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July 29, 2005

Mr. Norman Shopay
Project Manager
California Department of Toxic Substances Control
Geology and Corrective Action Branch
700 Heinz Avenue
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Subject: Draft Work Plan for Installation of Supplemental Extraction Well
IM Groundwater Extraction System
Pacific Gas and Electric Company, Topock Project

Dear Mr. Shopay:

This letter transmits the draft *Work Plan for Supplemental Extraction Well, Interim Measures Groundwater Extraction System* for the Pacific Gas and Electric Company (PG&E) Topock site, in compliance with the Department of Toxic Substances Control (DTSC) June 30, 2005 letter request. DTSC's letter requested that an additional (backup) extraction well be installed for the groundwater extraction system to minimize potential downtime if the primary extraction well TW-2D was not operational and to provide the capacity to pump up to 135 gpm from the lower interval of the Alluvial Aquifer to the Interim Measures No. 3(IM No. 3) treatment system.

The enclosed Work Plan provides an evaluation of potential locations for additional groundwater extraction well(s) that could be installed to supplement the current extraction system and describes the proposed drilling methods, well design, and specifications for the recommended supplemental extraction well locations.

As agreed by DTSC, the draft work plan does not include plans or details for conveyance piping, well testing, or well connection to the IM No. 3 system. These items are to be addressed in an addendum or separate work plan following agreement on the scope and location of additional extraction wells.

PG&E understands that DTSC considers the new extraction well to be needed in part to avoid extended down time due to pump failure in existing well TW-2D. Although a spare pump for TW-2D is maintained at the site, PG&E has estimated that it could take as much as a week to mobilize a pump installation subcontractor to remove and replace the existing pump if it were to fail. As an alternative to installing another extraction well, PG&E could procure a boom truck or tripod winch to allow replacement of the extraction well pumps without the need for a pump subcontractor. With this equipment and a spare pump on site, the expected downtime for pump replacement would be two days or less.

It is important to note that a third extraction well (PE-1) will be connected and operational in the near future. PG&E believes that with this new well and the two existing wells (TW-2D and TW-2S), the extraction well system will be more than adequate to meet the necessary extraction rate to maintain a landward gradient during any river stage conditions. Using recent performance monitoring data and updated simulations to the groundwater model, the maximum anticipated pumping rate needed to maintain hydraulic control in the lower interval of the Alluvial Aquifer is approximately 90 to 100 gpm, during extremely low river stage periods (worst case conditions). If a larger pump were installed in TW-2S, concurrent operation of any two of the three wells could meet this target extraction rate during the period of time it would take to replace a pump.

Well TW-2S is screened across the water table, and the response to pumping in this well is typical of an unconfined aquifer. The drawdown cone from TW-2S would be expected to propagate much slower than the drawdown cone from TW-2D, which is screened in semi-confined aquifer conditions. During the previous short-term pumping tests, well TW-2S was not pumped long enough to allow the unconfined cone of depression to develop out to the river. Longer-term pumping from TW-2S is expected to have a significant effect on water levels in the MW-34 wells. Although pumping from TW-2S is not as effective at controlling gradients as pumping from TW-2D, it is likely that gradient targets could still be achieved if pumping had to be shifted to TW-2S for a few days while the pump in TW-2D was repaired. In addition, the estimated distance of groundwater movement during one week of down time, even with no pumping, is less than 10 feet, even using conservative hydraulic parameter assumptions.

PG&E believes that once PE-1 is brought online, the existing three extraction wells will provide more than adequate flexibility and capacity for the IM extraction system, even during the low river flow period. Accordingly, PG&E questions the need for installation of more supplemental or backup extraction well(s) at this time. As a suggested alternate to constructing an additional backup extraction well, we propose to prepare a detailed contingency plan that will minimize down time in the event of a pump failure.

This said, the enclosed draft work plan evaluates potential viable sites for new extraction wells and provides preliminary plans and specifications for the drilling and construction of new extractions well(s), if supplemental well installation is required to meet the IM performance objectives.

If you have any questions, please do not hesitate to contact me. I can be reached at 805/546-5243.

Sincerely,

Julie Eakins for Yvonne Meeks

Cc: Karen Baker
Aaron Yue
Kate Burger

Draft

Work Plan for Supplemental Extraction Well, Interim Measures Groundwater Extraction System

PG&E Topock Compressor Station Needles, California

July 29, 2005

Prepared for

California Department of Toxic Substances Control

on behalf of

Pacific Gas and Electric Company

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Draft

Work Plan for Supplemental Extraction Well, Interim Measures Groundwater Extraction System PG&E Topock Compressor Station Needles, California

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This work plan was prepared under supervision of a California Certified Engineering Geologist,

Paul Bertucci, C.E.G.
Project Hydrogeologist

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Acronyms and Abbreviations

µg/L	micrograms per liter
bgs	below ground surface
BLM	U.S. Bureau of Land Management
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
DTSC	California Department of Toxic Substances Control
gpm	gallons per minute
IDW	investigation-derived waste
IM	Interim Measure
PG&E	Pacific Gas and Electric Company
PVC	polyvinyl chloride

1.0 Introduction

Pacific Gas and Electric Company (PG&E) is addressing chromium in groundwater at the Topock Compressor Station in Needles, California under the oversight of the California Department of Toxic Substances Control (DTSC). An Interim Measure (IM) is being implemented consisting of a groundwater extraction and treatment system to provide hydraulic control of the plume boundaries near the Colorado River.

In a letter dated June 30, 2005, DTSC requested that PG&E prepare and submit a work plan to install an additional groundwater extraction well for the IM groundwater extraction system. The purposes of the additional extraction well, as described in DTSC's letter, are to provide redundant pumping capacity for the currently-operating extraction well and to allow for pumping and conveyance of groundwater at a maximum rate of 135 gallons per minute (gpm) from the lower interval of the aquifer in the floodplain area to the IM No. 3 treatment plant. The existing extraction system consists of one actively-pumped deep well (TW-2D), with a pumping capacity of approximately 90 gpm, and one standby/inactive shallow well (TW-2S), with pumping capacity of approximately 40 gpm. The IM No. 3 treatment facilities were designed with a maximum capacity of 135 gpm.

This draft work plan was prepared in compliance with the DTSC's June 30, 2005 letter (DTSC 2005a). The work plan provides an evaluation of potential extraction well locations and describes the proposed construction methods and well design for a new, additional extraction well that could be used to supplement the existing groundwater extraction system.

1.1 Project Background

The Topock Compressor Station is located in San Bernardino County, approximately 15 miles to the southeast of Needles, California (inset map, Figure 1). In February 1996, PG&E and DTSC entered into a Corrective Action Consent Agreement pursuant to Section 25187 of the California Health and Safety Code. Under the terms of that agreement, PG&E was directed to conduct a Resource Conservation and Recovery Act facility investigation and to implement corrective measures to address constituents of concern released in the Bat Cave Wash Area near the PG&E Topock Compressor Station. The primary constituents of concern at Topock are hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]. The source was Cr(VI) salts historically used as a corrosion inhibitor in the station's cooling towers.

DTSC is the lead administering agency for the project. Assisting DTSC and PG&E with the planning and review of interim remedial measures are the members of the Topock Consultative Workgroup, constituted under California's Site Designation Process, and consisting of representatives of DTSC, Colorado River Basin Regional Water Quality Control Board, Metropolitan Water District of Southern California, Arizona Department of Environmental Quality, various federal agencies who own or manage adjacent property, and other project stakeholders.

In February 2004, DTSC directed PG&E to initiate an IM in the floodplain area of the site to prevent movement of the chromium plume toward the Colorado River. As stated in DTSC directives, the goal of the IM is "hydraulic control of the plume boundaries near the Colorado River to achieve a net reversal of groundwater gradient from the Colorado River" (DTSC 2005b). Since March 2004, the IM extraction system and associated activities have been operated continuously under DTSC oversight.

Between March 2004 and the present, the IM in the floodplain area included pumping from one or more extraction wells in the MW-20 bench area. In March 2005, an additional extraction well, designated PE-1, was installed in the floodplain area (CH2M HILL 2005a-b); however, piping from the extraction well to the treatment system has not yet been constructed and PE-1 has not been operational. When PE-1 becomes operational, expected in the fall of 2005, the IM is expected to be operated under normal conditions using a combination of TW-2D and PE-1.

Figure 1 shows the location of the existing IM extraction wells TW-2D, TW-2S, and PE-1; the IM No. 3 treatment plant; the conveyance piping from the MW-20 bench to the treatment plant; and the conveyance piping for effluent from the treatment plant to the injection well area (injection wells IW-2 and IW-3). Extraction well TW-2D and potential supplemental extraction well sites addressed in this work plan are all located on United States Bureau of Reclamation lands that are managed by United States Bureau of Land Management (BLM).

1.2 Current IM Extraction System

As directed by the DTSC under the IM, PG&E is currently pumping groundwater from one deep extraction well (TW-2D), located on the MW-20 bench along the station access road and above the Colorado River floodplain. Other existing extraction wells include one shallow extraction well (TW-2S), located adjacent to TW-2D, and one new extraction well (PE-1), located on the floodplain approximately 450 feet east of TW-2D (Figure 1). The existing pumping rates and operational status of the current extraction well facilities are:

- TW-2D: active pumping well with 5-inch dedicated pump, maximum 90 gpm pumping rate to the treatment plant.
- TW-2S: connected standby pumping well with 4-inch dedicated pump, maximum 40 gpm pumping rate to the treatment plant.
- PE-1: new extraction well, currently awaiting installation of dedicated well pump (40 gpm rate) and conveyance piping and connection to the treatment system.

1.3 Authorizations

BLM has authorized installation of contingency extraction wells for the IM system under a previous Action Memorandum, dated March 3, 2004 (BLM 2004a). In a letter dated March 22, 2004, DTSC approved the initially proposed locations for the IM extraction wells, including the PE-3 site and additional wells on the MW-20 bench (DTSC 2004).

At the direction of DTSC, PG&E submitted a work plan on December 22, 2004 to summarize the proposed Phase 2 IM groundwater investigation activities on BLM land. The *Field*

Activity Summary for Supplemental Interim Measures No. 2 Well Installation (CH2M HILL 2004) identified the potential installation of monitoring wells and up to two additional extraction wells in the middle portion of the floodplain. In a letter dated December 29, 2004, BLM approved the drilling at seven well locations, including PE-3 and additional wells on the MW-20 bench (BLM 2004b).

Prior to construction of an additional extraction well, authorization will be sought from BLM for updating the drilling plans and field activities for the potential installation of supplemental extraction wells. Other activities such as pipeline and power supply installation on BLM-managed property will be addressed in new Action Memoranda, as appropriate. Other permits and approvals are discussed in Section 5.0 of this work plan.

2.0 Siting and Design of Supplemental Extraction Well

2.1 Evaluation of Potential Sites for Supplemental Extraction Well

The design and locations reviewed for this new extraction well were based on the performance and success of the TW-2D installation. TW-2D is screened from 115 feet to 150 feet below ground surface (bgs), in the lower portion of the Alluvial Aquifer above Miocene conglomerate bedrock. During initial pumping tests, TW-2D was pumped at sustained rates of 90 to 100 gpm. As a consequence of the ongoing pumping operations, the specific capacity of TW-2D appears to have increased since installation and is currently 8 gpm per foot of drawdown.

Well TW-2D is screened in sandy gravel alluvial deposits that appear to be more conductive than the formations encountered at similar elevations in monitoring wells MW-20 to the south or MW-31 to the north. Although the saturated alluvium above bedrock is thicker to the north of TW-2D, the alluvial sequence at the two monitoring well locations generally had higher clay content and may be less productive than the formation at the TW-2 well pair.

Well TW-2S is screened as a water table extraction well, with the bottom of the screen at 95 feet bgs and the top of the screen at 45 feet bgs. The static water level in both TW-2S and TW-2D is roughly 45 feet bgs under non-pumping conditions. The reason for installing separate shallow TW-2S and deep TW-2D wells was that an aquitard appeared to be present at the intervening depth in the MW-20 wells, and Consultative Workgroup Technical Workgroup members expressed concern that a single extraction well should not be screened across the aquitard. However, this aquitard does not appear to be present in the northern portion of the MW-20 bench at the MW-31 location.

The possible locations that were considered for a supplemental extraction well include PE-2, PE-3, the MW-20 bench, and the areas in the floodplain, south, east, and north of the TW-2 well pair. Figure 2 shows the locations of the existing extraction and monitoring wells and the potential sites that were evaluated for supplemental extraction wells in the floodplain area.

Using information on hydrogeology and aquifer conditions, the potential extraction well locations are evaluated and compared in Table 1. It should be noted that a new extraction well operating anywhere except adjacent to the TW-2 well cluster would cause the groundwater gradient to be influenced by two distinct pumping centers. The current set of gradient control monitoring wells is designed to monitor the gradients around the TW-2 pumping center. As a result, one or more of the key gradient well pairs may need to be relocated if a new extraction well were installed in a location different from the TW-2 area.

TABLE 1
Evaluation of Potential Extraction Wells Locations
Interim Measures No. 3 Groundwater Extraction System
PG&E Topock Compressor Station

Location	Description	Aquifer Conditions relative to TW-2 Location	Other Considerations	Location Viable for Supplemental Extraction - yes or no -
MW-20 area	On MW-20 Bench south of existing TW-2 wells	Finer-grained, flowing sand present ~ 100 feet bgs.	MW-20 bench already disturbed.	No (hydrogeology, yield concern)
MW-31 area	At north end of MW-20 bench	Finer grained formation is likely to have lower yield than TW-2 well site.	MW-20 bench already disturbed.	No (hydrogeology, yield concern)
Floodplain area	East of MW-20 bench near MW-39	Aquifer thinner than MW-20 bench	Floodplain access and permitting issues related to biological resources are significant for drilling and piping	No (access/permitting, and aquifer thickness)
PE-2	Contingent well location along Park Moabi Rd. south of railroad bridge	Aquifer thickness is reduced. Elevation of bedrock higher than MW-20 bench and floodplain; lower aquifer interval may not be present	Model indicates no additional extraction influence is needed in this area. Railroad and utility encroachments required for piping	No (reduced aquifer thickness, yield concern, involved permitting)
PE-3	Contingent well location northwest of MW-20 bench	Aquifer thickness (depth to bedrock) may be greater than at TW-2D. Deep portion of aquifer not characterized; may be more similar to TW-2D than locations to north or south.	Well site in graded area along access road and conveyance facilities. Outside sensitive biological and cultural resources	Yes (initially approved well site by BLM; would augment hydraulic influence in northern floodplain well pair)
TW-3D	15 feet west of TW-2D	Aquifer conditions are known as productive based on TW-2D success.	Drilling and piping access to MW-20 bench lies in previously disturbed area. Location close to TW-2D minimizes adjustments to gradient pairs used for performance monitoring.	Yes (aquifer conditions well characterized; established operations area; capture zone best understood)

Based on this analysis, the locations considered most viable for installation of potential supplemental extraction wells include a new well located adjacent to TW-2D (a "twin-well"

designated TW-3D) and the initially proposed contingent extraction well location PE-3 (Figure 2).

The locations considered most viable for installation of the potential supplemental IM extraction wells are shown on Figure 2. The PE-3 location is near well MW-19, which is a shallow well drilled to 66 feet bgs. The lithology of the deeper portion of the aquifer at this location is unknown. The nearest well that has penetrated to bedrock is MW-31, which did not encounter any substantial thicknesses of coarse-grained sand or gravel in the lower portion of the aquifer. Consequently, it is possible that an extraction well at PE-3 might not be able to produce the quantity of water required by DTSC.

A well at the TW-3D location is likely to encounter similar geology as that at TW-2D. The thick sequence of sand and gravel encountered at this location is the best encountered for an extraction well. Based on logs of monitoring wells at MW-20 and MW-31, this sand and gravel zone is limited in extent on the MW-20 bench. Drilling close to TW-2D provides the best opportunity to complete an extraction well with the requisite capacity. Additionally, by locating the supplemental well near TW-2D, the existing gradient observation well pairs would still be usable.

2.3 Extraction Well Design

Figure 3 shows a schematic diagram of the well construction recommended for the supplemental extraction well. The well screen will be constructed of stainless-steel, 6-inch-diameter, 0.060-inch slot size Roscoe Moss louvered screen. The stainless-steel screen will be connected to an 8-inch schedule 80 PVC blank casing riser. The 8-inch riser will enable the use of 6-inch-diameter submersible pump. A pump size capable of delivering up to 135 gpm to the IM No. 3 treatment plant would be installed in the well. Details of the proposed procedures and specifications for the drilling, installation, and completion of the supplemental extraction wells are provided in Section 3.0.

3.0 Well Drilling, Construction and Completion

3.1 Site Preparation

The new extraction well will be drilled using sonic drilling equipment similar to that used to install the floodplain extraction well PE-1 and IM monitoring wells. The sonic drilling method has proven effective at the PG&E Topock site. The two most common alternative methods, mud rotary and air rotary drilling, have serious drawbacks for this particular application. Drilling using mud rotary methods close to TW-2D would require shutting down TW-2D during drilling to prevent drilling mud from being drawn into the pumping well. Air rotary drilling methods produce a fine mist of groundwater from the top of the cyclone. Hexavalent chromium could be present in this mist and this would pose a potential hazard to drilling crews, likely requiring the use of respirators and waterproof Tyvek suits. The heat stress caused by this level of PPE could seriously limit the working time and greatly slow the progress of the drilling. Sonic drilling will provide a safe and effective method for installation of the supplemental extraction well at the anticipated depth.

The extraction well will be located in open areas, where no clearing of vegetation would be required. The same biological mitigation measures approved for the floodplain monitoring well and PE-1 installation activities performed in February and March 2005 on the floodplain area will be implemented. All activities associated with the extraction well drilling activities will be coordinated with BLM to ensure the protection of cultural and biological resources.

Site preparation shall occur prior to execution of drilling and well installation tasks. Site preparation shall include identifying and avoiding biologically- and/or culturally-sensitive areas and site hazards. The drill rig shall be cleaned before mobilization to the drill site. After the drill rig has mobilized into place, short-term staging areas will be established. Plastic sheeting will be laid on the ground surface in the staging areas to keep the drilling materials and equipment clean and to minimize impacts to the ground surface from the drilling materials and equipment. Materials to be stored at the well site include drilling equipment and well construction materials (e.g., casing, sand, bentonite, and grout). Additional supplies and equipment not in use will be stored at the Topock Compressor Station, near the core storage area.

3.2 General Drilling Requirements

Figure 3 shows a schematic diagram of the drilling and well construction plan for potential supplemental IM extraction wells. Exploratory drilling and well installation shall conform to state and local regulations. CH2M HILL will obtain all permits, applications, and other documents required by state and local authorities. Utility clearances will also be obtained prior to commencement of drilling. The drilling, core/borehole logging, and well construction will be performed under the supervision of a California Professional Geologist. The drilling, logging, and extraction well construction activities will follow the procedures,

field methods described in Section 5.0 and Appendix B of the Topock program *Sampling, Analysis, and Field Procedures Manual* (CH2M HILL 2005c).

3.2.1 Drilling Method

Drilling will be accomplished using the rotosonic drilling technique, which involves advancing a rotating and vibrating drill head or core barrel through the subsurface. This method can produce a continuous core, generates minimal drilling wastes, and can typically drill through gravel, cobble, and competent bedrock formations. The continuous core obtained from sonic drilling will facilitate the final screened interval selection for the new extraction well.

The pilot borings for core logging will be approximately 7 inches in diameter. The borehole will be drilled out to approximately 12.8 inches in diameter from the ground surface to a minimum depth of 50 feet bgs (Figure 3). The lower section of the borehole for extraction well installation will be approximately 10.7 inches in diameter and straight enough to allow the constructed extraction well to accommodate the installation of a pump.

Potable water may be added during drilling to assist with lifting cuttings from the well when advancing casing. The driller will keep the amount of water added to a minimum. The field geologist will record the volume of water added and ensure that this water volume, at a minimum, is removed from the well during development.

The location of the proposed extraction well in the MW-20 bench area will allow use of truck-mounted drilling equipment. A truck-mounted sonic drilling rig, similar to the type that was used to construct the previous IM monitoring wells, will be used to drill the new extraction well.

To support the drilling rig, a forklift and one or more pickup truck crew vehicles will be used to transport crew, equipment, and materials from staging areas near the compressor station to the drill site. The forklift will also be used to transport cuttings and excess core generated from drilling the soil borings to lined, steel roll-off soil bins that will be temporarily staged on the MW-20 bench, on PG&E property, or, with permission of the property owners, in other suitable locations (such as the MW-19 area near the proposed PE-3 location) on BLM property. Disposal procedures for the investigation-derived waste (IDW) are discussed in Section 4.0.

3.2.2 Core Logging

The core logging of the pilot borings will be performed under the supervision of a California Professional Geologist. At pilot boring, the field log will document:

- Unique soil boring or well identification.
- Purpose of the soil boring (e.g., extraction well).
- Location in relation to an easily identifiable landmark.
- Names of the drilling subcontractor and logger.
- Start and finish dates and times.
- Drilling method.
- If applicable, types of drilling fluids and depths at which they were used.
- Diameters of surface casing, casing type, and methods of installation.

- Depth at which saturated conditions were first encountered.
- Lithologic descriptions (based on the Unified Soil Classification System).
- Other geologic information including clast rounding and lithology.
- Sampling-interval depths.
- Zones of caving or heaving.
- Depth at which drilling fluid was lost and the volume lost.
- Changes in drilling fluid properties.
- Drilling rate.
- Drilling rig reactions, such as chatter, rod drops, and bouncing.

The initial pilot borings will be cored from 40 feet bgs to bedrock, approximately 160 feet target depth for the TW-3D drill site. The boring at location PE-3 will be cored to bedrock or the maximum coring depth using the sonic drilling equipment (whichever occurs first). The field log from this coring will be used to select the final screen interval in consultation with DTSC.

3.3 Extraction Well Construction

The extraction well will be installed and constructed to an approximate depth of 150 feet bgs, the estimated lowest depth of permeable deposits in the alluvial aquifer. It is anticipated that the extraction well will be selectively screened in the deep portion of the aquifer with approximately 40 to 60 feet of screen. The final depth and quantities of material will be determined by the onsite CH2M HILL representative following drilling of a pilot hole. A schematic drawing of a typical extraction well and construction details is presented on Figure 3.

3.3.1 Casing Requirements

The extraction well will be completed with 6-inch-diameter, louvered, stainless-steel screen coupled to 8-inch-diameter Schedule 80 PVC blank casing using a casing adaptor (Figure 3). Casing requirements are as follows:

- All casing will be new, unused, and decontaminated.
- Glue will not be used to join casing, and casings will be joined only with compatible threads that will not interfere with the planned use of the well.
- All PVC will conform to ASTM Standard F 480-88A or the National Sanitation Foundation Standard 14 (Plastic Pipe System).
- The casing will be straight and plumb.

3.3.2 Well Screen Requirements

Well screen requirements are as follows:

- All requirements that apply to casing will also apply to well screen, except for strength requirements.

- Screens will be 6-diameter type 304 stainless-steel, louvered screen, with 0.060-inch slot size.
- The bottom of the screen will be capped with a blank casing sump (sediment trap).

3.3.3 Annular Space Requirements

The annular space will be filled with a filter pack, a transition sand, a bentonite seal, or casing grout between the well casing and the borehole wall. Centralizers will be used as appropriate to assure a straight and true well installation.

3.3.4 Filter Pack Requirements

The filter pack will consist of Lonestar 6-12 sand (or equivalent) and will extend from the bottom of the hole to approximately 5 to 7 feet above the top of the well screen. The top of the sand pack will be sounded to verify its depth during placement. A tight-fitting swab will be used to surge the well during placement of the filter pack. Additional filter pack will be placed as required during swabbing to return the level of the pack to 5 to 7 feet above the screen. A minimum 2-foot-thick layer of fine sand will be placed above the No. 3 sand filter pack to minimize the potential for the bentonite slurry (seal) material to invade the filter pack adjacent to the top of the well screen during well construction.

The contractor will record the volume of the filter pack placed in the well. With the approval of the field geologist, potable water may be used to place the filter pack, as long as no contaminants are introduced to the subsurface.

3.3.5 Bentonite Seal Requirements

The bentonite seal requirements are as follows:

- The bentonite seal will consist of at least 2 feet of bentonite between the filter pack and the casing grout.
- Only 100 percent sodium bentonite will be used.
- Bentonite chips or pellets will be hydrated with potable water if the transition seal is not below the water table; otherwise, bentonite slurry (1 gallon water for 2 pounds bentonite) will be used.

3.3.6 Casing Grout Requirements

The casing grout requirements are as follows:

- The casing grout will extend from the top of the bentonite seal to ground surface.
- The grout will be either a 30-percent solids bentonite grout or a cement mixture in the following proportions:
  - Ninety-four pounds of neat Type I or II Portland or American Petroleum Institute Class A cement
  - Not more than 4 pounds of 100 percent sodium bentonite powder

  - Not more than 6.5 gallons of potable water

- All grout will be pumped into place using a tremmie pipe.
- The expected volume of each ingredient in the grout mixture will be pre-calculated and documented.
- No accelerator compounds will be used in the grout mixture.

San Bernardino County will be notified at least 2 hours prior to grouting to provide them the opportunity to have a representative onsite during grouting.

3.3.7 Surface Completion Requirements

The supplemental extraction well(s) will be initially completed with a temporary aboveground surface completion (locking stove-pipe well monument). After well development and testing, the surface completions will be converted to a below-grade utility vault similar to those installed at extraction wells TW-2D and TW-2S. The vaults will be constructed with provisions for connecting to the existing underground conveyance piping to the IM No. 3 treatment system. The piping plan will be completed and submitted subsequent to this well installation work plan.

3.3.8 Well Development

Following well construction and annular seal placement, the extraction well(s) will be developed using a combination of surge block, bailer, and pumping. Development will not begin until at least 48 hours after placement of the grout. During development, temperature, pH, specific conductance, and turbidity will be measured using field instruments. Well development will continue until field parameters stabilize and turbidity is reduced to less than 50 nephelometric turbidity units. The purge water produced during well development will be collected in phase-separator bins or storage tanks in the staging area. Disposal procedures for the IDW are discussed in Section 4.0.

3.3.9 Well Completion Diagrams

A completion diagram will be prepared for the extraction well. It will include the following information:

- Well identification
- Drilling method
- Installation date(s)
- Elevations of ground surface and the measuring point
- Total boring depth
- Lengths and descriptions of the screen and casing
- Lengths and descriptions of the filter pack, bentonite seal, casing grout, and any back filled material

- Static depth to water

3.4 Extraction Well Initial Sampling

Following well development, the new extraction well will be purged and sampled for initial water quality characterization. The sampling activity will follow the procedures, analytical methods, reporting limits, and quality control plan used for the Topock groundwater sampling and drilling investigation activities as described in the Topock program *Field Procedures Manual* (CH2M HILL 2005c).

Groundwater samples from the new extraction well(s) will be analyzed for Cr(VI), Cr(T), total dissolved solids, specific conductance, and cations/anions (chloride, sulfate, alkalinity, carbonate/bicarbonate, nitrate, and general minerals). Field water quality parameters (temperature, pH, specific conductance, oxidation-reduction potential, and turbidity) will also be measured.

3.5 Well Testing

Well capacity/pumping tests for the new extraction wells will be scheduled after the wells have been developed and piping and connection to the IM No. 3 conveyance system have been completed. However, initial estimates of the hydraulic properties and extent of influence of the extraction well will be obtained by pumping the well in stages during development and monitoring water levels with pressure transducers in nearby deep monitoring wells. The water pumped from well development testing will be introduced to the IM No. 3 treatment system or directly disposed of by trucking. Hydraulic testing will be conducted in accordance with methods and procedures in the *Field Procedures Manual* (CH2M HILL 2005c).

3.6 Well Connection and Piping

The well will be completed with a below-grade vault similar to the TW-2S and TW-2D well pair. Underground piping with double-walled construction will be installed to connect the new extraction well to the IM No. 3 system valve vault 1 on the MW-20 bench. The plans and specifications for the conveyance piping and well connection will be submitted separately from this well installation work plan.

4.0 Waste Management and Equipment Decontamination

4.1 Waste Management

Several types of waste materials will be generated during the drilling, development, and sampling of the supplemental extraction wells. IDW materials that will be generated include groundwater, drill cuttings, and incidental trash.

Water generated during drilling and development activity will be collected in bins or portable storage tanks temporarily located at the drilling site and transferred by forklift to storage tanks in a staging area for characterization, treatment, or disposal at a permitted waste disposal facility. A secondary containment will be set up at the drilling area for the portable storage tanks or bins.

Drill cuttings include the fragments of rock and soil that are removed to create the borehole. The cuttings will be contained in lined roll-off bins at the staging area during the drilling and sampling activities. After sampling and characterization, all cuttings bins will be removed from the staging area for ultimate disposal by PG&E. The cuttings will be screened for chromium. If the cuttings are characterized as a hazardous waste, they will be transported offsite for disposal at a permitted hazardous waste disposal facility. It is estimated that the soil IDW bins temporarily staged at the drill site will not remain in excess of 45 days.

Incidental trash will be collected at the end of each drilling shift and hauled off the drill site to an appropriate disposal facility.

4.2 Equipment Decontamination

The back of the drilling rig and all downhole drilling tools will be decontaminated prior to starting each new borehole. Decontamination will be accomplished by steam cleaning the core barrel, drill stem, drive casing, and back of the drilling rig. Steam cleaning will be conducted on a decontamination pad so that all rinseate can be contained and collected. Rinseate from the decontamination operation will be transferred to the cuttings bin or purge water tank that contains materials from the borehole last drilled by the rig. The decontamination rinseate will be managed along with the cuttings or purge water.

5.0 Permits, Approvals, and Implementation Plan

This section summarizes the permits, approvals and certifications for the drilling and installation of an additional extraction wells to support the IM at the Topock site. A decision for installation of an additional extraction well(s) will be made after review of this draft work plan and discussion with the DTSC. An implementation schedule will be provided after DTSC review comments on the draft work plan are received.

Table 2 provides a listing of permits and approvals applicable to the installation of an additional extraction well(s) on the BLM-managed land adjacent to the Colorado River at the Topock site. All applicable and necessary permits and approvals will be documented prior to moving drilling equipment to the drilling site.

TABLE 2
Permits, Approvals, and Certifications for Supplemental Extraction Well
Interim Measure No. 3 Groundwater Extraction System
PG&E Topock Compressor Station, Needles, California

Agency	Permits, Approvals and Certifications
BLM	BLM Action Memorandum dated March 3, 2004 authorized potential extraction wells including the PE-3 location and additional extraction wells on the MW-20 bench. Implementation of additional extraction wells and piping will require approval of a work plan by the BLM field office.
DTSC	California Environmental Quality Act Notice of Exemption dated February 10, 2004 (emergency project)
State Water Resources Control Board/ Colorado River Basin Regional Water Quality Control Board	Notice of Intent and Storm Water Pollution Prevention Plan for construction activities; coverage under statewide general permit
United States Fish and Wildlife Service	Informal Consultation
State Historic Preservation Office	to be determined – subject to BLM decision
San Bernardino County	Well Drilling Permit

6.0 References

CH2M HILL. 2004. *Field Activity Summary for Supplemental Interim Measures No. 2 Well Installation*. December 22.

_____. 2005a. *Final Extraction Well Installation Work Plan, PG&E Topock Compressor Station, Needles, California.* March 15.

_____. 2005b. *Groundwater Extraction Well PE-1 Installation Report, PG&E Topock Compressor Station, Needles, California.* April 26.

_____. 2005c. *Sampling, Analysis, and Field Procedures Manual, Revision 1, PG&E Topock Compressor Station, Needles, California. March* 11.

Department of Toxic Substances Control (DTSC). 2004. Letter Yvonne Meeks, PG&E, from Norman Shopay, DTSC. *March* 22.

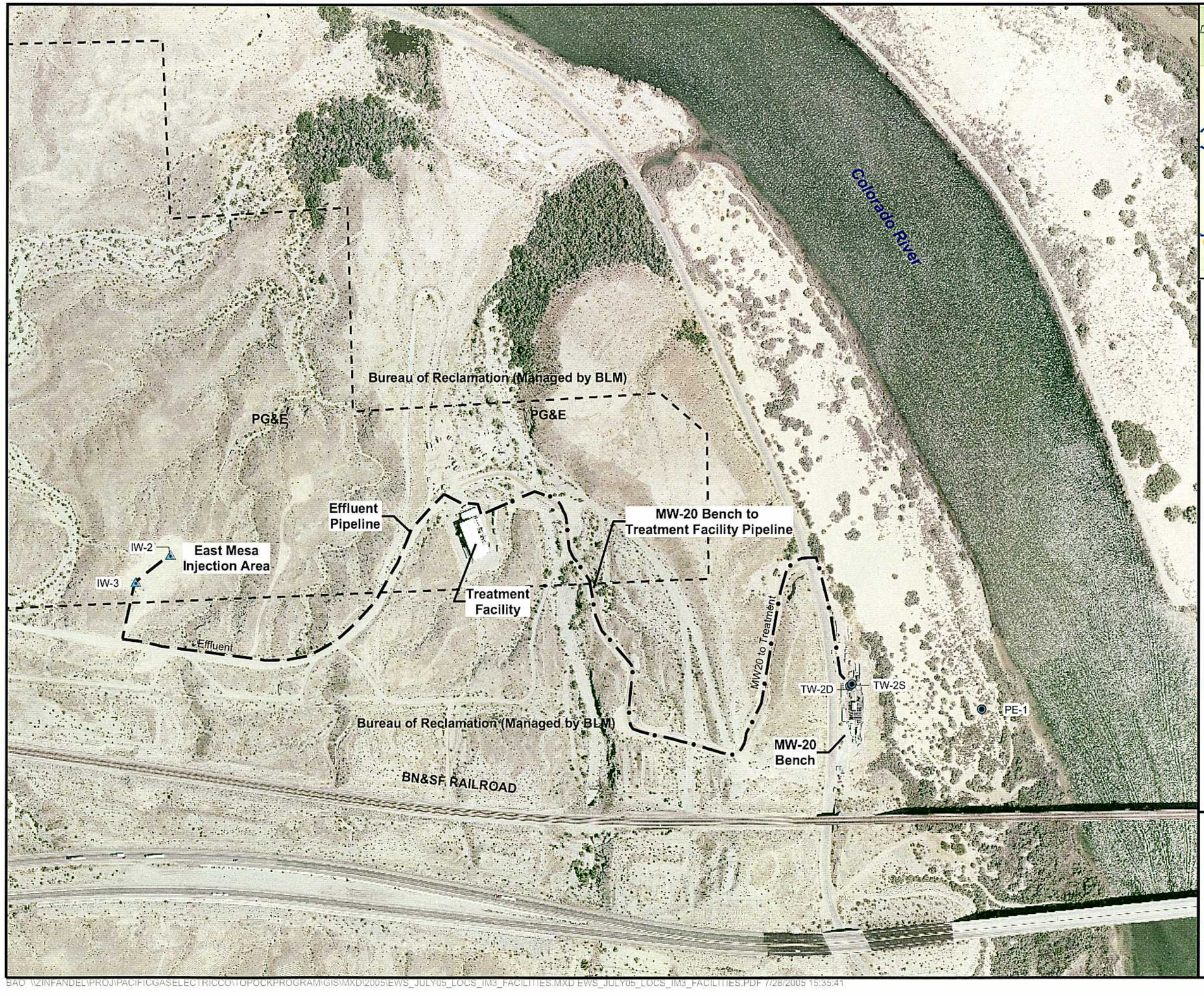
_____. 2005a. Letter to Yvonne Meeks/PG&E from Norman Shopay, DTSC. June 30.

_____. 2005b. Letter to Yvonne Meeks/PG&E from Norman Shopay, DTSC. February 14.

U.S. Bureau of Land Management (BLM). 2004a. *Time Critical Removal Action, Pacific Gas and Electric Topock Compressor Facility*. March 3.

_____.2004b. Letter to Yvonne Meeks/PG&E from Patricia Taylor, BLM. December 29.

Figures



N

0 350 700 Feet

1 inch equals 350 feet

LEGEND

- PG&E Property Line
- Existing IM Extraction Well
- Existing IM Injection Well

FIGURE 1
LOCATIONS OF IM-3 GROUNDWATER EXTRACTION, CONVEYANCE, AND TREATMENT FACILITIES, JULY 2005

INTERIM MEASURES NO. 3
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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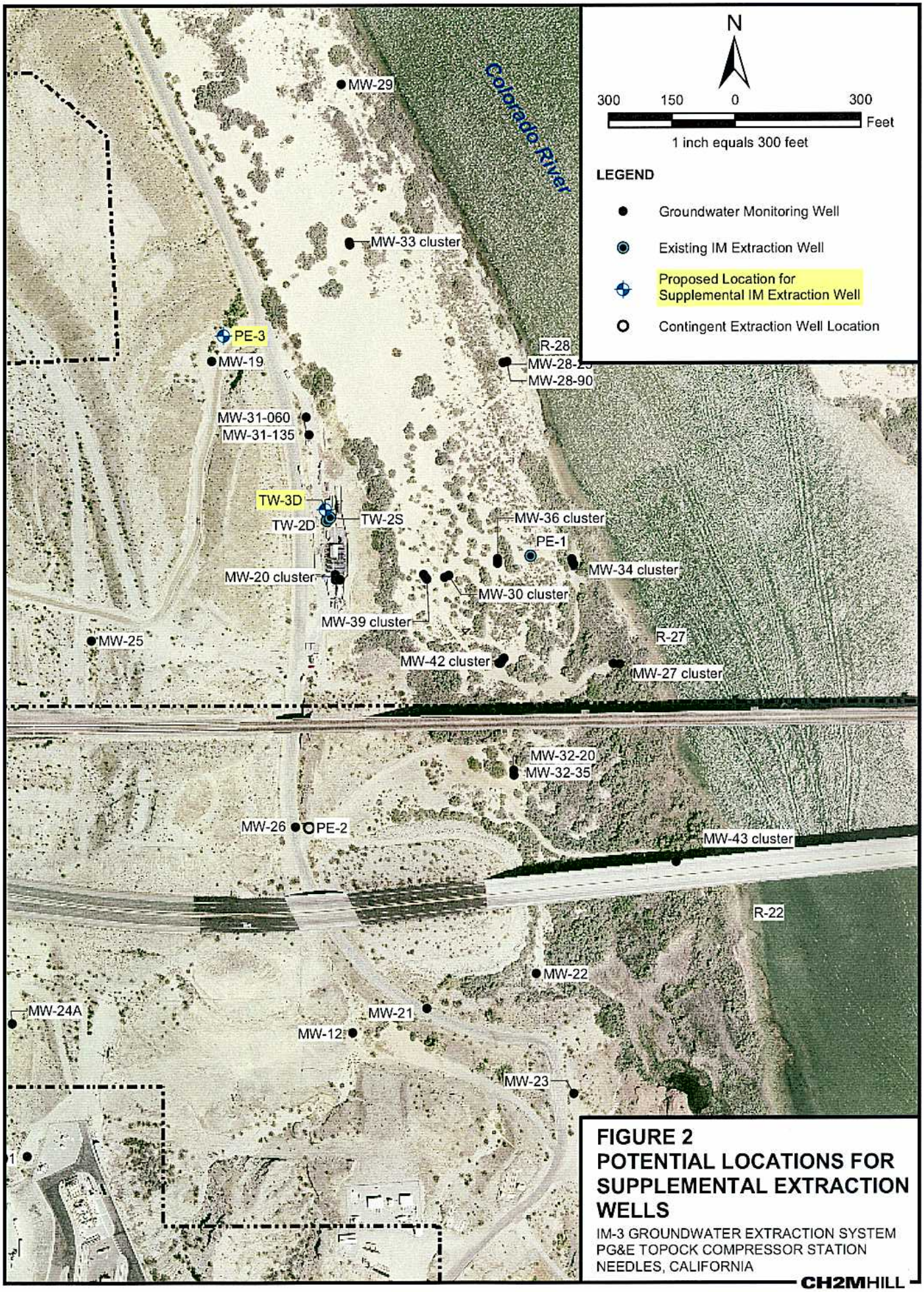

FIGURE 2
POTENTIAL LOCATIONS FOR SUPPLEMENTAL EXTRACTION WELLS
IM-3 GROUNDWATER EXTRACTION SYSTEM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

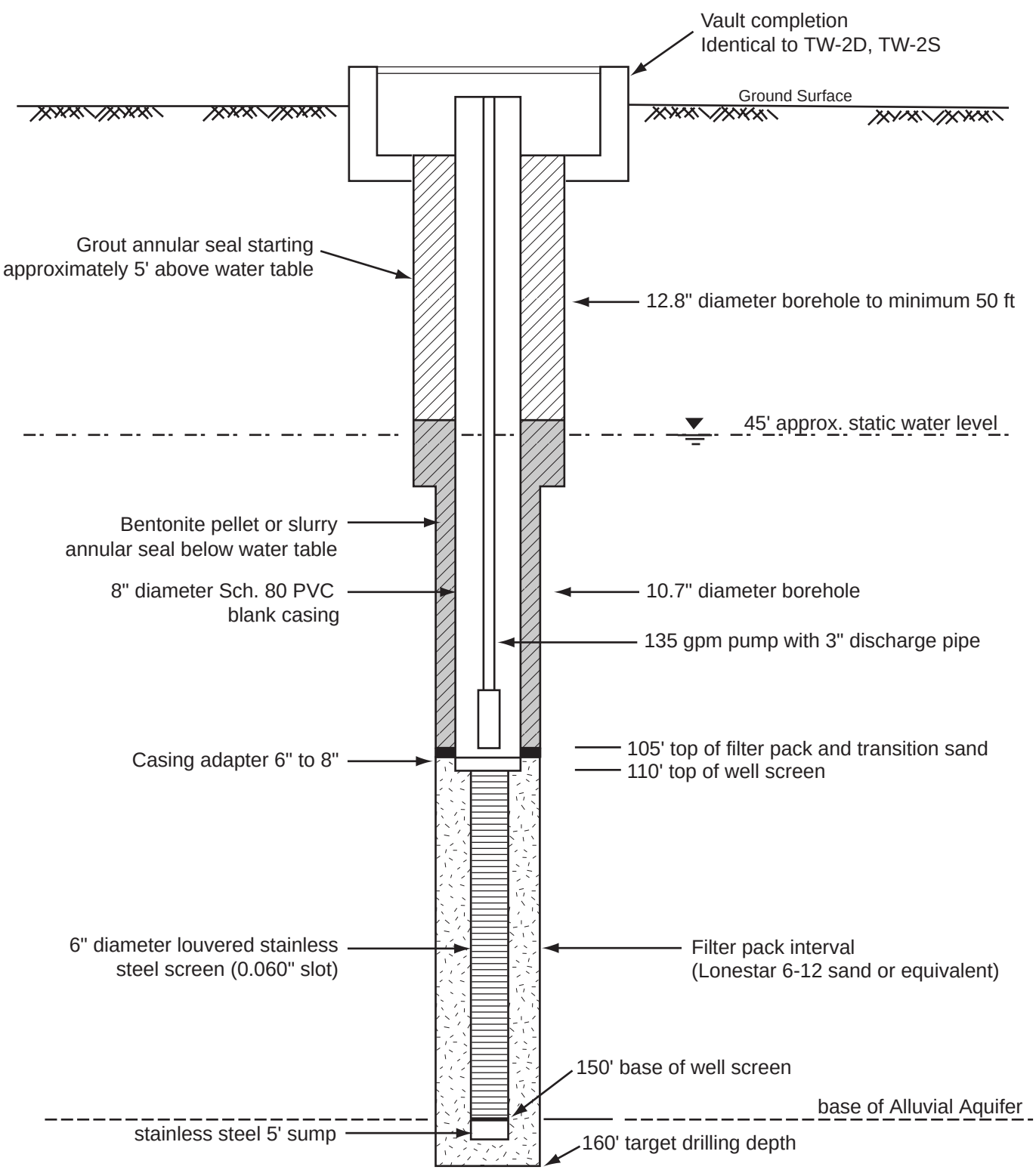

DIAGRAM NOT TO SCALE
All depths are approximate.

Actual depths for extraction wells will be determined based on field conditions in consultation with DTSC.

FIGURE 3
SCHEMATIC DIAGRAM OF SUPPLEMENTAL EXTRACTION WELL
IM NO.3 GROUNDWATER EXTRACTION SYSTEM
PG&E TOPOCK COMPRESSOR STATION

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