,000	$ 77,165,000
Treated Injection	Southern Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 3,359,388	$ 319,660	0	10	$ 3,359,388	$ 2,703,260	$ 6,062,648	0	10	$ 3,196,600	$ 6,555,988
Treated Injection	Southern Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 319,660	10	15	$ -	$ 1,066,318	$ 1,066,318	10	15	$ 1,598,300	$ 1,598,300
Treated Injection	Southern Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 319,660	15	140	$ -	$ 6,186,647	$ 6,186,647	15	140	$ 39,957,500	$ 39,957,500
Treated Injection	Southwest Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 916,197	$ 92,180	0	10	$ 916,197	$ 779,536	$ 1,695,733	0	10	$ 921,800	$ 1,837,997
Treated Injection	Southwest Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 92,180	10	15	$ -	$ 307,493	$ 307,493	10	15	$ 460,900	$ 460,900
Treated Injection	Southwest Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 92,180	15	140	$ -	$ 1,784,036	$ 1,784,036	15	140	$ 11,522,500	$ 11,522,500
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A	$ 8,012,515	$ 4,130,732	0	140	$ 8,012,515	$ 128,657,005	$ 136,669,520	0	140	$ 578,302,548	$ 586,315,063
Land Acquisition	Land Acquisition or Other	Initial	Alt 5 Land Acq	$ 454,000	$ -	0	140	$ 454,000	$ -	$ 454,000	0	140	$ -	$ 454,000
TOTAL				**$ 27,429,515**				**$ 26,916,864**	**$ 191,439,800**	**$ 218,356,664**			**$ 854,620,667**	**$ 882,050,182**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 3.1 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 3.1 ug/L Hexavalent Chromium* Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Combined Alternative														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	90	$ -	$ 4,424,586	$ 4,424,586	0	90	$ 13,433,127	$ 13,433,127
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	90	$ -	$ 2,199,208	$ 2,199,208	30	90	$ 12,606,000	$ 12,606,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (Combined)	$ 2,623,560	$ -	0	90	$ 2,623,560	$ -	$ 2,623,560	0	90	$ -	$ 2,623,560
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	40	$ -	$ 1,940,526	$ 1,940,526	0	40	$ 3,450,973	$ 3,450,973
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	40	$ -	$ 1,227,175	$ 1,227,175	0	40	$ 2,182,371	$ 2,182,371
Groundwater Extraction	SCRIA Extraction	Initial	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	40	$ 543,234	$ 782,564	$ 1,325,798	10	40	$ 1,672,642	$ 2,414,842
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction for low dose	$ -	$ 142,029	40	90	$ -	$ 1,015,731	$ 1,015,731	40	90	$ 7,101,453	$ 7,101,453
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #6_0 to 10 yrs	$ 2,394,426	$ 904,760	0	10	$ 2,394,426	$ 7,651,254	$ 10,045,681	0	10	$ 9,047,595	$ 11,442,022
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #6_0 to 10 yrs	$ 3,374,635	$ 478,213	0	10	$ 3,374,635	$ 4,044,089	$ 7,418,724	0	10	$ 4,782,128	$ 8,156,763
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #6_10 to 40 yrs	$ -	$ 904,760	10	40	$ -	$ 12,699,060	$ 12,699,060	10	40	$ 27,142,786	$ 27,142,786
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #6_10 to 40 yrs	$ 937,022	$ 539,845	10	40	$ 685,828	$ 7,577,182	$ 8,263,010	10	40	$ 16,195,358	$ 17,132,379
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #6_40 to 42 yrs	$ -	$ -	40	42	$ -	$ -	$ -	40	42	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #6_40 to 42 yrs	$ 377,067	$ 365,220	40	42	$ 108,213	$ 200,064	$ 308,278	40	42	$ 730,440	$ 1,107,507
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #6_40 to 42 yrs	$ 107,733	$ 652,153	40	42	$ 30,918	$ 357,244	$ 388,162	40	42	$ 1,304,306	$ 1,412,039
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #6_42+ yrs	$ -	$ 88,342	42	90	$ -	$ 583,392	$ 583,392	42	90	$ 4,240,418	$ 4,240,418
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #6_42+ yrs	$ -	$ 38,842	42	90	$ -	$ 256,504	$ 256,504	42	90	$ 1,864,418	$ 1,864,418
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	90	$ 240,000	$ -	$ 240,000	0	90	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	90	$ 3,469,796	$ -	$ 3,469,796	0	90	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	90	$ -	$ 14,582,047	$ 14,582,047	0	90	$ 44,271,369	$ 44,271,369
Land Acquisition	Land Acquisition or Other	Initial	Alt 6 Land Acq	$ 1,130,400	$ -	0	90	$ 1,130,400	$ -	$ 1,130,400	0	90	$ -	$ 1,130,400
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (200 gpm)	$ 3,494,573	$ 2,123,267	0	40	$ 3,494,573	$ 47,757,614	$ 51,252,188	0	40	$ 84,930,690	$ 88,425,263
Groundwater Extraction & O&M for plant and treated injection	Ex-Situ Treatment (Chem Precip)	Initial	Alt 6_PIPE-WELL (0-10)	$ 4,221,720	$ 624,855	0	10	$ 4,221,720	$ 5,284,195	$ 9,505,915	0	10	$ 6,248,552	$ 10,470,272
Groundwater Extraction & O&M for plant and treated injection	Ex-Situ Treatment (Chem Precip)	Opt 1	Alt 6_PIPE-WELL (10-40)	$ 598,500	$ 624,811	10	40	$ 438,056	$ 8,769,750	$ 9,207,807	10	40	$ 18,744,336	$ 19,342,836
TOTAL				**$ 23,711,633**				**$ 22,755,361**	**$ 128,634,507**	**$ 151,389,868**			**$ 270,979,211**	**$ 294,690,844**

*Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedial Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation.
** Timeframe to reach 1.2 ug/L shown above, to the extent achieving this criteria is feasible, is based on modeling.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 2 - Containment														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	320	$ -	$ 4,968,998	$ 4,968,998	0	320	$ 50,407,835	$ 50,407,835
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	25	$ -	$ 7,180,314	$ 7,180,314	0	25	$ 10,505,000	$ 10,505,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	25	320	$ -	$ 4,555,947	$ 4,555,947	25	320	$ 92,969,250	$ 92,969,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (2)	$ 900,600	$ 84,747	0	320	$ 900,600	$ 2,673,284	$ 3,573,884	0	320	$ 27,119,044	$ 28,019,644
Extraction for AU Application	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	320	$ -	$ 2,293,974	$ 2,293,974	0	320	$ 23,271,146	$ 23,271,146
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	320	$ 240,000	$ -	$ 240,000	0	320	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU	$ 2,213,475	$ -	0	320	$ 2,213,475	$ -	$ 2,213,475	0	320	$ -	$ 2,213,475
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 339,181	0	320	$ -	$ 10,699,230	$ 10,699,230	0	320	$ 108,537,979	$ 108,537,979
Land Acquisition	Land Acquisition or Other	Initial	Alt 2 Land Acq	$ 320,000	$ -	0	320	$ 320,000	$ -	$ 320,000	0	320	$ -	$ 320,000
TOTAL				**$ 3,674,075**				**$ 3,674,075**	**$ 32,371,748**	**$ 36,045,823**			**$ 312,810,255**	**$ 316,484,330**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 3 - Plume-Wide In-Situ Treatment														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	180	$ -	$ 4,951,169	$ 4,951,169	0	180	$ 28,354,407	$ 28,354,407
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	180	$ -	$ 4,826,928	$ 4,826,928	10	180	$ 35,717,000	$ 35,717,000
Groundwater Extraction	Northern Extraction	Initial	Northern Extraction (3)	$ 1,675,800	$ 86,455	0	180	$ 1,675,800	$ 2,717,370	$ 4,393,170	0	180	$ 15,561,867	$ 17,237,667
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	180	$ -	$ 2,285,743	$ 2,285,743	0	180	$ 13,090,020	$ 13,090,020
Groundwater Extraction	DVD Extraction	Initial	Alt 3_PIPE-WELL (0 - 5)	$ -	$ 76,992	0	5	$ -	$ 350,895	$ 350,895	0	5	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 76,992	5	10	$ -	$ 300,200	$ 300,200	5	10	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 76,992	10	15	$ -	$ 256,828	$ 256,828	10	15	$ 384,959	$ 384,959
Groundwater Extraction	DVD Extraction	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 76,992	15	180	$ -	$ 1,512,015	$ 1,512,015	15	180	$ 12,703,653	$ 12,703,653
Groundwater Extraction	Gorman Extraction	Initial	Alt 3_PIPE-WELL (0 - 5)	$ -	$ 60,024	0	5	$ -	$ 273,564	$ 273,564	0	5	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 60,024	5	10	$ -	$ 234,041	$ 234,041	5	10	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 60,024	10	15	$ -	$ 200,228	$ 200,228	10	15	$ 300,121	$ 300,121
Groundwater Extraction	Gorman Extraction	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 60,024	15	180	$ -	$ 1,178,795	$ 1,178,795	15	180	$ 9,903,999	$ 9,903,999
Dosed Injection	Northern Injection	Initial	Alt #3_0 to 5 yrs	$ -	$ -	0	5	$ -	$ -	$ -	0	5	$ -	$ -
Dosed Injection	Northern Injection	Opt 1	Alt #3_5 to 10 yrs	$ 4,642,022	$ 666,354	5	10	$ 3,971,367	$ 2,598,188	$ 6,569,555	5	10	$ 3,331,771	$ 7,973,792
Dosed Injection	Northern Injection	Opt 2	Alt #3_10 to 15 yrs	$ 2,024,500	$ 742,545	10	15	$ 1,481,779	$ 2,476,972	$ 3,958,751	10	15	$ 3,712,725	$ 5,737,225
Dosed Injection	Northern Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 495,898	15	180	$ -	$ 9,738,769	$ 9,738,769	15	180	$ 81,823,199	$ 81,823,199
Dosed Injection	Central Area IRZ / Injection	Initial	Alt #3_0 to 5 yrs	$ 1,353,685	$ 918,288	0	5	$ 1,353,685	$ 4,185,153	$ 5,538,838	0	5	$ 4,591,438	$ 5,945,123
Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 918,288	5	10	$ -	$ 3,580,504	$ 3,580,504	5	10	$ 4,591,438	$ 4,591,438
Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	10	15	$ -	$ -	$ -	10	15	$ -	$ -
Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #3_15+ yrs	$ -	$ -	15	180	$ -	$ -	$ -	15	180	$ -	$ -
Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #3_0 to 5 yrs	$ 2,115,069	$ 643,490	0	5	$ 2,115,069	$ 2,932,746	$ 5,047,815	0	5	$ 3,217,450	$ 5,332,519
Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 357,888	5	10	$ -	$ 1,395,444	$ 1,395,444	5	10	$ 1,789,439	$ 1,789,439
Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	10	15	$ -	$ -	$ -	10	15	$ -	$ -
Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 358,973	15	180	$ -	$ 7,049,750	$ 7,049,750	15	180	$ 59,230,594	$ 59,230,594
Dosed Injection	Source Area IRZ / Injection	Initial	Alt #3_0 to 5 yrs	$ 3,595,618	$ 946,596	0	5	$ 3,595,618	$ 4,314,169	$ 7,909,787	0	5	$ 4,732,978	$ 8,328,596
Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #3_5 to 10 yrs	$ -	$ -	5	10	$ -	$ -	$ -	5	10	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #3_10 to 15 yrs	$ -	$ -	10	15	$ -	$ -	$ -	10	15	$ -	$ -
Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #3_15+ yrs	$ -	$ 669,535	15	180	$ -	$ 13,148,756	$ 13,148,756	15	180	$ 110,473,236	$ 110,473,236
Dosed Injection	Northern Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 112,201	0	5	$ -	$ 511,362	$ 511,362	0	5	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 112,201	5	10	$ -	$ 437,483	$ 437,483	5	10	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 112,201	10	15	$ -	$ 374,278	$ 374,278	10	15	$ 561,004	$ 561,004
Dosed Injection	Northern Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 112,201	15	180	$ -	$ 2,203,473	$ 2,203,473	15	180	$ 18,513,139	$ 18,513,139
Dosed Injection	Southeast and East Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 168,301	0	5	$ -	$ 767,043	$ 767,043	0	5	$ 841,506	$ 841,506
Dosed Injection	Southeast and East Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 209,102	5	10	$ -	$ 815,310	$ 815,310	5	10	$ 1,045,508	$ 1,045,508
Dosed Injection	Southeast and East Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 173,401	10	15	$ -	$ 578,430	$ 578,430	10	15	$ 867,007	$ 867,007
Dosed Injection	Southeast and East Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 173,401	15	180	$ -	$ 3,405,367	$ 3,405,367	15	180	$ 28,611,215	$ 28,611,215
Dosed Injection	Southern Plume Fringe	Initial	Alt #3_0 to 5 yrs	$ -	$ 158,101	0	5	$ -	$ 720,556	$ 720,556	0	5	$ 790,506	$ 790,506
Dosed Injection	Southern Plume Fringe	Opt 1	Alt #3_5 to 10 yrs	$ -	$ 249,902	5	10	$ -	$ 974,395	$ 974,395	5	10	$ 1,249,509	$ 1,249,509
Dosed Injection	Southern Plume Fringe	Opt 2	Alt #3_10 to 15 yrs	$ -	$ 249,902	10	15	$ -	$ 833,619	$ 833,619	10	15	$ 1,249,509	$ 1,249,509
Dosed Injection	Southern Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 249,902	15	180	$ -	$ 4,907,735	$ 4,907,735	15	180	$ 41,233,810	$ 41,233,810

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

						NPV to reach 1.2 ug/L Hexavalent Chromium**					Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium**			
						Optimization					Optimization			
ALT	**Area**	**Opt No.**	**Sheet Name**	**Capital**	**Annual O&M**	**Begin**	**End**	**Capital**	**O&M x No. of years**	**Total Capital & O&M**	**Begin**	**End**	**O&M x No. of years**	**Total Capital & O&M**
Dosed Injection	Northern Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 1,745,667	$ 146,300	0	5	$ 1,745,667	$ 666,771	$ 2,412,438	0	5	$ 731,500	$ 2,477,167
Dosed Injection	Northern Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ -	$ 146,300	5	10	$ -	$ 570,440	$ 570,440	5	10	$ 731,500	$ 731,500
Dosed Injection	Northern Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 146,300	10	15	$ -	$ 488,026	$ 488,026	10	15	$ 731,500	$ 731,500
Dosed Injection	Northern Plume Fringe	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 146,300	15	180	$ -	$ 2,873,134	$ 2,873,134	15	180	$ 24,139,500	$ 24,139,500
Dosed Injection	Southeast and East Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 2,094,800	$ 184,360	0	5	$ 2,094,800	$ 840,232	$ 2,935,032	0	5	$ 921,800	$ 3,016,600
Dosed Injection	Southeast and East Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ 1,401,273	$ 265,540	5	10	$ 1,198,824	$ 1,035,370	$ 2,234,194	5	10	$ 1,327,700	$ 2,728,973
Dosed Injection	Southeast and East Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 184,360	10	15	$ -	$ 614,986	$ 614,986	10	15	$ 921,800	$ 921,800
Dosed Injection	Southeast and East Plume Fringe	Opt 3	Alt #3_15+ yrs	$ -	$ 173,401	15	180	$ -	$ 3,405,367	$ 3,405,367	15	180	$ 28,611,215	$ 28,611,215
Dosed Injection	Southern Plume Fringe	Initial	Alt 3_PIPE-WELL (0 - 5)	$ 2,443,933	$ 211,420	0	5	$ 2,443,933	$ 963,560	$ 3,407,493	0	5	$ 1,057,100	$ 3,501,033
Dosed Injection	Southern Plume Fringe	Opt 1	Alt 3_PIPE-WELL (5 - 10)	$ 800,727	$ 319,660	5	10	$ 685,042	$ 1,246,389	$ 1,931,432	5	10	$ 1,598,300	$ 2,399,027
Dosed Injection	Southern Plume Fringe	Opt 2	Alt 3_PIPE-WELL (10+)	$ -	$ 319,660	10	15	$ -	$ 1,066,318	$ 1,066,318	10	15	$ 1,598,300	$ 1,598,300
Dosed Injection	Southern Plume Fringe	Opt 3	Alt 3_PIPE-WELL (10+)	$ -	$ 319,660	15	180	$ -	$ 6,277,690	$ 6,277,690	15	180	$ 52,743,900	$ 52,743,900
Land Acquisition	Land Acquisition or Other	Initial	Alt 3 Land Acq	$ 20,000	$ -	0	180	$ 20,000	$ -	$ 20,000	0	180	$ -	$ 20,000
TOTAL				**$ 23,913,094**				**$ 22,381,585**	**$ 110,639,053**	**$ 133,020,637**			**$ 610,281,292**	**$ 634,194,386**

Alternative 4 - Core In-Site Treatment and Beneficial Agricultural Use

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Begin	End	O&M x No. of years	Total Capital & O&M
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	220	$ -	$ 4,964,044	$ 4,964,044	0	220	$ 34,655,387	$ 34,655,387
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	220	$ -	$ 4,844,101	$ 4,844,101	10	220	$ 44,121,000	$ 44,121,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4)	$ 1,103,400	$ 84,747	0	220	$ 1,103,400	$ 2,670,619	$ 3,774,019	0	220	$ 18,644,343	$ 19,747,743
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	220	$ -	$ 2,291,687	$ 2,291,687	0	220	$ 15,998,913	$ 15,998,913
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	5	$ -	$ 248,657	$ 248,657	0	5	$ 272,796	$ 272,796
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4_0 to 5 yrs	$ 1,337,296	$ 918,288	0	5	$ 1,337,296	$ 4,185,153	$ 5,522,449	0	5	$ 4,591,438	$ 5,928,734
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4_0 to 5 yrs	$ 4,698,720	$ 476,809	0	5	$ 4,698,720	$ 2,173,086	$ 6,871,806	0	5	$ 2,384,044	$ 7,082,764
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4_0 to 5 yrs	$ 1,249,906	$ 814,241	0	5	$ 1,249,906	$ 3,710,952	$ 4,960,858	0	5	$ 4,071,203	$ 5,321,109
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	5	$ 240,000	$ -	$ 240,000	0	5	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU	$ 2,213,475	$ -	0	5	$ 2,213,475	$ -	$ 2,213,475	0	5	$ -	$ 2,213,475
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 319,636	0	5	$ -	$ 1,456,759	$ 1,456,759	0	5	$ 1,598,178	$ 1,598,178
AU Application	Agricultural Units	Opt 1	AU O&M Summary	$ -	$ 339,181	5	220	$ -	$ 9,142,724	$ 9,142,724	5	220	$ 72,923,955	$ 72,923,955
Land Acquisition	Land Acquisition or Other	Initial	Alt 4 Land Acq	$ 337,600	$ -	0	220	$ 337,600	$ -	$ 337,600	0	220	$ -	$ 337,600
TOTAL				**$ 11,180,397**					**$ 39,241,277**	**$ 50,421,674**			**$ 203,463,257**	**$ 214,643,654**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4A - Aggressive Core In-Site Treatment and Beneficial Agricultural Use														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	130	$ -	$ 4,626,965	$ 4,626,965	0	130	$ 19,403,406	$ 19,403,406
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	130	$ -	$ 2,484,084	$ 2,484,084	30	130	$ 21,010,000	$ 21,010,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4A)	$ 2,623,560	$ -	0	130	$ 2,623,560	$ -	$ 2,623,560	0	130	$ -	$ 2,623,560
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	20	$ -	$ 1,263,600	$ 1,263,600	0	20	$ 1,725,487	$ 1,725,487
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	20	$ -	$ 799,092	$ 799,092	0	20	$ 1,091,185	$ 1,091,185
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	20	$ 543,234	$ 345,102	$ 888,335	10	20	$ 557,547	$ 1,299,747
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extraction for low dose	$ -	$ 142,029	20	130	$ -	$ 2,322,698	$ 2,322,698	20	130	$ 15,623,196	$ 15,623,196
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 848,241	$ 416,508	10	20	$ 620,848	$ 2,578,035	$ 3,198,883	10	20	$ 4,165,083	$ 5,013,325
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 327,581	$ 294,136	10	20	$ 239,764	$ 1,820,593	$ 2,060,357	10	20	$ 2,941,356	$ 3,268,937
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	130	$ -	$ -	$ -	20	130	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	130	$ -	$ 1,444,718	$ 1,444,718	20	130	$ 9,717,625	$ 9,717,625
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	130	$ -	$ 635,210	$ 635,210	20	130	$ 4,272,625	$ 4,272,625
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	130	$ 240,000	$ -	$ 240,000	0	130	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	130	$ 3,469,796	$ -	$ 3,469,796	0	130	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	130	$ -	$ 15,249,022	$ 15,249,022	0	130	$ 63,947,533	$ 63,947,533
Land Acquisition	Land Acquisition or Other	Initial	Alt 4a Land Acq	$ 1,012,600	$ -	0	130	$ 1,012,600	$ -	$ 1,012,600	0	130	$ -	$ 1,012,600
TOTAL				**$ 17,777,770**				**$ 17,202,134**	**$ 64,306,594**	**$ 81,508,727**			**$ 185,567,400**	**$ 203,345,170**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4B - Aggressive Core In-Site Treatment and Beneficial Agricultural Use with Targeted Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	95	$ -	$ 4,465,593	$ 4,465,593	0	95	$ 14,179,412	$ 14,179,412
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	95	$ -	$ 2,256,931	$ 2,256,931	30	95	$ 13,656,500	$ 13,656,500
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4A)	$ 2,623,560	$ -	0	95	$ 2,623,560	$ -	$ 2,623,560	0	95	$ -	$ 2,623,560
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4B at 10)	$ 3,390,900	$ 100,562	10	95	$ 2,481,879	$ 2,158,277	$ 4,640,157	10	95	$ 8,547,770	$ 11,938,670
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	20	$ -	$ 1,263,600	$ 1,263,600	0	20	$ 1,725,487	$ 1,725,487
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	20	$ -	$ 799,092	$ 799,092	0	20	$ 1,091,185	$ 1,091,185
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	20	$ 543,234	$ 345,102	$ 888,335	10	20	$ 557,547	$ 1,299,747
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extraction for low dose	$ -	$ 142,029	20	95	$ -	$ 2,169,141	$ 2,169,141	20	95	$ 10,652,179	$ 10,652,179
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 848,241	$ 416,508	10	20	$ 620,848	$ 2,578,035	$ 3,198,883	10	20	$ 4,165,083	$ 5,013,325
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4A_10 to 20 yrs	$ 327,581	$ 294,136	10	20	$ 239,764	$ 1,820,593	$ 2,060,357	10	20	$ 2,941,356	$ 3,268,937
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	95	$ -	$ -	$ -	20	95	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	95	$ -	$ 1,349,205	$ 1,349,205	20	95	$ 6,625,653	$ 6,625,653
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	95	$ -	$ 593,216	$ 593,216	20	95	$ 2,913,153	$ 2,913,153
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	95	$ 240,000	$ -	$ 240,000	0	95	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	95	$ 3,469,796	$ -	$ 3,469,796	0	95	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	95	$ -	$ 14,717,193	$ 14,717,193	0	95	$ 46,730,889	$ 46,730,889
Land Acquisition	Land Acquisition or Other	Initial	Alt 4a Land Acq	$ 1,012,600	$ -	0	95	$ 1,012,600	$ -	$ 1,012,600	0	95	$ -	$ 1,012,600
TOTAL				**$ 21,168,670**				**$ 19,684,013**	**$ 65,253,455**	**$ 84,937,468**			**$ 154,898,573**	**$ 176,067,242**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	**Project Number:**	**36385**
Cost Breakdown Detail by Component			**Date:**	**13-Sep-11**

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 4C-1 In-Situ and Enhanced Agricultural Treatment - 1 Crop														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	95	$ -	$ 4,465,593	$ 4,465,593	0	95	$ 14,179,412	$ 14,179,412
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	95	$ -	$ 2,256,931	$ 2,256,931	30	95	$ 13,656,500	$ 13,656,500
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	10	$ 4,417,800	$ 474,373	$ 4,892,173	0	10	$ 560,945	$ 4,978,745
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	95	$ 2,206,200	$ 719,264	$ 2,925,464	0	95	$ 2,283,848	$ 4,490,048
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extraction (4C at 10)	$ 3,195,300	$ 156,657	10	20	$ 2,338,715	$ 969,647	$ 3,308,362	10	20	$ 1,566,565	$ 4,761,865
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	95	$ -	$ 1,535,835	$ 1,535,835	20	95	$ 7,542,150	$ 7,542,150
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	95	$ -	$ 468,333	$ 468,333	20	95	$ 2,299,879	$ 2,299,879
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	95	$ -	$ -	$ -	20	95	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	95	$ -	$ 1,349,205	$ 1,349,205	20	95	$ 6,625,653	$ 6,625,653
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	95	$ -	$ 593,216	$ 593,216	20	95	$ 2,913,153	$ 2,913,153
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	95	$ 240,000	$ -	$ 240,000	0	95	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	95	$ 8,096,191	$ -	$ 8,096,191	0	95	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 1,895,326	0	20	$ -	$ 27,759,523	$ 27,759,523	0	20	$ 37,906,512	$ 37,906,512
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 690,537	20	95	$ -	$ 10,546,238	$ 10,546,238	20	95	$ 51,790,274	$ 51,790,274
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C Land Acq	$ 1,052,000	$ -	0	95	$ 1,052,000	$ -	$ 1,052,000	0	95	$ -	$ 1,052,000
TOTAL				**$ 29,496,805**				**$ 28,102,785**	**$ 87,571,034**	**$ 115,673,819**			**$ 191,400,772**	**$ 220,897,577**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	Optimization End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	Optimization End	O&M x No. of years	Total Capital & O&M
Alternative 4C-2 - In-Situ Treatment and Year-round Beneficial Agricultural Use														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	90	$ -	$ 4,424,586	$ 4,424,586	0	90	$ 13,433,127	$ 13,433,127
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	90	$ -	$ 2,199,208	$ 2,199,208	30	90	$ 12,606,000	$ 12,606,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	10	$ 4,417,800	$ 474,373	$ 4,892,173	0	10	$ 560,945	$ 4,978,745
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	90	$ 2,206,200	$ 712,659	$ 2,918,859	0	90	$ 2,163,645	$ 4,369,845
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extraction (4C at 10)	$ 3,195,300	$ 156,657	10	20	$ 2,338,715	$ 969,647	$ 3,308,362	10	20	$ 1,566,565	$ 4,761,865
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	90	$ -	$ 1,508,206	$ 1,508,206	20	90	$ 7,039,340	$ 7,039,340
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	90	$ -	$ 459,908	$ 459,908	20	90	$ 2,146,554	$ 2,146,554
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	90	$ -	$ -	$ -	20	90	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	90	$ -	$ 1,324,934	$ 1,324,934	20	90	$ 6,183,943	$ 6,183,943
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	90	$ -	$ 582,544	$ 582,544	20	90	$ 2,718,943	$ 2,718,943
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	90	$ 240,000	$ -	$ 240,000	0	90	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	90	$ 8,096,191	$ -	$ 8,096,191	0	90	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 2,018,957	0	20	$ -	$ 29,570,260	$ 29,570,260	0	20	$ 40,379,130	$ 40,379,130
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 734,677	20	90	$ -	$ 11,018,517	$ 11,018,517	20	90	$ 51,427,368	$ 51,427,368
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C Land Acq	$ 1,052,000	$ -	0	90	$ 1,052,000	$ -	$ 1,052,000	0	90	$ -	$ 1,052,000
TOTAL				**$ 29,496,805**				**$ 28,102,785**	**$ 89,677,718**	**$ 117,780,503**			**$ 190,301,441**	**$ 219,798,246**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4C-3 - In-Situ Treatment and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuc														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	85	$ -	$ 4,376,654	$ 4,376,654	0	85	$ 12,686,842	$ 12,686,842
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	50	$ -	$ 10,471,161	$ 10,471,161	0	50	$ 21,010,000	$ 21,010,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	50	85	$ -	$ 1,387,756	$ 1,387,756	50	85	$ 11,030,250	$ 11,030,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C)	$ 4,417,800	$ 56,095	0	10	$ 4,417,800	$ 474,373	$ 4,892,173	0	10	$ 560,945	$ 4,978,745
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C)	$ 2,206,200	$ 24,041	0	85	$ 2,206,200	$ 704,938	$ 2,911,138	0	85	$ 2,043,443	$ 4,249,643
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extr (4C-3 at 10)	$ 2,939,700	$ 156,657	10	20	$ 2,151,636	$ 969,647	$ 3,121,282	10	20	$ 1,566,565	$ 4,506,265
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	85	$ -	$ 1,475,912	$ 1,475,912	20	85	$ 6,536,530	$ 6,536,530
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	85	$ -	$ 450,060	$ 450,060	20	85	$ 1,993,229	$ 1,993,229
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	85	$ -	$ -	$ -	20	85	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	85	$ -	$ 1,296,564	$ 1,296,564	20	85	$ 5,742,233	$ 5,742,233
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	85	$ -	$ 570,071	$ 570,071	20	85	$ 2,524,733	$ 2,524,733
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	85	$ 240,000	$ -	$ 240,000	0	85	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 8,096,191	$ -	0	85	$ 8,096,191	$ -	$ 8,096,191	0	85	$ -	$ 8,096,191
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 2,018,957	0	20	$ -	$ 29,570,260	$ 29,570,260	0	20	$ 40,379,130	$ 40,379,130
AU Application	Agricultural Units	Opt 3	AU O&M Summary	$ -	$ 734,677	20	85	$ -	$ 10,782,585	$ 10,782,585	20	85	$ 47,753,985	$ 47,753,985
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C-3 Land Acq	$ 1,093,400	$ -	0	85	$ 1,093,400	$ -	$ 1,093,400	0	85	$ -	$ 1,093,400
Groundwater Extraction	DVD Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ -	$ 17,148	0	20	$ -	$ 251,156	$ 251,156	0	20	$ 342,962	$ 342,962
Groundwater Extraction	DVD Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 17,148	20	85	$ -	$ 251,676	$ 251,676	20	85	$ 1,114,626	$ 1,114,626
Groundwater Extraction	Gorman Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ -	$ 15,526	0	20	$ -	$ 227,394	$ 227,394	0	20	$ 310,514	$ 310,514
Groundwater Extraction	Gorman Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 15,526	20	85	$ -	$ 227,865	$ 227,865	20	85	$ 1,009,169	$ 1,009,169
Groundwater Extraction	Ranch or Other Extraction	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 256,087	$ 27,250	0	20	$ 256,087	$ 399,108	$ 655,195	0	20	$ 544,995	$ 801,082
Groundwater Extraction	Ranch or Other Extraction	Opt 3	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 22,126	20	85	$ -	$ 324,740	$ 324,740	20	85	$ 1,438,212	$ 1,438,212
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (1200 gpm)	$ 8,012,515	$ -	0	85	$ 8,012,515	$ -	$ 8,012,515	0	85	$ -	$ 8,012,515
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (450 gpm)	$ 5,086,428	$ -	0	85	$ 5,086,428	$ -	$ 5,086,428	0	85	$ -	$ 5,086,428
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A O&M (Alt 4C-3)	$ -	$ 4,061,665	0	85	$ -	$ 119,099,999	$ 119,099,999	0	85	$ 345,241,550	$ 345,241,550
Treated Injection	Northern Plume Fringe	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 3,749,137	$ 281,600	0	20	$ 3,749,137	$ 4,124,400	$ 7,873,538	0	20	$ 5,632,000	$ 9,381,137
Treated Injection	Northern Plume Fringe	Opt 1	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 281,600	20	85	$ -	$ 4,132,942	$ 4,132,942	20	85	$ 18,304,000	$ 18,304,000
Treated Injection	Southern Plume Fringe	Initial	Alt 4C-3_PIPE-WELL(0-20)	$ 2,304,376	$ 265,540	0	20	$ 2,304,376	$ 3,889,181	$ 6,193,557	0	20	$ 5,310,800	$ 7,615,176
Treated Injection	Southern Plume Fringe	Opt 1	Alt 4C-3_PIPE-WELL(20+)	$ -	$ 265,540	20	85	$ -	$ 3,897,235	$ 3,897,235	20	85	$ 17,260,100	$ 17,260,100
TOTAL				**$ 48,691,148**				**$ 47,365,649**	**$ 228,506,234**	**$ 275,871,883**			**$ 589,382,441**	**$ 638,073,590**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 4C-4 - In-Situ and Enhanced Agricultural Treatment - Continuous Pumping														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	75	$ -	$ 4,255,140	$ 4,255,140	0	75	$ 11,194,273	$ 11,194,273
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	50	$ -	$ 10,471,161	$ 10,471,161	0	50	$ 21,010,000	$ 21,010,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	50	75	$ -	$ 1,131,184	$ 1,131,184	50	75	$ 7,878,750	$ 7,878,750
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (4C-4)	$ 5,834,400	$ 56,095	0	10	$ 5,834,400	$ 474,373	$ 6,308,773	0	10	$ 560,945	$ 6,395,345
Extraction for AU Application	Southern Extraction	Initial	Southern Extraction (4C-4)	$ 2,776,800	$ 24,041	0	75	$ 2,776,800	$ 685,366	$ 3,462,166	0	75	$ 1,803,038	$ 4,579,838
Extraction for AU Application	Northern Extraction	Opt 2	Northern Extr (4C-3 at 10)	$ 2,939,700	$ 156,657	10	20	$ 2,151,636	$ 969,647	$ 3,121,282	10	20	$ 1,566,565	$ 4,506,265
Extraction for AU Application	Northern Extraction	Opt 3	Northern Extraction (4C at 20)	$ -	$ 100,562	20	75	$ -	$ 1,394,042	$ 1,394,042	20	75	$ 5,530,910	$ 5,530,910
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (4C)	$ -	$ 64,977	0	20	$ -	$ 951,671	$ 951,671	0	20	$ 1,299,537	$ 1,299,537
Groundwater Extraction	SCRIA Extraction	Opt 2	DVD_SCRIA Extr Alt 4C (60 gpm)	$ 660,600	$ 55,755	10	20	$ 483,509	$ 345,102	$ 828,610	10	20	$ 557,547	$ 1,218,147
Groundwater Extraction	SCRIA Extraction	Opt 3	SCRIA Extr for low dose Alt 4C	$ -	$ 30,665	20	75	$ -	$ 425,095	$ 425,095	20	75	$ 1,686,578	$ 1,686,578
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,077,153	$ 904,760	0	5	$ 2,077,153	$ 4,123,498	$ 6,200,651	0	5	$ 4,523,798	$ 6,600,951
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #4A_0 to 5 yrs	$ 2,927,479	$ 478,213	0	5	$ 2,927,479	$ 2,179,485	$ 5,106,964	0	5	$ 2,391,064	$ 5,318,543
IRZ/Dosed Injection	Source Area IRZ / Injection	Initial	Alt #4A_0 to 5 yrs	$ 3,083,759	$ 821,971	0	5	$ 3,083,759	$ 3,746,184	$ 6,829,944	0	5	$ 4,109,855	$ 7,193,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ -	$ 904,760	5	10	$ -	$ 3,527,757	$ 3,527,757	5	10	$ 4,523,798	$ 4,523,798
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 356,104	$ 380,628	5	10	$ 304,656	$ 1,484,111	$ 1,788,767	5	10	$ 1,903,140	$ 2,259,244
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 1	Alt #4A_5 to 10 yrs	$ 69,296	$ 716,571	5	10	$ 59,284	$ 2,793,990	$ 2,853,274	5	10	$ 3,582,856	$ 3,652,152
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ -	$ 904,760	10	20	$ -	$ 5,600,133	$ 5,600,133	10	20	$ 9,047,595	$ 9,047,595
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 758,788	$ 416,508	10	20	$ 555,375	$ 2,578,035	$ 3,133,410	10	20	$ 4,165,083	$ 4,923,872
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #4C_10 to 20 yrs	$ 356,134	$ 294,136	10	20	$ 260,663	$ 1,820,593	$ 2,081,255	10	20	$ 2,941,356	$ 3,297,490
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ -	20	75	$ -	$ -	$ -	20	75	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 88,342	20	75	$ -	$ 1,224,643	$ 1,224,643	20	75	$ 4,858,812	$ 4,858,812
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #4A_20+ yrs	$ -	$ 38,842	20	75	$ -	$ 538,448	$ 538,448	20	75	$ 2,136,312	$ 2,136,312
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	75	$ 240,000	$ -	$ 240,000	0	75	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 26,601,771	$ -	0	75	$ 26,601,771	$ -	$ 26,601,771	0	75	$ -	$ 26,601,771
AU Application	Agricultural Units	Initial	AU O&M Summary (V2)	$ -	$ 3,254,880	0	20	$ -	$ 47,671,978	$ 47,671,978	0	20	$ 65,097,601	$ 65,097,601
AU Application	Agricultural Units	Opt 3	AU O&M Summary (V2)	$ -	$ 1,833,604	20	75	$ -	$ 25,418,363	$ 25,418,363	20	75	$ 100,848,241	$ 100,848,241
Land Acquisition	Land Acquisition or Other	Initial	Alt 4C-4 Land Acq	$ 2,230,720	$ -	0	75	$ 2,230,720	$ -	$ 2,230,720	0	75	$ -	$ 2,230,720
TOTAL				**$ 50,912,705**				**$ 49,587,205**	**$ 123,809,997**	**$ 173,397,202**			**$ 263,217,656**	**$ 314,130,361**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	NPV to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium** Optimization Begin	End	O&M x No. of years	Total Capital & O&M
Alternative 5 - Plume-Wide Pump and Treat														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 40 gpm	$ -	$ 157,524	0	210	$ -	$ 4,962,146	$ 4,962,146	0	210	$ 33,080,142	$ 33,080,142
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	10	$ -	$ 3,553,493	$ 3,553,493	0	10	$ 4,202,000	$ 4,202,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	0	0	$ -	$ -	$ -	0	0	$ -	$ -
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	10	210	$ -	$ 4,841,570	$ 4,841,570	10	210	$ 42,020,000	$ 42,020,000
Groundwater Extraction	Northern Extraction	Initial	Northern Extraction (5)	$ 1,675,800	$ 84,747	0	210	$ 1,675,800	$ 2,669,598	$ 4,345,398	0	210	$ 17,796,873	$ 19,472,673
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction	$ -	$ 72,722	0	210	$ -	$ 2,290,811	$ 2,290,811	0	210	$ 15,271,690	$ 15,271,690
Groundwater Extraction	DVD Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ -	$ 73,576	0	10	$ -	$ 622,210	$ 622,210	0	10	$ 735,762	$ 735,762
Groundwater Extraction	DVD Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 73,576	10	15	$ -	$ 245,435	$ 245,435	10	15	$ 367,881	$ 367,881
Groundwater Extraction	DVD Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 73,576	15	210	$ -	$ 1,450,065	$ 1,450,065	15	210	$ 14,347,366	$ 14,347,366
Groundwater Extraction	Gorman Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ -	$ 58,316	0	10	$ -	$ 493,163	$ 493,163	0	10	$ 583,164	$ 583,164
Groundwater Extraction	Gorman Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 58,316	10	15	$ -	$ 194,531	$ 194,531	10	15	$ 291,582	$ 291,582
Groundwater Extraction	Gorman Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 58,316	15	210	$ -	$ 1,149,320	$ 1,149,320	15	210	$ 11,371,704	$ 11,371,704
Groundwater Extraction	Ranch or Other Extraction	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 3,202,844	$ 126,247	0	10	$ 3,202,844	$ 1,067,631	$ 4,270,475	0	10	$ 1,262,472	$ 4,465,316
Groundwater Extraction	Ranch or Other Extraction	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ 677,400	$ 126,247	10	15	$ 495,805	$ 421,134	$ 916,939	10	15	$ 631,236	$ 1,308,636
Groundwater Extraction	Ranch or Other Extraction	Opt 2	Alt 5_PIPE-WELL (15+)	$ 885,600	$ 126,247	15	210	$ 554,544	$ 2,488,122	$ 3,042,666	15	210	$ 24,618,206	$ 25,503,806
Treated Injection	Northern Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 1,526,995	$ 146,300	0	10	$ 1,526,995	$ 1,237,211	$ 2,764,206	0	10	$ 1,463,000	$ 2,989,995
Treated Injection	Northern Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 146,300	10	15	$ -	$ 488,026	$ 488,026	10	15	$ 731,500	$ 731,500
Treated Injection	Northern Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 146,300	15	210	$ -	$ 2,883,329	$ 2,883,329	15	210	$ 28,528,500	$ 28,528,500
Treated Injection	Southeast and East Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 6,718,776	$ 617,320	0	10	$ 6,718,776	$ 5,220,473	$ 11,939,249	0	10	$ 6,173,200	$ 12,891,976
Treated Injection	Southeast and East Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 617,320	10	15	$ -	$ 2,059,248	$ 2,059,248	10	15	$ 3,086,600	$ 3,086,600
Treated Injection	Southeast and East Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 617,320	15	210	$ -	$ 12,166,349	$ 12,166,349	15	210	$ 120,377,400	$ 120,377,400
Treated Injection	Southern Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 3,359,388	$ 319,660	0	10	$ 3,359,388	$ 2,703,260	$ 6,062,648	0	10	$ 3,196,600	$ 6,555,988
Treated Injection	Southern Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 319,660	10	15	$ -	$ 1,066,318	$ 1,066,318	10	15	$ 1,598,300	$ 1,598,300
Treated Injection	Southern Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 319,660	15	210	$ -	$ 6,299,966	$ 6,299,966	15	210	$ 62,333,700	$ 62,333,700
Treated Injection	Southwest Plume Fringe	Initial	Alt 5_PIPE-WELL (0 - 10)	$ 916,197	$ 92,180	0	10	$ 916,197	$ 779,536	$ 1,695,733	0	10	$ 921,800	$ 1,837,997
Treated Injection	Southwest Plume Fringe	Opt 1	Alt 5_PIPE-WELL (10 - 15)	$ -	$ 92,180	10	15	$ -	$ 307,493	$ 307,493	10	15	$ 460,900	$ 460,900
Treated Injection	Southwest Plume Fringe	Opt 2	Alt 5_PIPE-WELL (15+)	$ -	$ 92,180	15	210	$ -	$ 1,816,714	$ 1,816,714	15	210	$ 17,975,100	$ 17,975,100
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A	$ 8,012,515	$ 4,130,732	0	210	$ 8,012,515	$ 130,121,346	$ 138,133,861	0	210	$ 867,453,822	$ 875,466,337
Land Acquisition	Land Acquisition or Other	Initial	Alt 5 Land Acq	$ 454,000	$ -	0	210	$ 454,000	$ -	$ 454,000	0	210	$ -	$ 454,000
TOTAL				**$ 27,429,515**				**$ 26,916,864**	**$ 193,598,496**	**$ 220,515,361**			**$ 1,280,880,500**	**$ 1,308,310,015**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study Including Addendum #3*	*Costs to 1.2 ug/L*	Project Number:	36385
Cost Breakdown Detail by Component			Date:	13-Sep-11

						NPV to reach 1.2 ug/L Hexavalent Chromium**					Non-discounted Cash Flow to reach 1.2 ug/L Hexavalent Chromium**			
						Optimization					Optimization			
ALT	Area	Opt No.	Sheet Name	Capital	Annual O&M	Begin	End	Capital	O&M x No. of years	Total Capital & O&M	Begin	End	O&M x No. of years	Total Capital & O&M
Combined Alternative														
Freshwater Injection	Northwest Freshwater Injection	Initial	NW Injection 80 gpm	$ -	$ 149,257	0	130	$ -	$ 4,626,965	$ 4,626,965	0	130	$ 19,403,406	$ 19,403,406
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (Current)	$ -	$ 420,200	0	15	$ -	$ 4,955,191	$ 4,955,191	0	15	$ 6,303,000	$ 6,303,000
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (75%)	$ -	$ 315,150	15	30	$ -	$ 2,327,128	$ 2,327,128	15	30	$ 4,727,250	$ 4,727,250
Groundwater Monitoring Program	GMP Including BCMP	Initial	GMP&BCMP (50%)	$ -	$ 210,100	30	130	$ -	$ 2,484,084	$ 2,484,084	30	130	$ 21,010,000	$ 21,010,000
Extraction for AU Application	Northern Extraction	Initial	Northern Extraction (Combined)	$ 2,623,560	$ -	0	130	$ 2,623,560	$ -	$ 2,623,560	0	130	$ -	$ 2,623,560
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction (5 wells)	$ -	$ 86,274	0	40	$ -	$ 1,940,526	$ 1,940,526	0	40	$ 3,450,973	$ 3,450,973
Groundwater Extraction	SCRIA Extraction	Initial	Supplemental SCRIA Extraction	$ -	$ 54,559	0	40	$ -	$ 1,227,175	$ 1,227,175	0	40	$ 2,182,371	$ 2,182,371
Groundwater Extraction	SCRIA Extraction	Initial	DVD_SCRIA Extr (60 gpm)	$ 742,200	$ 55,755	10	40	$ 543,234	$ 782,564	$ 1,325,798	10	40	$ 1,672,642	$ 2,414,842
Groundwater Extraction	SCRIA Extraction	Initial	SCRIA Extraction for low dose	$ -	$ 142,029	40	130	$ -	$ 1,208,309	$ 1,208,309	40	130	$ 12,782,615	$ 12,782,615
IRZ/Dosed Injection	Central Area IRZ / Injection	Initial	Alt #6_0 to 10 yrs	$ 2,394,426	$ 904,760	0	10	$ 2,394,426	$ 7,651,254	$ 10,045,681	0	10	$ 9,047,595	$ 11,442,022
IRZ/Dosed Injection	SCRIA / Dosed Injection	Initial	Alt #6_0 to 10 yrs	$ 3,374,635	$ 478,213	0	10	$ 3,374,635	$ 4,044,089	$ 7,418,724	0	10	$ 4,782,128	$ 8,156,763
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 1	Alt #6_10 to 40 yrs	$ -	$ 904,760	10	40	$ -	$ 12,699,060	$ 12,699,060	10	40	$ 27,142,786	$ 27,142,786
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 1	Alt #6_10 to 40 yrs	$ 937,022	$ 539,845	10	40	$ 685,828	$ 7,577,182	$ 8,263,010	10	40	$ 16,195,358	$ 17,132,379
IRZ/Dosed Injection	Central Area IRZ / Injection	Opt 2	Alt #6_40 to 42 yrs	$ -	$ -	40	42	$ -	$ -	$ -	40	42	$ -	$ -
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 2	Alt #6_40 to 42 yrs	$ 377,067	$ 365,220	40	42	$ 108,213	$ 200,064	$ 308,278	40	42	$ 730,440	$ 1,107,507
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 2	Alt #6_40 to 42 yrs	$ 107,733	$ 652,153	40	42	$ 30,918	$ 357,244	$ 388,162	40	42	$ 1,304,306	$ 1,412,039
IRZ/Dosed Injection	SCRIA / Dosed Injection	Opt 3	Alt #6_42+ yrs	$ -	$ 88,342	42	130	$ -	$ 703,175	$ 703,175	42	130	$ 7,774,100	$ 7,774,100
IRZ/Dosed Injection	Source Area IRZ / Injection	Opt 3	Alt #6_42+ yrs	$ -	$ 38,842	42	130	$ -	$ 309,170	$ 309,170	42	130	$ 3,418,100	$ 3,418,100
AU Application	Agricultural Units	Initial	AU Mods	$ 240,000	$ -	0	130	$ 240,000	$ -	$ 240,000	0	130	$ -	$ 240,000
AU Application	Agricultural Units	Initial	New AU (Rev)	$ 3,469,796	$ -	0	130	$ 3,469,796	$ -	$ 3,469,796	0	130	$ -	$ 3,469,796
AU Application	Agricultural Units	Initial	AU O&M Summary	$ -	$ 491,904	0	130	$ -	$ 15,249,022	$ 15,249,022	0	130	$ 63,947,533	$ 63,947,533
Land Acquisition	Land Acquisition or Other	Initial	Alt 6 Land Acq	$ 1,130,400	$ -	0	130	$ 1,130,400	$ -	$ 1,130,400	0	130	$ -	$ 1,130,400
Groundwater Treatment	Ex-Situ Treatment (Chem Precip)	Initial	EX-A (200 gpm)	$ 3,494,573	$ 2,123,267	0	40	$ 3,494,573	$ 47,757,614	$ 51,252,188	0	40	$ 84,930,690	$ 88,425,263
Groundwater Extraction & O&M for plant and treated injection	Ex-Situ Treatment (Chem Precip)	Initial	Alt 6_PIPE-WELL (0-10)	$ 4,221,720	$ 624,855	0	10	$ 4,221,720	$ 5,284,195	$ 9,505,915	0	10	$ 6,248,552	$ 10,470,272
Groundwater Extraction & O&M for plant and treated injection	Ex-Situ Treatment (Chem Precip)	Opt 1	Alt 6_PIPE-WELL (10-40)	$ 598,500	$ 624,811	10	40	$ 438,056	$ 8,769,750	$ 9,207,807	10	40	$ 18,744,336	$ 19,342,836
TOTAL				**$ 23,711,633**				**$ 22,755,361**	**$ 130,153,763**	**$ 152,909,124**			**$ 315,798,180**	**$ 339,509,813**

*Except for 80% mass reduction timeframe, durations based on fate & transport model performed by ARCADIS and represent time when the starting plume area has been reduced by 99 percent in the Remedial Area. The values in these tables represent the longer of Layers 1 and 3. Durations are capped at 1000 years for purposes of this costing and feasibility evaluation.

** Timeframe to reach 1.2 ug/L shown above, to the extent achieving this criteria is feasible, is based on modeling.

Cost Detail Sheets for Alternative 4C-1 In-Situ and Enhanced Agricultural Treatment - 1 crop

Hinkley Feasibility Study - Addendum #3

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 80 gpm		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection	$ 135,688	$ 13,569	$ 149,257
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 28-Jun-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 382,000	$ 38,200	$ 420,200
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	GMP Including BCMP						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	$286,500 - $286,500	$286,500	
				CONTINGENCY (10%):	$28,650 - $28,650	$28,650	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	$315,150 - $315,150	$315,150	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	TOTAL:	0%	$ -	$ -	$ -

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 286,500	$ 28,650	$ 315,150
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	$ 286,500	$ 28,650	$ 315,150

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 191,000	$ 19,100	$ 210,100
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$293,720. - $293,720.	$293,720 - $293,720	$293,720	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$293,720 - $293,720***	***$293,720***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$293,720. - $293,720.	$293,720 - $293,720	$293,720	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$146,860. - $146,860.	$146,860 - $146,860	$146,860	1, 3
				Construction Monitoring and Site Security Subtotal:	***$450,580 - $450,580***	***$450,580***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	19 - 19	EA	$73,000. - $73,000.	$1,387,000 - $1,387,000	$1,387,000	1, 4
6.02	Well Completion	7 - 7	EA	$53,000. - $53,000.	$371,000 - $371,000	$371,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	14,740 - 14,740	LF	$80. - $80.	$1,179,200 - $1,179,200	$1,179,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$2,937,200 - $2,937,200***	***$2,937,200***	
				SUBTOTAL (BARE):	**$3,681,500 - $3,681,500**	**$3,681,500**	
				CONTINGENCY (20%):	**$736,300 - $736,300**	**$736,300**	
				TOTAL ESTIMATED CAPITAL COST:	**$4,417,800 - $4,417,800**	**$4,417,800**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	7 - 7	WELL	$7,285. - $7,285.	$50,995 - $50,995	$50,995	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$50,995 - $50,995**	**$50,995**	
				CONTINGENCY (10%):	**$5,100 - $5,100**	**$5,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$56,095 - $56,095**	**$56,095**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 3,681,500	$ 736,300	$ 4,417,800
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 3,681,500**	**$ 736,300**	**$ 4,417,800**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction	$ 50,995	$ 5,100	$ 56,095
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 50,995**	**$ 5,100**	**$ 56,095**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate
8	O&M costs not already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs for AU Extraction Wells located off the AU property		Date: 29-Aug-11

Extraction Well O&M Cost Estimate

Description	Quantity Low		Quantity High	Units	Unit Cost Low		Unit Cost High	Midpoint Cost		Notes
Routine - Weekly extraction well inspection - Labor	13	-	13	HRS	$70		$70	$	910	0.25 hours/well with 1 person
Routine - Weekly extraction well inspection - Expenses	52	-	52	WKS	$50		$50	$	2,600	estimate
Annual Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	-	1	YR	$625		$625	$	625	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	-	1	YR	$2,500		$2,500	$	2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	-	7.5	HRS	$70	-	$70	$	525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	-	0.25	LS	$500	-	$500	$	125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0	-	0	DAYS	$3,000	-	$3,000	$	-	3 days/well, $3,000/day (every 4 years)
								$	**7,285**	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)							$ XX		A = Flow rate; B = total head

Other

Other costs not directly scalable:

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Southern Extraction		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$146,280. - $146,280.	$146,280 - $146,280	$146,280	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$146,280 - $146,280*	*$146,280*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$146,280. - $146,280.	$146,280 - $146,280	$146,280	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$73,140. - $73,140.	$73,140 - $73,140	$73,140	1, 3
				Construction Monitoring and Site Security Subtotal:	*$229,420 - $229,420*	*$229,420*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	7,335 - 7,335	LF	$80. - $80.	$586,800 - $586,800	$586,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$1,462,800 - $1,462,800*	*$1,462,800*	
				SUBTOTAL (BARE):	**$1,838,500 - $1,838,500**	**$1,838,500**	
				CONTINGENCY (20%):	**$367,700 - $367,700**	**$367,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,206,200 - $2,206,200**	**$2,206,200**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$7,285. - $7,285.	$21,855 - $21,855	$21,855	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$21,855 - $21,855**	**$21,855**	
				CONTINGENCY (10%):	**$2,186 - $2,186**	**$2,186**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$24,041 - $24,041**	**$24,041**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Southern Extraction		100.0%	$ 1,838,500	$ 367,700	$ 2,206,200
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 1,838,500**	**$ 367,700**	**$ 2,206,200**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Southern Extraction	$ 21,855	$ 2,186	$ 24,041
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 21,855**	**$ 2,186**	**$ 24,041**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Southern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate
8	O&M costs not already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (10 yrs)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$212,220. - $212,220.	$212,220 - $212,220	$212,220	1, 2
	Design and Contractor Bidding / Procurement Subtotal:				***$212,220 - $212,220***	***$212,220***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$212,220. - $212,220.	$212,220 - $212,220	$212,220	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$106,110. - $106,110.	$106,110 - $106,110	$106,110	1, 3
	Construction Monitoring and Site Security Subtotal:				***$328,330 - $328,330***	***$328,330***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	12 - 12	EA	$53,000. - $53,000.	$636,000 - $636,000	$636,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	7,440 - 7,440	LF	$80. - $80.	$595,200 - $595,200	$595,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
6.08	Pressure Boosting System	1 - 1	EA	$15,000. - $15,000.	$15,000 - $15,000	$15,000	1, 7
	Systems / Equipment Install / Field Labor Subtotal:				***$2,122,200 - $2,122,200***	***$2,122,200***	
	SUBTOTAL (BARE):				**$2,662,750 - $2,662,750**	**$2,662,750**	
	CONTINGENCY (20%):				**$532,550 - $532,550**	**$532,550**	
	TOTAL ESTIMATED CAPITAL COST:				**$3,195,300 - $3,195,300**	**$3,195,300**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	8
1.02	Scaled Operating Cost (per off-site AU extraction well)	19 - 19	WELL	$7,285. - $7,285.	$138,415 - $138,415	$138,415	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	9
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	7, 8
	SUBTOTAL (BARE):				**$142,415 - $142,415**	**$142,415**	
	CONTINGENCY (10%):				**$14,242 - $14,242**	**$14,242**	
	TOTAL ESTIMATED ANNUAL O&M COSTS:				**$156,657 - $156,657**	**$156,657**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 2,662,750	$ 532,550	$ 3,195,300
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,662,750**	**$ 532,550**	**$ 3,195,300**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction		$ 142,415	$ 14,242	$ 156,657
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 142,415**	**$ 14,242**	**$ 156,657**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (10 yrs)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.
8	O&M costs not already covered under AU O&M estimate
9	O&M costs already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (20 yrs)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1,2
1.02	Scaled Operating Cost (per off-site AU extraction well)	12 - 12	WELL	$7,285. - $7,285.	$87,420 - $87,420	$87,420	1,2
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1,3
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	1,2,4
				SUBTOTAL (BARE):	**$91,420 - $91,420**	**$91,420**	
				CONTINGENCY (10%):	**$9,142 - $9,142**	**$9,142**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$100,562 - $100,562**	**$100,562**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 91,420	$ 9,142	$ 100,562
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 91,420**	**$ 9,142**	**$ 100,562**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	O&M costs not already covered under AU O&M estimate
3	O&M costs already covered under AU O&M estimate
4	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction (4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1, 2
1.02	Electricity	80,732 - 80,732	KWH	$0.12 - $0.18	$9,688 - $14,532	$12,110	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$56,648 - $61,492**	**$59,070**	
				CONTINGENCY (10%):	**$5,665 - $6,149**	**$5,907**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$62,313 - $67,641**	**$64,977**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 59,070	$ 5,907	$ 64,977
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 59,070**	**$ 5,907**	**$ 64,977**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells supporting SCRIA only. The remaining wells support AUs, and extraction well O&M costs are covered elsewhere; 195 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$44,040 - $44,040*	*$44,040*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
5.02	Project Management through Startup	1 - 1	LS	$22,020. - $22,020.	$22,020 - $22,020	$22,020	1, 3
				Construction Monitoring and Site Security Subtotal:	*$66,060 - $66,060*	*$66,060*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	780 - 780	LF	$80. - $80.	$62,400 - $62,400	$62,400	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$440,400 - $440,400*	*$440,400*	
				SUBTOTAL (BARE):	**$550,500 - $550,500**	**$550,500**	
				CONTINGENCY (20%):	**$110,100 - $110,100**	**$110,100**	
				TOTAL ESTIMATED CAPITAL COST:	**$660,600 - $660,600**	**$660,600**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
				SUBTOTAL (BARE):	**$49,941 - $51,431**	**$50,686**	
				CONTINGENCY (10%):	**$4,994 - $5,143**	**$5,069**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 550,500	$ 110,100	$ 660,600
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 550,500**	**$ 110,100**	**$ 660,600**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 50,686	$ 5,069	$ 55,755
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 170 gpm for low dose (Alt 4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	1 - 1	EA	$12,320 - $12,320	$12,320 - $12,320	$12,320	1, 2
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 3
1.03	Quarterly Compliance Reporting	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.04	Project Management	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$25,766 - $29,989**	**$27,877**	
				CONTINGENCY (10%):	**$2,577 - $2,999**	**$2,788**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$28,342 - $32,988**	**$30,665**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 27,877	$ 2,788	$ 30,665
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 27,877**	**$ 2,788**	**$ 30,665**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	1 SCRIA Well not already covered by AU O&M estimate; 110 gpm total @ 200' heaŘ
3	170 gpm total @ 200' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$180,000 - $240,000***	***$210,000***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	12 - 12	EA	$30,000. - $40,000.	$360,000. - $480,000.	$420,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	40 - 40	EA	$30,000. - $40,000.	$1,200,000. - $1,600,000.	$1,400,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	52 - 52	EA	$12,000. - $14,500.	$624,000. - $754,000.	$689,000	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	22,634 - 22,634	LF	$75. - $100.	$1,697,550. - $2,263,400.	$1,980,475	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	4 - 4	LS	$20,000. - $20,000.	$80,000. - $80,000.	$80,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	***$5,136,550 - $6,587,400***	***$5,861,975***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$5,872,139 - $7,608,514**	**$6,740,327**	
				CONTINGENCY (20%):	**$1,174,428 - $1,521,703**	**$1,348,065**	
				TOTAL ESTIMATED CAPITAL COST:	**$7,046,567 - $9,130,217**	**$8,088,392**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	25.7%	$ 2,077,153
SCRIA / Dosed Injection	36.2%	$ 2,927,479
Source Area IRZ / Injection	38.1%	$ 3,083,759
	100.0%	$ 8,088,392

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	302,930 - 302,930	KWH	$0.12 - $0.18	$36,352. - $54,527.	$45,440	1, 7
5.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,507,024 - $2,501,964**	**$2,004,494**	
				CONTINGENCY (10%):	**$150,702 - $250,196**	**$200,449**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,657,727 - $2,752,160**	**$2,204,943**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		25.7%	$ 1,730,961	$ 346,192	$ 2,077,153
SCRIA / Dosed Injection		36.2%	$ 2,439,566	$ 487,913	$ 2,927,479
Source Area IRZ / Injection		38.1%	$ 2,569,800	$ 513,960	$ 3,083,759
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,740,327**	**$ 1,348,065**	**$ 8,088,392**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection		$ 747,246	$ 74,725	$ 821,971
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 2,004,494**	**$ 200,449**	**$ 2,204,943**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	Derived at Compressor Station
8	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 4A (5-10 years)		**Date:**	**27-Jan-11**

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
	Design and Contractor Bidding / Procurement Subtotal:				***$42,500 - $49,500***	***$46,000***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
	Performance Monitoring Well Installation Subtotal:				***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$25,000. - $50,000.	$25,000. - $50,000.	$37,500	1
3.02							
	Mobilization/Demobilization/Site Prep/General Conditions Subtotal:				***$25,000 - $50,000***	***$37,500***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
	Construction Monitoring and Site Security Subtotal:				***$50,000 - $50,000***	***$50,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	6 - 6	LS	$3,000. - $3,000.	$18,000. - $18,000.	$18,000	1
5.19							
	Systems / Equipment Install / Field Labor Subtotal:				***$190,000 - $224,000***	***$207,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$10,000. - $15,000.	$10,000. - $15,000.	$12,500	1
6.02							
	Treatment System Startup Subtotal:				***$10,000 - $15,000***	***$12,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
	Permits and Regulatory Compliance Subtotal:				***$1,000 - $2,000***	***$1,500***	
	SUBTOTAL (BARE):				**$318,500 - $390,500**	**$354,500**	
	CONTINGENCY (20%):				**$63,700 - $78,100**	**$70,900**	
	TOTAL ESTIMATED CAPITAL COST:				**$382,200 - $468,600**	**$425,400**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	83.7%	$ 356,104
Source Area IRZ / Injection	16.3%	$ 69,296
	100.0%	$ 425,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	4,364 - 4,364	KWH	$0.12 - $0.18	$524. - $785.	$655	1
4.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	4,145 - 4,145	KWH	$0.12 - $0.18	$497. - $746.	$622	1
5.03	Biological / Chemical Consumables	16,017 - 16,017	GAL	$5. - $6.	$80,083. - $96,100.	$88,092	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,344,226 - $2,295,700**	**$1,819,963**	
				CONTINGENCY (10%):	**$134,423 - $229,570**	**$181,996**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,478,648 - $2,525,269**	**$2,001,959**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		83.7%	$ 296,753	$ 59,351	$ 356,104
Source Area IRZ / Injection		16.3%	$ 57,747	$ 11,549	$ 69,296
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 354,500**	**$ 70,900**	**$ 425,400**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 346,026	$ 34,603	$ 380,628
Source Area IRZ / Injection		$ 651,428	$ 65,143	$ 716,571
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 1,819,963**	**$ 181,996**	**$ 2,001,959**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$87,089 - $128,614***	***$107,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$100,000 - $150,000***	***$125,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$28,000. - $52,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	6 - 6	EA	$12,000. - $14,500.	$72,000. - $87,000.	$79,500	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	1,900 - 1,900	LF	$75. - $100.	$142,500. - $190,000.	$166,250	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$521,500 - $663,000***	***$592,250***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	***$25,000 - $30,000***	***$27,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$784,589 - $1,073,614**	**$929,102**	
				CONTINGENCY (20%):	**$156,918 - $214,723**	**$185,820**	
				TOTAL ESTIMATED CAPITAL COST:	**$941,507 - $1,288,337**	**$1,114,922**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	68.1%	$ 758,788
Source Area IRZ / Injection	31.9%	$ 356,134
	100.0%	$ 1,114,922

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	5,455 - 5,455	KWH	$0.12 - $0.18	$655. - $982.	$818	1
4.03	Biological / Chemical Consumables	22,761 - 22,761	GAL	$5. - $6.	$113,803. - $136,563.	$125,183	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
5.02	Electricity	5,236 - 5,236	KWH	$0.12 - $0.18	$628. - $943.	$785	1
5.03	Biological / Chemical Consumables	20,232 - 20,232	GAL	$5. - $6.	$101,158. - $121,389.	$111,274	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$25,200. - $46,800.	$23,940. - $44,460.	$34,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,109,902 - $1,827,196**	**$1,468,549**	
				CONTINGENCY (10%):	**$110,990 - $182,720**	**$146,855**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,220,892 - $2,009,915**	**$1,615,403**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		68.1%	$ 632,324	$ 126,465	$ 758,788
Source Area IRZ / Injection		31.9%	$ 296,778	$ 59,356	$ 356,134
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 929,102**	**$ 185,820**	**$ 1,114,922**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 378,644	$ 37,864	$ 416,508
Source Area IRZ / Injection	$ 267,396	$ 26,740	$ 294,136
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,468,549**	**$ 146,855**	**$ 1,615,403**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 4C (10-20 years)		**Date: 29-Aug-11**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivereŘ
6	255 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivereŘ

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (20+ years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

ALTERNATIVE 4/ℿM: TABLE 1y
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Agricultural Unit Modifications		**Date:**	**28-Jun-10**

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$16,000 - $16,000***	***$16,000***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	***$24,000 - $24,000***	***$24,000***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$160,000 - $160,000***	***$160,000***	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Agricultural Units		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K pŜr ǇЛØ2ǘ

OPINION OF PROBABLE COST New Agricultural Unit (Revised)	*Hinkley Feasibility Study*	Project Number: 36385 Date: 28-Jun-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$901,332 - $1,026,332**	**$963,832**	
				CONTINGENCY (20%):	**$180,266 - $205,266**	**$192,766**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	**Project Number:**	**36385**
Agricultural Unit O&M Backup (Varied Level of Technical Input)		**Date:**	**29-Aug-11**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

														CALCULATED	
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated				
Number of Agricultural Units			3			3			4			3			
Application Rate and Pressure			800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head			840 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**		
Operations															
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000	1	$ 62,000	$ 62,000		
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -		
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -		
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000	405	$ 100	$ 40,533		
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000	1	$ 10,267	$ 10,267		
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000	1	$ 6,160	$ 6,160		
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -		
Electrical Power															
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471	173,885	$ 0.15	$ 26,083		
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	16,466	$ 0.15	$ 2,470		
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	329,323	$ 0.15	$ 49,398		
Outside Services															
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000	1	$ 68,000	$ 68,000		
Parts/repairs															
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000	2	$ 1,283,333	$ 25,667		
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**			**$ 290,578**		
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880	10	$ 290,578	$ 29,058		
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**			**$ 319,636**		

ESTIMATED ANNUAL O&M COSTS: FARMER-OP
WITH INCREASED TECHNICAL INPUT

		Farmer-Operated with Technical Input			Farmer-Operated with Technical Input			Farmer-Operated with Technical Input		
Number of AUs			3			3			4	
Application Rate and Pressure			800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head	
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Technical Input	hrs	8,000	$ 80	$ 640,000	10,000	$ 80	$ 800,000	13,300	$ 80	$ 1,064,000
Engineering support	hrs	2,800	$ 100	$ 280,000	3,000	$ 100	$ 300,000	4,000	$ 100	$ 400,000
General oversight	hrs	400	$ 100	$ 40,000	400	$ 100	$ 40,000	400	$ 100	$ 40,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 75,000	$ 75,000	1	$ 90,000	$ 90,000	1	$ 120,000	$ 120,000
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power										
Pump Water from Aquifer to LTUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	1	$ 190,000	$ 190,000	1	$ 238,000	$ 238,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				**$ 1,398,709**			**$ 1,619,904**			**$ 2,124,802**
Contingency on Materials/Services	percent	10	$ 1,398,709	$ 139,871	10	$ 1,619,904	$ 161,990	10	$ 2,124,802	$ 212,480
GRAND TOTAL				**$ 1,538,580**			**$ 1,781,895**			**$ 2,337,282**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 13-Sep-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

								Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs	
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			6			7			8		
Application Rate and Pressure		950 gpm at 100 ft head			1270 gpm at 100 ft head			1380 gpm at 100 ft head			1530 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	420	$ 100	$ 42,000	520	$ 100	$ 52,000	570	$ 100	$ 57,000	640	$ 100	$ 64,000
Health & safety training/monitoring	ea	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700	1	$ 14,800	$ 14,800	1	$ 16,300	$ 16,300
Other expenses	ea	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220	1	$ 8,880	$ 8,880	1	$ 9,780	$ 9,780
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435	285,669	$ 0.15	$ 42,850	316,720	$ 0.15	$ 47,508
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	89,000	$ 89,000	1	138,000	$ 138,000	1	149,000	$ 149,000
Parts/repairs													
(Percent of capital cost)	percent	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000
Subtotal				**$ 308,347**			**$ 447,186**			**$ 554,532**			**$ 627,761**
Contingency on Materials/Services	percent	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719	10	$ 554,532	$ 55,453	10	$ 627,761	$ 62,776
GRAND TOTAL				**$ 339,181**			**$ 491,904**			**$ 609,985**			**$ 690,537**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs
		CALCULATED			
		Farmer-Operated with Technical Input			
Number of AUs		3			
Application Rate and Pressure		450 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	
Operations					
Property Management	ea	1	$ 62,000	$ 62,000	
Technical Input	hrs	5,670	$ 80	$ 453,600	
Engineering support	hrs	2,570	$ 100	$ 257,000	
General oversight	hrs	400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 7,670	$ 7,670	
Other expenses	ea	1	$ 57,500	$ 57,500	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	
Electrical Power					
Pump Water from Aquifer to LTUs	kW-hr	93,153	$ 0.15	$ 13,973	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	
Outside Services					
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	
Parts/repairs					
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	
Subtotal				**$ 1,168,491**	
Contingency on Materials/Services	percent	10	$ 1,168,491	$ 116,849	
GRAND TOTAL				**$ 1,285,340**	

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 13-Sep-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs			Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		7			8			18			21		
Application Rate and Pressure		1510 gpm at 100 ft head			1687 gpm at 100 ft head			2068 gpm at 100 ft head			2325 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500	1	$ 348,500	$ 348,500	1	$ 410,000	$ 410,000
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	630	$ 100	$ 63,000	710	$ 100	$ 71,000	890	$ 100	$ 89,000	1,010	$ 100	$ 101,000
Health & safety training/monitoring	ea	1	$ 16,100	$ 16,100	1	$ 17,870	$ 17,870	1	$ 21,680	$ 21,680	1	$ 24,250	$ 24,250
Other expenses	ea	1	$ 9,660	$ 9,660	1	$ 10,722	$ 10,722	1	$ 13,008	$ 13,008	1	$ 14,550	$ 14,550
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	5	$ 4,290	$ 21,450	6	$ 4,290	$ 25,740	16	$ 4,290	$ 68,640	19	$ 4,290	$ 81,510
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	312,580	$ 0.15	$ 46,887	349,220	$ 0.15	$ 52,383	428,089	$ 0.15	$ 64,213	481,290	$ 0.15	$ 72,193
Misc. Controls/Lights	kW-hr	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117	61,748	$ 0.15	$ 9,262	49,873	$ 0.15	$ 7,481
Pivot motor	kW-hr	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556	2,107,669	$ 0.15	$ 316,150	2,502,857	$ 0.15	$ 375,429
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	138,000	$ 138,000	1	149,000	$ 149,000	1	353,000	$ 353,000	1	393,000	$ 393,000
Parts/repairs													
(Percent of capital cost)	percent	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000	3	5,625,000	$ 168,750	3	6,250,000	$ 187,500
Subtotal				**$ 588,099**			**$ 667,888**			**$ 1,452,204**			**$ 1,666,913**
Contingency on Materials/Services	percent	10	$ 588,099	$ 58,810	10	$ 667,888	$ 66,789	10	$ 1,452,204	$ 145,220	10	$ 1,666,913	$ 166,691
GRAND TOTAL				**$ 646,909**			**$ 734,677**			**$ 1,597,424**			**$ 1,833,604**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs	Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs
		CALCULATED				CALCULATED			
		Farmer-Operated with Technical Input				Farmer-Operated with Technical Input			
Number of AUs		3				8			
Application Rate and Pressure		531 gpm at 100 ft head				761 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**		**Number Required**	**Unit Cost**	**Total Cost**	
Operations									
Property Management	ea	1	$ 62,000	$ 62,000		1	$ 143,500	$ 143,500	
Technical Input	hrs	6,210	$ 80	$ 496,800		7,740	$ 80	$ 619,200	
Engineering support	hrs	2,620	$ 100	$ 262,000		2,770	$ 100	$ 277,000	
General oversight	hrs	400	$ 100	$ 40,000		400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 9,460	$ 9,460		1	$ 7,930	$ 7,930	
Other expenses	ea	1	$ 70,950	$ 70,950		1	$ 59,450	$ 59,450	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	3	$ 4,290	$ 12,870		8	$ 4,290	$ 34,320	
Electrical Power									
Pump Water from Aquifer to LTUs	kW-hr	109,920	$ 0.15	$ 16,488		157,532	$ 0.15	$ 23,630	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470		16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278		395,188	$ 0.15	$ 59,278	
Outside Services									
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000		1	$ 190,000	$ 190,000	
Parts/repairs									
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000		2	$ 2,500,000	$ 50,000	
Subtotal				**$ 1,247,316**				**$ 1,506,778**	
Contingency on Materials/Services	percent	10	$ 1,247,316	$ 124,732		10	$ 1,506,778	$ 150,678	
GRAND TOTAL				**$ 1,372,048**				**$ 1,657,456**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	**Project Number:**	**36385**
Agricultural Unit O&M Backup (Varied Level of Technical Input)		**Date:**	**13-Sep-11**

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Additional Consultant Oversight
9	Controls/lights operated at 1.5 kW.
10	Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S WITH INCREASED TECHNICAL INPUT

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers, with technical input by consultants as necessary.
4	General oversight to include planning, contracting, and the regulatory interface.
5	Health & safety training/monitoring is required for workers.
6	Other expenses include travel, equipment, and miscellaneous.
7	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
8	Controls/lights operated at 1.5 kW.
9	Each pivot motor operated at 6 kW.
10	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Land Acquisition		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Applicatior	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition for Agricultural Applicatior	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.03	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.04	Land Acquisition	46 - 46	AC	$2,000. - $2,000.	$92,000 - $92,000	$92,000	1, 4
				Land Acquisition Costs Subtotal:	***$1,052,000 - $1,052,000***	***$1,052,000***	
				SUBTOTAL (BARE):	**$1,052,000 - $1,052,000**	**$1,052,000**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,052,000 - $1,052,000**	**$1,052,000**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for agricultural units
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for an easement.

Cost Detail Sheets for Alternative 4C-2 In-Situ and Enhanced Agricultural Treatment - 2 crops

Hinkley Feasibility Study - Addendum #3

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 80 gpm		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection	$ 135,688	$ 13,569	$ 149,257
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well	Ȯ	Date: 28-Jun-10

Injection Well Cost Estimate

Description	Quantity Low		Quantity High	Units	Unit Cost Low		Unit Cost High	Midpoint Cost		Notes
Routine - Monthly injection well backwashing - Labor	24	-	144	HRS	$70	-	$70	$	5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	-	12	MO	$500	-	$500	$	3,500	estimate
Routine - Weekly injection well inspection - Labor	26	-	26	HRS	$70	-	$70	$	1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	-	52	WKS	$50	-	$50	$	2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	-	15	HRS	$70	-	$70	$	1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	-	0.5	LS	$500	-	$500	$	250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	-	1.5	DAYS	$3,000	-	$3,000	$	4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	-	1	YR	$5,000	-	$5,000	$	5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
								$	**24,600**	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low		Quantity High	Units	Unit Cost Low		Unit Cost High	Midpoint Cost		Notes
Routine - Weekly extraction well inspection - Labor	26	-	26	HRS	$70		$70	$	1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	-	52	WKS	$50		$50	$	2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	-	1	YR	$2,500		$2,500	$	2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	-	1	YR	$2,500		$2,500	$	2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	-	7.5	HRS	$70	-	$70	$	525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	-	0.25	LS	$500	-	$500	$	125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	-	0.75	DAYS	$3,000	-	$3,000	$	2,250	3 days/well, $3,000/day (every 4 years)
								$	**12,320**	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)							$ XX		A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 382,000	$ 38,200	$ 420,200
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 286,500	$ 28,650	$ 315,150
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 191,000	$ 19,100	$ 210,100
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$293,720. - $293,720.	$293,720 - $293,720	$293,720	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$293,720 - $293,720***	***$293,720***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$293,720. - $293,720.	$293,720 - $293,720	$293,720	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$146,860. - $146,860.	$146,860 - $146,860	$146,860	1, 3
				Construction Monitoring and Site Security Subtotal:	***$450,580 - $450,580***	***$450,580***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	19 - 19	EA	$73,000. - $73,000.	$1,387,000 - $1,387,000	$1,387,000	1, 4
6.02	Well Completion	7 - 7	EA	$53,000. - $53,000.	$371,000 - $371,000	$371,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	14,740 - 14,740	LF	$80. - $80.	$1,179,200 - $1,179,200	$1,179,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$2,937,200 - $2,937,200***	***$2,937,200***	
				SUBTOTAL (BARE):	**$3,681,500 - $3,681,500**	**$3,681,500**	
				CONTINGENCY (20%):	**$736,300 - $736,300**	**$736,300**	
				TOTAL ESTIMATED CAPITAL COST:	**$4,417,800 - $4,417,800**	**$4,417,800**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	7 - 7	WELL	$7,285. - $7,285.	$50,995 - $50,995	$50,995	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$50,995 - $50,995**	**$50,995**	
				CONTINGENCY (10%):	**$5,100 - $5,100**	**$5,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$56,095 - $56,095**	**$56,095**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 3,681,500	$ 736,300	$ 4,417,800
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 3,681,500**	**$ 736,300**	**$ 4,417,800**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction	$ 50,995	$ 5,100	$ 56,095
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 50,995**	**$ 5,100**	**$ 56,095**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter wel
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrica
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate
8	O&M costs not already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs for AU Extraction Wells located off the AU property		Date: 29-Aug-11

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	13	13	HRS	$70	$70	$ 910	0.25 hours/well with 1 person
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Annual Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$625	$625	$ 625	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0	0	DAYS	$3,000	$3,000	$ -	3 days/well, $3,000/day (every 4 years)
						$ 7,285	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

Other costs not directly scalable:

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Southern Extraction		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$146,280. - $146,280.	$146,280 - $146,280	$146,280	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$146,280 - $146,280*	*$146,280*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$146,280. - $146,280.	$146,280 - $146,280	$146,280	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$73,140. - $73,140.	$73,140 - $73,140	$73,140	1, 3
				Construction Monitoring and Site Security Subtotal:	*$229,420 - $229,420*	*$229,420*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	7,335 - 7,335	LF	$80. - $80.	$586,800 - $586,800	$586,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$1,462,800 - $1,462,800*	*$1,462,800*	
				SUBTOTAL (BARE):	**$1,838,500 - $1,838,500**	**$1,838,500**	
				CONTINGENCY (20%):	**$367,700 - $367,700**	**$367,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,206,200 - $2,206,200**	**$2,206,200**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$7,285. - $7,285.	$21,855 - $21,855	$21,855	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$21,855 - $21,855**	**$21,855**	
				CONTINGENCY (10%):	**$2,186 - $2,186**	**$2,186**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$24,041 - $24,041**	**$24,041**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Southern Extraction		100.0%	$ 1,838,500	$ 367,700	$ 2,206,200
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 1,838,500**	**$ 367,700**	**$ 2,206,200**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Southern Extraction	$ 21,855	$ 2,186	$ 24,041
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 21,855**	**$ 2,186**	**$ 24,041**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Southern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter wel
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrica
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate
8	O&M costs not already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (10 yrs)		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$212,220. - $212,220.	$212,220 - $212,220	$212,220	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$212,220 - $212,220*	*$212,220*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$212,220. - $212,220.	$212,220 - $212,220	$212,220	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$106,110. - $106,110.	$106,110 - $106,110	$106,110	1, 3
				Construction Monitoring and Site Security Subtotal:	*$328,330 - $328,330*	*$328,330*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	12 - 12	EA	$53,000. - $53,000.	$636,000 - $636,000	$636,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	7,440 - 7,440	LF	$80. - $80.	$595,200 - $595,200	$595,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
6.08	Pressure Boosting System	1 - 1	EA	$15,000. - $15,000.	$15,000 - $15,000	$15,000	1, 7
				Systems / Equipment Install / Field Labor Subtotal:	*$2,122,200 - $2,122,200*	*$2,122,200*	
				SUBTOTAL (BARE):	**$2,662,750 - $2,662,750**	**$2,662,750**	
				CONTINGENCY (20%):	**$532,550 - $532,550**	**$532,550**	
				TOTAL ESTIMATED CAPITAL COST:	**$3,195,300 - $3,195,300**	**$3,195,300**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	8
1.02	Scaled Operating Cost (per off-site AU extraction well)	19 - 19	WELL	$7,285. - $7,285.	$138,415 - $138,415	$138,415	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	9
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	7, 8
				SUBTOTAL (BARE):	**$142,415 - $142,415**	**$142,415**	
				CONTINGENCY (10%):	**$14,242 - $14,242**	**$14,242**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,657 - $156,657**	**$156,657**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 2,662,750	$ 532,550	$ 3,195,300
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,662,750**	**$ 532,550**	**$ 3,195,300**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction		$ 142,415	$ 14,242	$ 156,657
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 142,415**	**$ 14,242**	**$ 156,657**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (10 yrs)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter wel
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrica
6	$/lf includes piping + conduit + pullboxes
7	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.
8	O&M costs not already covered under AU O&M estimate
9	O&M costs already covered under AU O&M estimate

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:** 36385
Alt 4C - Northern Extraction (20 yrs)		**Date:** 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1,2
1.02	Scaled Operating Cost (per off-site AU extraction well)	12 - 12	WELL	$7,285. - $7,285.	$87,420 - $87,420	$87,420	1,2
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1,3
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	1,2,4
				SUBTOTAL (BARE):	**$91,420 - $91,420**	**$91,420**	
				CONTINGENCY (10%):	**$9,142 - $9,142**	**$9,142**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$100,562 - $100,562**	**$100,562**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 91,420	$ 9,142	$ 100,562
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 91,420**	**$ 9,142**	**$ 100,562**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	O&M costs not already covered under AU O&M estimate
3	O&M costs already covered under AU O&M estimate
4	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction (4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1, 2
1.02	Electricity	80,732 - 80,732	KWH	$0.12 - $0.18	$9,688 - $14,532	$12,110	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$56,648 - $61,492**	**$59,070**	
				CONTINGENCY (10%):	**$5,665 - $6,149**	**$5,907**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$62,313 - $67,641**	**$64,977**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 59,070	$ 5,907	$ 64,977
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 59,070**	**$ 5,907**	**$ 64,977**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells supporting SCRIA only. The remaining wells support AUs, and extraction well O&M costs are covered elsewhere; 195 gpm total @ 200' head

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
	Design and Contractor Bidding / Procurement Subtotal:				*$44,040 - $44,040*	*$44,040*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
5.02	Project Management through Startup	1 - 1	LS	$22,020. - $22,020.	$22,020 - $22,020	$22,020	1, 3
	Construction Monitoring and Site Security Subtotal:				*$66,060 - $66,060*	*$66,060*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	780 - 780	LF	$80. - $80.	$62,400 - $62,400	$62,400	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
	Systems / Equipment Install / Field Labor Subtotal:				*$440,400 - $440,400*	*$440,400*	
	SUBTOTAL (BARE):				**$550,500 - $550,500**	**$550,500**	
	CONTINGENCY (20%):				**$110,100 - $110,100**	**$110,100**	
	TOTAL ESTIMATED CAPITAL COST:				**$660,600 - $660,600**	**$660,600**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
	SUBTOTAL (BARE):				**$49,941 - $51,431**	**$50,686**	
	CONTINGENCY (10%):				**$4,994 - $5,143**	**$5,069**	
	TOTAL ESTIMATED ANNUAL O&M COSTS:				**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 550,500	$ 110,100	$ 660,600
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 550,500**	**$ 110,100**	**$ 660,600**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 50,686	$ 5,069	$ 55,755
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST SCRIA Extraction at 170 gpm for low dose (Alt 4C)	*Hinkley Feasibility Study*	Project Number: 36385 Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	1 - 1	EA	$12,320 - $12,320	$12,320 - $12,320	$12,320	1, 2
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 3
1.03	Quarterly Compliance Reporting	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.04	Project Management	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$25,766 - $29,989**	**$27,877**	
				CONTINGENCY (10%):	**$2,577 - $2,999**	**$2,788**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$28,342 - $32,988**	**$30,665**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 27,877	$ 2,788	$ 30,665
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 27,877**	**$ 2,788**	**$ 30,665**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	1 SCRIA Well not already covered by AU O&M estimate; 110 gpm total @ 200' head
3	170 gpm total @ 200' head

OPINION OF PROBABLE COST

Alt 4A (0-5 years)

Hinkley Feasibility Study

Project Number: 36385

Date: 27-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	*$204,589 - $269,114*	*$236,852*	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	*$180,000 - $240,000*	*$210,000*	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	*$50,000 - $100,000*	*$75,000*	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	*$225,000 - $310,000*	*$267,500*	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	12 - 12	EA	$30,000. - $40,000.	$360,000. - $480,000.	$420,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	40 - 40	EA	$30,000. - $40,000.	$1,200,000. - $1,600,000.	$1,400,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	52 - 52	EA	$12,000. - $14,500.	$624,000. - $754,000.	$689,000	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	22,634 - 22,634	LF	$75. - $100.	$1,697,550. - $2,263,400.	$1,980,475	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	4 - 4	LS	$20,000. - $20,000.	$80,000. - $80,000.	$80,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	*$5,136,550 - $6,587,400*	*$5,861,975*	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	*$75,000 - $100,000*	*$87,500*	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	*$1,000 - $2,000*	*$1,500*	
				SUBTOTAL (BARE):	**$5,872,139 - $7,608,514**	**$6,740,327**	
				CONTINGENCY (20%):	**$1,174,428 - $1,521,703**	**$1,348,065**	
				TOTAL ESTIMATED CAPITAL COST:	**$7,046,567 - $9,130,217**	**$8,088,392**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	25.7%	$ 2,077,153
SCRIA / Dosed Injection	36.2%	$ 2,927,479
Source Area IRZ / Injection	38.1%	$ 3,083,759
	100.0%	$ 8,088,392

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	302,930 - 302,930	KWH	$0.12 - $0.18	$36,352. - $54,527.	$45,440	1, 7
5.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,507,024 - $2,501,964**	**$2,004,494**	
				CONTINGENCY (10%):	**$150,702 - $250,196**	**$200,449**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,657,727 - $2,752,160**	**$2,204,943**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		25.7%	$ 1,730,961	$ 346,192	$ 2,077,153
SCRIA / Dosed Injection		36.2%	$ 2,439,566	$ 487,913	$ 2,927,479
Source Area IRZ / Injection		38.1%	$ 2,569,800	$ 513,960	$ 3,083,759
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,740,327**	**$ 1,348,065**	**$ 8,088,392**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection		$ 747,246	$ 74,725	$ 821,971
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 2,004,494**	**$ 200,449**	**$ 2,204,943**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	Derived at Compressor Station
8	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	*$42,500 - $49,500*	*$46,000*	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	*$0 - $0*	*$0*	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$25,000. - $50,000.	$25,000. - $50,000.	$37,500	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	*$25,000 - $50,000*	*$37,500*	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	*$50,000 - $50,000*	*$50,000*	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	6 - 6	LS	$3,000. - $3,000.	$18,000. - $18,000.	$18,000	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	*$190,000 - $224,000*	*$207,000*	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$10,000. - $15,000.	$10,000. - $15,000.	$12,500	1
6.02							
				Treatment System Startup Subtotal:	*$10,000 - $15,000*	*$12,500*	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	*$1,000 - $2,000*	*$1,500*	
				SUBTOTAL (BARE):	**$318,500 - $390,500**	**$354,500**	
				CONTINGENCY (20%):	**$63,700 - $78,100**	**$70,900**	
				TOTAL ESTIMATED CAPITAL COST:	**$382,200 - $468,600**	**$425,400**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	83.7%	$ 356,104
	Source Area IRZ / Injection	16.3%	$ 69,296
		100.0%	$ 425,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	4,364 - 4,364	KWH	$0.12 - $0.18	$524. - $785.	$655	1
4.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	4,145 - 4,145	KWH	$0.12 - $0.18	$497. - $746.	$622	1
5.03	Biological / Chemical Consumables	16,017 - 16,017	GAL	$5. - $6.	$80,083. - $96,100.	$88,092	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,344,226 - $2,295,700**	**$1,819,963**	
				CONTINGENCY (10%):	**$134,423 - $229,570**	**$181,996**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,478,648 - $2,525,269**	**$2,001,959**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		83.7%	$ 296,753	$ 59,351	$ 356,104
Source Area IRZ / Injection		16.3%	$ 57,747	$ 11,549	$ 69,296
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 354,500**	**$ 70,900**	**$ 425,400**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 346,026	$ 34,603	$ 380,628
Source Area IRZ / Injection	$ 651,428	$ 65,143	$ 716,571
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,819,963**	**$ 181,996**	**$ 2,001,959**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$87,089 - $128,614***	***$107,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$100,000 - $150,000***	***$125,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$28,000. - $52,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	6 - 6	EA	$12,000. - $14,500.	$72,000. - $87,000.	$79,500	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	1,900 - 1,900	LF	$75. - $100.	$142,500. - $190,000.	$166,250	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$521,500 - $663,000***	***$592,250***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	***$25,000 - $30,000***	***$27,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$784,589 - $1,073,614**	**$929,102**	
				CONTINGENCY (20%):	**$156,918 - $214,723**	**$185,820**	
				TOTAL ESTIMATED CAPITAL COST:	**$941,507 - $1,288,337**	**$1,114,922**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	68.1%	$ 758,788
Source Area IRZ / Injection	31.9%	$ 356,134
	100.0%	$ 1,114,922

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	5,455 - 5,455	KWH	$0.12 - $0.18	$655. - $982.	$818	1
4.03	Biological / Chemical Consumables	22,761 - 22,761	GAL	$5. - $6.	$113,803. - $136,563.	$125,183	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
5.02	Electricity	5,236 - 5,236	KWH	$0.12 - $0.18	$628. - $943.	$785	1
5.03	Biological / Chemical Consumables	20,232 - 20,232	GAL	$5. - $6.	$101,158. - $121,389.	$111,274	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$25,200. - $46,800.	$23,940. - $44,460.	$34,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,109,902 - $1,827,196**	**$1,468,549**	
				CONTINGENCY (10%):	**$110,990 - $182,720**	**$146,855**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,220,892 - $2,009,915**	**$1,615,403**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		68.1%	$ 632,324	$ 126,465	$ 758,788
Source Area IRZ / Injection		31.9%	$ 296,778	$ 59,356	$ 356,134
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 929,102**	**$ 185,820**	**$ 1,114,922**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 378,644	$ 37,864	$ 416,508
Source Area IRZ / Injection		$ 267,396	$ 26,740	$ 294,136
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 1,468,549**	**$ 146,855**	**$ 1,615,403**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	255 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (20+ years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit Modifications		Date: 28-Jun-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$16,000 - $16,000*	*$16,000*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	*$24,000 - $24,000*	*$24,000*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$160,000 - $160,000*	*$160,000*	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K perpivot

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
New Agricultural Unit (Revised)		Date: 28-Jun-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$901,332 - $1,026,332**	**$963,832**	
				CONTINGENCY (20%):	**$180,266 - $205,266**	**$192,766**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 29-Aug-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

													CALCULATED	
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			
Number of Agricultural Units		3			3			4			3			
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head			840 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	
Operations														
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000	1	$ 62,000	$ 62,000	
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000	405	$ 100	$ 40,533	
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000	1	$ 10,267	$ 10,267	
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000	1	$ 6,160	$ 6,160	
Pivot reconfiguration:														
Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
Electrical Power														
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471	173,885	$ 0.15	$ 26,083	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	329,323	$ 0.15	$ 49,398	
Outside Services														
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000	1	$ 68,000	$ 68,000	
Parts/repairs														
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000	2	$ 1,283,333	$ 25,667	
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**			**$ 290,578**	
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880	10	$ 290,578	$ 29,058	
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**			**$ 319,636**	

ESTIMATED ANNUAL O&M COSTS: FARMER-OP
WITH INCREASED TECHNICAL INPUT

		Farmer-Operated with Technical Input			Farmer-Operated with Technical Input			Farmer-Operated with Technical Input		
Number of AUs		3			3			4		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Technical Input	hrs	8,000	$ 80	$ 640,000	10,000	$ 80	$ 800,000	13,300	$ 80	$ 1,064,000
Engineering support	hrs	2,800	$ 100	$ 280,000	3,000	$ 100	$ 300,000	4,000	$ 100	$ 400,000
General oversight	hrs	400	$ 100	$ 40,000	400	$ 100	$ 40,000	400	$ 100	$ 40,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 75,000	$ 75,000	1	$ 90,000	$ 90,000	1	$ 120,000	$ 120,000
Pivot reconfiguration:										
Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power										
Pump Water from Aquifer to LTUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	1	$ 190,000	$ 190,000	1	$ 238,000	$ 238,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				**$ 1,398,709**			**$ 1,619,904**			**$ 2,124,802**
Contingency on Materials/Services	percent	10	$ 1,398,709	$ 139,871	10	$ 1,619,904	$ 161,990	10	$ 2,124,802	$ 212,480
GRAND TOTAL				**$ 1,538,580**			**$ 1,781,895**			**$ 2,337,282**

OPINION OF PROBABLE COST

Agricultural Unit O&M Backup (Varied Level of Technical Input)

Hinkley Feasibility Study

Project Number: 36385

Date: 13-Sep-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

								Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			6			7			8		
Application Rate and Pressure		950 gpm at 100 ft head			1270 gpm at 100 ft head			1380 gpm at 100 ft head			1530 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	420	$ 100	$ 42,000	520	$ 100	$ 52,000	570	$ 100	$ 57,000	640	$ 100	$ 64,000
Health & safety training/monitoring	ea	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700	1	$ 14,800	$ 14,800	1	$ 16,300	$ 16,300
Other expenses	ea	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220	1	$ 8,880	$ 8,880	1	$ 9,780	$ 9,780
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435	285,669	$ 0.15	$ 42,850	316,720	$ 0.15	$ 47,508
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	89,000	$ 89,000	1	138,000	$ 138,000	1	149,000	$ 149,000
Parts/repairs													
(Percent of capital cost)	percent	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000
Subtotal				**$ 308,347**			**$ 447,186**			**$ 554,532**			**$ 627,761**
Contingency on Materials/Services	percent	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719	10	$ 554,532	$ 55,453	10	$ 627,761	$ 62,776
GRAND TOTAL				**$ 339,181**			**$ 491,904**			**$ 609,985**			**$ 690,537**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-1, 0-20 yrs		
		CALCULATED		
		Farmer-Operated with Technical Input		
Number of AUs		3		
Application Rate and Pressure		450 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**
Operations				
Property Management	ea	1	$ 62,000	$ 62,000
Technical Input	hrs	5,670	$ 80	$ 453,600
Engineering support	hrs	2,570	$ 100	$ 257,000
General oversight	hrs	400	$ 100	$ 40,000
Health & safety training/monitoring	ea	1	$ 7,670	$ 7,670
Other expenses	ea	1	$ 57,500	$ 57,500
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -
Electrical Power				
Pump Water from Aquifer to LTUs	kW-hr	93,153	$ 0.15	$ 13,973
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278
Outside Services				
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000
Parts/repairs				
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000
Subtotal				**$ 1,168,491**
Contingency on Materials/Services	percent	10	$ 1,168,491	$ 116,849
GRAND TOTAL				**$ 1,285,340**

Alt 4C-1, 20+ yrs

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 13-Sep-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs			Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		7			8			18			21		
Application Rate and Pressure		1510 gpm at 100 ft head			1687 gpm at 100 ft head			2068 gpm at 100 ft head			2325 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500	1	$ 348,500	$ 348,500	1	$ 410,000	$ 410,000
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	630	$ 100	$ 63,000	710	$ 100	$ 71,000	890	$ 100	$ 89,000	1,010	$ 100	$ 101,000
Health & safety training/monitoring	ea	1	$ 16,100	$ 16,100	1	$ 17,870	$ 17,870	1	$ 21,680	$ 21,680	1	$ 24,250	$ 24,250
Other expenses	ea	1	$ 9,660	$ 9,660	1	$ 10,722	$ 10,722	1	$ 13,008	$ 13,008	1	$ 14,550	$ 14,550
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	5	$ 4,290	$ 21,450	6	$ 4,290	$ 25,740	16	$ 4,290	$ 68,640	19	$ 4,290	$ 81,510
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	312,580	$ 0.15	$ 46,887	349,220	$ 0.15	$ 52,383	428,089	$ 0.15	$ 64,213	481,290	$ 0.15	$ 72,193
Misc. Controls/Lights	kW-hr	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117	61,748	$ 0.15	$ 9,262	49,873	$ 0.15	$ 7,481
Pivot motor	kW-hr	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556	2,107,669	$ 0.15	$ 316,150	2,502,857	$ 0.15	$ 375,429
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	138,000	$ 138,000	1	149,000	$ 149,000	1	353,000	$ 353,000	1	393,000	$ 393,000
Parts/repairs													
(Percent of capital cost)	percent	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000	3	5,625,000	$ 168,750	3	6,250,000	$ 187,500
Subtotal				**$ 588,099**			**$ 667,888**			**$ 1,452,204**			**$ 1,666,913**
Contingency on Materials/Services	percent	10	$ 588,099	$ 58,810	10	$ 667,888	$ 66,789	10	$ 1,452,204	$ 145,220	10	$ 1,666,913	$ 166,691
GRAND TOTAL				**$ 646,909**			**$ 734,677**			**$ 1,597,424**			**$ 1,833,604**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP
WITH INCREASED TECHNICAL INPUT

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs	Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs
		CALCULATED				CALCULATED			
		Farmer-Operated with Technical Input				Farmer-Operated with Technical Input			
Number of AUs		3				8			
Application Rate and Pressure		531 gpm at 100 ft head				761 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**		**Number Required**	**Unit Cost**	**Total Cost**	
Operations									
Property Management	ea	1	$ 62,000	$ 62,000		1	$ 143,500	$ 143,500	
Technical Input	hrs	6,210	$ 80	$ 496,800		7,740	$ 80	$ 619,200	
Engineering support	hrs	2,620	$ 100	$ 262,000		2,770	$ 100	$ 277,000	
General oversight	hrs	400	$ 100	$ 40,000		400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 9,460	$ 9,460		1	$ 7,930	$ 7,930	
Other expenses	ea	1	$ 70,950	$ 70,950		1	$ 59,450	$ 59,450	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	3	$ 4,290	$ 12,870		8	$ 4,290	$ 34,320	
Electrical Power									
Pump Water from Aquifer to LTUs	kW-hr	109,920	$ 0.15	$ 16,488		157,532	$ 0.15	$ 23,630	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470		16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278		395,188	$ 0.15	$ 59,278	
Outside Services									
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000		1	$ 190,000	$ 190,000	
Parts/repairs									
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000		2	$ 2,500,000	$ 50,000	
Subtotal				**$ 1,247,316**				**$ 1,506,778**	
Contingency on Materials/Services	percent	10	$ 1,247,316	$ 124,732		10	$ 1,506,778	$ 150,678	
GRAND TOTAL				**$ 1,372,048**				**$ 1,657,456**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 13-Sep-11

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Additional Consultant Oversight
9	Controls/lights operated at 1.5 kW.
10	Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S WITH INCREASED TECHNICAL INPUT

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers, with technical input by consultants as necessary.
4	General oversight to include planning, contracting, and the regulatory interface.
5	Health & safety training/monitoring is required for workers.
6	Other expenses include travel, equipment, and miscellaneous.
7	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
8	Controls/lights operated at 1.5 kW.
9	Each pivot motor operated at 6 kW.
10	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Land Acquisition		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Applicatior	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition for Agricultural Applicatior	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.03	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.04	Land Acquisition	46 - 46	AC	$2,000. - $2,000.	$92,000 - $92,000	$92,000	1, 4
				Land Acquisition Costs Subtotal:	***$1,052,000 - $1,052,000***	***$1,052,000***	
				SUBTOTAL (BARE):	**$1,052,000 - $1,052,000**	**$1,052,000**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,052,000 - $1,052,000**	**$1,052,000**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for agricultural units.
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for an easement.

Cost Detail Sheets for Alternative 4C-3 In-Situ and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuous Pumping

Hinkley Feasibility Study - Addendum #3

Cost Detail Sheets for Alternative 4C-3 In-Situ and Enhanced Agricultural Treatment & Winter Ex-Situ Treatment - Continuous Pumping

Hinkley Feasibility Study - Addendum #3

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 80 gpm		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northwest Freshwater Injection		$ 135,688	$ 13,569	$ 149,257
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 28-Jun-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	GMP Including BCMP						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	$382,000 - $382,000	$382,000	
				CONTINGENCY (10%):	$38,200 - $38,200	$38,200	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	$420,200 - $420,200	$420,200	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	TOTAL:	0%	$ -	$ -	$ -

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 382,000	$ 38,200	$ 420,200
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	$ 382,000	$ 38,200	$ 420,200

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 286,500	$ 28,650	$ 315,150
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 191,000	$ 19,100	$ 210,100
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$293,720. - $293,720.	$293,720 - $293,720	$293,720	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$293,720 - $293,720*	*$293,720*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$293,720. - $293,720.	$293,720 - $293,720	$293,720	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$146,860. - $146,860.	$146,860 - $146,860	$146,860	1, 3
				Construction Monitoring and Site Security Subtotal:	*$450,580 - $450,580*	*$450,580*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	19 - 19	EA	$73,000. - $73,000.	$1,387,000 - $1,387,000	$1,387,000	1, 4
6.02	Well Completion	7 - 7	EA	$53,000. - $53,000.	$371,000 - $371,000	$371,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	14,740 - 14,740	LF	$80. - $80.	$1,179,200 - $1,179,200	$1,179,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$2,937,200 - $2,937,200*	*$2,937,200*	
				SUBTOTAL (BARE):	**$3,681,500 - $3,681,500**	**$3,681,500**	
				CONTINGENCY (20%):	**$736,300 - $736,300**	**$736,300**	
				TOTAL ESTIMATED CAPITAL COST:	**$4,417,800 - $4,417,800**	**$4,417,800**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	7 - 7	WELL	$7,285. - $7,285.	$50,995 - $50,995	$50,995	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$50,995 - $50,995**	**$50,995**	
				CONTINGENCY (10%):	**$5,100 - $5,100**	**$5,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$56,095 - $56,095**	**$56,095**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ 3,681,500	$ 736,300	$ 4,417,800
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 3,681,500**	**$ 736,300**	**$ 4,417,800**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 50,995	$ 5,100	$ 56,095
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 50,995**	**$ 5,100**	**$ 56,095**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter wel
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrica
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate
8	O&M costs not already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs for AU Extraction Wells located off the AU property		Date: 29-Aug-11

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	13	13	HRS	$70	$70	$ 910	0.25 hours/well with 1 person
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Annual Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$625	$625	$ 625	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0	0	DAYS	$3,000	$3,000	$ -	3 days/well, $3,000/day (every 4 years)
						$ 7,285	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

Other costs not directly scalable:

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Southern Extraction		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$146,280. - $146,280.	$146,280 - $146,280	$146,280	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$146,280 - $146,280***	***$146,280***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$146,280. - $146,280.	$146,280 - $146,280	$146,280	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$73,140. - $73,140.	$73,140 - $73,140	$73,140	1, 3
				Construction Monitoring and Site Security Subtotal:	***$229,420 - $229,420***	***$229,420***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	7,335 - 7,335	LF	$80. - $80.	$586,800 - $586,800	$586,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$1,462,800 - $1,462,800***	***$1,462,800***	
				SUBTOTAL (BARE):	**$1,838,500 - $1,838,500**	**$1,838,500**	
				CONTINGENCY (20%):	**$367,700 - $367,700**	**$367,700**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,206,200 - $2,206,200**	**$2,206,200**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$7,285. - $7,285.	$21,855 - $21,855	$21,855	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$21,855 - $21,855**	**$21,855**	
				CONTINGENCY (10%):	**$2,186 - $2,186**	**$2,186**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$24,041 - $24,041**	**$24,041**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Southern Extraction		100.0%	$ 1,838,500	$ 367,700	$ 2,206,200
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 1,838,500**	**$ 367,700**	**$ 2,206,200**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Southern Extraction		$ 21,855	$ 2,186	$ 24,041
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 21,855**	**$ 2,186**	**$ 24,041**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Southern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
I6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate
8	O&M costs not already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 - Northern Extraction (10 yrs)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$195,180. - $195,180.	$195,180 - $195,180	$195,180	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$195,180 - $195,180***	***$195,180***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$195,180. - $195,180.	$195,180 - $195,180	$195,180	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$97,590. - $97,590.	$97,590 - $97,590	$97,590	1, 3
				Construction Monitoring and Site Security Subtotal:	***$302,770 - $302,770***	***$302,770***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	12 - 12	EA	$53,000. - $53,000.	$636,000 - $636,000	$636,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	5,310 - 5,310	LF	$80. - $80.	$424,800 - $424,800	$424,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
6.08	Pressure Boosting System	1 - 1	EA	$15,000. - $15,000.	$15,000 - $15,000	$15,000	1, 7
				Systems / Equipment Install / Field Labor Subtotal:	***$1,951,800 - $1,951,800***	***$1,951,800***	
				SUBTOTAL (BARE):	**$2,449,750 - $2,449,750**	**$2,449,750**	
				CONTINGENCY (20%):	**$489,950 - $489,950**	**$489,950**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,939,700 - $2,939,700**	**$2,939,700**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	8
1.02	Scaled Operating Cost (per off-site AU extraction well)	19 - 19	WELL	$7,285. - $7,285.	$138,415 - $138,415	$138,415	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	9
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	7, 8
				SUBTOTAL (BARE):	**$142,415 - $142,415**	**$142,415**	
				CONTINGENCY (10%):	**$14,242 - $14,242**	**$14,242**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,657 - $156,657**	**$156,657**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 2,449,750	$ 489,950	$ 2,939,700
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,449,750**	**$ 489,950**	**$ 2,939,700**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction		$ 142,415	$ 14,242	$ 156,657
Gorman Extraction		$ -	$ -	$ -
Central Area IRZ / Injection		$ -	$ -	$ -
SCRIA / Dosed Injection		$ -	$ -	$ -
Source Area IRZ / Injection		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 142,415**	**$ 14,242**	**$ 156,657**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 - Northern Extraction (10 yrs)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.
8	O&M costs not already covered under AU O&M estimate
9	O&M costs already covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (20 yrs)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1,2
1.02	Scaled Operating Cost (per off-site AU extraction well)	12 - 12	WELL	$7,285. - $7,285.	$87,420 - $87,420	$87,420	1,2
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1,3
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	1,2,4
				SUBTOTAL (BARE):	**$91,420 - $91,420**	**$91,420**	
				CONTINGENCY (10%):	**$9,142 - $9,142**	**$9,142**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$100,562 - $100,562**	**$100,562**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 91,420	$ 9,142	$ 100,562
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 91,420**	**$ 9,142**	**$ 100,562**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	O&M costs not already covered under AU O&M estimate
3	O&M costs already covered under AU O&M estimate
4	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction (4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1, 2
1.02	Electricity	80,732 - 80,732	KWH	$0.12 - $0.18	$9,688 - $14,532	$12,110	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$56,648 - $61,492**	**$59,070**	
				CONTINGENCY (10%):	**$5,665 - $6,149**	**$5,907**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$62,313 - $67,641**	**$64,977**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 59,070	$ 5,907	$ 64,977
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 59,070**	**$ 5,907**	**$ 64,977**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells supporting SCRIA only. The remaining wells support AUs, and extraction well O&M costs are covered elsewhere; 195 gpm total @ 200' hea

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$44,040 - $44,040***	***$44,040***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
5.02	Project Management through Startup	1 - 1	LS	$22,020. - $22,020.	$22,020 - $22,020	$22,020	1, 3
				Construction Monitoring and Site Security Subtotal:	***$66,060 - $66,060***	***$66,060***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	780 - 780	LF	$80. - $80.	$62,400 - $62,400	$62,400	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$440,400 - $440,400***	***$440,400***	
				SUBTOTAL (BARE):	**$550,500 - $550,500**	**$550,500**	
				CONTINGENCY (20%):	**$110,100 - $110,100**	**$110,100**	
				TOTAL ESTIMATED CAPITAL COST:	**$660,600 - $660,600**	**$660,600**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
				SUBTOTAL (BARE):	**$49,941 - $51,431**	**$50,686**	
				CONTINGENCY (10%):	**$4,994 - $5,143**	**$5,069**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 550,500	$ 110,100	$ 660,600
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 550,500**	**$ 110,100**	**$ 660,600**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 50,686	$ 5,069	$ 55,755
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 170 gpm for low dose (Alt 4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	1 - 1	EA	$12,320 - $12,320	$12,320 - $12,320	$12,320	1, 2
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 3
1.03	Quarterly Compliance Reporting	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.04	Project Management	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$25,766 - $29,989**	**$27,877**	
				CONTINGENCY (10%):	**$2,577 - $2,999**	**$2,788**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$28,342 - $32,988**	**$30,665**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 27,877	$ 2,788	$ 30,665
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 27,877**	**$ 2,788**	**$ 30,665**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	1 SCRIA Well not already covered by AU O&M estimate; 110 gpm total @ 200' heac
3	170 gpm total @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$180,000 - $240,000***	***$210,000***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	12 - 12	EA	$30,000. - $40,000.	$360,000. - $480,000.	$420,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	40 - 40	EA	$30,000. - $40,000.	$1,200,000. - $1,600,000.	$1,400,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	52 - 52	EA	$12,000. - $14,500.	$624,000. - $754,000.	$689,000	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	22,634 - 22,634	LF	$75. - $100.	$1,697,550. - $2,263,400.	$1,980,475	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	4 - 4	LS	$20,000. - $20,000.	$80,000. - $80,000.	$80,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	***$5,136,550 - $6,587,400***	***$5,861,975***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$5,872,139 - $7,608,514**	**$6,740,327**	
				CONTINGENCY (20%):	**$1,174,428 - $1,521,703**	**$1,348,065**	
				TOTAL ESTIMATED CAPITAL COST:	**$7,046,567 - $9,130,217**	**$8,088,392**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	25.7%	$ 2,077,153
	SCRIA / Dosed Injection	36.2%	$ 2,927,479
	Source Area IRZ / Injection	38.1%	$ 3,083,759
		100.0%	$ 8,088,392

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	302,930 - 302,930	KWH	$0.12 - $0.18	$36,352. - $54,527.	$45,440	1, 7
5.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,507,024 - $2,501,964**	**$2,004,494**	
				CONTINGENCY (10%):	**$150,702 - $250,196**	**$200,449**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,657,727 - $2,752,160**	**$2,204,943**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		25.7%	$ 1,730,961	$ 346,192	$ 2,077,153
SCRIA / Dosed Injection		36.2%	$ 2,439,566	$ 487,913	$ 2,927,479
Source Area IRZ / Injection		38.1%	$ 2,569,800	$ 513,960	$ 3,083,759
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,740,327**	**$ 1,348,065**	**$ 8,088,392**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection		$ 747,246	$ 74,725	$ 821,971
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 2,004,494**	**$ 200,449**	**$ 2,204,943**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	Derived at Compressor Station
8	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$42,500 - $49,500***	***$46,000***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$25,000. - $50,000.	$25,000. - $50,000.	$37,500	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$25,000 - $50,000***	***$37,500***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$50,000 - $50,000***	***$50,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	6 - 6	LS	$3,000. - $3,000.	$18,000. - $18,000.	$18,000	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$190,000 - $224,000***	***$207,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$10,000. - $15,000.	$10,000. - $15,000.	$12,500	1
6.02							
				Treatment System Startup Subtotal:	***$10,000 - $15,000***	***$12,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$318,500 - $390,500**	**$354,500**	
				CONTINGENCY (20%):	**$63,700 - $78,100**	**$70,900**	
				TOTAL ESTIMATED CAPITAL COST:	**$382,200 - $468,600**	**$425,400**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	83.7%	$ 356,104
	Source Area IRZ / Injection	16.3%	$ 69,296
		100.0%	$ 425,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	4,364 - 4,364	KWH	$0.12 - $0.18	$524. - $785.	$655	1
4.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	4,145 - 4,145	KWH	$0.12 - $0.18	$497. - $746.	$622	1
5.03	Biological / Chemical Consumables	16,017 - 16,017	GAL	$5. - $6.	$80,083. - $96,100.	$88,092	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,344,226 - $2,295,700**	**$1,819,963**	
				CONTINGENCY (10%):	**$134,423 - $229,570**	**$181,996**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,478,648 - $2,525,269**	**$2,001,959**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		83.7%	$ 296,753	$ 59,351	$ 356,104
Source Area IRZ / Injection		16.3%	$ 57,747	$ 11,549	$ 69,296
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 354,500**	**$ 70,900**	**$ 425,400**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe		$ -	$ -	$ -
Northern Injection		$ -	$ -	$ -
Central Area IRZ / Injection		$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection		$ 346,026	$ 34,603	$ 380,628
Source Area IRZ / Injection		$ 651,428	$ 65,143	$ 716,571
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 1,819,963**	**$ 181,996**	**$ 2,001,959**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

ALTERNATIVE 4C-3: TABLE 16
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$87,089 - $128,614***	***$107,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$100,000 - $150,000***	***$125,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$28,000. - $52,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	6 - 6	EA	$12,000. - $14,500.	$72,000. - $87,000.	$79,500	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	1,900 - 1,900	LF	$75. - $100.	$142,500. - $190,000.	$166,250	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$521,500 - $663,000***	***$592,250***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	***$25,000 - $30,000***	***$27,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$784,589 - $1,073,614**	**$929,102**	
				CONTINGENCY (20%):	**$156,918 - $214,723**	**$185,820**	
				TOTAL ESTIMATED CAPITAL COST:	**$941,507 - $1,288,337**	**$1,114,922**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	0.0%	$ -
SCRIA / Dosed Injection	68.1%	$ 758,788
Source Area IRZ / Injection	31.9%	$ 356,134
	100.0%	$ 1,114,922

OPINION OF PROBABLE COST Alt 4C (10-20 years)	*Hinkley Feasibility Study*	Project Number: 36385 Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	5,455 - 5,455	KWH	$0.12 - $0.18	$655. - $982.	$818	1
4.03	Biological / Chemical Consumables	22,761 - 22,761	GAL	$5. - $6.	$113,803. - $136,563.	$125,183	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
5.02	Electricity	5,236 - 5,236	KWH	$0.12 - $0.18	$628. - $943.	$785	1
5.03	Biological / Chemical Consumables	20,232 - 20,232	GAL	$5. - $6.	$101,158. - $121,389.	$111,274	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$25,200. - $46,800.	$23,940. - $44,460.	$34,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,109,902 - $1,827,196**	**$1,468,549**	
				CONTINGENCY (10%):	**$110,990 - $182,720**	**$146,855**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,220,892 - $2,009,915**	**$1,615,403**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		68.1%	$ 632,324	$ 126,465	$ 758,788
Source Area IRZ / Injection		31.9%	$ 296,778	$ 59,356	$ 356,134
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 929,102**	**$ 185,820**	**$ 1,114,922**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 378,644	$ 37,864	$ 416,508
Source Area IRZ / Injection	$ 267,396	$ 26,740	$ 294,136
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,468,549**	**$ 146,855**	**$ 1,615,403**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:** 36385
Alt 4C (10-20 years)		**Date:** 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	255 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (20+ years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit Modifications		Date: 28-Jun-10

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	Design and Contractor Bidding / Procurement						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	$16,000 - $16,000	$16,000	
5.00	Construction Monitoring and Site Security						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	$24,000 - $24,000	$24,000	
6.00	Systems / Equipment Install / Field Labor						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	$160,000 - $160,000	$160,000	
				SUBTOTAL (BARE):	$200,000 - $200,000	$200,000	
				CONTINGENCY (20%):	$40,000 - $40,000	$40,000	
				TOTAL ESTIMATED CAPITAL COST:	$240,000 - $240,000	$240,000	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	TOTAL:	100%	$ 200,000	$ 40,000	$ 240,000

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	$ -	$ -	$ -

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K pei

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
New Agricultural Unit (Revised)		Date: 28-Jun-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
	Design and Contractor Bidding / Procurement Subtotal:				***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
	Mobilization/Demobilization/Site Prep/General Conditions Subtotal:				***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
	Construction Monitoring and Site Security Subtotal:				***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
	Systems / Equipment Install / Field Labor Subtotal:				***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
	Permits and Regulatory Compliance Subtotal:				***$50,000 - $50,000***	***$50,000***	
	SUBTOTAL (BARE):				**$901,332 - $1,026,332**	**$963,832**	
	CONTINGENCY (20%):				**$180,266 - $205,266**	**$192,766**	
	TOTAL ESTIMATED CAPITAL COST:				**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number:	36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date:	29-Aug-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

													CALCULATED	
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			
Number of Agricultural Units		3			3			4			3			
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head			840 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	
Operations														
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000	1	$ 62,000	$ 62,000	
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000	405	$ 100	$ 40,533	
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000	1	$ 10,267	$ 10,267	
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000	1	$ 6,160	$ 6,160	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
Electrical Power														
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471	173,885	$ 0.15	$ 26,083	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	329,323	$ 0.15	$ 49,398	
Outside Services														
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000	1	$ 68,000	$ 68,000	
Parts/repairs														
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000	2	$ 1,283,333	$ 25,667	
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**			**$ 290,578**	
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880	10	$ 290,578	$ 29,058	
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**			**$ 319,636**	

ESTIMATED ANNUAL O&M COSTS: FARMER-OP
WITH INCREASED TECHNICAL INPUT

		Farmer-Operated with Technical Input			Farmer-Operated with Technical Input			Farmer-Operated with Technical Input		
Number of AUs		3			3			4		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Technical Input	hrs	8,000	$ 80	$ 640,000	10,000	$ 80	$ 800,000	13,300	$ 80	$ 1,064,000
Engineering support	hrs	2,800	$ 100	$ 280,000	3,000	$ 100	$ 300,000	4,000	$ 100	$ 400,000
General oversight	hrs	400	$ 100	$ 40,000	400	$ 100	$ 40,000	400	$ 100	$ 40,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 75,000	$ 75,000	1	$ 90,000	$ 90,000	1	$ 120,000	$ 120,000
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power										
Pump Water from Aquifer to LTUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	1	$ 190,000	$ 190,000	1	$ 238,000	$ 238,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				**$ 1,398,709**			**$ 1,619,904**			**$ 2,124,802**
Contingency on Materials/Services	percent	10	$ 1,398,709	$ 139,871	10	$ 1,619,904	$ 161,990	10	$ 2,124,802	$ 212,480
GRAND TOTAL				**$ 1,538,580**			**$ 1,781,895**			**$ 2,337,282**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 13-Sep-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

									Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED			
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated			
Number of Agricultural Units		3			6			7			8			
Application Rate and Pressure		950 gpm at 100 ft head			1270 gpm at 100 ft head			1380 gpm at 100 ft head			1530 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	
Operations														
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500	
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
General oversight	hrs	420	$ 100	$ 42,000	520	$ 100	$ 52,000	570	$ 100	$ 57,000	640	$ 100	$ 64,000	
Health & safety training/monitoring	ea	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700	1	$ 14,800	$ 14,800	1	$ 16,300	$ 16,300	
Other expenses	ea	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220	1	$ 8,880	$ 8,880	1	$ 9,780	$ 9,780	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	
Electrical Power														
Pump Water from Aquifer to AUs	kW-hr	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435	285,669	$ 0.15	$ 42,850	316,720	$ 0.15	$ 47,508	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556	
Outside Services														
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	89,000	$ 89,000	1	138,000	$ 138,000	1	149,000	$ 149,000	
Parts/repairs														
(Percent of capital cost)	percent	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000	
Subtotal				**$ 308,347**			**$ 447,186**			**$ 554,532**			**$ 627,761**	
Contingency on Materials/Services	percent	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719	10	$ 554,532	$ 55,453	10	$ 627,761	$ 62,776	
GRAND TOTAL				**$ 339,181**			**$ 491,904**			**$ 609,985**			**$ 690,537**	

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs
		CALCULATED			
		Farmer-Operated with Technical Input			
Number of AUs		3			
Application Rate and Pressure		450 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	
Operations					
Property Management	ea	1	$ 62,000	$ 62,000	
Technical Input	hrs	5,670	$ 80	$ 453,600	
Engineering support	hrs	2,570	$ 100	$ 257,000	
General oversight	hrs	400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 7,670	$ 7,670	
Other expenses	ea	1	$ 57,500	$ 57,500	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	
Electrical Power					
Pump Water from Aquifer to LTUs	kW-hr	93,153	$ 0.15	$ 13,973	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	
Outside Services					
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	
Parts/repairs					
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	
Subtotal				**$ 1,168,491**	
Contingency on Materials/Services	percent	10	$ 1,168,491	$ 116,849	
GRAND TOTAL				**$ 1,285,340**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number:	36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date:	13-Sep-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs			Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		7			8			18			21		
Application Rate and Pressure		1510 gpm at 100 ft head			1687 gpm at 100 ft head			2068 gpm at 100 ft head			2325 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500	1	$ 348,500	$ 348,500	1	$ 410,000	$ 410,000
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	630	$ 100	$ 63,000	710	$ 100	$ 71,000	890	$ 100	$ 89,000	1,010	$ 100	$ 101,000
Health & safety training/monitoring	ea	1	$ 16,100	$ 16,100	1	$ 17,870	$ 17,870	1	$ 21,680	$ 21,680	1	$ 24,250	$ 24,250
Other expenses	ea	1	$ 9,660	$ 9,660	1	$ 10,722	$ 10,722	1	$ 13,008	$ 13,008	1	$ 14,550	$ 14,550
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	5	$ 4,290	$ 21,450	6	$ 4,290	$ 25,740	16	$ 4,290	$ 68,640	19	$ 4,290	$ 81,510
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	312,580	$ 0.15	$ 46,887	349,220	$ 0.15	$ 52,383	428,089	$ 0.15	$ 64,213	481,290	$ 0.15	$ 72,193
Misc. Controls/Lights	kW-hr	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117	61,748	$ 0.15	$ 9,262	49,873	$ 0.15	$ 7,481
Pivot motor	kW-hr	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556	2,107,669	$ 0.15	$ 316,150	2,502,857	$ 0.15	$ 375,429
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	138,000	$ 138,000	1	149,000	$ 149,000	1	353,000	$ 353,000	1	393,000	$ 393,000
Parts/repairs													
(Percent of capital cost)	percent	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000	3	5,625,000	$ 168,750	3	6,250,000	$ 187,500
Subtotal				**$ 588,099**			**$ 667,888**			**$ 1,452,204**			**$ 1,666,913**
Contingency on Materials/Services	percent	10	$ 588,099	$ 58,810	10	$ 667,888	$ 66,789	10	$ 1,452,204	$ 145,220	10	$ 1,666,913	$ 166,691
GRAND TOTAL				**$ 646,909**			**$ 734,677**			**$ 1,597,424**			**$ 1,833,604**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs	Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs
		CALCULATED				CALCULATED			
		Farmer-Operated with Technical Input				Farmer-Operated with Technical Input			
Number of AUs		3				8			
Application Rate and Pressure		531 gpm at 100 ft head				761 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**		**Number Required**	**Unit Cost**	**Total Cost**	
Operations									
Property Management	ea	1	$ 62,000	$ 62,000		1	$ 143,500	$ 143,500	
Technical Input	hrs	6,210	$ 80	$ 496,800		7,740	$ 80	$ 619,200	
Engineering support	hrs	2,620	$ 100	$ 262,000		2,770	$ 100	$ 277,000	
General oversight	hrs	400	$ 100	$ 40,000		400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 9,460	$ 9,460		1	$ 7,930	$ 7,930	
Other expenses	ea	1	$ 70,950	$ 70,950		1	$ 59,450	$ 59,450	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	3	$ 4,290	$ 12,870		8	$ 4,290	$ 34,320	
Electrical Power									
Pump Water from Aquifer to LTUs	kW-hr	109,920	$ 0.15	$ 16,488		157,532	$ 0.15	$ 23,630	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470		16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278		395,188	$ 0.15	$ 59,278	
Outside Services									
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000		1	$ 190,000	$ 190,000	
Parts/repairs									
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000		2	$ 2,500,000	$ 50,000	
Subtotal				**$ 1,247,316**				**$ 1,506,778**	
Contingency on Materials/Services	percent	10	$ 1,247,316	$ 124,732		10	$ 1,506,778	$ 150,678	
GRAND TOTAL				**$ 1,372,048**				**$ 1,657,456**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:** **36385**
Agricultural Unit O&M Backup (Varied Level of Technical Input)		**Date:** **13-Sep-11**

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Additional Consultant Oversight
9	Controls/lights operated at 1.5 kW.
10	Each pivot motor operated at 6 kW.
11	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S WITH INCREASED TECHNICAL INPUT

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers, with technical input by consultants as necessary.
4	General oversight to include planning, contracting, and the regulatory interface.
5	Health & safety training/monitoring is required for workers.
6	Other expenses include travel, equipment, and miscellaneous.
7	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
8	Controls/lights operated at 1.5 kW.
9	Each pivot motor operated at 6 kW.
10	Electrical rate varies from $0.12/kW-hr to $0.18/kW-hr. Average electrical rate is $0.15/kW-hr.

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C-3 - Land Acquisition		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Applicatior	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.02	Land Acquisition for Agricultural Applicatior	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 2
1.03	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.04	Land Acquisition	20.7 - 20.7	AC	$2,000. - $2,000.	$41,400 - $41,400	$41,400	1, 4
1.05	Land Acquisition	46 - 46	AC	$2,000. - $2,000.	$92,000 - $92,000	$92,000	1, 5
				Land Acquisition Costs Subtotal:	***$1,093,400 - $1,093,400***	***$1,093,400***	
				SUBTOTAL (BARE):	**$1,093,400 - $1,093,400**	**$1,093,400**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,093,400 - $1,093,400**	**$1,093,400**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for agricultural units.
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for ex-situ treatment injection wells.
5	Property will be used for an easement.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	**Project Number:** 36385
Ex-Situ Treatment (1,200 gpm)		**Date:** 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$602,482 - $602,482	$602,482 - $602,482	$602,482	1, 2
2.02	Bench / Pilot Scale Testing	1 - 1	LS	$50,000 - $50,000	$50,000. - $50,000.	$50,000	1
2.03							
				Design and Contractor Bidding / Procurement Subtotal:	***$652,482 - $652,482***	***$652,482***	
5.00	**Construction Monitoring and Site Security**						
5.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$351,448 - $351,448	$351,448 - $351,448	$351,448	1, 3
5.02	Construction Management	1 - 1	LS	$401,655 - $401,655	$401,655 - $401,655	$401,655	1, 4
5.03	Project Management through Startup	1 - 1	LS	$200,827 - $200,827	$200,827 - $200,827	$200,827	1, 5
5.04							
				Construction Monitoring and Site Security Subtotal:	***$953,930 - $953,930***	***$953,930***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Site Grading/Baserock	3,240 - 3,240	CY	$17 - $17	$55,080 - $55,080	$55,080	1
6.02	Utilities - Electrical	1 - 1	LS	$90,000 - $90,000	$90,000 - $90,000	$90,000	1
6.03	Utilities - Water	1 - 1	LS	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
6.04	Influent/Effluent Yard Piping	292 - 292	LF	$90 - $90	$26,244 - $26,244	$26,244	1
6.05	Concrete Slab	778 - 778	CY	$700 - $700	$544,320 - $544,320	$544,320	1
6.06	Receiving Tank	1 - 1	EA	$100,440 - $100,440	$100,440 - $100,440	$100,440	1
6.07	Batch Treatment Tanks	12 - 12	EA	$45,000 - $45,000	$540,000 - $540,000	$540,000	1
6.08	Ferrous Iron Tank	1 - 1	EA	$17,280 - $17,280	$17,280 - $17,280	$17,280	1
6.09	FE/NaOH/Sulfide Metering Pump/Tank System	4 - 4	EA	$15,120 - $15,120	$60,480 - $60,480	$60,480	1
6.10	Oxidation Reactors	1 - 1	EA	$54,000 - $54,000	$54,000 - $54,000	$54,000	1
6.11	Parkson Lamella Clarifier/Flocculent Mix Tank	1 - 1	EA	$108,000 - $108,000	$108,000 - $108,000	$108,000	1
6.12	Clarifier Effluent Tank	1 - 1	EA	$54,000 - $54,000	$54,000 - $54,000	$54,000	1
6.13	Blowers	4 - 4	EA	$15,000 - $15,000	$60,000 - $60,000	$60,000	1
6.14	Aeration Systems	24 - 24	EA	$5,000 - $5,000	$120,000 - $120,000	$120,000	1
6.15	Microfiltration 180 gpm	1 - 1	LS	$766,800 - $766,800	$766,800 - $766,800	$766,800	1
6.16	Sludge Thickening Tank w/Pump system	1 - 1	LS	$108,000 - $108,000	$108,000 - $108,000	$108,000	1
6.17	Treated Water Storage	4 - 4	LS	$40,000 - $40,000	$160,000 - $160,000	$160,000	1
6.18	Misc Pumps/mixers	11 - 11	EA	$19,440 - $19,440	$213,840 - $213,840	$213,840	1
6.19	Plant Process Valves/Misc Fittings & Equip	1 - 1	LS	$216,000 - $216,000	$216,000 - $216,000	$216,000	1
6.20	Plant Process Piping	1 1	LS	$247,000 - $247,000	$247,000 - $247,000	$247,000	1
6.21	Plant Electrical	1 1	LS	$247,000 - $247,000	$247,000 - $247,000	$247,000	1
6.22	Instrumentation	1 - 1	LS	$309,000 - $309,000	$309,000 - $309,000	$309,000	1
6.23	Fire Suppression	1 - 1	LS	$75,600 - $75,600	$75,600 - $75,600	$75,600	1
6.24	Roof	31,104 31,104	SF	$25 - $25	$777,600 - $777,600	$777,600	1
6.25	Lab Trailer & Furniture	1 - 1	LS	$35,000 - $35,000	$35,000 - $35,000	$35,000	1
6.26	Lab Equipment	1 - 1	LS	$25,000 - $25,000	$25,000 - $25,000	$25,000	1
6.27							
				Systems / Equipment Install / Field Labor Subtotal:	***$5,020,684 - $5,020,684***	***$5,020,684***	
11.00	**Permits and Regulatory Compliance**						
11.01	Local Permits	1 - 1	EA	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
11.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$1,656,412 - $1,656,412**	**$6,677,096**	
				CONTINGENCY (20%):	**$331,282 - $331,282**	**$1,335,419**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,987,694 - $1,987,694**	**$8,012,515**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Ex-Situ Treatment (1,200 gpm)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**General**						
1.01	Operations, Monitoring and Reporting	0 - 0	HR	$80. - $80.	$0 - $0	$0	6
1.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	6
1.03	Equipment Rental (tools, instruments)	0 - 0	MO	$500. - $500.	$0 - $0	$0	6
1.04	Forklift Rental	0 - 0	MO	$1,500. - $1,500.	$0 - $0	$0	6
1.05	Other (Office Supplies, transportation, comm., etc.)	0 - 0	MO	$2,500. - $2,500.	$0 - $0	$0	6
1.06	Sludge Disposal	0 - 0	LB	$0.36 - $0.36	$0 - $0	$0	6
1.07	10% fee on expenses	0 - 0	LS	$147,000. - $147,000.	$0 - $0	$0	6
2.00	**Chemicals**						
2.01	FeCl2 (35% Solution)	0 - 0	LB	$0.4 - $0.4	$0 - $0	$0	6
2.02	Filtration Polymer	0 - 0	LB	$5. - $5.	$0 - $0	$0	6
2.03	Dewatering Polymer	0 - 0	LB	$5. - $5.	$0 - $0	$0	6
2.04	Acid	0 - 0	LB	$0.09 - $0.09	$0 - $0	$0	6
2.05	Caustic	0 - 0	LB	$0.25 - $0.25	$0 - $0	$0	6
2.06	Anti-Scalant	0 - 0	LB	$2. - $2.	$0 - $0	$0	6
3.00	**Analytical**						
3.01	Supplies	0 - 0	LS	$120,000. - $120,000.	$0 - $0	$0	6
3.02	Consumables	0 - 0	LS	$40,000. - $40,000.	$0 - $0	$0	6
3.03	QC Samples	0 - 0	EA	$105. - $105.	$0 - $0	$0	6
3.04	Other (Water Chemistry, Misc.)	0 - 0	WK	$200. - $200.	$0 - $0	$0	6
3.05	Lab Courier	0 - 0	TRIP	$130. - $130.	$0 - $0	$0	6
				SUBTOTAL (BARE):	**$0 - $0**	**$0**	
				CONTINGENCY (10%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$0 - $0**	**$0**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Ex-Situ Treatment (Chem Precip)		100.0%	$ 6,677,096	$ 1,335,419	$ 8,012,515
Non-Specific	**TOTAL:**	**100%**	**$ 6,677,096**	**$ 1,335,419**	**$ 8,012,515**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Ex-Situ Treatment (Chem Precip)		$ -	$ -	$ -
	TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	12% of total project capital cost
3	7% of total project capital cost
4	8% of total project capital cost
5	50% of Construction Management cost
6	Ex-situ treatment O&M north of Highway 58 combined with estimate south of Highway 58, and presented on a separate page

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Ex-Situ Treatment (450 gpm)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$379,117 - $379,117	$379,117 - $379,117	$379,117	1, 2
2.02	Bench / Pilot Scale Testing	1 - 1	LS	$50,000 - $50,000	$50,000. - $50,000.	$50,000	1
2.03							
				Design and Contractor Bidding / Procurement Subtotal:	*$429,117 - $429,117*	*$429,117*	
5.00	**Construction Monitoring and Site Security**						
5.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$221,151 - $221,151	$221,151 - $221,151	$221,151	1, 3
5.02	Construction Management	1 - 1	LS	$252,744 - $252,744	$252,744 - $252,744	$252,744	1, 4
5.03	Project Management through Startup	1 - 1	LS	$126,372 - $126,372	$126,372 - $126,372	$126,372	1, 5
5.04							
				Construction Monitoring and Site Security Subtotal:	*$600,268 - $600,268*	*$600,268*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Site Grading/Baserock	2,018 - 2,018	CY	$17 - $17	$34,306 - $34,306	$34,306	1
6.02	Utilities - Electrical	1 - 1	LS	$90,000 - $90,000	$90,000 - $90,000	$90,000	1
6.03	Utilities - Water	1 - 1	LS	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
6.04	Influent/Effluent Yard Piping	182 - 182	LF	$90 - $90	$16,349 - $16,349	$16,349	1
6.05	Concrete Slab	482 - 482	CY	$700 - $700	$337,400 - $337,400	$337,400	1
6.06	Receiving Tank	1 - 1	EA	$62,570.4 - $62,570	$62,570 - $62,570	$62,570	1
6.07	Batch Treatment Tanks	6 - 6	EA	$45,000 - $45,000	$270,000 - $270,000	$270,000	1
6.08	Ferrous Iron Tank	1 - 1	EA	$10,764.8 - $10,765	$10,765 - $10,765	$10,765	1
6.09	FE/NaOH/Sulfide Metering Pump/Tank System	4 - 4	EA	$9,419.2 - $9,419	$37,677 - $37,677	$37,677	1
6.10	Oxidation Reactors	1 - 1	EA	$33,640. - $33,640	$33,640 - $33,640	$33,640	1
6.11	Parkson Lamella Clarifier/Flocculent Mix Tank	1 - 1	EA	$67,280. - $67,280	$67,280 - $67,280	$67,280	1
6.12	Clarifier Effluent Tank	1 - 1	EA	$33,640. - $33,640	$33,640 - $33,640	$33,640	1
6.13	Blowers	2 - 2	EA	$15,000 - $15,000	$30,000 - $30,000	$30,000	1
6.14	Aeration Systems	12 - 12	EA	$5,000 - $5,000	$60,000 - $60,000	$60,000	1
6.15	Microfiltration 180 gpm	1 - 1	LS	$477,688 - $477,688	$477,688 - $477,688	$477,688	1
6.16	Sludge Thickening Tank w/Pump system	1 - 1	LS	$67,280. - $67,280	$67,280 - $67,280	$67,280	1
6.17	Treated Water Storage	4 - 4	LS	$40,000 - $40,000	$160,000 - $160,000	$160,000	1
6.18	Misc Pumps/mixers	11 - 11	EA	$12,110.40 - $12,110.40	$133,214 - $133,214	$133,214	1
6.19	Plant Process Valves/Misc Fittings & Equip	1 - 1	LS	$135,000. - $135,000	$135,000 - $135,000	$135,000	1
6.20	Plant Process Piping	1 1	LS	$155,000. - $155,000	$155,000 - $155,000	$155,000	1
6.21	Plant Electrical	1 1	LS	$155,000. - $155,000	$155,000 - $155,000	$155,000	1
6.22	Instrumentation	1 - 1	LS	$193,000. - $193,000	$193,000 - $193,000	$193,000	1
6.23	Fire Suppression	1 - 1	LS	$47,096. - $47,096	$47,096 - $47,096	$47,096	1
6.24	Roof	19,296 19,296	SF	$25 - $25	$482,400 - $482,400	$482,400	1
6.25	Lab Trailer & Furniture	1 - 1	LS	$35,000 - $35,000	$35,000 - $35,000	$35,000	1
6.26	Lab Equipment	1 - 1	LS	$25,000 - $25,000	$25,000 - $25,000	$25,000	1
6.27							
				Systems / Equipment Install / Field Labor Subtotal:	*$3,159,305 - $3,159,305*	*$3,159,305*	
11.00	**Permits and Regulatory Compliance**						
11.01	Local Permits	1 - 1	EA	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
11.02							
				Permits and Regulatory Compliance Subtotal:	*$50,000 - $50,000*	*$50,000*	
				SUBTOTAL (BARE):	**$1,079,385 - $1,079,385**	**$4,238,690**	
				CONTINGENCY (20%):	**$215,877 - $215,877**	**$847,738**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,295,262 - $1,295,262**	**$5,086,428**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Ex-Situ Treatment (450 gpm)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**General**						
1.01	Operations, Monitoring and Reporting	0 - 0	HR	$80. - $80.	$0 - $0	$0	6
1.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	6
1.03	Equipment Rental (tools, instruments)	0 - 0	MO	$500. - $500.	$0 - $0	$0	6
1.04	Forklift Rental	0 - 0	MO	$1,500. - $1,500.	$0 - $0	$0	6
1.05	Other (Office Supplies, transportation, comm., etc.)	0 - 0	MO	$2,500. - $2,500.	$0 - $0	$0	6
1.06	Sludge Disposal	0 - 0	LB	$0.36 - $0.36	$0 - $0	$0	6
1.07	10% fee on expenses	0 - 0	LS	$147,000. - $147,000.	$0 - $0	$0	6
2.00	**Chemicals**						
2.01	FeCl2 (35% Solution)	0 - 0	LB	$0.4 - $0.4	$0 - $0	$0	6
2.02	Filtration Polymer	0 - 0	LB	$5. - $5.	$0 - $0	$0	6
2.03	Dewatering Polymer	0 - 0	LB	$5. - $5.	$0 - $0	$0	6
2.04	Acid	0 - 0	LB	$0.09 - $0.09	$0 - $0	$0	6
2.05	Caustic	0 - 0	LB	$0.25 - $0.25	$0 - $0	$0	6
2.06	Anti-Scalant	0 - 0	LB	$2. - $2.	$0 - $0	$0	6
3.00	**Analytical**						
3.01	Supplies	0 - 0	LS	$120,000. - $120,000.	$0 - $0	$0	6
3.02	Consumables	0 - 0	LS	$40,000. - $40,000.	$0 - $0	$0	6
3.03	QC Samples	0 - 0	EA	$105. - $105.	$0 - $0	$0	6
3.04	Other (Water Chemistry, Misc.)	0 - 0	WK	$200. - $200.	$0 - $0	$0	6
3.05	Lab Courier	0 - 0	TRIP	$130. - $130.	$0 - $0	$0	6
				SUBTOTAL (BARE):	**$0 - $0**	**$0**	
				CONTINGENCY (10%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$0 - $0**	**$0**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Ex-Situ Treatment (Chem Precip)		100.0%	$ 4,238,690	$ 847,738	$ 5,086,428
Non-Specific	**TOTAL:**	**100%**	**$ 4,238,690**	**$ 847,738**	**$ 5,086,428**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
Ex-Situ Treatment (Chem Precip)		$ -	$ -	$ -
	TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	12% of total project capital cost
3	7% of total project capital cost
4	8% of total project capital cost
5	50% of Construction Management cost
6	Ex-situ treatment O&M north of Highway 58 combined with estimate south of Highway 58, and presented on a separate page

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Ex-Situ Treatment O&M (Alt 4C-3)		**Date:**	**29-Aug-11**

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**General**						
1.01	Operations, Monitoring and Reporting	21,924 - 21,924	HR	$80. - $80.	$1,753,920 - $1,753,920	$1,753,920	1, 2
1.02	Electricity	2,385,491 - 2,385,491	KWH	$0.12 - $0.18	$286,259 - $429,388	$357,824	1
1.03	Equipment Rental (tools, instruments)	9 - 9	MO	$1,000. - $1,000.	$9,000 - $9,000	$9,000	1
1.04	Forklift Rental	6 - 6	MO	$1,500. - $1,500.	$9,000 - $9,000	$9,000	1
1.05	Other (Office Supplies, transportation, comm., etc.)	9 - 9	MO	$3,750. - $3,750.	$33,750 - $33,750	$33,750	1
1.06	Sludge Disposal	40,000 - 40,000	LB	$0.36 - $0.36	$14,400 - $14,400	$14,400	1
1.07	10% fee on expenses	1 - 1	LS	$147,000. - $147,000.	$147,000 - $147,000	$147,000	1
2.00	**Chemicals**						
2.01	FeCl2 (35% Solution)	12,637 - 12,637	LB	$0.4 - $0.4	$5,055 - $5,055	$5,055	1
2.02	Filtration Polymer	4,320 - 4,320	LB	$5. - $5.	$21,599 - $21,599	$21,599	1
2.03	Dewatering Polymer	4,320 - 4,320	LB	$5. - $5.	$21,599 - $21,599	$21,599	1
2.04	Acid	177,300 - 177,300	LB	$0.09 - $0.09	$15,957 - $15,957	$15,957	1
2.05	Caustic	141,840 - 141,840	LB	$0.25 - $0.25	$35,460 - $35,460	$35,460	1
2.06	Anti-Scalant	451,310 - 451,310	LB	$2. - $2.	$902,619 - $902,619	$902,619	1
3.00	**Analytical**						
3.01	Supplies	2 - 2	LS	$120,000. - $120,000.	$240,000 - $240,000	$240,000	1
3.02	Consumables	2 - 2	LS	$40,000. - $40,000.	$80,000 - $80,000	$80,000	1
3.03	QC Samples	104 - 104	EA	$105. - $105.	$10,920 - $10,920	$10,920	1
3.04	Other (Water Chemistry, Misc.)	104 - 104	WK	$200. - $200.	$20,800 - $20,800	$20,800	1
3.05	Lab Courier	104 - 104	TRIP	$130. - $130.	$13,520 - $13,520	$13,520	1
				SUBTOTAL (BARE):	**$3,620,858 - $3,763,988**	**$3,692,423**	
				CONTINGENCY (10%):	**$362,086 - $376,399**	**$369,242**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$3,982,944 - $4,140,386**	**$4,061,665**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Ex-Situ Treatment (Chem Precip)		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Ex-Situ Treatment (Chem Precip)		$ 3,692,423	$ 369,242	$ 4,061,665
	TOTAL:	**$ 3,692,423**	**$ 369,242**	**$ 4,061,665**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Scaled up from 1,000 gpm and 200 gpm plant O&M labor totals based on FS and Addendum #1 alternatives that include ex-situ treatment

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C-3 (0-20 yrs) - Piping & Wells Module		Date: 13-Sep-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$419,840. - $419,840.	$419,840. - $419,840.	$419,840	1, 2
2.02							
				Design and Contractor Bidding / Procurement Subtotal:	*$419,840 - $419,840*	*$419,840*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$419,840. - $419,840.	$419,840. - $419,840.	$419,840	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$209,920. - $209,920.	$209,920. - $209,920.	$209,920	1, 3
5.04							
				Construction Monitoring and Site Security Subtotal:	*$639,760 - $639,760*	*$639,760*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0. - $0.	$0	1, 4
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0. - $0.	$0	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0. - $0.	$0	1, 6
6.04	Influent Piping	2,130 - 2,130	LF	$80. - $80.	$170,400. - $170,400.	$170,400	1, 7
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0. - $0.	$0	1
6.06	Effluent Piping	22,050 - 22,050	LF	$80. - $80.	$1,764,000. - $1,764,000.	$1,764,000	1, 8
6.07	Injection Wells	19 - 19	EA	$116,000. - $116,000.	$2,204,000. - $2,204,000.	$2,204,000	1, 9
6.08	Road Crossing - Surface Cut	3 - 3	LS	$20,000. - $20,000.	$60,000. - $60,000.	$60,000	1
				Systems / Equipment Install / Field Labor Subtotal:	*$4,198,400 - $4,198,400*	*$4,198,400*	
				SUBTOTAL (BARE):	**$5,258,000 - $5,258,000**	**$5,258,000**	
				CONTINGENCY (20%):	**$1,051,600 - $1,051,600**	**$1,051,600**	
				TOTAL ESTIMATED CAPITAL COST:	**$6,309,600 - $6,309,600**	**$6,309,600**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
SCRIA Extraction	0.0%	$ -
DVD Extraction	0.0%	$ -
Ranch or Other Extraction	4.1%	$ 256,087
Gorman Extraction	0.0%	$ -
Northern Plume Fringe	59.4%	$ 3,749,137
Southeast and East Plume Fringe	0.0%	$ -
Southern Plume Fringe	36.5%	$ 2,304,376
Southwest Plume Fringe	0.0%	$ -
	100.0%	$ 6,309,600

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 (0-20 yrs) - Piping & Wells Module		Date: 13-Sep-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1, 10
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	37,261 - 37,261	KWH	$0.12 - $0.18	$4,471 - $6,707	$5,589	1, 11
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1, 10
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	27,428 - 27,428	KWH	$0.12 - $0.18	$3,291 - $4,937	$4,114	1, 12
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1, 10
3.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.05	Electricity	98,483 - 98,483	KWH	$0.12 - $0.18	$11,818 - $17,727	$14,772	1, 13
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	10 - 10	WELL	$24,600. - $24,600.	$246,000 - $246,000	$246,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1
5.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	9 - 9	WELL	$24,600. - $24,600.	$221,400 - $221,400	$221,400	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$546,981 - $556,771**	**$551,876**	
				CONTINGENCY (10%):	**$54,698 - $55,677**	**$55,188**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$601,679 - $612,448**	**$607,064**	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 (0-20 yrs) - Piping & Wells Module		Date: 13-Sep-11

CAPITAL COSTS

	ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction	0.0%	$ -	$ -	$ -
DVD Extraction	0.0%	$ -	$ -	$ -
Ranch or Other Extraction	4.1%	$ 213,406	$ 42,681	$ 256,087
Gorman Extraction	0.0%	$ -	$ -	$ -
Northern Plume Fringe	59.4%	$ 3,124,281	$ 624,856	$ 3,749,137
Southeast and East Plume Fringe	0.0%	$ -	$ -	$ -
Southern Plume Fringe	36.5%	$ 1,920,313	$ 384,063	$ 2,304,376
Southwest Plume Fringe	0.0%	$ -	$ -	$ -
Non-Specific — **TOTAL:**	**100%**	**$ 5,258,000**	**$ 1,051,600**	**$ 6,309,600**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ -	$ -	$ -
DVD Extraction	$ 15,589	$ 1,559	$ 17,148
Ranch or Other Extraction	$ 24,772	$ 2,477	$ 27,250
Gorman Extraction	$ 14,114	$ 1,411	$ 15,526
Northern Plume Fringe	$ 256,000	$ 25,600	$ 281,600
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ 241,400	$ 24,140	$ 265,540
Southwest Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 551,876**	**$ 55,188**	**$ 607,064**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	Per 2009 Well Installation: Development + analytical cost/well
7	$/lf includes piping + conduit + pullboxes
8	$/lf includes piping + conduit + pullboxes
9	Per 2009 work: Well installation: $54K + $7K + $9K (development) + $18K downhole equip + $28K wellhead mech/elect - 130 foot, 8-inch diameter well
10	Excess flow from AU EWs is treated ex-situ and injected. O&M costs for the EWs are covered under AU and Northern and southern Extraction O&M costs
11	180 gpm @ 100' head
12	132.5 gpm @ 100' head
13	475.75 gpm @ 100' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 (20+ yrs) - Piping & Wells Module		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**DVD Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
1.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.05	Electricity	37,261 - 37,261	KWH	$0.12 - $0.18	$4,471 - $6,707	$5,589	1, 3
2.00	**Gorman Extraction**						
2.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
2.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1, 2
2.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
2.05	Electricity	27,428 - 27,428	KWH	$0.12 - $0.18	$3,291 - $4,937	$4,114	1, 4
3.00	**Ranch or Other Extraction**						
3.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
3.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1, 2
3.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
3.05	Electricity	67,432 - 67,432	KWH	$0.12 - $0.18	$8,092 - $12,138	$10,115	1, 5
4.00	**Northern Plume Fringe**						
4.01	Scaled Operating Cost (per injection well)	10 - 10	WELL	$24,600. - $24,600.	$246,000 - $246,000	$246,000	1
4.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
4.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.04	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
4.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
5.00	**Southeast and East Plume Fringe**						
5.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
5.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
5.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1
5.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1
5.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
6.00	**Southern Plume Fringe**						
6.01	Scaled Operating Cost (per injection well)	9 - 9	WELL	$24,600. - $24,600.	$221,400 - $221,400	$221,400	1
6.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
6.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.04	Project Management	1 - 1	YR	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
6.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
7.00	**Southwest Plume Fringe**						
7.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1
7.02	Scaled Operating Cost (per extraction well)	0 - 0	WELL	$12,320. - $12,320.	$0 - $0	$0	1
7.03	Quarterly Compliance Reporting	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.04	Project Management	0 - 0	YR	$5,000. - $5,000.	$0 - $0	$0	1
7.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1
				SUBTOTAL (BARE):	**$543,255 - $551,182**	**$547,218**	
				CONTINGENCY (10%):	**$54,325 - $55,118**	**$54,722**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$597,580 - $606,300**	**$601,940**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Alt 4C-3 (20+ yrs) - Piping & Wells Module		**Date:**	**29-Aug-11**

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch or Other Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Southwest Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
SCRIA Extraction		$ -	$ -	$ -
DVD Extraction		$ 15,589	$ 1,559	$ 17,148
Ranch or Other Extraction		$ 20,115	$ 2,011	$ 22,126
Gorman Extraction		$ 14,114	$ 1,411	$ 15,526
Northern Plume Fringe		$ 256,000	$ 25,600	$ 281,600
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ 241,400	$ 24,140	$ 265,540
Southwest Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 547,218**	**$ 54,722**	**$ 601,940**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Excess flow from AU EWs is treated ex-situ and injected. O&M costs for the EWs are covered under AU and Northern and southern Extraction O&M costs
3	180 gpm @ 100' head
4	132.5 gpm @ 100' head
5	325.75 gpm @ 100' head

Cost Detail Sheets for Alternative 4C-4 In-Situ and Enhanced Agricultural Treatment - Continuous Pumping

Hinkley Feasibility Study - Addendum #3

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Northwest Freshwater Injection at 80 gpm		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northwest Freshwater Injection**						
1.01	Scaled Operating Cost (per injection well)	4 - 4	EA	$24,600 - $24,600	$98,400 - $98,400	$98,400	1
1.02	Scaled Operating Cost (per extraction well)	1 - 1	YR	$12,320 - $12,320	$12,320 - $12,320	$12,320	1
1.03	Quarterly Compliance Reporting	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.04	Project Management	1 - 1	YR	$10,000 - $10,000	$10,000 - $10,000	$10,000	1
1.05	Electricity	33,121 - 33,121	KWH	$0.12 $0.18	$3,975 - $5,962	$4,968	1, 2
1.06							
				SUBTOTAL (BARE):	**$134,695 - $136,682**	**$135,688**	
				CONTINGENCY (10%):	**$13,469 - $13,668**	**$13,569**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$148,164 - $150,350**	**$149,257**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northwest Freshwater Injection		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northwest Freshwater Injection	$ 135,688	$ 13,569	$ 149,257
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 135,688**	**$ 13,569**	**$ 149,257**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	PGE-14; 80 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Scaled O&M Costs per Injection Well and Extraction Well		Date: 28-Jun-10

Injection Well Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Monthly injection well backwashing - Labor	24	144	HRS	$70	$70	$ 5,880	1 to 6 hours/well per month with 2 people
Routine - Monthly injection well backwashing - Expenses	2	12	MO	$500	$500	$ 3,500	estimate
Routine - Weekly injection well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well per week with 2 people
Routine - Weekly injection well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Non-routine - Annual injection well redevelopment - Labor	15	15	HRS	$70	$70	$ 1,050	3 days/well, 10 hrs/day (every other year)
Non-routine - Annual injection well redevelopment - Expenses	0.5	0.5	LS	$500	$500	$ 250	estimate (every other year)
Non-routine - Annual injection well redevelopment - Driller	1.5	1.5	DAYS	$3,000	$3,000	$ 4,500	3 days/well, $3,000/day (every other year)
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$5,000	$5,000	$ 5,000	Assume each injection well sampled quarterly, plus one downgradient monitoring well per injection well (in addition to normal plume monitoring)
						$ 24,600	= per injection well cost

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	26	26	HRS	$70	$70	$ 1,820	0.25 hours/well with 2 people
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Quarterly Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$2,500	$2,500	$ 2,500	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0.75	0.75	DAYS	$3,000	$3,000	$ 2,250	3 days/well, $3,000/day (every 4 years)
						$ 12,320	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - Current		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	1 - 1	YR	$235,000 - $235,000.	$235,000 - $235,000	$235,000	1
1.02	Data Management	1 - 1	YR	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
1.03	Reporting	1 - 1	YR	$97,000. - $97,000	$97,000 - $97,000	$97,000	1, 2
1.04							
				SUBTOTAL (BARE):	**$382,000 - $382,000**	**$382,000**	
				CONTINGENCY (10%):	**$38,200 - $38,200**	**$38,200**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$420,200 - $420,200**	**$420,200**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 382,000	$ 38,200	$ 420,200
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 382,000**	**$ 38,200**	**$ 420,200**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 75% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.75 - 0.75	YR	$235,000 - $235,000.	$176,250 - $176,250	$176,250	1
1.02	Data Management	0.75 - 0.75	YR	$50,000. - $50,000.	$37,500 - $37,500	$37,500	1
1.03	Reporting	0.75 - 0.75	YR	$97,000. - $97,000	$72,750 - $72,750	$72,750	1, 2
1.04							
				SUBTOTAL (BARE):	**$286,500 - $286,500**	**$286,500**	
				CONTINGENCY (10%):	**$28,650 - $28,650**	**$28,650**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$315,150 - $315,150**	**$315,150**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP		$ 286,500	$ 28,650	$ 315,150
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 286,500**	**$ 28,650**	**$ 315,150**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report
Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)	

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Groundwater Monitoring Program - 50% of Current Program		Date: 28-Jun-10

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**GMP Including BCMP**						
1.01	GMP (Sample Collection & Laboratory Analysis)	0.5 - 0.5	YR	$235,000 - $235,000.	$117,500 - $117,500	$117,500	1
1.02	Data Management	0.5 - 0.5	YR	$50,000. - $50,000.	$25,000 - $25,000	$25,000	1
1.03	Reporting	0.5 - 0.5	YR	$97,000. - $97,000	$48,500 - $48,500	$48,500	1, 2
1.04							
				SUBTOTAL (BARE):	**$191,000 - $191,000**	**$191,000**	
				CONTINGENCY (10%):	**$19,100 - $19,100**	**$19,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$210,100 - $210,100**	**$210,100**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
GMP Including BCMP		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
GMP Including BCMP	$ 191,000	$ 19,100	$ 210,100
DVD Extraction	$ -	$ -	$ -
Ranch Extraction	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 191,000**	**$ 19,100**	**$ 210,100**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Added semi-annual performance report

Includes GMP and BCMP programs per Water Board Order No. R6V-2008-0002 on various sampling schedules (i.e., annual, semiannual and quarterly)

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-4 - Northern Extraction		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	\$388,160. - \$388,160.	\$388,160 - \$388,160	\$388,160	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***\$388,160 - \$388,160***	***\$388,160***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	\$388,160. - \$388,160.	\$388,160 - \$388,160	\$388,160	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	\$10,000. - \$10,000.	\$10,000 - \$10,000	\$10,000	1
5.03	Project Management through Startup	1 - 1	LS	\$194,080. - \$194,080.	\$194,080 - \$194,080	\$194,080	1, 3
				Construction Monitoring and Site Security Subtotal:	***\$592,240 - \$592,240***	***\$592,240***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	19 - 19	EA	\$73,000. - \$73,000.	\$1,387,000 - \$1,387,000	\$1,387,000	1, 4
6.02	Well Completion	7 - 7	EA	\$53,000. - \$53,000.	\$371,000 - \$371,000	\$371,000	1, 5
6.03	Well Rehab	0 - 0	EA	\$9,000. - \$9,000.	\$0 - \$0	\$0	1
6.04	Influent Piping	26,545 - 26,545	LF	\$80. - \$80.	\$2,123,600 - \$2,123,600	\$2,123,600	1, 6
6.05	Bore & Jack	0 - 0	LS	\$570,000. - \$570,000.	\$0 - \$0	\$0	1
6.06	Effluent Piping	0 - 0	LF	\$80. - \$80.	\$0 - \$0	\$0	1
6.07	Injection Wells	0 - 0	EA	\$116,000. - \$116,000.	\$0 - \$0	\$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***\$3,881,600 - \$3,881,600***	***\$3,881,600***	
				SUBTOTAL (BARE):	**\$4,862,000 - \$4,862,000**	**\$4,862,000**	
				CONTINGENCY (20%):	**\$972,400 - \$972,400**	**\$972,400**	
				TOTAL ESTIMATED CAPITAL COST:	**\$5,834,400 - \$5,834,400**	**\$5,834,400**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	\$24,600. - \$24,600.	\$0 - \$0	\$0	7
1.02	Scaled Operating Cost (per extraction well)	7 - 7	WELL	\$7,285. - \$7,285.	\$50,995 - \$50,995	\$50,995	7
1.03	Quarterly Compliance Reporting	0 - 0	YR	\$10,000. - \$10,000.	\$0 - \$0	\$0	7
1.04	Project Management	0 - 0	YR	\$10,000. - \$10,000.	\$0 - \$0	\$0	7
1.05	Electricity	0 - 0	KWH	\$0.12 - \$0.18	\$0 - \$0	\$0	7
				SUBTOTAL (BARE):	**\$50,995 - \$50,995**	**\$50,995**	
				CONTINGENCY (10%):	**\$5,100 - \$5,100**	**\$5,100**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**\$56,095 - \$56,095**	**\$56,095**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	\$ 4,862,000	\$ 972,400	\$ 5,834,400
Gorman Extraction		0.0%	\$ -	\$ -	\$ -
Central Area IRZ / Injection		0.0%	\$ -	\$ -	\$ -
SCRIA / Dosed Injection		0.0%	\$ -	\$ -	\$ -
Source Area IRZ / Injection		0.0%	\$ -	\$ -	\$ -
Non-Specific	**TOTAL:**	**100%**	**\$ 4,862,000**	**\$ 972,400**	**\$ 5,834,400**

O&M COSTS		**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction		\$ 50,995	\$ 5,100	\$ 56,095
Gorman Extraction		\$ -	\$ -	\$ -
Central Area IRZ / Injection		\$ -	\$ -	\$ -
SCRIA / Dosed Injection		\$ -	\$ -	\$ -
Source Area IRZ / Injection		\$ -	\$ -	\$ -
Southeast and East Plume Fringe		\$ -	\$ -	\$ -
Southern Plume Fringe		\$ -	\$ -	\$ -
	TOTAL:	**\$ 50,995**	**\$ 5,100**	**\$ 56,095**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-4 - Northern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Scaled O&M Costs for AU Extraction Wells located off the AU property		**Date: 29-Aug-11**

Extraction Well O&M Cost Estimate

Description	Quantity Low	Quantity High	Units	Unit Cost Low	Unit Cost High	Midpoint Cost	Notes
Routine - Weekly extraction well inspection - Labor	13	13	HRS	$70	$70	$ 910	0.25 hours/well with 1 person
Routine - Weekly extraction well inspection - Expenses	52	52	WKS	$50	$50	$ 2,600	estimate
Annual Compliance Sampling (Fieldwork/Analytical/Data Mgt)	1	1	YR	$625	$625	$ 625	Assume each extraction well sampled quarterly; no additional monitoring required (except general plume monitoring)
Equipment Replacement Allowance	1	1	YR	$2,500	$2,500	$ 2,500	
Non-routine - Annual injection well redevelopment - Labor	7.5	7.5	HRS	$70	$70	$ 525	3 days/well, 10 hrs/day (every 4 years)
Non-routine - Annual injection well redevelopment - Expenses	0.25	0.25	LS	$500	$500	$ 125	estimate (every 4 years)
Non-routine - Annual injection well redevelopment - Driller	0	0	DAYS	$3,000	$3,000	$ -	3 days/well, $3,000/day (every 4 years)
						$ 7,285	= per extraction well cost + Electricity
Electricity	=((A*B)/3956)*0.746*24*365/(0.84*0.95)					$ XX	A = Flow rate; B = total head

Other

<u>Other costs not directly scalable:</u>

Quarterly Compliance Reporting	(between $15K and $40K)
Project Management	(between $15K and $40K)

Will range between $15,00 and $40,000 depending on the number of wells.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-4 - Southern Extraction		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$184,320. - $184,320.	$184,320 - $184,320	$184,320	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$184,320 - $184,320***	***$184,320***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$184,320. - $184,320.	$184,320 - $184,320	$184,320	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$92,160. - $92,160.	$92,160 - $92,160	$92,160	1, 3
				Construction Monitoring and Site Security Subtotal:	***$286,480 - $286,480***	***$286,480***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	12,090 - 12,090	LF	$80. - $80.	$967,200 - $967,200	$967,200	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	***$1,843,200 - $1,843,200***	***$1,843,200***	
				SUBTOTAL (BARE):	**$2,314,000 - $2,314,000**	**$2,314,000**	
				CONTINGENCY (20%):	**$462,800 - $462,800**	**$462,800**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,776,800 - $2,776,800**	**$2,776,800**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	7
1.02	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$7,285. - $7,285.	$21,855 - $21,855	$21,855	7
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	7
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	7
				SUBTOTAL (BARE):	**$21,855 - $21,855**	**$21,855**	
				CONTINGENCY (10%):	**$2,186 - $2,186**	**$2,186**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$24,041 - $24,041**	**$24,041**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Southern Extraction		100.0%	$ 2,314,000	$ 462,800	$ 2,776,800
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,314,000**	**$ 462,800**	**$ 2,776,800**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Southern Extraction	$ 21,855	$ 2,186	$ 24,041
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 21,855**	**$ 2,186**	**$ 24,041**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-4 - Southern Extraction		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	O&M costs covered under AU O&M estimate

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 - Northern Extraction (10 yrs)		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED CAPITAL COSTS							
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$195,180. - $195,180.	$195,180 - $195,180	$195,180	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	***$195,180 - $195,180***	***$195,180***	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$195,180. - $195,180.	$195,180 - $195,180	$195,180	1, 2
5.02	Vendor Support During Fabrication and Testing	1 - 1	LS	$10,000. - $10,000.	$10,000 - $10,000	$10,000	1
5.03	Project Management through Startup	1 - 1	LS	$97,590. - $97,590.	$97,590 - $97,590	$97,590	1, 3
				Construction Monitoring and Site Security Subtotal:	***$302,770 - $302,770***	***$302,770***	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	12 - 12	EA	$73,000. - $73,000.	$876,000 - $876,000	$876,000	1, 4
6.02	Well Completion	12 - 12	EA	$53,000. - $53,000.	$636,000 - $636,000	$636,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	5,310 - 5,310	LF	$80. - $80.	$424,800 - $424,800	$424,800	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
6.08	Pressure Boosting System	1 - 1	EA	$15,000. - $15,000.	$15,000 - $15,000	$15,000	1, 7
				Systems / Equipment Install / Field Labor Subtotal:	***$1,951,800 - $1,951,800***	***$1,951,800***	
				SUBTOTAL (BARE):	**$2,449,750 - $2,449,750**	**$2,449,750**	
				CONTINGENCY (20%):	**$489,950 - $489,950**	**$489,950**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,939,700 - $2,939,700**	**$2,939,700**	

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	8
1.02	Scaled Operating Cost (per off-site AU extraction well)	19 - 19	WELL	$7,285. - $7,285.	$138,415 - $138,415	$138,415	8
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	9
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	9
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	7, 8
				SUBTOTAL (BARE):	**$142,415 - $142,415**	**$142,415**	
				CONTINGENCY (10%):	**$14,242 - $14,242**	**$14,242**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$156,657 - $156,657**	**$156,657**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Extraction		100.0%	$ 2,449,750	$ 489,950	$ 2,939,700
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 2,449,750**	**$ 489,950**	**$ 2,939,700**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Extraction	$ 142,415	$ 14,242	$ 156,657
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 142,415**	**$ 14,242**	**$ 156,657**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-3 - Northern Extraction (10 yrs)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.
8	O&M costs not already covered under AU O&M estimate
9	O&M costs already covered under AU O&M estimate

PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C - Northern Extraction (20 yrs)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per injection well)	0 - 0	WELL	$24,600. - $24,600.	$0 - $0	$0	1,2
1.02	Scaled Operating Cost (per off-site AU extraction well)	12 - 12	WELL	$7,285. - $7,285.	$87,420 - $87,420	$87,420	1,2
1.03	Quarterly Compliance Reporting	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.04	Project Management	0 - 0	YR	$10,000. - $10,000.	$0 - $0	$0	1,3
1.05	Electricity	0 - 0	KWH	$0.12 - $0.18	$0 - $0	$0	1,3
1.06	Pressure Boosting System	1 - 1	YR	$4,000. - $4,000.	$4,000 - $4,000	$4,000	1,2,4
				SUBTOTAL (BARE):	**$91,420 - $91,420**	**$91,420**	
				CONTINGENCY (10%):	**$9,142 - $9,142**	**$9,142**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$100,562 - $100,562**	**$100,562**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		100.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ -**	**$ -**	**$ -**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Northern Extraction	$ 91,420	$ 9,142	$ 100,562
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 91,420**	**$ 9,142**	**$ 100,562**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	O&M costs not already covered under AU O&M estimate
3	O&M costs already covered under AU O&M estimate
4	Pressure boosting system to include small pump with controls and actuated valve(s). System will be surrounded by a fence.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction (4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	EA	$12,320 - $12,320	$36,960 - $36,960	$36,960	1, 2
1.02	Electricity	80,732 - 80,732	KWH	$0.12 - $0.18	$9,688 - $14,532	$12,110	1, 2
1.03	Quarterly Compliance Reporting	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.04	Project Management	1 - 1	YR	$5,000 - $5,000	$5,000 - $5,000	$5,000	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$56,648 - $61,492**	**$59,070**	
				CONTINGENCY (10%):	**$5,665 - $6,149**	**$5,907**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$62,313 - $67,641**	**$64,977**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 59,070	$ 5,907	$ 64,977
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 59,070**	**$ 5,907**	**$ 64,977**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	3 SCRIA Wells supporting SCRIA only. The remaining wells support AUs, and extraction well O&M costs are covered elsewhere; 195 gpm total @ 200' head

ALTERNATIVE 4C-4: TABLE 12
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$44,040 - $44,040*	*$44,040*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$44,040. - $44,040.	$44,040 - $44,040	$44,040	1, 2
5.02	Project Management through Startup	1 - 1	LS	$22,020. - $22,020.	$22,020 - $22,020	$22,020	1, 3
				Construction Monitoring and Site Security Subtotal:	*$66,060 - $66,060*	*$66,060*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Extraction Well - Installation	3 - 3	EA	$73,000. - $73,000.	$219,000 - $219,000	$219,000	1, 4
6.02	Well Completion	3 - 3	EA	$53,000. - $53,000.	$159,000 - $159,000	$159,000	1, 5
6.03	Well Rehab	0 - 0	EA	$9,000. - $9,000.	$0 - $0	$0	1
6.04	Influent Piping	780 - 780	LF	$80. - $80.	$62,400 - $62,400	$62,400	1, 6
6.05	Bore & Jack	0 - 0	LS	$570,000. - $570,000.	$0 - $0	$0	1
6.06	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.07	Injection Wells	0 - 0	EA	$116,000. - $116,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$440,400 - $440,400*	*$440,400*	
				SUBTOTAL (BARE):	**$550,500 - $550,500**	**$550,500**	
				CONTINGENCY (20%):	**$110,100 - $110,100**	**$110,100**	
				TOTAL ESTIMATED CAPITAL COST:	**$660,600 - $660,600**	**$660,600**	

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Extraction**						
1.01	Scaled Operating Cost (per extraction well)	3 - 3	WELL	$12,320. - $12,320.	$36,960 - $36,960	$36,960	1, 7
1.02	Quarterly Compliance Reporting	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.03	Project Management	1 - 1	YR	$5,000. - $5,000.	$5,000 - $5,000	$5,000	1
1.04	Electricity	24,841 - 24,841	KWH	$0.12 - $0.18	$2,981 - $4,471	$3,726	1, 8
				SUBTOTAL (BARE):	**$49,941 - $51,431**	**$50,686**	
				CONTINGENCY (10%):	**$4,994 - $5,143**	**$5,069**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$54,935 - $56,574**	**$55,755**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Extraction		0.0%	$ -	$ -	$ -
Gorman Extraction		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA Extraction		100.0%	$ 550,500	$ 110,100	$ 660,600
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 550,500**	**$ 110,100**	**$ 660,600**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction	$ 50,686	$ 5,069	$ 55,755
Gorman Extraction	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 50,686**	**$ 5,069**	**$ 55,755**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:** 36385
DVD/SCRIA Extraction Alt 4C (60 gpm)		**Date:** 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% of Total Capital Cost
3	5% of Total Capital Cost
4	Per 2009 Well Installation: $57K (Layne + 5% Northstar markup) + $7K Northstar Labor + $9K development - 180 foot, 8-inch diameter well
5	Per Ahtna bid: $25.5K downhole + $27.5K Vault Mechanical/Electrical
6	$/lf includes piping + conduit + pullboxes
7	3 new extraction wells; O&M for the rest of the SCRIA Extraction wells are covered under separate estimates
8	60 gpm @ 200' head

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
SCRIA Extraction at 170 gpm for low dose (Alt 4C)		Date: 29-Aug-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**SCRIA Extraction**						
1.01	Scaled Operating Cost (per extraction well)	1 - 1	EA	$12,320 - $12,320	$12,320 - $12,320	$12,320	1, 2
1.02	Electricity	70,382 - 70,382	KWH	$0.12 - $0.18	$8,446 - $12,669	$10,557	1, 3
1.03	Quarterly Compliance Reporting	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.04	Project Management	1 - 1	YR	$2,500 - $2,500	$2,500 - $2,500	$2,500	1
1.05							
1.06							
				SUBTOTAL (BARE):	**$25,766 - $29,989**	**$27,877**	
				CONTINGENCY (10%):	**$2,577 - $2,999**	**$2,788**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$28,342 - $32,988**	**$30,665**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
SCRIA Extraction		0.0%	$ -	$ -	$ -
DVD Extraction		0.0%	$ -	$ -	$ -
Ranch Extraction		0.0%	$ -	$ -	$ -
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**0%**	**$ -**	**$ -**	**$ -**

O&M COSTS

		SUBTOTAL	CONT. (10%)	TOTAL
SCRIA Extraction		$ 27,877	$ 2,788	$ 30,665
DVD Extraction		$ -	$ -	$ -
Ranch Extraction		$ -	$ -	$ -
Southeast and East Plume Fringe		$ -	$ -	$ -
Southern Plume Fringe		$ -	$ -	$ -
	TOTAL:	**$ 27,877**	**$ 2,788**	**$ 30,665**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	1 SCRIA Well not already covered by AU O&M estimate; 110 gpm total @ 200' head
3	170 gpm total @ 200' head

ALTERNATIVE 4C-4: TABLE 14
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY, CALIFORNIA

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$125,000. - $150,000.	$125,000. - $150,000.	$137,500	1
1.02	Bidding Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.03	Procurement Costs	1 - 1	LS	$15,000. - $25,000.	$15,000. - $25,000.	$20,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$204,589 - $269,114***	***$236,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	12 - 12	EA	$15,000. - $20,000.	$180,000. - $240,000.	$210,000	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$180,000 - $240,000***	***$210,000***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$225,000. - $310,000.	$225,000. - $310,000.	$267,500	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$225,000 - $310,000***	***$267,500***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	12 - 12	EA	$30,000. - $40,000.	$360,000. - $480,000.	$420,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	40 - 40	EA	$30,000. - $40,000.	$1,200,000. - $1,600,000.	$1,400,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$100,000. - $120,000.	$100,000. - $120,000.	$110,000	1
5.09	Electrical, Instrumentation and Controls Components	1 - 1	LS	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	52 - 52	EA	$12,000. - $14,500.	$624,000. - $754,000.	$689,000	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	22,634 - 22,634	LF	$75. - $100.	$1,697,550. - $2,263,400.	$1,980,475	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
5.14	Equipment Installation	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.15	Mechanical Installation	1 - 1	LS	$80,000. - $90,000.	$80,000. - $90,000.	$85,000	1
5.16	Electrical Installation	1 - 1	LS	$235,000. - $260,000.	$235,000. - $260,000.	$247,500	1
5.17	Central Area Modifications	1 - 1	LS	$500,000. - $500,000.	$500,000. - $500,000.	$500,000	1, 4
5.18	Road Crossing - Surface Cut	4 - 4	LS	$20,000. - $20,000.	$80,000. - $80,000.	$80,000	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.20							
				Systems / Equipment Install / Field Labor Subtotal:	***$5,136,550 - $6,587,400***	***$5,861,975***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$75,000. - $100,000.	$75,000. - $100,000.	$87,500	1
6.02							
				Treatment System Startup Subtotal:	***$75,000 - $100,000***	***$87,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$5,872,139 - $7,608,514**	**$6,740,327**	
				CONTINGENCY (20%):	**$1,174,428 - $1,521,703**	**$1,348,065**	
				TOTAL ESTIMATED CAPITAL COST:	**$7,046,567 - $9,130,217**	**$8,088,392**	

CAPITAL COST DISTRIBUTION

REMEDY AREA	ALLOCATION	TOTAL
Northern Injection	0.0%	$ -
Central Area IRZ / Injection	25.7%	$ 2,077,153
SCRIA / Dosed Injection	36.2%	$ 2,927,479
Source Area IRZ / Injection	38.1%	$ 3,083,759
	100.0%	$ 8,088,392

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	8,509 - 8,509	KWH	$0.12 - $0.18	$1,021. - $1,532.	$1,276	1
4.03	Biological / Chemical Consumables	32,876 - 32,876	GAL	$5. - $6.	$164,381. - $197,258.	$180,820	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	302,930 - 302,930	KWH	$0.12 - $0.18	$36,352. - $54,527.	$45,440	1, 7
5.03	Biological / Chemical Consumables	25,289 - 25,289	GAL	$5. - $6.	$126,447. - $151,737.	$139,092	1, 8
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,507,024 - $2,501,964**	**$2,004,494**	
				CONTINGENCY (10%):	**$150,702 - $250,196**	**$200,449**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,657,727 - $2,752,160**	**$2,204,943**	

CAPITAL COSTS		**ALLOCATION**	**SUBTOTAL**	**CONT. (20%)**	**TOTAL**
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		25.7%	$ 1,730,961	$ 346,192	$ 2,077,153
SCRIA / Dosed Injection		36.2%	$ 2,439,566	$ 487,913	$ 2,927,479
Source Area IRZ / Injection		38.1%	$ 2,569,800	$ 513,960	$ 3,083,759
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 6,740,327**	**$ 1,348,065**	**$ 8,088,392**

O&M COSTS	**SUBTOTAL**	**CONT. (10%)**	**TOTAL**
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 434,739	$ 43,474	$ 478,213
Source Area IRZ / Injection	$ 747,246	$ 74,725	$ 821,971
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 2,004,494**	**$ 200,449**	**$ 2,204,943**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (0-5 years)		Date: 27-Jan-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
7	Derived at Compressor Station
8	150 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number:	36385
Alt 4A (5-10 years)		Date:	27-Jan-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$15,000. - $15,000.	$15,000. - $15,000.	$15,000	1
1.02	Bidding Costs	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.05	O&M Plan	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$42,500 - $49,500***	***$46,000***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$25,000. - $50,000.	$25,000. - $50,000.	$37,500	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$25,000 - $50,000***	***$37,500***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$50,000 - $50,000***	***$50,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	0 - 0	EA	$30,000. - $40,000.	$0. - $0.	$0	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$140,000. - $260,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	0 - 0	EA	$12,000. - $14,500.	$0. - $0.	$0	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	600 - 600	LF	$75. - $100.	$45,000. - $60,000.	$52,500	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	6 - 6	LS	$3,000. - $3,000.	$18,000. - $18,000.	$18,000	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$190,000 - $224,000***	***$207,000***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$10,000. - $15,000.	$10,000. - $15,000.	$12,500	1
6.02							
				Treatment System Startup Subtotal:	***$10,000 - $15,000***	***$12,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$318,500 - $390,500**	**$354,500**	
				CONTINGENCY (20%):	**$63,700 - $78,100**	**$70,900**	
				TOTAL ESTIMATED CAPITAL COST:	**$382,200 - $468,600**	**$425,400**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	83.7%	$ 356,104
	Source Area IRZ / Injection	16.3%	$ 69,296
		100.0%	$ 425,400

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (5-10 years)		Date: 27-Jan-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	4,364 - 4,364	KWH	$0.12 - $0.18	$524. - $785.	$655	1
4.03	Biological / Chemical Consumables	16,860 - 16,860	GAL	$5. - $6.	$84,298. - $101,158.	$92,728	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$140,000. - $260,000.	$140,000. - $260,000.	$200,000	1
5.02	Electricity	4,145 - 4,145	KWH	$0.12 - $0.18	$497. - $746.	$622	1
5.03	Biological / Chemical Consumables	16,017 - 16,017	GAL	$5. - $6.	$80,083. - $96,100.	$88,092	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$13,255.2 - $24,616.8	$13,255. - $24,617.	$18,936	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$163,800. - $304,200.	$155,610. - $288,990.	$222,300	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$50,578.5 - $93,931.5	$50,579. - $93,932.	$72,255	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,344,226 - $2,295,700**	**$1,819,963**	
				CONTINGENCY (10%):	**$134,423 - $229,570**	**$181,996**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,478,648 - $2,525,269**	**$2,001,959**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		83.7%	$ 296,753	$ 59,351	$ 356,104
Source Area IRZ / Injection		16.3%	$ 57,747	$ 11,549	$ 69,296
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 354,500**	**$ 70,900**	**$ 425,400**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 346,026	$ 34,603	$ 380,628
Source Area IRZ / Injection	$ 651,428	$ 65,143	$ 716,571
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,819,963**	**$ 181,996**	**$ 2,001,959**

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number: 36385**
Alt 4A (5-10 years)		**Date: 27-Jan-11**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	195 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Design Costs	1 - 1	LS	$25,000. - $45,000.	$25,000. - $45,000.	$35,000	1
1.02	Bidding Costs	1 - 1	LS	$15,000. - $20,000.	$15,000. - $20,000.	$17,500	1
1.03	Procurement Costs	1 - 1	LS	$7,500. - $14,500.	$7,500. - $14,500.	$11,000	1
1.04	Record Drawings	1 - 1	LS	$17,650. - $21,767.	$17,650. - $21,767.	$19,709	1
1.05	O&M Plan	1 - 1	LS	$21,939. - $27,347.	$21,939. - $27,347.	$24,643	1
1.06							
				Design and Contractor Bidding / Procurement Subtotal:	***$87,089 - $128,614***	***$107,852***	
2.00	**Performance Monitoring Well Installation**						
2.01	Well Install - Shallow	0 - 0	EA	$15,000. - $20,000.	$0. - $0.	$0	1
2.02							
				Performance Monitoring Well Installation Subtotal:	***$0 - $0***	***$0***	
3.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
3.01	Site Work Contractor - Mob/Demob	1 - 1	LS	$50,000. - $100,000.	$50,000. - $100,000.	$75,000	1
3.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $100,000***	***$75,000***	
4.00	**Construction Monitoring and Site Security**						
4.01	Construction Monitoring Field Labor and Office Support	1 - 1	LS	$100,000. - $150,000.	$100,000. - $150,000.	$125,000	1
4.02							
				Construction Monitoring and Site Security Subtotal:	***$100,000 - $150,000***	***$125,000***	
5.00	**Systems / Equipment Install / Field Labor**						
5.01	Extraction Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.02	Extraction Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.03	Injection Wells - Shallow	0 - 0	EA	$20,000. - $25,000.	$0. - $0.	$0	1, 2
5.04	Injection Wells - Dual Screen	3 - 3	EA	$30,000. - $40,000.	$90,000. - $120,000.	$105,000	1, 3
5.05	Carbon Storage Tank (Double Wall Steel Tank)	0 - 0	EA	$56,000. - $104,000.	$0. - $0.	$0	1
5.06	Building(s) (Modified Shipping Containers)	0 - 0	LS	$31,500. - $58,500.	$0. - $0.	$0	1
5.07	Chemical Feed Pumps	0 - 0	EA	$3,500. - $6,500.	$0. - $0.	$0	1
5.08	Mechanical Components (Pipe, Valves and Appurtenances	1 - 1	LS	$40,000. - $40,000.	$40,000. - $40,000.	$40,000	1
5.09	Electrical, Instrumentation and Controls Components	0 - 0	LS	$28,000. - $52,000.	$0. - $0.	$0	1
5.10	Reinforced Concrete (Tank Building Pads and Tanker Offlo	0 - 0	LS	$87,500. - $162,500.	$0. - $0.	$0	1
5.11	IRZ Well Head/Downhole Completion	6 - 6	EA	$12,000. - $14,500.	$72,000. - $87,000.	$79,500	1
5.12	Trenching, Subgrade Piping and Electrical Duct Bank	1,900 - 1,900	LF	$75. - $100.	$142,500. - $190,000.	$166,250	1
5.13	Miscellaneous Equipment/Materials (Remote Panels, Wire	1 - 1	LS	$20,000. - $30,000.	$20,000. - $30,000.	$25,000	1
5.14	Equipment Installation	1 - 1	LS	$4,000. - $6,000.	$4,000. - $6,000.	$5,000	1
5.15	Mechanical Installation	1 - 1	LS	$16,000. - $18,000.	$16,000. - $18,000.	$17,000	1
5.16	Electrical Installation	1 - 1	LS	$47,000. - $52,000.	$47,000. - $52,000.	$49,500	1
5.17	Central Area Modifications	0 - 0	LS	$500,000. - $500,000.	$0. - $0.	$0	1, 4
5.18	Road Crossing - Surface Cut	0 - 0	LS	$20,000. - $20,000.	$0. - $0.	$0	1
5.19	Convert Extraction Well to Injection Well	0 - 0	LS	$3,000. - $3,000.	$0. - $0.	$0	1
5.19							
				Systems / Equipment Install / Field Labor Subtotal:	***$521,500 - $663,000***	***$592,250***	
6.00	**Treatment System Startup**						
6.01	Startup, Shakedown and Optimization	1 - 1	LS	$25,000. - $30,000.	$25,000. - $30,000.	$27,500	1
6.02							
				Treatment System Startup Subtotal:	***$25,000 - $30,000***	***$27,500***	
7.00	**Permits and Regulatory Compliance**						
7.01	Health & Safety Plan	1 - 1	LS	$1,000. - $2,000.	$1,000. - $2,000.	$1,500	1
7.02							
				Permits and Regulatory Compliance Subtotal:	***$1,000 - $2,000***	***$1,500***	
				SUBTOTAL (BARE):	**$784,589 - $1,073,614**	**$929,102**	
				CONTINGENCY (20%):	**$156,918 - $214,723**	**$185,820**	
				TOTAL ESTIMATED CAPITAL COST:	**$941,507 - $1,288,337**	**$1,114,922**	

CAPITAL COST DISTRIBUTION	REMEDY AREA	ALLOCATION	TOTAL
	Northern Injection	0.0%	$ -
	Central Area IRZ / Injection	0.0%	$ -
	SCRIA / Dosed Injection	68.1%	$ 758,788
	Source Area IRZ / Injection	31.9%	$ 356,134
		100.0%	$ 1,114,922

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS							
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	1 - 1	YR	$175,000. - $325,000.	$175,000. - $325,000.	$250,000	1
3.02	Electricity	344,830 - 344,830	KWH	$0.12 - $0.18	$41,380. - $62,069.	$51,725	1
3.03	Biological / Chemical Consumables	23,603 - 23,603	GAL	$5. - $6.	$118,017. - $141,621.	$129,819	1, 5
3.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$12,699.4 - $23,584.6	$12,699. - $23,585.	$18,142	1
3.05	Routine / General Maintenance	1 - 1	LS	$168,000. - $312,000.	$168,000. - $312,000.	$240,000	1
3.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$59,715.6 - $110,900.4	$59,716. - $110,900.	$85,308	1
3.07	Compliance - Permits, etc.	1 - 1	LS	$33,260.5 - $61,769.5	$33,261. - $61,770.	$47,515	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
4.02	Electricity	5,455 - 5,455	KWH	$0.12 - $0.18	$655. - $982.	$818	1
4.03	Biological / Chemical Consumables	22,761 - 22,761	GAL	$5. - $6.	$113,803. - $136,563.	$125,183	1, 6
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$109,200. - $202,800.	$103,740. - $192,660.	$148,200	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$29,771. - $55,289.	$29,771. - $55,289.	$42,530	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	1 - 1	YR	$35,000. - $65,000.	$35,000. - $65,000.	$50,000	1
5.02	Electricity	5,236 - 5,236	KWH	$0.12 - $0.18	$628. - $943.	$785	1
5.03	Biological / Chemical Consumables	20,232 - 20,232	GAL	$5. - $6.	$101,158. - $121,389.	$111,274	1, 6
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$8,339.1 - $15,486.9	$8,339. - $15,487.	$11,913	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$25,200. - $46,800.	$23,940. - $44,460.	$34,200	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$7,000. - $13,000.	$7,000. - $13,000.	$10,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$34,456.8 - $63,991.2	$34,457. - $63,991.	$49,224	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$1,109,902 - $1,827,196**	**$1,468,549**	
				CONTINGENCY (10%):	**$110,990 - $182,720**	**$146,855**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$1,220,892 - $2,009,915**	**$1,615,403**	

CAPITAL COSTS		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Northern Plume Fringe		0.0%	$ -	$ -	$ -
Northern Injection		0.0%	$ -	$ -	$ -
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		68.1%	$ 632,324	$ 126,465	$ 758,788
Source Area IRZ / Injection		31.9%	$ 296,778	$ 59,356	$ 356,134
Southeast and East Plume Fringe		0.0%	$ -	$ -	$ -
Southern Plume Fringe		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 929,102**	**$ 185,820**	**$ 1,114,922**

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ 822,509	$ 82,251	$ 904,760
SCRIA / Dosed Injection	$ 378,644	$ 37,864	$ 416,508
Source Area IRZ / Injection	$ 267,396	$ 26,740	$ 294,136
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 1,468,549**	**$ 146,855**	**$ 1,615,403**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C (10-20 years)		Date: 29-Aug-11

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system
5	140 gpm dosed with 125 mg/L carbon; Current price $5.86/gal, delivered
6	255 gpm dosed with 125 mg/L carbon and split between SCRIA Injection Area and Source Area; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4A (20+ years)		Date: 27-Jan-11

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Northern Plume Fringe**						
1.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.00	**Northern Injection**						
2.01	Long Term Performance Monitoring	0 - 0	YR	$35,000. - $65,000.	$0. - $0.	$0	1
2.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
2.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
2.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$8,339.1 - $15,486.9	$0. - $0.	$0	1
2.05	Routine / General Maintenance	0 - 0	LS	$25,200. - $46,800.	$0. - $0.	$0	1
2.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$7,000. - $13,000.	$0. - $0.	$0	1
2.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
3.00	**Central Area IRZ**						
3.01	Long Term Performance Monitoring	0 - 0	YR	$175,000. - $325,000.	$0. - $0.	$0	1
3.02	Electricity	0 - 0	KWH	$0.12 - $0.18	$0. - $0.	$0	1
3.03	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
3.04	H&S/Routine Inspections and Reporting	0 - 0	LS	$12,699.4 - $23,584.6	$0. - $0.	$0	1
3.05	Routine / General Maintenance	0 - 0	LS	$168,000. - $312,000.	$0. - $0.	$0	1
3.06	Equipment Replacement and Non-Routine Maintenance	0 - 0	LS	$59,715.6 - $110,900.4	$0. - $0.	$0	1
3.07	Compliance - Permits, etc.	0 - 0	LS	$33,260.5 - $61,769.5	$0. - $0.	$0	1
4.00	**SCRIA Injection**						
4.01	Long Term Performance Monitoring	1 - 1	YR	$50,000. - $50,000.	$50,000. - $50,000.	$50,000	1
4.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
4.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
4.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
4.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
4.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
4.07	Compliance - Permits, etc.	0 - 0	YR	$0. - $0.	$0. - $0.	$0	
5.00	**Source Area Injection and/or Recirc**						
5.01	Long Term Performance Monitoring	0 - 0	YR	$140,000. - $260,000.	$0. - $0.	$0	1
5.02	Electricity	3,709 - 3,709	KWH	$0.12 - $0.18	$445. - $668.	$556	1
5.03	Biological / Chemical Consumables	955 - 955	GAL	$5. - $6.	$4,777. - $5,732.	$5,255	1, 5
5.04	H&S/Routine Inspections and Reporting	1 - 1	LS	$10,000. - $10,000.	$10,000. - $10,000.	$10,000	1
5.05	Routine / General Maintenance	0.95 - 0.95	LS	$10,000. - $10,000.	$9,500. - $9,500.	$9,500	1
5.06	Equipment Replacement and Non-Routine Maintenance	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
5.07	Compliance - Permits, etc.	1 - 1	LS	$5,000. - $5,000.	$5,000. - $5,000.	$5,000	1
6.00	**Southeast and East Plume Fringe**						
6.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
7.00	**Southern Plume Fringe**						
7.01	Biological / Chemical Consumables	0 - 0	GAL	$5. - $6.	$0. - $0.	$0	1
				SUBTOTAL (BARE):	**$114,444 - $116,800**	**$115,622**	
				CONTINGENCY (10%):	**$11,444 - $11,680**	**$11,562**	
				TOTAL ESTIMATED ANNUAL O&M COSTS:	**$125,888 - $128,480**	**$127,184**	

O&M COSTS	SUBTOTAL	CONT. (10%)	TOTAL
Northern Plume Fringe	$ -	$ -	$ -
Northern Injection	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ 80,311	$ 8,031	$ 88,342
Source Area IRZ / Injection	$ 35,311	$ 3,531	$ 38,842
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ 115,622**	**$ 11,562**	**$ 127,184**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Wells to be located in Source Area
3	Wells to be located in SCRIA Extraction Area
4	Modifications to deepen wells in existing IRZ system.
5	170 gpm dosed with 25 mg/L carbon and split between SCRIA Injection Area and Source Area; Operates only 4 months of the year; Current price $5.86/gal, delivered

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
Agricultural Unit Modifications		Date: 28-Jun-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
2.00	**Design and Contractor Bidding / Procurement**						
2.01	Engineering Final Design	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
				Design and Contractor Bidding / Procurement Subtotal:	*$16,000 - $16,000*	*$16,000*	
5.00	**Construction Monitoring and Site Security**						
5.01	Construction Management	1 - 1	LS	$16,000. - $16,000.	$16,000 - $16,000	$16,000	1, 2
5.02	Vendor Support During Fabrication and Testing	0 - 0	LS	$0. - $0.	$0 - $0	$0	
5.03	Project Management through Startup	1 - 1	LS	$8,000. - $8,000.	$8,000 - $8,000	$8,000	1, 3
				Construction Monitoring and Site Security Subtotal:	*$24,000 - $24,000*	*$24,000*	
6.00	**Systems / Equipment Install / Field Labor**						
6.01	Convert Gorman AU to drag-drip	2 - 2	EA	$80,000. - $80,000.	$160,000 - $160,000	$160,000	1, 4
6.02	Effluent Piping	0 - 0	LF	$80. - $80.	$0 - $0	$0	1
6.03	Bore & Jack	0 - 0	EA	$570,000. - $570,000.	$0 - $0	$0	1
6.04	Extraction Well - Installation	0 - 0	EA	$73,000. - $73,000.	$0 - $0	$0	1
6.05	Well Completion	0 - 0	EA	$53,000. - $53,000.	$0 - $0	$0	1
				Systems / Equipment Install / Field Labor Subtotal:	*$160,000 - $160,000*	*$160,000*	
				SUBTOTAL (BARE):	**$200,000 - $200,000**	**$200,000**	
				CONTINGENCY (20%):	**$40,000 - $40,000**	**$40,000**	
				TOTAL ESTIMATED CAPITAL COST:	**$240,000 - $240,000**	**$240,000**	

CAPITAL COSTS

		ALLOCATION	SUBTOTAL	CONT. (20%)	TOTAL
Agricultural Units		100.0%	$ 200,000	$ 40,000	$ 240,000
Central Area IRZ / Injection		0.0%	$ -	$ -	$ -
SCRIA / Dosed Injection		0.0%	$ -	$ -	$ -
Source Area IRZ / Injection		0.0%	$ -	$ -	$ -
Non-Specific	**TOTAL:**	**100%**	**$ 200,000**	**$ 40,000**	**$ 240,000**

O&M COSTS

	SUBTOTAL	CONT. (10%)	TOTAL
Agricultural Units	$ -	$ -	$ -
Central Area IRZ / Injection	$ -	$ -	$ -
SCRIA / Dosed Injection	$ -	$ -	$ -
Source Area IRZ / Injection	$ -	$ -	$ -
Southeast and East Plume Fringe	$ -	$ -	$ -
Southern Plume Fringe	$ -	$ -	$ -
TOTAL:	**$ -**	**$ -**	**$ -**

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	10% Total Capital Cost
3	5% of Total Capital Cost
4	Per JL phone conversation w/JCB on 3/14/2010 - 2 converts @ $80K per pivot

OPINION OF PROBABLE COST	Hinkley Feasibility Study	Project Number: 36385
New Agricultural Unit (Revised)		Date: 28-Jun-10

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Design and Contractor Bidding / Procurement**						
1.01	Project Workplan, Site Survey, and Design	1 - 1	LS	$98,231 - $98,231	$98,231 - $98,231	$98,231	1, 2
1.02	Bidding Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.03	Procurement Costs	1 - 1	LS	$0. - $0.	$0 - $0	$0	
1.04							
				Design and Contractor Bidding / Procurement Subtotal:	***$98,231 - $98,231***	***$98,231***	
2.00	**Mobilization/Demobilization/Site Prep/General Conditions**						
2.01	Site Work Contractor - Mob	1 - 1	LS	$50,000. - $75,000.	$50,000 - $75,000	$62,500	1
2.02							
				Mobilization/Demobilization/Site Prep/General Conditions Subtotal:	***$50,000 - $75,000***	***$62,500***	
3.00	**Construction Monitoring and Site Security**						
3.01	Project Management	1 - 1	LS	$32,743.55 - $32,743.55	$32,744 - $32,744	$32,744	1, 3
3.02	Construction Management	1 - 1	LS	$65,487.1 - $65,487.1	$65,487 - $65,487	$65,487	1, 4
3.03							
				Construction Monitoring and Site Security Subtotal:	***$98,231 - $98,231***	***$98,231***	
4.00	**Systems / Equipment Install / Field Labor**						
4.01	Wellhead Modifications	3 - 3	LS	$40,000. - $40,000.	$120,000 - $120,000	$120,000	1
4.02	AU Building Construction	1 - 1	LS	$242,371. - $342,371.	$242,371 - $342,371	$292,371	1
4.03	Irrigation Piping, Including Trench Work, Fittings, Valves, D	1 - 1	LS	$140,000. - $140,000.	$140,000 - $140,000	$140,000	1
4.04	Electrical	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
4.05	Vaults	1 - 1	LS	$20,000. - $20,000.	$20,000 - $20,000	$20,000	1
4.06	Access Road	1 - 1	LS	$7,500. - $7,500.	$7,500 - $7,500	$7,500	1
4.07	Instrumentation & Controls	1 - 1	LS	$25,000. - $25,000.	$25,000 - $25,000	$25,000	1
4.08							
				Systems / Equipment Install / Field Labor Subtotal:	***$604,871 - $704,871***	***$654,871***	
5.00	**Permits and Regulatory Compliance**						
5.01	Local Permits	1 - 1	LS	$50,000. - $50,000.	$50,000 - $50,000	$50,000	1
5.02							
				Permits and Regulatory Compliance Subtotal:	***$50,000 - $50,000***	***$50,000***	
				SUBTOTAL (BARE):	**$901,332 - $1,026,332**	**$963,832**	
				CONTINGENCY (20%):	**$180,266 - $205,266**	**$192,766**	
				TOTAL ESTIMATED CAPITAL COST:	**$1,081,599 - $1,231,599**	**$1,156,599**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience for installation of one (1) typical 30-40 acre farm using a 3-span drag/drip pivot supplied by 3 wells irrigating at 120 gpm annual average
2	15% of Total Capital Cost
3	5% of Total Capital Cost
4	10% of Total Capital Cost

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Agricultural Unit O&M Backup (Varied Level of Technical Input)		Date: 29-Aug-11

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

											CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			3			4			3		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head			840 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000	1	$ 62,000	$ 62,000
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	400	$ 100	$ 40,000	440	$ 100	$ 44,000	580	$ 100	$ 58,000	405	$ 100	$ 40,533
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000	1	$ 10,267	$ 10,267
Other expenses	ea	1	$ 6,000	$ 6,000	1	$ 7,200	$ 7,200	1	$ 9,000	$ 9,000	1	$ 6,160	$ 6,160
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471	173,885	$ 0.15	$ 26,083
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	16,466	$ 0.15	$ 2,470
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	329,323	$ 0.15	$ 49,398
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	$ 68,000	$ 68,000	1	$ 89,000	$ 89,000	1	$ 68,000	$ 68,000
Parts/repairs													
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000	2	$ 1,283,333	$ 25,667
Subtotal				**$ 287,709**			**$ 319,104**			**$ 418,802**			**$ 290,578**
Contingency on Materials/Services	percent	10	$ 287,709	$ 28,771	10	$ 319,104	$ 31,910	$ 10	$ 418,802	$ 41,880	10	$ 290,578	$ 29,058
GRAND TOTAL				**$ 316,480**			**$ 351,015**			**$ 460,682**			**$ 319,636**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP
WITH INCREASED TECHNICAL INPUT

		Farmer-Operated with Technical Input			Farmer-Operated with Technical Input			Farmer-Operated with Technical Input		
Number of AUs		3			3			4		
Application Rate and Pressure		800 gpm at 100 ft head			1,100 gpm at 100 ft head			1,400 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations										
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 62,000	$ 62,000	1	$ 82,000	$ 82,000
Technical Input	hrs	8,000	$ 80	$ 640,000	10,000	$ 80	$ 800,000	13,300	$ 80	$ 1,064,000
Engineering support	hrs	2,800	$ 100	$ 280,000	3,000	$ 100	$ 300,000	4,000	$ 100	$ 400,000
General oversight	hrs	400	$ 100	$ 40,000	400	$ 100	$ 40,000	400	$ 100	$ 40,000
Health & safety training/monitoring	ea	1	$ 10,000	$ 10,000	1	$ 12,000	$ 12,000	1	$ 15,000	$ 15,000
Other expenses	ea	1	$ 75,000	$ 75,000	1	$ 90,000	$ 90,000	1	$ 120,000	$ 120,000
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power										
Pump Water from Aquifer to LTUs	kW-hr	165,605	$ 0.15	$ 24,841	227,707	$ 0.15	$ 34,156	289,809	$ 0.15	$ 43,471
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293
Pivot motor	kW-hr	329,323	$ 0.15	$ 49,398	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038
Outside Services										
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	1	$ 190,000	$ 190,000	1	$ 238,000	$ 238,000
Parts/repairs										
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	2	$ 1,500,000	$ 30,000	2	$ 2,000,000	$ 40,000
Subtotal				**$ 1,398,709**			**$ 1,619,904**			**$ 2,124,802**
Contingency on Materials/Services	percent	10	$ 1,398,709	$ 139,871	10	$ 1,619,904	$ 161,990	10	$ 2,124,802	$ 212,480
GRAND TOTAL				**$ 1,538,580**			**$ 1,781,895**			**$ 2,337,282**

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	**Project Number:**	**36385**
Agricultural Unit O&M Backup (Varied Level of Technical Input)		**Date:**	**13-Sep-11**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

								Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		3			6			7			8		
Application Rate and Pressure		950 gpm at 100 ft head			1270 gpm at 100 ft head			1380 gpm at 100 ft head			1530 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 62,000	$ 62,000	1	$ 102,500	$ 102,500	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	420	$ 100	$ 42,000	520	$ 100	$ 52,000	570	$ 100	$ 57,000	640	$ 100	$ 64,000
Health & safety training/monitoring	ea	1	$ 11,000	$ 11,000	1	$ 13,700	$ 13,700	1	$ 14,800	$ 14,800	1	$ 16,300	$ 16,300
Other expenses	ea	1	$ 6,600	$ 6,600	1	$ 8,220	$ 8,220	1	$ 8,880	$ 8,880	1	$ 9,780	$ 9,780
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	196,656	$ 0.15	$ 29,498	262,898	$ 0.15	$ 39,435	285,669	$ 0.15	$ 42,850	316,720	$ 0.15	$ 47,508
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	21,955	$ 0.15	$ 3,293	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	526,917	$ 0.15	$ 79,038	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	$ 68,000	$ 68,000	1	89,000	$ 89,000	1	138,000	$ 138,000	1	149,000	$ 149,000
Parts/repairs													
(Percent of capital cost)	percent	2	$ 1,375,000	$ 27,500	3	2,000,000	$ 60,000	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000
Subtotal				**$ 308,347**			**$ 447,186**			**$ 554,532**			**$ 627,761**
Contingency on Materials/Services	percent	10	$ 308,347	$ 30,835	10	$ 447,186	$ 44,719	10	$ 554,532	$ 55,453	10	$ 627,761	$ 62,776
GRAND TOTAL				**$ 339,181**			**$ 491,904**			**$ 609,985**			**$ 690,537**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-1, 0-20 yrs			Alt 4C-1, 20+ yrs
		CALCULATED			
		Farmer-Operated with Technical Input			
Number of AUs		3			
Application Rate and Pressure		450 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	
Operations					
Property Management	ea	1	$ 62,000	$ 62,000	
Technical Input	hrs	5,670	$ 80	$ 453,600	
Engineering support	hrs	2,570	$ 100	$ 257,000	
General oversight	hrs	400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 7,670	$ 7,670	
Other expenses	ea	1	$ 57,500	$ 57,500	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	0	$ -	$ -	
Electrical Power					
Pump Water from Aquifer to LTUs	kW-hr	93,153	$ 0.15	$ 13,973	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278	
Outside Services					
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000	
Parts/repairs					
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000	
Subtotal				**$ 1,168,491**	
Contingency on Materials/Services	percent	10	$ 1,168,491	$ 116,849	
GRAND TOTAL				**$ 1,285,340**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:**	**36385**
Agricultural Unit O&M Backup (Varied Level of Technical Input)		**Date:**	**13-Sep-11**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs			Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs		
		CALCULATED			CALCULATED			CALCULATED			CALCULATED		
		Farmer-Operated			Farmer-Operated			Farmer-Operated			Farmer-Operated		
Number of Agricultural Units		7			8			18			21		
Application Rate and Pressure		1510 gpm at 100 ft head			1687 gpm at 100 ft head			2068 gpm at 100 ft head			2325 gpm at 100 ft head		
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**	**Number Required**	**Unit Cost**	**Total Cost**
Operations													
Property Management	ea	1	$ 123,000	$ 123,000	1	$ 143,500	$ 143,500	1	$ 348,500	$ 348,500	1	$ 410,000	$ 410,000
Technical Input	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
Engineering support	hrs	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
General oversight	hrs	630	$ 100	$ 63,000	710	$ 100	$ 71,000	890	$ 100	$ 89,000	1,010	$ 100	$ 101,000
Health & safety training/monitoring	ea	1	$ 16,100	$ 16,100	1	$ 17,870	$ 17,870	1	$ 21,680	$ 21,680	1	$ 24,250	$ 24,250
Other expenses	ea	1	$ 9,660	$ 9,660	1	$ 10,722	$ 10,722	1	$ 13,008	$ 13,008	1	$ 14,550	$ 14,550
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	5	$ 4,290	$ 21,450	6	$ 4,290	$ 25,740	16	$ 4,290	$ 68,640	19	$ 4,290	$ 81,510
Electrical Power													
Pump Water from Aquifer to AUs	kW-hr	312,580	$ 0.15	$ 46,887	349,220	$ 0.15	$ 52,383	428,089	$ 0.15	$ 64,213	481,290	$ 0.15	$ 72,193
Misc. Controls/Lights	kW-hr	24,699	$ 0.15	$ 3,705	27,444	$ 0.15	$ 4,117	61,748	$ 0.15	$ 9,262	49,873	$ 0.15	$ 7,481
Pivot motor	kW-hr	658,647	$ 0.15	$ 98,797	790,376	$ 0.15	$ 118,556	2,107,669	$ 0.15	$ 316,150	2,502,857	$ 0.15	$ 375,429
Outside Services													
Water Quality Monitoring/Reporting	ea.	1	138,000	$ 138,000	1	149,000	$ 149,000	1	353,000	$ 353,000	1	393,000	$ 393,000
Parts/repairs													
(Percent of capital cost)	percent	3	2,250,000	$ 67,500	3	2,500,000	$ 75,000	3	5,625,000	$ 168,750	3	6,250,000	$ 187,500
Subtotal				**$ 588,099**			**$ 667,888**			**$ 1,452,204**			**$ 1,666,913**
Contingency on Materials/Services	percent	10	$ 588,099	$ 58,810	10	$ 667,888	$ 66,789	10	$ 1,452,204	$ 145,220	10	$ 1,666,913	$ 166,691
GRAND TOTAL				**$ 646,909**			**$ 734,677**			**$ 1,597,424**			**$ 1,833,604**

ESTIMATED ANNUAL O&M COSTS: FARMER-OP WITH INCREASED TECHNICAL INPUT

		Alt 4C-2 & Alt 4C-3, 0-20 yrs			Alt 4C-2 & Alt 4C-3, 20+ yrs	Alt 4C-4, 0-20 yrs			Alt 4C-4, 20+ yrs
		CALCULATED				CALCULATED			
		Farmer-Operated with Technical Input				Farmer-Operated with Technical Input			
Number of AUs		3				8			
Application Rate and Pressure		531 gpm at 100 ft head				761 gpm at 100 ft head			
Equipment/Process Name	**Unit of Measure**	**Number Required**	**Unit Cost**	**Total Cost**		**Number Required**	**Unit Cost**	**Total Cost**	
Operations									
Property Management	ea	1	$ 62,000	$ 62,000		1	$ 143,500	$ 143,500	
Technical Input	hrs	6,210	$ 80	$ 496,800		7,740	$ 80	$ 619,200	
Engineering support	hrs	2,620	$ 100	$ 262,000		2,770	$ 100	$ 277,000	
General oversight	hrs	400	$ 100	$ 40,000		400	$ 100	$ 40,000	
Health & safety training/monitoring	ea	1	$ 9,460	$ 9,460		1	$ 7,930	$ 7,930	
Other expenses	ea	1	$ 70,950	$ 70,950		1	$ 59,450	$ 59,450	
Pivot reconfiguration: Summer/Winter Crop Rotation	ea	3	$ 4,290	$ 12,870		8	$ 4,290	$ 34,320	
Electrical Power									
Pump Water from Aquifer to LTUs	kW-hr	109,920	$ 0.15	$ 16,488		157,532	$ 0.15	$ 23,630	
Misc. Controls/Lights	kW-hr	16,466	$ 0.15	$ 2,470		16,466	$ 0.15	$ 2,470	
Pivot motor	kW-hr	395,188	$ 0.15	$ 59,278		395,188	$ 0.15	$ 59,278	
Outside Services									
Water Quality Monitoring/Reporting	ea.	1	$ 190,000	$ 190,000		1	$ 190,000	$ 190,000	
Parts/repairs									
(Percent of capital cost)	percent	2	$ 1,250,000	$ 25,000		2	$ 2,500,000	$ 50,000	
Subtotal				**$ 1,247,316**				**$ 1,506,778**	
Contingency on Materials/Services	percent	10	$ 1,247,316	$ 124,732		10	$ 1,506,778	$ 150,678	
GRAND TOTAL				**$ 1,372,048**				**$ 1,657,456**	

OPINION OF PROBABLE COST	***Hinkley Feasibility Study***	**Project Number:** **36385**
Agricultural Unit O&M Backup (Varied Level of Technical Input)		**Date:** **13-Sep-11**

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers.
4	Engineering support is not needed when AUs are operated by farmers.
5	General oversight to include planning, contracting, and the regulatory interface.
6	Health & safety training/monitoring is required for workers.
7	Other expenses include travel, equipment, and miscellaneous.
8	Additional Consultant Oversight
9	Controls/lights operated at 1.5 kW.
10	Each pivot motor operated at 6 kW.
11	Electrical rate varies from \$0.12/kW-hr to \$0.18/kW-hr. Average electrical rate is \$0.15/kW-hr.

NOTES AND ASSUMPTIONS - FARMER OPERATED AU'S WITH INCREASED TECHNICAL INPUT

1	Costs based on Contractor Experience
2	Property Management cost is a flat rate.
3	AUs are operated by farmers, with technical input by consultants as necessary.
4	General oversight to include planning, contracting, and the regulatory interface.
5	Health & safety training/monitoring is required for workers.
6	Other expenses include travel, equipment, and miscellaneous.
7	Cost to Pump Water from Aquifer to AUs is based on flow rate and pressure head.
8	Controls/lights operated at 1.5 kW.
9	Each pivot motor operated at 6 kW.
10	Electrical rate varies from \$0.12/kW-hr to \$0.18/kW-hr. Average electrical rate is \$0.15/kW-hr.

OPINION OF PROBABLE COST	*Hinkley Feasibility Study*	Project Number: 36385
Alt 4C-4 - Land Acquisition		Date: 29-Aug-11

ESTIMATED CAPITAL COSTS

NO.	ITEM	ESTIMATED QUANTITY RANGE	UNIT	UNIT PRICE RANGE	ESTIMATED COST RANGE	MIDPOINT COST	NOTE NO.
1.00	**Land Acquisition Costs**						
1.01	Land Acquisition for Agricultural Applicatior	80 - 80	AC	$8,000. - $8,000.	$640,000 - $640,000	$640,000	1, 2
1.02	Land Acquisition for Agricultural Applicatior	147.34 - 147.34	AC	$8,000. - $8,000.	$1,178,720 - $1,178,720	$1,178,720	1, 2
1.03	Land Acquisition	40 - 40	AC	$8,000. - $8,000.	$320,000 - $320,000	$320,000	1, 3
1.04	Land Acquisition	46 - 46	AC	$2,000. - $2,000.	$92,000 - $92,000	$92,000	1, 4
				Land Acquisition Costs Subtotal:	***$2,230,720 - $2,230,720***	***$2,230,720***	
				SUBTOTAL (BARE):	**$2,230,720 - $2,230,720**	**$2,230,720**	
				CONTINGENCY (0%):	**$0 - $0**	**$0**	
				TOTAL ESTIMATED CAPITAL COST:	**$2,230,720 - $2,230,720**	**$2,230,720**	

NOTES AND ASSUMPTIONS

1	Costs based on Contractor Experience
2	Property will be used for new agricultural units.
3	Property will be used for the Central Area IRZ Expansion.
4	Property will be used for an easement.

APPENDIX F

Chromium Stability

Summary of the Stability of Trivalent Chromium Precipitates:

In general, when hexavalent chromium Cr6 has been converted via microbial reduction, Cr3 is immobile in the subsurface - where it precipitates as an insoluble hydroxide and sorbs strongly to iron and manganese materials in the soil. Cr3, particularly as a hydroxide solid, is stable in groundwater exhibiting a pH greater than 5 and a redox potential of less than 600 mV (Deutsch 1997).Significant conversion from Cr3 back to Cr6 will only take place if there are changes in geochemical conditions, such as a significant change in pH. There can, however, be a limited reconversion as a result of natural geochemical processes, which typically result in overall Cr6 levels in groundwater at or around the natural background concentration. The Department of Toxic Substances presented this assessment of the geochemical stability of Cr3 precipitates in their review of the feasibility study, dated May 17, 2011. The potential natural reconversion processes specific to Hinkley are discussed in further detail below.

While the kinetics of Cr6 reduction are rapid in typical groundwater environments, the same is not true of Cr3 oxidation. There are only a few oxidants present in natural systems that are known to be capable of oxidizing Cr3 to Cr6. These include:

- **Oxygen.** Dissolved oxygen can oxidize Cr3 to Cr6, but the kinetics are very slow at the neutral groundwater pH typical of most aquifer systems, such as Hinkley (average pH 7.25 $\pm$0.45). As a result, dissolved oxygen will preferentially react with other materials in the subsurface before reacting with Cr3. This is particularly true in a former anaerobic reactive zone, where reduced minerals (such as iron sulfides) are formed and stored in the aquifer during the treatment cycle. These reduced minerals act as a buffer to the oxidation of Cr(III). As a result, the available literature concludes that the oxidation of Cr(III) by dissolved oxygen is not a meaningful pathway in typical groundwater systems (Schroeder & Lee, 1975; Eary & Rai, 1987; Rai et al, 1989; Hwang et al, 2002; Guertin et al, 2005).

- **Manganese oxides.** These minerals are more effective at oxidizing Cr3 than dissolved oxygen. They occur in the subsurface primarily as coatings on soil grains. The rate at which they react with Cr3 is affected by their reactive surface area and the dissolved concentrations of Cr3. For the oxidation reactions to proceed, Cr3 must sorb directly to the surface of the manganese oxide mineral (Schroeder & Lee, 1975; Rai et al, 1986; Eary & Rai, 1987; Richard & Bourg, 1991; Hwang et al, 2002; Guertin et al, 2005). Because aqueous Cr3 concentrations will be effectively controlled by low solubility Cr3 hydroxides and mixed iron-Cr3 hydroxides formed through treatment, the amount of aqueous Cr3 available for adsorption onto manganese oxide surfaces and subsequent oxidation will be very limited by its insoluble nature.

The mechanisms discussed above that act to oxidize Cr3 are responsible for the natural background concentration of Cr6 in groundwater. These processes have acted upon the naturally-occurring Cr3 in the soil, and have occurred in the unsaturated and saturated zones. At Hinkley within the unsaturated zone, soil concentrations of Cr6 are estimated to increase by an insignificant amount, i.e. 0.4 mg/kg, in comparison to the range of naturally occurring vadose zone concentrations at the site (6 to 19 mg/kg). Once irrigation processes have ceased, the potential input of Cr(VI) via oxidation and recharge is therefore expected to be comparable to naturally occurring conditions.

Within the aquifer following in-situ treatment, there are a number of mechanisms that will work together to minimize re-oxidation of the treated chromium. These include the following:

No meaningful change in total Cr in soil. Hinkley soil concentrations in background samples ranged from less than 0.5 to 6 mg/kg. The predicted range of increased concentrations due to in-situ treatment is 0.01 to 0.8 mg/kg, insignificant in comparison with the range of background concentrations. Site-specific data verifies the prediction that the change in soil chromium concentrations due to in-situ treatment has not been significant. Baseline soil samples collected from the saturated zone during installation of the CA-MW-100 series monitoring wells for the Central Area IRZ system yielded concentrations ranging from 0.708 to 27.4 mg/kg. In soil samples collected from the Central Area after one year of IRZ operation, total chromium concentrations were within the same range, 2.31 to 11.8 mg/kg, indicating that the amount of precipitated chromium was not significant in comparison to the amount of existing chromium.

Formation of low solubility Cr3 precipitates. The Cr3 minerals formed in the IRZ will include some pure chromium hydroxides but are expected to predominately take the form of a mixed iron-chromium hydroxide mineral with a relatively low solubility. The formation of low solubility Cr3 was demonstrated within the Central Area through analysis of samples collected during the installation of CA-RW-07R after over a year of operation (January 2009), as follows:

- Soil samples collected before and after Central Area IRZ treatment (Figure 1) were analyzed by a technique used to identify oxidation states, micro x-ray adsorption near edge structure (μ-XANES). This powerful analytical method is capable of resolving metal oxidation states in mineralogically heterogeneous soil samples without perturbation of the chemical nature of the soil (D'Amore et al., 2005). The results, shown on Figure 1, demonstrate that the chromium left on solids following treatment was in the trivalent state, and was found at concentrations similar to before treatment.
- X-ray fluorescence elemental maps from post treatment soil samples (Figure 2) showed the co-location of chromium and iron in the soil, indicating the presence of mixed iron/Cr3 hydroxides with particularly low solubility.

Limited availability of reactive MnO_2 surfaces. The reaction between Cr3 and MnO_2 occurs at the surface of the manganese oxides (MnO_2). Within an IRZ treatment zone, there are a number of factors that limit the availability of reactive MnO_2 surfaces to support re-oxidation of Cr3. First, a portion of the manganese liberated in the IRZ precipitates as a carbonate mineral (e.g., manganese carbonate (rhodochrosite)). Second, both during and after treatment, there are a number of minerals that form along with manganese precipitates (e.g., calcite, ferrous and ferric iron minerals). This bulk precipitation will cover up the surfaces of MnO_2, reducing the opportunity for reaction with Cr3. Chromium hydroxide precipitates themselves have been shown to passivat the reactive surfaces of MnO_2, that is coat the surfaces making them unreactive, through the same mechanisms (Fendorf et al., 1992; Fendorf, 1995). In addition, reaction of manganese with Cr3 is inhibited by the presence of reduced iron minerals such as iron sulfide (Deng and Wu, 2006), a mineral that will be formed within the IRZs in the same area where chromium is precipitated. The presence of iron sulfide essentially inactivates manganese oxides, and precludes them from reacting with Cr3.

Reduction in availability of easily exchangeable Cr3. Weakly sorbed naturally occurring Cr3 will be more reactive towards oxidation than Cr3 produced by remedial activities that is incorporated into stable minerals, because it is more easily displaced into the dissolved phase. Under the encountered pH conditions at Hinkley, the weakly sorbed fraction is likely to be a weathering product of natural Cr3 minerals. In an anaerobic IRZ, this fraction can be displaced and converted into the stable mineral forms discussed above, along with the dissolved Cr3 that is the primary target of treatment. The end result is Cr3 that is more stable after operation of the IRZ than before.

At a PG&E site similar to Hinkley, (the Topock site) soil samples were collected for analysis before and after an in-situ pilot test was conducted. The results demonstrate a significant decrease in the easily exchangeable (weakly sorbed) Cr3 after in-situ treatment (Figure 3). This figure shows the chromium dissolution behavior for soil prior to and after operation of the IRZ. Prior to operation of the IRZ, a greater portion of chromium in soil could be extracted using chemical reagents than after operation of the IRZ. The chemical reagents are labeled on the x-axis as follows: dilute acid (0.5 molar hydrochloric acid) labeled “H-H,” extracts weakly sorbed chromium; hydroxylamine hydrochloride “H-H Hydroxy,” extracts labile mineral phases (such as amorphous, poorly crystalline minerals); and citrate-bicarbonate-dithionite “CBD,” extracts crystalline minerals . After IRZ operation, there was a significantly lower concentration of chromium that could be extracted by these reagents – and there was not a significant difference in the total chromium concentration in the soil. This indicates that after IRZ treatment, the Cr3 was redistributed into a more stable mineral phase in the soil (ARCADIS, 2009). The formation of similar low solubility forms of Cr3 are expected at the Hinkley site.

In summary, several factors limit the re-conversion of Cr3 to Cr6 after in-situ reduction: the minimal amount of Cr3 added to the soil due to in-situ treatment, the limited solubility of the Cr3 formed, and the lack of reactivity of an adequate oxidizer (MnO_2). Together, these factors are expected to limit reconversion of Cr3 to Cr6 to levels similar to natural background.

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Schroeder, D.C. and G.F. Lee. 1975. Potential transformations of chromium in natural waters. Water Air and Soil Pollution 4: 355-365.

Figure 1. X-Ray Spectroscopy Chromium XANES

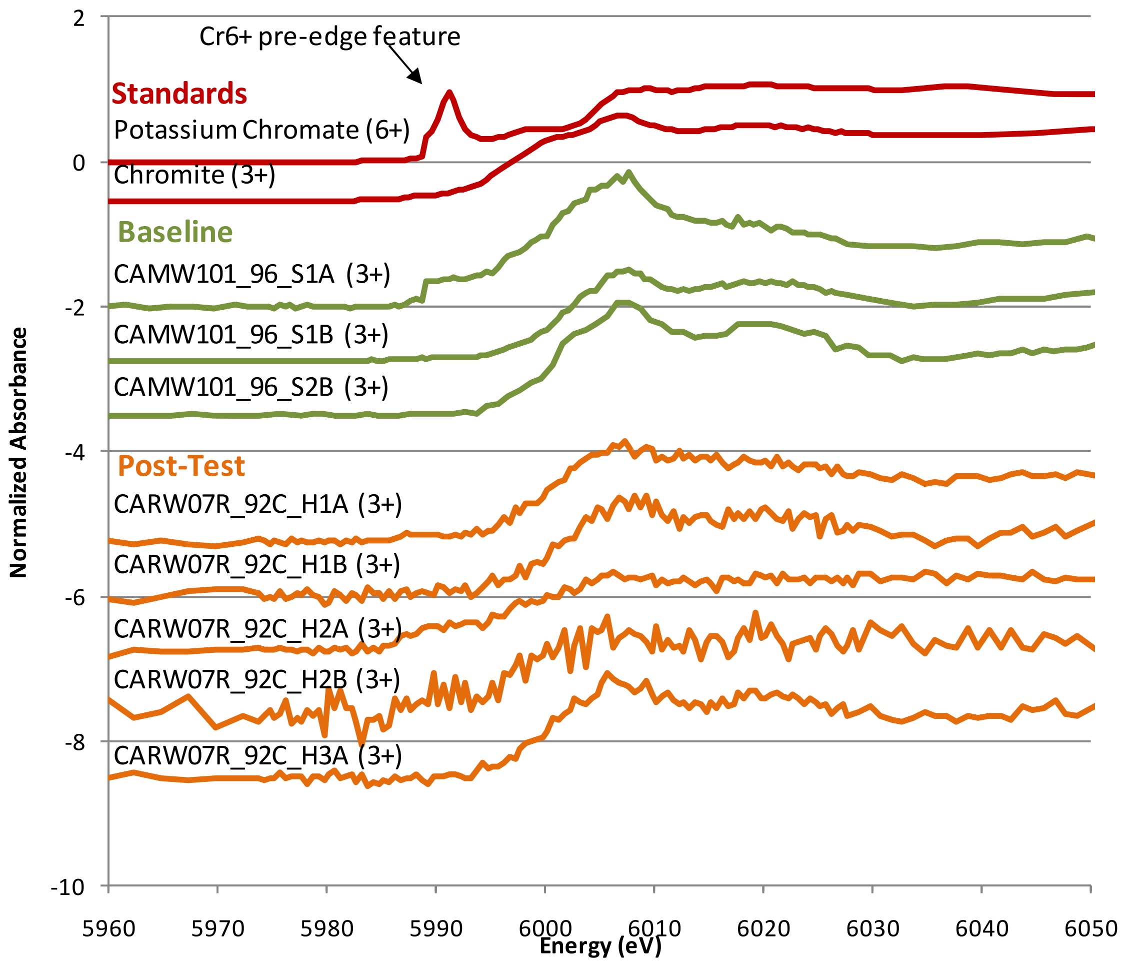


Figure 2. X-Ray Spectoscopy Central Area Soils Following 1 Year of IRZ Treatment. Elemental map of sample collected from 99 feet below ground surface during installation of CA-RW-07R in January 2009 after over 1 year of Central Area IRZ operation. Chromium distribution is shown on the panel on the left and iron distribution is shown on the panel on the right. Results show that where chromium is detected (light colored areas), iron is also present.

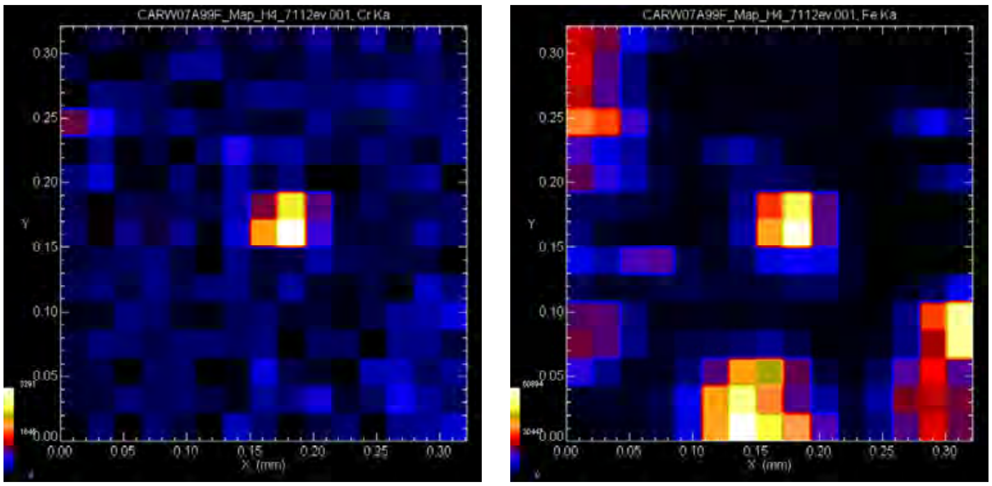
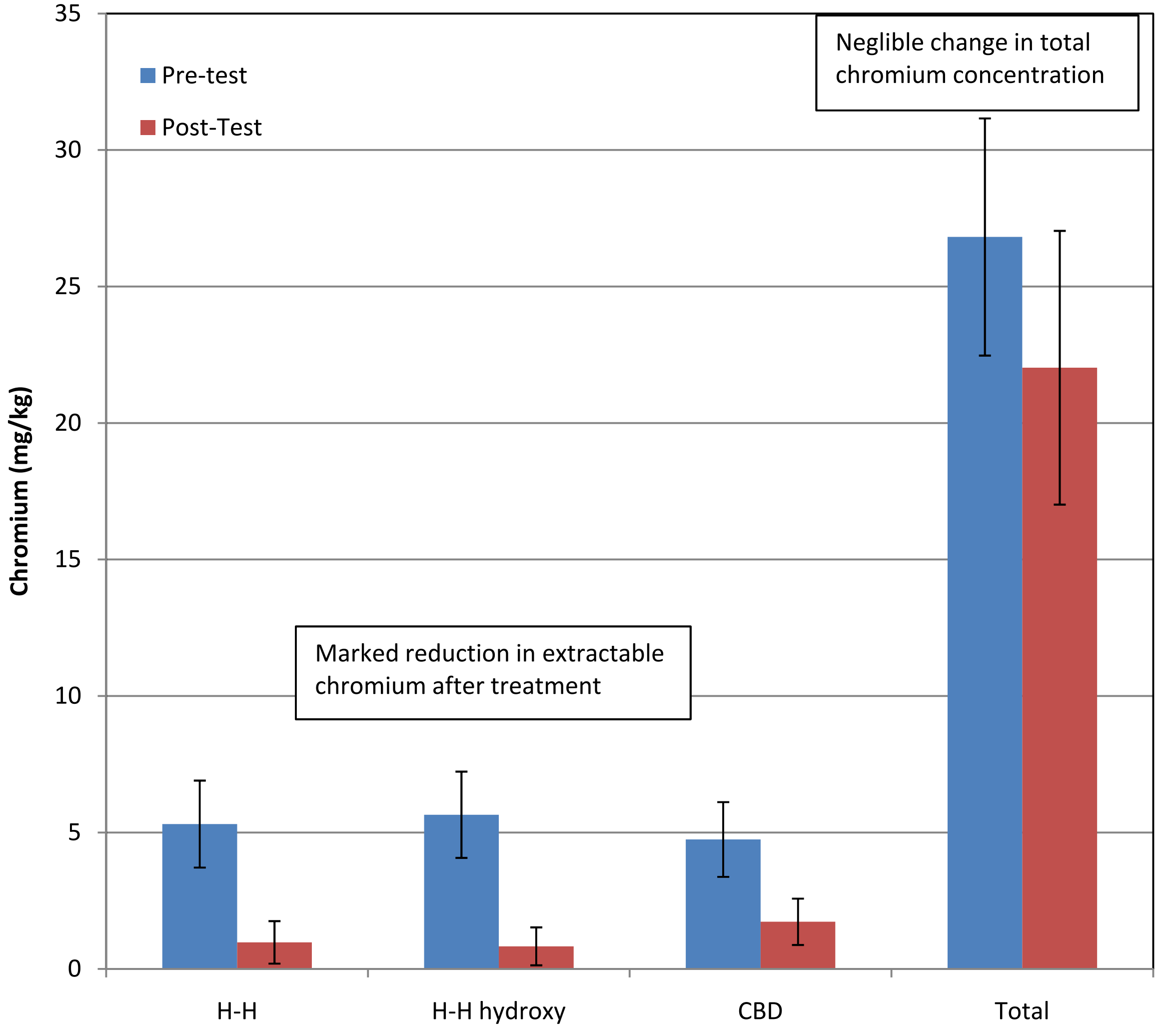


Figure 3. Characterization of the Total Chromium in Topock Upland Soil before and after IRZ Treatment



H-H: dilute hydrochloric acid extraction H-H hydroxy: hydroxylamine hydrochloric extraction, CBD: citrate bicarbonate dithionite extraction

APPENDIX G

Groundwater Model Construction and Assumptions

Pacific Gas & Electric Company

Appendix G: Development of a Groundwater Flow and Solute Transport Model

Pacific Gas & Electric
Hinkley, California

September 2011

Tables

Figures

1. Introduction and Objectives

1.1 Introduction

Pacific Gas and Electric Company (PG&E) is working with, and under the direction of the California Regional Water Quality Control Board – Lahontan Region (LRWQCB) to clean up hexavalent chromium in groundwater resulting from historical operations at the Hinkley Compressor Station (Site) in San Bernardino County, 5 miles west of Barstow, California. This appendix documents the construction of the groundwater flow and solute transport model that was generated for the Site.

1.2 Study Objectives and Scope

The objectives of this modeling study were to develop a groundwater flow and solute transport model for use as follows:

- Evaluate subsurface flow conditions
- Evaluate the fate and transport of hexavalent chromium
- Evaluate potential remedial systems

This report describes the results of five major components of the modeling study at the Site:

- Review of recently collected hydrogeologic data
- Refinement of the conceptual site model
- Development and calibration of the groundwater flow model
- Flow system analysis
- Solute transport model development and remedial system analysis

2. Conceptual Site Model

A conceptual groundwater flow model is a narrative description of the principal components of a groundwater flow system developed from regional, local, and site-specific data. The primary components of a groundwater flow system include: (1) areal extent, configuration, and types of aquifers and aquitards; (2) hydraulic properties of aquifers and aquitards; (3) natural groundwater recharge and discharge zones; (4) anthropogenic influence on groundwater (sources and sinks); and, (5) areal and vertical distribution of groundwater hydraulic head potential. These aquifer system components serve as the framework for the construction of a numerical groundwater flow model. The following sections describe the regional and Site hydrogeology and are taken from earlier investigation reports.

2.1 Regional Geologic Framework

The Mojave River groundwater basin consists primarily of unconsolidated alluvial deposits. The aquifer system extends across 1,400 square miles (mi^2) of the Mojave Desert. The limits of the basin are defined by nonwater-bearing consolidated rocks that underlie the alluvial deposits of the basin and outcrop in the surrounding mountains and hills. In some places, the confining rocks at the limits of the basin are buried by unsaturated alluvial deposits. The unconsolidated sediments consist of gravel, sand, silt, and clay deposited by the recent Mojave River and the Pliocene-Pleistocene ancestral Mojave River, by tributary alluvial fans, and by older streams and alluvial fans that predate the origin of the Mojave River surface water drainage basin. Interbedded within the aquifer are local deposits of silt and clay that accumulated in lakes and playas along the margins of the basin. The consolidated deposits consist of igneous, metamorphic, and sedimentary rocks of pre-Tertiary to Tertiary age (Stamos et al. 2001).

2.2 Site Hydrogeology and Groundwater Occurrence

The Hinkley Valley is north of the Mojave River, west of Barstow, California. The main valley is approximately 6.8 miles (mi) long and 2.8 mi wide extending northwest from the river toward Harper Valley. The Hinkley Valley is a narrow northwest-trending alluvium-filled depression between uplifted ridges of Mesozoic or older igneous intrusive granitic rocks, Tertiary volcanics, and Precambrian sedimentary and metamorphic rocks (Dibblee 1967). The total thickness of alluvial sediments along the axis of the valley is only about 300 ft. The alluvium in the valley consists of three distinct lithologic units: (1) a basal unit of alternating layers of coarse sand and silt, (2) a middle unit of lacustrine clay, and (3) an overlying unit consisting of primarily sand and gravel layers that have alternating thin silt and clay layers along the axis of the valley grading to finer-grained deposits along the valley margins. The lacustrine clay represents deposits from a past lake, averaging 40 ft thick in the valley center. Along the axis of the valley, the coarse deposits above the clay unit, referred to as the upper aquifer, represent recent alluvial deposits along the ancestral Mojave River, which once flowed northward through the valley. These deposits range in thickness along the valley axis from 120 ft in the southeast to 90 ft in the northwest. The finer-grained deposits along the margin of the valley above the clay unit represent fan and alluvial deposits derived from the bedrock ridges (Andrews et al., 2003).

2.3 Site Hydraulic Properties

The estimated hydraulic conductivities of the materials of the upper aquifer range from 150 ft/day along the present course of the Mojave River, to 100 ft/day along the ancestral channel through the center of the valley and 25 ft/day along the valley margins. The hydraulic conductivities were estimated from a number of aquifer tests in the Hinkley Valley and model calibration. The thickness and continuity of the lacustrine clay is such that there is little hydraulic communication between the upper and lower aquifer (Andrews et al. 2003).

3. Groundwater Flow Model Development

This section details the development and calibration of a numerical groundwater flow model for the Hinkley area. The primary phases in the development of a numerical groundwater flow model include the construction of a finite-difference grid for the model area, specification of model structure, assignment of boundary conditions and hydraulic parameter values, and selection of appropriate water level measurements for model calibration. These elements serve as the basis for the construction and subsequent calibration of the numerical model to observed groundwater flow conditions at the Site.

3.1 Code Selection and Description

The simulation program MODFLOW was selected for the construction and calibration of the numerical groundwater flow model at the Site. MODFLOW is, a publicly available groundwater flow simulation program developed by the U.S. Geological Survey (USGS) (McDonald and Harbaugh 1988). MODFLOW is thoroughly documented; widely used by consultants, government agencies, and researchers; and is consistently accepted in regulatory and litigation proceedings.

MODFLOW simulates transient or steady-state, saturated groundwater flow in three dimensions. The program is designed to simplify the specification of boundary conditions by designing the data input to align with common field variables. The boundary conditions supported by MODFLOW include specified head, precipitation recharge, injection or extraction wells, evapotranspiration, horizontal flow barriers (HFBs), drains, and rivers or streams. Aquifers simulated by MODFLOW can be confined or unconfined, or convertible between conditions. For the Site, which consists of a heterogeneous geologic system with variable unit thicknesses and boundary conditions, MODFLOW's three-dimensional capability and boundary condition versatility are essential for the proper simulation of groundwater flow conditions.

MODFLOW uses the method of finite differences to solve the equations of groundwater flow. Using a block-centered finite-difference approach, MODFLOW replaces the continuous system represented by the equations of flow, by a system of discrete blocks in space. The solution of the finite-difference equations produces time-varying values of head at each of the discrete points representing the real aquifer system. Given a sufficient number of discrete points, the simulated values of head yield close approximations of the head distributions given by exact analytical solutions.

3.2 Model Domain

The model was designed to represent groundwater conditions over approximately 25 square miles of Hinkley Valley. The model domain is shown in Figure G-1. The model extends about 5 miles in the north-south direction, from about 4000 ft south of the PG&E compressor station to Red Rock Canyon, 4.5 miles north. The model is about 5 miles wide at the compressor station, extending 2 miles to the west and 3 miles to the east, and narrows following valley width to the north.

3.3 Model Discretization

The finite-difference technique employed in MODFLOW to simulate hydraulic head distributions in multi-aquifer systems requires areal and vertical discretization, or subdivision of the continuous aquifer system into a set of discrete blocks that form a three-dimensional model grid. In the block-centered finite-difference formulation used in these codes, the center of each grid block corresponds to a computational point or node. When MODFLOW solves the set of linear algebraic finite-difference equations for the complete set of blocks, the solution yields values of hydraulic head at each node (or three-dimensional block) in the three-dimensional grid.

Water levels computed for each block represent an average water level over the volume of the block. Thus, adequate discretization (i.e., a sufficiently fine grid) is required to resolve features of interest, and yet not be computationally burdensome. MODFLOW allows the use of variable grid spacing such that a model may have a finer grid in areas of interest where greater accuracy is required and a coarser grid in areas requiring less detail.

The model contains 610 rows, 425 columns, and 6 layers and a total of 1,483,990 active cells (Figure G-2). Minimum cell size is 25 ft by 25 ft, occurring throughout most of the defined 1Q 2011 hexavalent chromium plume. The largest sized cells are 500 x 1000 ft at the periphery of the model domain. The model grid was not rotated, and the majority of grid cells are aligned with the direction of groundwater flow. The boundaries of the model grid are specified to coincide with natural hydrogeologic boundaries, where possible, and the boundaries were set at a significant distance from the Site to minimize the influence of model boundaries on simulation results at the Site.

Individual model layers were used to represent each of the significant hydrogeologic units. The layer elevations of are based on observed lithology from well boring logs and geophysical surveys (Figure G-3). In general, layers 1 through 3 represent the upper aquifer, with layer 2 representing the low-transmissivity “brown clay” layer, where present, that divides the upper aquifer in places. The bottoms of layers 3 and 4 represent the top and bottom of the blue clay where present, respectively. The bottoms of layer 4 and layer 5 represent the top and bottom of the lower aquifer, where present, respectively. The bottom of layer 5 represents the top of the bedrock contact except in areas of bedrock outcropping within the model domain.

Layer thicknesses vary from 5 ft to 50 ft within layers 1 through 4 (Figure G-4). Alluvial sediments thicken considerable along the Mojave River and extending north up the east side of the Hinkley Valley, resulting in thickness of layer 5 of more than 300 ft. Layer 6 is uniformly 200 ft thick.

The six model layers are identified as follows:

- Model layer 1 consists of the upper portion of the Upper Aquifer Unit.
- Model layer 2 consists of the discontinuous Brown Clay.
- Model layer 3 consists of the lower portion of the Upper Aquifer Unit.
- Model layer 4 consists of the Blue Clay.

- Model layer 5 consists of the Lower Aquifer Unit
- Model layer 6 consists of the Competent Bedrock.

3.3.1 Stress Periods

The calibration model was designed to simulate conditions during the 11-year period from 10/1/1996 through 9/30/2007. All stress periods represented 0.25 year, or 3 months.

3.4 Boundary Conditions

3.4.1 External Boundaries

General Head Boundaries

General head boundaries (GHBs) are often used to simulate groundwater elevations at a model boundary, and require a record of water levels at a known distance from the model boundary. A conductance term incorporates model cell dimensions and estimated hydraulic properties between the model domain and the source well.

Although the Mojave River is an intermittent steam, groundwater flows continuously within the highly transmissive aquifer underlying the river channel (Stamos et al. 2001). The Mojave River channel passes around the east side of Iron Mountain through a narrow channel at Hodge, CA, approximately 4 miles upstream from the southern model boundary. As the Mojave River enters the wider Hinkley valley, the river channel sits about 50 to 100 ft lower than a large assemblage of ancestral Mojave River sediments and alluvial fan material descending northeastward off of Iron Mountain toward the compressor station. Conceptually, as the constrained Mojave River aquifer enters the wider valley, most of the groundwater likely remains within the highly transmissive Mojave River channel, but a portion also likely enters the aquifer under the Iron Mountain alluvial fan. This conceptual model is consistent with previous groundwater modeling efforts in the Mojave River Basin (Stamos et al. 2001).

Based on this conceptual model, groundwater enters the southwest model domain along the Mojave River channel (Southern GHB) and from the alluvial fan or ancestral channel deposits west and southwest from the compressor station (Western GHB) (Figure G-5). Likewise, groundwater exits the model domain along the Mojave River channel toward Barstow (Eastern GHB).

The USGS maintains water level records at several wells in and near the model domain. Three of these wells were used to generate general head boundaries to drive flow into the model domain from the south for the and out of the model domain to the east. Well 09N03W21K001S is located up off the west bank of the Mojave River channel about 4 miles from the model domain, and was used for the alluvial fan general head boundary. Well 09N03W23F003S is on the east bank of the Mojave River channel about 3 miles from the model domain, and was used for the south channel general head boundary. Well 09N02W02E001S is located along the north side of the Mojave River channel, about 0.75 miles from the eastern model domain.

Because water level records from one well are seldom ideal for representing or driving head changes at a distance, the observed USGS water level records were adjusted in the model to better reproduce observed conditions within the model domain. Figures G-6 and G-7 show the original and modified water level records used to generate the two Southern GHBs, and the Eastern GHB, respectively. During model calibration, the conductance term was also subject to adjustment.

Constant Head Boundary

Groundwater also exits the model domain in the north toward Harper Lake (Figure G-5). A constant head boundary was used here, as a lack of water level records in this area prevented the use of a general head boundary in this area. Based on extrapolation of water level gradients to the north, a steady-state value of 2050 ft was used at the northern boundary.

No Flow Boundary

The remaining edges of the model domain were assumed to be no-flow boundaries. These generally represent the contact between alluvium and bedrock.

3.4.2 Internal Boundary Conditions and Fluxes

Mojave River

Although the Mojave River is an intermittent stream, when it does flow, it can deliver substantial amounts of water to the subsurface. Indeed, the sharp water level rises in the general head boundary well records occur in years of large discharge events on the Mojave River.

USGS has maintained a stream gauge approximately 1 mile downgradient from the model domain at Barstow since 1930 (Station 10262500). The nearest stream gauge upgradient of the model domain is about 6 miles south at Hodge (Station 10262000), but this gauge was only maintained from 1931to1932 and from late 1971 to early 1993. The relationship between measured discharge at Hodge and Barstow was analyzed with the intention of back-calculating the flow at Hodge during the simulated period (1996 to 2007) for the purpose of estimating stream loss between Hodge and Barstow. Figure G-8 shows the measured ratio of Hodge flow as a percent of measured flow at Barstow. These data show two apparent trends: Group 1 data fall along a logarithmic trend, and the sparser Group 2 data fall along an apparent linear trend. In both cases, the percent decrease in flow between the two stations is greater with smaller flows.

The variability in the discharge relationship between the two sites is likely due to the variable nature of precipitation in the desert (i.e., thunderstorms that deliver highly variable amounts of water across the landscape), the lack of data regarding the input of intermittent streams between Hodge and Barstow, and errors associated with stage gauges in desert environments (e.g., scouring flow can disrupt gauge stage-discharge relationship).

The relationships in Figure G-8 were used to estimate flow at Hodge during measured discharge events, with the logarithmic Trend 1 curve preferred. The total distance between the Hodge and Barstow gauges is about 12 miles, 5 miles of which is in the model domain. Thus, 5/12 was multiplied by the estimated difference in discharge for any single discharge event measured at Barstow to estimate the amount of water infiltrating within the model domain (Figure G-9). A series of 45 injection wells along the Mojave River channel was used to simulate this recharge from the riverbed.

Faults

The Lockhart fault extends in a northwest to southeast trend south and west of the compressor station (Figure G-5). According to the USGS, “This fault appears to impede the movement of ground water in the regional and the floodplain aquifers, although there is no evidence of this effect in the floodplain aquifer along the river” (Stamos et al. 2001 p. 27).

Conceptually, a fault through an alluvial basin can impede flow by offsetting alluvial stratigraphy and/or causing zones of well-graded material with low hydraulic conductivity. In the model, the Lockhart fault is assumed to provide significant resistance to flow, but not to entirely prevent flow, and is simulated as a zone of low hydraulic conductivity (discussed in Section 4).

The Mount General fault also extends northwest-to-southeast along the northeast model boundary. There is no evidence of this fault extending into the north Hinkley Valley.

3.4.2.1 Agricultural Withdrawals, Irrigation, and Recharge

The Hinkley Basin is agricultural in nature, with several dairies and farms. Alfalfa and grass are the primary crops. Water is supplied to irrigated fields from wells with the Hinkley Basin, including within the model domain.

The Mojave Basin was adjudicated in 1996, and the Mojave Watermaster maintains records of groundwater withdrawals, available to the public in annual reports. The annual reports only include average annual rates, but the Watermaster provided a quarterly breakdown of pumping rates from 1993 to 2004 for use in the groundwater model. These quarterly rates were used as input to the model for the relevant years, and the average quarterly distribution from 1993 to 2004 was used to break up the average annual pumping rates beyond 2004 as follows:

- Q1 (Oct. –Dec.): 10%
- Q2 (Jan. – March): 19%
- Q3 (April – June): 33%
- Q4 (July – Sept.): 39%

Under standard agricultural management practices, deep percolation and groundwater recharge from agricultural irrigation was estimated at 20% of applied water based on climatic conditions and an alfalfa crop. This specified recharge flux was applied to the model using the MODFLOW recharge (RCH) package.

3.4.2.2 Domestic Withdrawals

The Mojave Watermaster typically does not collect or record use rates from domestic wells. The estimated population within the model domain is about 1,000 residents. Groundwater withdrawals for domestic use were estimated within the more populated areas within the model domain by assuming a use rate of 100 gallons per day per person (USGS Circular 1268 estimated average water use of 82 gallons per person in 2000). The total estimated average domestic demand over the model domain is thus 70 gallons per minute (gpm), and 10 domestic surrogate wells pumping 7 gpm were used to simulate domestic withdrawals. Return flow from septic systems was not included in the model.

3.4.2.3 PGE Pumping

PG&E operates supply wells for the compressor station and for various site remedial actions. These flow rates were incorporated into the model.

3.4.2.4 Precipitation

The average annual precipitation at Barstow from 1889 to 2000 (Station W28 0519 50) was 4.3 inches, while the maximum annual precipitation during this period less than 10 inches. Because these rates are low, and evapotranspiration rates far exceed precipitation rates on an annual basis, recharge into the model from infiltrating precipitation was not included in the model.

4. Groundwater Flow Model Calibration

Calibration of a groundwater flow model refers to the process of adjusting model parameters to obtain a reasonable match between observed and simulated water levels. In general, model calibration is an iterative procedure that involves adjustment of hydraulic properties or boundary conditions to achieve the best match between observed and simulated water levels. During model calibration, site-specific data were used as a guide to constrain estimates of hydraulic conductivity.

4.1 Calibration Procedure

For best results, the calibration of a model should rely on discrete measurements (water levels) to produce answers free of contouring interpretations. In the calibration of a groundwater flow model, use of point data eliminates the potential for interpretive bias that may result from attempting to match a contoured potentiometric surface (Konikow 1978; Anderson and Woessner 1992). The groundwater flow model for the Site was calibrated using 192 wells comprising 4,230 individual observations. The locations of the calibration wells are shown on Figure G-10.

As a further goal for the calibration of a model, the principle of parameter parsimony is applied to achieve an adequate calibration of the model through the use of the fewest possible number of model parameters for representation of the data. It should be noted that the use of greater numbers of model parameters during model calibration creates a situation in which many combinations of model parameter values produce similar calibration results. In this case, the model calibration parameters are called non-unique. Following the principal of parameter parsimony reduces the degree of non-uniqueness and results in more reliable calibrated parameter values. The information gathered for the conceptual model guides any decision to add model parameters (e.g., zones of hydraulic conductivity) to the model during the calibration process. Therefore, the simpler model is preferred.

Iterative trials were used to adjust model parameters during calibration. The primary criterion for evaluating the calibration of a groundwater flow model is the difference between simulated and observed water levels at a set of calibration targets. A residual or model error, e_i , is defined as the difference between the observed (h_i) and simulated ($\hat{h}_i$) hydraulic head measured at a target location:

$$e_i = h_i - \hat{h}_i \tag{4-1}$$

A residual with a negative sign indicates overprediction by the model (i.e., the simulated head is higher than the measured value). Conversely, a positive residual indicates underprediction.

The residual sum of squares (RSS) is defined as:

$$RSS = \sum_{i=1}^{n} \left(h_i - \hat{h}_i\right)^2 \tag{4-2}$$

where h_i is the measured value of hydraulic head and $\hat{h}_i$ is the simulated value at a specific target location. The root mean squared error (RMS) is the RSS divided by the total number of head observations, and is a standard measure of model calibration, with the goal of minimizing the value.

The residual standard deviation (RSTD) is useful for comparing model calibrations with different numbers of calibration targets and estimated parameters.

$$RSTD = \sqrt{\frac{RSS}{n - p}} \tag{4-3}$$

Another calibration measure is the mean of all residuals ($\bar{e}$):

$$\bar{e} = \frac{1}{n}\sum_{i=1}^{n} e_i \qquad (4\text{-}4)$$

A mean residual significantly different from zero indicates model bias.

Typically the RSTD, mean error, and RMS are divided by the range in observed values within the calibration dataset to calculate scaled parameters. These scaled parameters are often preferred indicators of the quality of the calibration as they take into account the range of heads within the model domain.

The groundwater flow model calibration required numerous individual computer simulations. The values and shapes of the various parameter zones in the model were gradually varied until a reasonable solution was achieved in agreement with the conceptual model.

4.2 Hydraulic Parameters

In constructing the model for the Site, representative values for model parameters were selected based on site-specific data. These model parameters included aquifer recharge, and the horizontal and vertical hydraulic conductivity of the aquifer. The model was initially constructed with a uniform hydraulic conductivity and parameter values based on Site aquifer and slug test data. During the calibration of the model, hydraulic conductivity zones were added and parameter values were adjusted within reason to minimize the difference between observed and simulated groundwater elevations. The hydraulic conductivity distribution for all model layers is depicted in Figure G-11:

- Model layer 1 represents the upper portion of the Upper Aquifer Unit.
- Model layer 2 represents the discontinuous Brown Clay.
- Model layer 3 represents the lower portion of the Upper Aquifer Unit.
- Model layer 4 represents the Blue Clay.
- Model layer 5 represents the Lower Aquifer Unit
- Model layer 6 represents the Competent Bedrock.

The ratio of horizontal to vertical hydraulic conductivity for most zones was 50:1, with the primary exception of zones representing bedrock.

4.3 Calibration Results

Calibration results for the hydraulic property distributions discussed in Section 4.2 are summarized in Table G-1. The mean residual was low at -1.1 ft, the RMS error was about 5 ft, the scaled absolute mean error was less than 3%, and the scaled RMS error was 4%. These values indicate a good correlation between predicted and observed head values.

Figure G-12 shows the average residual for each observation well displayed by layer. The mean error at the majority of wells falls within the -2 to 2 foot range. Hydrographs for selected wells with extensive observation records located within the plume boundary and near the Mojave River are shown in Figure G-13.

4.4 Sensitivity Analysis

Sensitivity to the magnitude of hydraulic conductivity was evaluated by multiplying all hydraulic conductivity values by factors of 0.75 and 1.5. These changes resulted in generally poorer calibration statistics, including larger absolute residual means errors, RMS errors, and scaled RMS errors, as shown in Table G-2. These results suggest that the hydraulic conductivity distribution and general configuration of the groundwater flow model appropriately represents groundwater conditions at the site and is suitable as a platform for contaminant transport modeling.

5. Solute Transport Model Development

Solute transport modeling was performed to evaluate the migration and fate of hexavalent chromium detected in the groundwater. The solute transport model used the results from the calibrated groundwater flow model to simulate solute transport constituent under average flow conditions. The solute transport model was used to evaluate the fate and transport of hexavalent chromium and to evaluate various potential remedial systems.

5.1 Code Selection

The solute transport was performed using the modular three-dimensional transport model referred to as MT3D. MT3D was originally developed by Zheng (1990) at S.S. Papadopulos & Associates, Inc., and was subsequently documented for the Robert S. Kerr Environmental Research Laboratory of the U.S. Environmental Protection Agency. The MT3D code uses the flows computed by MODFLOW in its transport calculations. MT3D also uses the same finite-difference grid structure and boundary conditions as MODFLOW, simplifying the effort to construct the solute transport model. MT3D is regularly updated (Zheng and Wang 1999), and the most recent version is referred to in the literature as MT3DMS, where MS denotes the Multi-Species structure for accommodating add-on reaction packages. MT3DMS has a comprehensive set of options and capabilities for simulating advection, dispersion/diffusion, and chemical reactions of contaminants in groundwater flow systems under a range of hydrogeologic conditions. Recent updates to MT3DMS have included the dual-domain formulation and the ability to incorporate site specific processes.

The major inputs to MT3DMS for the modeling assessment are as follows:

- Mobile and Immobile Porosity: affecting the groundwater velocity and dissolved storage;

- Mass Transfer Coefficient: affecting the exchange of mass between mobile and immobile portions of the aquifer;

- Partition Coefficient: affecting the adsorption on hexavalent chromium to soil particles;

- Carbon Degradation Rate: affecting the rate of hexavalent chromium reduction/precipitation.

5.2 Solute Transport Parameters

5.2.1 Porosity

The first phase of calibration was to accurately represent the groundwater velocity in the impacted portion of the aquifer. The groundwater velocity is computed within MT3DMS by dividing the groundwater flux term from MODFLOW by the mobile porosity. The mobile porosity is that fraction of the aquifer through which the majority of groundwater is moving. While often conceptualized as solely a pore scale concept, it also represents aquifer-scale behavior driven by hydraulic conductivity contrasts in different portions of the aquifer matrix. The immobile porosity is the remaining portion of the void space, where groundwater flows much slower or not at all, and the void space is primarily a storage reservoir for dissolved mass. Mass is exchanged between mobile and immobile portions of the aquifer by diffusion. This conceptualization of solute transport is the dual-domain formulation, and is often referred to as *advection-diffusion*. There is extensive literature on the dual-domain model (Gillham et al. 1984; Molz et al. 2006; Flach et al. 2004; Harvey and Gorelick 2000; Feehley et al. 2000; Julian et al. 2001; Zheng and Bennet 2002), and it is generally considered the most accurate approach for simulating solute transport.

The total (combination of mobile and immobile) porosity of the aquifer is controlled by grain sizes and sorting. The mechanics of deposition and consolidation of unconsolidated materials result in aquifer soils in Hinkley exhibiting a total porosity of approximately 35%. Local variability will not have an impact on overall results, and 35% is a reliable estimate for the total porosity of modeled Layers 1, 3, and 5. This is the reference value that was used to divide the aquifer between mobile and immobile regions.

The mobile porosity can be measured only through tracer studies. Tracer studies at Hinkley involved the injection of chromium-free water or dye (fluorosine or eosine) into the aquifer, and observing concentration and arrival time at down gradient monitoring wells. The best aquifer scale tracer data for the Site was performed at the Central Area In-Situ Reactive Zone (IRZ). The chromium-free water that was injected for this study exhibited a velocity of about 600 ft/yr (under the influence of remedial pumping in the vicinity of the Desert View Dairy), while beyond 600 feet, there is an incomplete flush of chromium-impacted groundwater, so the study could not be continued past this point (PG&E, 2011).

The clean water front provided area-specific calibration of the mobile porosity, while the incomplete flush of chromium provided calibration of the mass transfer coefficient between mobile and immobile portions of the aquifer. This calibration process estimated the mobile porosity of the aquifer to be 7% of the total volume, and the immobile porosity to be 28% of the total volume. These values are consistent with the dye tracer studies performed in 2006 and 2007 during the initial design of the Central and Source Area IRZ systems. They are typical of porosity values obtained at other sites (Payne et al. 2008).

5.2.2 Mass Transfer Coefficient

The mass transfer coefficient zonation and values used for Model Layer 1 and Model Layers 2 and 3 are shown in Figures G-14 and G-15, respectively. The mass transfer coefficient (MTC) values were calibrated using the performance data from the Central Area IRZ, and changes in the plume observed over the last 10 years. The distribution of the selected MTC values was based on observed soil characteristics (depositional environments) and source area concentrations. When determining the MTC for the plume, it was apparent based of the plume footprint over time that multiple MTC zones and values were appropriate. The low chromium concentrations in the northern plume footprint and the changes in plume extents over the last 10 years suggest that this portion of the plume is diffuse; that is, this portion of the plume is primarily in the mobile phase, and concentrations are still diffusing or maturing into the immobile phase. In contrast, some southern areas of the plume (near the compressor station) have exhibited consistently higher chromium concentrations, indicating little movement in the source areas over the past decade.

To match observed plume movement in the field, the MTC in the model must be sufficient to transfer mass at a rate to maintain the present concentrations in the dissolved phase, while small enough that the modeled core of the plume does not move rapidly to the north in the model. To better model the source area concentrations in place over time, an MTC of 6.0×10^{-5} [1/day] was calibrated to areas where plume concentrations exceed 500 parts per billion (ppb) in Model Layers 1, 2, and 3 (Figures G-14 and G-15). This value was developed through iterative trials. The selection was based upon actual changes in the plume since 2000, along with the age of the plume.

The southwestern portion of the plume, where the alluvial fan extends in the northeastern direction, was assigned an MTC value of 6.0×10^{-04} [1/day] (Figure G-14 and G-15) in Model Layers 1 through 3. In Model Layer 1 of most of the remainder of the plume, an MTC value of 2.0×10^{-05} [1/day] was assigned (Figure G-14). In Model Layers 2 and 3, of the remainder of the plume, an MTC value of 6.0×10^{-04} [1/day] was assigned (Figure G-15). The MTC values for Model Layers 4, 5, and 6 are held constant at 6.0×10^{-04} [1/day] across the entire plume area. These values are reasonable for the deeper units in the model, as virtually all the hexavalent chromium is found in Layers 1, 2, and 3.

The solute transport model was run with initialized historic plumes to determine if the selected MTCs produced reasonable results with respect to observed current plume distributions. It was recognized that variations in historic plume interpretations were not just a function of plume movement, but also improved delineation of the plume that developed over time as the monitoring well network density evolved. The current plume interpretation is based on a much more advanced monitoring well network, which improved the resolution of the plume delineation. Despite these variations in plume interpretations over time, a few aspects of the plume remained consistent - including a persistent source area and a diffuse downgradient plume. The MTC values for the identified areas of concerned were systematically adjusted between 1.0×10^{-05} [1/day] and 1.0 [1/day], until a reasonably accurate present plume distribution was achieved after running the solute transport model several years with an initialized historic plume from 2002.

The estimated MTC values were then applied to the February 2010 plume, and evaluated with the solute transport model. Figure G-16 shows a comparative analysis between an example of a solute transport model that does not effectively simulate a persistent source and an example of the solute transport model that utilizes the selected parameters to better represent the persistent source areas. For the purpose of this comparison, neither scenario includes active treatment or pumping within the footprint of the plume. The solute transport results shown in Figure G-16 indicate that the selected MTC value distribution and the enhanced immobile portion concentration that were initialized to represent persistent concentrations present below the water table (discussed in the initial concentration section below), effectively simulate source area concentrations that have been observed at the Site over time.

5.2.3 Chromium Adsorption

The retardation factor (R_f) is used by the solute transport model to represent the amount of adsorption of a constituent between the dissolved or solute phase and adsorbed to the aquifer. The retardation factor is calculated in MT3D using the bulk density (ρ_b), the mobile porosity (n_m) of the aquifer material, and a distribution coefficient (K_d), according to the following equation:

$$R_f = 1 + \frac{\rho_b K_d}{n_m} \qquad (5\text{-}1)$$

The distribution coefficient is the product of the organic carbon content in the aquifer (f_{oc}) and the constituent distribution coefficient normalized to particulate organic carbon (K_{oc}):

$$K_d = K_{oc} \times f_{oc} \qquad (5\text{-}2)$$

The presence of background hexavalent chromium concentrations associated with the naturally occurring mineralogy suggests nominal adsorption (low Kd value) is representative of the aquifer. This assessment is consistent with the literature, which identifies a wide range of Kd values (USEPA 1999) for naturally occurring hexavalent chromium in aquifer soils with a normal pH range. The model includes a very small amount of adsorption for hexavalent chromium, incorporating a distribution coefficient (Kd) of 0.005 liter per kilogram (L/kg). This Kd value was determined through iterative trials to match the observed clean water flush downgradient of the Central Area IRZ. A Kd value of 0.005 L/kg results in a retardation factor of approximately 1.25 for the hexavalent chromium plume in the solute transport model. This indicates the plume will migrate about 25% slower than the ambient groundwater flow velocity. Given the current plume distribution and the understanding of groundwater flow through the region, the Kd value of 0.005 L/kg is a reasonable estimate of natural chromium adsorption rates in Hinkley.

5.2.4 Chromium Reduction

The reduction and precipitation of hexavalent chromium in the aquifer was simulated using two different methods. The first was to simulate the natural reductive capacity of the aquifer. There is no clear evidence that hexavalent chromium is reducing within Model Layers 1, 2, 3, or 5 of the aquifer; however, column studies and Site data demonstrate that reduction is occurring within the Blue Clay (Hill, 2010). Therefore, chromium reduction/precipitation was only simulated in Model Layer 4 to represent the observed natural reductive capacity. The second method was to simulate the reduction/precipitation of chromium in the presence of injected carbon (as part of an in situ remediation approach). To account for this, the model assumed hexavalent chromium reduction/precipitation whenever the injected carbon exceeds a concentration of 0.1 parts per million (ppm). At the same time, a carbon half-life of 14 days was assumed to account for the degradation of the injected carbon over time. By simulating both hexavalent chromium and carbon simultaneously, the interactions between the plume and the active IRZ were accounted for in the solute transport model.

5.2.5 Initial Conditions

The initial chromium plume concentration distribution was based on February 2010 data. In the mobile phase, the shallow plume delineation was initialized in Model Layer 1, and the deep plume delineation was initialized in Model Layers 2 and 3. In most of the immobile portions of the aquifer, hexavalent chromium concentrations were assumed to be equal to concentrations in the mobile portions. The exceptions were high chromium concentrations areas in the vicinity of the compressor station. The existence of residual source areas below the water table was extensively evaluated during modeling exercises, because zones of high concentration chromium in groundwater near the compressor station were flushing out too quickly in early model runs (when compared to observed field conditions). A review of historic hexavalent chromium concentration trends in these areas document that there have been prolonged periods of high concentrations in groundwater in this area, implying that chromium has had time to diffuse into finer-grained aquifer materials below the water table. Groundwater contained within these affected finer-grained materials will be less mobile as compared to that contained within coarser materials, and thus will be the slowest to remediate. In addition, samples collected well below the water table in this area show discoloration consistent with chromium impact. These field phenomena support the modeling assumption of complete equilibrium between the mobile and immobile model portions of the aquifer. To model these persistent source areas, higher immobile portion concentrations (exceeding the maximum observed Cr(VI) concentration) were input as base conditions (initialized). Specifically, in locations where the initialized mobile portion plume exceeded 500 ppb Cr(VI), the immobile portion Cr(VI) concentrations were initialized at 2,000 ppb. These concentrations were estimated based on calibration of the solute transport model to actual historic plume distributions observed over the past ten years.

Additional model runs were performed with a more recent plume distribution that was initialized based on first quarter 2011 observed concentration data. The same assumptions for the initial February 2010 conditions were made based on the revised plume delineation.

5.3 Parameter Assessment

Similar to the Total Maximum Daily Load (TMDL) Technical Report, levels of confidence can be assigned to the solute transport model parameters. The levels of confidence are based on a combination of methodologies including model calibration and validation, literature review, independent studies, and scientific expertise used to apply the concept of best professional judgment. Solute transport parameters utilized in the model, such as MTC, mobile and immobile porosity, and partition coefficient, cannot be measured directly in the field, so the level of confidence is inherently lower for these parameters. Each of these parameters were calibrated based on the historical understanding of the hexavalent chromium distribution in groundwater, and the parameters fell within the range of acceptable values from literature review. By relying on scientific expertise and applying best professional judgment, a level of medium to high confidence is attained for confidence in the solute transport model parameters.

A sensitivity analysis quantifies the impact that variations on model parameter values have on differences between Site observations and model predictions. This approach is extremely challenging for this study because of the various complexities of the area, including dramatic variations in regional pumping prior to 2000 and recharge due to agricultural demands and limited historical density of data points in the Site vicinity. However, various aspects of the plume were analyzed in detail with the solute transport model to determine appropriate solute transport parameters to use for the predictive modeling. The two main factors that allowed for better understanding of plume movement through the Hinkley Valley were historical hexavalent chromium data trends in groundwater and groundwater velocities determined from the clean water flush occurring downgradient of the Central Area IRZ since operation began.

Numerous solute transport model runs were conducted in an attempt to fit both the groundwater velocity estimates and observed historical hexavalent chromium concentration data. Ultimately, the solute transport model should simulate a relatively slow flushing of the source area, and a flow velocity of 600 ft/yr downgradient of the Central Area IRZ (under the influence of remedial pumping in the vicinity of the Desert View Dairy). By adjusting parameters such as mobile porosity, immobile porosity, MTC, immobile phase concentrations, and partition coefficient, a reasonable qualitative and quantitative fit to the observed data and flow conditions was obtained.

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Table G-1

Groundwater Flow Model Calibration Statistics
Pacific Gas and Electric Company, Hinkley, California.

Parameter	Value
Residual Mean (ft)	-1.10
Abs. Res. Mean (ft)	3.39
Res. Std. Dev. (ft)	5.02
Sum of Squares (ft)	111666
RMS Error (ft)	5.14
Min. Residual (ft)	-45.84
Max. Residual (ft)	21.59
Number of Observations	4230
Range in Observations (ft)	127.6
Scaled Std. Dev. (ft)	0.039
Scaled Abs. Mean (ft)	0.027
Scaled RMS (ft)	0.040

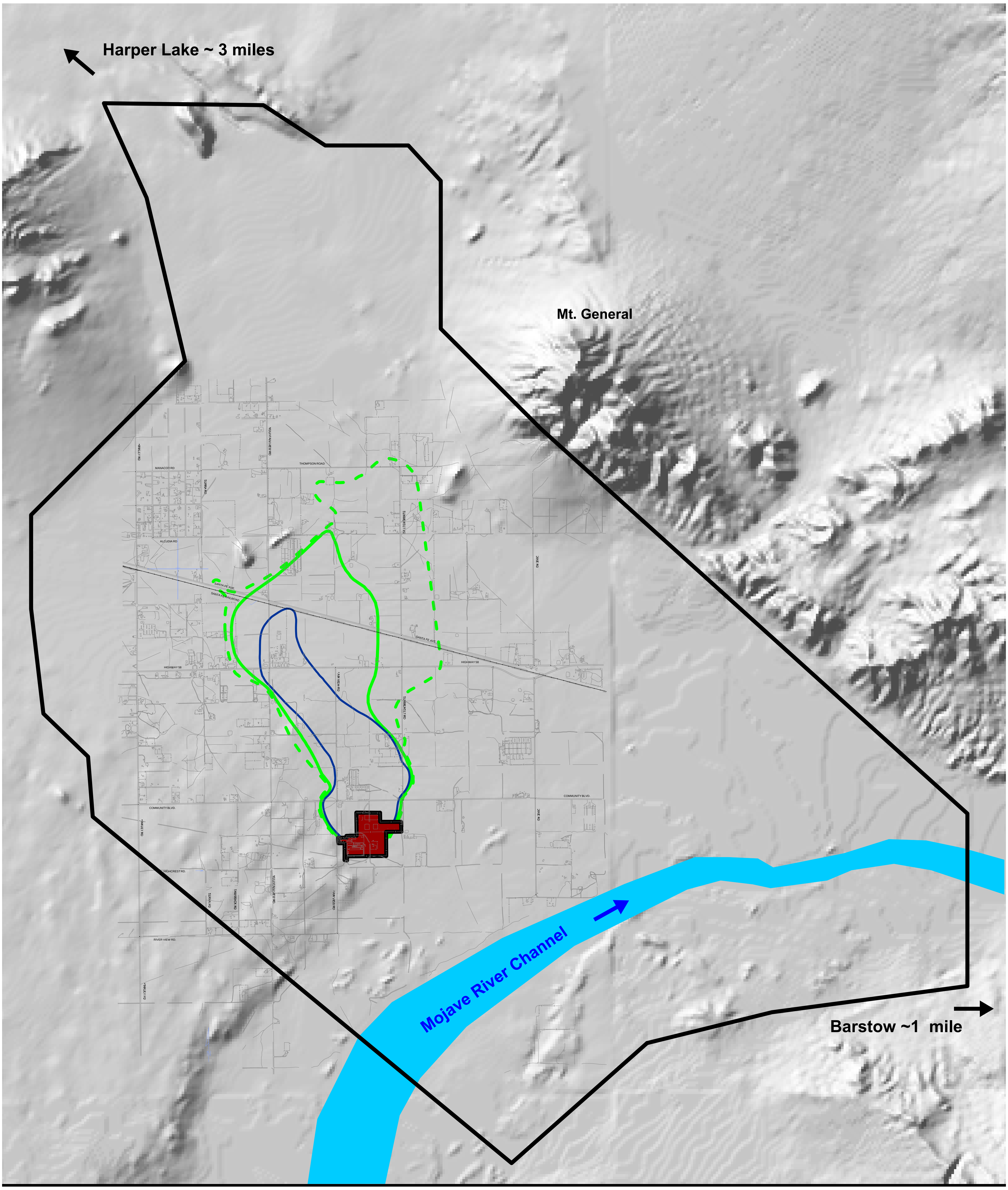
Notes:
ft = feet
RMS = root mean squared

Table G-2

Hydraulic Conductivity Sensitivity Analysis
Pacific Gas and Electric Company, Hinkley, California.

Parameter	Calibrated Model	Increased Hydraulic Conductivity by 50%	Decreased Hydraulic Conductivity by 25%
Residual Mean (ft)	-1.1	-8.0	5.0
Abs. Res. Mean (ft)	3.4	8.4	6.8
Res. Std. Dev. (ft)	5.0	5.9	6.0
Sum of Squares (ft)	111666	421791	257367
RMS Error (ft)	5.1	10.0	7.8
Min. Residual (ft)	-45.8	-59.6	-33.8
Max. Residual (ft)	21.6	20.4	43.0
Number of Observations	4230	4230	4230
Range in Observations	127.6	127.6	127.6
Scaled Std. Dev. (ft)	0.039	0.047	0.047
Scaled Abs. Mean (ft)	0.027	0.066	0.053
Scaled RMS (ft)	0.040	0.078	0.061

Notes:
ft = feet
RMS = root mean squared



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

PG&E Compressor Station

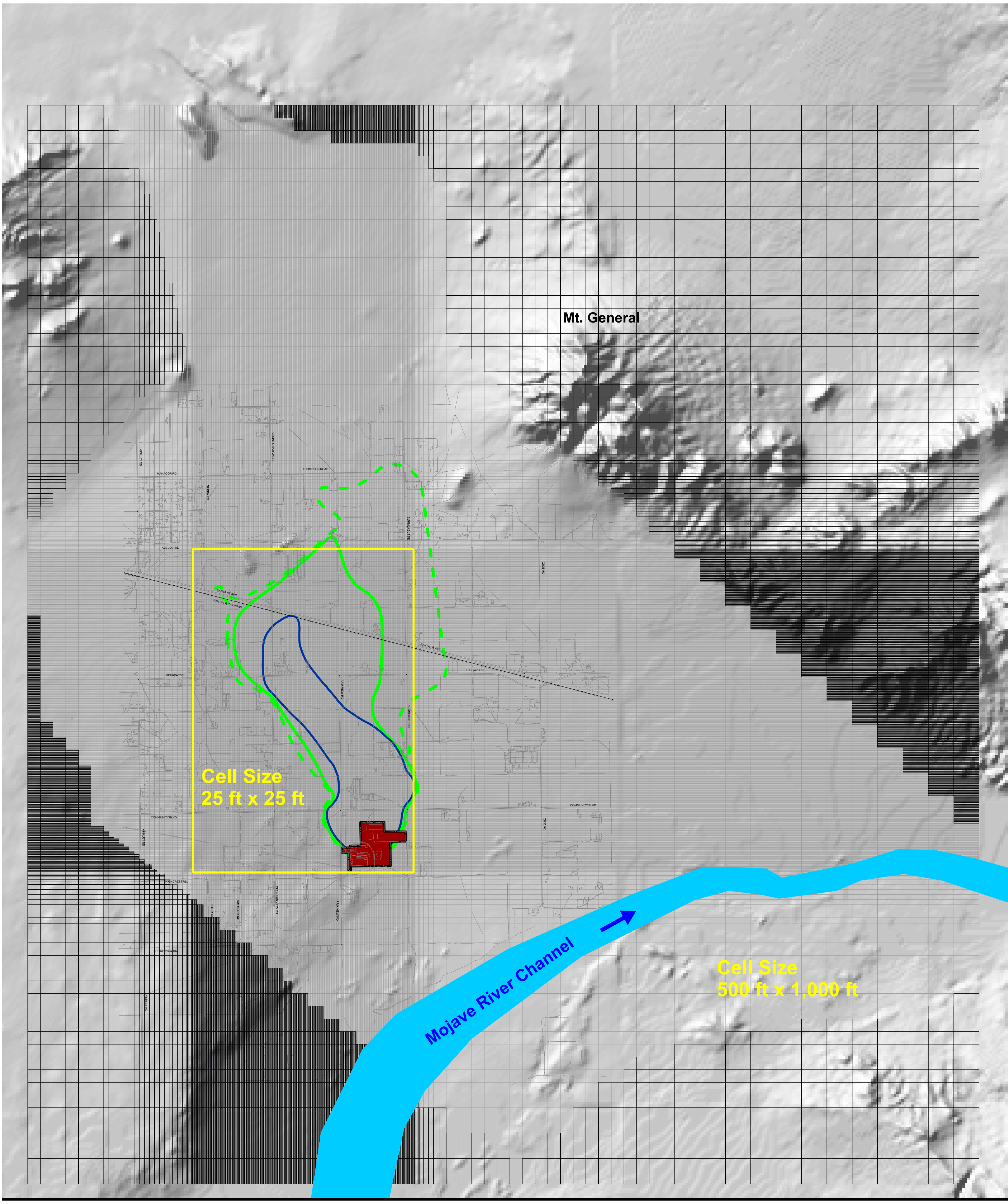
Extent of Model Domain

N

0 feet 2000 feet 4000 feet 6000 feet

Figure G-1
Model Domain

PG&E COMPRESSOR STATION, HINKLEY, CA
August 29, 2011
CH2MHILL



LEGEND

1st Quarter 2011 Cr(VI) Concentration

- 3.1 µg/L
- 10 µg/L
- 50 µg/L

PG&E Compressor Station

Active Model Grid

Inactive Model Grid

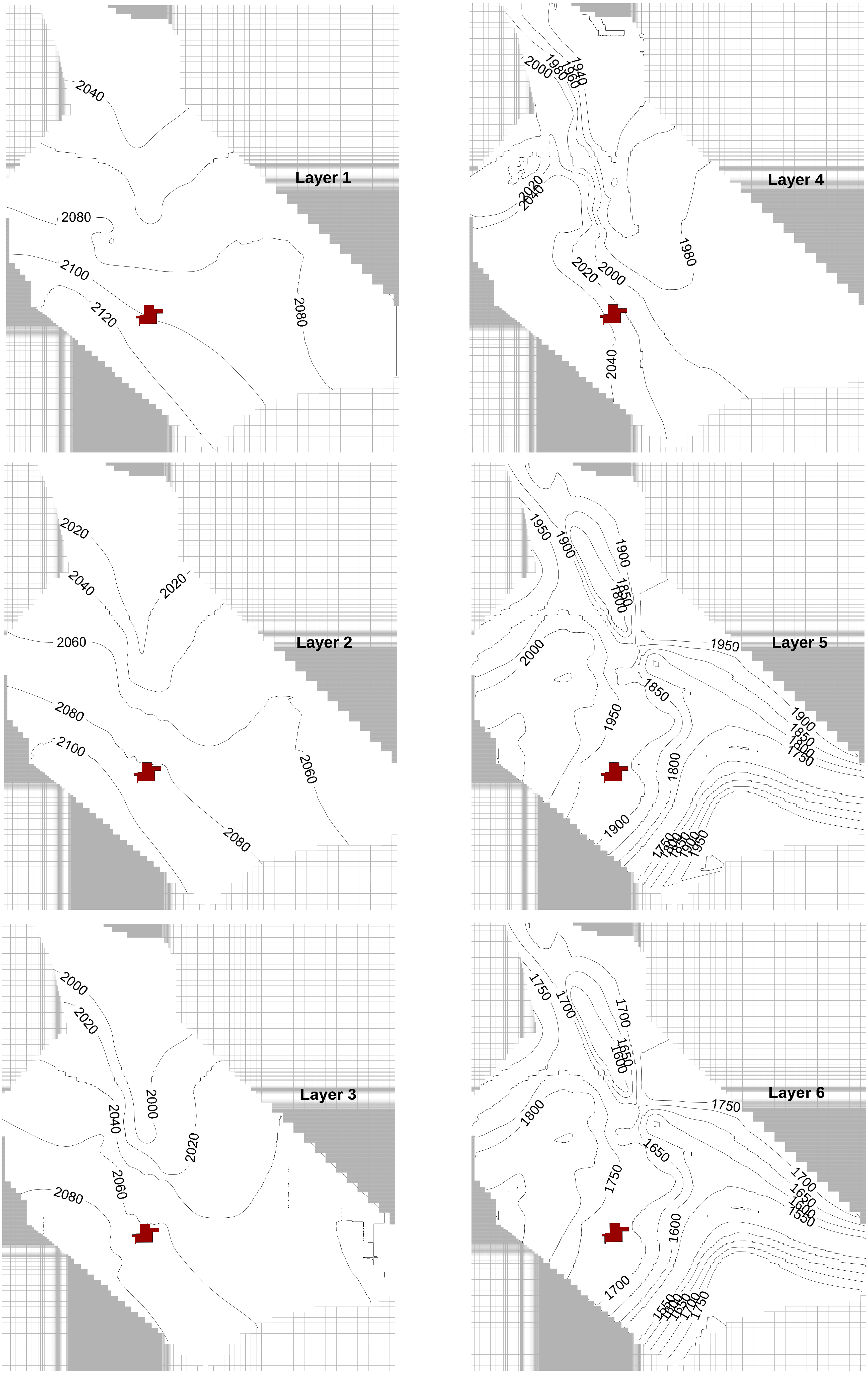
Note:
Model cells outside of model domain are inactive.

N

0 feet 2000 feet 4000 feet 6000 feet

Figure G-2
Model Grid

PG&E COMPRESSOR STATION, HINKLEY, CA
August 29, 2011
CH2MHILL



LEGEND

PG&E Compressor Station

1940 Bottom Layer Elevation (ft msl)

Inactive Grid

Notes:
1. Layers 1, 2 and 3 have 20 ft elevation contours.
2. Layers 4, 5 and 6 have 50 ft elevation contours.
3. ft msl = feet above mean sea level.

N

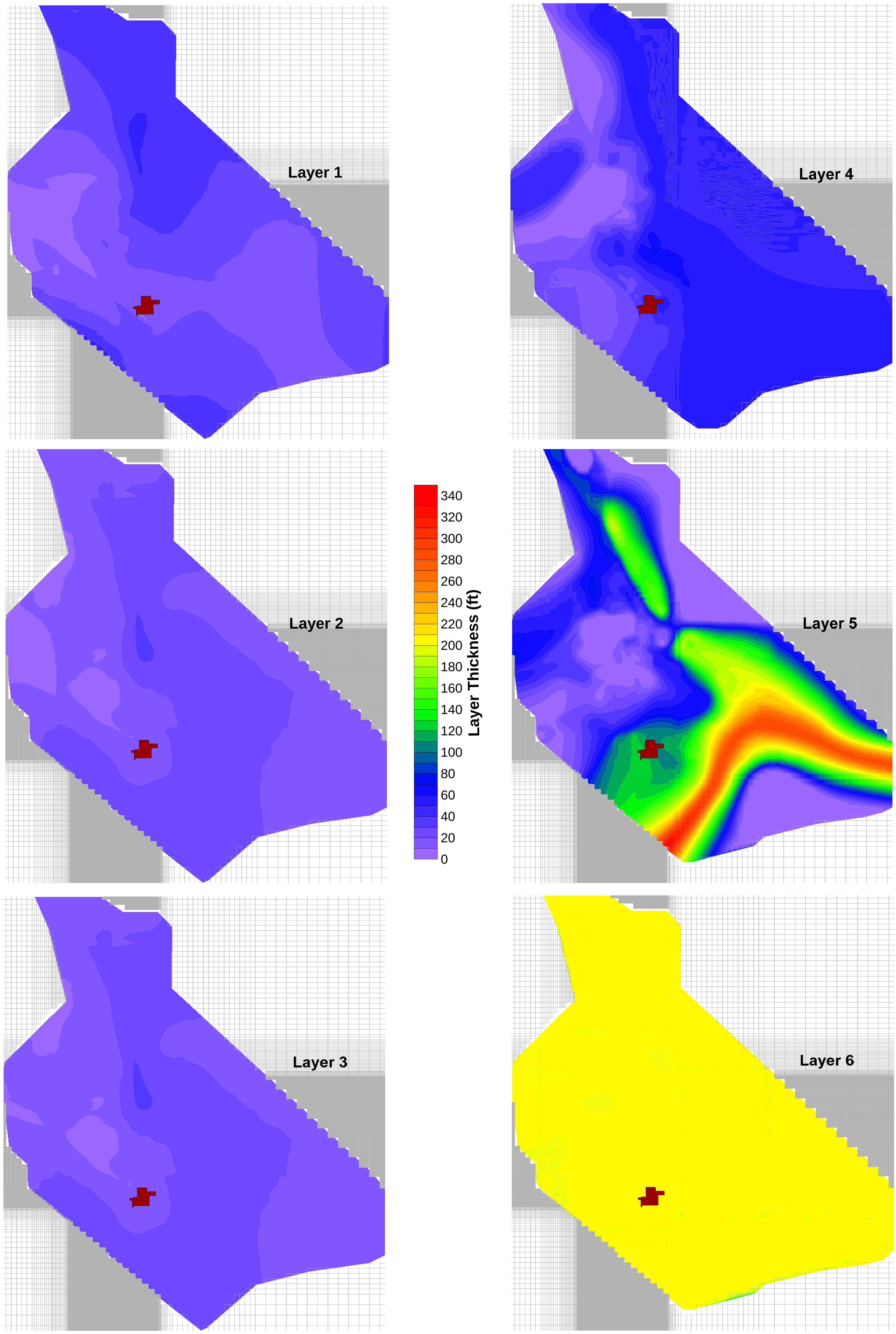
0 feet 5000 feet 10000 feet 15000 feet

Figure G-3
Layer Elevations

PG&E COMPRESSOR STATION, HINKLEY, CA

August 29, 2011

CH2MHILL



LEGEND

PG&E Compressor Station

Inactive Grid

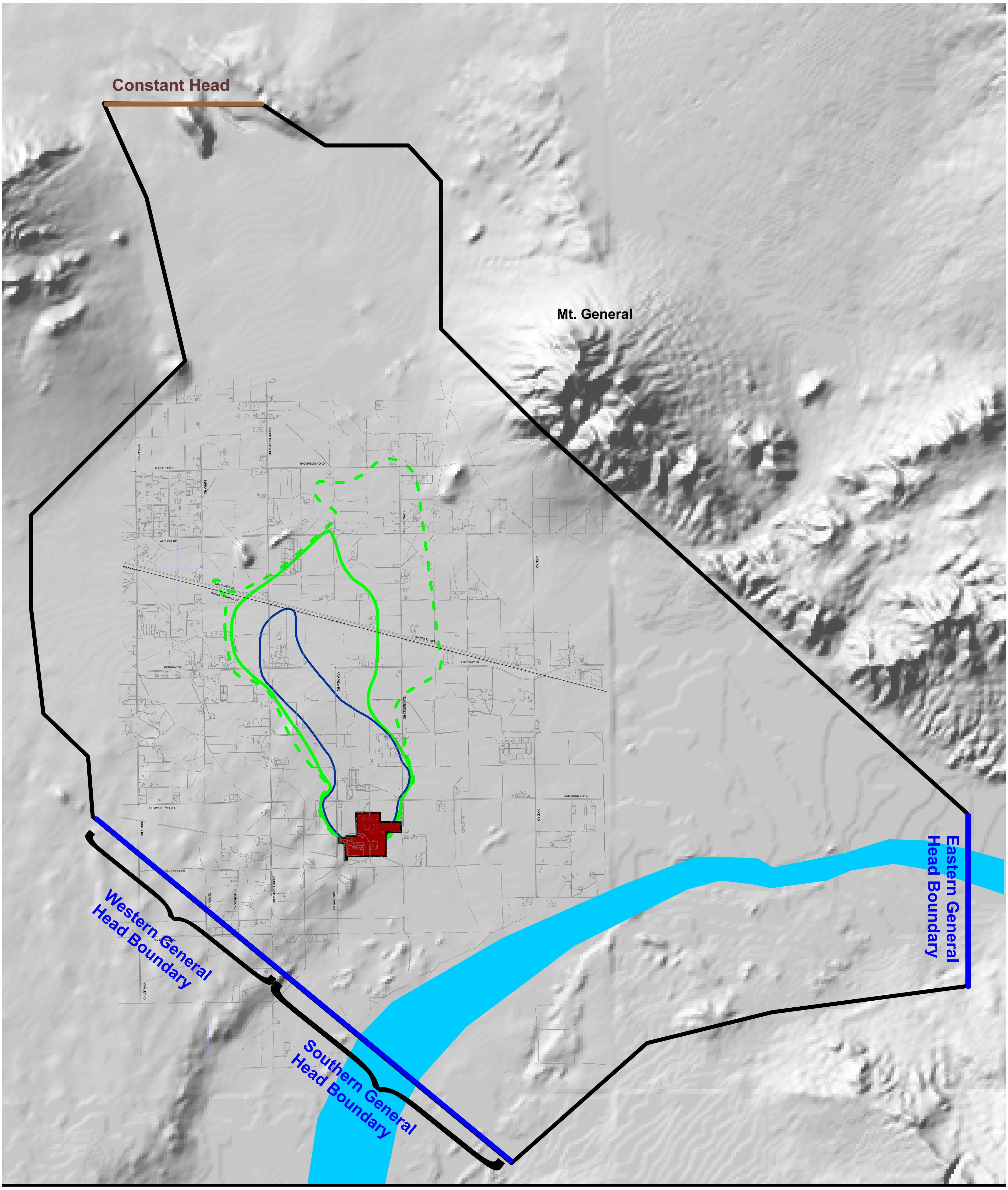
Note:
Layer thickness for Layer 1 is the saturated thickness at initial conditions.

N

0 feet 5000 feet 10000 feet 15000 feet

Figure G-4
Layer Thicknesses

PG&E COMPRESSOR STATION, HINKLEY, CA
August 29, 2011
CH2MHILL



LEGEND

1st Quarter 2011 Cr(VI) Concentration
- 3.1 µg/L
- 10 µg/L
- 50 µg/L

PG&E Compressor Station

Model Boundary Conditions
- Constant Head
- General Head
- No Flow

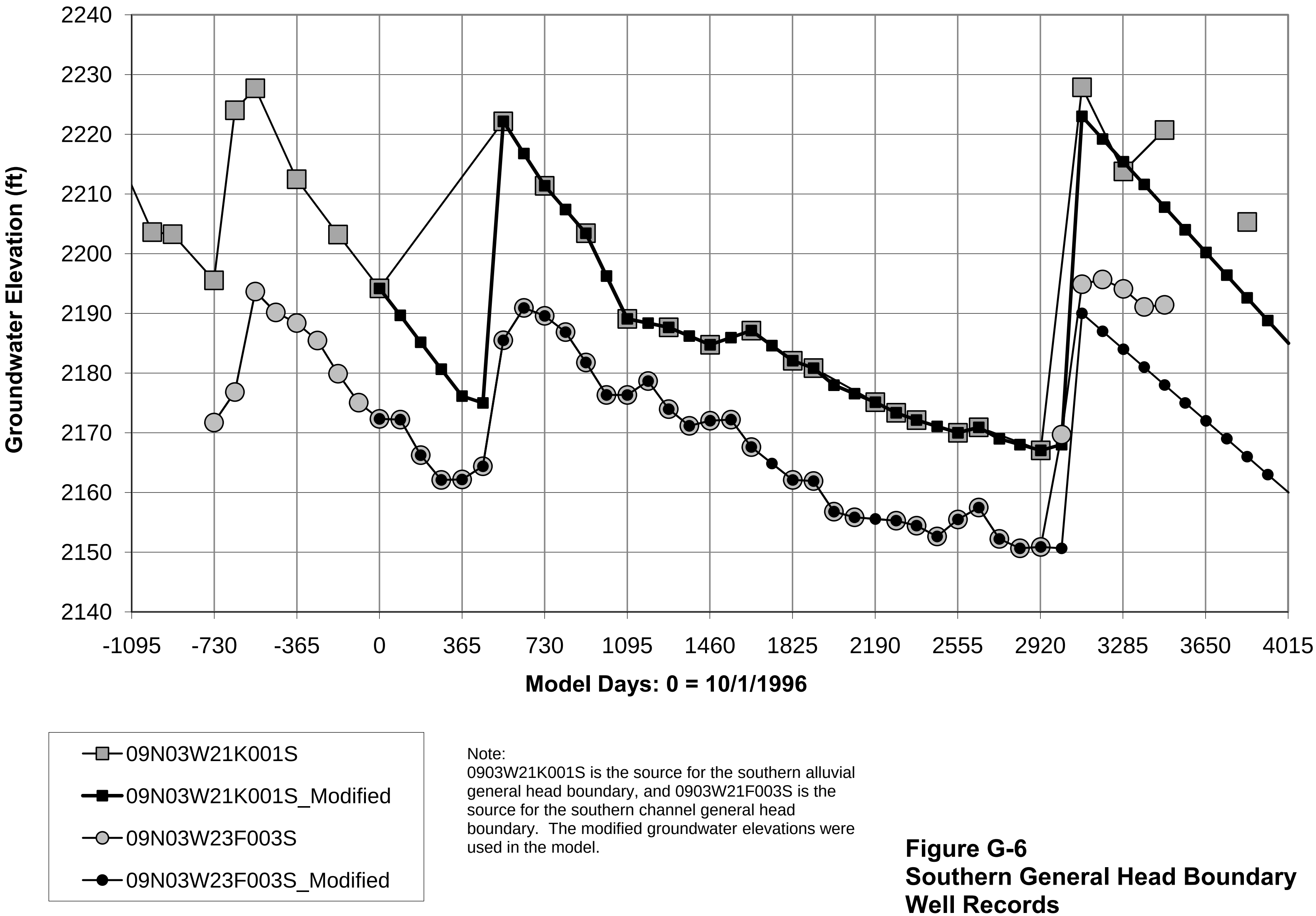
N

0 feet 2000 feet 4000 feet 6000 feet

Figure G-5
Boundary Conditions

PG&E COMPRESSOR STATION, HINKLEY, CA
August 29, 2011

CH2MHILL

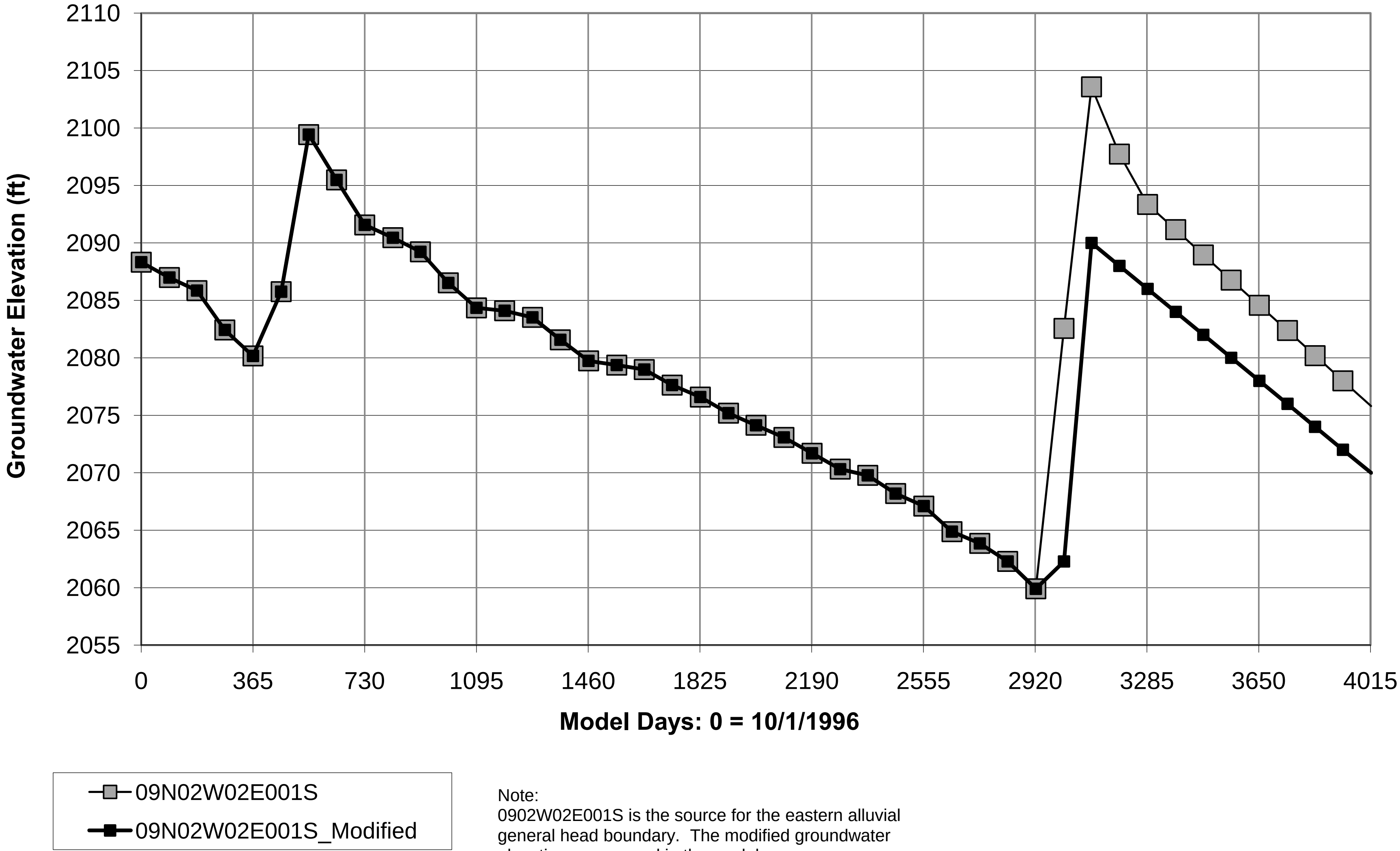


Note:
0903W21K001S is the source for the southern alluvial general head boundary, and 0903W21F003S is the source for the southern channel general head boundary. The modified groundwater elevations were used in the model.

Figure G-6
Southern General Head Boundary Well Records

PG&E COMPRESSOR STATION, HINKLEY, CA

CH2MHILL

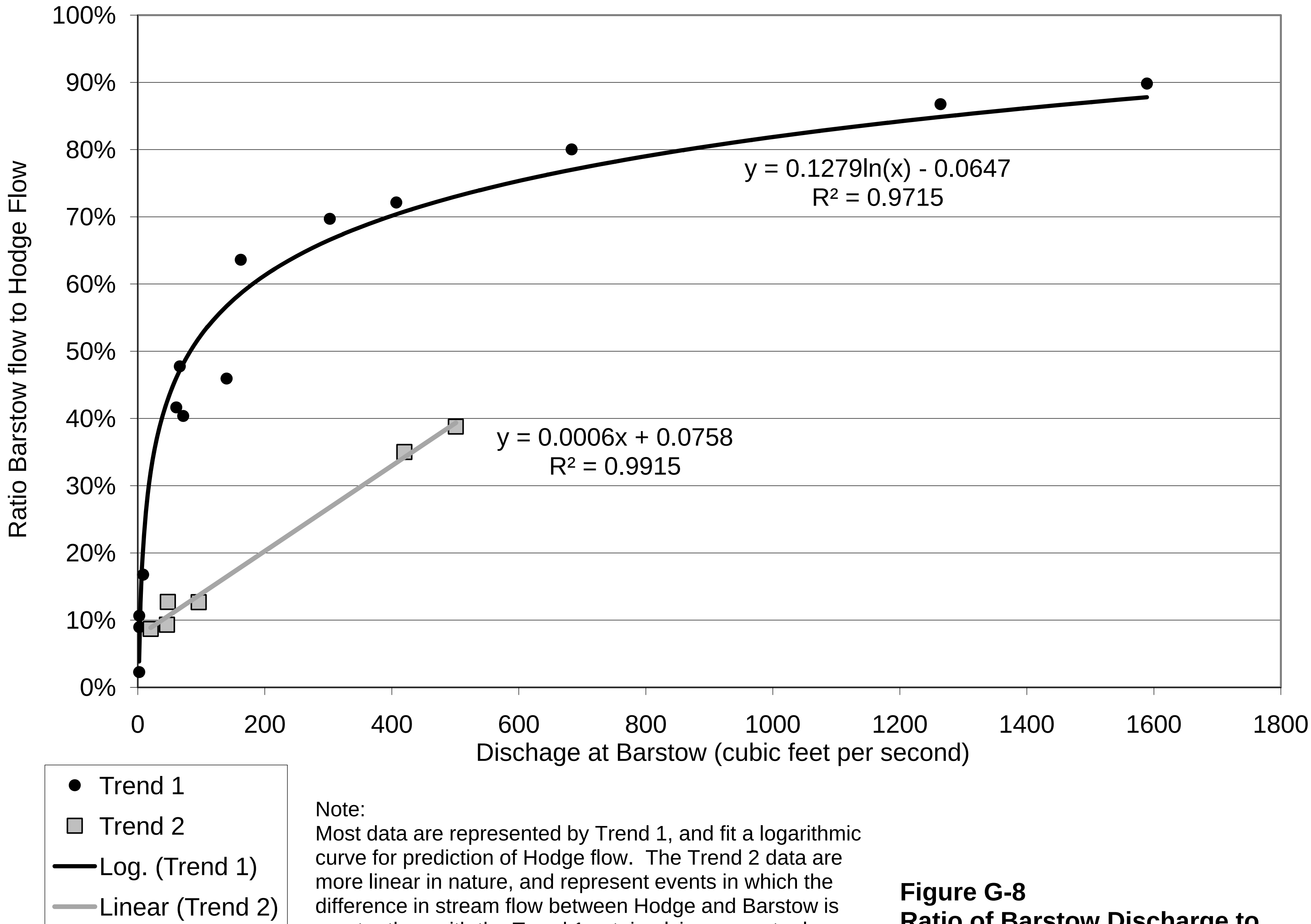


Note:
0902W02E001S is the source for the eastern alluvial general head boundary. The modified groundwater elevations were used in the model.

Figure G-7
Eastern General Head Boundary
Well Record

PG&E COMPRESSOR STATION, HINKLEY, CA

CH2MHILL

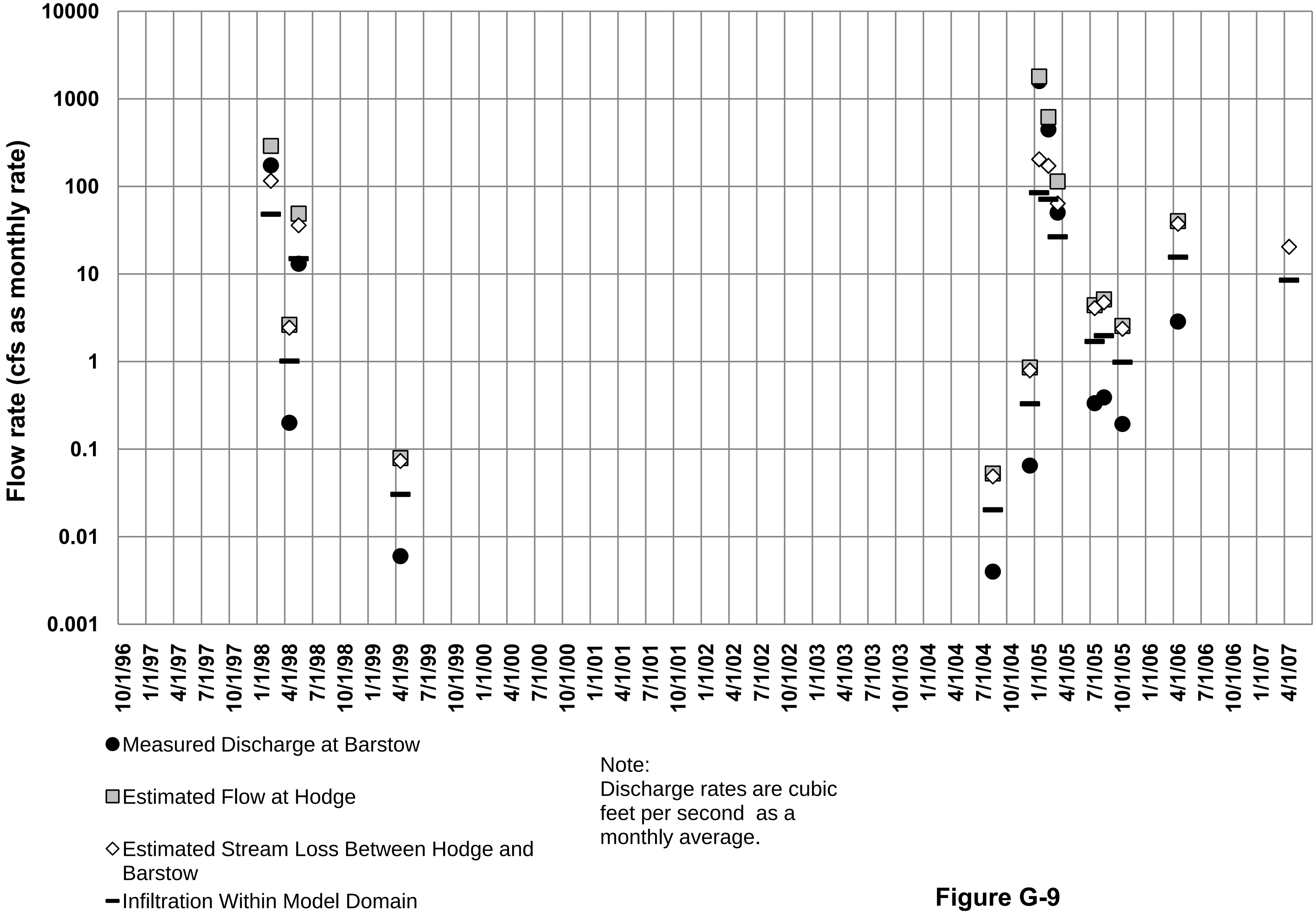


Note:
Most data are represented by Trend 1, and fit a logarithmic curve for prediction of Hodge flow. The Trend 2 data are more linear in nature, and represent events in which the difference in stream flow between Hodge and Barstow is greater than with the Trend 1 set, implying a greater loss of streamflow for an otherwise similar discharge as measured at Barstow.

Figure G-8
Ratio of Barstow Discharge to Hodge Discharge

PG&E COMPRESSOR STATION, HINKLEY, CA

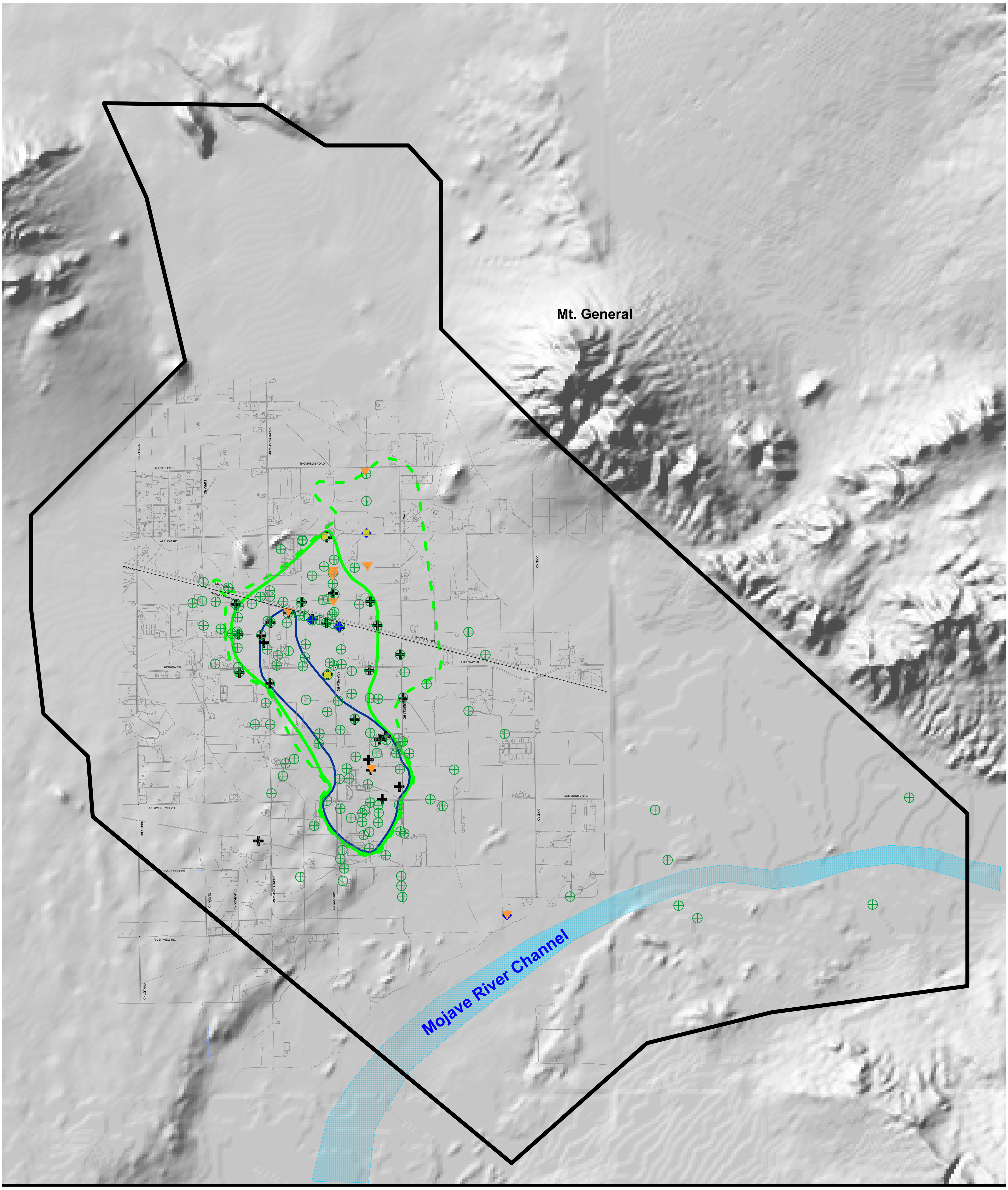
CH2MHILL



Note:
Discharge rates are cubic feet per second as a monthly average.

Figure G-9
Discharge and Infiltration Rates
PG&E COMPRESSOR STATION, HINKLEY, CA

CH2MHILL



LEGEND

1st Quarter 2011 Cr(VI) Concentration
3.1 µg/L
10 µg/L
50 µg/L

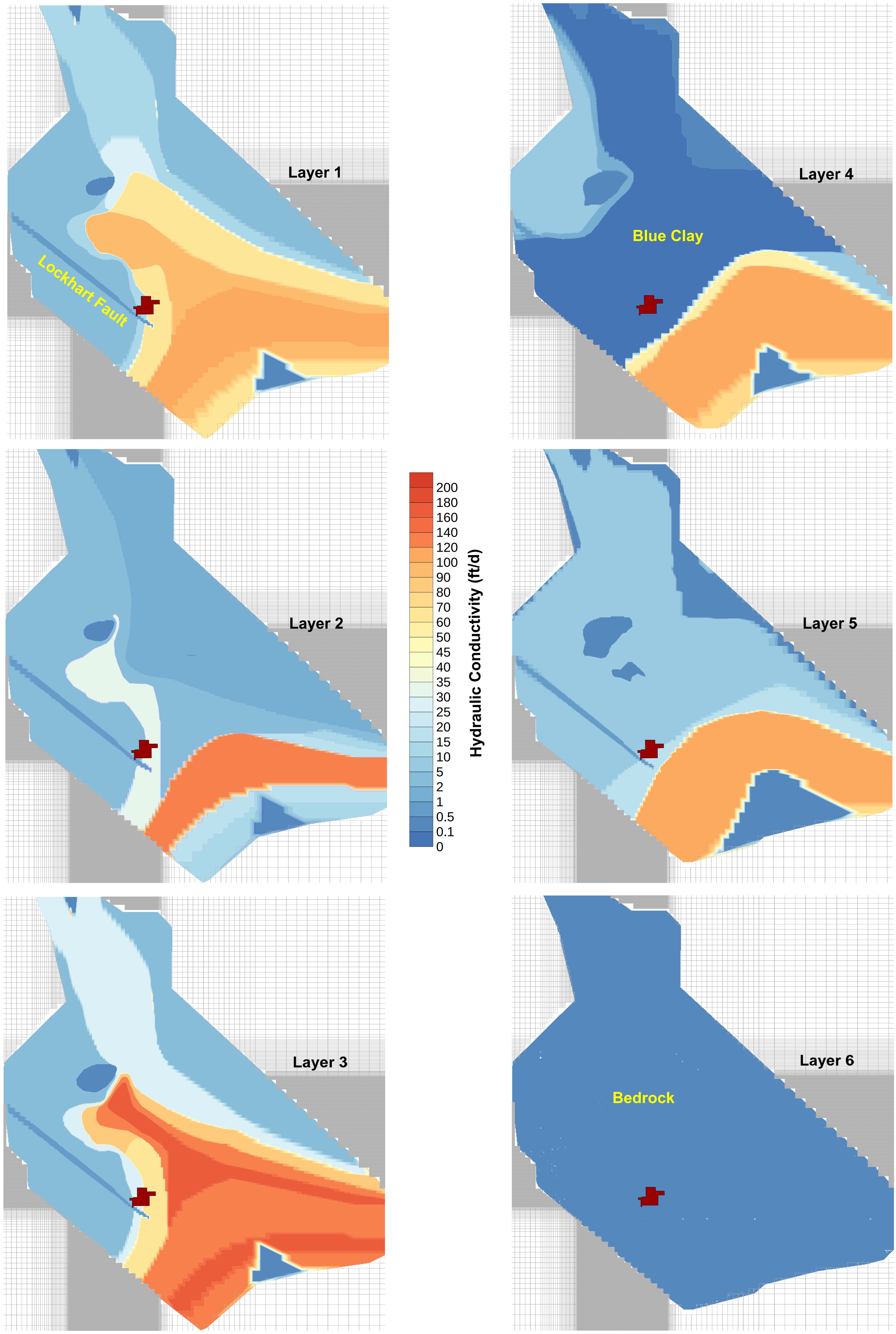
Model Domain

Calibration Wells
Layer 1
Layer 2
Layer 3
Layer 4
Layer 5

N
0 feet 2000 feet 4000 feet 6000 feet

Figure G-10
Calibration Wells

PG&E COMPRESSOR STATION, HINKLEY, CA
August 29, 2011
CH2MHILL



LEGEND

PG&E Compressor Station

Inactive Grid

N

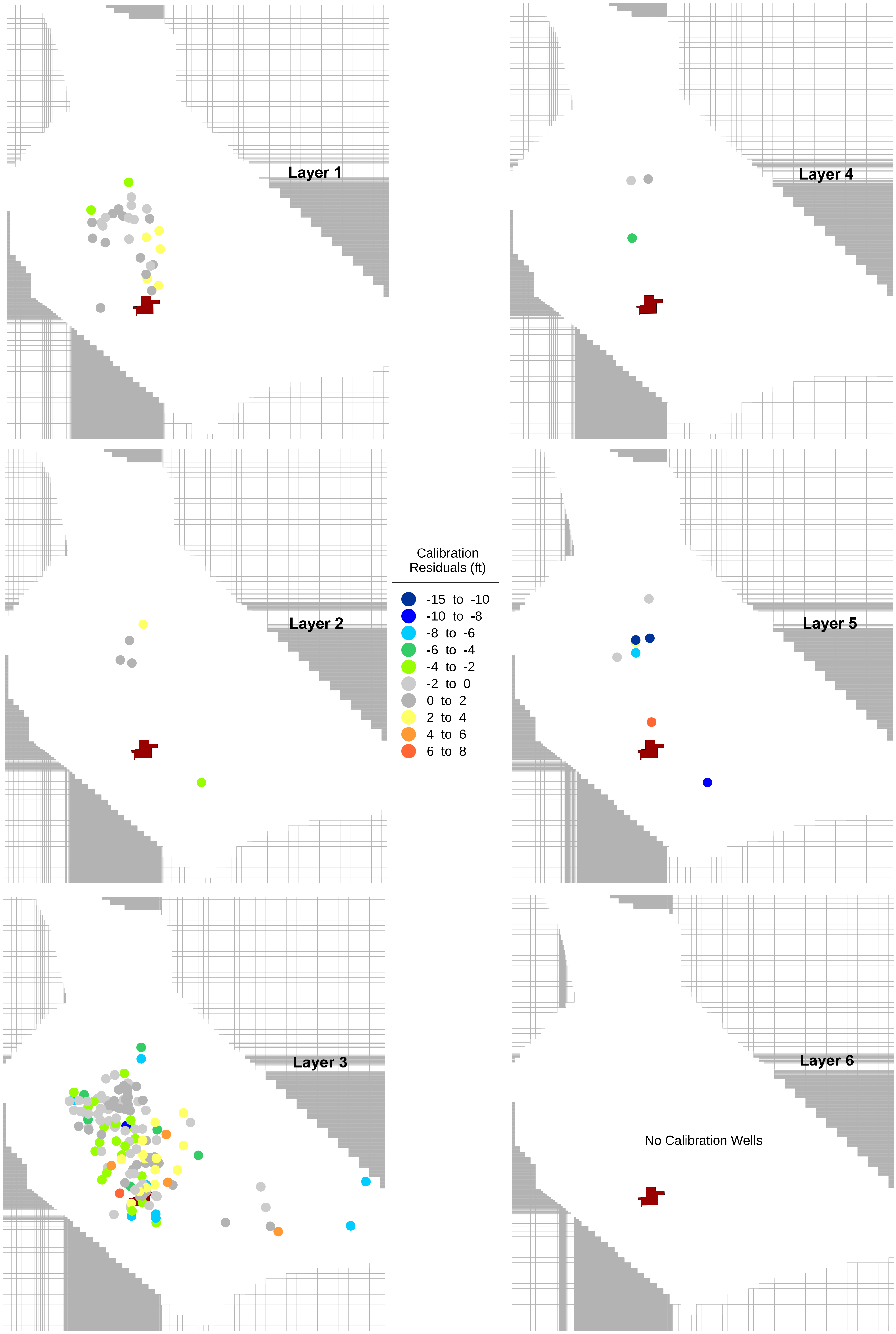
0 feet 5000 feet 10000 feet 15000 feet

Figure G-11
Hydraulic Conductivity Distribution

PG&E COMPRESSOR STATION, HINKLEY, CA

August 29, 2011

CH2MHILL



LEGEND

PG&E Compressor Station

Inactive Grid

Notes:
1. Residuals are calculated as observed - computed values.
2. Values posted are average for each well.

N

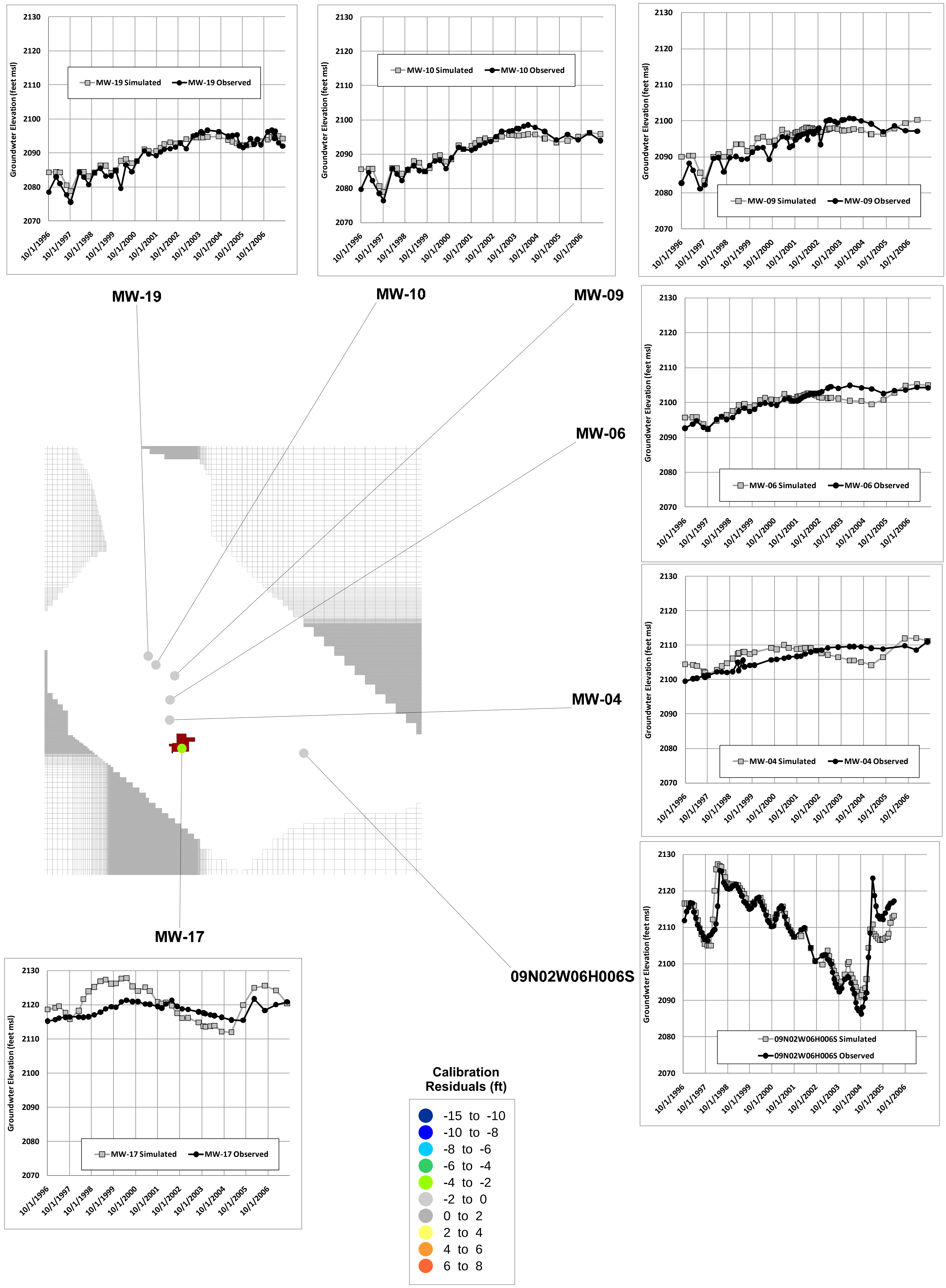
0 feet 5000 feet 10000 feet 15000 feet

Figure G-12
Calibration Residual Distribution

PG&E COMPRESSOR STATION, HINKLEY, CA

August 29, 2011

CH2MHILL



LEGEND

PG&E Compressor Station

Inactive Grid

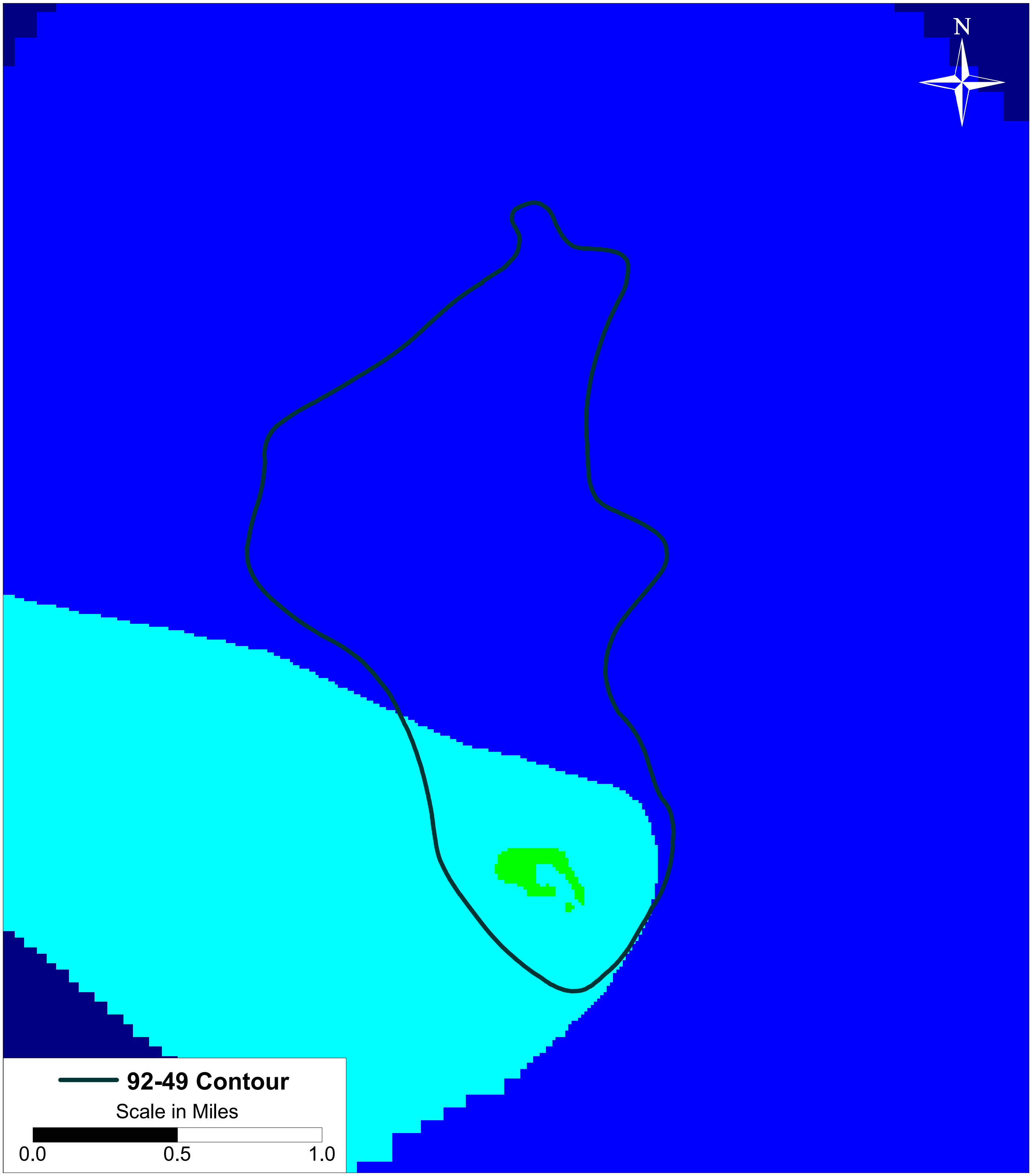
Notes:
1. Residuals are calculated as observed - computed values.
2. Values posted are average for each well.

N

0 feet 5000 feet 10000 feet 15000 feet

Figure G-13
Selected Calibration Hydrographs

PG&E COMPRESSOR STATION, HINKLEY, CA
September 9, 2011
CH2MHILL



LEGEND

No Flow Cell

Mass Transfer Coefficient Zones (1/day)

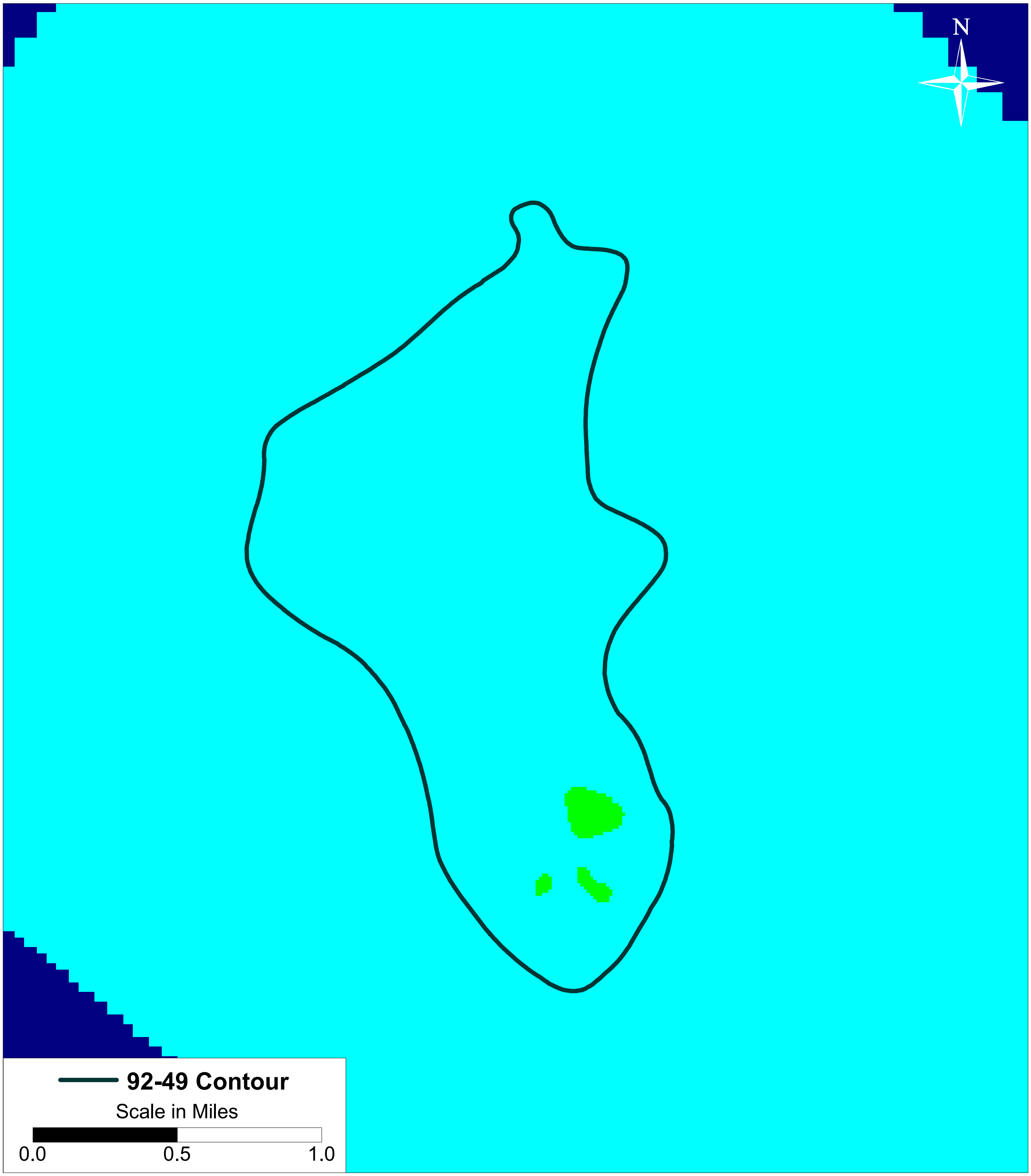
- 2.0E-5
- 6.0E-4
- 6.0E-5

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

MASS TRANSFER COEFFICIENT ZONES
MODEL LAYER 1

ARCADIS

FIGURE
G-14



LEGEND

No Flow Cell

Mass Transfer Coefficient Zones (1/day)

6.0E-4

6.0E-5

PG&E
HINKLEY, CALIFORNIA

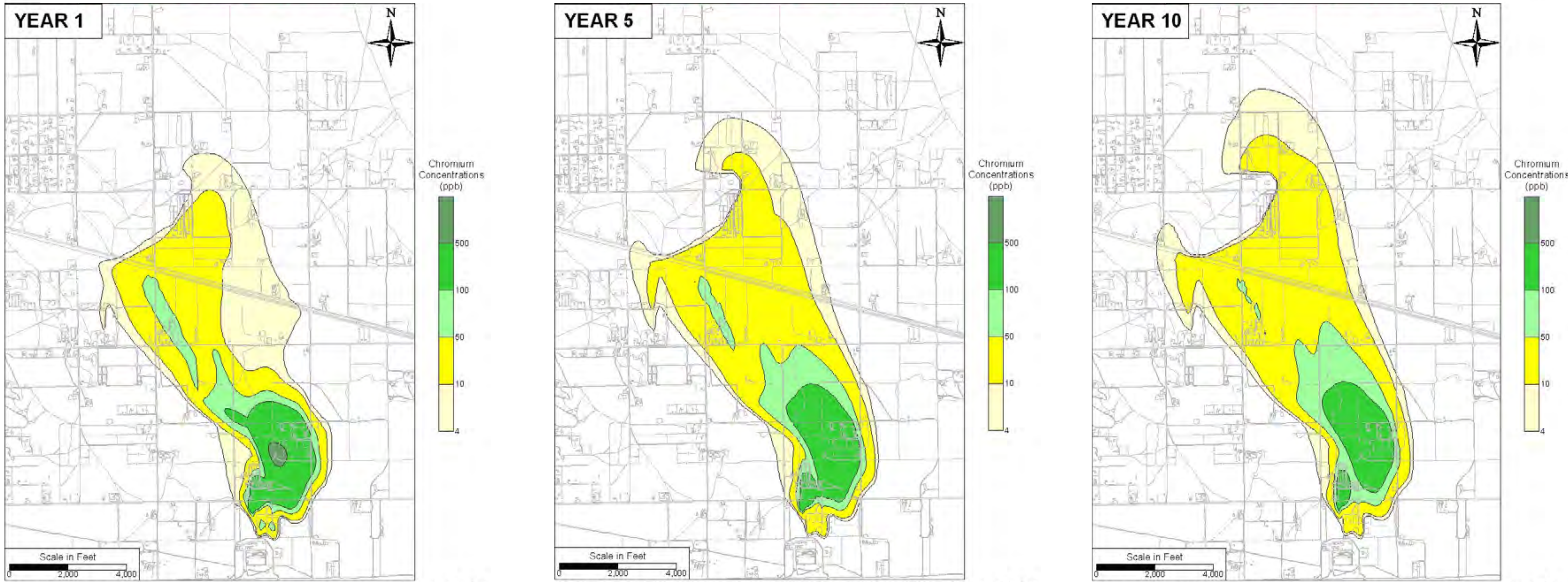
MODELING APPENDIX

MASS TRANSFER COEFFICIENT ZONES
MODEL LAYERS 2 AND 3

ARCADIS

FIGURE

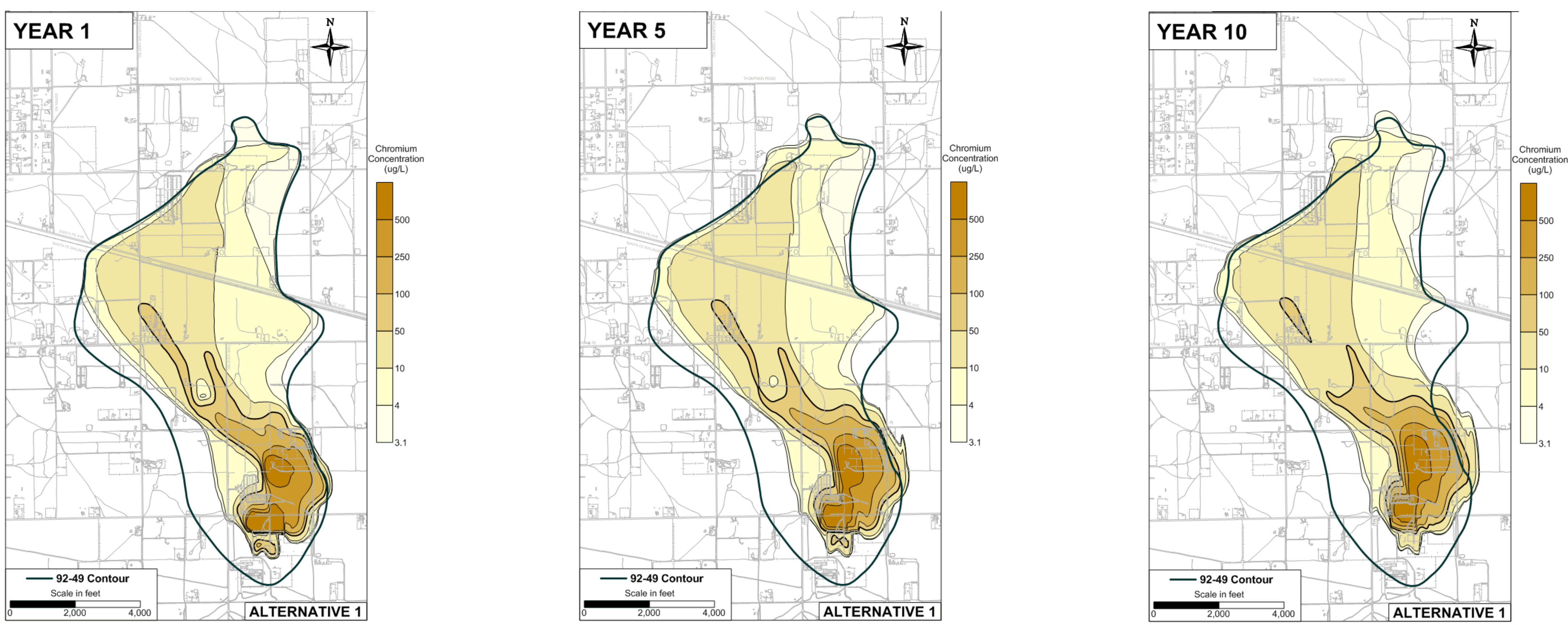
G-15



No Persistent Source Areas Simulated

No Persistent Source Areas

- No Active Treatment or Pumping Simulated
- Mass Transfer Coefficient = 1.0E-3 [1/day]
- No enhanced immobile portion concentrations in source areas
- No chromium sorption simulated (Kd = 0)
- Source areas flush more rapidly
- Concentrations in the deep Upper Aquifer drop below 500 ppb in 5 years without simulation of persistent source



Persistent Source Areas Simulated

Persistent Source Areas

- No Active Treatment or Pumping Simulated
- Mass Transfer Coefficients:
  6.0E-5 [1/day] in source areas
  2.0E-5 [1/day] to 6.0E-4 rest of domain
- Enhanced immobile portion concentrations in source areas
- Slight chromium sorption simulated (Kd = 0.05)
- Source areas flush less quickly
- Concentrations in the deep Upper Aquifer remain above 500 ppb after 10 years with simulation of persistent source

PG&E
HINKLEY, CALIFORNIA
MODELING APPENDIX

IMPACT OF PERSISTENT SOURCES ON PREDICTIVE TRANSPORT SIMULATION

ARCADIS

FIGURE
G-16

APPENDIX H

Contingency Plan for Hydraulic Capture and Treatment

CONTINGENCY PLAN FOR HYDRAULIC CAPTURE AND TREATMENT PACIFIC GAS AND ELECTRIC COMPANY HINKLEY COMPRESSOR STATION HINKLEY, CALIFORNIA

by

Haley & Aldrich, Inc.
San Diego, California

for

Pacific Gas and Electric Company
San Francisco, California

File No. 36385-008
September 2011

HALEY & ALDRICH

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

AU	Agricultural Unit
Cr(VI)	Hexavalent Chromium
gpm	Gallons per minute
Water Board	California Regional Water Quality Control Board – Lahontan Region
MBfR	Membrane Biofilter Reduction
NDMA	N-nitrosodimethylamine
NOAA	National Oceanic and Atmospheric Administration
PG&E	Pacific Gas and Electric Company
WBA	Weak Base Anion

H.1 INTRODUCTION

Pacific Gas and Electric Company (PG&E) was requested by the California Regional Water Quality Control Board – Lahontan Region (Water Board) in a letter dated 13 July 2011 (Water Board, 2011) to provide additional information regarding contingency actions should the Agricultural Units (AUs) be unable to treat the volume of extracted water required to maintain plume capture.

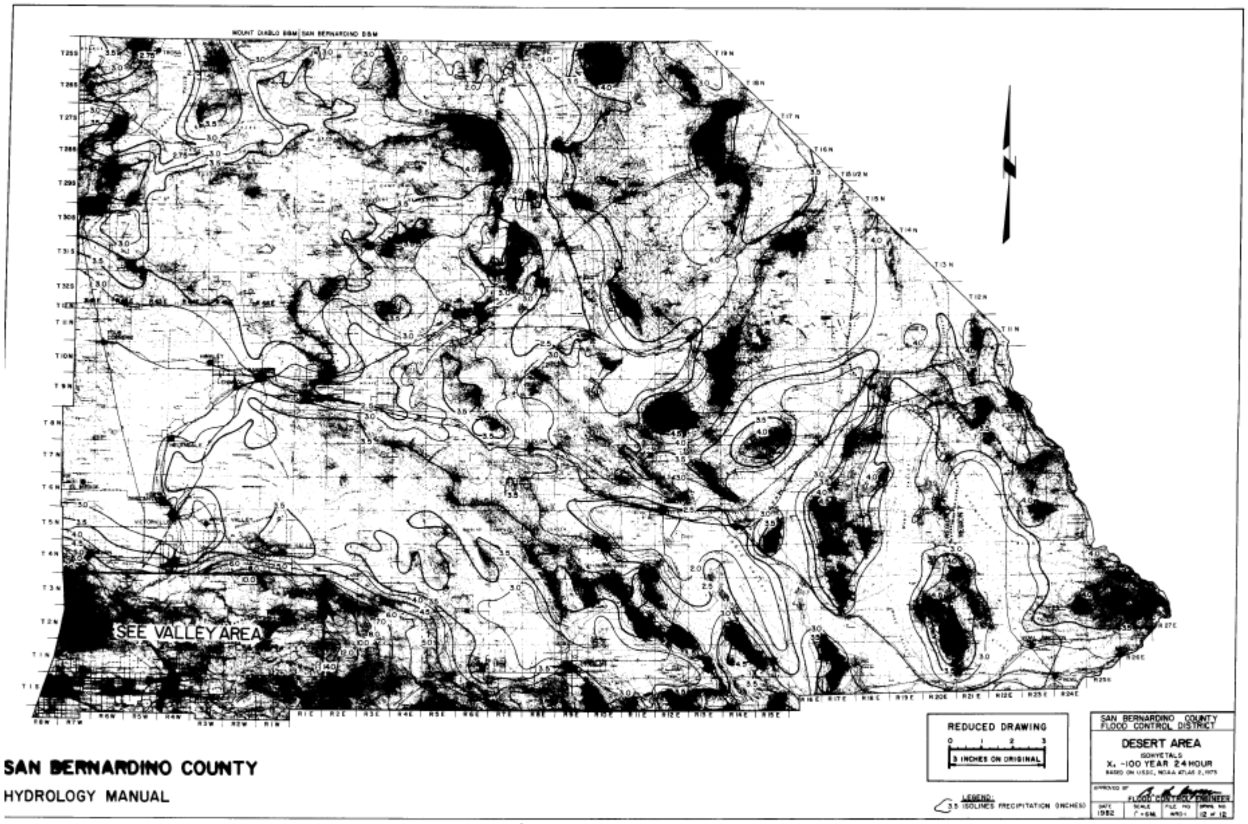
Comment #4b of the 13 July 2011 Water Board letter specifically requested a contingency plan for water treatment should the AUs be unable to treat the specified amount of water by the selected remedial alternative (Alternative 4C-2) to maintain year-round plume capture and flow rates that continue to hasten cleanup of the chromium plume. Specifically, the AUs currently operating grow only one crop (alfalfa), which uses less water in the winter months. Alternative 4C-2 was developed to enhance year-round plume capture, increase winter pumping rates, and maintain aggressive chromium remediation efforts; this will be accomplished by adding a winter crop (winter oats or similar crop). This additional crop will increase the average annual AU-related pumping rate by approximately 211.5 gallons per minute (gpm) over the Alternative 4C-1 AU-related pumping rate of 2,041.5 gpm for the first 20 years and approximately 1,687.5 gpm thereafter. The feasibility of AU treatment has been proven over years of testing and full-scale operation at the Site. The proposed operational conditions and parameters of Alternative 4C-2 are detailed in Section 5 of Addendum #3; the potential byproducts of AU operation in Appendix A.

Plume containment is one of the primary remedial objective requirements as defined by this Addendum and regulatory correspondence (Water Board, 2011). While the proposed pumping rate of Alternative 4C-2 varies over the course of the year based on crop requirements, robust hydraulic gradients and plume capture are maintained year-round as discussed in Section 5 and illustrated in Appendix B of Addendum #3. In fact, the extraction flow proposed in Alternative 4C-2 for the winter months is 23 percent more than the extraction flow required for plume containment. Figure H-1 illustrates the operational logic of the groundwater extraction system associated with the operation of the AUs.

Contingency measures were also developed should significantly abnormal winter rains reduce or eliminate groundwater treatment via AUs.

H.2 Contingency Plan Scenario

To evaluate the potential duration of a significant winter storm necessary to render the AUs inoperable (i.e., extensive rainfall would require the AU to stop irrigation due to water ponding), the available National Oceanic and Atmospheric Administration (NOAA) records for the Hinkley-Barstow area were reviewed (NOAA, National Climatic Data Center online database, Stations: Barstow1, Barstow2, and Cantil, 1902-2010). These records spanned from 1903 to December 2010. Over this 107-year period, the largest recorded rain event occurred in 2010, when 5.52 inches of rain fell during a 6-day storm. While past storms are not an accurate indication of what may occur in the future, they do provide guidance regarding the general magnitude of events that could be considered for reasonable scenarios for contingency planning. Based on a review of the San Bernardino County Hydrology Manual (County of San Bernardino, 1986), the Site is located within four townships and ranges: 9N/3W, 10N/3W, 9N/2W, and 10N/2W within the 3.0-inch contour (see Figure B-12 below). Therefore, a 100-yr/24-hr storm event at the Site is consistent with 3 inches of rainfall in 24 hours.



B-20 FIGURE B-12

Based on the 2010 NOAA storm records, and adding a 200 percent contingency factor to the largest recorded rain event to account for post-storm soil saturation levels, the potential duration of a significant rain storm event would be 18 days. During this time, the significant rainfall could result in AU soil ponding and/or flooding, requiring AU operation, including extraction flow, to be partially or fully suspended.

Since the primary criterion for implementing the contingency plan is loss of plume containment, extraction flow rates are fundamental to this evaluation. Under normal winter conditions, the proposed winter AU-related extraction flow rate for Alternative 4C-2 is approximately 1,171 gpm to maintain robust year-round plume capture/containment (Appendix C). Groundwater levels, hydraulic gradients, and capture zones will be monitored during implementation of the remedy. If weather or other contingency events require a temporary reduction in extraction pumping due to limited AU capacity, pumping rates and locations will be adjusted as necessary to maintain a capture zone that is equal to or greater than the designed and approved capture zone based on the latest groundwater assessment data. To improve hydraulic gradients and capture at the leading edge of the plume under a reduced flow scenario, the reduced-rate extraction pumping would be focused at the leading edge of the plume until full-flow capacity returns to the AUs.

If winter AU-related pumping has to be temporarily suspended due to weather or other contingency events, modeling results suggest that an 18-day gap in extraction pumping described above would not result in any meaningful plume movement or loss of plume capture and that even a 90-day gap in extraction pumping would not likely result in a full reversal of hydraulic gradients. Once pumping rates are restored, hydraulic gradients and plume capture zones would be re-established. PG&E is committed to maintaining plume capture during inclement weather and/or unusual events should they occur. Figure H-1 illustrates the proposed contingency plan decision logic to determine the responses necessary to maintain plume containment/capture, which includes three components: Routine AU Operations; Tier I Contingency AU Operations; and Tier II Contingency AU Operations.

H.2.1 Routine AU Operation

Routine AU operation is presented in the top section of the flow chart indicated in green. In this portion of the flow chart, the flow rates recommended in Alternative 4C-2 to achieve containment/capture and enhanced remediation are maintained by adjusting the number of AUs being operated. Routine AU operation is performed in accordance with applicable permits, guidance, and recommendations for managing byproducts and groundwater mounding included in Appendix A, Response to Comments #4a through 4h.

H.2.2 Tier I Contingency AU Operation (AU impacted but operates at reduced flow)

Tier I of the contingency plan is presented in the central yellow portion of the flow chart (Figure H-1) and addresses a reduced treatment capacity of the AU flow rate due to reduced AU efficiency or severe temporary inclement weather. It is assumed that a severe weather event would occur during the winter growing season when flow rates to the AUs are the lowest. In Tier I, it is assumed that the AUs can still operate and effectively treat chromium-impacted groundwater; however, each AU has a reduced flow capacity due to constraints in AU-specific operating parameters such as crop disease, inorganic constituent leaching, or water-logged soils. There are two response steps under this Tier I condition.

<u>Tier I - Scenario 1: Bring Additional AUs On Line</u>.

In an effort to maintain the Alternative 4C-2 groundwater extraction flow rates, PG&E proposes to bring additional AUs on line either by constructing new AUs or restarting idle AUs as needed. While additional AUs are being constructed or brought on line, flow rates may be reduced based on AU capacity for up to 90 days to a rate that the existing AUs can effectively treat (Figure H-1). If flow rate reductions are required, extraction will be focused at the leading edge of the plume. Groundwater levels, hydraulic gradients, and capture zones will be monitored during implementation of the remedy. If weather or other contingency events require a temporary reduction in extraction pumping due to limited AU capacity, pumping rates and locations will be adjusted as necessary to maintain a capture zone that is equal to or greater than the approved and designed target plume capture zone. It is estimated that it will take approximately 90 days or less to bring new AUs on line. To deploy the contingency scenarios as quickly as possible, PG&E proposes the following preparatory tasks:

- Install supplemental piping infrastructure as part of the initial 4C-2 build-out to accommodate future AUs, infiltration galleries, or ex-situ treatment;
- Perform updated groundwater modeling to determine the current required flow rate to maintain plume capture. It is anticipated that as the plume shrinks over time, the amount of pumping required to achieve the threshold objective of plume containment will decline.
- Initially develop and update construction-ready design drawings for the proposed systems as required; and
- Pre-select construction firms and have contracts ready for quick deployment.

As with Routine AU Operation, these AUs would be operated in accordance with the guidance and recommendations for managing byproducts and groundwater mounding included in Appendix A, Response to Comments #4a through 4h. The primary advantage of Scenario 1 is that the prescribed pumping schedule for Alternative 4C-2 is maintained through the contingency event; however, there are limitations to the number of AUs that can be constructed and operated due to winter AU treatment efficiency and available land for AU construction. Where AUs cannot be brought on line or added to maintain Alternative 4C-2 pumping rates, Tier I -Scenario 2 is proposed.

Tier I - Scenario 2: Temporary Flow Reduction & Tier II Planning

Tier I - Scenario 2 assumes that a temporary, severe and prolonged inclement weather event occurs that renders the AUs largely but not entirely inoperable for less than 90 days. (Figure H-1) Scenario 2 assumes that additional AUs cannot be added or brought on line. Based on historical NOAA weather data for the area detailed above, the likelihood that a hypothetical 20-day severe weather will occur is very small over the anticipated duration of the groundwater remedy. Despite this low probability, PG&E prepared a contingency plan to maintain plume capture.

Scenario 2 focuses on a temporary (less than 90 day) reduction of the groundwater extraction flow rate. Groundwater levels, hydraulic gradients, and capture zones will be monitored during implementation of the remedy. If weather or other contingency events require a temporary reduction in extraction pumping due to limited AU capacity, pumping rates and locations will be adjusted as necessary to maintain a capture zone that is equal to or greater than the approved and designed target capture zone. This flow is termed the minimum capture flow (Figure H-1). Scenario 2 recognizes that temporary flow reductions below the minimum capture flow due to inclement weather can be implemented (on an infrequent basis) without any appreciable change in overall plume capture zones or overall remediation time frames. This threshold was based on modeling potential winter flow scenarios (Appendix C). To maintain as much hydraulic gradient as possible at the leading edge of the plume during a significant weather event, it is proposed that the groundwater extraction flow rate be reduced to match the AU treatment capacity with flow focused at the plume leading edge. Long-range weather forecasts prepared by fee-based long-range weather forecasting services will be closely followed to facilitate AU operation planning. AU operation in this mode would continue for up to 90 days or until AU treatment capacity increases and full groundwater extraction rates can be restored, whichever comes first.

Since the duration of inclement weather cannot be accurately determined, PG&E will also begin parallel-path preparations for the deployment of the Tier II contingency plan when Scenario 2 begins. This will include updating construction bids, checking contractor schedules, securing contracts, and begin permitting and finalizing Tier II system drawings for construction.

As with routine AU operation, these AUs would be operated in accordance with the guidance and recommendations for managing byproducts and groundwater mounding included in Appendix A, Response to Comments #4a through 4h. If the AUs cannot treat any flow and the Tier I event lasts more than 90 days, Tier II Contingency Operation will commence.

H.2.3 Tier II Contingency AU Operation (AUs not operational)

Tier II of the contingency plan is presented in the lower orange portion of the flow chart (Figure H-1) and assumes excess groundwater that the AUs cannot treat must be extracted to maintain plume capture.

Tier II deploys the use of temporary alternate treatment and water disposal methods under an extreme and prolonged inclement weather event or other circumstances that render the AUs inoperable, such as crop disease. These methods include infiltration galleries and/or ex-situ water treatment coupled with groundwater reinjection. Like Tier I, Tier II includes two separate scenarios; however, depending upon the contingency event conditions, both scenarios may or may not be deployed and would be event-specific. The decision to implement Scenario 1 (Infiltration Galleries), Scenario 2 (Ex-Situ Treatment), or a combination of the two will be made in the Tier II Implementation Preparation stage of Tier I-Scenario 2 (Figure H-1).

Tier II - Scenario 1: In-Situ Infiltration Gallery Treatment:

Infiltration gallery treatment has been pilot tested and proven for use at the Site to treat chromium-impacted groundwater as well as certain byproducts such as manganese (Arcadis, 2010a). Details regarding the testing and feasibility of infiltration galleries are included in the 30 August 2010 Feasibility Study (Haley & Aldrich, 2010). They consist of a large bed of granular material placed approximately five feet below ground surface. Extracted groundwater containing chromium is amended with a carbon substrate such as ethanol and injected into the bed of granular material. The carbon-amended and chromium-impacted water is biologically reduced, completing the treatment process. The treated water then infiltrates the vadose zone and water table, while the reduced chromium remains in the infiltration gallery granular bed and vadose zone. An infiltration gallery is proposed to be installed in the Central Area as part of the manganese mitigation program. One advantage of infiltration galleries is that they do not rely upon crop growth for chromium treatment, but rather aerate the water or use microbes and an added carbon source such as ethanol. Other advantages to the use of infiltration galleries include proven chromium treatment performance and general ease of construction compared to ex-situ treatment plant construction.

Operational drawbacks of infiltration galleries include biofouling and potential byproduct generation. Infiltration galleries also require large areas of land for construction. The Site-specific pilot test indicated that approximately 2 acres of land are required for each 100 gpm of flow, or approximately 200 acres to treat 1,200 gpm of flow (Arcadis, 2010b). Other drawbacks include potentially reduced treatment performance during high precipitation events and groundwater mounding.

Tier II - Scenario 2: Ex-Situ Treatment and Reinjection

If infiltration galleries are not selected to treat the excess winter water as a result of extremely inclement and prolonged rain events, crop disease, crop infestation or other unusual circumstances, ex-situ water treatment and reinjection are proposed.

Because implementation of Tier II - Scenario 2 would likely be the result of an unusual, temporary and non-reoccurring condition, it is assumed that the treatment approach, system and infrastructure would also be temporary (less than 1 year) to maintain extraction rates required for plume capture. For the purpose of this contingency plan, the flow rate for ex-situ treatment is assumed to be approximately 1,170 gpm to maintain plume capture and was evaluated using groundwater modeling as discussed in Tier I. Actual pumping rates may be adjusted based on actual Site hydraulic data. The following sections discuss the proposed water treatment options and implementation of Scenario 2.

Ex-Situ Water Treatment Options

As previously stated, it is anticipated that ex-situ treatment under the contingency plan would be temporary (duration of less than 1 year). As such, the treatment method and associated system(s) must be able to be quickly deployed (within 180 days). The following discusses the leading water treatment options, including their ability to be skid-mounted for rapid contingency plan deployment.

The Feasibility Study (Haley & Aldrich, 2010) identified numerous water treatment technologies that were bench or pilot tested for Site-specific conditions able to achieve Site background concentrations. These technologies included:

- Chemical Reduction/Precipitation;
- Membrane Biofilter Reduction (MBfR); and
- Weak Base Anion (WBA) exchange.

Chemical reduction/precipitation has been demonstrated to be able to reliably treat groundwater to established background levels of hexavalent chromium [Cr(VI)] or below; however, significant logistical and process control issues exist. Separate process units are required to convert Cr(VI) to trivalent chromium (reduction), followed by oxidation to form large particles for settling (clarification) and also granular media extracted by low-pressure membrane filters (filtration) (Malcolm Pirnie/ARCADIS, 2011). Drawbacks to chemical reduction/precipitation include: a significant waste stream that needs to be managed, trucked off-site and disposed in a regulated facility; complex process operations requiring trained system operators and a large permanent building to house the process components. Pilot testing would be required to determine the Site-specific design parameters. Given the effectiveness of this water treatment approach at the PG&E Topock Site, it is retained for this contingency plan as a viable water treatment option.

Like chemical reduction/precipitation, MBfR was not considered applicable for implementations as part of the contingency plan due to the unproven nature of the technology and the difficulty of quickly deploying and starting up the process. MBfR would require much more pilot testing than chemical reduction/precipitation or WBA to confirm quick implementability and treatment effectiveness.

WBA exchange has been used to treat Cr(VI) and is a candidate ex-situ treatment technology for this contingency plan. Pilot testing programs at other sites indicate that certain resins have the ability to treat water to background levels of Cr(VI). Primary advantages to WBA exchange are general operation simplicity and process components that can be obtained and assembled in a more temporary/modular configuration. The WBA exchange technology also has potential drawbacks, including potential concentration of other anions present in the influent stream into the effluent, potential formaldehyde and N-nitrosodimethylamine (NDMA) formation in effluent, and spent resin disposal.

Formaldehyde and NDMA are potential components of these particular WBA exchange resins and may appear in the treated effluent as a result of leaching at extremely low levels. This WBA exchange resin is currently being utilized in many drinking water and food applications. Studies are being conducted to evaluate reformulations of the synthetic resin media to minimize or reduce the potential for formaldehyde leaching. The synthetic media also has the ability to concentrate other constituents in the water stream; in particular, copper, vanadium, and uranium. This can result in both effluent discharge and resin disposal issues.

WBA exchange resins typically have specific selectivities for other anions that may be present in the stream. The WBA exchange resin being evaluated for this project is less affected by other anions than a typical WBA exchange resin. The expectation is that chromate removal will be less influenced by other anions than with other WBA exchangers.

Additional technical information regarding the feasibility of WBA exchange is included in Appendix A, Response to Comments # 1a of this report. Bench and/or pilot testing would need to be performed using Site-specific water to evaluate the effectiveness of WBA exchange and the potential for byproduct formation to occur.

Once the water is treated, it requires discharge. For the purpose of this contingency plan, it is assume that the water would be reinjected into the aquifer, however it could potentially be used for other non-potable purposes. Water reinjection would be proposed in locations the groundwater model suggests it would have the greatest benefit to plume capture and reducing the overall remediation time frame. Potential issues with groundwater reinjection may include elevated concentrations of total dissolved solids, nitrate or other byproducts that may need to be addressed. This aspect would be evaluated during system design and pilot testing.

While there is no ideal technology available for the temporary treatment of Cr(VI)-impacted groundwater to background levels, WBA exchange and chemical reduction/precipitation both appear to be viable options and could be deployed in a timeframe consistent with this contingency plan. Since WBA exchange appears to have an advantage of simplicity of operation and minimal permanent infrastructure, it is recommended that bench and pilot testing be performed to verify it is best suited to Tier II contingency plan deployment. This work is proposed to be undertaken during routine operations so that it does not delay the deployment of Tier I and Tier II actions when needed. The results of this testing would then be used to select the most appropriate contingency plan treatment technology for system design.

The selected contingency plan water treatment system would likely be deployed using skid-mounted systems for temporary installation within a temporary treatment compound area(s) containing the appropriate temporary utility connections. Each skid-mounted system would have a rated flow capacity; therefore the number of systems deployed would depend upon the flow rate that cannot be treated by the AUs/infiltration galleries. Treated water would then be reinjected through existing or new groundwater injection wells around the perimeter of the plume. Water injection will be conducted in a manner to enhance inward gradients and plume capture. As AU/infiltration gallery treatment capacity returns, the skid-mounted ex-situ treatment systems would be taken off line and Tier I of the contingency plan followed.

H.3 Contingency Plan Implementation

Groundwater extraction will be maintained at flow rates prescribed in Alternative 4C-2 to maintain year-round plume capture. To ensure hydraulic gradients are being maintained for the required plume capture, a detailed groundwater monitoring plan will be prepared as part of the full-scale remedy implementation plan. In the event that weather or other events reduce the ability of AUs to treat the required flow of water, implementation of the contingency plan will be guided by the process and decision flow chart illustrated in Figure H-1.

Tier I of the contingency plan will be deployed if hydraulic gradients and/or concentration trends are not being maintained as required. Flow will be adjusted and conveyed to the available AUs. If sufficient AU treatment capacity does not exist, additional AUs will be added and brought on line within 90 days.

Tier II will be deployed if AUs cannot treat the required flow and flow must be reduced for greater than 90 days. Tier II involves the deployment of infiltration galleries, an ex-situ treatment system, or a combination of the two for water treatment. Ex-situ treatment would include water reinjection. Deployment of Tier II to restore water flow rates would be implemented within 180 days.

To ensure a timely deployment of the contingency options specified above, PG&E will complete the following preparatory work:

- Approval of the approaches by the Water Board;
- Community awareness of the plan;
- Installation of supplemental piping infrastructure as part of the initial 4C-2 build-out to accommodate future AUs, infiltration galleries, or ex-situ treatment;
- Completion of water treatment pilot testing to determine the best treatment option;
- Development of construction-ready design drawings for the proposed systems; and
- Pre-selection contract-ready construction firms for quick deployment.

The emphasis throughout the contingency plan process is to maintain the highest achievable flow rate under the prescribed extraction schedule of Alternative 4C-2.

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Figure H-1: Contingency Plan For Agricultural Unit (AU) Operation