Feasibility Study Addendum Operable Unit E

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Appendix A: Cost Summary Tables for Sediment Remediation Alternatives (Updated Appendix A, 2019 OU-E FS

LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AOI	Area of Interest
ARAR	applicable or relevant and appropriate requirement
BHHERA	Baseline Human Health and Ecological Risk Assessment
CA DFW	California Department of Fish and Wildlife
CalEPA	California Environmental Protection Agency
CCC	California Coastal Commission
CDP	Coastal Development Permit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituent of concern
CY	cubic yard
DSOD	California Division of Safety of Dams
ELCR	excess lifetime cancer risk
EPC	exposure point concentration
ERA	Ecological Risk Assessment
FS	Feasibility Study
GRA	General Response Action
HI	hazard index
IC	institutional control
ISB	in-situ biological oxidation
ISCO	in-situ chemical oxidation
ISM	in-situ soil mixing
LUC	land use control
MCAQMD	Mendocino County Air Quality Management District

MR	Mendocino Railway
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
NTE	not-to-exceed
O&M	operations and maintenance
OU-E	Operable Unit E
RAA	remedial action area
RACR	Remedial Action Completion Report
RAO	remedial action objective
RAP	Remedial Action Plan
RAW	Removal Action Work Plan
RI	Remedial Investigation
RSP	rock slope protection
RWQCB	Regional Water Quality Control Board
sf	square feet
SMP	Sediment Management Plan
TBC	to-be-considered
TEQ	toxic equivalent
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

This Feasibility Study (FS) Addendum was originally prepared by Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) and is revised by Woodard & Curran in response to DTSC comments on behalf of Mendocino Railway (MR) for Operable Unit E (OU-E) at the former Georgia-Pacific Wood Products Facility (Site) located at 90 West Redwood Avenue in Fort Bragg, Mendocino County, California, as shown on Figure 1-1. This document is an addendum to the 2019 OU-E FS dated 12 September 2019 (Kennedy Jenks 2019), which was approved by the Department of Toxic Substances Control (DTSC) on 24 October 2019 (DTSC 2019). Based on communication with the California Coastal Commission (CCC), DTSC requested preparation of an FS Addendum in a letter dated December 27, 2022, to evaluate alternatives to armoring at the Mill Pond Dam crib wall, a component of the preferred remedial action for Pond 8 in the 2019 OU-E FS (DTSC 2022, 2024a, 2024b)[1]. Therefore, this FS Addendum expands on the work presented in the 2019 OU-E FS and uses the same approach to evaluate the alternatives described in the 2019 OU-E FS. The purpose of this FS Addendum is to evaluate select new alternatives requested in DTSC's letter and, together with alternatives previously evaluated in the 2019 OU-E FS, identify feasible remedial methods for OU-E that will meet cleanup objectives, comply with applicable laws and requirements, and protect human health and the environment.

This FS Addendum was prepared as required by DTSC under the Second Amendment to the Site Investigation and Remediation Order Docket No. HAS-RAO 06-07-150 (Order Second Amendment) in accordance with the federal National Oil and Hazardous Substances Pollution Contingency Plan (NCP; U.S. Environmental Protection Agency [USEPA] 1990) and the Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) under the federal Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA; USEPA 1988).

The FS Addendum focuses on new alternatives for three Areas of Concern (AOCs) in OU-E: Pond 7 Aquatic Sediment AOC, North Pond and Pond 6 Aquatic Sediment AOC, and Pond 8 Aquatic Sediment AOC.

1.1 Background

The 415-acre site is located west of Highway 1 along the Pacific Ocean coastline and is bounded by Noyo Bay to the south, the City of Fort Bragg (City) to the east and north, and the Pacific Ocean to the west. OU-E is one of five operable units on the Site (Figure 1-2) and consists of approximately 12 acres of man-made ponds and seasonal wetland areas and 45 terrestrial acres divided into eight Areas of Interest (AOIs)[2]. The ponds were constructed and operated by prior owners during mill operation to manage wastewater from Site operations, provide a source of water for firefighting, and as a log pond. Pond 8 also currently provides stormwater management for runoff from the City. The historical use of the ponds was described in the Preliminary Site Investigation Work Plan Operable Unit E – Onsite Ponds (Arcadis BBL 2007a).

[1] Mendocino Railway provided responses to DTSC letters (Mendocino Railway 2023, 2024a, 2024b) and held a meeting with DTSC and other agencies on 26 April 2024 to discuss Pond 8 and next steps.

[2] Areas evaluated due to the presence of potential risk following completion of the remedial investigation (RI), Baseline Human Health and Ecological Risk Assessment (BHHERA), and subsequent OU-E Removal Action Work Plan (RAW) implementation are herein described as "Areas of Concern" or AOCs. In some cases, AOIs were grouped into AOCs due to similarities in nature and extent of chemicals of interest (COIs) and affected media for development of remedial alternatives.

Additional Site and OU-E information, including site setting and the conceptual site model, was presented in the 2019 OU-E FS. Select information from the 2019 OU-E FS is provided herein where relevant for the additional alternatives evaluation.

1.1.1 OU-E Regulatory Status

The 2019 OU-E FS (Kennedy Jenks 2019) and this FS Addendum are based on data presented in the Final Remedial Investigation Report Operable Unit E (OU-E RI Report; Arcadis 2013, DTSC 2013), the Baseline Human Health and Ecological Risk Assessment – Operable Unit E (OU-E BHHERA; Arcadis 2015, DTSC 2015) and data collected from subsequent investigations. Sediment constituents of concern (COCs) for OU-E include polychlorinated dibenzo-p-dioxin (dioxin) and polychlorinated dibenzofuran (furan), which is evaluated by estimating the 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxic equivalent (TEQ), and arsenic.

As presented in the Baseline Human Health and Ecological Risk Assessment, the individual aquatic AOI evaluations indicate the hazard index (HI) for each pond is less than 1; a hazard index of 1 or less means estimated exposure to the contaminant at the screening level over a lifetime is not expected to cause harmful, noncancer health effects. This evaluation assumes a passive recreational visitor with an exposure frequency of 50 days per year with a dermal absorption and incidental ingestion period of 24 hours per day (meaning a person ignores fencing and/or signage restricting access to the ponds and enters the pond, and therefore comes into contact with pond sediment, at a frequency of 50 days each year, experiencing exposure to sediment for 24 hours while in and after leaving the pond, for a lifetime). Exposure scenario details are included in the OU-E BHHERA. Aquatic elevated lifetime cancer risks (ELCRs) for the passive recreational visitor, as analyzed on an individual pond basis, ranged from less than 1 x 10-6 (Ponds 5 and 9, individually) to 2 x 10-5 (Pond 7) and are all within the risk management range of 1 x 10-4 to 1 x 10-6 established in the NCP (40 CFR 300.430; NCP 2014) and by CalEPA (CalEPA 1996a). The Ecological Risk Assessment (ERA) contained within the BHHERA for the aquatic AOIs concluded that unacceptable risks are not expected for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to COCs in sediment (Arcadis 2015).

Exposure is also limited by physical access restrictions required by the Site Order, which separate visitors from the ponds, located on private property. Active recreation physically within the ponds is not an anticipated future use as there is no accessible open water; environmentally sensitive habitat areas, such as wetlands, within the coastal zone are protected; and the ponds are not attractive for trespassers. Evidence of trespassing within OU-E indicates access to the beach and ocean west of the OU-E lowland. No specific evidence of trespass within OU-E ponds has been observed. Fencing installed by the City of Fort Bragg during construction of the coastal trail separates the OU-E Lowland and Ponds 6, 7, 8, and North in a group from the central section of the coastal trail. A combination of city-installed fencing and pre-existing facility fencing surrounds the central area of the Site including the South Ponds. Damage to Site fencing may occur due to weathering of steel mesh in the saline marine environment; climbing or jumping wildlife such as deer, coyote, and other small mammals observed ranging across fenced areas at the Site; or due to illegal trespassing. Damaged fence material may indicate but is not necessarily always related to human access. Regular fenceline inspection and repair are currently ongoing and will continue as needed to maintain access restrictions. Fencing inspection and repair activities have been added to monthly status reports to communicate findings and follow up actions with DTSC. Some locations of deliberately damaged fence suggest the beach at Fort Bragg Landing as a primary trespasser target rather than Site ponds.

In addition to fencing, the ponds are surrounded by, and the sediment is covered by, thick, difficult to penetrate vegetation. Open water for recreation or wading is not accessible and the Ponds do not present as inviting environments for recreation or casual access. Ponds 6, 7, and North are relatively smaller (less than 7,500 square feet each) and are further isolated from contact by steep sheet pile or timber crib edging, steep natural slopes, or in the case of the south side of Pond 7, the face of the Mill Pond Dam. The South Ponds are relatively larger ranging from approximately 4,500 square feet to 50,000 square feet and are surrounded by steep slopes, berms, and dense vegetation. Pond 8 is the largest pond at 318,000 square feet (7.3 acres) and is surrounded by a combination of timber crib, sheet pile, concrete foundations, and steep vegetated slopes.

Hot spots identified in the OU-E BHHERA were removed in 2017. The BHHERA defined hot spots based on a comparison of soil/sediment data to not-to-exceed (NTE) values, approved by DTSC (Arcadis 2015, 2016; DTSC 2014). The OU-E Removal Action Work Plan (OU-E RAW; Arcadis 2016) was developed to expedite remediation of identified AOIs/AOCs to facilitate construction of the City's coastal trail and expedite remediation of the Site. The AOIs/AOCs included in the OU-E RAW were the Lowland Terrestrial AOI, the Ponds 1, 2, 3, and 4 (Southern Ponds) AOC, the Riparian AOI, and the Pond 7 AOC. The OU-E RAW included an evaluation of remedial alternatives and proposed excavation and disposal as the selected remedial action. The NTE values defined target concentrations for the hot spot excavations; if confirmation sampling indicated residual concentrations were below the NTE value, excavation was complete, but if confirmation sample results were greater than the NTE value a step out excavation was completed. The NTE value represented a value protective of the 12-day passive child/adult recreator for sediment where, if concentrations were below that value, concentrations did not represent unacceptable risk to human health and could remain in place. The Arsenic NTE value was 67 milligrams per kilogram (mg/kg); the dioxin TEQ value was 503 picograms per gram (pg/g). The OU-E RAW and, therefore, the excavation and disposal remedial alternative, was approved by DTSC on 13 October 2016 (DTSC 2016). A summary of completed activities is presented in the Final Remedial Action Completion Report (RACR; Kennedy Jenks 2018, DTSC 2018).The RACR documented transport of non-hazardous soil and sediment generated during the 2017 removal action to the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, for use as alternative daily cover. California hazardous soil generated from lead excavations was transported to the Kettleman Hills Landfill in Kettleman City, California (Kennedy Jenks 2018). The Lowland Terrestrial Soil AOI and its four associated AOIs and the Riparian AOI were recommended for No Further Action (NFA) in the 2018 RACR, which was approved by DTSC (DTSC 2018).

Additional sediment sampling activities were completed in 2019 in Pond 6, North Pond, and Pond 8 per DTSC request. The results were summarized in the Pond 6, North Pond, and Pond 8 Sediment Sampling Report (Kennedy Jenks 2020a), which was approved by DTSC on 26 May 2020 (DTSC 2020a). Data collected was consistent with or lower than past results. The report concluded that the additional data continued to support the remedial alternative recommended in the 2019 OU-E FS. The comprehensive data set was used to calculate the 95% upper confidence limit on the mean (95% UCL) of the Pond 8 and combined lowland pond datasets, independent of exposure depth intervals. Comprehensive 95% UCLs were of interest during DTSC evaluation of potential risks from combined lowland ponds, collectively protected by the beach berm and individual sections of Pond 8 proposed to be segregated in the OU-E FS. Information about comprehensive sediment 95% UCL concentrations is presented below.

In a letter dated December 8, 2020, Ponds 5 and 9 AOIs were approved for NFA by DTSC (DTSC 2020b).

As described in the 2019 OU-E FS, the AOIs have been grouped into AOCs by media (lowland terrestrial, aquatic, and groundwater) and by nature and extent of constituents. The AOI/AOC locations and site features are shown on Figure 1-3. The additional alternatives evaluated in this FS Addendum are relevant for the following AOCs:

- Pond 7 Aquatic Sediment
- North Pond and Pond 6 Aquatic Sediment
- Pond 8 Aquatic Sediment

1.1.2 Ponds

The following sections provide pond descriptions, risk summaries, and removal action areas (RAAs) for Pond 7, the North Pond, Pond 6, and Pond 8. The OU-E RAW evaluated risk, presented estimated areas and volumes for excavation, and evaluated the selected remedial action for aquatic sediment in Pond 7. For aquatic AOCs, RAAs were developed based on risk drivers identified in the OU-E BHHERA. Additional information is provided in the 2019 OU-E FS and the Final Remedial Action Completion Report (RACR; Kennedy Jenks 2018).

An exposure point concentration (EPC) was calculated for a combined Pond 6, Pond 7, and North Pond dataset and west and east segments of Pond 8 and presented in the Pond 6, North Pond, and Pond 8 Sediment Sampling Report (Kennedy Jenks 2020a). For sediment at all depths, Pond 8 arsenic 95% UCLs were 12 mg/kg in Pond 8 West, 9.1 mg/kg in Pond 8 East, and 9.7 mg/kg for the pond as a whole, compared with the 10 mg/kg unrestricted goal and the 0.6-to-31-mg/kg background range. Dioxin TEQ 95% UCLs were 58 pg/g in Pond 8 West, 142 pg/g in Pond 8 East, and 107 pg/g for the pond as a whole; these values exceed the 50-pg/g unrestricted/residential cleanup goal but are below the 200-pg/g commercial/industrial cleanup goal and the 503-pg/g NTE sediment goal protective of the 12-day recreator. For the combined Pond 6, Pond 7, and North Pond dataset, the arsenic 95% UCL was 25 mg/kg, which exceeds the 10-mg/kg remedial goal but is within the background range, and the dioxin TEQ EPC was 109 pg/g, which exceeds the 50-pg/g residential screening level but is below the 200-pg/g commercial/industrial screening level and the 503-pg/g NTE sediment goal (Kennedy Jenks 2020b).

The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to site sediment and surface water.

1.1.2.1 Pond 7

Pond 7 (5,000 square feet) is located in the OU-E Lowlands and was part of active mill operations from the mid-1970s until 1996.

1.1.2.1.1 Risk Summary

Pond 7 was evaluated as an individual aquatic AOI in the OU-E BHHERA. Arsenic and dioxin TEQ were identified as the primary risk contributors through incidental ingestion of sediment. For the passive recreational visitor, the cumulative noncancer hazard index (HI) was less than 1 for both the 0-to-0.5-foot and 0-to-2-foot below-sediment-surface exposure intervals. The cumulative excess lifetime cancer risk (ELCR) was 2 x 10-5 for each interval, assuming exposure 50 days per year. The ELCR estimates exceed 1 x

10-6 but are within the NCP and CalEPA risk management range of 1 x 10-6 to 1 x 10-4. Dioxin TEQ was the principal contributor to the cumulative cancer risk.

As documented in the RACR, the 2017 removal action excavated Pond 7 sediment across the pond footprint and placed approximately 3 feet of clean fill after excavation. Excavation removed the sediment targeted by the OU-E RAW leaving material in place at the pond bottom and along the pond edges at concentrations above unrestricted use goals but below the not-to-exceed clean up goal. Post-excavation confirmation samples contained dioxin TEQ at 93 to 350 pg/g and arsenic at 11 to 61 mg/kg. Dioxin concentrations were above the 50 pg/g unrestricted-use goal but below the 503 pg/g not-to-exceed criterion. Arsenic concentrations were above the 10 mg/kg unrestricted use goal but below the 67 mg/kg not-to-exceed criterion. The excavated pond footprint was backfilled with clean fill (Kennedy Jenks 2018).

The reduction of the quantity and accessibility of sediment containing dioxins and arsenic in Pond 7 is a material factor in evaluating potential exposure and risk from residual materials. Though residual concentrations of dioxins and arsenic remain along a narrow strip along the south edge adjacent to the Mill Pond Dam and in residuals on or amid concrete, steel, and wooden crib materials along the west, north, and east edges, additional soil and sediment could not be practically removed because they were not accessible. Sediment remaining along the south edge of the pond was not reachable by large excavation equipment for removal and samples were collected by attaching clean PVC pipe to the excavator bucket to collect bulk material for a subsample. Samples along the west, north, and east edges of Pond 7 were collected with the excavator bucket or pole-mounted sampling tools from along pond walls made of concrete, steel, and timber cribbing. Pond 7 is located south of the wetland area established as mitigation for 2017 temporary wetland disturbance. Access to this area is difficult from a practical standpoint and restricted to protect environmentally sensitive habitat areas.

Recreation physically within Pond 7 is not an anticipated future use as there is no accessible open water; environmentally sensitive habitat areas, such as wetlands, are protected within the coastal zone; and Pond 7 is not attractive for trespassers. Evidence of trespassing within OU-E indicates access to the beach and ocean west of Pond 7. No specific evidence of trespass within Pond 7 has been observed. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to site sediment and surface water.

1.1.2.1.2 Removal Action Area and Remedial Alternative Development

Prior to Pond 7 sediment removal in 2017, water depth was typically 6 ft and sediment was approximately 7 ft thick. Currently, water is approximately 10 ft deep, and approximately 3 ft of fill was placed in Pond 7 following excavation activities. The surrounding land surface is approximately 2 ft above the observed water level and has been modified as a created wetland as mitigation for temporary disturbance during 2017 activities.

Post-excavation confirmation samples were collected, as described in the RACR. Confirmation samples indicate residual dioxin TEQ concentrations (between 93 and 350 pg/g) above the unrestricted use goal (50 pg/g) but below the NTE sediment goals established in the OU-E RAW (503 pg/g) as protective of the 12-day recreator for sediment (Arcadis 2016). Additional excavation was not feasible (Kennedy Jenks 2018).

The area where concentrations remain above unrestricted use goals is assumed as the new remedial action area (RAA) for Pond 7 (results of remediation activities and confirmation samples are presented in the RACR). An area of approximately 5 ft wide and 180 ft long along the south perimeter of the pond where

concentrations remain above unrestricted use goals is assumed as the new RAA for Pond 7. The north wall of Pond 7 includes steel sheet pile and timber cribbing that defines the Pond limit to the North. Samples containing arsenic above unrestricted use goals collected from the north wall represent residual material adhered to or in gaps between steel or wood features and are not expected to represent measurable sediment volumes overall. Assuming a depth of approximately 5 ft, it is estimated that approximately 170 cubic yards (CY) of sediment containing COCs above unrestricted cleanup goals remains in Pond 7.

The approximate limits of the 2017 removal action, representative post-removal sediment results, and the area considered for additional excavation under the removal alternative are shown on Figure 1-4.

1.1.2.2 Pond 6 and North Pond

The North Pond (0.06 acres) and Pond 6 (0.17 acres) are located in the OU-E Lowlands, north of Pond 7.

1.1.2.2.1 Risk Summary

The OU-E BHHERA identified arsenic and dioxin TEQ as the primary risk contributors in Pond 6 sediment and arsenic as the primary risk contributor in North Pond sediment. For the passive recreational visitor, cumulative noncancer HIs for Pond 6 and North Pond were less than 1. The cumulative ELCR for Pond 6 ranged from 3 x 10-6 to 4 x 10-6 across the evaluated sediment intervals, and the cumulative ELCR for North Pond was 2 x 10-6. These estimates exceed 1 x 10-6 but are within the NCP and CalEPA risk management range of 1 x 10-6 to 1 x 10-4.

The Pond 6 arsenic EPC in the 0 to 0.5 ft bss interval is 37.2 mg/kg (equal to the maximum detected concentration of arsenic in Pond 6) and in the 0 to 2-ft bss range is 28.2 mg/kg; these EPCs are less than the NTE sediment goal for arsenic established in the OU-E RAW (67 mg/kg) as protective of the 12-day recreator (Arcadis 2016). The dioxin TEQ EPC is 175 pg/g in both the 0 to 0.5 ft bss and 0 to 2 ft bss intervals; this is less than the NTE sediment goal for dioxin TEQ established in the OU-E RAW (503 pg/g) as protective of the 12-day recreator (Arcadis 2016). At the North Pond, the EPC and maximum concentration of arsenic is 103 mg/kg (EPC equal to maximum in North Pond), which is greater than the NTE sediment goal for arsenic established in the OU-E RAW.

Recreation physically within Pond 6 and the North Pond is not an anticipated future use as there is no accessible open water; environmentally sensitive habitat areas, such as wetlands, are protected within the coastal zone; and Pond 6 and the North Pond are not attractive for trespassers. Evidence of trespassing within OU-E indicates access to the beach and ocean west of Pond 6 and the North Pond. No specific evidence of trespass within Pond 6 and the North Pond has been observed. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, birds, mammals and amphibians exposed to site sediment and surface water.

1.1.2.2.2 Removal Action Area and Remedial Alternative Development

In the North Pond, the maximum water depth is typically 1.5 ft and sediment is approximately 8.5 ft thick. In Pond 6, the maximum water depth is typically 2 ft and sediment is approximately 10 ft thick. The surrounding land surface is approximately 3 ft above the observed water.

The site-specific sediment dataset, including the 2019 sampling results, indicates that arsenic concentrations in Pond 6 and North Pond are generally highest at depths less than 5 ft. In Pond 6, the arsenic EPCs were 37.2 mg/kg for the 0- to 0.5-ft interval and 28.2 mg/kg for the 0- to 2-ft interval, and the dioxin TEQ EPC

was 175 pg/g for both intervals. For the combined Pond 6, Pond 7, and North Pond dataset evaluated following the 2019 sampling, the arsenic EPC was 25 mg/kg and the dioxin TEQ EPC was 109 pg/g (Kennedy Jenks 2020a). These results, together with the depth-discrete concentration profile showing the highest arsenic concentrations in the upper 5 ft, support using a 6-ft target depth, including a 1-foot buffer for remedial alternative volume development across the pond footprints. The areas used for remedial alternative development are approximately 3,000 square feet for North Pond and 7,000 square feet for Pond 6. Applying a 6-ft depth, including a 1-foot buffer to the combined 10,000-square-foot area yields approximately 2,222 cubic yards, rounded to 2,200 cubic yards, of sediment containing COCs above unrestricted cleanup goals in North Pond and Pond 6.

The locations of Pond 6 and North Pond and the approximate areas evaluated under the additional excavation alternative are shown on Figure 1-5.

1.1.2.3 Pond 8

Pond 8 (7.3 acres, 318,000 square feet), also known as the Log Pond or Mill Pond, was created in the late 1800s by the damming of Alder and Maple Creeks. Pond 8 receives stormwater runoff from the Site and the City as well as overflow from Pond 5. Water from Pond 8 discharges over the dam spillway to the beach adjacent to Fort Bragg Landing. The total contributing watershed to Pond 8 is approximately 417 acres, consisting of 190 acres (including Pond 8) within the Mill Site property and 227 acres outside the Mill Site property (related to stormwater management for the City). Total direct rainfall to the surface of the pond is less than 2 percent (%) of the total inflow to the pond.

1.1.2.3.1 Risk Summary

The OU-E BHHERA identified arsenic and dioxin TEQ as the primary risk contributors through incidental ingestion of Pond 8 sediment. For the passive recreational visitor, the cumulative noncancer HI was less than 1 for both the 0-to-0.5-foot and 0-to-2-foot below-sediment-surface exposure intervals. The cumulative ELCR was 2 x 10-6 for each interval, assuming exposure 50 days per year. The estimates exceed 1 x 10-6 but are within the NCP and CalEPA risk management range of 1 x 10-6 to 1 x 10-4.

Recreation physically within Pond 8 is not an anticipated future use as there is no accessible open water; environmentally sensitive habitat areas, such as wetlands, are protected within the coastal zone; and Pond 8 is not attractive for trespassers. Evidence of trespassing within OU-E indicates access to the beach and ocean northwest of Pond 8. No specific evidence of trespass within Pond 8 has been observed. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, birds, mammals and amphibians exposed to site sediment and surface water.

While the OU-E BHHERA findings indicated dioxin does not pose an unacceptable risk based on the expected future use for Pond 8, the pond does not meet the criteria for unrestricted use. The dioxins TEQ EPCs (110 pg/g in 0 to 2 ft bss; 118 pg/g in 0 to 0.5 ft bss) are above the California residential screening level of 50 pg/g, but less than the NTE sediment goal for dioxin TEQ established in the OU-E RAW (503 pg/g) as protective of the 12-day recreator (Arcadis 2016) and below the commercial/industrial screening level of 200 pg/g. The maximum concentration of dioxin TEQ in Pond 8 is 243 pg/g, which is less than the NTE sediment goal for dioxin TEQ established in the OU-E RAW (503 pg/g) as protective of the 12-day recreator. Arsenic EPCs ranged from 11.2 mg/kg (0 – 2 ft bss) to 12.3 mg/kg (0 – 0.5 ft bss), which are similar to the background screening criteria for arsenic in soil (10 mg/kg) and below the NTE sediment goal for

arsenic established in the OU-E RAW (67 mg/kg) as protective of the 12-day recreator (Arcadis 2016). As presented in the Background Metals Report, background concentrations of arsenic in California soil range from 0.6 mg/kg to 31 mg/kg (Arcadis BBL 2007b).

The results presented in the BHHRA for Pond 8 are mitigated by the following factors:

- From a practical standpoint, human exposure to the Pond 8 sediments for any duration is unlikely and remote due to site-specific factors that discourage access such as barrier fencing, dense vegetation, steep banks, and cold surface water and air temperatures for much of the year. Damage to wire fencing is periodically evident and may be related to illegal trespass. Fenceline inspections and repairs are ongoing to maintain access restrictions. The locations of damaged fence suggest the beach at Fort Bragg Landing as the primary trespasser target rather than Pond 8. Potential future restrictions on boating, swimming, wading, fishing, and other active recreation in Pond 8 for the protection of public safety from physical hazards such as drowning and entrapment in deep, soft sediment and the protection of wildlife are also consistent with a more limited estimate of exposure.
- From a risk analysis standpoint, arsenic concentrations in Pond 8 are comparable to background; arsenic ELCRs are not associated with site conditions for the Pond 8 AOC. When the Pond 8 occasional recreator is evaluated without considering background arsenic exposures, the resulting cumulative ELCR in Pond 8 is 1 x 10-6 [equal to the low end of the risk management range of 1 x 10-4 to 1 x 10-6 established in the NCP (40 CFR 300.430; NCP 2014) and by CalEPA (CalEPA 1996a)].
- The range of COC concentrations in Pond 8 is generally similar in magnitude throughout the pond, but decrease within that range to the west, where water is shallowest. Concentrations increase toward the east where the discharges from Alder and Maple Creeks enter the pond and water is deepest.
- Additional samples were collected in 2019 (Kennedy Jenks 2020a). Arsenic 95% UCLs for Pond 8 West (12 mg/kg), Pond 8 East (9.1 mg/kg), and Pond 8 as a whole (9.7 mg/kg) are approximately equal to the 10-mg/kg remedial goal. The dioxin TEQ EPC is 58 pg/g in Pond 8 West and 142 pg/g in Pond 8 East. The 95% UCL for the full-depth Pond 8 sediment dataset is 107 pg/g. The107-pg/g 95% UCL exceeds the California residential screening level of 50 pg/g but is below the 200-pg/g commercial/industrial screening level and the 503-pg/g NTE sediment goal established in the OU-E RAW (Arcadis 2016).

1.1.2.3.2 Removal Action Area and Remedial Alternative Development

In Pond 8, the water depth is typically less than 1 ft in the west and up to approximately 5 ft in the east, and sediments range from approximately 6 ft to 24 ft thick. The top of the dam and surrounding land surface is approximately 10 ft above the observed water surface. While concentrations of dioxin in the pond are generally highest in the east near the storm drain outfalls and lowest in the west close to the ocean, significant variability is not observed laterally or vertically, particularly as compared to the screening levels, and no discernable patterns are observed.

Pond 8 has an overall footprint of approximately 7.3 acres, or 318,000 square feet. Based on the area exceeding remedial goals and the relative uniformity of sediment quality, the area used for remedial alternative development is the entire 318,000 square feet. Sediment thickness ranges from approximately 6 to 24 feet and is typically on the order of 10 feet on average. The total volume of sediment within the

remedial area is estimated to be approximately 106,000 cubic yards based on an analysis of bottom and top of pond sediment surfaces developed from sediment thickness measurements.

The Pond 8 footprint and the approximate Pond 8 West and Pond 8 East areas used in developing the additional remedial alternatives are shown on Figure 1-5.

1.1.3 Evaluation Approach

The additional alternatives included in this FS Addendum will be evaluated consistent with the approach taken in the 2019 OU-E FS. The approach generally follows the process outlined below:

- Definition of the objectives and requirements of remediation (Section 3 of the 2019 OU-E FS)
- Identification and screening of remedial technologies and process options (Section 5 of the 2019 OU-E FS)
- Identification of screening criteria (Section 6 of the 2019 OU-E FS)
- Further development and evaluation of the remedial alternatives retained for consideration after the above steps (Section 7 of the 2019 OU-E FS).

A brief description of these steps is provided in the following sections. Additional information on the evaluation approach is provided in the 2019 OU-E FS.

1.1.3.1 Objectives and Requirements of Remediation

The objectives and requirements of remediation were presented in Section 3 of the 2019 OU-E FS and have not changed. These objectives and requirements drive the development and screening of remedial alternatives and are briefly summarized in the following sections.

- **Applicable or Relevant and Appropriate Requirements (ARARs):** As required by CERCLA, ARARs include chemical-specific ARARs, performance, design, or action-specific ARARs, and location-specific ARARs. Some requirements are called to-be-considered (TBC) criteria; the TBC requirements are non-promulgated advisories or guidance issued by federal, state, or local government that are not legally binding, but may provide useful information or recommend procedures for remedial action.

  ARARs were presented in Table 3-1 of the 2019 OU-E FS. A table presenting ARARs in more detail was provided to DTSC in July 2024 (Kennedy Jenks 2024); DTSC subsequently provided the ARARs table to the California Coastal Commission (CCC), the City, the California Division of Safety of Dams (DSOD), the California Department of Fish and Wildlife (CA DFW), National Oceanic and Atmospheric Administration (NOAA), the United States Army Corps of Engineers (USACE), the Sherwood Valley Band of Pomo Indians, and the North Coast Regional Water Quality Control Board (RWQCB). To date, feedback has been received from DTSC, CCC, the City, the Sherwood Valley Band of Pomo Indians (through DTSC), and the RWQCB; DSOD acknowledged receipt. In a letter dated May 8, 2023, DSOD accepted concepts included in the 60% design drawings.
- **Remedial Action Objectives (RAOs):** RAOs are medium-specific goals for protecting human health and the environment that, in consideration with the estimated remedial scope and cost for screening alternatives and existing data, are used to define the scope of remediation work. The applicable sediment RAO from the 2019 OU-E FS has not changed and is:

Prevent the ingestion of and incidental contact with chemicals of concern in sediments that exceed Remedial Goals established in the RAP by future users of the former Mill Site. The relevant human exposure pathways for the passive recreator receptor in the aquatic area included: incidental sediment ingestion, dermal contact with sediment, and contact with surface water.

- **Chemical-Specific Remedial Goals:** Remedial goals were defined for arsenic and dioxin TEQ in sediment in Table 3-2 of the 2019 OU-E FS are listed below.
  - Arsenic: 10 mg/kg.
  - Dioxin TEQ: 50 pg/g.

1.1.3.2 Identification and Screening of Remedial Technologies and Process Options

Identification and screening of general response actions (GRAs), remedial technologies, and process options were presented in Section 5 of the 2019 OU-E FS. and include:

- No action
- ICs
- Containment
- In-situ treatment
- Ex-situ treatment
- Removal

No new GRAs or technologies are identified or evaluated in the OU-E FS Addendum. The same GRAs and technologies are applied using different footprints or construction approaches. Process options are first screened based on technical implementability. The screening for technical implementability is based on 1) the site-specific RAOs and ARARs, 2) site-specific conditions, such as geologic setting and contaminant distribution, and 3) contaminant characteristics. During the preliminary identification and screening process, remedial technologies that cannot be technically implemented are eliminated from further evaluation. If retained after the first screening step, the technology and/or process option is further evaluated and refined based on effectiveness, implementability, and relative cost. Remedial technologies or process options retained after both screening steps are developed into remedial alternatives and evaluated against screening criteria, as presented in Section 7 of the 2019 OU-E FS. The remedial technologies and process options considered previously are summarized in Section 2.1. The remedial technologies and process options associated with new alternatives are presented in Section 2.2. The effectiveness, implementability, and relative cost of no action, ICs, containment, in-situ treatment, ex-situ treatment, and removal and disposal are unchanged from the original analysis, though may apply to different areas, volumes, or locations of sediment.

1.1.3.3 Screening Criteria

Remedial alternative screening criteria were presented in the 2019 OU-E FS and have not changed for this FS Addendum. In accordance with USEPA FS and DTSC RAP guidance, the nine criteria listed below must be used to evaluate remedial alternatives (USEPA 1988; DTSC 1995). For an alternative to be selected, it must meet the first two threshold criteria, which are: 1) overall protection of human health and the environment; and 2) compliance with ARARs. Criteria 3 through 7 are the five primary balancing criteria that provide

comparisons between the alternatives and identify tradeoffs between them; Criteria 8 and 9 are the two modifying criteria that consider acceptance by the state and local community.

1.1.3.3.1 Threshold Screening Criteria

Threshold screening criteria are those considered absolutely necessary for an alternative to be considered sound. Threshold criteria are typically considered "yes or no" criteria. If a screened technology fails a threshold criterion, the technology is considered as not viable for further consideration. The two threshold criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs

As requested by DTSC, potential climate change impacts and sea level rise are considered in the evaluation of the alternatives to confirm overall protection of human health and the environment under future conditions (Kennedy Jenks 2025a).

1.1.3.3.1.1 Sea-Level-Rise Evaluation

The Fort Bragg Landing local coastal setting is materially different from an exposed, open-coast shoreline. Shallow nearshore bathymetry, an offshore bar, and rocky margins cause large waves to break seaward of the shoreline adjacent to the Mill Pond Dam. Environmental Science Associates (ESA) performed a site-specific wave study to support the 60% design of the rock slope protection (RSP) element of the Mill Pond Dam modifications, including RSP material sizing. The wave study provides technical basis for the 1%-annual-exceedance still-water elevation, wave setup, breaking-wave heights, and tsunami runup that result in selection of rock in the 8-ton Caltrans material size category. The wave study uses older guidance values for sea level rise of between 5.4 and 6.7 feet. Revised sea-level-rise increments selected based on the October 2024 DTSC Sea Level Rise Guidance include the 2100 Intermediate-High increment of 4.5 feet as a low end and the 2100 High increment of 6.4 feet as a high end for long-term planning. Therefore, the current design for the RSP already accounts for sea-level rise in a range greater than indicated by DTSC guidance. The current mean high-tide-line elevation used for jurisdictional evaluation is 5.38 feet NAVD88 and the toe of the bluff, Mill Pond Dam, and beach berm are between approximately 6 and 10 feet NAVD88 based on topographic surveys included in the 60% design. Based on conservative assumptions, sea levels remain well below the top of both the beach berm elevation of 20 feet NAVD88 and the Mill Pond Dam crest of 43 feet NAVD88. With a selected design wave breaker height of 7.8 feet, design of the RSP at the Mill Pond Dam remains suitable in the range of evaluated sea-level rise and overtopping of the beach berm is not indicated unless multiple conservative assumptions of king tides and extreme wave setup and height occur simultaneously after the most conservative assumptions about sea-level rise are observed.

ESA separately evaluated the Maximum Considered Tsunami, defined as a tsunami with a 2% probability of being exceeded in a 50-year period, equivalent to a 2,475-year mean recurrence interval, using the ASCE 7-16 energy-grade-line method. Inundation water level of 33.2 feet NAVD88 is estimated for existing conditions. Applying the 4.5-foot and 6.4-foot sea-level-rise cases yields 37.7 and 39.6 feet NAVD88 respectively. Conservative estimates of tsunami run up do not exceed the 43-foot NAVD88 Mill Pond Dam crest. This elevation would overtop the lowest portion of the beach berm west of Pond 6, at an elevation of approximately 20-feet NAVD88. Overtopping of the beach berm does not alone indicate potential failure of the berm or release of sediment. Further, a tsunami of this nature would likely affect parts of the City of

Fort Bragg Waste Water Treatment Plant, the entirety of Noyo Harbor, and many other facilities with greater potential for environmental damage.

1.1.3.3.1.2 Groundwater Evaluation

Groundwater is not directly exposed to sea-level rise because it lies landward of the Beach Berm and Mill Pond Dam. Sea-level rise can, however, raise the coastal groundwater boundary, increase groundwater elevations, extend saline influence inland, and reduce discharge gradients. Groundwater elevations in the westernmost well in the OU-E lowland are the lowest at the Site and in the range of19 – 20 feet NAVD88. Based on recent monitoring data, COCs are below cleanup goals in the western portion of the OU-E lowland. OU-E groundwater wells monitored for petroleum hydrocarbons in the eastern portion of the Site have groundwater elevations in the range of 40 – 50 feet NAVD88. Groundwater elevations to the north and south of OU-E wells range in elevation from 60 to 80 feet NAVD88, indicating driving potentiometric head toward OU-E wells that is unlikely to be strongly influenced by differences at the shoreline. While a change of up to 6.4 feet in sea level would reduce the overall gradient from Site wells, a change in groundwater flow direction is not expected. Gradients would decrease from current conditions, potentially reducing groundwater flow and velocity; however, groundwater elevations are not observed to be strongly influenced by tidal action, indicating effects of sea-levels during current conditions attenuate at the distances and elevations of monitoring wells.

1.1.3.3.2 Balancing Criteria

Balancing criteria represent a combination of technical measures and management controls for addressing the environmental issues at the Site. The five balancing criteria are:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

1.1.3.3.3 Modifying Criteria

Modifying criteria, which include state (support agency) and community acceptance, will be evaluated after submission of the FS Addendum to DTSC and submittal of a RAP and receipt of public comments. The modifying criteria are:

- State support/agency acceptance
- Community acceptance
- Other criteria[1]

[1] As described in the 2019 OU-E FS, California Health and Safety Code Section 25356.1(d) also outlines six additional criteria, which need to be addressed for the recommended remedial alternative. As these criteria are addressed within the nine USEPA criteria, a separate analysis has not been conducted.

1.1.4 Additional Project Objectives

In addition to CERCLA criteria for evaluating remedial alternatives, there are other objectives that must be considered when evaluating a comprehensive project to address aquatic sediment in OU-E. Ultimately, a project must be identified to address two agency requirements related to long-existing ponds at the Mill Site: 1) manage human health and environmental risk due to arsenic and dioxins/furans in Pond 6, Pond 7, Pond 8, Southern Ponds (Ponds 1-4), and North Pond sediment and petroleum hydrocarbons and arsenic in OU-E groundwater-[1] (DTSC), and 2) maintain safe operation of the Mill Pond Dam such that sediment and water are retained in the impoundment during and following a seismic event (DSOD). Separately, a project is needed to manage human health and environmental risk due to petroleum hydrocarbons and arsenic in OU-E groundwater (DTSC).

As presented in the 30 August 2024 letter (Mendocino Railway 2024c) and discussed in the December 2024 meeting with agencies, project objectives include the following:

- Control the public's exposure, including trespassers or occasional recreators, to incidental ingestion of dioxins/furans in pond sediments.
- Control the public's exposure, including trespassers or occasional recreators, to incidental ingestion of petroleum hydrocarbons and arsenic in groundwater.
- Control migration of arsenic and dioxins/furans in pond sediment.
- Retention of stormwater management and treatment functions currently provided by Pond 8, if feasible.
- Control risk to public safety due to loss of containment of water and sediment at the existing Mill Pond Dam, a structural component of Pond 8, due to seismic activity, sea level rise, tsunami, and/or episodic, short-term or long-term erosion events.
- Improve safety and reduce risk of dam failure and associated environmental or economic losses by modifying the existing Mill Pond Dam so that it no longer falls within DSOD jurisdictional risk thresholds.
- Meet and balance laws, regulations and policies, and agency requirements, to identify a feasible project that meets the above project objectives.

Project objectives to control exposure to sediment and groundwater are evaluated in the context of the current and anticipated future use. The Mill Pond Dam, Pond 6, Pond 7, Pond 8, the Southern Ponds (Ponds 1-4), North Pond, and groundwater are currently and expected to remain on private property with restricted access, public recreation within the ponds is not allowed. Due to City restrictions on groundwater use and concerns for saltwater intrusion, groundwater use from OU-E is not anticipated and therefore exposure to OU-E groundwater is not anticipated.

[1] As reported in prior project documents, including the 2019 OU-E FS, barium was included as a groundwater COC for the OU-E Lowlands due to detections in MW-4.1 only. As reported in the Five-Year Review Report, barium concentrations in MW-4.1 consistently meet the barium remedial goal as of the March 2023 groundwater monitoring event (Kennedy Jenks 2025). Accordingly, barium is no longer a COC for OU-E groundwater.

1.2 Objectives

The purpose of this FS Addendum is to develop and evaluate additional remedial alternatives for OU-E, as requested by DTSC in letters dated 27 December 2022 (DTSC 2022), 28 March 2024 (DTSC 2024a), and 16 May 2024 (DTSC 2024b), such that relevant information concerning the remedial action options can be presented and an appropriate remedy selected. A draft list of alternatives was submitted to DTSC in a letter dated 30 August 2024 (Mendocino Railway 2024c), and these alternatives were discussed with the California Coastal Commission (CCC), the City, the DTSC, DSOD, and the Regional Water Quality Control Board (RWQCB) in a meeting on 17 December 2024. Discussion in the December 2024 meeting was documented in meeting minutes (Kennedy Jenks 2025a).

Consistent with the December 2024 meeting minutes (Kennedy Jenks 2025a) and February 2025 letter (Mendocino Railway 2025), the additional remedial alternatives to be evaluated in this FS Addendum consist of the following:

- Excavation and filling of Pond 8 west, disposal of excavated sediment, and dam modifications
- Institutional controls with dam modifications, including north dam improvements, cutoff wall, and rock slope protection on the interior of Pond 8 at the crib wall
- Institutional controls with dam modifications, including north dam improvements, cutoff wall, and a seawall at the crib wall

1.3 Report Organization

The remainder of this FS Addendum is organized as follows:

Section 2: Identification and Screening of Remedial Technologies and Process Options evaluates the effectiveness, implementability, and cost-effectiveness of potential technologies associated with the additional alternatives to be evaluated and screens for further analysis.

Section 3: Development and Evaluation of Remedial Alternatives develops remedial alternatives for select aquatic sediment areas (North Pond and Pond 6, Pond 7, and Pond 8) and evaluates against the screening criteria. Remedial alternatives are compared and a preferred alternative is selected, per area.

Section 4: Summary of Recommended Remedial Alternatives summarizes the preferred alternative for the North Pond and Pond 6 AOC, Pond 7 AOC, and Pond 8 AOC.

Section 5: References presents the references cited throughout this report. Table 3-1: Comparison of Remedial Alternatives (Updated Table 7-1, 2019 FS)

Table 4-1: Remedial Alternative Recommendations Summary (Updated Table 8-1, 2019 FS)

Figure 1-1: Site Location Map

Figure 1-2: Operable Units Location Map

Figure 1-3: Ou-E Area of Interest Map and Associated Features

Figure 1-4: Pond 7 Removal Alternative

Figure 1-5: Ponds 6, 7, 8, and North Pond Removal Alternative Area

Figure 1-6: Ponds 1 – 4 (South Ponds) Removal Alternative Area

Appendix A: Cost Summary Tables for Sediment Remediation Alternatives (Updated Appendix A, 2019 OU-E Fs)

2. IDENTIFICATION AND SCREENING OF ADDITIONAL REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Remedial technologies and process options were formally identified and screened in the 2019 OU-E FS. As discussed in Section 1, DTSC has since requested evaluation of additional remedial alternatives. A summary of previously considered remedial alternatives and descriptions of new alternatives are provided in the following sections.

2.1 Creek Daylighting

DTSC and community feedback has highlighted the concept of "creek daylighting." A narrative is provided herein to address this topic.

Future daylighting of Alder Creek and Maple Creek along their former drainage alignments is feasible with each remedial alternative evaluated in this FS Addendum and is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans.

As discussed in the December 2024 meeting (documented in meeting minutes; Kennedy Jenks 2025a), creek daylighting and restoration are not remedial technologies or process options and therefore do not address COCs in pond sediment. In the context of this feasibility study and addendum effort, where the objective is selection of an appropriate and effective remedial technology for managing dioxins/furans in OU-E aquatic sediment, the potential for creek daylighting will be considered under the Community Acceptance modifying criterion.

2.2 Alternatives Evaluated in 2019 OU-E Feasibility Study

As presented in the 2019 OU-E FS, General Response Actions (GRAs) were developed for sediment. GRAs are categories of actions that, when implemented, will allow meeting of RAOs established for the Site, and provide a basis for identifying specific remedial technologies and process options. GRAs are developed for each medium of interest and define remedial actions that may, as standalone or in combination, be taken to satisfy the RAOs for the Site. The GRAs that have previously been considered for remediation of site sediment are as follows:

- No action
- Institutional controls (ICs)
- Containment
- In-situ treatment
- Ex-situ treatment
- Removal

Specific process options within each GRA were described and screened based on technical implementability in the 2019 OU-E FS. The screening for technical implementability is based on 1) the site-specific RAOs and

ARARs, 2) site-specific conditions, such as geologic setting and contaminant distribution, and 3) contaminant characteristics. During the preliminary identification and screening process, remedial technologies that cannot be technically implemented are eliminated from further evaluation. If retained after the first screening step, the technology and/or process option is further evaluated and refined based on effectiveness, implementability, and relative cost. A summary of technologies screened in the 2019 OU-E FS is provided in the following section.

2.2.1 Sediment Remedial Technologies

The preliminary identification and screening process of remedial technologies and associated process options for treatment of sediment at the Site are discussed in this section; this process was summarized in Table 5-2 of the 2019 OU-E FS. The following remedial technologies and associated process options for sediment were identified and evaluated based on technical implementability:

No action: To provide a baseline for comparison of alternatives as required by the National Oil and Hazardous Substances Contingency Plan (NCP; USEPA 1990), the "No Action" technology was retained in the 2019 OU-E FS.

ICs and natural recovery: ICs, such as land use restrictions / land use controls (LUCs), along with natural recovery, have been retained to provide protection of human health and the environment through administratively restricting land use until chemical-specific cleanup goals are met.

- Natural recovery is the process of degradation or transformation of a COC into less toxic compounds or forms. These natural recovery processes are present in aquatic sediment at the Site and are documented in the OU-E BHHERA via arsenic speciation testing and carbon equilibrium partitioning (EqP) modeling. Further, geomorphological and biological cycles in the ponds generate additional sediment mass and organic carbon, subsequently reducing residual COC concentrations over time. OU-E's isolated, low-energy pond-wetland setting, continuing accumulation of sediment and vegetation-derived organic matter, and ability to restrict disturbance provide a favorable basis for natural recovery. Longer recovery periods may be considered where natural processes are substantiated and institutional controls are maintained.

  Natural recovery relies on documented natural processes to reduce exposure where affected sediment remains in place. A typical natural recovery process includes stable burial by incoming sediment and vegetation-derived organic matter, consolidation of underlying deposits, and progressive natural degradation of COCs due to naturally occurring chemical and biological processes in buried sediment. Due to documented continuing discharge of sediment containing dioxin to Pond 8 via stormwater and a lack of incoming runoff in other ponds, natural recovery would rely principally on sediment accumulation from vegetation-derived organic matter, sequestration due to organic carbon content, and natural degradation of dioxin. Arsenic concentrations in existing sediment will not degrade but are covered by natural burial.

  A first-order screening relationship was used to bracket the time required for dioxin/furan TEQ to decline to the 50 pg/g unrestricted-use goal through degradation alone. While dioxin half-lives are reported in literature as low as 9 to 14 years, those values represent a lower bound when dioxin is exposed to sunlight. Half-life between 25 and 100 years is more realistic for buried sediments, with 50 years as the central tendency based on the geometric midpoint on the exponential decay curve. For evaluation 25-, 50-, and 100-year assumptions were used to represent a literature-based range for degradation. (Paustenbach, 1992)

TABLE 2-1: NATURAL RECOVERY YEARS TO DIOXIN CLEANUP GOAL – DEGRADATION ONLY

Area / Starting TEQ	25-year	50-year	100-year
Pond 7, minimum (93 pg/g)	22 years	45 years	90 years
Pond 7, maximum (350 pg/g)	70 years	140 years	280 years
Pond 6 EPC (175 pg/g)	45 years	90 years	180 years
Combined Pond 6, 7, and North 95% UCL (109 pg/g)	28 years	56 years	110 years
Pond 8 West 95% UCL (58 pg/g)	5.4 years	11 years	21 years
Pond 8 East 95% UCL (142 pg/g)	38 years	75 years	151 years

The screening calculations show timeframes to reach remedial goals as follows:

- at the low end the remedial goal is met sitewide in approximately 70 years, with all but the maximum in Pond 7 and the post-removal EPC in the South Ponds on the order of 45 years or less,
- at a realistic midpoint value the remedial goal is met sitewide in approximately 140 years, with all but the maximum in Pond 7 and the post-removal EPC in the South Ponds on the order of 90 years or less,
- at a worst case value the remedial goal timeframe approach or exceed 100 years, except in Pond 8 West.

These estimates do not establish predicted OU-E cleanup dates and do not account for new loading, mixing, or burial. Generally, a reasonable timeframe for natural attenuation in groundwater is acceptable at timeframes on the order of 50 to 100 years, which is within the design life for Mill Pond Dam modifications. In some cases, data supporting 95% UCL values and EPCs were collected up to 20 years ago, indicating that progress towards these timeframes may have already been substantially completed.

- ICs include a variety of measures designed to restrict current and future property owners from taking actions that would expose potential receptors to unacceptable risk, interfere with effectiveness of the final remedial action, and/or convert the Site to an end use that is not consistent with the level of remediation. The primary objective of ICs is to limit potential for exposure to COCs by restricting access to impacted areas.
- For sediment, this technology would protect human health by assigning LUCs to prevent the potential risk of receptors encountering COC-impacted sediment. A Sediment Management Plan (SMP) would be developed based on COCs and associated risks to further protect potential future receptors. Implementing ICs is possible given current site conditions, and the overall cost is relatively low. ICs were retained in the 2019 OU-E FS to provide protectiveness through administrative actions until chemical-specific ARARs are met.

- The ICs and LUCs do not establish unrestricted use while sediment remains above the unrestricted-use cleanup goals. To achieve unrestricted use, sediment exceeding cleanup goals would need to be excavated or otherwise remediated, with confirmation sampling demonstrating that remaining sediment meets goals. Excavated sediment would be characterized, managed, and transported to an appropriately permitted offsite disposal facility. Until those criteria are met, the LUCs and Sediment Management Plan would restrict uses and sediment-disturbing activities, require review and sampling before disturbance, and define requirements for handling, reuse, or offsite disposal of disturbed sediment.

Containment: Covers with sand, gravel, or other suitable materials, or structures such as a dam or berm.

- Existing sediment data indicate OU-E pond sediment is not likely to be hazardous waste under federal or California criteria if generated (removed from the ponds). On that basis, RCRA Subtitle C and Title 22 hazardous-waste requirements (which govern hazardous-waste identification, management, and disposal, including land-disposal restrictions requiring treatment before land disposal) are not expected to apply to sediments in OU-E relative to containment and cover alternatives. Classification would be revisited if new data indicate hazardous-waste characteristics following generation.
- Sediment containment alternatives would be evaluated under Title 27 (California's solid-waste land-disposal standards for classification, unit construction, monitoring, and closure) and the Porter-Cologne Water Quality Control Act (state regulation of waste discharges to protect water quality) as non-hazardous solid waste. Under Title 27 section 20090(d), cleanup actions taken at the direction of a public agency are exempt from Title 27 for management of sediment in the immediate place of release (left in place in the ponds). While exempt, remedial actions that contain waste at the place of release implement applicable Title 27 provisions to the extent feasible under the oversight of DTSC in consultation with the RWQCB.
- Sediment consolidated outside of the immediate place of release in a purpose-built containment cell presents the highest regulatory burden. Sediment moved into a discrete lined, bermed, or otherwise separately engineered unit may be evaluated as a new containment unit and, where the sediment is removed from its immediate place of release, would be discharged in accordance with Title 27 section 20200 et seq. under section 20090(d). Those provisions generally address waste classification and unit siting, liner and leachate-control construction, construction quality assurance (testing and documentation that the unit is built to specification), water-quality monitoring, final cover and closure, post-closure maintenance, and financial assurance (demonstration that funds are available for long-term care). The City of Fort Bragg LCP would further inform design, permitting, and implementation of on-site consolidation.
- Covers and containment would be evaluated in the context of RAOs to demonstrate ingestion of and incidental contact with chemicals of concern in sediments that exceed Remedial Goals established in the RAP by future users of the former Mill Site are prevented from occurring via incidental sediment ingestion, dermal contact with sediment, and contact with surface water.
- A cover would be implemented as a vegetated barrier to cover sediments in the ponds to restrict exposure of potential receptors to affected media. A cover would effectively restrict the potential risk to receptors in accordance with RAOs until cleanup goals are achieved; therefore, covers were retained for incorporation in remedial alternatives in the 2019 OU-E FS.

- Containment can also be achieved via a dam or berm. The existing Mill Pond Dam and beach berm currently act as vertical containment structures, keeping sediment in place laterally and protecting sediment from storms, erosion, tsunamis, and sea-level rise. These structures are current containment structures for Ponds 6, 7, 8, and the North Pond. The Mill Pond Dam is a jurisdictional structure under DSOD oversight for the retention of water and sediment. The beach berm is a soil berm armored on the ocean side with rock and concrete. Both structures have been in place for on the order of over 50 to 100 years and have been maintained periodically. Erosion of soil and vegetation and displacement of rock and riprap have occurred, including recently in November 2026, without observed sediment release from Site ponds and are subject to periodic repair and maintenance similar to other coastal structures. Containment by the existing Mill Pond Dam and beach berm, including inspection and maintenance, combined with ICs was retained in the 2019 OU-E FS.
- The locations of the Mill Pond Dam, crib wall, spillway, beach berm, and associated OU-E features are shown on Figure 1-3.
- On-site consolidation in a lined cell may not be acceptable within the Coastal Zone. Past experience with consolidation of contaminants at the former Mill Site demonstrated the difficulty with implementing this type of process option; therefore, on-site consolidation was not retained for further evaluation in the 2019 OU-E FS. DTSC has requested that on-site consolidation be re-considered in this FS Addendum (see Section 2.3).

In-situ physical treatment: In-situ soil mixing.

- In-situ soil mixing (ISM) technology can be used to immobilize organic and inorganic compounds in saturated sediments, using reagents to produce an inert, geotechnically strong, and relatively less permeable material, such as Portland cement. This process option does not destroy COCs, but incorporates them into a dense, homogeneous, low-permeability structure that reduces concentrations and mobility.
- Implementation of in-situ soil mixing may pose difficulties due to accessibility restrictions for construction equipment; however, various modifications of the technology exist to adapt to site conditions. Previous treatability tests of in-situ soil mixing have been conducted at the Site to evaluate the technical feasibility and the effectiveness at reducing COC accessibility to receptors. Results of the treatability test indicate that due to high sediment organic and moisture content and poor post-treatment strength results, in-situ soil mixing requires binder and Portland cement quantities that would materially increase the treated sediment volume to achieve the required strength and permeability performance.
- Adding Portland cement to the sediment increases the volume of treated material to greater than the original material volume. In order to account for bulking, excess material would be tested and used for backfill elsewhere at the Site, or transported offsite for disposal. Use of Portland cement in aquatic environments would require measures to manage elevated pH and replace lost aquatic habitat; areas treated by soil mixing would not remain aquatic habitat. In-situ mixing was retained for further evaluation in the 2019 OU-E FS.

In-situ biological treatment: Mycoremediation and in-situ biological oxidation (ISB).

- Mycoremediation within the Pond AOIs sediment is not feasible as the sediments are typically submerged. Further, mycoremediation was not shown to be effective in previous bench-scale

tests. Based on these results, mycoremediation was determined to not be a viable remedial process option and was not carried forward for further evaluation in the 2019 OU-E FS.

- ISB involves injection of substrates into the target media to promote biological degradation of target COCs. ISB relies upon reactions within the aqueous phase, which would occur within the pore space of the target sediments. Technical implementability concerns exist with ISB; additionally, installation and direct push injection activities to deliver reagents would be restricted for sediments located in pond areas due to water quality effects in a surface water body. Discharge of chemical reagents needed to enhance biological treatment would adversely affect pond water chemistry overall. Further, achieving significant distribution of reagents is likely not feasible within fine-grained matrices characteristic of the sediments at the Site whether injected vertically or horizontally. ISB was not retained for further evaluation in the 2019 OU-E FS.

In-situ chemical treatment: In-situ chemical oxidation (ISCO).

- ISCO technology involves reduction/oxidation reactions that chemically convert hazardous contaminants to non-hazardous or less toxic compounds that are more stable or inert. One reactant is oxidized (loses electrons) and another is reduced (gains electrons). ISCO relies upon abiotic reactions between reagents and target COCs to achieve mass reduction. Technical implementability concerns exist with ISCO; additionally, installation and direct push injection activities to deliver reagents would be restricted for sediments located in pond areas due to water quality effects in a surface water body. Discharge of chemical reagents needed to provide chemical treatment would adversely affect pond water chemistry overall. Further, achieving significant distribution of reagents is likely not feasible within fine-grained matrices characteristic of the sediments at the Site whether injected vertically or horizontally. ISCO was not retained for further evaluation in the 2019 OU-E FS.

Ex-situ physical/biological treatment: Landfarming, biopiling.

- Land farming and biopiling can both be readily implemented for COCs in sediment; however, both rely upon biological treatment of COCs to achieve effective mass reduction. Based on the nature of COCs driving risk within the sediment AOIs, biological treatment will not be sufficient to reduce COC concentrations to meet target cleanup goals and achieve RAOs. Landfarming and biopiling were not retained for further evaluation for sediment in the 2019 OU-E FS.

Removal: Excavation and offsite disposal.

- Removal (i.e., excavation) provides immediate and effective removal of impacted sediment from the Site to achieve RAOs. Excavation of sediment relies upon similar methods of removal as excavation of soils; however, additional consideration is required to address access restrictions and dewatering. Excavation may require the need for long-stick excavators and potential engineered controls adjacent the excavation to support equipment during removal. Dewatering of excavated sediment is required to reduce the moisture content prior to transportation and disposal. After dewatering, excavated sediment would be transported to an appropriately permitted offsite landfill in accordance with federal and state transportation and disposal regulations. Restoration following excavation of sediments may require backfilling and revegetation to restore existing habitat. When compared to other technologies, excavation and disposal may have a higher capital cost but represents a lower risk as all COCs are removed offsite. Excavation and disposal was retained for further consideration in the 2019 OU-E FS.

- For planning and cost-estimating purposes, excavated waste is assumed to be transported to the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, as the planning and cost-estimating basis. The actual receiving landfill would be selected during implementation based on waste characterization, facility acceptance, capacity, and applicable permitting requirements; another appropriately permitted facility may ultimately be selected and is expected to be at a similar or greater transportation distance.

2.2.2 Recommended Alternative

The recommended alternatives for the Pond 7 AOC, the Pond 6 and North Pond AOC, and the Pond 8 AOC in the 2019 OU-E FS are the following:

- Pond 7 AOC: Institutional Controls: Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Management
- North Pond and Pond 6 AOC: Institutional Controls: Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Management
- Pond 8 AOC: Institutional Controls: Containment (including modification of the Mill Pond Dam to include an RSP buttress at the crib wall section, ground improvements and an earth-fill buttress at the eastern dam section, and a cutoff wall near the center of the pond to divide it into two smaller ponds),Land Use Controls, Sediment Management, and Long-Term Operations and Management

The Institutional Controls: Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Management alternative recommended in the 2019 OU-E FS includes containment, land use controls, sediment management, and long-term O&M. Containment includes modifications to the existing Mill Pond Dam to comply with DSOD requirements. Proposed modifications to the Mill Pond Dam include: 1) a rock slope protection (RSP) buttress at the crib wall section; 2) ground improvements and an earth-fill buttress at the eastern dam section; and 3) a cutoff wall installed near the center of the pond to divide into two smaller ponds. The proposed cutoff wall is approximately 9 feet thick, 63 feet long, and would extend the full depth of the pond at the center section, estimated to be up to 21 feet. The wall would be constructed of precast concrete units in an A-frame with structural concrete infill. A hydraulic notch 5.5 feet high by 18 feet wide in the cutoff wall would allow flow from the Pond 8 East to Pond 8 West. Ponds 6, 7, and North are hydraulically independent and no flow enters or exits these ponds to or from other ponds. Ponds 7 and North are hydraulically isolated with limited inflow from immediately surrounding areas. Pond 6 is likewise isolated with inflow from the OU-E lowland and an overflow pipe at the top of the pond through the beach berm to the ocean. Modification of the Mill Pond Dam would not affect flow within other Site ponds. Static and dynamic stability of the Mill Pond Dam is addressed in the 60% design and supporting documentation. A Coastal Development Permit (CDP) application including the 60% design and supporting documentation was submitted to the City in July 2022 (CDP 9-22) to complete the Mill Pond Dam improvements. Additional information was provided per City request in January 2023 (Kennedy Jenks 2023).

2.3 New Remedial Alternatives

As described in Section 1, additional alternatives have been identified per DTSC request. The following sections complement the identification and screening of technologies and process options presented in Section 5.2 of the 2019 OU-E FS.

These alternatives were developed over multiple discussions with DTSC and other agencies, including in agency meetings in April 2024 and December 2024 and recurring Project Manager Meetings with DTSC. The list of alternatives in the section below is the culmination of these discussions and was presented to DTSC and other agencies in a letter dated 30 August 2024 (Mendocino Railway 2024c) and discussed in a meeting in December 2024 (documented in meeting minutes; Kennedy Jenks 2025a).

2.3.1 Preliminary Identification and Screening of Technologies and Process Options

The preliminary identification and screening process of new remedial technologies and associated process options for treatment of sediment at the Site consist of the following:

- Excavation and filling of Pond 8 west, disposal of excavated sediment, and dam modifications (herein termed "Pond 8 West, with Lowland Ponds, Excavation and Disposal")
- Institutional controls/containment with dam modifications, including north dam improvements, cutoff wall, and rock slope protection on the interior of Pond 8 at the crib wall(alternative to current proposed rock slope protection design; herein termed "Institutional Controls with Interior Rock Slope Protection Alternative")
- Institutional controls/containment with dam modifications, including north dam improvements, cutoff wall, and a seawall at the crib wall (alternative to current proposed rock slope protection design; herein termed "Institutional Controls with Seawall Alternative")
- Institutional controls/containment with dam modifications, including north dam improvements, cutoff wall, and construction of a secant pile wall at the crib wall (alternative to current proposed rock slope protection design; herein termed "Institutional Controls with Secant Pile Wall Alternative")
- Institutional controls/containment with dam modifications, including north dam improvements, cutoff wall, and jet grouting at the crib wall (alternative to current proposed rock slope protection design; herein termed "Institutional Controls with Jet Grouting Alternative")
- On-site terrestrial treatment and consolidation

The Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative is a combination of removal and ICs. Pond 8 West, with Lowland Ponds, Excavation and Disposal was retained for further evaluation.

The approximate excavation areas associated with this alternative, including Pond 8 West and the applicable portions of Pond 7, Pond 6, and North Pond, are shown on Figure 1-5.

The Institutional Controls with Interior Rock Slope Protection Alternative, the Institutional Controls with Seawall Alternative, the Institutional Controls with Secant Pile Wall Alternative, and the Institutional Controls with Jet Grouting Alternative incorporate design alternatives to the "Institutional Controls: Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Management" remediation process option evaluated in the 2019OU-E FS for the Pond 7 AOC, the North Pond and Pond 6 AOC, and the Pond 8 AOC. The Institutional Controls with Interior Rock Slope Protection Alternative, the Institutional Controls with Seawall Alternative, the Institutional Controls with Secant Pile Wall Alternative, and the Institutional Controls with Jet Grouting Alternative were retained for further evaluation.

The on-site terrestrial treatment and consolidation alternative is a combination of removal and containment. As described in Section 2.1.1, on-site consolidation was considered in the 2019 OU-E FS but not retained

for further evaluation. The on-site terrestrial treatment and consolidation alternative is included herein per DTSC request (DTSC 2022, 2024a).

2.3.2 Evaluation of Technology Types and Selection of Representative Process Options

Following completion of the preliminary screening based on technical implementability, the retained remedial technologies and associated process options are to be further evaluated in greater detail based on effectiveness, implementability (i.e., administrative), and relative cost, as described in Section 5.2.2 of the 2019 OU-E FS. The detailed screening of process options for treatment of sediment at the Site are discussed in this section.

The Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative is a combination of removal and ICs. As described in Section 2.1.1 and the 2019 OU-E FS, ICs can provide protectiveness through administrative actions until chemical-specific ARARs are met and excavation is immediately effective and readily implementable; therefore, Pond 8 West, with Lowland Ponds, Excavation and Disposal was retained for further evaluation.

The Institutional Controls with Interior Rock Slope Protection Alternative and the Institutional Controls with Seawall Alternative incorporate design alternatives to the "Institutional Controls: Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Management" remediation process option evaluated in the 2019 OU-E FS for the Pond 7 AOC, the North Pond and Pond 6 AOC, and the Pond 8 AOC. As described in Section 2.1.1 and the 2019 OU-E FS, ICs can provide protectiveness through administrative actions until chemical-specific ARARs are met, and interior rock slope protection and a seawall may balance ARARs differently as compared to the rock slope protection recommended in the 2019 OU-E FS and included in the CDP 9-22 application; therefore, the Institutional Controls with Interior Rock Slope Protection Alternative and the Institutional Controls with Seawall Alternative were retained for further evaluation.

The Institutional Controls with Secant Pile Wall Alternative and the Institutional Controls with Jet Grouting Alternative also incorporate design alternatives to the "Institutional Controls: Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Management" remediation process option evaluated in the 2019OU-E FS for the Pond 7 AOC, the North Pond and Pond 6 AOC, and the Pond 8 AOC. However, based on discussion in the meeting with agencies on 17 December 2024 (as documented in the meeting minutes; Kennedy Jenks 2025a), a secant pile wall and jet grouting would likely not be accepted by DSOD due to considerations of constructability. Both methods include the placement of Portland cement grout or concrete within the body of the dam structure, which may not adequately contain the emplaced material during construction using these methods, which would include high pressure injection or large diameter borings and tremie fill operations. While subsurface ground improvements for buttress foundations using soil mixing with Portland cement grout are anticipated, these materials are not mixed, emplaced, or jet-injected within the body of the dam structure. Therefore, secant piles and jet grouting were not retained for further evaluation.

The on-site terrestrial treatment and consolidation alternative is a combination of removal and containment. As described in Section 2.1.1, on-site consolidation was considered in the 2019 OU-E FS but not retained for further evaluation. The on-site terrestrial treatment and consolidation alternative is included herein per DTSC request (DTSC 2022, 2024a). This alternative involves the excavation and on-site consolidation of sediment from Pond 8, Pond 6, North Pond, and Pond 7. Removal of sediment would be completed until

confirmation sampling indicates remaining concentrations of COCs in sediment allow for unrestricted use classification of Pond 8, Pond 6, North Pond, and Pond 7. The alternative would include the following steps:

- Sediment would be removed and dewatered and/or stabilized with Portland cement. A new Title 27 (California Code of Regulations [CCR]) landfill would be constructed on-site for consolidation of treated sediment. Assuming a height of 8 ft, the footprint of the new Title 27 landfill is roughly estimated to be over 11 acres (or approximately the size of two Pond 8-sized areas). The excavation areas may be backfilled with clean imported soil or the pond depth may be allowed to increase depending on the resulting geometry and agency permit requirements. Institutional controls would be implemented for the new Title 27 landfill and an operation and maintenance plan would be developed.
- Although not required to comply with DTSC requirements, the Mill Pond Dam would remain, and modifications would be required in this alternative. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end and rock slope protection at the crib wall near the ocean. A cutoff wall would also be installed near the center of Pond 8 to divide into two smaller ponds. Pond 8 would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins, as is currently the configuration of City stormwater drainage. Continued use of the former Mill Pond for stormwater treatment would not affect the ability of the remedy to remove existing sediments containing COCs. Once existing sediment is removed the remedy for Mill Site contributions of COCs would be complete. Continued stormwater input is likely to continue to contribute COCs to Pond 8. Future assessment and maintenance removal of contaminated sediment may be required by the party responsible for City stormwater discharge. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. Regular inspection and maintenance of both the Mill Pond Dam and the beach berm would be required.

Past experience with consolidation of contaminants at the former Mill Site demonstrated the difficulty with implementing this type of process option; ultimately, the OU-A consolidation cell was removed and soil requiring disposal was hauled to an off-site landfill for disposal (Arcadis 2012b). During implementation of the OU-A consolidation cell, the RWQCB clarified that removing soil (or, by extension, sediment) containing COCs and encapsulating it underground for permanent storage constitutes a waste management unit, and designated or non-hazardous solid waste may only be discharged at a waste management unit that has been approved and classified by the RWQCB (RWQCB 2008). RWQCB requires that the waste management unit be designed to comply with the requirements of Title 27 (RWQCB 2008). The entirety of the Site is within the Coastal Zone. Section 30233 of the Coastal Act limits allowable use for wetland fill to seven specific uses. Consolidating contaminants within a wetland is not included within the listed allowable uses for wetland fill. On-site consolidation in a lined cell may not be acceptable within the Coastal Zone and has other issues with implementability.

In a letter from the City of Fort Bragg to DTSC dated November 7, 2025, the City's consultant outlines prior CDP review and approval for the previously constructed consolidation cell and current LCP policies as they relate to potential establishment of a new consolidation cell. The letter explicitly states that "While a consolidation cell was approved in 2008, that prior authorization cannot be utilized to predict the outcome of a future consolidation cell permit request." The discussion of the history of the previous consolidation cell permit highlights the temporary nature of the past approval and strong opposition from the community. While the letter acknowledges the possibility of a consolidation cell as a permissible use, it outlines

uncertainties and regulatory requirements that cannot easily be evaluated outside the context of a full design and permitting process, leaving material risk that the baseline implementability criteria required for FS consideration of remedial technologies would not be met.

Beyond the regulatory and permitting challenges, the volume of sediment under evaluation and requirements outlined in the City's letter introduces practical limitations to implementability. Per LCP requirements, the consolidation cell could not be placed within 100 feet of wetlands, environmentally sensitive habitat areas, and archeological resources, constraining placement to limited areas, if at all possible. During previous design and construction of the removed consolidation cell, depth and height limitations were established by the agencies and City of Fort Bragg. Consolidated material could not be placed within 5 feet of the shallowest groundwater elevation and could not extend more than 1 foot above the current grade to avoid loss of scenic visibility of the ocean across the Site. Shallow groundwater was identified as 10 to 12 feet below ground surface and 18 inches (1.5 feet) of clean soil cover was required above consolidated material. The available section thickness for consolidated material based on these constraints is 4.5 feet or less. Consolidation of 106,000 cubic yards (2,862,000 cubic feet) of material 4.5 feet thick requires an area of 636,000 square feet or nearly 15 acres, not including areas required for stormwater infiltration and supporting monitoring and maintenance infrastructure. For reference this is an area approximately 40% larger than the City's Central Business District (11 acres). This area would be first excavated to a depth of 5 feet prior to construction. With consolidation cell preparation and sediment and cover placement, over 259,000 cy of soil and sediment would be handled. By comparison the recommended alternative from the OU-E FS includes 37,000 square feet (0.85 acres) and 7,700 cubic yards of cut and fill at the north berm buttress and 7,400 square feet (0.17 acres) and 1,375 cubic yards of fill at the crib wall RSP, less than 7 percent of the consolidation cell area and 3.5 percent of the material handling volume.

As stated in an email to DTSC in January 2025 (Kennedy Jenks 2025b) and letter dated 24 February 2025 (Mendocino Railway 2025), these factors indicate that implementation of an on-site consolidation cell may face significant permitting challenges and involves physical implementation constraints that limit the feasibility of implementation beyond reasonable consideration, and therefore, this alternative was not retained for further evaluation.

2.3.3 Alternatives Retained for Further Evaluation

Following the December 2024 meeting with agencies, the following alternatives were retained for further consideration in the FS Addendum:

- Pond 8 West, with lowland ponds, Excavation and Disposal
- Interior Rock Slope Protection Alternative
- Seawall Alternative

The following sections present a detailed description of the new remedial alternatives for consideration. These descriptions were provided to DTSC in a letter dated 24 February 2025 (Mendocino Railway 2025).

2.3.3.1 Pond 8 West, with Lowland Ponds, Excavation and Disposal

This alternative involves the excavation and offsite disposal of sediment in the western portion of Pond 8, Pond 7, Pond 6, and North Pond until confirmation sampling indicates remaining concentrations of COCs in sediment allow for unrestricted use classification of Pond 8 West.

Under the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative, future daylighting of Alder Creek and Maple Creek along their former drainage alignments is feasible and is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans.

Sediment would be excavated from Pond 8 West, Pond 7, Pond 6, and North Pond using conventional construction equipment and would be either temporarily stockpiled and managed to control dust and odors or directly loaded into truck beds. Dewatering and/or stabilization with Portland cement may be necessary for excavated material with free-draining water that cannot be dried within a reasonable space or time. Immediately after loading, truck beds would be covered with a tarp and transported to the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, as the planning and cost-estimating basis, subject to waste characterization and facility acceptance. Existing sediment data indicate lower concentrations of COCs than in materials removed during excavation of soil and sediment that was classified as non-hazardous in 2017. The final condition of each excavated area, including whether the crib wall would be removed and whether clean backfill would be placed, would be evaluated during design based on final excavation geometry and agency permit requirements. The estimated sediment-disturbance areas are approximately 98,000 square feet in Pond 8 West, approximately 900 square feet in Pond 7, and approximately 10,000 square feet in Pond 6 and North Pond, for a combined area of approximately 108,900 square feet. Sediment excavation and disturbance of aquatic habitat in these areas would require habitat restoration and/or mitigation.

Modifications to the Mill Pond Dam would be required. The existing spillway would remain, and a new spillway would be constructed at the approximate middle point of Pond 8, where the pond is narrow. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end. Pond 8 East would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland and would provide sediment containment for Pond 7, Pond 6, and the North Pond. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm.

Sediment in Pond 8 East would remain in place. ICs would be implemented for Pond 8 East to provide land use controls (LUCs) for future site use which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable. The LUCs would provide requirements for development within the restricted area, such as development of a comprehensive SMP that provides detailed procedures for sediment-disturbing activities and describes required sampling and criteria for reuse of disturbed sediment. The LUCs and SMP would be consistent with future site use.

The ICs and LUCs do not establish unrestricted use while sediment remains above the unrestricted-use cleanup goals. To achieve unrestricted use, sediment exceeding cleanup goals would need to be excavated or otherwise remediated, with confirmation sampling demonstrating that remaining sediment meets goals. Excavated sediment would be characterized, managed, and transported to an appropriately permitted offsite disposal facility. Until those criteria are met, the LUCs and Sediment Management Plan would restrict uses and sediment-disturbing activities, require review and sampling before disturbance, and define requirements for handling, reuse, or offsite disposal of disturbed sediment.

Following removal of selected sediment, natural recovery would apply to residual sediment remaining in stable depositional areas. The Section 2.2.1 screening analysis indicates that due to documented continuing discharge of sediment containing dioxin to Pond 8 via stormwater, natural recovery would rely principally on sediment accumulation from vegetation-derived organic matter, sequestration due to organic carbon content, and natural degradation of dioxin. A half-life analysis for natural degradation is presented in Section 2.2.1.

2.3.3.2 Interior Rock Slope Protection Alternative

This alternative is consistent with the current recommended alternative for Pond 8, North Pond, Pond 6 sediments in the 2019 OU-E FS ,but proposes an alternative design element at the crib wall.

Under the Interior Rock Slope Protection alternative, future daylighting of Alder Creek and Maple Creek along their former drainage alignments is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans.

Sediment in Pond 8, Pond 7, Pond 6, and the North Pond would remain in place. ICs would be implemented for Pond 8, Pond 7, Pond 6, and the North Pond to provide LUCs for future site use which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable. The LUCs would provide requirements for development within the restricted area, such as development of a comprehensive SMP that provides detailed procedures for sediment-disturbing activities and describes required sampling and criteria for reuse of disturbed sediment. The LUCs and SMP would be consistent with future site use.

The ICs and LUCs do not establish unrestricted use while sediment remains above the unrestricted-use cleanup goals. To achieve unrestricted use, sediment exceeding cleanup goals would need to be excavated or otherwise remediated, with confirmation sampling demonstrating that remaining sediment meets goals. Excavated sediment would be characterized, managed, and transported to an appropriately permitted offsite disposal facility. Until those criteria are met, the LUCs and Sediment Management Plan would restrict uses and sediment-disturbing activities, require review and sampling before disturbance, and define requirements for handling, reuse, or offsite disposal of disturbed sediment.

Containment of sediment in Pond 8, Pond 7, Pond 6, and the North Pond would be provided by the existing Mill Pond Dam and beach berm. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end and rock slope protection on the interior of Pond 8 at the crib wall near the ocean. Mitigation for disturbing the existing wetlands of Pond 8 for the interior rock slope protection is expected. A cutoff wall would also be installed near the center of Pond 8 to divide into two smaller ponds. Pond 8 would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm.

Following removal of selected sediment, natural recovery would apply to residual sediment remaining in stable depositional areas. The Section 2.2.1 screening analysis indicates that due to documented continuing discharge of sediment containing dioxin to Pond 8 via stormwater, natural recovery would rely principally

on sediment accumulation from vegetation-derived organic matter, sequestration due to organic carbon content, and natural degradation of dioxin. A half-life analysis for natural degradation is presented in Section 2.2.1.

2.3.3.3 Seawall Alternative

This alternative is based on the institutional-controls and containment alternative recommended for Pond 8, North Pond, and Pond 6 sediment in the 2019 OU-E FS ,but proposes an alternative design element at the crib wall.

Under the Seawall alternative, future daylighting of Alder Creek and Maple Creek along their former drainage alignments is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans.

Sediment in Pond 8, Pond 7, Pond 6, and the North Pond would remain in place. ICs would be implemented for Pond 8, Pond 7, Pond 6, and the North Pond to provide LUCs for future site use which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable. The LUCs would provide requirements for development within the restricted area, such as development of a comprehensive SMP that provides detailed procedures for sediment-disturbing activities and describes required sampling and criteria for reuse of disturbed sediment. The LUCs and SMP would be consistent with future site use.

Containment of sediment in Pond 8, Pond 7, Pond 6, and the North Pond would be provided by the existing Mill Pond Dam and beach berm. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end and a seawall at the crib wall near the ocean. The seawall is assumed to be a new structure on the beach side of the existing Mill Pond Dam at the crib wall. A cutoff wall would also be installed near the center of Pond 8 to divide into two smaller ponds. Pond 8 would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm. This alternative is not expected to require significant soil removal or destruction of habitat.

Following removal of selected sediment, natural recovery would apply to residual sediment remaining in stable depositional areas. The Section 2.2.1 screening analysis indicates that due to documented continuing discharge of sediment containing dioxin to Pond 8 via stormwater, natural recovery would rely principally on sediment accumulation from vegetation-derived organic matter, sequestration due to organic carbon content, and natural degradation of dioxin. A half-life analysis for natural degradation is presented in Section 2.2.1.

3. DEVELOPMENT AND EVALUATION OF ADDITIONAL REMEDIAL ALTERNATIVES

As discussed previously, remedial alternatives are developed by combining remedial technologies and process options for sediment. Additional alternatives are described and evaluated herein for select AOCs per DTSC request.

AOCs evaluated in the 2019 OU-E FS and in this FS Addendum and the remedial alternatives considered are summarized as follows:

- Pond 7 Aquatic Sediment
  - 2019 OU-E FS
    - No Action (Alternative 1)
    - Institutional Controls (Alternative 2)
    - Vegetated Soil Cover (Alternative 3)
    - Excavation and Disposal (Alternative 4)
    - Vegetated Sediment Cover (Alternative 5)
    - FS Addendum
    - Pond 8 West, with Lowland Ponds, Excavation and Disposal (Alternative 6)
- North Pond and Pond 6 Aquatic Sediment
  - 2019 OU-E FS
    - No Action (Alternative 1)
    - Institutional Controls (Alternative 2)
    - Vegetated Soil Cover (Alternative 3)
    - Excavation and Disposal (Alternative 4)
    - Vegetated Sediment Cover (Alternative 5)
    - FS Addendum
    - Pond 8 West, with Lowland Ponds, Excavation and Disposal (Alternative 6)
- Pond 8 Aquatic Sediment
  - 2019 OU-E FS
    - No Action (Alternative 1)
    - Institutional Controls (Alternative 2)
    - In-situ Soil Mixing (Alternative 3)
    - Excavation and Disposal (Alternative 4)
    - Vegetated Sediment Cover (Alternative 5)
    - Vegetated Soil Cover (Alternative 6)

- FS Addendum
  - Pond 8 West, with Lowland Ponds, Excavation and Disposal (Alternative 7)
  - Institutional Controls with Interior Rock Slope Protection (Alternative 8)
  - Institutional Controls with Seawall (Alternative 9)

The new remedial alternatives were compared against the nine screening criteria presented in Section 1.1.2.3 and are developed and evaluated in the following section. A cost estimate presenting estimated remedial alternative costs is provided in Table 3-1.

The principal site features and approximate areas addressed by the additional excavation alternatives retained for detailed evaluation are shown on Figure 1-5.

3.1 Pond 7 Aquatic Sediment

Remedial technologies for this AOC were preliminarily screened in Section 2. This section presents an evaluation of the selected alternatives for the Pond 7 AOC based on the screening criteria presented in Section 1.

3.1.1 Development and Evaluation of Remedial Alternatives

3.1.1.1 Pond 7 Aquatic Sediment: Alternative 6 – Pond 8 West, with Lowland Ponds, Excavation and Disposal

As described in Section 2.3.3.1, the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative involves the excavation and offsite disposal of non-hazardous sediment in Pond 8 West, Pond 7, Pond 6, and North Pond and containment in place for sediment in Pond 8 East.

Modifications to the Mill Pond Dam would be required. The existing spillway would remain, and a new spillway would be constructed at the approximate middle point of Pond 8, where the pond is narrow. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end. Pond 8 East would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm. This alternative would disturb approximately 109,000 square feet in Pond 8 West, approximately 900 square feet in Pond 7, and approximately 10,000 square feet in Pond 6 and North Pond, for a combined disturbance area of approximately 119,900 square feet. Sediment excavation and disturbance of aquatic habitat in these areas would require habitat restoration and/or mitigation .The sections below focus on the Pond 7 element of the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative. For Pond 7, this alternative is comparable to the excavation and disposal alternative (Alternative 4).

3.1.1.1.1 Overall Protection of Human Health and the Environment

The affected sediment would be directly removed and disposed of offsite in an accredited non-hazardous-landfill, assumed to be the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, as the planning and cost-estimating basis, subject to waste characterization and facility acceptance. This alternative is anticipated to be

protective of human health and the environment as it provides restrictions for access to the affected sediment and guidelines for disturbing the remaining sediment.

3.1.1.1.2 Compliance with ARARs

This alternative is generally in compliance with the projected ARARs, though may be difficult to permit within the California Coastal Zone as excavation and disposal will result in the disruption and destruction of wetland habitat which would require significant mitigation. Other alternatives (e.g., Alternative 2) are anticipated to be less environmentally damaging as they require less disturbance of a wetland area. At a minimum, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost.

Pond 7 sediment would be removed; therefore, climate change and sea level rise are not anticipated to affect the ability of this alternative to comply with projected ARARs. Sea level rise will be considered during design development of the Mill Pond Dam soil buttress and new spillway; an updated wave study and sea level rise evaluation will be completed by ESA. Additional analysis of the beach berm to assess future tidal conditions and sea level rise will be considered during design development and address the feasibility of beach berm modifications, given the known zoning constraints. This alternative would require regular inspection and maintenance of the Mill Pond Dam and the beach berm to address impacts from sea level rise. As discussed in Section 3.3.1.1.5, transportation of excavated sediment to an appropriate non-hazardous-waste disposal facility would generate CO2 emissions.

3.1.1.1.3 Long-Term Effectiveness and Permanence

O&M is not required for Pond 7 after completion of the excavation and disposal and affected sediment would be removed, as confirmed by confirmation sampling. Removing affected sediment to allow unrestricted land use would be expected to reduce risk such that institutional controls for Pond 7are not necessary. The design life of the proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design. Periodic inspection and maintenance of the Mill Pond Dam and the beach berm will be required. Major repairs are anticipated to be relatively infrequent, on the order of 50 or more years between major maintenance activities. Therefore, this alternative is ranked high for long-term effectiveness and permanence.

3.1.1.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Excavation and disposal would remove residual affected sediment from Pond 7, thereby reducing the volume of affected sediment and the toxicity and mobility of the COCs remaining. However, affected sediment would remain in Pond 8 East. Overall, this alternative ranks moderate for this criterion. The majority of sediments were removed from Pond 7 in 2017; therefore, the reduction in toxicity or risk from remaining residual sediments is limited. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to site sediment and surface water.

3.1.1.1.5 Short-Term Effectiveness

An estimated 1,500 truckloads would be required to transport the sediment in the pond to an appropriate non-hazardous waste disposal facility, assumed to be the Class III Potrero Hills Landfill in Suisun City, California. Existing sediment data indicate lower concentrations of COCs than in materials removed during

excavation of soil and sediment that was classified as non-hazardous in 2017. Potrero Hills Landfill is approximately 180 road miles from the Site, and each round trip is estimated to be approximately 360 miles and the total sediment transport effort is estimated to generate[1] approximately 1,300,000 kilograms of CO2. Additionally, there is a risk of upset and spill on each trip to Potrero Hills Landfill, and construction workers would be temporarily exposed to COC-affected sediment during implementation. Therefore, this alternative is ranked low for short-term effectiveness. The actual receiving landfill would be selected during implementation based on waste characterization, facility acceptance, capacity, and applicable permitting requirements; another appropriately permitted facility may ultimately be selected and is expected to be at a similar or greater transportation distance.

Transportation of sediment out of Fort Bragg via rail is not currently viable due to the collapse of Noyo Canyon Tunnel No. 1. There are plans to repair the tunnel, however, the timeline for funding of the needed repairs is uncertain and the tunnel is unlikely to be repaired in a time frame such that transport by rail is a viable option for this project. In the short-term, transportation by truck is the only available transportation method.

3.1.1.1.6 Implementability

The Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative is ranked moderate for implementability. It is readily implementable with standard construction equipment, backfilling materials would be locally obtainable, and waste likely qualifies as non-hazardous waste based on known concentrations in sediment compared with 2017 excavation and disposal activities for reduced disposal hazards and transport; however, required permitting and mitigation requirements would be significant, and the depth of the excavation and likely soft sediment conditions would pose significant challenges. As discussed above, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost. Anticipated permits required to complete this alternative include: CCC CDP, City Coastal Development and Grading Permits, Mendocino County Air Quality Management District (MCAQMD) Dust Control Permit, RWQCB Section 401 of the Clean Water Act Permit, USACE Section 404 of the Clean Water Act Permit, and Stormwater Construction General Permit. A wetland mitigation modifier of 4:1 was assumed for cost estimation purposes. It is assumed that mitigation will be performed on-site. Approximately 900 sf are estimated to be disturbed in Pond 7, which would correspond to 0.3 acres of required mitigation.

3.1.1.1.7 Cost

Excavation and disposal for unrestricted use is ranked low as it is significantly more expensive than other remedial alternatives. Costs include documentation of permitting, removal, disposal, wetland restoration/mitigation, institutional controls and annual inspection and periodic maintenance of established controls such as fencing, routine maintenance, and vegetation control on the beach berm as well as annual inspection, maintenance, vegetation control, and periodic survey of the Mill Pond Dam. The design life of proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design.

[1] CO_2 generation estimate based on an emission factor from the Environmental Defense Fund's "The Green Freight Handbook."

3.1.1.1.8 Overall Rating

Overall, the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative ranks moderate (see Section 3.3.1.1) and, for Pond 7, is comparable to the excavation and disposal alternative (Alternative 4). It is ranked high for long term effectiveness and permanence, but moderate to low for other criteria. The benefits of this alternative are partly offset by the likelihood that not all sediment containing COCs would be able to be removed from Pond 8 West, and a contingency remedy of containment and institutional controls would still be required administratively. The quantity and locations of remaining sediment are likely to be small and relatively inaccessible (deeper sediments unreachable by excavator at the center of the pond are the most likely to remain) compared with current conditions. In addition, this alternative has a high cost as compared to other alternatives evaluated for the relatively small reduction of risk achieved.

3.1.2 Selection of Preferred Alternative – Pond 7 Aquatic Sediment

The Institutional Controls alternative (Alternative 2), which was recommended in the 2019 OU-E FS, remains the preferred alternative for the Pond 7 AOC as it provides adequate elimination of potential exposure pathways for future receptors while minimizing the destruction of wetlands and associated mitigation. The Institutional Controls alternative evaluates the risk associated with affected sediment and provides LUCs for future site use which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable. It would also include a comprehensive SMP which would provide detailed procedures for sediment disturbing activities and describe required sampling and criteria for reuse of disturbed sediment. In addition, ongoing O&M of the existing beach berm would provide continued sediment containment. Although it is associated with a slightly lower reduction of toxicity, mobility and volume, ICs would provide adequate elimination of potential exposure pathways for future receptors.

The reduction of the quantity and accessibility of sediment containing dioxins and arsenic in Pond 7 is a material factor in evaluating potential exposure and risk from residual materials. Pond 7 sediment was removed to the extent practical throughout the pond footprint in 2017. Though residual concentrations of dioxins and arsenic remain along a narrow strip along the south edge adjacent to the Mill Pond Dam and in residuals on or amid concrete, steel, and wooden crib materials along the west, north, and east edges, additional soil and sediment could not be practically removed because of inaccessibility. Sediment remaining along the south edge of the pond was not reachable by large excavation equipment for removal. Samples were collected by attaching clean PVC pipe to the excavator bucket to collect bulk material for a subsample. Samples along the west, north, and east edges of Pond 7 were collected with the excavator bucket or pole-mounted sampling tools from along pond walls made of concrete, steel, and timber cribbing. These features make incidental recreational access infeasible. Pond 7 is located south of the wetland area established as mitigation for 2017 temporary wetland disturbance. Access to this area as a whole is difficult from a practical standpoint and restricted to protect environmentally sensitive habitat areas. While the Mill Site Specific Plan indicates open space surrounding Pond 7, recreational access to Pond 7 is not practical.

The Pond 7 institutional-controls alternative is compatible with future daylighting of Alder Creek and Maple Creek along their former drainage alignments and is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans. The benefits of a physical cover are offset by the effort and disruption required for implementation and potentially regular O&M, as well as the disturbance of the newly-created wetland establishment area.

The benefits of Excavation and Disposal are offset by the effort and disruption required for implementation and the need to transport the sediment approximately 180 road miles one way for disposal at Potrero Hills Landfill as the planning and cost-estimating basis; another appropriately permitted landfill may ultimately be selected and is expected to be at a similar or greater distance. The cost difference between the alternatives is not justified by any significant benefits of the Vegetated Soil Cover or Excavation and Disposal alternatives. The benefits of Pond 8 West, with Lowland Ponds, Excavation and Disposal are offset by the effort and disruption required for implementation and the need to transport the sediment approximately 180 road miles one way for disposal at Potrero Hills Landfill as the planning and cost-estimating basis; another appropriately permitted landfill may ultimately be selected and is expected to be at a similar or greater distance.

3.2 North Pond and Pond 6 Aquatic Sediment

Remedial technologies for this AOC were preliminarily screened in Section 2. This section presents an evaluation of the selected alternatives for the North Pond and Pond 6 AOC based on the screening criteria presented in Section 1.

3.2.1 Development and Evaluation of Remedial Alternatives

3.2.1.1 North Pond and Pond 6 Aquatic Sediment: Alternative 6 – Pond 8 West, with Lowland Ponds, Excavation and Disposal

As described in Section 2.3.3.1, the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative involves the excavation and offsite disposal of non-hazardous sediment in Pond 8 West, Pond 7, Pond 6, and North Pond and containment in place for sediment in Pond 8 East.

Modifications to the Mill Pond Dam would be required. The existing spillway would remain, and a new spillway would be constructed at the approximate middle point of Pond 8, where the pond is narrow. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end. Pond 8 East would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm. This alternative would disturb approximately 109,000 square feet in Pond 8 West, approximately 900 square feet in Pond 7, and approximately 10,000 square feet in Pond 6 and North Pond, for a combined disturbance area of approximately 119,900 square feet. Sediment excavation and disturbance of aquatic habitat in these areas would require habitat restoration and/or mitigation.

The sections below focus on the North Pond and Pond 6 element of the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative. For the North Pond and Pond 6, this alternative is comparable to the excavation and disposal alternative (Alternative 4).

3.2.1.1.1 Overall Protection of Human Health and the Environment

The affected sediment would be directly removed and disposed of offsite in an accredited non-hazardous-landfill, assumed to be the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, as the planning and cost-estimating basis, subject to waste characterization and facility acceptance. This alternative is anticipated to be

protective of human health and the environment as it provides restrictions for access to the affected sediment and guidelines for disturbing the remaining sediment.

3.2.1.1.2 Compliance with ARARs

This alternative is generally in compliance with the projected ARARs, though may be difficult to permit within the California Coastal Zone as excavation and disposal will result in the disruption and destruction of wetland habitat which would require significant mitigation. Other alternatives (e.g., Alternative 2) are anticipated to be less environmentally damaging as they require less disturbance of a wetland area. At a minimum, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost.

Pond 6 and North Pond sediment would be removed; therefore, climate change and sea level rise are not anticipated to affect the ability of this alternative to comply with projected ARARs. Sea level rise will be considered during design development of the Mill Pond Dam soil buttress and new spillway; an updated wave study and sea level rise evaluation will be completed by ESA. Additional analysis of the beach berm to assess future tidal conditions and sea level rise will be considered during design development and address the feasibility of beach berm modifications, given the known zoning constraints. This alternative would require regular inspection and maintenance of the Mill Pond Dam and the beach berm to address impacts from sea level rise. As discussed in Section 3.3.1.1.5, transportation of excavated sediment to an appropriate non-hazardous waste disposal facility would generate CO2 emissions.

3.2.1.1.3 Long-Term Effectiveness and Permanence

O&M is not required for Pond 6 and North Pond after completion of the excavation and disposal and affected sediment would be removed, as confirmed by confirmation sampling. Removing affected sediment to allow unrestricted land use would be expected to reduce risk such that institutional controls for Pond 6 and North Pond are not necessary. The design life of the proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design. Periodic inspection and maintenance of the Mill Pond Dam and the beach berm will be required. Major repairs are anticipated to be relatively infrequent, on the order of 50 or more years between major maintenance activities. Therefore, this alternative is ranked high for long-term effectiveness and permanence.

3.2.1.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Excavation and disposal would remove affected sediment from Pond 6 and North Pond, thereby reducing the volume and mobility of affected sediment. Affected sediment would remain in Pond 8 East. Overall, this alternative is ranked moderate for this criterion. The OU-E BHHERA estimated cumulative ELCRs of 3 x 10-6 to 4 x 10-6 for Pond 6 and 2 x 10-6 for North Pond, with cumulative noncancer HIs below 1. Excavation would reduce these risk estimates, but the baseline estimates are within the NCP and CalEPA risk management range. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to site sediment and surface water.

3.2.1.1.5 Short-Term Effectiveness

An estimated 1,500 truckloads would be required to transport the sediment in the pond to an appropriate non-hazardous waste disposal facility, assumed to be the Class III Potrero Hills Landfill in Suisun City, California. Existing sediment data indicate lower concentrations of COCs than in materials removed during excavation of soil and sediment that was classified as non-hazardous in 2017. Potrero Hills Landfill is approximately 180 road miles from the Site, and each round trip is estimated to be approximately 360 miles and the total sediment transport effort is estimated to generate[1] approximately 1,300,000 kilograms of CO2. Additionally, there is a risk of upset and spill on each trip to the appropriate waste disposal facility, and construction workers would be temporarily exposed to COC-affected- sediment during implementation. Therefore, this alternative is ranked low for short-term effectiveness. The actual receiving landfill would be selected during implementation based on waste characterization, facility acceptance, capacity, and applicable permitting requirements; another appropriately permitted facility may ultimately be selected and is expected to be at a similar or greater transportation distance.

Transportation of sediment out of Fort Bragg via rail is not currently viable due to the collapse of Noyo Canyon Tunnel No. 1. There are plans to repair the tunnel, however, the timeline is uncertain and the tunnel is unlikely to be repaired such that transport by rail is a viable option for this project; in the short term, transportation by truck is the available transportation method.

3.2.1.1.6 Implementability

The Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative is ranked moderate for implementability. It is readily implementable with standard construction equipment, backfilling materials would be locally obtainable, and waste likely qualifies as non-hazardous waste for reduced disposal hazards and transport; however, required permitting and mitigation requirements would be significant, and the depth of the excavation and likely soft sediment conditions would pose significant challenges. As discussed above, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost. Anticipated permits required to complete this alternative include: CCC CDP, City Coastal Development and Grading Permits, MCAQMD Dust Control Permit, RWQCB Section 401 of the Clean Water Act Permit, USACE Section 404 of the Clean Water Act Permit, and Stormwater Construction General Permit. A wetland mitigation modifier of 4:1 was assumed for cost estimation purposes. It is assumed that mitigation will be performed on-site. Approximately 10,000 sf are estimated to be disturbed in Pond 6 and North Pond, which would correspond to 0.9 acres of required mitigation.

3.2.1.1.7 Cost

Excavation and disposal for unrestricted use is ranked low as it is more expensive than other remedial alternatives. Costs include documentation of permitting, removal, disposal, wetland restoration/mitigation, institutional controls and annual inspection and periodic maintenance of established controls such as fencing, routine maintenance, and vegetation control on the beach berm as well as annual inspection, maintenance, vegetation control, and periodic survey of the Mill Pond Dam. The design life of proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design.

[1] CO_2 generation estimate based on an emission factor from the Environmental Defense Fund's "The Green Freight Handbook."

3.2.1.1.8 Overall Rating

Overall, the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative ranks moderate (see Section 3.3.1.1) and, for the North Pond and Pond 6, is comparable to the excavation and disposal alternative (Alternative 4). It is ranked high for long term effectiveness and permanence, but moderate for other criteria. The benefits of this alternative are offset by the likelihood that not all sediment containing COCs would be able to be removed from Pond 8 West, and a contingency remedy of containment and institutional controls would still be required. In addition, this alternative has a high cost as compared to other alternatives evaluated for the relatively small reduction of risk achieved.

3.2.2 Selection of Preferred Alternative – North Pond and Pond 6 Aquatic Sediment

The Institutional Controls alternative (Alternative 2), which was recommended in the 2019 OU-E FS, remains the preferred alternative for the North Pond and Pond 6 AOC as it provides adequate elimination of potential exposure pathways for future receptors while minimizing the destruction of wetlands and associated mitigation. The Institutional Controls alternative evaluates the risk associated with affected sediment and provides LUCs for future site use which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable. It would also include a comprehensive SMP which would provide detailed procedures for sediment disturbing activities and describe required sampling and criteria for reuse of disturbed sediment. In addition, ongoing O&M of the existing beach berm would provide continued sediment containment. Although it is associated with a slightly lower reduction of toxicity, mobility and volume, ICs would provide adequate elimination of potential exposure pathways for future receptors.

The ICs and LUCs do not establish unrestricted use while sediment remains above the unrestricted-use cleanup goals. To achieve unrestricted use, sediment exceedingcleanup goals would need to be excavated or otherwise remediated, with confirmation sampling demonstrating that remaining sediment meets goals. Excavated sediment would be characterized, managed, and transported to an appropriately permitted offsite disposal facility. Until those criteria are met, the LUCs and Sediment Management Plan would restrict uses and sediment-disturbing activities, require review and sampling before disturbance, and define requirements for handling, reuse, or offsite disposal of disturbed sediment.

The North Pond and Pond 6 institutional-controls alternative is compatible with future daylighting of Alder Creek and Maple Creek along their former drainage alignments and is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans.

The benefits of a physical cover are offset by the effort and disruption required for implementation and potentially regular O&M. The benefits of Excavation and Disposal are offset by the effort and disruption required for implementation and the need to transport the sediment approximately 180 road miles one way for disposal at Potrero Hills Landfill as the planning and cost-estimating basis; another appropriately permitted landfill may ultimately be selected and is expected to be at a similar or greater distance. The cost difference between the alternatives is not justified by any significant benefits of the Vegetated Soil Cover or Excavation and Disposal alternatives. The benefits of Pond 8 West, with Lowland Ponds, Excavation and Disposal are offset by the effort and disruption required for implementation and the need to transport the

sediment approximately 180 road miles one way for disposal at Potrero Hills Landfill as the planning and cost-estimating basis; another appropriately permitted landfill may ultimately be selected and is expected to be at a similar or greater distance.

3.3 Pond 8 Aquatic Sediment

Remedial technologies for this AOC were preliminarily screened in Section 2. This section presents an evaluation of the selected new alternatives for the Pond 8 AOC based on the screening criteria presented in Section 1.

3.3.1 Development and Evaluation of Remedial Alternatives

3.3.1.1 Pond 8 Aquatic Sediment: Alternative 7 – Pond 8 West, with Lowland Ponds, Excavation and Disposal

As described in Section 2.3.3.1, the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative involves the excavation and offsite disposal of non-hazardous sediment in Pond 8 West, Pond 7, Pond 6, and North Pond and containment in place for sediment in Pond 8 East. Institutional controls would be implemented for Pond 8 East to establish LUCs which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable.

Modifications to the Mill Pond Dam would be required. The existing spillway would remain, and a new spillway would be constructed at the approximate middle point of Pond 8, where the pond is narrow. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end. Pond 8 East would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm. This alternative would disturb approximately 109,000 square feet in Pond 8 West, approximately 900 square feet in Pond 7, and approximately 10,000 square feet in Pond 6 and North Pond, for a combined disturbance area of approximately 119,900 square feet. Sediment excavation and disturbance of aquatic habitat in these areas would require habitat restoration and/or mitigation.

The sections below focus on the Pond 8 element of the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative.

3.3.1.1.1 Overall Protection of Human Health and the Environment

The affected sediment would be directly removed and disposed of offsite in an accredited non-hazardous-landfill, assumed to be the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, as the planning and cost-estimating basis, subject to waste characterization and facility acceptance. ICs would be implemented for Pond 8 East following implementation of Pond 8 West excavation. This alternative is anticipated to be protective of human health and the environment as it provides restrictions for access to the affected sediment and guidelines for disturbing the remaining sediment.

3.3.1.1.2 Compliance with ARARs

This alternative is generally in compliance with the projected ARARs, though may be difficult to permit within the California Coastal Zone as excavation and disposal will result in the disruption and destruction of wetland habitat which would require significant mitigation. Other alternatives (e.g., Alternative 2) are anticipated to be less environmentally damaging as they require less disturbance of a wetland area. At a minimum, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost.

Pond 8 West sediment would be removed and sediment remaining in Pond 8 East would be protected by the new spillway; therefore, climate change and sea level rise are not anticipated to affect the ability of this alternative to comply with projected ARARs. Sea level rise will be considered during design development of the Mill Pond Dam soil buttress and new spillway; an updated wave study and sea level rise evaluation will be completed by ESA. Additional analysis of the beach berm to assess future tidal conditions and sea level rise can be considered during design development. This alternative would require regular inspection and maintenance of the Mill Pond Dam and the beach berm to address impacts from sea level rise. As discussed in Section 3.3.1.1.5, transportation of excavated sediment to an appropriate non-hazardous waste disposal facility, assumed to be the Class III Potrero Hills Landfill in Suisun City, California, approximately 180 road miles from the Site and approximately 360 miles round trip, as the planning and cost-estimating basis would generate CO2 emissions.

3.3.1.1.3 Long-Term Effectiveness and Permanence

O&M is not required for Pond 8 West after completion of the excavation and disposal and affected sediment would be removed, as confirmed by confirmation sampling. Removing affected sediment to allow unrestricted land use would be expected to reduce risk such that institutional controls for Pond 8 West are not necessary. The Institutional Controls would provide adequate protection of potential receptors in the long-term from remaining affected sediment in Pond 8 East. The design life of the proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design. The design considers sea-level rise consistent with DTSC guidance for 2100 as described in Section 1.1.3.3.1.1. Periodic inspection and maintenance of the Mill Pond Dam and the beach berm will be required. Major repairs are anticipated to be relatively infrequent, on the order of 50 or more years between major maintenance activities. Therefore, this alternative is ranked high for long-term effectiveness and permanence.

3.3.1.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Excavation and disposal would remove affected sediment from Pond 8 West, thereby reducing the volume and mobility of affected sediment. Affected sediment would remain in Pond 8 East. Overall, this alternative ranks moderate for this criterion. The OU-E BHHERA estimated a cumulative ELCR of 2 x 10-6 for Pond 8 for both evaluated sediment intervals, with cumulative noncancer HIs below 1. Excavation would reduce these risk estimates, but the baseline estimates are within the NCP and CalEPA risk management range. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to Site sediment and surface water.

3.3.1.1.5 Short-Term Effectiveness

An estimated 1,500 truckloads would be required to transport the sediment in the pond to an appropriate non-hazardous waste disposal facility, assumed to be the Class III Potrero Hills Landfill in Suisun City, California. Existing sediment data indicate lower concentrations of COCs than in materials removed during excavation of soil and sediment that was classified as non-hazardous in 2017. Potrero Hills Landfill is approximately 180 road miles from the Site, and each round trip is estimated to be approximately 360 miles and the total sediment transport effort is estimated to generate[1] approximately 1,300,000 kilograms of CO2. Additionally, there is a risk of upset and spill on each trip to the appropriate waste disposal facility, and construction workers would be temporarily exposed to COC-affected- sediment during implementation. Therefore, this alternative is ranked low for short-term effectiveness. The actual receiving landfill would be selected during implementation based on waste characterization, facility acceptance, capacity, and applicable permitting requirements; another appropriately permitted facility may ultimately be selected and is expected to be at a similar or greater transportation distance.

Transportation of sediment out of Fort Bragg via rail is not currently viable due to the collapse of Noyo Canyon Tunnel No. 1. There are plans to repair the tunnel, however, the timeline is uncertain and the tunnel is unlikely to be repaired such that transport by rail is a viable option for this project; in the short term, transportation by truck is the available transportation method.

3.3.1.1.6 Implementability

The Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative is ranked moderate for implementability. It is readily implementable with standard construction equipment, backfilling materials would be locally obtainable, and waste likely qualifies as non-hazardous waste for reduced disposal hazards and transport; however, required permitting and mitigation requirements would be significant, and the depth of the excavation and likely soft sediment conditions would pose significant challenges. It is likely that not all sediment containing COCs would be able to be removed from Pond 8 West and a contingency remedy of containment and institutional controls would still be required. As discussed above, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost. Anticipated permits required to complete this alternative include: CCC CDP, City Coastal Development and Grading Permits, MCAQMD Dust Control Permit, RWQCB Section 401 of the Clean Water Act Permit, USACE Section 404 of the Clean Water Act Permit, and Stormwater Construction General Permit. A wetland mitigation modifier of 4:1 was assumed for cost estimation purposes. It is assumed that mitigation will be performed onsite. Approximately 98,000 sf are estimated to be disturbed in Pond 8 West, which would correspond to 9 acres of required mitigation.

3.3.1.1.7 Cost

Excavation and disposal for unrestricted use is ranked low as it is more expensive than other remedial alternatives. Costs include documentation of permitting, removal, disposal, wetland restoration/mitigation, institutional controls and annual inspection and periodic maintenance of established controls such as fencing, routine maintenance, and vegetation control on the beach berm as well as annual inspection, maintenance, vegetation control, and periodic survey of the Mill Pond Dam. The design life of proposed

[1] CO_2 generation estimate based on an emission factor from the Environmental Defense Fund's "The Green Freight Handbook."

repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design.

3.3.1.1.8 Overall Rating

Overall, the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative ranks moderate. It is ranked high for long term effectiveness and permanence, but moderate for other criteria. The benefits of this alternative are offset by the likelihood that not all sediment containing COCs would be able to be removed from Pond 8 West, and a contingency remedy of containment and institutional controls would still be required. In addition, this alternative has a high cost as compared to other alternatives evaluated for the relatively small reduction of risk achieved.

3.3.1.2 Pond 8 Aquatic Sediment: Alternative 8 - Institutional Controls (Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Maintenance) – Interior Rock Slope Protection

This alternative is based on the institutional-controls and containment alternative recommended for Pond 8, North Pond, and Pond 6 sediment in the 2019 OU-E FS and applies the same remedy framework to Pond 7, but proposes an alternative design element at the crib wall.

As described in Section 2.3.3.2, sediment in Pond 8 would remain in place. ICs would be implemented to provide LUCs which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable.

The ICs and LUCs do not establish unrestricted use while sediment remains above the unrestricted-use cleanup goals. To achieve unrestricted use, sediment exceeding cleanup goals would need to be excavated or otherwise remediated, with confirmation sampling demonstrating that remaining sediment meets goals. Excavated sediment would be characterized, managed, and transported to an appropriately permitted offsite disposal facility. Until those criteria are met, the LUCs and Sediment Management Plan would restrict uses and sediment-disturbing activities, require review and sampling before disturbance, and define requirements for handling, reuse, or offsite disposal of disturbed sediment.

Containment of sediment in Pond 8, Pond 7, Pond 6, and the North Pond would be provided by the existing Mill Pond Dam and beach berm. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end and rock slope protection on the interior of Pond 8 at the crib wall near the ocean. A cutoff wall would also be installed near the center of Pond 8 to divide into two smaller ponds. Pond 8 would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm. This alternative is not expected to require significant soil removal or destruction of habitat.

For the passive recreational visitor evaluated in the OU-E BHHERA, the cumulative Pond 8 ELCR was 2 x 10-6 for both the 0-to-0.5-foot and 0-to-2-foot below-sediment-surface intervals, and the cumulative noncancer HI was less than 1 for both intervals. These estimates exceed 1 x 10-6 but are within the NCP and CalEPA risk management range of 1 x 10-6 to 1 x 10-4. Notification to DTSC and sediment removal may occur as part of future redevelopment activities or a change in use to maintain acceptable risk under the changed conditions.

3.3.1.2.1 Overall Protection of Human Health and the Environment

The Institutional Controls – Interior Rock Slope Protection alternative is anticipated to be protective of human health and the environment as it provides restrictions for access to the affected sediment and guidelines for disturbing the sediment. This alternative likely meets the RAOs.

3.3.1.2.2 Compliance with ARARs

This alternative is generally in compliance with the projected ARARs. Other alternatives (e.g., Alternative 2) are anticipated to be less environmentally damaging as they require less disturbance and fill of a wetland area. At minimum, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost.

Climate change and sea level rise are not anticipated to affect the ability of this alternative to comply with projected ARARs. Sea level rise will be considered during design development of the Mill Pond Dam soil buttress; an updated wave study and sea level rise evaluation will be completed by ESA. Additional analysis of the beach berm to assess future tidal conditions and sea level rise can be considered during design development. This alternative would require regular inspection and maintenance of the Mill Pond Dam and the beach berm to address impacts from sea level rise.

3.3.1.2.3 Long-Term Effectiveness and Permanence

The Institutional Controls – Interior Rock Slope Protection alternative ranks high for the long-term effectiveness criterion as the proposed LUCs and SMP would provide adequate protection of potential receptors in the long term. The design life of proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design. The design considers sea-level rise consistent with DTSC guidance for 2100 as described in Section 1.1.3.3.1.1. Periodic inspection and maintenance of the Mill Pond Dam and the beach berm will be required. Major repairs are anticipated to be relatively infrequent, on the order of 50 or more years between major maintenance activities.

3.3.1.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The Institutional Controls – Interior Rock Slope Protection alternative was ranked moderate for reduction of toxicity, mobility, or volume through treatment because no COC-affected media would be removed or treated, although containment would reduce potential sediment mobility. The OU-E BHHERA estimated a cumulative ELCR of 2 x 10-6 for both evaluated Pond 8 sediment intervals and cumulative noncancer HIs below 1. Institutional controls and containment would address exposure and mobility rather than reduce COC toxicity or volume. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to site sediment and surface water.

3.3.1.2.5 Short-Term Effectiveness

The Institutional Controls – Interior Rock Slope Protection alternative was ranked moderate for the short-term effectiveness criteria, as construction of the interior rock slope protection requires working within Pond 8 and therefore exposing construction workers to COC-impacted media.

3.3.1.2.6 Implementability

The Institutional Controls – Interior Rock Slope Protection alternative received a high ranking for the implementability criteria, as it is implementable. As discussed above, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost.

3.3.1.2.7 Cost

The Institutional Controls – Interior Rock Slope Protection alternative ranked high, as the cost is comparatively lower than other process options. However, as discussed above, additional wetland would be expected to be disturbed in this alternative as compared to other alternatives, and therefore additional permitting and mitigation would be expected which may impact implementability and cost. Costs include documentation of institutional controls and annual inspection and periodic maintenance of established controls such as fencing, routine maintenance, and vegetation control on the beach berm as well as annual inspection, maintenance, vegetation control, and periodic survey of the Mill Pond Dam. The design life of proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design.

3.3.1.2.8 Overall Rating

Overall, the Institutional Controls – Interior Rock Slope Protection alternative ranks high. Although it is ranked moderate for the reduction of toxicity, mobility and volume criterion, institutional controls would provide adequate elimination of potential exposure pathways for future receptors. This alternative ranks similarly to the recommended alternative in the 2019 OU-E FS (Alternative 2), but ultimately ranks lower due to a lower short-term effectiveness ranking, additional uncertainty related to implementability and cost, and potential compliance with ARARs concerns related to filling of a wetland.

3.3.1.3 Pond 8 Aquatic Sediment: Alternative 9 - Institutional Controls (Containment, Land Use Controls, Sediment Management, and Long-Term Operations and Maintenance) – Seawall

This alternative is based on the institutional-controls and containment alternative recommended for Pond 8, North Pond, and Pond 6 sediment in the 2019 OU-E FS ,but proposes an alternative design element at the crib wall.

As described in Section 2.3.3.3, sediment in Pond 8 would remain in place. ICs would be implemented to provide LUCs which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable.

The ICs and LUCs do not establish unrestricted use while sediment remains above the unrestricted-use cleanup goals. To achieve unrestricted use, sediment exceeding cleanup goals would need to be excavated or otherwise remediated, with confirmation sampling demonstrating that remaining sediment meets goals. Excavated sediment would be characterized, managed, and transported to an appropriately permitted offsite disposal facility. Until those criteria are met, the LUCs and Sediment Management Plan would restrict uses and sediment-disturbing activities, require review and sampling before disturbance, and define requirements for handling, reuse, or offsite disposal of disturbed sediment.

Containment of sediment in Pond 8, Pond 7, Pond 6, and the North Pond would be provided by the existing Mill Pond Dam and beach berm. To address DSOD requirements, the Mill Pond Dam would be modified to add a soil buttress at the northeast end and a seawall at the crib wall near the ocean. The seawall is assumed to be a new structure on the beach side of the existing Mill Pond Dam at the crib wall. A cutoff wall would also be installed near the center of Pond 8 to divide into two smaller ponds. Pond 8 would continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The beach berm would continue to protect the Mill Pond Dam from damage due to ocean intrusion in the lowland. This alternative would require regular inspection and maintenance of both the Mill Pond Dam and the beach berm. This alternative is not expected to require significant soil removal or destruction of habitat.

For the passive recreational visitor evaluated in the OU-E BHHERA, the cumulative Pond 8 ELCR was 2 x 10-6 for both the 0-to-0.5-foot and 0-to-2-foot below-sediment-surface intervals, and the cumulative noncancer HI was less than 1 for both intervals. These estimates exceed 1 x 10-6 but are within the NCP and CalEPA risk management range of 1 x 10-6 to 1 x 10-4. Notification to DTSC and sediment removal may occur as part of future redevelopment activities or a change in use to maintain acceptable risk under the changed conditions.

3.3.1.3.1 Overall Protection of Human Health and the Environment

The Institutional Controls – Seawall alternative is anticipated to be protective of human health and the environment as it provides restrictions for access to the affected sediment and guidelines for disturbing the sediment. This alternative likely meets the RAOs.

3.3.1.3.2 Compliance with ARARs

This alternative is in compliance with the projected ARARs.

Climate change and sea level rise are not anticipated to affect the ability of this alternative to comply with projected ARARs. Sea level rise will be considered during design development of the Mill Pond Dam soil buttress and seawall; an updated wave study and sea level rise evaluation will be completed by ESA. Additional analysis of the beach berm to assess future tidal conditions and sea level rise can be considered during design development. This alternative would require regular inspection and maintenance of the Mill Pond Dam and the beach berm to address impacts from sea level rise.

3.3.1.3.3 Long-Term Effectiveness and Permanence

The Institutional Controls – Seawall alternative was ranked high for the long-term effectiveness criterion as the proposed LUCs and SMP would provide adequate protection of potential receptors in the long term. The design life of proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design. The design considers sea-level rise consistent with DTSC guidance for 2100 as described in Section 1.1.3.3.1.1. Periodic inspection and maintenance of the Mill Pond Dam and the beach berm will be required. Major repairs are anticipated to be relatively infrequent, on the order of 50 or more years between major maintenance activities.

3.3.1.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The Institutional Controls – Seawall alternative was ranked moderate for the reduction of toxicity, mobility, or volume through treatment criterion as no COC-impacted media would be physically removed or treated, but sediment containment reduces the potential mobility. The OU-E BHHERA estimated a cumulative ELCR

of 2 x 10-6 for both evaluated Pond 8 sediment intervals and cumulative noncancer HIs below 1. Institutional controls and containment would address exposure and mobility rather than reduce COC toxicity or volume. The Ecological Risk Assessment in the OU-E BHHERA concluded that unacceptable ecological risk is not likely for populations of plants, benthic organisms, amphibians, birds, or mammals exposed to site sediment and surface water.

3.3.1.3.5 Short-Term Effectiveness

The Institutional Controls – Interior Rock Slope Protection alternative was ranked high for the short-term effectiveness criteria, as exposure to COC-impacted media by construction workers is limited to construction of the cutoff wall; the remaining work would be completed outside of Pond 8.

3.3.1.3.6 Implementability

The Institutional Controls – Seawall alternative received a moderate ranking for the implementability criteria, as it is implementable but may be a challenge to permit.

3.3.1.3.7 Cost

The Institutional Controls – Seawall alternative ranked low, as the cost is higher than other process options. Costs include documentation of institutional controls and annual inspection and periodic maintenance of established controls such as fencing, routine maintenance, and vegetation control on the beach berm as well as annual inspection, maintenance, vegetation control, and periodic survey of the Mill Pond Dam. The design life of proposed repairs for the Mill Pond Dam is estimated to be over 100 years as the maximum credible earthquake and maximum probable flood will be used for design.

3.3.1.3.8 Overall Rating

Overall, the Institutional Controls – Seawall alternative ranks moderate. Although it is ranked moderate for the reduction of toxicity, mobility and volume criterion, institutional controls would provide adequate elimination of potential exposure pathways for future receptors. This alternative ranks similarly to the recommended alternative in the 2019 OU-E FS (Alternative 2) but ranks lower due to a lower cost ranking.

3.3.2 Selection of Preferred Alternative

The Institutional Controls alternative (Alternative 2), which was recommended in the 2019 OU-E FS, remains the preferred alternative for the Pond 8 AOC as it provides adequate elimination of potential exposure pathways for future receptors while minimizing the destruction of wetlands and associated mitigation. This alternative also allows Pond 8 to continue to receive and treat stormwater from the Site and the City, including stormwater containing dioxins. The Institutional Controls alternative evaluates the risk associated with affected sediment and provides LUCs for future Site use which limit land use and control activities in areas where the risk from one or more exposure pathways is deemed unacceptable for unrestricted use. It would also include a comprehensive SMP which would provide detailed procedures for sediment disturbing activities and describe required sampling and criteria for reuse of disturbed sediment. In addition, ongoing O&M of the existing beach berm would provide continued sediment containment. Although it is associated with moderate reduction of toxicity, mobility, and volume, institutional controls is protective through elimination of potential exposure pathways for future receptors.

The Pond 8 institutional-controls alternative is compatible with future daylighting of Alder Creek and Maple Creek along their former drainage alignments and is not precluded by remedy selection. Daylighting design would be coordinated with the selected remedy by others and may route the drainages through Pond 8 East or through swales or stream channels connected to freshwater wetland areas in the OU-E lowlands. Implementation alignments would need to maintain access for emergency services and integrate the daylighted corridors, crossings, and associated drainage features with approved future redevelopment plans.

Arsenic EPC for Pond 8 sediment (9.7 mg/kg) is approximately equal to the draft remedial goal (10 mg/kg) and is below the NTE sediment goal for arsenic established in the OU-E RAW (67 mg/kg) as protective of the 12-day recreator (Arcadis 2016). The dioxin TEQ EPC for Pond 8 sediment (107 pg/g) is greater than the California residential screening level of 50 pg/g but below the NTE sediment goal for dioxin TEQ established in the OU-E RAW (503 pg/g) as protective of the 12-day recreator (Arcadis 2016) and below the commercial/industrial screening level of 200 pg/g. Institutional Controls are appropriately protective of human health and the environment given the low concentrations relative to NTE and commercial/industrial values.

Proposed modifications to the Mill Pond Dam include: 1) a RSP buttress at the crib wall section; 2) ground improvements and an earth-fill buttress at the eastern dam section; and 3) a cutoff wall installed near the center of the pond to divide it into two smaller ponds.

The potential benefits of the Pond 8 West, with Lowland Ponds, Excavation and Disposal alternative are offset by the scale of effort and environmental disruption required for implementation of this alternative, and the need to transport the sediment approximately 180 road miles one way for disposal at Potrero Hills Landfill as the planning and cost-estimating basis; another appropriately permitted landfill may ultimately be selected and is expected to be at a similar or greater distance. The benefits of the interior rock slope protection alternative (Alternative 8) are similarly offset by the disruption required in Pond 8 to construct an interior rock slope protection and the associated increased short-term effects and habitat mitigation. The seawall alternative (Alternative 9) scores similarly to Alternative 2, but is significantly more expensive and therefore ranks lower for the cost criteria; the cost difference is not justified by significant reduction of other impacts.

4. SUMMARY OF RECOMMENDED ALTERNATIVES

A summary of AOC recommendations for Pond 8 AOC, Pond 7 AOC, and North Pond and Pond 6 AOC is provided below and presented in Table 4-1.

- Pond 8, Pond 7, North Pond and Pond 6 Aquatic Sediment AOCs
- Pond 8 Aquatic Sediment Primary COCs: arsenic, dioxin TEQ
- North Pond and Pond 6 Aquatic Sediment Primary COCs: arsenic, dioxin TEQ.
- Pond 7 Aquatic Sediment Primary COCs: arsenic, barium, dioxin TEQ
- Recommended Alternative: Institutional Controls: containment, land use controls, sediment management, and long-term operations and maintenance (Alternative 2)
- When evaluated as individual aquatic AOCs, human health risks evaluated as excess lifetime cancer risk for Southern Ponds, Pond 6, Pond 7, Pond 8, and North Pond were within the risk management range of 10-4 to 10-6 established in the NCP (40 CFR 300.430; NCP 2014) and by CalEPA (1996), indicating risk management measures are appropriate remedies for these AOCs.
- The ERA indicated that unacceptable ecological risk is not likely for populations of plants, benthic organisms, birds, mammals and amphibians exposed to site sediment and surface water.
- ICs are appropriately protective given the EPCs are below NTE and commercial/industrial values, which reflect potential exposures with restrictive ICs in place.
- Eliminates exposure pathways for potential future on and offsite receptors via institutional and administrative management and provides protection of human health and the environment.
- Includes implementation of a SMP to restrict site use and soil and sediment disturbing activities.
- Easily implementable and effective in the short term as no workers are exposure to COC-affected-media during implementation.
- Allows possible future restoration of Maple and Alder Creeks while preserving existing wetland habitats.
- Cost effective.

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TABLES

TABLE 3-1 COMPARISON OF REMEDIAL ALTERNATIVES (UPDATED TABLE 7-1, 2019 FS)

TABLE 4-1 REMEDIAL ALTERNATIVE RECOMMENDATIONS SUMMARY (UPDATED TABLE 8-1, 2019 FS)

Table 3-1: Comparison of Remedial Alternatives (Updated Table 7-1, 2019 OU-E FS)

Media	AOC	Risk Summary	Category	Alternative	Description	Threshold (Yes or No) Criteria		Balancing (Low, Moderate, or High) Criteria				
						Overall Protection of Human Health and the Environment	Compliance with ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short Term Effectiveness	Implementability	Cost
Aquatic Sediment	Pond 7	Arsenic and dioxin TEQ are the primary risk drivers in Pond 7 sediment. Risks evaluated in the BHHERA indicate ELCR of 2E-05.	Evaluated in 2019 OU-E FS	No Action	Site remains as is; provide no additional control or action to protect human health or the environment from affected sediment. Existing beach berm would continue to provide sediment containment.	No	No	Low	Low	High	High	$0
			Evaluated in 2019 OU-E FS; Recommended Alternative in 2019 FS	Institutional Controls	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	High	$200,000
			Evaluated in 2019 OU-E FS	Vegetative Soil Cover and Institutional Controls	Provide an upland vegetative cover to cover the pond. Eliminate exposure pathways through vegetative containment, and implementation of a deed restriction and risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	Moderate	$752,000
			Evaluated in 2019 OU-E FS	Excavation and Disposal	Eliminate exposure pathways through sediment excavation and disposal offsite at a permitted landfill. Beach berm repairs provide improved sediment containment.	Yes	Yes	High	High	Low	Moderate	$452,600
			Evaluated in 2019 OU-E FS	Vegetative Sediment Cover and Institutional Controls	Provide a vegetative wetland cover to cover the pond. Eliminate exposure pathways through vegetative containment, and implementation of a deed restriction and risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	Moderate	$589,000
			New	Excavation of Pond 8 West, with Lowland Ponds, Sediment Disposal, and Dam Modifications	Pond 7 elements related to new alternative to reduce exposure pathways through sediment excavation of Pond 8 West along with lowland ponds and disposal offsite at a permitted landfill. Restrict future land use of Pond 8 East via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	High	Moderate	Low	Moderate	$452,600
	North Pond and Pond 6	Arsenic and dioxin TEQ are the primary risk drivers in Pond 6 sediment, while arsenic was the primary risk contributor in North Pond sediment. Risks evaluated in the BHHERA indicate ELCR of 2E10-6.	Evaluated in 2019 OU-E FS	No Action	Site remains as is; provide no additional control or action to protect human health or the environment from affected sediment. Existing beach berm would continue to provide sediment containment.	No	No	Low	Low	High	High	$0
			Evaluated in 2019 OU-E FS; Recommended Alternative in 2019 FS	Institutional Controls	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	High	$201,000
			Evaluated in 2019 OU-E FS	Vegetative Soil Cover and Institutional Controls	Provide an upland vegetative cover to cover the pond. Eliminate exposure pathways through vegetative containment, and implementation of a deed restriction and risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	Moderate	$840,000
			Evaluated in 2019 OU-E FS	Excavation and Disposal	Eliminate exposure pathways through soil excavation and disposal offsite at a permitted landfill.	Yes	Yes	High	High	Low	Moderate	$1,086,000
			Evaluated in 2019 OU-E FS	Vegetative Sediment Cover and Institutional Controls	Provide a vegetative wetland cover to cover the pond. Eliminate exposure pathways through vegetative containment, and implementation of a deed restriction and risk management plan for soil/sediment based on COIs and associated risks.	Yes	Yes	Moderate	Low	High	Moderate	$725,000
			New	Excavation of Pond 8 West, with Lowland Ponds, Sediment Disposal, and Dam Modifications	Pond 6 and North Pond elements related to new alternative to reduce exposure pathways through sediment excavation of Pond 8 West along with lowland ponds and disposal offsite at a permitted landfill. Restrict future land use of Pond 8 East via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	High	Moderate	Low	Moderate	$1,086,000

Table 3-1: Comparison of Remedial Alternatives (Updated Table 7-1, 2019 OU-E FS)

Media	AOC	Risk Summary	Category	Alternative	Description	Threshold (Yes or No) Criteria		Balancing (Low, Moderate, or High) Criteria				
						Overall Protection of Human Health and the Environment	Compliance with ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short Term Effectiveness	Implementability	Cost
Aquatic Sediment	Pond 8	Dioxin TEQ is the primary risk drivers in sediment. Risks evaluated in the BHHERA indicate ELCRs are 2E-6 cumulative with the primary contributors of 1E-6 for dioxin and 1E-6 for arsenic. Arsenic concentrations are at background.	Evaluated in 2019 OU-E FS	No Action	Site remains as is; provide no additional control or action to protect human health or the environment from affected sediment. Mill Pond Dam continues to provide sediment containment.	No	No	Low	Low	High	High	$0
			Evaluated in 2019 OU-E FS; Recommended Alternative in 2019 FS	Institutional Controls	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Dam repairs provide improved sediment containment.	Yes	Yes	High	Moderate	High	High	$7,610,000
			Evaluated in 2019 OU-E FS	In-Situ Soil Mixing and Institutional Controls	Proposes to treat sediment in place through stabilization by the addition of binders and Portland cement to restrict exposure of potential receptors to affected media, and would limit potential direct contact with affected sediment, or infiltration of water. Dam repairs provide improved sediment containment.	Yes	Yes	High	Moderate	Low	Low	$20,086,000
			Evaluated in 2019 OU-E FS	Excavation and Disposal	Eliminate exposure pathways through excavation and disposal offsite at a permitted landfill. Dam repairs provide improved sediment containment.	Yes	Yes	High	High	Low	Moderate	$38,977,000
			Evaluated in 2019 OU-E FS	Vegatative Sediment Cover and Institutional Controls	Provide a vegetative wetland cover to cover the pond. Eliminate exposure pathways through vegetative containment, and implementation of a deed restriction and risk management plan for soil/sediment based on COIs and associated risks. Dam repairs provide improved sediment containment.	Yes	Yes	Low	Moderate	High	Low	$20,315,000
			Evaluated in 2019 OU-E FS	Vegetated Soil Cover and Institutional Controls	Alternative proposes to provide a vegetative cover to cover the pond to restrict exposure of potential receptors to affected media, and would limit potential direct contact with affected sediment, or infiltration of water. Dam repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	Low	$21,262,000
			New	Excavation of Pond 8 West, with Lowland Ponds, Sediment Disposal, and Dam Modifications	Pond 8 elements to reduce exposure pathways through sediment excavation of Pond 8 West along with lowland ponds and disposal offsite at a permitted landfill. Restrict future land use of Pond 8 East via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	High	Moderate	Low	Moderate	$15,276,000
			New	Institutional Controls (Interior Rock Slope Protection Design Alternative to Rock Slope Protection)	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Dam repairs provide improved sediment containment. Propose interior rock slope protection at cribwall (alternate design to beach-side rock slope protection).	Yes	Yes	High	Moderate	Moderate	High	$9,167,000
			New	Institutional Controls (Seawall Design Alternative to Rock Slope Protection)	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Dam repairs provide improved sediment containment. Propose seawall at cribwall (alternate design to beach-side rock slope protection).	Yes	Yes	High	Moderate	High	Moderate	$12,642,000

Notes:

Recommended alternatives are outlined with bold lines.

Cost estimates for alternatives evaluated in 2019 OU-E FS escalated to 2025 for comparison with the new alternatives.

Green shading indicates that the screening criteria is met or has a high ranking in preference.

Yellow shading indicates that the screening criteria is likely met or has a moderate ranking in preference.

Red shading indicates that the screening criteria may not be met or has a low ranking in preference.

Acronyms:

AOC - area of concern
AOI - area of interest
ARARs - Applicable or Relevant and Appropriate Requirements
BHHERA - Baseline Human Health and Ecological Risk Assessment - Operable Unit E (ARCADIS, 2015)
COI - chemical of interest
dioxin - polychlorinated dibenzo-p-dioxin (in case of TEQ, 2,3,7,8-tetrachlorodibenzo-p-dioxin [2,3,7,8-TCDD] in particular)
ELCR - excess lifetime cancer risk
ERA - ecological risk assessment
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
TEQ - toxic equivalent

Reference:

Kennedy/Jenks. 2019. Final Feasibility Study, Operable Unit E, Former Georgia-Pacific Wood Products Facility, Fort Bragg, California. 12 September.
ARCADIS. 2015. Baseline Human Health and Ecological Risk Assessment – Operable Unit E, Former Georgia-Pacific Wood Products Facility, Fort Bragg, California. Prepared for Georgia-Pacific LLC. August.

Table 4-1: Remedial Alternative Recommendations Summary (Updated Table 8-1, 2019 OU-E FS)

Media	AOC	Primary Risk Drivers	ELCR	Alternative	Objective	Threshold (Yes or No) Criteria		Balancing (Low, Moderate, or High) Criteria				
						Overall Protection of Human Health and the Environment	Compliance with ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short Term Effectiveness	Implementability	Cost
Sediment	Pond 7	Arsenic and dioxin TEQ	2E-5 Prior to excavation in 2017.	Institutional Controls	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	High	$200,000
	North Pond and Pond 6	Arsenic and dioxin TEQ	2E-6 (North) 3E-6 (Pond 6 0-2ft) 4E-6 (Pond 6 0-0.5 ft)	Institutional Controls	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Beach berm repairs provide improved sediment containment.	Yes	Yes	Moderate	Low	High	High	$201,000
	Pond 8	Dioxin TEQ	2E-6 (1E-6 each for Dioxin and Arsenic, Arsenic concentrations are at background)	Institutional Controls	Restrict future land use via deed restriction and implement risk management plan for soil/sediment based on COIs and associated risks. Mill Pond Dam repairs provide improved sediment containment.	Yes	Yes	High	Moderate	High	High	$7,610,000

Notes:

Green shading indicates that the screening criteria is met or has a high ranking in preference.
Yellow shading indicates that the screening criteria is likely met or has a moderate ranking in preference.
Red shading indicates that the screening criteria may not be met or has a low ranking in preference.

Acronyms:

AOC - area of concern
ARARs - Applicable or Relevant and Appropriate Requirements
COI - chemical of interest
dioxin - polychlorinated dibenzo-p-dioxin (in case of TEQ, 2,3,7,8-tetrachlorodibenzo-p-dioxin [2,3,7,8-TCDD] in particular)
ELCR - Excess Lifetime Cancer Risk
TEQ - toxic equivalent

Reference:

Kennedy/Jenks. 2019. Final Feasibility Study, Operable Unit E, Former Georgia-Pacific Wood Products Facility, Fort Bragg, California. 12 September.
ARCADIS. 2015. Baseline Human Health and Ecological Risk Assessment – Operable Unit E, Former Georgia-Pacific Wood Products Facility, Fort Bragg, California. Prepared for Georgia-Pacific LLC. August.

FIGURES

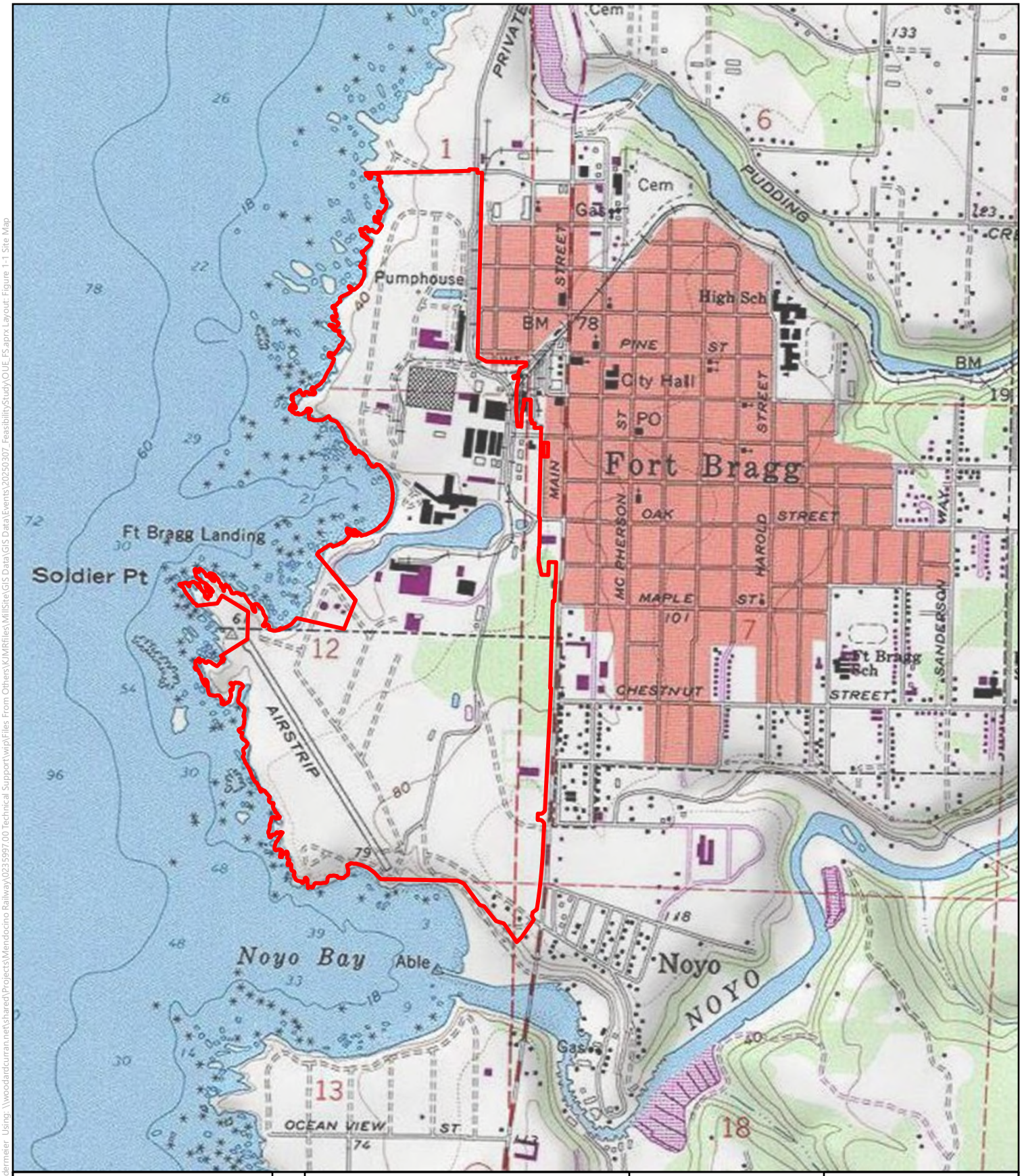
FIGURE 1-1: SITE LOCATION MAP

FIGURE 1-2: OPERABLE UNITS LOCATION MAP

FIGURE 1-3: OU-E AREA OF INTEREST MAP AND ASSOCIATED FEATURES

FIGURE 1-4: POND 7 REMOVAL ALTERNATIVE

FIGURE 1-5: PONDS 6, 7, 8, AND NORTH POND AREAS



Site Location Map

Former Georgia-Pacific Wood Products Facility
Fort Bragg, California

Figure 1-1

Legend

SITE BOUNDARY

N

0 500 1,000 Feet

Woodard & Curran

Project #: 0235997.00
Map Created: November 2026

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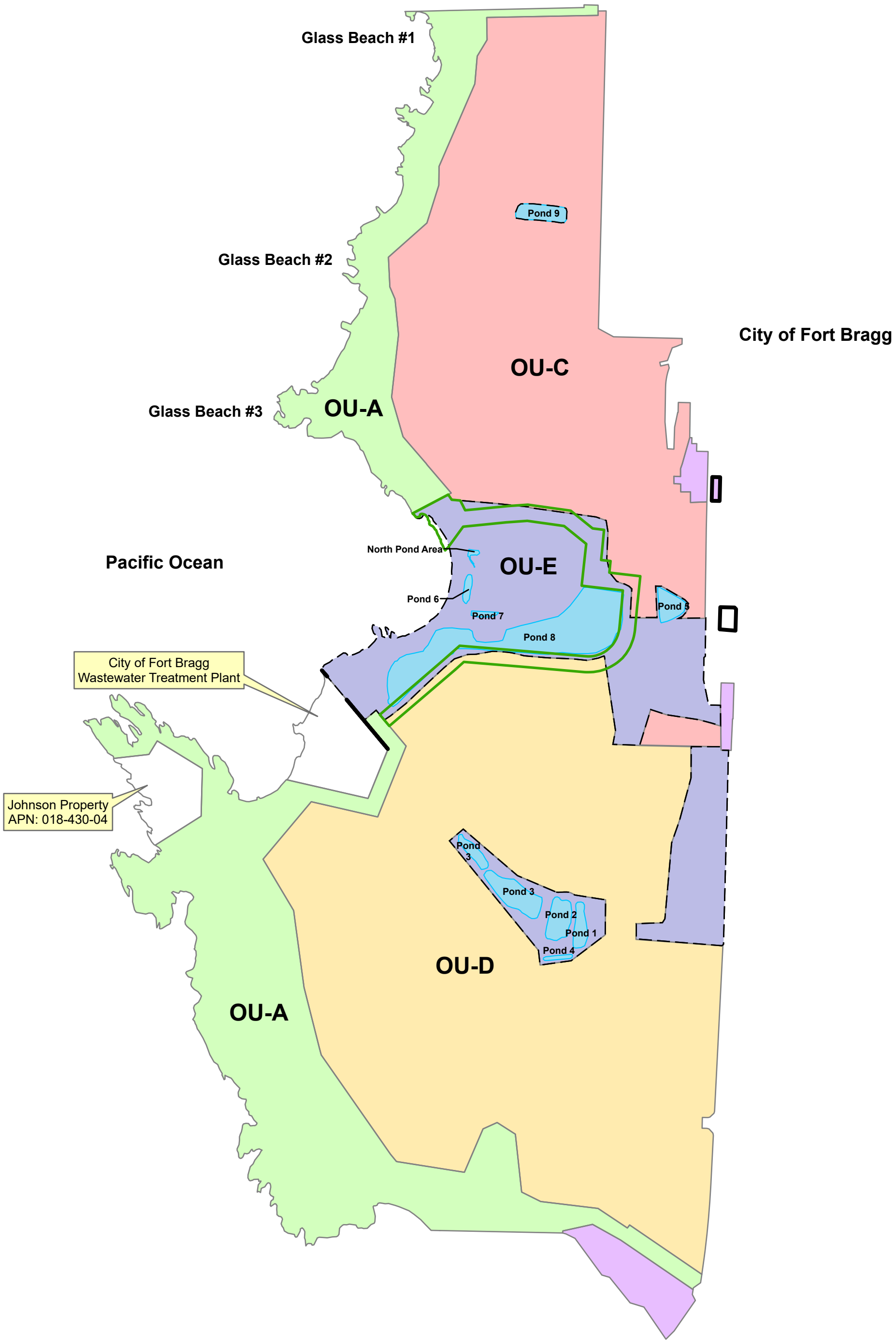

Operable Units Location Map

Former Georgia-Pacific Wood Products Facility
Fort Bragg, California

Figure 1-2

Legend

- APPROXIMATE CENTRAL COASTAL TRAIL PROPERTY (CITY OF FORT BRAGG)
- SITE BOUNDARY
- POND

Operable Units
- OU-A
- "OFFSITE" NON-INDUSTRIAL (OU-B)
- NORTHERN (OU-C)
- SOUTHERN (OU-D)
- CENTRAL/AQUATIC (OU-E)

Notes:
1. Abbreviation: OU = Operable Unit

N

0 250 500 Feet

Woodard & Curran

Project #: 0235997.00
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OU-E Area of Interest Map and Associated Features

Former Georgia-Pacific Wood Products Facility
Fort Bragg, California

Figure 1-3

Legend

Legend

- SITE BOUNDARY
- NEWLY IDENTIFIED POND 8 FILL AREA AOIS
- AOI BOUNDARY
- OU-E BOUNDARY
- OU-A BOUNDARY
- APPROXIMATE CENTRAL COASTAL TRAIL PROPERTY (CITY OF FORT BRAGG)
- PONDS
- AREA OF CONCERN BOUNDARY
- MILL POND DAM ALIGNMENT
- BEACH BERM ALIGNMENT

Notes:
1. Acronyms:
AOI - Area of Interest
OU - Operable Unit

AREAS OF CONCERN:

- (A) OUE LOWLAND
- (B) SOUTHERN PONDS
- (C) POND 5
- (D) POND 6
- (E) POND 7
- (F) NORTH POND
- (G) POND 8
- (H) POND 9

N

0 200 400 Feet

1 inch = 390 feet

Woodard & Curran

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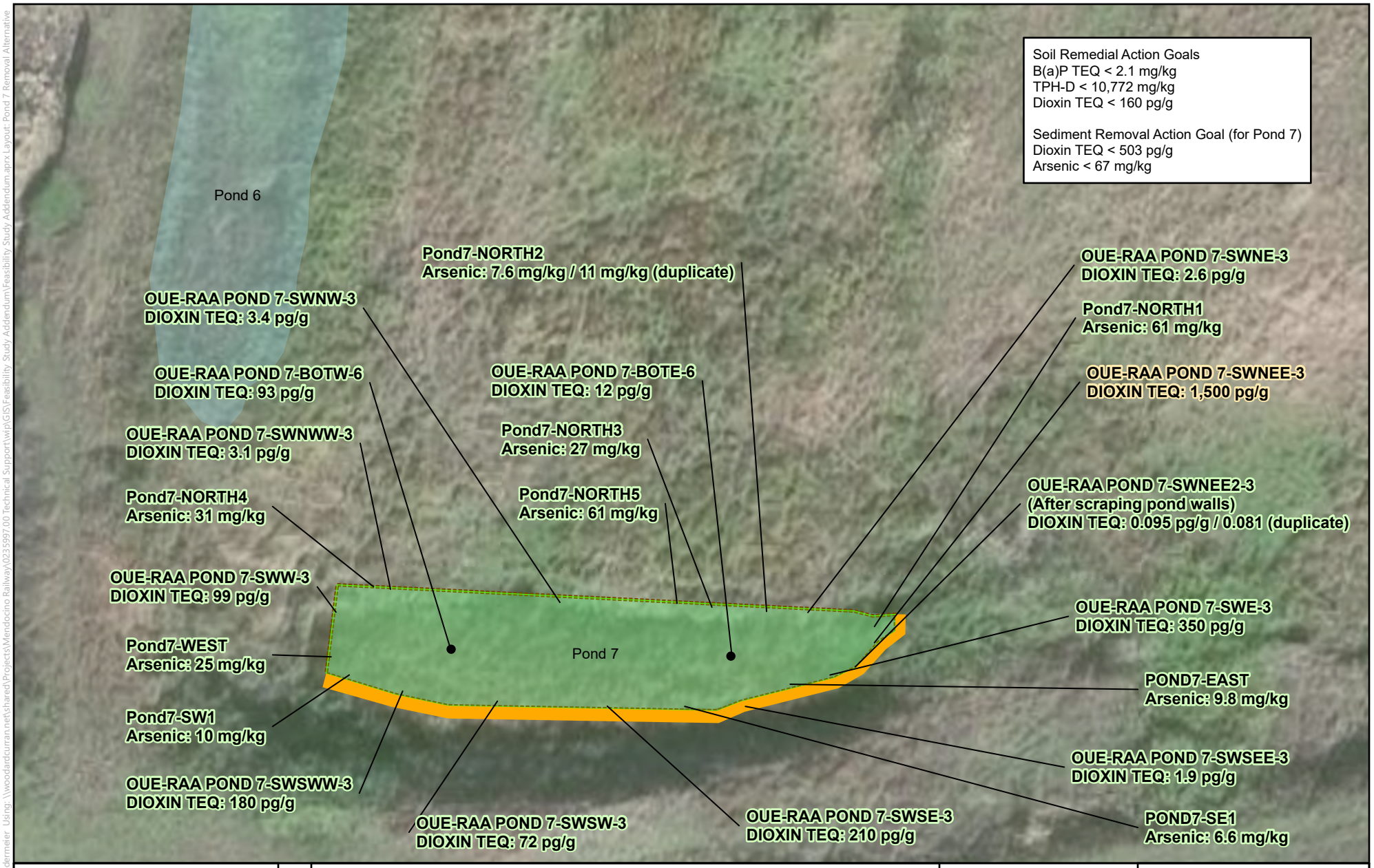

Pond 7 Removal Alternative

Former Georgia-Pacific Wood Products Facility
Fort Bragg, California

Figure 1-4

Legend

- Site Boundary
- OU-E Boundary
- Pond
- Areas Excavated Fall 2017
- 2017 Excavation
- Estimated Removal Alternative Area

Notes:
TEQ = Tetrachlorodibenzo-p-dioxin Toxic Equivalent

N

0 20 40 Feet

1 inch = 40 feet

Woodard & Curran

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Ponds 6, 7, 8, and North Pond Areas

Former Georgia-Pacific Wood Products Facility
Fort Bragg, California

Figure 1-5

Legend

- Site Boundary
- OU-E Boundary
- Pond
- Removal Alternative Area

N

0 100 200 Feet

1 inch = 200 feet

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APPENDIX A: COST SUMMARY TABLES FOR SEDIMENT REMEDIATION ALTERNATIVES (UPDATED APPENDIX A, 2019 OU-E FS

Appendix A
Cost Summary Table - Sediment Remediation Alternatives Assumptions
(Updated Appendix A, 2019 OU-E FS)

Feasibility Study Addendum - Operable Unit E
Former Georgia Pacific Wood Products Facility
Fort Bragg, California

Line Item	Unit Price	Units	Source
Soil and Sediment Costs			
Delineation and survey	Varies by AOC	per Square Foot	Assumed $0.20 per sf of AOI area, consistent with the OU-C/D FS.
Reporting	$60,000	Lump Sum	Typical cost based on previous work completed
Deed Restriction	$30,000	Lump Sum	Typical cost based on previous work completed
Soil Management Plan	$45,000	Lump Sum	Typical cost based on previous work completed
Beach Berm Repairs and Long-Term O&M	$270,000	Lump Sum	Based on repair/replacement of portions of beach berm armoring in year 30 of estimate, adjusted to NPV
Project Management	Varies by AOC	percent	Typically 10% of project cost
Design, preparation and oversight	Varies by AOC	percent	Typically 10% of Construction Costs
Permitting	$200,000	Lump Sum	Typical permitting cost for this project, based on previous work at the site, includes biological surveys, cultural resource consultation and reports, stormwater, air, city, and resource agency permits
Mobilization/Demobilization	$50,000	Lump Sum	Based on 2017 excavation effort
Installation of Cover	$80	per Cubic Yard	Based on 2017 excavation effort. Earthwork effort assumed to be similar for excavation as installation of cover.
Annual Maintenance (10% cover replacement annually)	Varies by AOC	Years (NPV)	An annual replacement rate of 10% is assumed for the wet vegetative cover alternatives. This replacement rate is based on sediment cap replacement in areas of active water flow and likely sediment cover scour and transport.
Restoration (4:1)	$64,000 - $320,000	per Acre	Based on creation of wetland establishment area as part of 2017 excavation effort. Restoration costs greater than 20 acres assumed to be an increased unit price due to higher scale of level of effort, including significant earthwork and creek daylighting needed to meet larger area requirements. A mitigation ratio of 4:1 was assumed. If existing pond remains a pond or wetland after alternative is implemented, the existing structure was counted as part of the mitigation (i.e., create new wetland area equal to three times the pond area to achieve 4:1 mitigation). In this scenario, the pond area would require reseeding but not the effort to create new wetland area, and therefore was included in the hydroseed line item but not included in the restoration line item. If the existing pond will not remain after the alternative is implemented, create new wetland area equal to four times the pond area to achieve 4:1 mitigation.
Engineer Oversight and Office Support	$3,700	per Day	Based on 2017 excavation effort. Assumes full-time engineering oversight in field with support from the office as-needed.
Contractor Non-labor Costs (Per Diem, etc.)	$2,000	per Day	Based on 2017 excavation effort. Average contractor team size of four, including one supervisor and one operator.
Misc. Supplies and Fuel	$800	per Day	Based on 2017 excavation effort
Equipment Costs	$3,000	per Day	Based on 2017 excavation effort. Includes Contractor vehicles, water truck, on-site trucking, skid steer, mini-excavator, and excavator (335F).
Excavation	$26	per Cubic Yard	Based on 2017 excavation effort. Assumes Contractor labor was equally divided between excavation, backfill, and stockpile and sediment management.
Stockpile and Sediment Management	$26	per Cubic Yard	Based on 2017 excavation effort. Assumes Contractor labor was equally divided between excavation, backfill, and stockpile and sediment management.
Transportation and Disposal (Class 2 Non-Hazardous)	$100	Tons	Based on 2017 excavation effort
Biological and Cultural Monitoring	$2,300	per Day	Based on 2017 excavation effort. Assumes monitors on-site as needed (not full-time).
Hydroseed	$12,700	per Acre	Based on 2017 excavation effort
In-situ Soil Mixing	$70	per Cubic Yard	Unit cost based on the in-situ soil mixing cost presented in the Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (https://frtr.gov/matrix2/top_page.html).

Appendix A
Cost Summary Table - Sediment Remediation Alternatives
(Updated Appendix A, 2019 OU-E FS)

Feasibility Study Addendum - Operable Unit E
Former Georgia Pacific Wood Products Facility
Fort Bragg, California

		Pond 7 AOC				North Pond and Pond 6 AOC				Pond 8 AOC			
	Nature and Extent	**• Arsenic, Dioxin TEQ • 900 sf • 170 cy average depth of 5 feet**				**• Arsenic, Dioxin TEQ • 3,000 sf (North Pond); 7,000 sf (Pond 6) • 2,200 cy to depth of 6 feet**				**• Dioxin TEQ • 318,000 sf • 106,000 cy average depth of 10 ft**			
	Remediation Alternative Cost Estimates and Assumptions	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**
Sediment Remediation Alternatives (2019 OU-E FS)	**No Action**	**No Action**				**No Action**				**No Action**			
	Assumptions:	No remediation activities required				No remediation activities required				No remediation activities required			
	Total Cost				**$ -**				**$ -**				**$ -**
	Institutional Controls[5]	**Institutional Controls**				**Institutional Controls**				**Institutional Controls**			
	Assumptions:	Deed restriction, survey, SMP				Deed restriction, survey, SMP				Containment, deed restriction, survey, SMP [2.]			
	Delineation and survey	1	Lump Sum	$ 2,000	$ 2,000	1	Lump Sum	$ 3,000	$ 3,000	1	Lump Sum	$ 58,000	$ 58,000
	Reporting	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000
	Deed Restriction	1	Lump Sum	$ 30,000	$ 30,000	1	Lump Sum	$ 30,000	$ 30,000	1	Lump Sum	$ 30,000	$ 30,000
	Soil Management Plan	1	Lump Sum	$ 45,000	$ 45,000	1	Lump Sum	$ 45,000	$ 45,000	1	Lump Sum	$ 45,000	$ 45,000
	Permitting	Not Applicable				Not Applicable				1	Lump Sum	$ 200,000	$ 200,000
	Rock slope protection (RSP)	Not Applicable				Not Applicable				1,375	Cubic Yards	$ 412	$ 567,000
	Pond 8 cutoff wall	Not Applicable				Not Applicable				63	Linear Feet	$ 23,524	$ 1,482,000
	CDSM soil mixing	Not Applicable				Not Applicable				1,100	Cubic Yards	$ 3,380	$ 3,711,000
	Soil buttress	Not Applicable				Not Applicable				5,700	Cubic Yards	$ 103	$ 585,000
	Mill Pond Dam Inspection and Long-Term O&M ($1,000/acre/year NPV + 5 yr survey)	Not Applicable				Not Applicable				30	Years (NPV)	$ 6,000	$ 36,000
	Beach Berm Repairs at year 30	1	NPV of repair	$ 270,000	$ 36,000	1	NPV of repair	$ 270,000	$ 36,000	1	NPV of repair	$ 270,000	$ 36,000
	Beach Berm Inspection and Long-Term O&M ($1,000/acre/year NPV)	30	Years (NPV)	$ 1,000	$ 8,000	30	Years (NPV)	$ 1,000	$ 8,000	30	Years (NPV)	$ 1,000	$ 8,000
	Hydroseed	Not Applicable				Not Applicable				1.3	Acres	$ 12,700	$ 17,000
	Restoration (4:1) [2]	Not Applicable				Not Applicable				1.3	Acres	$ 64,000	$ 83,000
	Project Management	1	10% of subtotal	$ 18,100	$ 19,000	1	10% of subtotal	$ 18,200	$ 19,000	1	10% of subtotal	$ 691,800	$ 692,000
	Total Cost				**$ 200,000**				**$ 201,000**				**$ 7,610,000**
	Sediment Cover[5]	**Vegetative Cover (Wet)**				**Vegetative Cover (Wet)**				**Vegetative Cover (Wet)**			
	Assumptions:	5,000 sf vegetative cover 2 feet thick, restoration of 0.6 acres as wet meadow (includes pond)				10,000 sf vegetative cover 2 feet thick, restoration of 0.9 acres as wet meadow (includes ponds)				318,000 sf vegetative cover 2 feet thick, restoration of 20 acres with creek restoration (includes pond)			
	Design, preparation and oversight (10% of Construction)	1	Lump Sum	$ 15,000	$ 15,000	1	Lump Sum	$ 26,000	$ 26,000	1	Lump Sum	$ 1,065,000	$ 1,065,000
	Permitting	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000
	Mobilization/Demobilization	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 150,000	$ 150,000
	Installation of Cover	380	Cubic Yards	$ 80	$ 30,000	750	Cubic Yards	$ 80	$ 60,000	24,000	Cubic Yards	$ 80	$ 1,920,000
	Annual Maintenance (10% cover replacement annually[3])	30	Years (NPV)	$ 3,040	$ 38,000	30	Years (NPV)	$ 6,000	$ 75,000	30	Years (NPV)	$ 192,000	$ 2,085,000
	Hydroseed	0.3	Acres	$ 12,700	$ 4,000	0.9	Acres	$ 12,700	$ 11,000	20	Acres	$ 12,700	$ 248,000
	Restoration (3:1) [2]	0.3	Acres	$ 64,000	$ 19,000	0.9	Acres	$ 64,000	$ 58,000	20	Acres	$ 320,000	$ 6,240,000
	Reporting	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000
	Deed Restriction	1	Lump Sum	$ 30,000	$ 30,000	1	Lump Sum	$ 30,000	$ 30,000	1	Lump Sum	$ 30,000	$ 30,000
	Soil Management Plan	1	Lump Sum	$ 45,000	$ 45,000	1	Lump Sum	$ 45,000	$ 45,000	1	Lump Sum	$ 45,000	$ 45,000
	Rock slope protection (RSP)	Not Applicable				Not Applicable				1,375	Cubic Yards	$ 412	$ 567,000
	Pond 8 cutoff wall	Not Applicable				Not Applicable				63	Linear Feet	$ 23,524	$ 1,482,000
	CDSM soil mixing	Not Applicable				Not Applicable				1,100	Cubic Yards	$ 3,380	$ 3,711,000
	Soil buttress	Not Applicable				Not Applicable				5,700	Cubic Yards	$ 103	$ 585,000
	Mill Pond Dam Inspection and Long-Term O&M ($1,000/acre/year NPV + 5 yr survey)	Not Applicable				Not Applicable				30	Years (NPV)	$ 6,000	$ 36,000
	Beach Berm Repairs at year 30	1	NPV of repair	$ 270,000	$ 36,000	1	NPV of repair	$ 270,000	$ 36,000	1	NPV of repair	$ 270,000	$ 36,000
	Beach Berm Inspection and Long-Term O&M ($1,000/acre/year NPV)	30	Years (NPV)	$ 1,000	$ 8,000	30	Years (NPV)	$ 1,000	$ 8,000	30	Years (NPV)	$ 1,000	$ 8,000
	Project Management	1	10% of subtotal	$ 53,500	$ 54,000	1	10% of subtotal	$ 65,900	$ 66,000	1	10% of subtotal	$ 1,846,800	$ 1,847,000
	Total Cost				**$ 589,000**				**$ 725,000**				**$ 20,315,000**

Appendix A
Cost Summary Table - Sediment Remediation Alternatives
(Updated Appendix A, 2019 OU-E FS)

Feasibility Study Addendum - Operable Unit E
Former Georgia Pacific Wood Products Facility
Fort Bragg, California

		Pond 7 AOC				North Pond and Pond 6 AOC				Pond 8 AOC			
	Nature and Extent	**• Arsenic, Dioxin TEQ • 900 sf • 170 cy average depth of 5 feet**				**• Arsenic, Dioxin TEQ • 3,000 sf (North Pond); 7,000 sf (Pond 6) • 2,200 cy to depth of 6 feet**				**• Dioxin TEQ • 318,000 sf • 106,000 cy average depth of 10 ft**			
	Remediation Alternative Cost Estimates and Assumptions	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**
Sediment Remediation Alternatives (2019 OU-E FS)	**Soil Cover[5]**	**Vegetative Cover (Dry)**				**Vegetative Cover (Dry)**				**Vegetative Cover (Dry)**			
	Assumptions:	5,000 sf vegetative cover 2 feet thick plus fill to rim of pond (11 feet), restoration of 0.8 acres as wet meadow (excludes pond)				10,000 sf vegetative cover 2 feet thick plus depth of water, restoration of 1.2 acres as wet meadow (excludes ponds)				318,000 sf vegetative cover 3 feet thick, restoration of 26 acres with creek restoration, divert water flow (excludes pond)			
	Design, preparation and oversight (10% of Construction)	1	Lump Sum	$ 28,000	$ 28,000	1	Lump Sum	$ 35,000	$ 35,000	1	Lump Sum	$ 1,179,000	$ 1,179,000
	Permitting	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000
	Mobilization/Demobilization	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 150,000	$ 150,000
	Installation of Cover	2,410	Cubic Yards	$ 80	$ 193,000	2,520	Cubic Yards	$ 80	$ 202,000	36,000	Cubic Yards	$ 80	$ 2,880,000
	Annual Maintenance ($1,000/acre/year NPV)	30	Years (NPV)	$ 200	$ 2,000	30	Years (NPV)	$ 400	$ 5,000	30	Years (NPV)	$ 8,200	$ 101,000
	Hydroseed	0.4	Acres	$ 12,700	$ 5,000	1.2	Acres	$ 12,700	$ 15,000	26	Acres	$ 12,700	$ 330,000
	Restoration (4:1) [2]	0.4	Acres	$ 64,000	$ 26,000	1.2	Acres	$ 64,000	$ 77,000	26	Acres	$ 320,000	$ 8,320,000
	Reporting	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000
	Deed Restriction	1	Lump Sum	$ 30,000	$ 30,000	1	Lump Sum	$ 30,000	$ 30,000	1	Lump Sum	$ 30,000	$ 30,000
	Soil Management Plan	1	Lump Sum	$ 45,000	$ 45,000	1	Lump Sum	$ 45,000	$ 45,000	1	Lump Sum	$ 45,000	$ 45,000
	Rock slope protection (RSP)	Not Applicable				Not Applicable				1,375	Cubic Yards	$ 412	$ 567,000
	Pond 8 cutoff wall	Not Applicable				Not Applicable				63	Linear Feet	$ 23,524	$ 1,482,000
	CDSM soil mixing	Not Applicable				Not Applicable				1,100	Cubic Yards	$ 3,380	$ 3,711,000
	Soil buttress	Not Applicable				Not Applicable				5,700	Cubic Yards	$ 103	$ 585,000
	Mill Pond Dam Inspection and Long-Term O&M ($1,000/acre/year NPV)	Not Applicable				Not Applicable				30	Years (NPV)	$ 6,000	$ 36,000
	Beach Berm Repairs at year 30	1	NPV of repair	$ 270,000	$ 36,000	1	NPV of repair	$ 270,000	$ 36,000	1	NPV of repair	$ 270,000	$ 36,000
	Beach Berm Inspection and Long-Term O&M	30	Years (NPV)	$ 1,000	$ 8,000	30	Years (NPV)	$ 1,000	$ 8,000	30	Years (NPV)	$ 1,000	$ 8,000
	Project Management	1	10% of subtotal	$ 68,300	$ 69,000	1	10% of subtotal	$ 76,300	$ 77,000	1	10% of subtotal	$ 1,972,000	$ 1,972,000
	Total Cost				**$ 752,000**				**$ 840,000**				**$ 21,692,000**
	Excavation and Disposal[5]	**Excavation and Disposal**				**Excavation and Disposal**				**Excavation and Disposal**			
	Assumptions: Costs based on recent 2017 excavation effort	Excavation and offsite disposal of 170 cy, restoration mitigation of 0.3 acres as wet meadow (includes pond)				Excavation and offsite disposal of 2,200 cy, restoration mitigation of 0.9 acres as wet meadow (includes ponds)				Excavation and offsite disposal of 106,000 cy, restoration mitigation of 20 acres as stream restoration [2] (includes pond)			
	Design (10% of Construction)	1	Lump Sum	$ 20,000	$ 20,000	1	Lump Sum	$ 70,000	$ 70,000	1	Lump Sum	$ 3,010,000	$ 3,010,000
	Permitting	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000
	Engineer Oversight and Office Support	2	Days	$ 3,700	$ 7,400	8	Days	$ 3,700	$ 30,000	350	Days	$ 3,700	$ 1,295,000
	Mobilization/Demobilization	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 150,000	$ 150,000
	Contractor Non-labor Costs (Per Diem, etc.)	2	Days	$ 2,000	$ 4,000	8	Days	$ 2,000	$ 16,000	348	Days	$ 2,000	$ 696,000
	Misc. Supplies and Fuel	2	Days	$ 800	$ 1,600	8	Days	$ 800	$ 6,000	348	Days	$ 800	$ 278,000
	Equipment Costs	2	Days	$ 3,000	$ 6,000	8	Days	$ 3,000	$ 24,000	348	Days	$ 3,000	$ 1,044,000
	Excavation	170	Cubic Yards	$ 26	$ 4,000	2,200	Cubic Yards	$ 26	$ 57,000	106,000	Cubic Yards	$ 26	$ 2,756,000
	Stockpile and Sediment Management	170	Cubic Yards	$ 26	$ 4,000	2,200	Cubic Yards	$ 26	$ 57,000	106,000	Cubic Yards	$ 26	$ 2,756,000
	Transportation and Disposal (Class 2 Non-Hazardous)	255	Tons	$ 100	$ 26,000	3,300	Tons	$ 100	$ 330,000	159,000	Tons	$ 100	$ 15,900,000
	Biological and Cultural Monitoring	2	Days	$ 2,300	$ 4,600	8	Days	$ 2,300	$ 18,000	348	Days	$ 2,300	$ 800,000
	Hydroseed	0.3	Acres	$ 12,700	$ 4,000	0.9	Acres	$ 12,700	$ 11,000	20	Acres	$ 12,700	$ 248,000
	Restoration (3:1) [2]	0.3	Acres	$ 64,000	$ 19,000	0.9	Acres	$ 64,000	$ 58,000	20	Acres	$ 320,000	$ 6,240,000
	Reporting	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000
	Project Management	1	10% of subtotal	$ 41,060	$ 42,000	1	10% of subtotal	$ 98,700	$ 99,000	1	10% of subtotal	$ 3,543,300	$ 3,544,000
	Total Cost				**$ 452,600**				**$ 1,086,000**				**$ 38,977,000**

Appendix A
Cost Summary Table - Sediment Remediation Alternatives
(Updated Appendix A, 2019 OU-E FS)

Feasibility Study Addendum - Operable Unit E
Former Georgia Pacific Wood Products Facility
Fort Bragg, California

		Pond 7 AOC				North Pond and Pond 6 AOC				Pond 8 AOC			
	Nature and Extent	**• Arsenic, Dioxin TEQ • 900 sf • 170 cy average depth of 5 feet**				**• Arsenic, Dioxin TEQ • 3,000 sf (North Pond); 7,000 sf (Pond 6) • 2,200 cy to depth of 6 feet**				**• Dioxin TEQ • 318,000 sf • 106,000 cy average depth of 10 ft**			
	Remediation Alternative Cost Estimates and Assumptions	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**
Sediment Remediation Alternatives (2019 OU-E FS)	**In-situ Soil Mixing[5]**									**In-situ Soil Mixing**			
	Assumptions:									106,000 cy in-situ soil mixing, restoration of 20 acres with creek restoration			
	Design, preparation and oversight (10% of Construction)									1	Lump Sum	$ 1,630,000	$ 1,630,000
	Permitting									1	Lump Sum	$ 200,000	$ 200,000
	Mobilization/Demobilization									1	Lump Sum	$ 225,000	$ 225,000
	In-situ Soil Mixing [4]									106,000	Cubic Yards	$ 70	$ 7,420,000
	Hydroseeding									26	Acres	$ 12,700	$ 330,000
	Restoration (4:1) [2]									26	Acres	$ 320,000	$ 8,320,000
	Reporting									1	Lump Sum	$ 60,000	$ 60,000
	Deed Restriction									1	Lump Sum	$ 30,000	$ 30,000
	Soil Management Plan									1	Lump Sum	$ 45,000	$ 45,000
	Project Management									1	10% of subtotal	$ 1,826,000	$ 1,826,000
	Total Cost												**$ 20,086,000**
Sediment Remediation Alternatives (New)	**Pond 8 West Excavation and Disposal**	**Pond 8 West Excavation and Disposal**				**Pond 8 West Excavation and Disposal**				**Pond 8 West Excavation and Disposal**			
	Assumptions: Costs based on recent 2017 excavation effort	Excavation and offsite disposal of 170 cy, restoration mitigation of 0.3 acres as wet meadow (includes pond)				Excavation and offsite disposal of 2,200 cy, restoration mitigation of 0.9 acres as wet meadow (includes ponds)				Excavation and offsite disposal of 24,000 cy, restoration mitigation of 9.0 acres as wet meadow (includes pond)			
	Design (10% of Construction)	1	Lump Sum	$ 20,000	$ 20,000	1	Lump Sum	$ 70,000	$ 70,000	1	Lump Sum	$ 620,000	$ 620,000
	Permitting	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000	1	Lump Sum	$ 200,000	$ 200,000
	Engineer Oversight and Office Support	2	Days	$ 3,700	$ 7,400	8	Days	$ 3,700	$ 30,000	80	Days	$ 3,700	$ 296,000
	Mobilization/Demobilization	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 50,000	$ 50,000	1	Lump Sum	$ 100,000	$ 100,000
	Contractor Non-labor Costs (Per Diem, etc.)	2	Days	$ 2,000	$ 4,000	8	Days	$ 2,000	$ 16,000	80	Days	$ 2,000	$ 160,000
	Misc. Supplies and Fuel	2	Days	$ 800	$ 1,600	8	Days	$ 800	$ 6,000	80	Days	$ 800	$ 64,000
	Equipment Costs	2	Days	$ 3,000	$ 6,000	8	Days	$ 3,000	$ 24,000	80	Days	$ 3,000	$ 240,000
	Excavation	170	Cubic Yards	$ 26	$ 4,000	2,200	Cubic Yards	$ 26	$ 57,000	24,000	Cubic Yards	$ 26	$ 624,000
	Stockpile and Sediment Management	170	Cubic Yards	$ 26	$ 4,000	2,200	Cubic Yards	$ 26	$ 57,000	24,000	Cubic Yards	$ 26	$ 624,000
	Transportation and Disposal (Class 2 Non-Hazardous)	255	Tons	$ 100	$ 26,000	3,300	Tons	$ 100	$ 330,000	36,000	Tons	$ 100	$ 3,600,000
	Biological and Cultural Monitoring	2	Days	$ 2,300	$ 4,600	8	Days	$ 2,300	$ 18,000	80	Days	$ 2,300	$ 184,000
	Rock slope protection (RSP)	Not Applicable				Not Applicable				1,375	Cubic Yards	$ 412	$ 567,000
	Pond 8 cutoff wall	Not Applicable				Not Applicable				63	Linear Feet	$ 23,524	$ 1,482,000
	CDSM soil mixing	Not Applicable				Not Applicable				1,100	Cubic Yards	$ 3,380	$ 3,711,000
	Soil buttress	Not Applicable				Not Applicable				5,700	Cubic Yards	$ 103	$ 585,000
	Mill Pond Dam Inspection and Long-Term O&M ($1,000/acre/year NPV + 5 yr survey)	Not Applicable				Not Applicable				30	Years (NPV)	$ 6,000	$ 36,000
	Beach Berm Repairs at year 30	Not Applicable				Not Applicable				1	NPV of repair	$ 270,000	$ 36,000
	Beach Berm Inspection and Long-Term O&M ($1,000/acre/year NPV)	Not Applicable				Not Applicable				30	Years (NPV)	$ 1,000	$ 8,000
	Hydroseed	0.3	Acres	$ 12,700	$ 4,000	0.9	Acres	$ 12,700	$ 11,000	9	Acres	$ 12,700	$ 114,000
	Restoration (3:1) [2]	0.3	Acres	$ 64,000	$ 19,000	0.9	Acres	$ 64,000	$ 58,000	9	Acres	$ 64,000	$ 576,000
	Reporting	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000	1	Lump Sum	$ 60,000	$ 60,000
	Project Management	1	10% of subtotal	$ 41,060	$ 42,000	1	10% of subtotal	$ 98,700	$ 99,000	1	10% of subtotal	$ 1,388,700	$ 1,389,000
	Total Cost				**$ 452,600**				**$ 1,086,000**				**$ 15,276,000**

Appendix A
Cost Summary Table - Sediment Remediation Alternatives
(Updated Appendix A, 2019 OU-E FS)

Feasibility Study Addendum - Operable Unit E
Former Georgia Pacific Wood Products Facility
Fort Bragg, California

		Pond 7 AOC				North Pond and Pond 6 AOC				Pond 8 AOC			
	Nature and Extent	• Arsenic, Dioxin TEQ • 900 sf • 170 cy average depth of 5 feet				• Arsenic, Dioxin TEQ • 3,000 sf (North Pond); 7,000 sf (Pond 6) • 2,200 cy to depth of 6 feet				• Dioxin TEQ • 318,000 sf • 106,000 cy average depth of 10 ft			
	Remediation Alternative Cost Estimates and Assumptions	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**	**Quantity [1.]**	**Units**	**Unit Rate**	**NPV Cost**
Sediment Remediation Alternatives (New)	**Institutional Controls with Interior Rock Slope Protection[6]**									**Institutional Controls with Interior Rock Slope Protection**			
	Assumptions:									Containment, deed restriction, survey, SMP [2.]			
	Delineation and survey									1	Lump Sum	$ 63,000	$ 63,000
	Reporting									1	Lump Sum	$ 60,000	$ 60,000
	Deed Restriction									1	Lump Sum	$ 30,000	$ 30,000
	Soil Management Plan									1	Lump Sum	$ 45,000	$ 45,000
	Permitting									1	Lump Sum	$ 200,000	$ 200,000
	Rock slope protection (RSP)									1,375	Cubic Yards	$ 412	$ 567,000
	Interior RSP Pond Preparation									4,500	Cubic Yards	$ 233	$ 1,050,000
	Pond 8 cutoff wall									63	Linear Feet	$ 23,524	$ 1,482,000
	CDSM soil mixing									1,100	Cubic Yards	$ 3,380	$ 3,711,000
	Soil buttress									5,700	Cubic Yards	$ 103	$ 585,000
	Mill Pond Dam Inspection and Long-Term O&M ($1,000/acre/year NPV + 5 yr survey)									30	Years (NPV)	$ 6,000	$ 36,000
	Beach Berm Repairs at year 30									1	NPV of repair	$ 270,000	$ 36,000
	Beach Berm Inspection and Long-Term O&M ($1,000/acre/year NPV)									30	Years (NPV)	$ 1,000	$ 8,000
	Hydroseed									6	Acres	$ 12,700	$ 76,000
	Restoration (4:1) [2]									6	Acres	$ 64,000	$ 384,000
	Project Management									1	10% of subtotal	$ 833,300	$ 834,000
	Total Cost												**$ 9,167,000**
	Institutional Controls with Seawall									**Institutional Controls with Seawall**			
	Assumptions:									Containment, deed restriction, survey, SMP [2.]			
	Delineation and survey									1	Lump Sum	$ 63,000	$ 63,000
	Reporting									1	Lump Sum	$ 60,000	$ 60,000
	Deed Restriction									1	Lump Sum	$ 30,000	$ 30,000
	Soil Management Plan									1	Lump Sum	$ 45,000	$ 45,000
	Permitting									1	Lump Sum	$ 200,000	$ 200,000
	Seawall[7]									130	Linear Feet	$ 32,500	$ 4,225,000
	Pond 8 cutoff wall									63	Linear Feet	$ 23,524	$ 1,482,000
	CDSM soil mixing									1,100	Cubic Yards	$ 3,380	$ 3,711,000
	Soil buttress									5,700	Cubic Yards	$ 103	$ 585,000
	Mill Pond Dam Inspection and Long-Term O&M ($1,000/acre/year NPV + 5 yr survey)									30	Years (NPV)	$ 76,250	$ 947,000
	Beach Berm Repairs at year 30									1	NPV of repair	$ 270,000	$ 36,000
	Beach Berm Inspection and Long-Term O&M ($1,000/acre/year NPV)									30	Years (NPV)	$ 1,000	$ 8,000
	Hydroseed									1.3	Acres	$ 12,700	$ 17,000
	Restoration (4:1) [2]									1.3	Acres	$ 64,000	$ 83,000
	Project Management									1	10% of subtotal	$ 1,149,200	$ 1,150,000
	Total Cost												**$ 12,642,000**

Notes:

1. Area and volume estimates were based on available AOC data. Most probable estimates of affected areas were utilized for costing; however, actual costs may increase/decrease based on further characterization efforts. Costs are assumed to be within the -30%, +50% range over 30 years using a discount rate of 9% and an inflation rate of

2. A mitigation ratio of 4:1 was assumed. If existing pond remains a pond or wetland after alternative is implemented, the existing structure was counted as part of the mitigation (i.e., create new wetland area equal to three times the pond area [3:1] to achieve 4:1 mitigation). In this scenario, the pond area would require reseeding but not the effort to create new wetland area, and therefore was included in the hydroseed line item but not included in the restoration line item. If the existing pond will not remain after the alternative is implemented, create new wetland area equal to four times the pond area to achieve 4:1 mitigation. In the case of Pond 8 institutional controls, minor wetlands in former concrete tanks along the north berm and the seeps and beach below the crib wall are affected.

3. An annual replacement rate of 10% is assumed for the wet vegetative cover alternatives. This replacement rate is based on sediment cap replacement in areas of active water flow and likely sediment cover scour and transport.

4. Unit cost based on the Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (https://frtr.gov/matrix2/top_page.html).

5. Cost estimate for this alternative was previously presented in the 2019 OU-E FS. Costs have been escalated to 2025 for comparison with the new alternatives.

6. Interior RSP costs estimated assume exterior RSP and excavation and disposal costs.

7. Seawall costs based on reported costs for seawalls constructed in Northern California; no site specific design has been performed.

AOC = area of concern

cy = cubic yards sf = square feet

SMP = soil management plan TEQ = toxic equivalency factor