San Jacinto River Waste Pits Superfund Site
National Remedy Review Board
EPA Region 6 Responses to Board Comments
May 27, 2016

1. Based on the package and presentation, the Board notes that the risk assessment information was difficult to understand. Cancer risks were presented as hazard quotients. Soil and sediment exposure were merged into a single hazard index. The Board recommends that the Region correct the risk calculations using the most current IRIS information and clarify the risk information prior to using it in the decision documents.

Response: As described on page 36 and 37 of the Site Information Package, dioxins/furans were assessed using three approaches: cancer risk, non-cancer hazard, and cancer hazard. Only the cancer hazard approach deviated from traditional EPA risk assessment guidance. Similar to the non-cancer hazard assessment, this approach assumed a threshold dose, utilized a reference dose rather than a cancer slope factor, and generated hazard quotients. Although dioxin/furan risk was calculated from all three approaches, the non-cancer hazard assessment proved to be the most conservative. As such, preliminary remediation goals are based on the non-cancer hazard indices.

2. RAO – In the package prepared for the Board, the RAOs do not appear to match the risk assessment results. The Board recommends that the Region clarify in the decision documents the RAOs for direct contact risk in addition to RAOs for addressing risk from fish or shellfish consumption. The Region should refer to OSWER Directive No. 9355.3-01, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Chapter 4, October 1988 and OSWER Directive No. 9200.1-23P, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, Chapter 6, July 1999 when drafting RAOs. The Board also recommends that the decision documents clarify that this action will be addressing only part of a larger watershed problem and when the RAOs are achieved the fish advisories may not be lifted.

Response: At this time, an overall watershed plan to address fish consumption, PCBs, and dioxin does not exist for the Houston Ship Channel/Galveston Bay watershed. The EPA and TCEQ are looking for sources of dioxins and PCBs in the Houston Ship Channel as part of the Total Maximum Daily Load program. In addition, a fish consumption advisory exists for the San Jacinto River in which the site is located. This advisory (TX DSHS ADV-55) identifies that: For all species of fish and blue crabs, adults should limit consumption to no more than one, 8-ounce meal per month and women of childbearing age and children under 12 should not consume any fish or blue crabs from this area.

As the study for an overall watershed plan is ongoing by the TMDL program, the following are proposed RAOs to address the site specific direct contact risks from dioxin and furans:

RAO 1: Eliminate releases of dioxins and furans to protective levels from the former waste impoundments to sediments and surface water of the San Jacinto River.

RAO 2: Reduce human exposure to dioxins and furans from consumption of fish by remediating sediments affected by paper mill wastes to appropriate cleanup levels.

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RAO 3: Reduce human exposure to dioxins and furans from direct contact with paper mill waste, soil, and sediment by remediating affected media to appropriate cleanup levels.

RAO 4: Reduce exposures of benthic invertebrates, birds, and mammals to paper mill waste-derived dioxins and furans by remediating affected media to appropriate cleanup levels.

The RAOs developed consider the current and reasonably anticipated future land use including the use for industrial applications and by recreational fishers. While the Baseline Human Health Risk Assessment (BHHRA) considered subsistence fisher populations, none have been identified at the site and therefore this receptor is not considered to be consistent with the current or future land use.

Reducing exposure of human and ecological receptors of concern to dioxins and furans will mitigate site baseline risks identified in the BHHRA and Baseline Ecological Risk Assessment. The quantitative cleanup levels that need to be met to achieve the RAOs are presented below.

Human Health Chemicals of Concern and Cleanup Levels

Chemical of Concern	Media	Preliminary Remediation Goal (PRG)	Basis for Cleanup Level
TEQ_{DF}	Paper Mill Waste & Sediment	200 ng/kg[1]	Child Recreational Visitor[2], Calculated Risk Based Noncancer Endpoint[3]
TEQ_{DF}	Soil	240 ng/kg[1]	Construction Worker, Calculated Risk Based Noncancer Endpoint[3]

Note:
[1] Assumptions and derivations of PRGs are presented in Anchor 2016.
[2] Development of a PRG based on recreational fisher exposure would also be appropriate and considered, however the cleanup level based on exposure to a recreational visitor is more conservative and will therefore be protective of recreational fishers.
[3] Calculations based on a relative bioavailability adjustment of 1.
[4] Assumptions and derivations of cleanup levels are presented in Integral and Anchor 2013a
ng/kg – nanograms per kilogram
TEQ_{DF} – 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient

Further, the State of Texas has set a surface water quality standard for dioxins and furans in the San Jacinto River. For the river section that includes the San Jacinto River Waste Pits Superfund Site, the surface water quality standard is 7.8 $x10^{-8}$ µg/L as TCDD equivalents. The PRG for surface water is set at the surface water quality standard of 7.8 $x10^{-8}$ µg/L as TCDD equivalents.

3. Policy and Guidance – The Board notes that designing a remedy located within a floodplain area and hurricane inundation zone presents additional considerations during remedy design. The Board recommends that the Region should consider any existing Agency guidelines related to Executive Order 13653, *Preparing the United States for the Impacts of Climate Change*, and Executive Order 13690, *Establishing a Federal Flood Risk Management Standard and Process*, when developing the remedial design or preparing other decision documents. The Board notes that the Region took into consideration the site's location within the San Jacinto River when selecting its preferred remedy. The Board also recommends that the Region include documentation in the administrative record in the form of a climate change vulnerability evaluation, which may include a climate-change exposure assessment to evaluate a wide range of climate change scenarios, including, but not limited to, major flood and storm events and how such events might impact the remedial alternatives.

Response: The U.S. Army Engineer Research and Development Center (ERDC) provided technical support to EPA. The goal of ERDC's work was to prepare an independent assessment of the Potentially Responsible Parties' (PRP) remedial alternative designs for the San Jacinto River

Waste Pits Superfund Site. The report prepared by ERDC presented the results from tasks that were identified by EPA for the ERDC to perform. The following discussion summarizes tasks conducted by ERDC that address this NRRB comments.

ERDC performed an assessment of the San Jacinto River (SJR) flow/hydraulic conditions and river bed scour in and around the Site for severe storms, hurricanes, storm surge, etc., using surface water hydrology model(s) appropriate for the Site. The assessment included an evaluation of potential river bed scour/erosion in light of the historical scour reports for the Banana Bend area and for the SJR south of the I-10 Bridge.

The simulation showed that the current cap is expected to be generally resistant to erosion except for very extreme hydrologic events, which could erode a sizable portion of the cap and more than 1.5 feet of underlying sediment. The most severe event simulated was the hypothetical synoptic occurrence of Hurricane Ike and the October 1994 flood, with a peak discharge of approximately 390,000 cubic feet per second occurring at the time of the peak storm surge height at the Site. Approximately 80 percent (12.5 acres) of the 15.7 acre TCRA cap incurred severe erosion during the simulated extreme storm. Issues related to cap permanence can be addressed by additional cap modifications, including upgrading the blended filter in the Northwestern Area to control sediment migration into the cap, upgrading the armor stone size in vulnerable areas by doubling its size to prevent movement during very severe hydrologic and hydrodynamic events, thickening of the armor cap from a minimum of 12 inches to at least 24 to 30 inches across the site to minimize the potential for disturbance by anthropogenic activities or gas entrapment in submerged areas where a geotextile filter was used , and installing pilings to protect the cap from barge strikes. The armored cap is predicted to have long-term reliability from scour related processes except under very severe hydrologic and hydrodynamic events. The ERDC assessment recognized that the uncertainty associated with estimates of the effects of some of the potential cap failure mechanisms, e.g., propwash, stream instability, is very high.

The ERDC also evaluated floodplain management and impacts of remedy construction on flood control, water flow issues and obstructions in navigable waters. The evaluation concluded that the construction of any of the proposed Alternatives is not expected to cause any flooding in the vicinity of the Site, and therefore should not require the implementation of any flood control measures during the construction of any of the Alternatives under consideration for the Site.

If a storm (e.g., tropical storm or high flows under flood conditions) occurred during the actual removal/dredging operation, the likelihood of extremely significant releases of contaminated sediment occurring is very high. A silt curtain would not be able to withstand the forces of high flow or waves and therefore the bottom shear stresses would not be controlled. The only BMPs that would be capable of preventing most of the contaminated sediment releases would be a substantial containment structures to isolate the removal operations, residuals and exposed sediment. The containment structures could consist of berms and sheet pile walls or caissons to an elevation of about +9 NAVD88.

It may be advisable to perform the removals in small sections at a time such that the armor stone and geotextile within the small section would be removed, and then the sediment removed and a thin layer of sacrificial fill placed before advancing to the next section and repeating the process. Under these removal operations, it would also be advisable to limit or restrict removal activities to a period when there is a lower probability of tropical storms and flooding conditions.

4. Eco Risk - Within the ecological risk materials presented to the Board several contaminants including, but not limited to, Pb and Zn were concluded to pose an ecological risk. The Board recommends that the Region more fully present the risk characterization and results identified in the BERA related to these contaminants and how that risk is being addressed as part of the remedy.

Response: The ecological risk in question refers to potential risks found for the killdeer in the Southern Impoundment. Region 6 acknowledges that this table is misleading. Accounting for risks associated with background and the fact that this is an industrial site with very poor habitat quality, risk from these metals in soil are considered acceptable to killdeer populations. Reference to potential risks to this receptor will be removed.

5. Policy and Guidance – The package provided to the Board included sediments in the nature and extent of contamination. Because the remedy being contemplated addresses sediments, the region should follow the Tier 1 protocol under EPA's sediments guidance (OSWER Directive No. 9285.6-08, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites,* February 2002) prior to remedy selection.

Response: Region 6 will prepare and submit a CSTAG Tier 1 Memo for consideration.

6. PTW – The site information package provided to the Board identified principal threat waste (PTW) in the northern waste pits sediment and southern impoundment soils. The Board notes that identifying PTW is meant to define a threshold for determining when treatment should be considered for the most highly mobile or toxic or generally cannot be contained in a reliable manner. In addition, the Region did not clearly explain its approach for identifying PTW and pursuing treatment "to the maximum extent practicable". The Board notes that OSWER Directive No. 9380.3-06FS, November 1991, *A Guide to Principal Threat and Low Level Threat Wastes,* provides guidance on identifying PTW, as well as on the statute's preference and the NCP's expectations for treatment of PTW. The Board recommends that the Region fully explain in its decision documents how its PTW approach at this site is consistent with CERCLA and the NCP, including, specifically, CERCLA § 121(b)(l)'s preference for treatment "to the maximum extent practicable;" CERCLA § 121(d)(l)'s requirements regarding selection of remedies that ensure protectiveness of human health and the environment and achieve (or where appropriate, waive) applicable or relevant and appropriate requirements (ARARs); 40 CFR § 300.430(a)(l)(iii)(A)'s expectation that "treatment [be used] to address the principal threats posed by a site, wherever practicable;" and 40 CFR § 300.430(f)(l)(ii)(E)'s preference for treatment "to the maximum extent practicable," while protecting human health and the environment, attaining ARARs identified in the ROD, and providing "the best balance of trade-offs" among the NCP's five balancing criteria.

Response: Elevated concentrations of $TEQ_{DF,M}$ have been detected at the Site in sediment (more than 43,000 ng/kg) and soil (more than 50,000 ng/kg). Dioxin and furans are highly toxic and persistent in nature (will not breakdown for hundreds of years). With the regular occurrence of severe storms and flooding in the area, there is uncertainty that the waste material can be reliably contained over the long term and therefore should be considered highly mobile. Because the dioxin and furan waste in the northern impoundments and southern impoundment at the site is both highly toxic and highly mobile, it is considered a principle threat waste.

Alternative 4N (Partial Solidification/Stabilization, Permanent Cap, Institutional Controls, and Monitored Natural Recovery) in the FS considered treatment of the most highly contaminated material. A dioxin and furan value that exceed 13,000 ng/kg $TEQ_{DF,M}$ was used to define the most

highly contaminated material. Under this alternative, approximately 52,000 cubic yards of contaminated material would be treated. This amount represents about one-quarter of the material that exceeds the PRG. If this alternative is selected, then a treatability study would be conducted to determine the appropriate type and amount of amendments, including stabilization amendments that would be required. Solidification was successfully performed during the TCRA on a portion of the Western Cell materials. However, the location of materials, either partially submerged within the San Jacinto River (northern impoundments) or on a small peninsula on the San Jacinto River (southern impoundment), result in limited ability to treat the waste in place without the increased threat of a release as a result of flooding during the remedial action.

For remedial alternatives that require removal and offsite disposal of contaminated material (Alternatives 5N, 5aN, 6N, and 4S) excavated material would be dewatered and potentially treated as required for transportation and disposal to eliminate free liquid prior to transporting it for disposal.

7. Remedy Effectiveness – In the package provided by Region 6, the preferred alternative mentions stabilizing sediment and potentially treating soil prior to transporting it for disposal The Board recommends that the decision documents clearly explain how the preferred alternative will achieve the NCPs preference for treatment. The Board further recommends that the Region consider a full range of alternatives (varying degrees of in-situ treatment) since there are no alternatives other than partial removal and total removal. The Region should refer to 40 CFR 300.430(e)(3)(i).

Response: For remedial alternatives that require removal and offsite disposal of contaminated material (Alternatives 5N, 5aN, 6N, and 4S), excavated material would be dewatered and treated as required for transportation and disposal to eliminate free liquid prior to transporting it for disposal.

In developing the range of remedial alternatives for the Site, EPA considered more alternatives than partial removal and total removal.

The PRPs' consultant submitted a report entitled "Remedial Alternatives Memorandum - San Jacinto River Waste Pits Superfund Site" (RAM) in December 2012. The objectives of the RAM are:

- *Identify and screen remedial alternatives and related technologies that may be applicable to the Site.*
- *Develop preliminary RAOs for the Site,*
- *Identify and screen potential disposal alternatives for removed contaminated sediment and eliminate disposal process options that are not practical to implement.*
- *Identify and screen remedial technologies (such as monitored natural recovery, sediment containment, or sediment treatment) to eliminate candidate remedial technologies that cannot be implemented or that may be limited in their applicability due to technical or other constraints at the Site.*
- *Following the screening to narrow the range of remedial technologies, assemble the retained technologies into potential remedial alternatives to be considered for detailed analysis in the FS.*

The RAM identified and described General Response Actions (GRAs), remedial and disposal technologies, and process options for the Site. The screening of alternatives was based on three evaluation criteria: 1) implementability, 2) effectiveness, and 3) cost. Results from the screening

process determined the technologies that were further evaluated in the Feasibility Study. The following table identifies the GRAs, technologies and process options evaluated for the Site and the determination for further evaluating the technology in the FS.

General Response Actions, Technology Types, and Process Options Potentially Appropriate for the San Jacinto River Waste Pits

GRA	Technology Type	Process Option		Screening Decision
		Sediment	Soil	
Institutional Controls	Administrative and Legal Controls	Waterway Use Restrictions and Maintenance Agreements	Access and Property Use Restrictions	Retained
		Access and Property Use Restrictions	Informational Devices (e.g., signage)	Retained
		Informational Devices (e.g., signage and fish consumption advisories)		Retained
Natural Recovery	Monitored Natural Recovery	Sedimentation	Not Applicable	Retained
		Placement of Thin Lay of Clean Cover		Retained
In situ Containment	Cap	Conventional Cap		Retained
		Low-Permeability Cap		Retained
In situ Treatment	Physical – Immobilization	Adsorptive Amendments	Adsorptive Amendments	Retained
		Solidification/Stabilization	Solidification/Stabilization	Retained
Removal	Dry Excavation	Excavator	Excavator	Retained
	Dredging	Mechanical Dredging		Retained
		Hydraulic Dredging		Retained
Ex situ Treatment	Thermal	Incineration	Incineration	Retained
		In Pile Thermal Desorption	In Pile Thermal Desorption	Not Retained
	Chemical	Solvated Electron Technology	Solvated Electron Technology	Not Retained
		Base-Catalyzed Decomposition	Base-Catalyzed Decomposition	Not Retained
Disposal/Reuse	Aquatic Disposal	Confined Aquatic Disposal (CAD)	Not Applicable	Retained
		Nearshore Confined Disposal Facility		Retained
		Open-Water Disposal		Not Retained
		Confined Disposal Facility / Landfill	Landfill	Retained

	Off-Site Upland Disposal	Beneficial Use	Beneficial use	Not Retained

The following table summarizes the remedial alternatives evaluated in the Feasibility Study and carried forward in the Proposed Plan of Action for the Site.

Area North of I-10	
Alternative	**Description of Alternative**
Alternative 1N – Armored Cap and Ongoing OMM (No Further Action)	Armored Cap would remain in place, together with fencing, warning signs and access restrictions established as part of the time-critical removal action (TCRA), and would be subject to ongoing operation, maintenance and monitoring (OMM).
Alternative 2N – Armored Cap, ICs, Ground Water Monitoring, and Monitored Natural Recovery (MNR),	Includes the actions described under Alternative 1N, ICs in the form of deed restrictions and notices, and periodic monitoring to assess the effectiveness of sediment natural recovery processes and confirm no long-term impacts to ground water.
Alternative 3N – Permanent Cap, ICs, Ground Water Monitoring, and MNR	Includes the actions described under Alternative 2N plus additional enhancements to the Armored Cap, many of which have already been implemented during the work performed in January 2014, consistent with the USACE recommendations
Alternative 4N – Partial Solidification/Stabilization, Permanent Cap, ICs, Ground Water Monitoring, and MNR	Includes the actions described under Alternative 3N; however about 25 percent of the Armored Cap (2.6 acres above the water surface and 1.0 acre in submerged areas) would be removed and about 52,000 cubic yards (cy) of materials beneath the cap with $TEQ_{DF,M}$ that exceeds a concentration set by USEPA of 13,000 ng/kg, would undergo solidification and stabilization (S/S). After the S/S is completed, the Permanent Cap would be constructed.
Alternative 5N – Partial Removal, Permanent Cap, ICs, Ground Water Monitoring, and MNR	The Armored Cap would be partially removed and the same 52,000 cy of material that would undergo S/S under Alternative 4N would instead be excavated for off-site disposal. After the removal was completed, the Permanent Cap would be constructed and the same ICs and MNR that are part of Alternatives 2N to 4N would be implemented, including monitoring to confirm no long-term impacts to ground water.
Alternative 5aN - Partial Removal of Materials Exceeding the PRG, Permanent Cap, ICs, Ground Water Monitoring, and MNR	All material beneath the Armored Cap in any location where the water depth is 10-feet or less and which has a of $TEQ_{DF,M}$ 200 nanograms per kilogram (ng/kg) or greater – about 137,600 cy – would be excavated for off-site disposal. To implement this alternative, about 11.3 acres (72 percent) of the Armored Cap would be removed to allow for this material to be dredged. After excavation of the material, the remaining areas of the Armored Cap would be enhanced to create a Permanent Cap, and the same ICs and MNR that are part of the preceding alternatives would be implemented, including monitoring to confirm no long-term impacts to ground water.
Alternative 6N – Full Removal of Materials	All material above the PRG 200 ng/kg beneath the Armored Cap and at depth in an area to the west would be removed. This would involve

Exceeding the PRG, ICs and MNR	removal of the existing Armored Cap in its entirety and the removal of 200,100 cy of material. The dredged area would then be covered with a layer of clean fill

Area South of I-10	
Alternative	**Description of Alternative**
Alternative 1S – No Further Action	
Alternative 2S – Institutional Controls and ground water monitoring	Includes the actions described under Alternative 1N, ICs in the form of deed restrictions and notices, and periodic monitoring to confirm no long-term impacts to ground water.
Alternative 3S – Enhanced Institutional Controls	This remedial alternative would incorporate the ICs and ground water monitoring identified in Alternative 1S and add physical features to enhance the effectiveness of the ICs. The physical features would include bollards to define the areal extent of the remedial action areas at the surface and a marker layer that would alert workers digging in the area that deeper soil may be impacted
Alternative 4S – Removal and Off-site Disposal	This remedial alternative involves excavation and replacement of soil in the areas exceeding the cleanup levels. Soil would be removed within these areas to a depth of 10 feet below grade. Excavated soil would be further dewatered and potentially treated to eliminate free liquids as necessary prior to transporting it for disposal. Excavated soil would be disposed of at an existing permitted landfill, the excavation would be backfilled with imported clean soil, and vegetation would be re-established.

8. HH Risk – The human health risk information provided to the Board included information on exposure to subsistence fishers. However, the package further stated that detailed information regarding fishing activities and consumption patterns was absent. The subsistence fisher was not quantitatively evaluated in the baseline risk assessment. The Board recommends that the Region strengthen the explanation of how the Region determined that indeed there is no significant subsistence fishing going on at the site. The Board notes that this information may lower the cleanup goal if subsistence fishing were occurring.

Response: The Texas Department of State and Health Services (DSHS) provided the following information by email on 24 June 2016. The information will be added to the Record of Decision (ROD) to strengthen the explanation of how it was determined there was no significant subsistence fishing at the site.

"The USEPA suggests that, along with ethnic characteristics and cultural practices of an area's population, the poverty rate could contribute to any determination of the rate of subsistence fishing in an area. The USEPA and the DSHS find it is important to consider subsistence fishing to occur at any water body because subsistence fishers (as well as recreational anglers and certain tribal and ethnic groups) usually consume more locally caught fish than the general population. These groups sometimes harvest fish or shellfish from the same water body over many

years to supplement caloric and protein intake. People, who routinely eat fish from chemically contaminated water bodies or those who eat large quantities of fish from the same waters, could increase their risk of adverse health effects. The USEPA suggests that states assume that at least 10% of licensed fishers in any area are subsistence fishers. Subsistence fishing, while not explicitly documented by the DSHS, likely occurs in Texas. The DSHS assumes the rate of subsistence fishing to be similar to that estimated by the USEPA.

In the DSHS Public Health Assessment that was released in October 2012, one of the exposure scenarios was that of a subsistence fishermen. This was incorporated to account for the potential exposure pathway to children and adults that may be subsistence fishermen and consume fish caught from areas surrounding the SJRWP. The scenario used was:

Adults who fish 260 days/year for 30 years and children of subsistence fishers who are exposed from age 3 – 50 (47 years).

Through DSHS outreach activities, ***most of the people interviewed along the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay have told DSHS that they are fishing and/or crabbing for recreational purposes****; however, some people do admit to consuming fish and/or crabs from these areas. One could assume that a small percentage of people found fishing in these areas could potentially be subsistence fishers but don't admit it."*

9. Remedy Effectiveness - The Region acknowledges that groundwater quality samples collected from within the waste material exceeded maximum contaminant levels (MCLs) for some contaminants of concern (COCs). However, groundwater quality samples collected beneath the waste material did not exceed MCLs. The Board recommends that during the development of remedial design documents, the Region include plans for monitoring groundwater quality during design (including all COCs) in areas bounding waste materials (laterally and vertically) to ensure ground water contamination does not become a concern, adjacent to the site, during remedial activities. The Board also recommends that the Region include plans for evaluating both dissolved phase COC concentrations and concentrations that may result from facilitated transport in their groundwater quality monitoring plan. If COCs are found to exceed MCLs in an area bounding the waste material, the Region will need to address groundwater contamination concerns as part of this remedial action.

Response: The recommendation to monitor ground water, and take appropriate action as necessary, during the remedial action will be included in the ROD.

10. In the presentation to the Board, the Region discussed the difficult issues related to human health exposure, the potential for site recontamination from upstream, point and non-point sources, and the challenges associated with the ability to achieve protectiveness. Background sampling was mentioned in the package but it lacked details. The Board recommends that decision documents provide details on how background concentrations were addressed according to OSWER Directive No. 9285.6-07P. The Board recommends that the Region clearly articulate the risks from non-site sources in the decision documents, explain how the preferred site remedy would achieve protectiveness and also explain how these risks provide a basis for action. In addition, the Region should explain how the site cleanup, with the help of ICs, is designed to achieve protectiveness. Furthermore, the Board believes it may be appropriate for the Region to highlight the accomplishment of mass removal of contaminants from the site, which may lead to future, long-term reduction in contaminant levels.

The Board acknowledges draft work by USACE on constructing a cap to withstand future hurricanes and 500-year floods. However, the preferred remedy presented to the Board is removal and off-site disposal of all contaminated waste and soils/sediments above the risk based level determined to be protective for direct exposure (6N). This alternative has the expressed advantage of being more effective in the long term due to uncertainties associated with future storm events that are expected to be extreme, and greater community acceptance. The capping alternative (3N), however, is identified as being easier to implement, more protective in the short term, and is an order of magnitude less expensive than the removal alternative. The Board recommends that the Region further consider the consequences of future extreme storm events and flooding, as well as the viability of maintaining cap integrity over the long term. Future extreme weather events must be considered when selecting the preferred alternative. The Board recommends that the Region explain in the decision documents the rationale for the risk management decision considering factors such as river conditions (stability, depositional, erosional), protectiveness and long-term effectiveness and permanence.

Response: The ROD will discuss the risks from non-site sources, basis for action, and explain how the preferred site remedy will achieve protectiveness. The area is generally depositional with some variations. The USACE is addressing the concerns presented by the Board, including the consequences of future extreme storm events and flooding and the viability of maintaining the cap integrity over the long term, in their report. The results of the USACE evaluation will be presented in the ROD.

11. Cost - (1) As discussed with the Region during the review, the alternative cost estimates should be more detailed. The Board recommends that the Region should: (1) break out the volumes of sediment to be dewatered and solidified and the volumes of sediment that will be stabilized, (2) evaluate any cost savings from increasing the size of the trucks used in the cost estimate for offsite disposal, and (3) include cost estimates for the treatability studies associated with either solidification or stabilization of the excavated sediments, (4) include the costs of best management practices (BMPs) and (5) assure the cost table accurately covers monitoring vs. monitored natural recovery (MNR) costs.

Response: The detailed cost estimates included in the Feasibility Study, and included as an appendix to the Site Information Package presented to the Board, break out sediment volumes, Best Management Practices, monitoring, and Monitored Natural Recovery. The ROD will include the information as requested. However, in response to part 2, the truck size will be determined during the Remedial Design or Remedial Action and will take into consideration road weight restrictions, maneuverability at the site, and other relevant issues. Feasibility Study cost estimates per EPA guidance are expected to provide an accuracy of plus 50 percent to minus 30 percent. Adjustment to the truck size costs is anticipated to be within the expected acceptable cost range. Similarly, while the cost estimates do not specifically identify a line item for treatability study costs, these studies will be conducted as needed. The costs of treatability studies for this purpose are minimal in comparison to other components of the alternatives and therefore expected to be within EPA's acceptable cost estimate range.

12. MNR – In the package presented to the Board, MNR is being considered to address contamination in the aquatic environment in North of I-10 alternatives 2-5 but it does not appear from the package that the Region has evaluated the effectiveness of MNR to demonstrate that it is likely to reach the remediation goals identified. Given the effects of storms on sediments, it is unclear whether MNR (either through dilution or covering with cleaner sediments) can be relied upon as a component of the remedy. The Board recommends that the Region include in the decision documents information on where MNR may

be used and based on aquatic conditions (deposition, erosion) an evaluation on whether this technology will enhance protectiveness and be permanent in the future.

Response: A Chemical Fate and Transport Modeling Study was conducted during the RI/FS to simulate physical and chemical processes governing chemical fate and transport of dioxins and furans at the Site. The fate and transport modeling was based on three linked models that simulate hydrodynamics, sediment transport and chemical fate and transport. The sediment transport portion of the model was used to simulate the erosion, deposition and transport of sediment in the San Jacinto River. Simulations were conducted to provide estimates of rates of natural recovery (i.e., reductions in surface sediment dioxin and furan concentrations over time) in various portions of the Model Study Area in the absence of any remedial action beyond the current Armored Cap.

In response to EPA's request for additional hydrodynamic and sediment transport model sensitivity analyses in its conditional approval letter for the draft final Chemical Fate and Transport Modeling Study report, a series of simulations was conducted to evaluate: 1) sediment deposition and erosion during high-flow events; and 2) the sensitivity of model predictions to water surface elevation (WSE) at the downstream boundary.

The calibrated hydrodynamic and sediment transport models prepared by the PRPs were used to simulate sediment transport processes in the San Jacinto River during high-flow events. A range of high-flow conditions, from 2- to 100-year events, were investigated. The effects of varying the following model inputs were evaluated: 1) erosion rate parameters; 2) incoming sediment load at the Lake Houston Dam, and 3) effective bed roughness.

Spatial distributions of predicted net sedimentation rates (NSRs) for the long-term simulation period for pre- (i.e., the sediment transport model calibration) and post-TCRA conditions as shown on Figures 3-4 and 3-5 (Appendix A of the FS), respectively are shown below.

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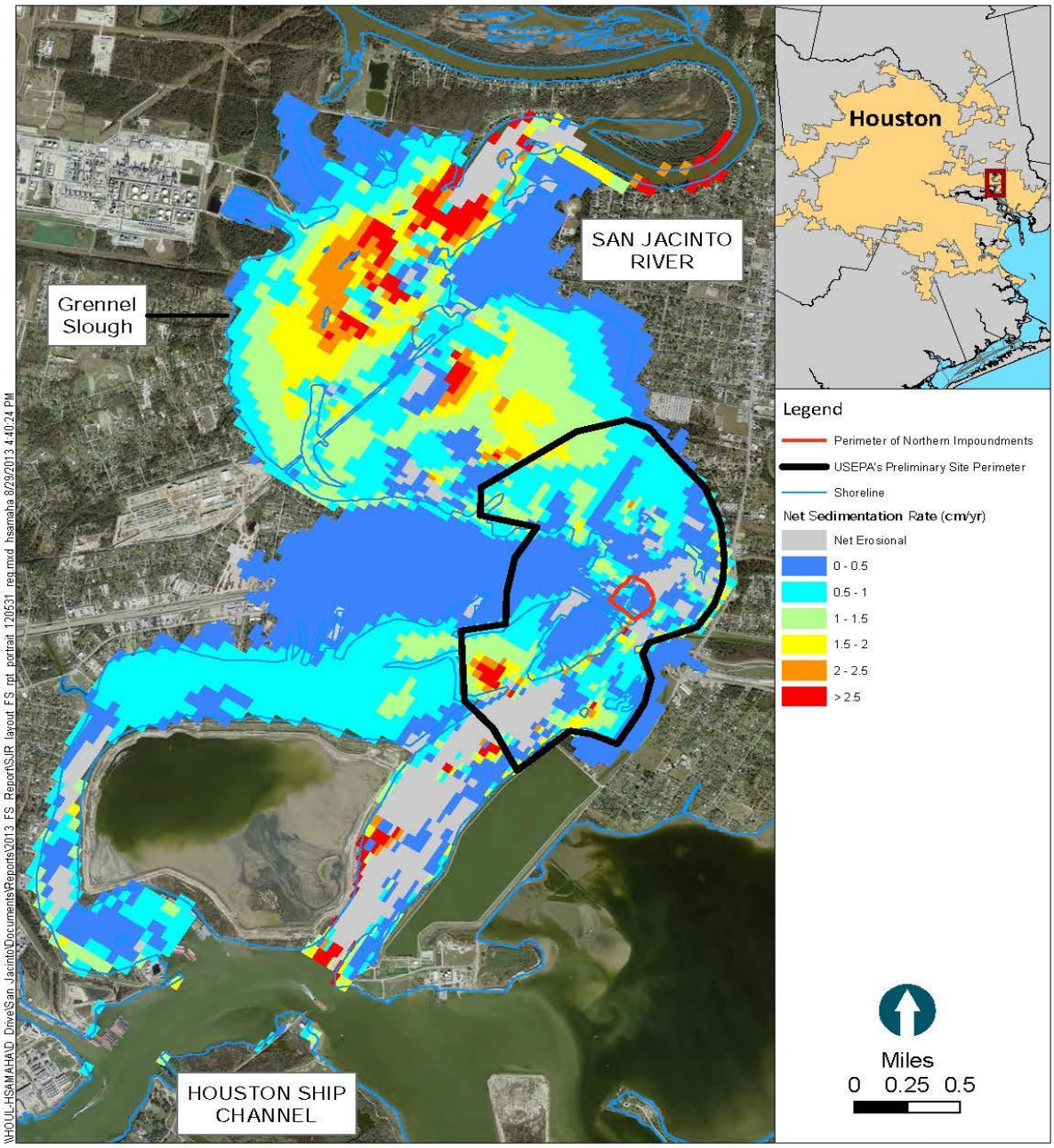

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Figure 3-4
Spatial Distribution of Predicted Net Sedimentation Rate for 21-Year Period: Pre-TCRA Base Case Simulation
Feasibility Study
San Jacinto River Waste Pits Superfund Site

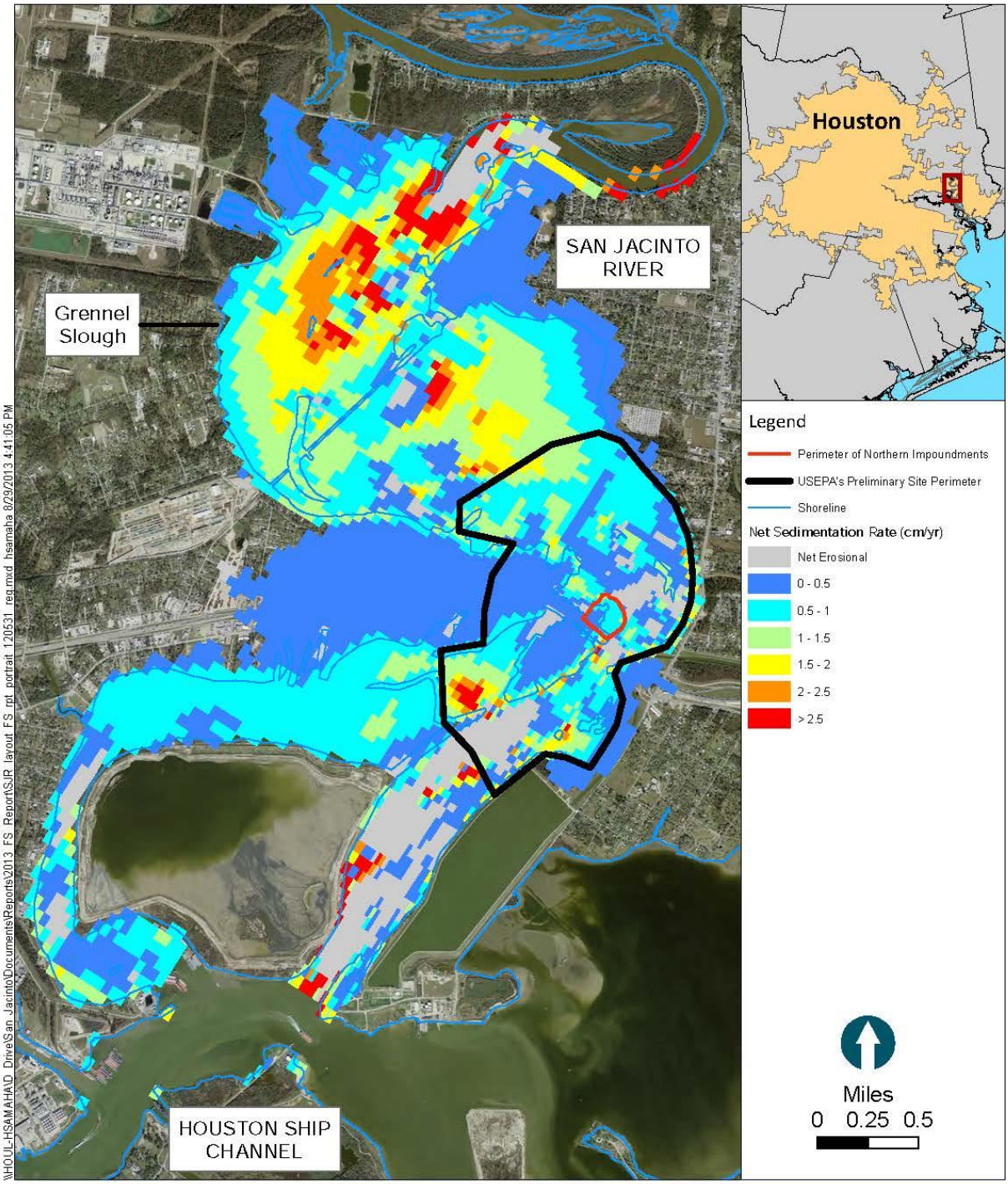

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Figure 3-5
Spatial Distribution of Predicted Net Sedimentation Rate for 21-Year Period: Post-TCRA Base Case Simulation
Feasibility Study
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Model-predicted future rates of natural recovery in surface sediments, including the range of model uncertainty, were evaluated at various spatial scales over the Model Study Area. Figure 3-18 from Appendix A of the Feasibility Study shown below presents a time series of model-predicted surface (0- to 6-inch) sediment TCDD concentrations averaged over the Preliminary Site Perimeter. The figure shows a base case predicted decrease in TCDD concentration of approximately 75 percent over the Future Projection Period (decreasing from an initial TCDD concentration of approximately 8 nanograms per kilogram [ng/kg] to 2 ng/kg by Year 21). To quantify the rate of decline, an exponential decay curve was fit through the model results, and the rate of decline was calculated (see example for the base case simulation shown as a dotted line on Figure 3-18); the model-predicted decline of TCDD in surface sediment concentrations within the Preliminary Site Perimeter corresponds to a half-life of 11 years.

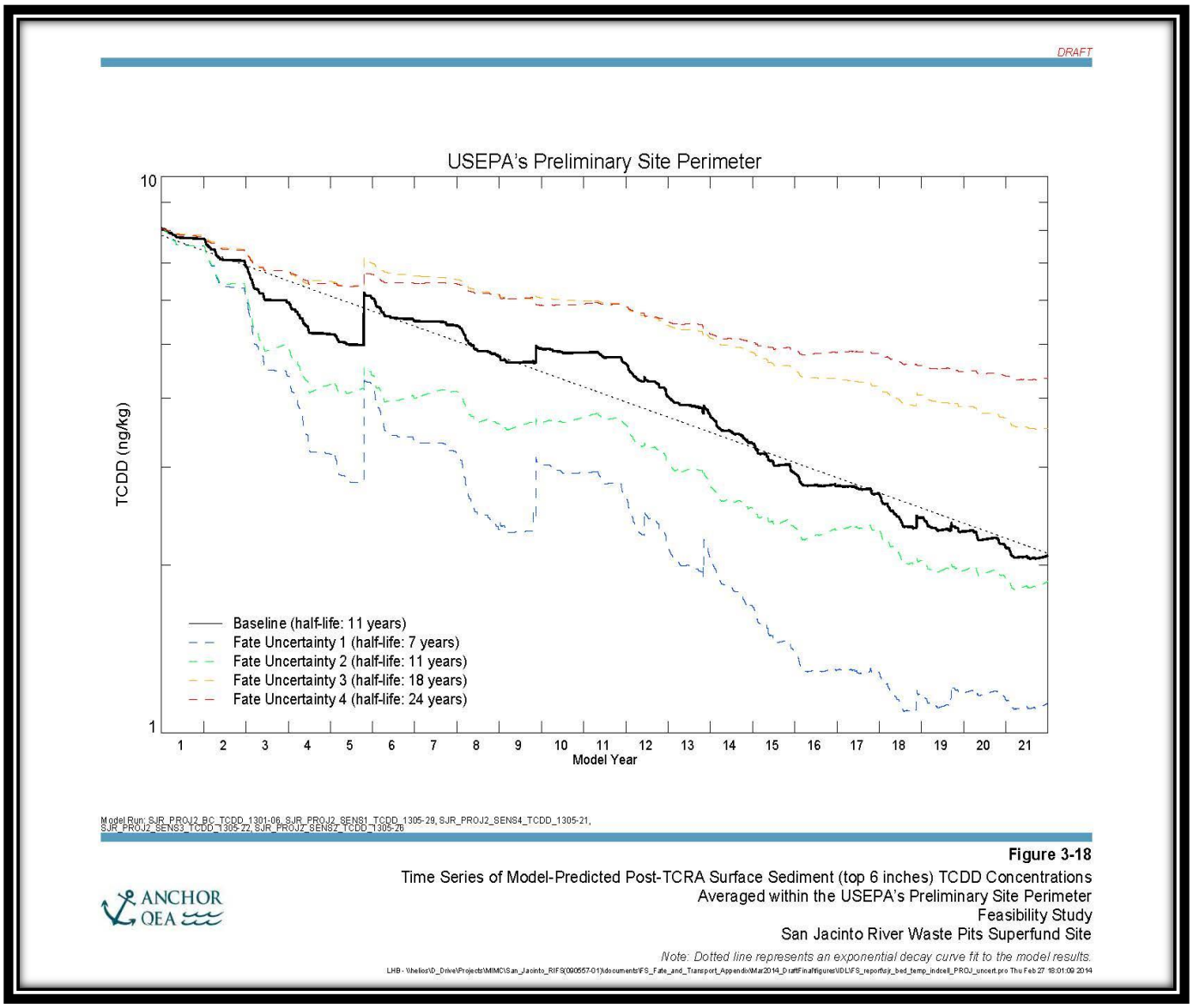

Figure 3-18

Time Series of Model-Predicted Post-TCRA Surface Sediment (top 6 inches) TCDD Concentrations Averaged within the USEPA's Preliminary Site Perimeter
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For the uncertainty simulations, the predicted decline ranged from more than 85 percent (Fate Uncertainty 1) to 40 percent (Fate Uncertainty 4), corresponding to half-lives that vary by about a

factor of 2 from the base case, ranging from 7 years to 24 years. The faster rates of natural recovery predicted for the Fate Uncertainty 1 simulation are a result of a combination of increased sedimentation rates and decreased mixing within the bed for this simulation. Conversely, the slower rates of recovery predicted for the Fate Uncertainty 4 simulation are a result of lower sedimentation and increased mixing within the bed.

As discussed above, the U.S. Army Engineer Research and Development Center (ERDC) provided technical support to the EPA. One of the tasks ERDC undertook was an evaluation of the rate of natural attenuation in sediment concentrations/residuals and the uncertainty regarding the rate of natural attenuation.

Based on the modeling performed by ERDC, the estimated range of net sedimentation rates (NSR) at the site is 1.3 cm/year ± 0.8 cm/yr. This NSR is the average value over the entire cap, and it is important to keep in mind that the NSR was calculated by averaging the instances of both erosion and deposition in each grid cell over the simulated time period. The latter included long periods of fair (i.e., normal) weather, as well as high energy events including storms and floods. The positive value, i.e., 1.3 cm/year, indicates that there was, averaged over the cap, more deposition than erosion, albeit a small net site-averaged quantity per year. Nevertheless, even this relatively low average NSR on the cap is predicted to maintain the cap's effectiveness, and will contribute to the rate of natural attenuation in the contaminated sediment concentrations found from the 500-year simulations performed. The uncertainty in the long-term NSR of ± 0.8 cm/year is based on the sensitivity analysis, and is in the same range as that given by the PRPs.

13. ARAR - The information provided to the Board included descriptions of various ARARs. The Board recommends that the Region explain why it included a reference to the SDWA, and include more specific references to the potential particular provisions in federal and state ARARs, consistent with the RIFS guidance. In addition, the Board recommends that the Region more clearly describe in its decision documents how it performed its CWA 404(b) analysis (e.g., how cleanup may impact or result in loss of aquatic habitat that would require environmental mitigation) and include that analysis in the administrative record supporting its decision (including compliance with substantive provisions of section 404 for purposes of the section 121(e)(1) permit exemption).

Response: Based on concerns from the local community, groundwater monitoring is proposed for remedial alternatives where waste is left in place. Under the preferred alternative (Alternative 6N), groundwater monitoring would not take place since all of the contaminated material is removed from the Site.

To project and compare the long-term effects of the existing capping alternative (3N) versus the full removal alternative (6N), ERDC modeled the contaminant flux and release into the overlying water over 500 years. As shown in Table 16-9 from the ERDC report, the total contaminant releases are low for all scenarios compared with the unremediated area.

Table 16-9. Total Contaminant Release over 500-yr Simulation Period

Scenario	Total Release over 500 years (mg)
Surrounding Conditions	28,900
Eastern Cell 3N - 5N Footprint	2.18
Eastern Cell 3N - 5aN Increment	8.11
Eastern Cell 3N - 6N Increment	0.0
NW Area 3N - 5N Footprint	0.0
NW Area 3N - 5aN Increment	2.54E-04
NW Area 3N - 6N Increment	2.54E-04
6N Dump Placement - 5N Footprint	10,200
6N Dump Placement - 5aN Increment	7,160
6N Dump Placement - 6N Increment	2,960
6N Rain Placement - 5N Footprint	4.06
6N Rain Placement - 5aN Increment	2.84
6N Rain Placement - 6N Increment	1.17
6N Best Practice Placement - 5N Footprint	1.22E-15
6N Best Practice Placement - 5aN Increment	8.49E-16
6N Best Practice Placement - 6N Increment	3.51E-16

Even though the potential total contaminant release is low compared to the surrounding conditions, surface water monitoring will be conducted. The reasons for conducting surface water monitoring is to confirm the assumption that potential releases from the Site are low when compared to the surrounding conditions. Furthermore, surface water monitoring is necessary to evaluate whether potential releases from the Site exceed the Texas Surface Water Quality Standard for dioxins/furans (TCDD Equivalents).

The FS did not provide a detailed CWA 404(b) analysis. The area within the Preliminary Site Perimeter includes wetlands in the area north of I-10, and a plan will need to be established that addresses the requirements (to the extent practicable) of Section 404 and 404(b)(1).

Implementation of Alternative 3N would involve the placement of fill material (the additional armor rock) into the San Jacinto River to create the Permanent Cap. The placement of fill would trigger compliance with CWA Section 404(b)(1). The removal and replacement of cap material under Alternative 4N would trigger compliance with CWA Section 404(b)(1). The removal of the Armored Cap and placement of rock for Permanent Cap construction under Alternative 5N would trigger compliance with CWA Section 404(b)(1). If Alternative 5aN is identified as the preferred alternative, additional evaluations would need to be conducted to determine the potential habitat impacts related to impacts of dredging and placement of clean residual layer management materials to document compliance with CWA Section 404(b)(1). If Alternative 6N is identified as the preferred alternative, additional evaluations would need to be conducted to determine the potential habitat impacts related to impacts of dredging and placement of clean residual layer management materials to document compliance with CWA Section 404(b)(1).

The PRPs previously prepared a report on potentially jurisdictional waters of the U.S. (including wetlands) as part of the TCRA implementation in compliance with the 1987 USACE Wetlands Delineation Manual and Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plan Region. A supplemental draft 404(b)(1) report may need to be prepared for consideration by EPA depending on the nature of the selected remedy.

Specific BMPs anticipated to be included in construction actions, if necessary to minimize the impacts of discharges of fill into the water, include:

- The use of a silt curtains and debris booms around in-water work areas.
- The use of upland erosion controls such as plastic covering of stockpiles.
- The use of silt fencing around upland areas.
- Construction of a stable upland haul route capable of handling construction traffic without creating ruts that would develop into a source of turbid water.
- Monitoring and maintenance during construction to ensure these BMPs are functioning as designed.

14. Remedy Performance - Information presented to the Board indicated that part of the preferred remedy would involve off-site disposal, but did not provide any details about what kind of facility would receive the waste (e.g., RCRA subtitle C) to ensure that the transfer of the dioxin contamination to another location would lead to long-term protectiveness of human health and the environment (i.e., that dioxin contamination would be reliably contained). The Board recommends that the Region explain in its decision documents how its approach to off-site disposal would ensure protectiveness with regard to disposal.

Response: Information regarding the approach to off-site disposal will be incorporated into the ROD. The Feasibility Study indicated the following regarding waste disposal:

- *"The sludge and sediment at the site are not listed hazardous waste, do not contain listed hazardous waste, and do not meet any of the characteristics of hazardous waste. Therefore, the RCRA rules for hazardous waste are neither applicable nor relevant and appropriate."*

- *"Total PCB concentrations in soil and sediment are below the regulatory threshold (50 mg/kg, calculated as specified in 40 CFR 761) that would require remedial action or trigger certain requirements for waste management."*

- *"…two landfill facilities were tentatively identified that indicated materials from the SJRWP Site could potentially be disposed of at these locations without incineration… The compliance status of the selected disposal facility would be confirmed, in conformance to the Off-site Rule, by communication with the USEPA Regional Off-Site Contact prior to beginning construction."*

- The landfill facilities mentioned in the previous bulleted statement are both Subtitle C facilities which accept RCRA hazardous waste. These landfills were previously identified to the Region by the PRP consultant as US Ecology in Robstown, Texas and ChemWaste Management of the Northwest in Arlington, Oregon.

15. Institutional controls - The information provided to the Board indicates that the preferred alternatives would rely on institutional controls (ICs) (including Coast Guard notices and a state law based restrictive covenant) to help ensure protectiveness. The Board recommends that the Region explain in its decision documents how the ICs would be monitored and enforced in order to maintain their effectiveness.

Response: ICs will be used to notify the public and prevent disturbance at and around the remediated areas. A special sampling and analysis protocol will be required for each permittee conducting activities under the Clean Water Act Section 404 and Rivers and Harbors Action Section 10 within a defined watershed area around the remediated areas. This protocol will be monitored and enforced by a joint EPA, USACE, and TCEQ agreement and will ensure that permitted dredging activities do not impact site cleanup. Additional land deed notices will be filed in Harris County for remediated areas owned by property landowners. All sections of the ROD that specify ICs to prevent dredging or disturbance of the dredge residuals at and around the remediated areas (e.g., dredging, anchoring, construction, and excavation) will refer to a special CWA 404/RHA 10 permits process.

16. Alternative remedy – During the review the Region indicated that dredging depth would be based on the cleanup level, not a specific depth. The Board recommends that if the preferred alternative cannot reach the cleanup level after dredging, the Region should consider the use of an engineered cap to assure protectiveness.

Response: The region will not be selecting a contingency remedy in the ROD. However, the region will rely on findings from the five-year reviews to determine whether the selected remedy is protective in the short- and long-term.