



**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

January 5, 2012

Ms. Lauri Kemper, Assistant Executive Officer
Ms. Lisa Dernbach, Senior Engineering Geologist
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150

Subject: Investigative Order No. R6V-2011-0104 for Well Information
Pacific Gas and Electric Company's Hinkley Compressor Station, Hinkley,
California

Dear Ms. Kemper and Ms. Dernbach:

On December 15, 2011 the Water Board issued Investigation Order No. R6V-2011-0104. The Order requires that Pacific Gas and Electric Company (PG&E) provide information to address whether PG&E's cleanup and containment activities in the northern plume area are potentially affecting the upper and lower aquifers used for domestic supply. The attached document addresses each of the specific information requests in the Order.

PG&E has been in contact with the property owners who expressed concerns regarding the production of their well at the December 8, 2011 Water Board meeting. Working with the owners and a local water well driller, it was determined that the well plumbing was in need of repair and that the non-performance of the well was not related to a change in groundwater levels (*i.e.*, the well was not dry) or to PG&E's activities. The well in question was restored to full operation by a repair of the well plumbing. Additionally, in early 2011 PG&E worked with another local home owner who had well production concerns; after review and inspection, it was found that the home owner's well had mechanical defects unrelated to PG&E's activities. That well also was restored to full operation through a repair of well components.

It is important that the community have confidence in our well monitoring and other environmental programs. PG&E is committed to working cooperatively with residents and the Water Board to respond to any concerns or questions regarding our activities. In this case, based on a thorough review, there is no reason to believe that the installation, development or sampling of monitoring wells by PG&E has caused any domestic well to go dry, or caused any other adverse effects.

As you know, PG&E has established a local office in the Hinkley community, staffed with full-time representatives who are able to respond to any questions or concerns regarding our cleanup program at Hinkley. We encourage all Hinkley residents to make use of these services.

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If you have any questions on this submittal, please feel free to contact me.

Best Regards,

A handwritten signature in blue ink, appearing to read "Kevin Sullivan", with a stylized, cursive script.

Kevin Sullivan

**Response to Investigative Order No. R6V-2011-0104 for Well Information
Pacific Gas and Electric Company's Hinkley Compressor Station, Hinkley,
California**

Investigation Order No. R6V-2011-0104 (Order) seeks information from Pacific Gas and Electric Company (PG&E) to address whether PG&E's cleanup and abatement activities in the northern plume area (i.e., north of Thompson Road) are potentially affecting the upper and lower aquifers used for domestic supply. The following provides responses to each of the 10 items identified in the Order.

1. A detailed description of drilling activities and methods used in the northern plume area, from Thompson Road and north.

On September 1, 2011 PG&E submitted to the Water Board the *Technical Report - Response to Investigative Order No. R6V-2011-0043 - Delineation of Chromium in the Upper Aquifer* (Stantec, 2011). The September 1 report presented the methods, data, and findings for investigations including the installation, development, and sampling of 28 monitoring wells at 11 locations north of Thompson Road. Since submittal of the September 1 report, PG&E has installed 25 additional monitoring wells at 12 locations north of Thompson Road.

In total, 53 monitoring wells have been installed by PG&E north of Thompson Road at 23 locations. The well locations are shown on Figure 1. Table 1 provides well construction details for these 53 monitoring wells.

Section 2.1 (Soil Boring Advancement and Logging) and Section 2.2 (Monitoring Well Construction) of the September 1 report provided a detailed description of the methods used for installation of monitoring wells. These methods also apply to the 25 additional monitor wells installed since September 1. In summary, monitoring wells are installed using hollow-stem auger drilling methods. Mud rotary methods have not been used for any recent monitoring well installations, including all monitoring wells located north of Thompson Road.

2. Description and amount of any chemicals or compounds injected into either aquifer.

No chemicals or compounds have been injected during monitoring well installations north of Thompson Road.

3. A narrative of well development activities, including pump size, volume extracted or injected, storage and fate of extracted water, monitoring parameters collected, and length of time.

Section 2.3 of the September 1 report detailed the methods used for monitoring well development prior to September 1. These methods also apply to all monitoring wells installed since September 1. Development logs for 28 monitoring wells are provided in Attachment B of the September 1 report. Development logs for the remaining 25 wells completed since submittal of the September 1 report will be provided in a subsequent technical report.

In summary, wells are developed by surging, bailing, and pumping. The following summarizes these methods in response to the items identified above:

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- Pump Size - The majority of the monitoring wells are 2 or 2.5 inch diameter PVC; a few of the water table wells are 4-inch diameter PVC. The pump used for development is a low horsepower ($\frac{1}{2}$ HP or less) small diameter (2-inch or less) pump capable of fitting down these relatively small diameter monitoring wells.
- Volume Extracted - The volume of groundwater extracted varies, depending upon well yield and the amount of development required to achieve the desired stability of parameters (including low turbidity). In general, between 150 and 500 gallons of water are extracted from each monitoring well as part of the development process. The extraction rate has ranged from approximately 0.5 to 2.0 gallons per minute (gpm).
- Volume of Water Injected - Water is typically not injected into the well as part of development; however, at locations where turbidity at the start of development is relatively high and minimal water is present in the well (i.e., water table monitoring wells), a small volume of fresh water has in a few cases been placed in the well, surged, and then bailed as part of the development process. The water has been sourced from lower aquifer well G-6 located on the former Gorman property. The volume of water placed in these wells and then removed is typically less than 10 gallons.
- Storage and Fate of Extracted Water - As documented in Section 2.3 of the September 1 report, development water is transferred directly to a trailer-mounted tank located at the well site. The water is then hauled to the Central In-Situ Reactive Zone (IRZ), where it is placed in a holding tank for ethanol amendment and injection. This process applies to all monitoring wells installed since September 1, including all wells north of Thompson Road.
- Monitoring Parameters Collected - The parameters collected during well development are documented on the development logs. These parameters include temperature, specific conductivity, dissolved oxygen, oxidation-reduction potential (ORP), pH, color, and turbidity.
- Length of Time - The length of time that well development has occurred is documented on the well development logs. Each development effort involving water pumping typically ranges from 30 to 90 minutes. Each well is developed two or three times prior to sampling, with the time period between each development typically ranging from two to five days. The first development typically comprises surging and bailing, and limited pumping at rates of 0.5 to 2.0 gpm. Subsequent development efforts typically involve only pumping, at the same rates of 0.5 to 2.0 gpm.

4. A description of the diameter and depth of wells installed and screen length and depth. State the aquifer that wells are being installed.

Table 1 provides the requested information with regards to well diameter, depth, and screen length. All of the 53 monitoring wells installed to date by PG&E north of Thompson Road have been installed in the upper aquifer.

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5. For the Sonoma Street and Mountain View Road areas, calculate the radius of influence for injected chemicals or compounds, if used, and well development actions.

As noted under item 2 above, no chemicals or compounds have been injected during the monitoring well installation activities.

Radius of influence (ROI) for well development is difficult to estimate because typical ROI calculations assume the aquifer has achieved steady state conditions during pumping. However, steady state is not achieved during 30 to 90 minutes of pumping (i.e., the calculations will likely estimate a larger ROI than was actually achieved during the limited time of pumping). Conservatively assuming steady state is achieved, the ROI during pumping can be estimated using Thiem's Method where:

$$\text{ROI (in meters)} = 3,000 \times \text{drawdown (s)} \times \text{square root of soil permeability (k)}.$$

In review of the soil boring and well development logs, conservative estimates are five (5) feet (1.52 meters) of drawdown (s) and a silty sand soil type with a k-value of 10^{-6} meters per second (m/s). The resulting ROI value would be approximately 15 feet.

In summary, the expected ROI during the development of a monitoring well is likely less than 15 feet. This value is a very conservative upper-end estimate of what can be expected in a 30 to 90 minute development process during which a limited volume of water (100 to 500 gallons) is removed. No monitoring wells have been installed within approximately 150 feet of an active domestic well. The home owner that expressed concern about the potential effect of PG&E investigation activities on the water level of their well during the December 8, 2011 public meeting in Hinkley is located approximately 700 feet from the nearest monitoring well installed by PG&E to the north of Thompson Road (MW-139).

6. State whether recent well installation, development, or sampling activities conducted since October 1, 2011 differ with similar activities described in the September 1, 2011 document, Delineation of Chromium in the Upper Aquifer.

The methods used since September 1, 2011 have not differed from those reported in the September 1 document.

7. Provide a map showing all wells installed by PG&E since October 1, 2011 and the location of all existing domestic and agricultural wells.

The requested map is attached as Figure 1.

8. Attach the well designs in PG&E's possession for domestic and agricultural wells in the northern plume area, from Thompson Road and North.

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As discussed with Water Board staff on January 3, 2012, each time PG&E or its contractors obtains a well completion report from the California Department of Water Resources (DWR), PG&E is required to sign a confidentiality agreement that indicates that the information obtained in the well completion reports will be kept confidential and will not be disseminated, published or made available for inspection by the public. Water Code section 13752 contains similar confidentiality provisions.

Given that PG&E's work is being performed at the direction of the Water Board and the fact that section 13752 provides for government agencies to be given access to well completion reports for the purposes of environmental studies, PG&E has concluded that it is permissible to forward a summary of the requested well completion information to the Water Board as part of this submittal. The summary is provided in Attachment A.

The requested well logs will be provided to the Water Board under separate cover. Based on Water Code section 13752, it appears that the well completion information to be provided to you under separate cover should remain confidential and not be disseminated to the general public.

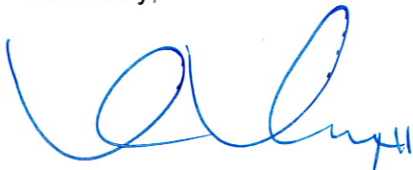
9. Stamp and signature of a California licensed geologist or civil engineer.

This document has been signed by a California licensed geologist.

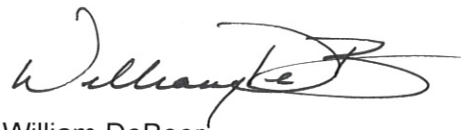
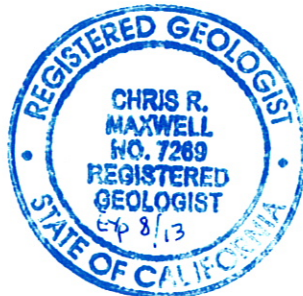
10. Any additional information you can provide that addresses the resident's concerns about their wells drying up, the rust-colored water some are seeing, and whether drilling mud or other injected materials may be affecting their wells.

Drilling mud has not been used for monitoring well installation north of Thompson Road, and no materials have been injected into monitoring wells as part of the installation or development process. For the 53 monitoring wells installed in the upper aquifer north of Thompson Road, the cumulative volume of groundwater removed as part of development and sampling between the initiation of PG&E investigations north of Thompson Road in May 2011 and most recent development activities in December 2011 is estimated to be less than 30,000 gallons. This volume of groundwater was pumped over a 6-month period from 48 individual wells spread over a very large area. By comparison, a well providing domestic water to a single household will typically pump at least this much water in one month. The installation and development of monitoring wells by PG&E has not caused any domestic well to go dry, or caused any other adverse effects such as discoloration.

Sincerely,



Chris R. Maxwell, PG
Principal Geologist



William DeBoer
Geologic Project Specialist

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Attachments:

Table 1 – Monitoring Well Construction Details – North of Thompson Road

Figure 1 – Monitoring Wells North of Thompson Road

A – Summary of Information for Available DOM and AG Wells North of Thompson Road

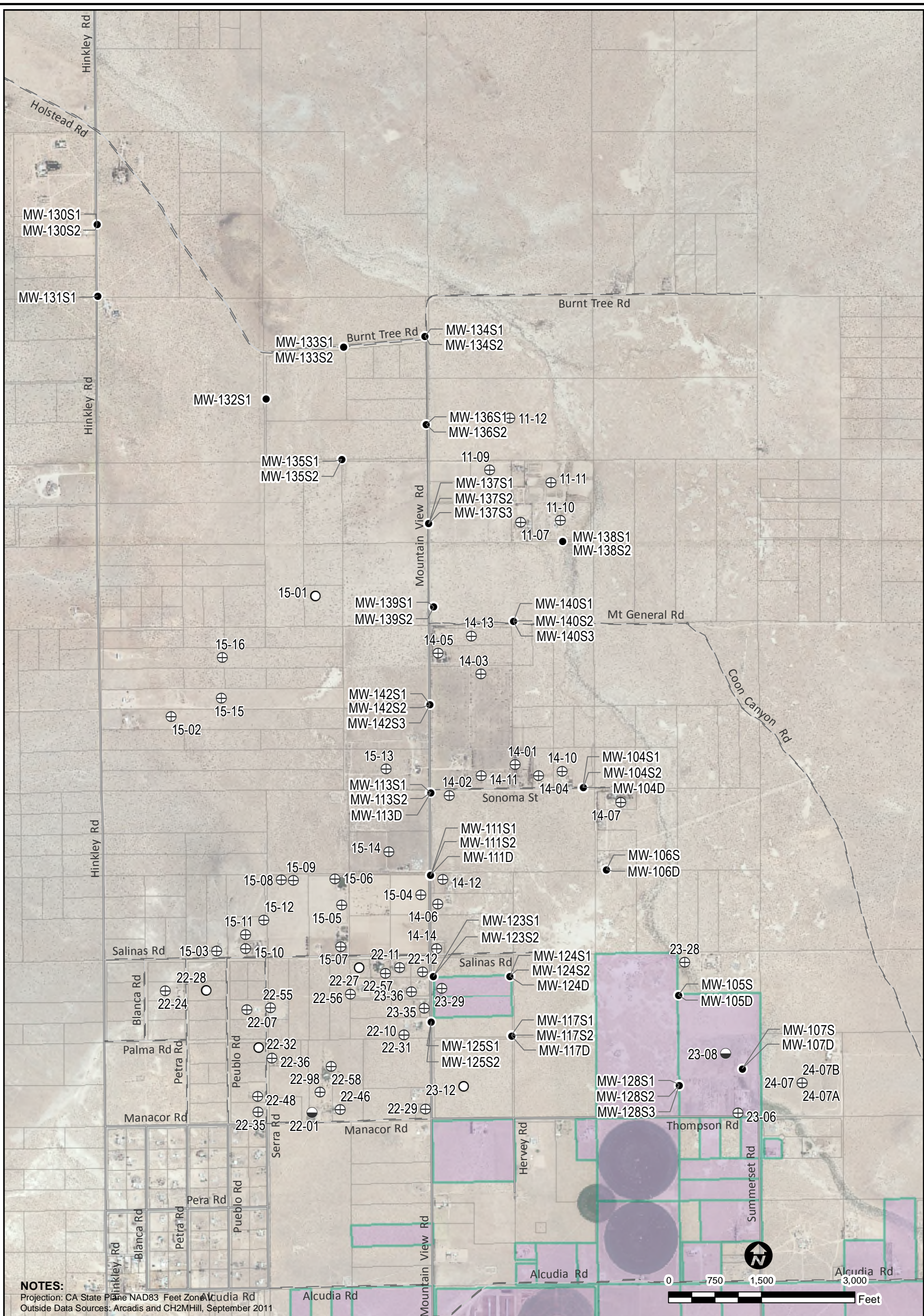
Table 1
Monitoring Well Construction Details - North of Thompson Road
Pacific Gas and Electric Company - Hinkley Chromium Remediation Project
Hinkley, California

Well ID	Total Well Depth (ft BGS)	Casing Diameter (inches)	Depth to Top of Perforated Interval (ft BGS)	Depth to Bottom of Perforated Interval (ft BGS)	Screened Interval Length (ft)
MW-104S1	90	2.0	75	90	15
MW-104S2	108	2.0	93	108	15
MW-104D	140	2.0	130	140	10
MW-105S	95	2.5	80	95	15
MW-105D	130	2.5	120	130	10
MW-106S	95	2.0	80	95	15
MW-106D	140	2.0	130	140	10
MW-107S	95	2.0	80	95	15
MW-107D	130	2.0	120	130	10
MW-111S1	97	2.5	82	97	15
MW-111S2	120	2.5	110	120	10
MW-111D	160	2.5	150	160	10
MW-113S1	100	2.5	85	100	15
MW-113S2	122	2.5	112	122	10
MW-113D	182	2.5	172	182	10
MW-117S1	95	2.5	80	95	15
MW-117S2	117	2.5	107	117	10
MW-117D	152	2.5	142	152	10
MW-123S1	95	2.5	80	95	15
MW-123S2	116	2.5	106	116	10
MW-124S1	95	2.5	80	95	15
MW-124S2	115	2.5	105	115	10
MW-124D	175	2.5	165	175	10
MW-125S1	95	2.5	80	95	15
MW-125S2	128	2.5	118	128	10
MW-128S1	97	2.5	82	97	15
MW-128S2	117	2.5	107	117	10
MW-128S3	134	2.5	124	134	15
MW-130S1	85	4.0	70	85	15
MW-130S2	100	2.5	90	100	10
MW-131S1	83	4.0	68	83	15
MW-132S1	82	2.5	67	82	15
MW-133S1	80	2.5	65	80	15
MW-133S2	110	2.5	100	110	10
MW-134S1	80	4.0	65	80	15
MW-134S2	104	2.5	94	104	10
MW-135S1	90	2.5	75	90	15

Table 1
Monitoring Well Construction Details - North of Thompson Road
Pacific Gas and Electric Company - Hinkley Chromium Remediation Project
Hinkley, California

Well ID	Total Well Depth (ft BGS)	Casing Diameter (inches)	Depth to Top of Perforated Interval (ft BGS)	Depth to Bottom of Perforated Interval (ft BGS)	Screened Interval Length (ft)
MW-135S2	114	2.5	104	114	10
MW-136S1	82	2.5	67	82	15
MW-136S2	127	2.5	117	127	10
MW-137S1	80	2.5	70	80	10
MW-137S2	99	2.5	89	99	10
MW-137S3	117	2.5	107	117	10
MW-138S1	87	4.0	72	87	15
MW-138S2	114	2.5	104	114	10
MW-139S1	90	4.0	75	90	15
MW-139S2	114	2.5	104	114	10
MW-140S1	90	2.5	75	90	15
MW-140S2	110	2.5	100	110	10
MW-140S3	124	2.5	114	124	10
MW-142S1	85	4.0	70	85	15
MW-142S2	103	2.5	93	103	10
MW-142S3	122	2.5	112	122	10


bgs = below ground surface
ft = feet



NOTES:
 Projection: CA State Plane NAD83 Feet Zone 10
 Outside Data Sources: Arcadis and CH2MHill, September 2011

- Wells by Well Type**
- Groundwater Monitoring Well
 - ⊕ Domestic Supply Well
 - Agricultural Supply Well
 - Other Supply Well

■ PGE Property Boundaries

 Stantec 57 LAFAYETTE CIRCLE, 2ND FLOOR LAFAYETTE, CALIFORNIA PHONE: (925) 299-9300 FAX: (925) 299-9302	FOR:		Pacific Gas & Electric Groundwater Remediation Project Hinkley, California		FIGURE:		1
	JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:		
	185702424	TF	BD	CM			01/04/12

Attachment A
Summary of Information Available DOM and AG Wells North of Thompson Road
Pacific Gas and Electric Company - Hinkley Chromium Remediation Project
Hinkley, California

Well ID	Assessors Parcel Number	Well Design in PG&E Possession (Yes/No)
11-07	0495-022-20	No
11-09	0495-022-04	No
11-10	0495-022-09	No
11-11	0495-022-08	No
11-12	0495-022-02	No
14-01	0495-023-13	Yes
14-02	0495-023-14	Yes
14-03	0495-023-06	Yes
14-04	0495-023-12	Yes
14-05	0495-023-02	Yes
14-06	0495-023-16	No
14-07	0495-023-25	Yes
14-10	0495-023-11	Yes
14-11	0495-023-06	Yes
14-12	0495-023-15	Yes
14-13	0495-023-01	Yes
14-14	0495-023-37	No
15-01	0495-102-27	No
15-02	0495-103-11	No
15-03	0495-103-31	Yes
15-04	0495-103-48	No
15-05	0495-103-34	No
15-06	0495-103-34	No
15-07	0495-103-34	No
15-08	0495-103-33	Yes
15-09	0495-103-33	Yes
15-10	0495-103-38	No
15-11	0495-103-38	No
15-12	0495-103-38	No
15-13	0495-103-17	No
15-14	0495-103-24	No
15-15	0495-103-10	Yes
15-16	0495-103-06	No
22-01	0495-051-24	No
22-07	0495-094-03	Yes
22-10	0495-051-12	Yes
22-11	0495-051-38	Yes

Attachment A
Summary of Information Available DOM and AG Wells North of Thompson Road
Pacific Gas and Electric Company - Hinkley Chromium Remediation Project
Hinkley, California

Well ID	Assessors Parcel Number	Well Design in PG&E Possession (Yes/No)
22-12	0495-051-37	Yes
22-24	0495-092-02	Yes
22-27	0495-051-31	No
22-28	0495-093-03	Yes
22-29	0495-051-15	No
22-31	0495-051-12	Yes
22-32	0495-083-01	No
22-35	0495-083-04	No
22-36	0495-051-29	No
22-46	0495-051-23	No
22-48	0495-083-03	No
22-55	0495-051-05	No
22-56	0495-051-43	Yes
22-57	0495-051-39	No
22-58	0495-051-24	No
22-98	0495-051-24	No
23-06	0495-031-05	Yes
23-08	0495-031-05	Yes
23-12	0495-031-21	Yes
23-28	0495-031-04	No
23-29	0495-031-34	Yes
23-35	0495-051-45	Yes
23-36	0495-051-40	Yes
24-07	0495-031-07	No
24-07A	0495-031-07	No
24-07B	0495-031-07	No