Attachment G

Maintenance of High Quality Waters in California, State Water Board Resolution 68-16
Anti-Degradation Analysis

Introduction

State Water Resources Control Board (State Water Board) Resolution 68-16, *Statement of Policy with Respect to Maintaining High Quality Waters in California* (Resolution 68-16) establishes the state policy that the discharge of waste should be regulated to achieve the highest water quality of waters of the state consistent with the maximum benefit to the people of the State. Waste discharge requirements issued by a regional board must be consistent with Resolution 68-16. This Attachment evaluates the application of Resolution 68-16 to the discharge authorized by the Order and describes how the various provisions and requirements of this Order and the Monitoring and Reporting Program (MRP) implement Resolution 68-16.

In summary, this Order meets the requirements of Resolution 68-16 through a combination of discharge and receiving water limitations, monitoring, and other requirements, including mitigation measures identified in the Environmental Impact Report (EIR) prepared pursuant to the California Environmental Quality Act for the Project. These requirements ensure that any degradation of existing high quality waters in the Project Area is limited in spatial extent, magnitude, and duration as feasible for the remediation project. The EIR analyzed potential environmental impacts associated with various cleanup methods, including agricultural treatment. The EIR concluded that temporary, localized decreases in groundwater quality may result from the Project due to the application of the extracted groundwater containing chromium to agricultural treatment units, and that those impacts are significant and unavoidable during the remediation without mitigation. The EIR identifies mitigation measures to minimize these impacts to the extent feasible, and requires that the Discharger restore water quality to pre-remedial reference conditions, which may include implementing a basin-wide approach to TDS and nitrate, as described in following sections.

Further, this Order specifies extensive domestic and supply well monitoring associated with ATU operations, including:

- Sampling of domestic and supply wells for pre-remedial reference conditions for agricultural byproducts in a one-mile buffer area around existing and proposed ATUs
- Determination of groundwater levels for pre-remedial reference conditions within a one-half mile buffer area around existing and proposed ATUs
- Operational monitoring for groundwater levels in domestic wells within one-quarter mile of ATU extraction points
- Ongoing monitoring for agricultural by-products within one-half mile downgradient and one-quarter mile cross-gradient of ATUs

An extensive monitoring well network is located in and around the existing ATUs for agricultural byproducts and chromium. Additionally, provisions are included for development of monitoring programs for agricultural byproducts for any new ATUs proposed and constructed.

Therefore, the requirements of this Order, which include the water resources mitigation measures specified in the EIR, ensure that compliance with Resolution 68-16 is achieved.

Maintenance of High Quality Waters in California, State Water Board Resolution 68-16

Resolution 68-16 establishes the state policy that where waters of the state are of quality higher than that required by state policies, such higher quality "shall be maintained to the maximum extent possible".

As set forth in Resolution 68-16, water quality degradation may be allowed if the following conditions are met: (1) any change in water quality must be consistent with maximum benefit to the people of the State; (2) the degradation will not unreasonably affect present and anticipated beneficial uses; (3) the degradation will not result in water quality less than that prescribed in the Basin Plan and other applicable policies. In addition, for any activity that results in discharges of waste to existing high quality waters, the discharge must meet waste discharge requirements that will result in the best practicable treatment or control of the discharge necessary to assure that pollution or nuisance will not occur and the highest water quality consistent with maximum benefit to the people of the State will be maintained.

Determining High Quality Waters

Resolution 68-16 applies to high quality surface and groundwaters; that is, waters of the state with existing background quality of better quality than that necessary to protect beneficial uses. The California Water Code directs the State Water Board and Regional Water Boards to establish beneficial uses and to set water quality objectives, which are limits or levels of constituents or characteristics established for the reasonable protection of the beneficial uses. Where waters contain levels of constituents or characteristics that are better than the established water quality objectives (such as maximum contaminant levels for drinking water) as of the date of adoption of Resolution 68-16, such waters are considered high quality waters. High quality waters are determined based on specific properties or characteristics. Therefore, waters can be of high quality for some constituents, but not for others.

In order to determine whether a water body is high quality water with regard to a given constituent, the background quality of the water body unaffected by the discharge must be compared to the water quality objectives. If the quality of a water body has declined since the adoption of Resolution 68-16 (in 1968) and that subsequent lowering was not a result of regulatory action consistent with the Resolution, a baseline representing the historically higher water quality may be an appropriate representation of background.

The next section describes where high quality waters are located within the Project Area. It is important to note that background water quality data going back to 1968 are not available for the Project Area, and therefore, the assessment of high quality water is based on available data which may reflect waste discharges from previous or ongoing activities. Where available data might reflect waste discharges, this is noted in Table G-1. A map of the Project Area, including locations of Operable Units (OUs) referred to in this Attachment, is shown in Attachment A. The Hinkley Valley aquifer, as referred to in this Order, is defined as the groundwater aquifer within the Project Area. The Hinkley Valley aquifer is located within the Harper Valley Hydrologic Subarea of the Mojave Hydrologic Unit.

Occurrence of High Quality Waters for Constituents Regulated Under this Order

Chromium

California has established a primary maximum contaminant level (MCL) in drinking water for total chromium of 50 μg/L. Hexavalent chromium is currently regulated by the total chromium MCL. In August 2013, the California Department of Public Health released for public comment a proposed draft MCL of 10 μg/L for hexavalent chromium. Because this draft MCL is not finalized as a regulatory standard, this analysis compares water quality in the Project Area to the total chromium MCL of 50 μg/L to identify existing high quality waters.

In general, existing water quality in the Hinkley Valley groundwater aquifer is considered high quality for chromium, with the exception of the area of the waste chromium plume which exceeds the MCL for total chromium (generally, all of OU1 and much of OU2). The plume "core", containing total chromium concentrations at and above 50 μg/L extends from the compressor station to just north of Santa Fe Avenue, a distance of 2 miles. Therefore, groundwater in the plume core of the Project Area does not presently support the beneficial use of a municipal and domestic supply, and is not considered high quality water. The majority of the Project Area outside the plume core (the northern portion of OU2 and all of OU3) represents high quality waters for chromium. The lower aquifer is considered high quality water for chromium, as chromium exceeding MCLs has not been detected in the lower aquifer.

The Hinkley Valley groundwater quality prior to the discharge of waste chromium in the 1950s and 1960s likely consisted of high quality waters for chromium. Groundwater sampling conducted in 2006 to determine background (pre-discharge) chromium groundwater concentrations determined that the maximum and average values for total and hexavalent chromium were 3.2/3.1 μg/L and 1.5/1.2 μg/L, respectively, well below the total chromium MCL of 50 μg/L, and the proposed MCL for hexavalent chromium of 10 μg/L. It is noted that a revised background study is planned to begin in spring 2014, and results from that study may show background values in areas which exceed current values or the proposed hexavalent chromium MCL. However, as noted above, for the purposes of this analysis, waters are considered high quality if chromium concentrations are less than current total chromium MCL of 50 μg/L.

Total Dissolved Solids (TDS)

The secondary MCL for TDS in drinking water is 500 milligrams per liter (mg/L) for a lower limit, 1,000 mg/L as an upper limit, and 1,500 mg/L as a short-term limit. TDS concentrations in groundwater are lower in the southern Project Area nearest the recharge area along the Mojave River, and in the southwest portion of the project area. Sampling conducted in 2006 found very low TDS levels (90 mg/L) near the Mojave River. Agricultural activities, primarily dairy operations and irrigated crops, are the major causes of increased TDS in the Hinkley Valley groundwater.

In general, western OU1 contains high quality waters for TDS, with limited concentrations between 1,000 and 1,500 mg/L in eastern OU1. Much of western and central OU2 is not considered high quality water for TDS, with concentrations up to 5,900 mg/L TDS, primarily beneath and downgradient of the Desert View Dairy near Thompson Road.

Pursuant to a previous Board Order issued to the Discharger regulating existing agricultural treatment units at the Desert View Dairy (R6V-2004-003A2), baseline levels of total dissolved solids and nitrate have been established for those ATUs. These levels are based on February 2005 groundwater monitoring data and represent groundwater quality not influenced by waste discharges related to ATUs. The baseline levels are as follows: average TDS concentration of 1,312 milligrams per liter (mg/L) and average nitrate as nitrogen concentration of 9.9 mg/L. These baseline levels will be used as pre-remedial reference levels for the Desert View Dairy ATUs for the purposes for restoring the groundwater aquifer water quality back to pre-project conditions, as required by the Project's Environmental Impact Report mitigation measure WTR-MM-4 (described in Attachment F of this Order).

The majority of OU3 is high quality for TDS with concentrations below 500 mg/L, with the exception of groundwater below existing agricultural fields just east of OU1. For northern OU3, data on TDS are limited or unavailable.

While groundwater in the vicinity of irrigation or dairy operations may not meet secondary MCLs for TDS, the groundwater is generally suitable for irrigation of alfalfa and other fodder crops which can tolerate higher salt levels.

Nitrate
The primary MCL for nitrate (as nitrogen) in California drinking water is 10 mg/L. Nitrate concentrations in groundwater in the Hinkley Valley are generally less than a few parts per million, where not affected by dairy or confined-animal operations. As mentioned above in the section discussing TDS, the quality of water entering the Hinkley groundwater basin from the Mojave River is considered to be high water quality.

Groundwater sampling in the Project Area conducted in 2006 found nitrate levels to range from less than 0.5 mg/L (equal to the method detection level) up to 21 mg/L. Five out of forty-seven wells sampled had one or more detections of nitrate greater than 10 mg/L. These five wells, however, were located near former or active dairies and an active heifer ranch, which were likely sources of nitrate pollution rather than reflective of naturally-occurring conditions. In general, upper aquifer groundwaters in OU1 are mostly high quality water for nitrate, with concentrations predominately less than the MCL, although detections up to 20 mg/L have been reported near in-situ remediation zones. OU2 is dominated by nitrate concentrations greater than the MCL, with detections greater than 40 mg/L downgradient of the Desert View Dairy; therefore OU2 is not considered to contain high quality waters for nitrate. Groundwaters in OU3 are generally high quality for nitrate, with the exception of the southeastern portion of the OU, where concentrations of nitrate up to 20 mg/L have been reported.

Uranium and other radionuclides
The state primary MCL for uranium is 20 picoCuries per liter (pCi/L), the primary MCL for gross alpha is 15 pCi/L and gross beta is 50 piC/L. Uranium is a naturally-occurring radioactive element in geologic materials. Uranium, gross alpha and gross beta are referred to as radionuclides, which are atoms with unstable nuclei that emit energy in the form of rays or high speed particles. Uranium and other radionuclides are not constituents associated with PG&E's waste discharge (i.e., they were not used by PG&E in its compressor station operations). However, agricultural pumping, including for remediation, could transport or mobilize naturally-occurring radionuclide concentrations in groundwater; therefore, they are constituents of concern for this Order.

The Water Board investigated radionuclide levels in the aquifer through collection of existing data and through a November 12, 2012, request to PG&E for its existing information. Data from agricultural unit supply wells and irrigation water sampling from the Gorman, Cottrell, and Ranch agricultural treatment units (sampling locations were in OU2) indicated total uranium levels of 25 to 59 pCi/L, 27 to 81 pCi/L for gross alpha and from below 4 to 27 pCi/L for gross beta. One multi-depth monitoring well sampled in OU2 located north (downgradient) of the Gorman Field showed total uranium from 3 to 32 pCi/L, gross alpha ranged from 7 to 34 pCi/L, and gross beta from 6 to 9 pCi/L. In general, the higher concentrations of uranium and gross alpha were detected in the deeper screened monitoring wells.

Data from supply wells located south (upgradient) of the compressor station in OU1 indicated that uranium and other radionuclide levels were all below MCLs (total uranium up to 4, gross alpha up to 8.5, and gross beta up to 23 pCi/L).

Periodic sampling by the State of California of drinking water at the Hinkley School from 2008 to 2011 indicated uranium levels ranging from 0.46 pCi/L to 25 pCi/L, with an average of 16 pCi/L. The Hinkley School during the time of this sampling was supplied by wells located in western OU3.

Lower aquifer monitoring wells in OU1 had dissolved uranium levels from 1 to 2 pCi/L, 3 to 4 pCi/L for gross alpha and less 4 to 5 pCi/L for gross beta, all less than MCLs.

In summary, uranium data for the Project Area are limited, both in number and spatial extent. From the limited available data, it appears that groundwaters in OU1 are high quality for uranium. In OU2, limited available data indicate MCLs for uranium and gross alpha are exceeded; therefore groundwaters are not considered high quality. In OU3, data are limited to wells supplying the Hinkley School only, showing uranium has been detected over the MCL for uranium but the average data do not exceed the MCL; however, for the rest of OU3 there are no data. Limited lower aquifer data indicates high quality for uranium and other radionuclides.

Arsenic

The federal and state MCL for arsenic is 10 µg/L. The US Geological Survey conducted sampling for various constituents in wells in the Mojave Water Agency management area from 1991 to 1997, including wells in the Hinkley area. The study found arsenic in wells (up to 200 feet in depth) ranging from less than 1 µg/L to 12 µg/L with most concentrations under 10 µg/L. Approximately four miles north of Highway 58, the study found arsenic in one well at a concentration of 52 µg/L. While the USGS study was conducted after the release of chromium from the Hinkley Compressor Station, sampling occurred before the use of carbon-amendment injections to groundwater, and thus reflects levels prior to in-situ remediation in OU1.

Three compressor station supply wells (PGE-14, FW-01, FW-02) located south (upgradient) of the plume, contain naturally-occurring arsenic at levels greater than 10 µg/L.

In August 2012, community-collected samples from wells west of the chromium plume (in southwestern OU3) indicated arsenic levels ranging from non-detect up to 170 µg/L, with 8 wells having concentrations above the MCL of 10 µg/L. Water Board staff collected follow-up samples from wells in that same area, and found arsenic levels ranging from non-detect up to 51 µg/L, with 5 wells having concentrations above the 10 µg/L MCL. Supply wells in northern OU3 indicate arsenic concentrations greater than the MCL. Limited data from the lower aquifer in southwestern OU3 indicated dissolved arsenic concentrations up to 41 µg/L.

In summary, background levels of arsenic throughout the Project Area are predominately below the arsenic MCL, and therefore represent high quality waters, but certain areas show higher background arsenic concentrations: upgradient of the compressor in southern OU1, and in the southwestern and northern portions of OU3. Data for the lower aquifer are limited but suggest that arsenic exceeds MCLs in southwestern OU3, and parts of southern OU2.

<u>Manganese</u>

The state secondary MCLfor manganese is 50 µg/L. The 2007 Background Study Report found dissolved manganese levels in areas outside the defined chromium plume, but within the Project Area to range from less than 1 µg/L (method detection level of 1 µg/L) up to 48 µg/L. The Discharger tested manganese levels in the in-situ area prior to initiating in-situ pilot testing and found manganese levels up to a maximum of 210 µg/L in the Central Area in-situ zone. Pre in-situ remediation monitoring in the Source Area had identified concentrations up to 34 µg/L in one part of the Source Area and up to 55 µg/L north of the Source Area.

In August 2012, Hinkley residents collected samples at domestic wells west of the in-situ remediation in response to complaints of "black water" in some residents' water supply. Results ranged from non-detect (below method detection levels) to over 1,000 µg/L with the highest concentration of 140,000 µg/L. Water Board samples from the same wells with the highest concentrations (> 1,000 µg/L) uniformly found much lower levels of manganese than found in community collected samples. Of the 17 manganese samples collected and analyzed by the Water Board, 8 were below method detection levels; and others ranged from 12 to 146 µg/L with one sample containing 789 µg/L manganese. Water Board samples in the southeastern and southwestern portion of the study area were all below method detection levels. The source of elevated manganese is unknown at this time.

In general, groundwaters in the Project Area are high quality for manganese, with the exception of limited data indicating that background concentrations of manganese exceed the MCL in the central portion of OU1, and in the southwestern portion of OU3.

<u>Iron</u>

The secondary MCL for iron is 300 µg/L. Sampling results from monitoring wells throughout the Project Area indicate that iron concentrations are typically less than 100 µg/L. The maximum baseline concentration in OU1 measured prior to starting in-situ remediation pilot testing was 377 µg/L, above the MCL. This information indicates that generally, groundwaters in the Project Area are high quality water for iron.

Summary of High Quality Waters in Project Area

Table G-1 summarizes the occurrences of high quality waters in the upper aquifer of the Project Area, by Operable Unit and constituent. Note that where water quality in an OU for a given constituent is indicated as high quality in Table G-1, that does not mean all sampling results were below MCLs. Rather, it indicates that a majority of available data indicate that water quality (either currently or historically) the below MCL for that constituent. In general, limited data for the lower aquifer of the Project Area indicates is considered high quality for constituents of concern regulated by this Order, with the exception of arsenic in certain areas.

Table G-1: Summary of High Quality Upper Aquifer Groundwaters in Project Area, by Operable Unit (OU) and Constituent.

Constituent	OU1	OU2	OU3
	High Quality Waters[1] Predominate?		
Chromium	Yes, prior to 1952. Not currently due to waste discharge.	Yes, prior to 1952. Currently, northern portion is high quality but southern portion affected by waste discharge.	Yes.
TDS	Yes.	No, affected by waste discharge.	Yes, except southeastern portion is affected by waste discharge. Also, limited data are available to determine water quality for the northern portion.
Nitrate as N	Yes, except near in-situ remediation zones.	No, affected by waste discharge.	Yes.
Uranium and other radionuclides	Yes, but data are very limited.	No.	Unknown due to very limited data.
Arsenic	Yes, except southern portion. Detections over MCLs a combination of waste discharge and naturally-occurring levels.	Yes.	Yes, except southwestern and northern portions with detections above MCLs due to naturally-occurring levels.
Manganese	No. Detections over MCLs likely a combination of waste discharge and naturally-occurring levels.	Yes	Yes, except southwestern portion with detections above MCLs likely due to naturally-occurring levels.
Iron	Yes	Yes	Yes

[1] An Operable Unit's groundwaters are considered high quality waters if they generally have background concentrations of constituents **less** than applicable primary or secondary MCLs. For hexavalent chromium, groundwaters with less than the total chromium MCL of 50 µg/L are considered high quality for the purposes of this analysis.

Applicability of Resolution 68-16 to this Order

Resolution 68-16 applies to high quality waters. The above analysis indicates that groundwaters of the Project Area have been degraded by historical and ongoing waste discharges, such as historical chromium discharges from the compressor station, historical and ongoing dairy and agricultural activities affecting TDS and nitrate concentrations. Also for some constituents in the Project Area, naturally-occurring levels exceed MCLs (arsenic and likely manganese in the southern Project Area). However, in general, available data suggests that pre-waste discharge concentrations of constituents of concern represent high quality waters, and those concentrations should be maintained or restored in compliance with 68-16.

Compliance with Resolution 68-16

Chromium

The primary purpose of agricultural treatment of chromium in extracted groundwater and the discharges associated with this Order is to restore groundwater quality to background conditions for chromium. .

Mitigation measures and monitoring are described in the EIR and required by this Order to ensure if domestic supply wells are affected by chromium due to remedial actions, that such degradation will not unreasonably affect beneficial uses, and high quality water will be restored or maintained, as described below.

Mitigation measure WTR-MM-2a requires that the Discharger provide alternate water supplies for those domestic wells users whose wells are impacted by chromium plume movement due to remediation activities. Quarterly monitoring of wells within one mile of the plume, and annual modeling of chromium plume movement will provide advance warning for wells that may become affected within the following year. The annual modeling (forecasted out to a three-year period) will be used to plan for either changing remediation activities and/or the provision of alternative water supplies in advance of effects on domestic wells. These mitigation measures are incorporated into this Order in Section I.E and Attachments E and F (WDRs Monitoring and Reporting Program, and EIR Mitigation Monitoring Program, respectively).

The overall goal of the actions authorized by this Order is to decrease chromium concentrations in groundwater to background levels and ultimately restore beneficial uses to the aquifer, consistent with the best interests of the people of the state. The Project incorporates best practicable treatment or control measures of groundwater extraction and treatment, includes the monitoring and mitigation measures identified in the EIR and required by this Order. Current beneficial uses are protected by implementation of mitigation measures, and any degradation of high quality water will be minimized during project implementation and restored following project completion.

<u>Nitrate, Uranium, and Total Dissolved Solids</u>

Nitrate
Agricultural treatment has the potential to reduce the nitrate concentration in the aquifer as the nitrate in irrigation water is taken up by crops as a nutrient. Data from existing agricultural treatment units shows nitrate concentrations in extracted groundwater have been reduced by up to 90%. The overall effect of agricultural treatment will be removal of nitrate from groundwater, which will be a beneficial effect for the aquifer as a whole.

There is, however, potential for localized nitrate increases to still occur due to movement of water during remediation. If groundwater were extracted from an area of higher nitrate concentrations and then discharged in an area with lower nitrate concentrations, it is possible that nitrate concentrations could increase in those areas due to percolation if plant uptake of nitrate was incomplete.

In order to determine if this is occurring, **Mitigation measure WTR-MM-6** requires the Discharger to monitor nitrate levels for one year before creating new agricultural treatment units (as feasible without delaying remediation), monitor at the start of new agricultural treatment, and continue monitoring nitrate levels during implementation of all new agricultural treatment units. If nitrate levels do not: 1) increase above 10 mg/L (as N), or 2) by more than 10% compared to existing levels (if current levels are already above 10 mg/L as N), or 3) by more than 20% compared to existing levels (if current levels are less than 10 mg/L as N) then no further action, other than monitoring, will be required.

If monitoring indicates that nitrate levels are approaching 10 mg/L (as N) or increasing by more than the criteria noted above, the Discharger will implement a contingency plan for managing nitrate levels which may include some combination of the following:

- Extraction source water will be shifted from application where it would raise concentrations substantially to locations with existing higher concentrations of nitrate, provided it would not increase nitrate levels at any domestic well.
- Extraction source water will be blended before application to agricultural treatment units so as to avoid exceeding 10 mg/L as N and avoid increases in existing levels that exceed the criteria noted above.

This Order requires the implementation of the above mitigation measure. Restoration of aquifer water quality for nitrate increases due to the Project, as required by **Mitigation measure WTR-MM-4**, is discussed below in the TDS section.

Uranium and Other Radionuclides
Uranium and other radionuclides are naturally occurring in Mojave Desert soils and rocks. Uranium is a constituent of concern for this Order because the Discharger's pumping for remediation could transport or mobilize background uranium and other radionuclides concentrations. Agricultural treatment for chromium plume remediation works by exposing chromium-contaminated irrigation water to subsurface root zone conditions that contain a reducing environment that converts soluble hexavalent chromium to relatively immobile trivalent chromium. Uranium chemistry is similar to that of chromium in which the oxidized form (U-6) is much more mobile than the reduced form. Like hexavalent chromium, U-6 can be changed to its reduced form (U-4) by microbial action in low oxygen, reducing conditions. Thus, background uranium in agricultural treatment water should also be immobilized by the reducing environment, and remain bound to soil particles. This Order requires monitoring for uranium and other radionuclides to confirm this.

Further, this Order requires monitoring and contingency actions in the event that agricultural treatment units have the potential to increase background uranium or other radionuclides in groundwater, as required in **Mitigation measure WTR-MM-5.** For affected or potentially affected water supply wells, alternative water supplies will be required to be provided per **Mitigation measure WTR-MM-2**. **Mitigation measure WTR-MM-4** require restoration of the drinking water aquifer from all substantial water quality impairments resultant from remedial activity within a timely manner (to be determined by the Water Board). WTR-MM-4 is discussed in the TDS section, below.

Total Dissolved Solids
Discharges authorized by this Order may degrade existing water quality for TDS. In OUs 1 and 3, where TDS concentrations are generally below the secondary TDS MCLs of 1,500 mg/L, 1,000 mg/L and 500 mg/L, respectively, this Order requires that where the discharge of waste causes a 20 percent increase in TDS concentrations, the Discharger must submit an action plan to reduce those exceedances to the extent feasible, considering remediation goals. Actions could include blending of irrigation water to reduce TDS concentrations applied to fields, participation in a Salt and Nutrient Management Plan, or by proposing a plan to implement EIR mitigation measure WTR-MM-4, described below. Further, this Order requires application of irrigation water at agronomic rates as a best management practice to minimize TDS buildup in soils to extent feasible.

Where the upper limit secondary MCL of 1,500 mg/L is already exceeded (for example, throughout much of OU2, where levels of TDS are up to 5,900 mg/L), agricultural treatment may result in further degradation. The EIR completed for the Project recognizes the potential increase in concentrations of TDS as a significant and unavoidable impact for the duration of the Project; therefore, a statement of overriding considerations is included in Attachment H. In addition, EIR mitigation measure WTR-MM-4, specifies that the Discharger will restore the Hinkley Valley aquifer to pre-remedial conditions following completion of the chromium remediation project, described below:

For drinking water wells affected by TDS increases due to remedial actions, this Order incorporates the requirements of **Mitigation measure WTR-MM-2b,** requiring alternative water supplies for all affected or potentially affected wells.

This analysis recognizes that high quality water within the aquifer related to TDS exists and may be degraded by agricultural treatment. While alternate water supply can address water supply wells impacts, there would remain the potential for longer-term degradation of aquifer water quality, even after completion of remediation of the chromium plume. **Mitigation measure WTR-MM-4** holds the Discharger responsible for restoring water quality in the Hinkley Valley aquifer back to pre-remedial reference conditions (defined as conditions prior to the initiation of remedial actions included in the Project defined in the EIR ,and including baseline concentrations defined in previous Orders that have been superseded by this Order). The requirements of Mitigation Measure WTR-MM-4 are recognized in this Order in Finding 25c, and will be incorporated into an upcoming Cleanup and Abatement Order issued to the Discharger.

Mitigation measure WTR-MM-4 specifies that no later than 10 years prior to the conclusion of the proposed Project, the Discharger shall conduct an assessment to evaluate adverse impacts or potential adverse impacts to the Hinkley aquifer from its remedial actions.

If the assessment finds that the aquifer contains constituents exceeding pre-remedial reference conditions and are due to remedial action, and that these constituents are likely to be present upon the conclusion of remedial actions, the Discharger will propose cleanup actions to restore the aquifer for beneficial uses. Aquifer water quality restoration to pre-remedial reference conditions will occur as soon as possible after completion of chromium remediation. The recommended timeframe for restoration is within 10 years of completion of chromium remediation but the Water Board will retain authority to determine the required duration for completion.

Every year following preparation of the assessment and approval of restoration timeframes, the Discharger must submit a status report of actions to restore the aquifer for beneficial uses related to agricultural treatment unit byproducts, including TDS, nitrate and uranium. The status report will describe all actions taken over the course of the year and list proposed actions for implementation during the following year. An updated schedule will be provided, predicting fulfillment of aquifer restoration.

The assessment described above can include analysis of the potential for natural attenuation to return pre-remedial reference conditions within an acceptable timeframe, as determined by the Water Board.

Several options exist for treatment of agricultural treatment byproducts (TDS, nitrate, uranium and other radionuclides) if necessary:

- *Aboveground Treatment*: Treatment technologies, including reverse osmosis, electrochemical treatment (such as electrocoagulation), ion exchange and possibly other methods can be used to remove TDS, nitrate and uranium from water.
- *In-Situ Remediation*: In-situ remediation using carbon amendment, like that proposed in the high concentration portion of the chromium plume, has been used to remediate elevated uranium levels in groundwater.
- *Basin-Wide Approach to TDS and Nitrate*: A basin-wide approach to reducing TDS and nitrate could involve fallowing of, or changes in farming practices at other agricultural fields within the basin that are not used for agricultural unit treatment and at area dairies. Since the project will increase agricultural fields and production of animal feed, a basin-wide approach may include an option to implement a “farm swap” to allow fallowing of other local agricultural fields to reduce TDS levels in the groundwater basin. There may also be options to improve irrigation techniques by using drag-drip irrigation instead of broadcast irrigation techniques (thus lowering irrigation amounts and TDS loading), and crop rotation (which may lower water demand). There may also be options to work with local Hinkley dairies to lower TDS and nitrate inputs through better site management practices of manure and runoff. Participation by owners/operators of other agricultural land and dairies would be voluntary and would be subject to private negotiation between PG&E and willing participants. While these approaches could lower overall loading of TDS and nitrate into the Hinkley groundwater aquifer, long-term use of agricultural treatment units for chromium treatment may still result in localized increases of TDS and nitrate.

The implementation of a basin-wide approach is limited to the Project Area for this EIR at this time. If in the future, PG&E proposes basin-wide approaches involving farms outside the Project Area, analysis under CEQA may be required.

Mitigation measure WTR-MM-4 is limited to addressing the effects of the Discharger's remedial actions that cause changes above pre-remedial reference conditions. It is possible that water quality or groundwater baseline levels may be affected by actions not authorized by this Order (such as other agricultural or dairy activity not controlled by the Discharger) during chromium remediation. The Discharger will only be responsible to remediate the effects that it causes, not those that are due to the actions of third-parties. Because prior dairy activities have resulted in elevated TDS levels in the project area, it is important to determine separately the effect of agricultural treatment authorized by this Order, compared to existing or future degradation from non-remedial agricultural operations. **Mitigation measure WTR-MM-5** requires investigation and monitoring of TDS levels to identify pre-remedial reference conditions and where and when remedial actions result in significant impacts for determining when replacement water and/or aquifer restoration are warranted.

The extraction and land application of groundwater are designed to be the equivalent of Best Practicable Treatment or Control measures, as required by Resolution No. 68-16. The Discharger uses a specialized irrigation system called "drag-drip" irrigation, where the water is applied directly to the ground surface rather than sprayed into the air. This approach reduces the evaporation rate of the irrigation water, and less water is needed to grow crops. This reduces the mass of TDS that is left in the soils that could percolate back down to groundwater. Further, this Order requires application of irrigation water at agronomic rates as a best management practice to minimize TDS buildup in soils to extent feasible.

The agricultural treatment approach authorized by this Order is one of the primary methods proposed for chromium remediation that results in the shortest cleanup times. It also puts the extracted groundwater to beneficial use, using the water to grow forage crops, consistent with the current and historic agricultural nature of the Hinkley Valley. Therefore, the use of agricultural treatment authorized by this Order represents the best practicable treatment or control to maintain the highest water quality consistent with the maximum benefit to the

<u>Arsenic and Manganese</u>
Where agricultural treatment units are co-located or in proximity to in-situ remediation zones, the extracted groundwater may contain arsenic and manganese in concentrations greater than naturally-occurring levels. As described above, arsenic and manganese occur at concentrations above their respective MCLs in parts of the Project Area. The primary water quality concern would be the potential leaching of arsenic and manganese from soils to groundwater due to irrigation.

The discharge of untreated groundwater to land surface will convert soluble hexavalent chromium to solid trivalent chromium under reducing conditions in soil. The same conversion is expected of other soluble metals or elements that may be present in groundwater, such as manganese, iron, arsenic, and uranium. Converted metals will accumulate in the upper five feet of soil when applied to land surface. The mass or concentration of such converted metals was determined to be a less-than-significant impact in the EIR, compared to naturally-occurring concentrations in soils in the Project Area.

The Project incorporates best practicable treatment or control measures, including the monitoring and mitigation measures specified in the EIR and required by this Order. Therefore, any temporary groundwater degradation related to arsenic or manganese in irrigation or treated water due to Project activities is consistent with Resolution 68-16.

Other Constituents of Concern

The use of acids and compounds to remove biofouling from screens in monitoring and extraction wells will alter pH in groundwater and increase the concentration of total organic carbon. Both effects, however, will be localized to the vicinity of the well screen due to the strong buffering capability of the aquifer, as demonstrated by previous sampling. Baseline sampling shows that bicarbonate alkalinity averaged 300 milligrams per liter (mg/L) and pH is neutral to slightly alkaline. These groundwater characteristics will confine acid and other reactions to the point of injection. Therefore, since groundwater pH will return to background conditions before reaching the Project Area boundaries, there will be no adverse impacts to beneficial uses following the injection of well rehabilitation compounds.

The discharge of tracers, including bromide and fluorescent dyes, will provide better information about aquifer conditions and the fate and transport of discharges. The injection of fluorescent tracers will cause a coloration of groundwater. Fluorescent and bromide tracers will become diluted in the aquifer during groundwater recirculation and/or natural mixing. Coloration will dissipate to undetectable levels prior to reaching the Project Area Boundary. There are no established standards for fluorescent tracers, such as fluorescein or eosine. The Basin Plan, however, does require compliance with narrative objectives, which includes nuisance. Coloration of groundwater from the disposal of wastes would fall under the definition of "nuisance." Since groundwater outside the Project Area boundaries is not expected to contain any color, there will be no adverse impacts to beneficial uses following the tracer test.

Conclusion

The Project involves the extraction of groundwater containing chromium and the application of the extracted groundwater to agricultural treatment units to reduce the hexavalent chromium to trivalent chromium, thereby cleaning up the polluted aquifer. The application of the extracted groundwater to the agricultural treatment units may result in some degradation of high quality groundwater within the Project Area. Such degradation is consistent with Resolution 68-16 because as described in this Attachment, the waste discharge requirements require the use of best practicable treatment or control of the discharge. The discharges will not result in exceedances of applicable water quality objectives over time. The limited term degradation is consistent with the maximum benefit to the people of the State because the Project will result in removal of hexavalent chromium from the groundwater and restoring the polluted groundwater to its beneficial uses.