



Pacific Gas and
Electric Company®

Yvonne J. Meeks
Site Remediation - Portfolio Manager
Environmental Affairs

6588 Ontario Road
San Luis Obispo, CA 93405
Mailing Address
4325 South Higuera Street
San Luis Obispo, CA 93401

805.546.5243
Internal: 664.5243
Fax: 805.546.5232
E-Mail: YJM1@pge.com

November 14, 2005

Norman Shopay
Project Manager
California Department of Toxic Substances Control
Geology and Corrective Action Branch
700 Heinz Avenue
Berkeley, California 94710

Subject: Sampling and Analysis Plan for Evaluating Reducing Geochemical Conditions in
River Sediment, Pore Water and Seepage Study
PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

Enclosed is the *Sampling and Analysis Plan for Evaluating Reducing Geochemical Conditions in River Sediment, Pore Water and Seepage Study*, prepared in compliance with the Department of Toxic Substances Control's (DTSC) letter dated October 20, 2005. This technical memorandum defines an approach to sediment and pore water analysis in response to DTSC's October 20 comments on the September 30, 2005 version of the Pore Water and Seepage Study Work Plan.

Please contact me at (805) 546-5243 if you have any questions or if you need additional information.

Sincerely,

Enclosure

Sampling and Analysis Plan for Evaluating Reducing Geochemical Conditions in River Sediment, Pore Water and Seepage Study

Pacific Gas & Electric Topock Compressor Station, Needles, CA

November 14, 2005

Background

This technical memorandum refines the sampling and analysis plan for river sediment and pore water sampling on the Colorado River near Needles, California. Work approaches and details for other aspects of the study were covered in the *Revised Pore Water and Seepage Work Plan*, which was submitted to DTSC on October 31, 2005.

Figure 1 presents a map of the proposed sediment sampling locations. At DTSC's request, ten locations were selected to provide a broad aerial coverage of the study area. One location was selected in each of ten of the pore water sampling transects.

Sixteen pore water sampling transects, each with 4 sampling locations, are proposed in the revised work plan, for a total of 64 pore water sampling locations. Figure 2 is a map of the proposed pore water sampling transects.

Objectives

The primary objectives of this study, as outlined in the August 9 DTSC memorandum, are to:

1. Assess chromium concentrations in pore water at multiple locations within the zone that has been historically downgradient of the chromium plume observed in the floodplain, during the next seasonal low river stand.
2. Assess chromium concentrations in pore water at multiple locations that are historically upgradient of Bat Cave Wash, during the next seasonal low river stand.
3. Assess whether geochemical conditions in shallow sediments below the Colorado River favor chromium reduction.

The objective of river bottom sediment sampling is to assess the geochemical conditions under the Colorado River, primarily to determine whether aerobic or anaerobic conditions are present in the shallow river sediments.

Sediment Analyses and Rationale

The proposed sediment analyses include particle size distribution, hydrometer (clay and silt) analyses, total organic carbon, and acid volatile sulfides. Table 1 presents the analytical methods, preservation, holding times, required sample volumes, and rationale for the

sediment analyses. All analyses will likely be performed by Columbia Analytical Services Inc., a California-certified laboratory in Redding, CA.

Pore Water Analyses and Rationale

All 64 pore water samples will be analyzed for hexavalent chromium [Cr(VI)], total chromium [Cr(T)], specific conductance, and pH. Samples collected for Cr(VI) and Cr(T) analysis will be field filtered with a 0.45-micron inline filter and preserved. Sample analyses for Cr(VI), Cr(T), specific conductance and pH will likely be performed by Truesdail Laboratories, Inc., a California-certified analytical laboratory in Tustin, California.

Ten out of the 64 pore water samples will undergo a more comprehensive suite of analyses to further characterize the redox conditions under the river. These 10 samples will approximately coincide with the locations of the sediment samples. The additional analyses in the comprehensive suite include: dissolved organic carbon, dissolved ammonia-nitrogen, dissolved phosphorus, sulfide, dissolved iron, dissolved manganese, dissolved oxygen, cations, anions, and bicarbonate. These analyses will likely be performed by Emax Laboratories. Table 2 presents analytical methods, preservation, holding times, required sample volumes, and rationale for the pore water samples.

Schedule

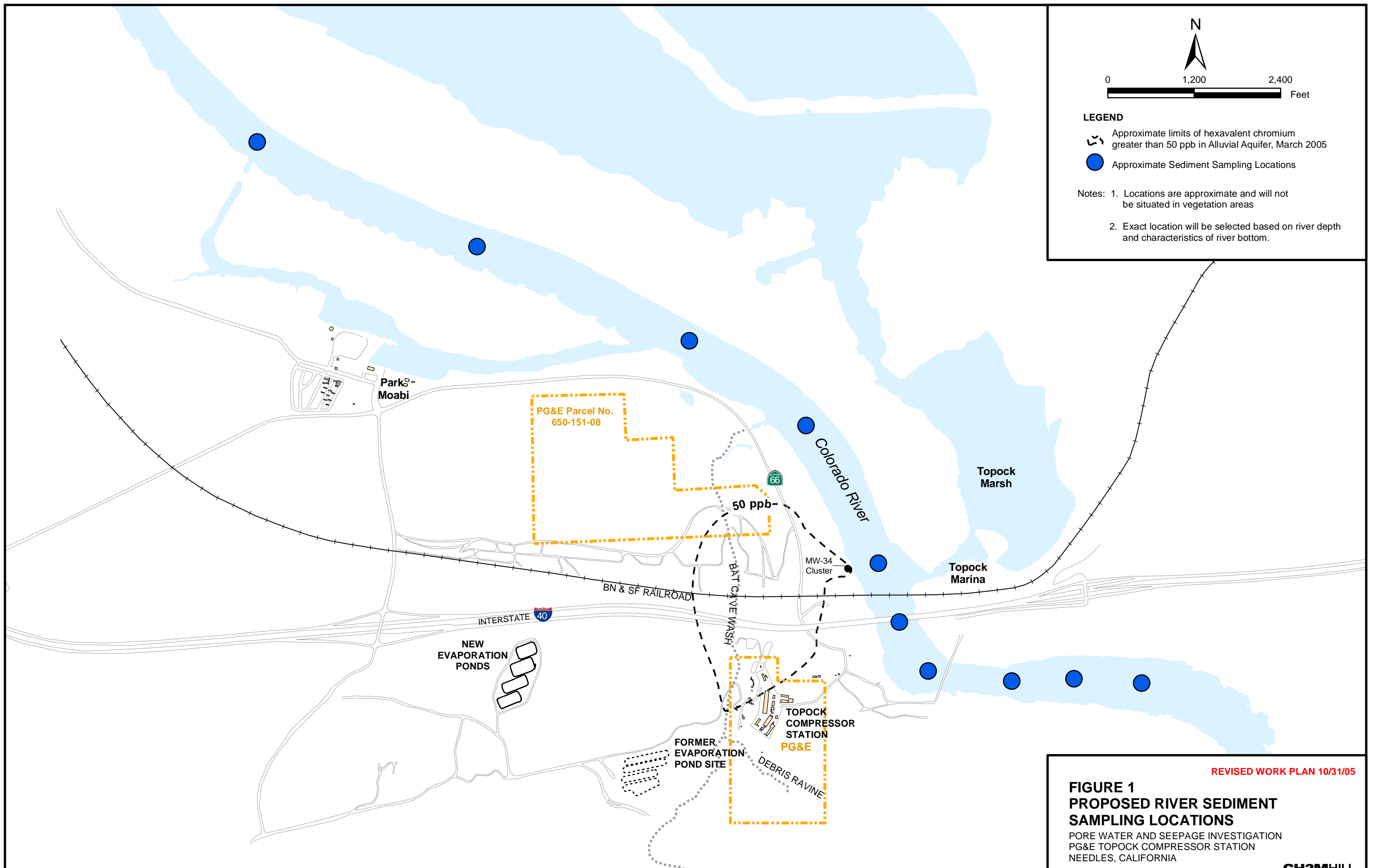
The river sediment sampling is an independent activity that will be performed either concurrently with the Phase 1 or pore water sampling mobilizations, or as a separate mobilization – whichever is most efficient. The timing for conducting the river sediment sampling does not need to be as tightly coordinated with seasonal or diurnal river stage conditions as does the pore water sampling. The geochemical conditions of the sediments are not as likely to change as quickly as the conditions of the pore water. The scheduling of the river sediment sampling will be determined after permits and approvals are obtained, and the implementation schedules for the Phase 1 and Pore Water Sampling have been confirmed.

Pore water sampling is planned as a one-time event which will follow analysis of the Phase 1 temperature data. The duration of the event will be determined based on the results of the pilot study. To minimize the effects of surface water recharge on pore water characteristics, pore water sampling should coincide with seasonally low river levels, which typically occur in the months of November to January.

Reporting

Preliminary results from the sediment sampling investigation will be submitted to DTSC approximately 30 days following the conclusion of data collection. As specified in the DTSC June 30 memorandum, pore water sampling results will be submitted in a tabular format within 7 days of data validation completion.

A PWSS report with interpretation of findings will be submitted to DTSC 45 days after validation of the pore water sampling data. The report will summarize the findings of the pilot study, the sediment sampling investigation, and the pore water sampling study. Results will be presented in tabular and graphical formats. Distribution and trends of pore water and sediment sampling results will be discussed.



LEGEND

Approximate limits of hexavalent chromium greater than 50 ppb in Alluvial Aquifer, March 2005

Approximate Sediment Sampling Locations

Notes: 1. Locations are approximate and will not be situated in vegetation areas

2. Exact location will be selected based on river depth and characteristics of river bottom.

REVISED WORK PLAN 10/31/05

**FIGURE 1
PROPOSED RIVER SEDIMENT
SAMPLING LOCATIONS**

PORE WATER AND SEEPAGE INVESTIGATION
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

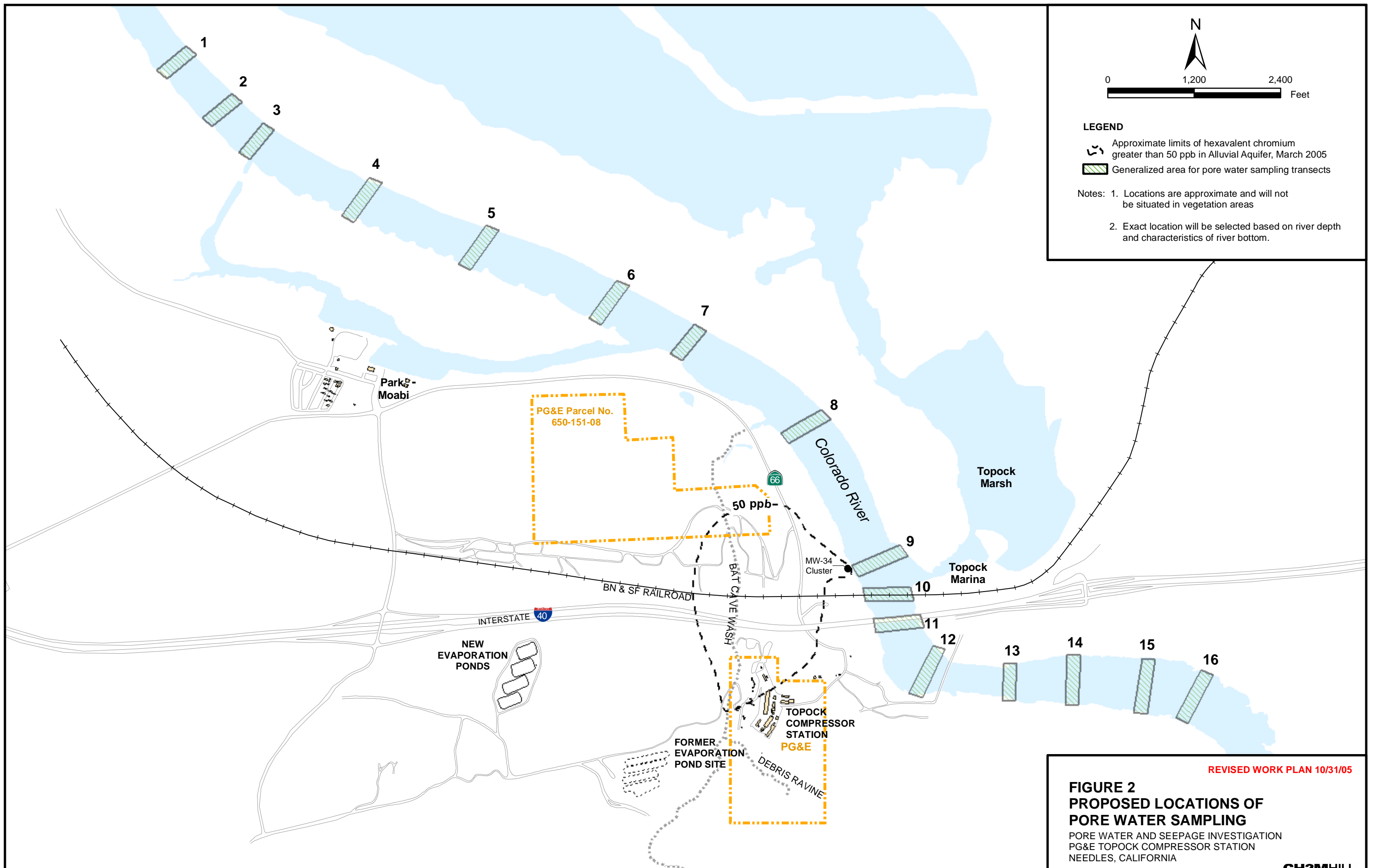


Table 1

Proposed Analyses for River Sediment Samples
Pore Water and Seepage Study
PG&E Topock Compressor Station, Needles, California

Parameter	Analytical Method	Preservation	Holding Times	Required Sample Volumes	Descriptions/Remarks	Rationale
Particle Size Distribution	ASTM E422	None	None	500 g	Defines grain size distribution of coarse sediments	Can infer whether surface area effects might be influencing "apparent" adsorption of constituents
Hydrometer Analyses	ASTM E422	None	None	see above	Defines clay and silt amounts (for samples with > 50% fines)	Can infer whether surface area effects might be influencing "apparent" adsorption of constituents
Total Organic Carbon	Walkley(1947)	4 ± 2°C	28 days	50g	Walkley-Black Method	Might provide carbon source for biochemical reduction of Cr(VI) unless biorefractory
Acid Volatile Sulfides	AVS	4 ± 2°C	14 days	50g	EPA 821/R-91-100	Indicates reducing (anaerobic) conditions

Notes:
Constituents in pore water can mask sediment-associated parameters - need to use caution in interpreting test results and/or employ special measures to account for pore water contribution of test parameters.

Table 2

Proposed Analyses for Pore Water Samples

Pore Water and Seepage Study

PG&E Topock Compressor Station, Needles, California

Parameter	Analytical Method	Preservation	Container	Holding Time	Required Sample Volumes	Descriptions/Remarks	Rationale
Hexavalent chromium	SW7199	Filtered, (NH ₄) ₂ SO ₄ /NH ₄ OH to pH > 9, 4 ± 2°C	250 mL polyethylene	24 Hours	250 mL		Constituent of Concern
Total Chromium	SW6010B	Filtered, HNO ₃ ¹ , 4 ± 2°C	250 mL polyethylene ³	180 Days	250 mL	All metals will be analyzed from one container	Constituent of Concern
pH	EPA 150.0	4 ± 2°C	1 Liter polyethylene ⁴	28 Days	100 mL		General water quality parameter
Specific Conductance	EPA120.0	4 ± 2°C	1 Liter polyethylene ⁴	28 Days	100 mL		A gradient with depth or over an area could indicate groundwater flow
Dissolved organic carbon	EPA 415.2	Add H ₂ SO ₄ to pH<2, 4 ± 2°C ²	500 mL amber Glass	28 Days	500 mL	Collect sample with no headspace (air)	Potentially metabolized by microorganisms, leading to reduction of Cr(VI)
Ammonia-nitrogen (dissolved)	EPA 350.2	Add H ₂ SO ₄ to pH<2, 4 ± 2°C	1 Liter polyethylene	28 Days	1 L		Suggests anaerobic biodegradation of microorganisms
Phosphorus (Total)	EPA 365.2	Add H ₂ SO ₄ to pH<2, 4 ± 2°C	250 mL polyethylene	28 Days	150 mL		Suggests anaerobic biodegradation of microorganisms
Sulfide	EPA 376.2	Add zinc acetate and NaOH to pH>9; 4 ± 2°C	500 mL polyethylene	7 Days	500 mL		Presence indicates (bio)chemically reducing conditions
Iron (dissolved)	SW6010B	Filtered, HNO ₃ ¹ , 4 ± 2°C	250 mL polyethylene ³	180 Days	250 mL		Dissolved iron indicates reducing conditions
Manganese (dissolved)	SW6010B	Filtered, HNO ₃ ¹ , 4 ± 2°C	250 mL polyethylene ³	180 Days	250 mL		Dissolved indicates reducing conditions
Dissolved oxygen	Field water quality meters						Indicates whether oxidizing or anoxic conditions are present in sediments (not necessarily definitive)
Cations: Ca, Mg, K, Na	SW6010B	Filtered, HNO ₃ ¹ , 4 ± 2°C	250 mL polyethylene ³	180 Days	250 mL		Dissolved ionic constituents might indicate similarity of pore water with either River water or groundwater
Anions: Cl, SO ₄ , F, NO ₃	EPA 300.0	4 ± 2°C	250 mL polyethylene ⁴	48 Hours	250 mL		Dissolved ionic constituents might indicate similarity of pore water with either River water or groundwater
HCO ₃	EPA 310.1	4 ± 2°C	250 mL polyethylene ⁴	14 Days	500 mL		Dissolved ionic constituents might indicate similarity of pore water with either River water or groundwater

Notes:

Most of these parameters are indicative, not definitive - need to weigh preponderance of evidence to infer actual sediment conditions.

¹ Field filter and preserve² Lab or field filtration³ 250 mL polyethylene: all 6010B analytes listed can be analyzed from one container unless using different labs⁴ 1 L polyethylene: all analytes listed can be analyzed from one container unless using different labs