California Water Research

October 20, 2020 **Via email**

Zachary Simmons, Project Manager
US Army Corps of Engineers, Sacramento District
1325 J Street, Room 1350
Sacramento, CA 95814-2911
Zachary.M.Simmons@usace.army.mil

**RE: Public Notice regarding SPK-2019-00899, Application, Delta Conveyance**

Dear Mr. Simmons,

Please accept the following comments, submitted on behalf of California Water

Research. The following topics are covered:

I. Effects on Navigable Capacity of the Sacramento River and Delta
II. Army Corps Authorization of the Project
III. Cumulative Effects with the Sacramento Deep Water Ship Channel
IV. Potential Adverse Impacts
V. Tunnel Construction Impacts on Flood Risk in the Delta
VI. Long Term Risks
VII. Toxics

Sincerely,

Deirdre Des Jardins
Director, California Water Research
145 Beel Dr
Santa Cruz, CA 95060
(831) 566-6320
ddj@cah2oresearch.com

## I. Effects on Navigable Capacity of the Sacramento River and Delta

The Notice of Preparation states,

> The scope of the USACE NEPA review for operations of the new facilities is limited to potential effects to navigation and long-term operations and maintenance of the modifications to federal levees. The scope does not extend to the potential downstream effects from the diversion of water through new intakes or to the overall SWP and water deliveries.

The associated PowerPoint further states, "*Future operations of the diversions are outside of the Corps' control and responsibility." This is contrary to the court's decision on the scope of Rivers and Harbors Act Section 10 in *Sierra Club v. Morton* 400 F.Supp. 610 (N.D. Cal. 1975.) The EIS should include an analysis of effects of operations of the diversions on water levels, and also on the potential to cause flow reversals.

In *Sierra Club v. Morton, supra*, the court considered that the operation of the CVP Tracy pumping plant "has two major effects on water in the Delta: (1) It tends to lower the water levels in the Delta, and (2) It causes net flow reversals." *Id* at 630. The court also noted that the SWP Delta pumping plant "tended to lower water levels in the Delta region and to cause net flow reversals." *Id* at 631. The court noted that "[i]t is not only the physical structure of the [SWP] Delta Plant, the Tracy Plant, or the Peripheral Canal which is significant but also the operation of these structures. If the functional effect of these structures is to obstruct navigable capacity in the Delta, then Section 10 approval will be required. *Id* at 628-29.

The court concluded that an obstruction to navigable capacity of the Sacramento River, and hence was governed by the third clause of Rivers and Harbors Act Section 10:

> Accordingly, the Court concludes that the operation of the Tracy and Delta Plants presently obstructs the navigable capacity of various navigable waters in the Delta. The Court further concludes that as presently proposed, the Peripheral Canal will also result in an obstruction to navigable capacity of the Sacramento River. More specifically, the Court finds that, in the case of each of the three facilities, the obstruction is the result of the modification or alteration of the condition or capacity of the channel of navigable water of the United States and hence is governed by the third clause of Section 10 (*Sierra Club v. Morton* at 632.)

Effects of lowered water levels and reverse flows were noted in simulations of operations of the three intake WaterFix project. Furthermore, the WaterFix operational simulations assumed bypass flows to protect Delta smelt, Longfin smelt, and Winter run and Spring run Chinook salmon. Given current population trends for these endangered fish, the Army Corps must not assume that bypass requirements to protect these fish will be operational for the lifetime of the project. The EIS should consider alternatives for bypass flows adequate to protect navigation on the Sacramento River at and below the intakes and in the channels of the Delta.

## II. Army Corps Authorization of the Project

*Sierra Club v. Morton*, supra, also notes that the third clause of Section 10 of the Rivers and Harbors Act "makes it unlawful to alter or modify in any manner the condition or capacity of the channel of any navigable water unless such alterations or modifications are recommended by the Chief of Engineers and authorized by the Secretary of the Army prior to beginning the same.*" Id* at 628.

Because the USACE approval of the project under Rivers and Harbors Act Section 10 will constitute federal authorization by the Chief of Engineers for the project's alterations to the Sacramento River and Delta channels, the EIS must adequately analyze the project design, both in terms of construction impacts, and in terms of potential long term effects.

## III. Cumulative Effects with the Sacramento Deep Water Ship Channel

The US Army Corps of Engineers 1949 Report on the Sacramento Deep Water Ship Channel noted that the project would increase the tidal prism by 7%, creating an increase in tidal flow in and out of the area.[1] The EIS should analyze the cumulative effect of reduced flows from the proposed action and the increased tidal prism of the Deep Water Ship Channel on salinity intrusion.

> 35. Salinity conditions. – Construction of the deep water channel will increase the tidal prism in the Sacramento-San Joaquin Delta by approximately 7 percent with a resultant theoretical increase in tidal flow into and out of the area in the order of approximately 2,000 acre-feet together with a tendency to decrease the amplitudes of tidal fluctuations throughout the area. The net effect, unless compensated for by increased fresh water flow into the delta, or by other means, will tend to increase saline conditions throughout the delta area. Present Central Valley Project objectives require that the saline content not exceed 100 parts per 100,000 at Antioch in order for the water to be satisfactory for irrigation purposes. Present operation requirements for Shasta Dam, provide for 3,300 c.f.s. in the Sacramento River at Collinsville for prevention of damaging saline water intrusion.
>
> 36. Practical consideration of the salinity problems indicates that after the ship channel is constructed, without any compensating works, the damaging saline content line would move upstream only a few miles, over reaches where there are no large scale irrigation diversions. Also it is possible that future releases from such reservoirs as the Folsom Dam Project, which is presently under construction, will provide sufficient incidental flow into the delta to prevent damaging upstream shifting of the saline intrusion line. However, if after the completion of the Sacramento

[1] U.S. Army Corps of Engineers, Sacramento District, Sacramento River Deep Water Ship Channel Project, Definite Project Report, July 1949, p. 11-12.

Deep Water Ship Channel, it develops that the project has created detrimental saline conditions in the delta area, then it is proposed to reclaim one or more of the presently unreclaimed delta tracts with a minimum area of 1,800 acres in order to reduce the tidal prism volume by 7,000 acre-feet, thus restoring it to preproject conditions

## IV. Potential Adverse Impacts

### A. Floodplain modification

The proposed project will be constructed almost entirely in floodplains in the Sacramento-San Joaquin Delta, which have been reclaimed with levees. CFR 33 Section 320.4(k)(2), the U.S. Army Corps of Engineer's regulations on Floodplain management, states:

> In accordance with the requirements of Executive Order 11988, district engineers, as part of their public interest review, should avoid to the extent practicable, long and short term significant adverse impacts associated with the occupancy and modification of floodplains, as well as the direct and indirect support of floodplain development whenever there is a practicable alternative. For those activities which in the public interest must occur in or impact upon floodplains, the district engineer shall ensure, to the maximum extent practicable, that the impacts of potential flooding on human health, safety, and welfare are minimized, the risks of flood losses are minimized, and, whenever practicable the natural and beneficial values served by floodplains are restored and preserved.

CFR 33 Section 320.4(k)(2) states:

> In accordance with Executive Order 11988, the district engineer should avoid authorizing floodplain developments whenever practicable alternatives exist outside the floodplain. If there are no such practicable alternatives, the district engineer shall consider, as a means of mitigation, alternatives within the floodplain which will lessen any significant adverse impact to the floodplain.

### B. Alternatives

To minimize the impacts of potential flooding on human health, safety, and welfare, the EIS should consider alternative locations for the Delta tunnel intakes that are further away from Delta legacy towns than intakes #3 and #5, and on better levees. The proposed locations for the Delta Conveyance intakes are on the sandiest and crumbliest levees in the North Delta. Gil Cosio, the engineer for many North Delta Reclamation Districts, has expressed concerns about the intakes for the Delta tunnel being on the "weakest levy in the entire North Delta." At the July 22, 2020 Stakeholder Engagement Committee, Cosio stated that "the Delta Stewardship Council estimated that with combined seismic and flood probability failure it's about a 14-year protection." Cosio also related that "We're currently working on a Maintenance Area 9 levee trying to help a farmer replace that irrigation pipe and we went to … fill up the excavation we couldn't get compaction because the levee is still dry. It's so sandy that we did not get compaction."

The County of Sacramento also expressed concerns in CEQA scoping comments[2] that "The proposed intake locations threaten significant impacts to cultural and historic resources, community health and welfare, the SRWTP, FRWP, Town of Hood wells, and surface and groundwater supplies." (p. 5.)

For alternative locations, Sacramento County suggested consideration of intake locations further downstream below Steamboat Slough:

> Information in the WaterFix EIR Appendix 3F, Intake Location Analyses (pp. 3.F.6 - 3.F.8), relying on the Fish Facilities Technical Team report, indicates that there are suitable intake locations farther downstream below Steamboat Slough (identified as intakes 6 and 7). Moving intakes farther south on the Sacramento River would reduce the potential for conflicts with and significant impacts to SRWTP operations, and thus the FRWP operations, as well as Town of Hood wells, and have the benefit of being better for salmon.
>
> Moving the intakes to avoid impacts to the FRWP and SRWTP also would avoid significant impacts to tribal cultural resources identified by Miwok Tribal government representatives at the February 26, 2020 Delta Stakeholder Engagement Committee meeting, where DWR staff was informed that all three intakes are highly sensitive to the Miwok and include several village sites and more than 5 burial grounds.

(Sacramento County CEQA scoping comments p. 5-6.)

Angelica Whaley, the North Delta Business Representative to the Stakeholder Engagement Committee, also requested that the Delta Conveyance Design and Construction Authority evaluate intakes downstream of Steamboat Slough, as well as evaluating smaller intakes, which would have more flexibility about location and fewer local impacts.[3]

In CEQA scoping comments, the County of Sacramento also requested evaluation of the Far Eastern main tunnel route suggested by the first Independent Technical Review Panel:

The ITRP identified significant problems with feasibility, including road and transportation impacts, from both of the tunnel corridor options described in the NOP. The panel thus recommended an alternative tunnel alignment, much closer to Interstate 5, indicating this alignment is potentially feasible. (See Exhibit A, p. 8.) This alternative should be fully evaluated in the EIR (Sacramento County CEQA scoping comments p. 5-6.)

The Far Eastern alignment would also have less impact on floodplains, and less flood risk during construction and operation.

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[2] County of Sacramento, Comments on Notice of Preparation for Environmental Impact Report – Delta Conveyance Project, April 17, 2020

[3] Angelica Whaley, Letter to Kathryn Mallon, September 23, 2020. Angelica Whaley, Letter to Kathryn Mallon, September 23, 2020.

The EIS must include a range of reasonable alternatives to the proposed action and identify the Least Environmentally Damaging Practicable Alternative (42 USC Sec 4332(2)(D). The EIS should consider alternatives with 1,500 cfs intakes, intakes downstream of Steamboat Slough, and the Far Eastern Corridor proposed by the ITRP.

## V. Tunnel Construction Impacts on Flood Risk in the Delta

A. Channel crossings

The economic costs of a levee failure due to tunneling damage are potentially very high. The 2004 failure of the Upper Jones Tract, an island of 6,259 acres, cost approximately $120 million to restore. This did not include damage to buildings and crops.


*1 Scour Hole from Jones Tract Levee Failure Source: East Bay MUD*

A levee breach on the northern part of Woodward Island has been estimated by URS corporation to cause a 50 deep scour hole, 1700 feet long, and 600 feet wide.[4] Such a scour hole could take out part of the Mokelumne Aqueduct, which would affect the water supply for 1.3 million people. It could also damage the Kinder-Morgan fuel pipeline, potentially causing a major leak. A levee breach on the northern part of Bouldin Island could impact the support structures for State Route 12.

B. Risks of tunnel boring

Chapter 9 of the WaterFix Final EIR/EIS, on Geology and Seismicity, discussed risks of tunnel boring:

[4] URS Corporation, In-Delta Storage Program Risk Analysis, 2001.

Impact GEO-3: Loss of Property, Personal Injury, or Death from Ground Settlement during Construction of Water Conveyance Features

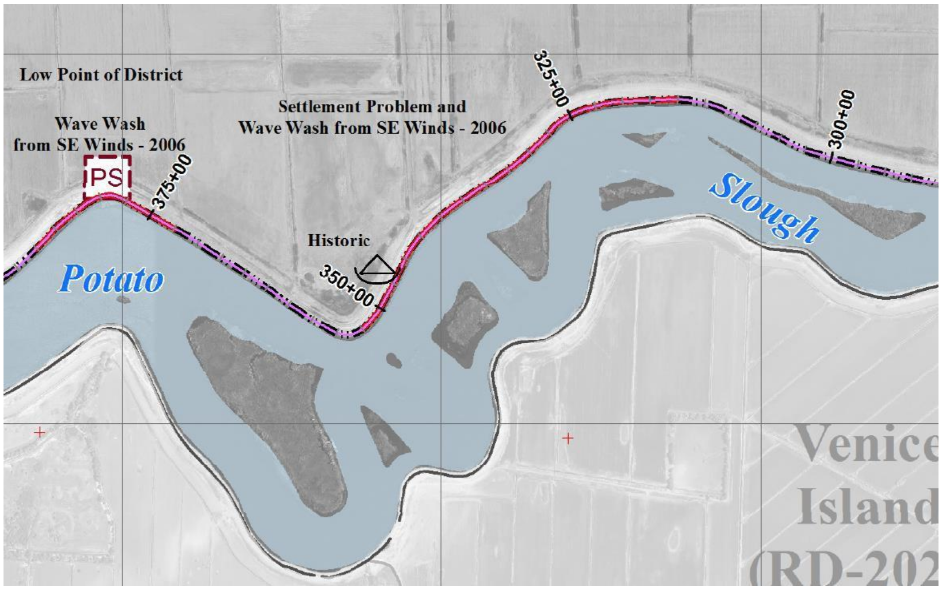
> Two types of ground settlement could be induced during tunneling operations: large settlement and systematic settlement. Large settlement occurs primarily as a result of over-excavation by the tunneling shield. The over-excavation is caused by failure of the tunnel boring machine to control unexpected or adverse ground conditions (for example, running, raveling, squeezing, and flowing ground) or operator error. Large settlement can lead to the creation of voids and/or sinkholes above the tunnel. In extreme circumstances, this settlement can affect the ground surface, potentially causing loss of property or personal injury above the tunneling operation.
>
> Systematic settlement usually results from ground movements that occur before tunnel supports can exit the shield and the tunnel to make full contact with the ground. Soil with higher silt and clay content tend to experience less settlement than sandy soil. (p. 9-195)

Boring logs show that there are adverse ground conditions in the Delta at the level of the tunnels, including wet, plastic clay soils that could be subject to squeezing, and wet silt that could be subject to running during tunnel boring. The ground is also very inhomogeneous so soil conditions could change unexpectedly.

While the effect of the maximum settlement on the freeboard of levees in the Delta is not large, the horizontal and vertical stresses on the levees from the tunneling movements could cause cracks, especially in levee areas that are prone to slope instability. Cracks in a levee could result in seepage and failure if they happened during times of high flows in the Delta, or if they happened during times of low flow and were not identified and repaired.

C. Evaluating Fragile Levee Sections Prior to Tunnel Boring

The Delta Risk Management Strategy estimated fragility classes of Delta levee segments. This information should be considered in the EIS, as well as any evaluations of historic issues with the levee sections from the local Reclamation Districts. An example below is shown from the San Joaquin County hazard mitigation map for Reclamation District on Bouldin Island. The pink colored sections of the levee have had historic problems. The section of levee next to Little Potato Slough has had problems with settlement and wave wash. To avoid flooding Bouldin Island, it may be necessary to reinforce vulnerable levee sections before tunnel boring.




D. Ground loss calculations

Tunneling boring machines excavate a larger amount of soil than is replaced by the volume of the tunnel lining, which typically causes a wide, shallow settlement trough on the surface. The over-excavation is measured by the volume of ground loss, which is defined as the percent difference between the volume of excavated soil and the volume of the tunnel lining. The volume of the settlement trough on the surface can be as large as the volume of ground loss. If groundwater is drained for tunnel construction, soil layers above the tunnel could settle even further.

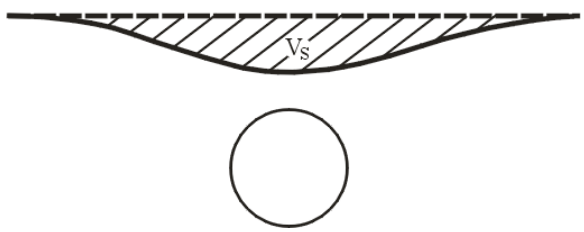



*Figure 2 Tunnel settlement trough*

East Bay Municipal Utilities District is proposing to construct a 21-foot diameter tunnel in the Delta to replace the Mokelumne Aqueduct. The Conceptual Design report[5] included a section on Ground Loss and Settlement, which states that ground loss could be up to 4% of the face.

Similar calculations of ground loss and settlement should be included in the EIS. Without such analysis, there can be no assessment of needed monitoring and mitigation, and the discussion in the EIS of channel crossings will be incomplete.

[5] East Bay MUD, *Technical Memorandum Number 2, Delta Tunnel Study Conceptual Design*.

E. Ground Loss Criteria

The Waterfix Final EIR/EIS referred to *Settlements Induced by Tunneling in Soft Ground,* by the International Tunneling and Underground Space Association, 2007. The monograph showed the ground volume loss in the tunneling for three London segments of the London Channel Tunnel Rail Link. The mean ground loss was around .5% for many segments, but the maximum was over 2.5% in the initial trials. In the Stratford to St Pancras link, once the tunnel ground volume loss exceeded 1, the boring was stopped, and the tunnel boring machine was reconfigured for clay soils.

The London Channel Tunnel Rail Link construction was tightly monitored and had provisions to stop tunneling when ground loss exceeded 1%. The 1% ground volume loss would be an appropriate criterion for maximum allowed ground loss for tunnel boring. The EIS needs to consider appropriate ground loss criteria for tunneling under Delta levees and Delta channels.

The EIS should consider seasonal limitations on tunneling under levees as a mitigation measure, particularly when storms could cause high flows. The levee fragility classes from the Delta Risk Management Strategy should be used in an assessment of potential effects of tunneling on the levees, as well as in an assessment of potential effects of vibration from intake construction on the levees.

F. Construction Safety Plan

The EIS should consider a safety plan to address risks to people on Delta islands in the event of a levee breach during tunnel construction.

G. Standard of Care for Tunnel Construction

For the public interest evaluation, the Army Corps needs to consider whether there is appropriate allocation for responsibility for risk management for the tunnel construction. The Standard of Care for construction of underground tunnels is defined in the International Tunneling Association's "Code of Practice for Risk Management of Tunnel Works" and the Underground Construction Association's *Guidelines for Improved Risk Management on Tunnel and Underground Construction Projects in the United States of America*[6]. The Guidelines state in part:

> The process of risk management—including risk assessment, characterization, and response, as well as elimination, mitigation, avoidance, transference, or acceptance—is required to identify and clarify ownership of risks and should detail clearly and concisely how the risks are to be allocated, controlled, mitigated, and managed.

The Delta Conveyance Design and Construction Joint Powers Agreement[7] fails this

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[6] Underground Construction Association's *Guidelines for Improved Risk Management on Tunnel and Underground Construction Projects in the United States of America*

[7] Joint Powers Agreement Forming the Delta Conveyance Design and Construction

basic standard of care, in that it does not identify how the risks of tunnel construction are to be allocated, controlled, mitigated, or managed. Instead, it simply states that the member agencies are not liable for the activities of the Delta Conveyance Design and Construction Authority.
Article XIII, Liability, section 13.1 states

> No Member Liability. The debt, liabilities and obligations of the Construction Authority shall be the debts, liabilities and obligations of the Authority alone, and not the individual Members.

## VI. Long Term Risks

The construction of a forty-foot diameter tunnel in soft soils consisting of sedimentary layers of sand and peat is a significant engineering challenge. Given the large diameter of the tunnel, the amount of water it will be carrying, and the sedimentary deposits surrounding the tunnels, significant preliminary engineering is required to document that the proposed conceptual design will have sufficient structural integrity to protect the main Delta tunnel, the water supply, and structures and people on the surface.

Assessments, monitoring, and mitigation under NEPA cannot be adequately addressed until adequate preliminary analyses of the probability of tunnel leakage and of seismic-induced tunnel lining and ground failures, are completed as summarized below.

A. Long Term Settlement and Leakage

The proposed Delta tunnel lining has a circumferential joint every five feet. Settlement could cause the tunnel lining segments to move relative to one another, opening up gaps at the circumferential joints over time. This has caused a shortened expected lifetime for tunnels in deep sedimentary soils in Shanghai.[8] Leaks also progressively increase the forces pulling the tunnel segments apart.[9] East Bay MUD commented on the Waterfix tunnel design in 2015, stating:

> Long-term degradation of segmental concrete lining may result in failure of the lining. In the event that the tunnel lining fails and results in a tunnel collapse or blowout, a collapse during operations would result in major ground movement extending to the ground surface and potentially sinkholes or blowout.

This potential leakage is of particular concern where the tunnels pass under important structures, including Delta island levees and channels, the Mokelumne aqueduct, and natural gas and other product and services pipelines.

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Authority Document, Effective May 14, 2018.

[8] Xu, Yeshuang & Ma, L & Shen, Shui-Long, 2011, Influential factors on development of land subsidence with process of urbanization in Shanghai. Yantu Lixue / Rock and Soil Mechanics. 32. 578-582. Link to Xu et al., 2011 publication.

[9] Yoo, Chungsik, 2016, Effect of water leakage in tunnel lining on structural performance of lining in subsea tunnels, Marine Georesources & Geotechnology Vol. 35, Iss. 3. Link to Yoo, 2016 publication.

The EIS should consider an inspection, monitoring, and remediation program and discuss contingencies, controls, and recovery following indication and evidence of leakage of the tunnel lining.

B. Seismic Safety

The EIS should consider seismic safety of the project, and in particular, whether adequate engineering analyses have been done to ensure that the tunnel lining and other critical project facilities will not have catastrophic failure in a Maximum Considered Earthquake.

The proposed tunnel lining has circumferential joints every five feet, so the seismic design criteria, and adequate strength for the circumferential joints, is a significant engineering concern. Since the tunnel may be bedded in silty clay or clayey silt, the opening of a joint could result in long term differential settlement.

The EIS should consider the performance of the tunnel lining and other critical project facilities in a Maximum Considered Earthquake, and associated risk to loss of life and critical infrastructure. Without such seismic analysis, the public interest analysis and the evaluation of potential seismic effects for the NEPA process is incomplete.

Particular attention should be paid to locations where the tunnel crosses under any occupied surface structures or critical infrastructure. State Route 12 and State Route 4 are in the main tunnel path for both the Central and Eastern Corridors, as are the Burlington Northern / Santa Fe railroad tracks used by the Amtrak train.

C. Differential movement of Tunnel and Shafts

Given the ground plasticity and potential liquefaction of the soft ground surrounding the tunnel, the issue of differential movement of the tunnel, intakes/outlets, and shafts is substantial. These must be carefully analyzed in the EIS and their impacts adequately addressed and mitigated.

Differential movements between the Delta Conveyance tunnel, intakes/outlets, and shafts also need a differential analysis and appropriate assessment of impacts and required mitigation. This is especially important because the shafts will be fixed vertically, while the tunnel will be bedded in deep alluvial deposits.

## VII. Toxics

A. Reusable Tunnel Material

According to the Reusable Tunnel Material testing report for the previous project[10], there needs to be a public health evaluation before placing the tunnel muck as fill in the landscape. The testing report states:

> However, exposure of people, wildlife and plants to conditioned soil has not been

[10] URS Corporation, Reusable Tunnel Material Testing Report. Prepared for the California Department of Water Resources, March 2014.

> fully assessed under unrestricted-use conditions, creating an uncertainty for potential adverse effects. If RTM is to be placed in the environment where people could contact the soil, either directly (e.g., through skin contact) or indirectly (e.g., as airborne particulate, or as leachate in surface or drinking water), then human health risk assessment(s) will need to be developed. Development of appropriate exposure scenarios for evaluation in the risk assessment will depend on the specific environmental context; for example, uses as surficial landscape fill for a residential area or subsurface use at a construction site. (p. 53.)

This public health assessment needs to be done, prior to approving any disposal of RTM on Bouldin Island across from the Tower Park Marina, or any other location where people could contact the soil directly or indirectly.

B. Chromium at Intakes

A 2011 twin tunnel project report, the Draft Phase II Geotechnical Investigation[11], documents that DWR found levels of chromium in the test borings at several of the proposed intake sites which could potentially meet the definition of hazardous wastes in Title 22 of the California Code of Regulations.

The Draft Phase II Geotechnical Investigation described environmental screening tests that were done on p. 2-13 (pdf p. 24):

> 2.3.4 Environmental Screening
> A detailed discussion of the environmental sampling program is provided in the DHCCP report Environmental Sampling Report – Phase I Geotechnical Investigations (DHCCP Team, 2010c). Environmental screening involved laboratory testing of soil samples obtained using the Mod Cal sampler described in Section 2.3.3.4. The target sampling zones were sediments immediately below the river bottom and tunnel grade soil samples. For the shallow samples, the planned analyses included CAM 17 metals plus mercury and methyl mercury. Analysis performed from the tunnel grade included CAM 17 metals plus mercury and TPH.

The report further stated on p. 2-18 (pdf p. 29):

> A summary of these results is presented in Table 3-6, and complete listing of these results will be presented in the DHCCP report Environmental Sampling Report – 2010 Phase II Geotechnical Investigations (DHCCP Team, 2011).

Table 3-6 on p. 3-36 of the Geotechnical showed exceedances for hazardous waste limits for Chromium at intakes 1,2,3, and 4. The sites, boring numbers, boring depths, and values of chromium that are found are shown below. The table below is compiled from Table 3-6 on p. 3- 36, cross-referencing the boring numbers with the boring locations. Further testing should be done and the results analyzed in the EIS.

[11] Draft Phase II Geotechnical Investigation—Geotechnical Data Report—Pipeline/Tunnel Option, Revision 1.1, August 22, 2011.

| Site | Boring number | Depth (feet) | Chromium (mg/kg) |
|---|---|---|---|
| Intake 1 | DCR1-DH-010-43 | 43 | **56.20** |
| Blank | DCRA-DH-001-01-158 | 158 | **57.00** |
| Intake 2 | DCRA-DH-002-01-155 | 155 | **91.20** |
| Intake 3 | DCR3-DH-005-01 | 1 | **56.60** |
| Blank | DCR3-DH-005-01 | 1 | **56.60** |
| Intake 4 | DCR4-DH-008-01 (no depth) | Blank | **51.10** |