MUD LAKE WEST DECISION SUMMARY
MINNESOTA POLLUTION CONTROL AGENCY
REMEDIATION DIVISION

Site Name:	Mud Lake West
Address:	St. Louis River Estuary, Duluth
SR/AI Number:	SAA #83
Project Manager:	Steve Schoff
Technical Analyst:	Mike Bares

STATEMENT OF PURPOSE

This Decision Summary presents the selected remedial action for the Mud Lake West (Site) section of the St. Louis River Area of Concern (SLRAOC or St. Louis River AOC) and summarizes the facts and determinations made by the Minnesota Pollution Control Agency (MPCA) in approving the selected response actions. MPCA has selected a No Action remedy decision. Although contamination with dioxin/furans is present in the sediment, it is at levels that don't currently present an unacceptable risk to human health or the environment. Dioxin/furan concentrations found at the site are close to background in the SLRAOC.

SITE BACKGROUND

The Mud Lake West Site (Site) is an approximately 39 acre open water and wetland complex in the St. Louis River (SLR) estuary. The majority of Site is marshland with limited open water located in the center of the lake and along portions of the rail causeway. The marshland areas are characterized mainly by cattails at the northern end of the Site and a mix of cattail and bog areas at the south and southwestern ends of the Site within the boundaries of the SLRAOC. Historical releases of contaminants to the SLR resulted in sediment contaminated with nickel, zinc, and polychlorinated dibenzo-p-dioxins/dibenzofurans (dioxins) that accumulated in Mud Lake West which is primarily a depositional environment. Due to these releases, the MPCA identified Mud Lake West as an area potentially requiring remedial action to address contamination, a "Remedial Action Area", for the SLRAOC.

SITE HISTORY

Mud Lake was once a shallow (0.5-8.0ft) sheltered bay with a wetland fringe directly connected to the St. Louis River. With the construction of the Lake Superior and Mississippi Railroad in 1870, the bay was bisected by a causeway, creating Mud Lake East and Mud Lake West. The U.S. Steel Duluth Works Facility previously existed in areas north of the bay. The upland immediately to the west was used by companies associated with U.S. Steel as a steel making waste material staging and disposal area. Large amounts of slag and other materials were dumped in this area, creating a large bluff of slag material adjacent to Mud Lake West. Both upland areas are currently owned by U.S. Steel and a portion of the area is part of the U.S. Steel Superfund Site. These areas are being managed outside of the AOC Program. The City of Duluth now owns the railway and associated causeway, and a non-profit organization uses the rail corridor and causeway to give historic train tours.

DESCRIPTION OF CONTAMINANTS

In 2010-2011, The MPCA, United States Environmental Protection Agency (USEPA), and United States Army Corps of Engineers (USACE) conducted an extensive sediment characterization project in the St. Louis River AOC. MPCA used the AOC-wide sediment characterization data as a baseline for its planning level analysis of the assessment data, which determined areas of the SLRAOC in need of additional investigation, remediation, or restoration. Site data for Mud Lake West is summarized in the 2015 Remedial Investigation Report (RI; Bay West, 2015). Potential contaminants of concern (COCs) identified for the Site included nickel, zinc and polychlorinated dibenzo-p-dioxins/dibenzofurans (dioxins). Potential COCs were identified in sediments within Mud Lake West that could pose a potential risk to benthic invertebrates from exposure to surficial sediments, fish from consumption of benthic invertebrates, and may present a human health risk through direct contact with sediments or ingestion of contaminated biota (i.e., fish consumption).

Additional data was collected in 2016 to address data gaps identified in the 2015 RI regarding the extent and volume of contaminated sediment within the Site, and to evaluate risks to human health and the environment due to potential impacts to the benthic community. Sediments were analyzed for nickel, zinc, and dioxins, and the analysis indicated that zinc and dioxin sediment contamination does not extend to deep sediment intervals; however, nickel contamination does extend to deeper sediment intervals.

Toxicity and bioaccumulation testing results indicate site sediments do not appear to be toxic to benthic organisms, and nickel and zinc do not appear to bioaccumulate in benthic tissue; however, dioxins do appear to bioaccumulate in benthic tissue and likely migrate up the food chain to higher trophic levels that consume benthic organisms. Based on these results, dioxins are considered the primary COC at the Site.

A Focused Feasibility Study (FFS) was prepared in June 2017 (Bay West, 2017) to evaluate potential remedial alternatives for contaminated sediment at the Site. These alternatives were further refined in the August 2019 FFS Addendum. Additional bioaccumulation testing was conducted in 2019. The bioaccumulation testing confirmed the potential for transfer of dioxins/furans to higher trophic level organisms. The addendum outlined the site-specific data used to determine potential ecological risk to benthic organisms from Site contaminants. Criteria used to define potential adverse impacts were updated based on stakeholder input, recently developed background threshold values (BTVs), and projects of similar size, environment. The following criteria was used to define two area types, one identified as a potential remedial footprint and the other as potential hotspot areas:

- Potential remedial footprint
  - Greater than the BTV of 24.9 nanograms per kilogram (ng/kg) toxic equivalency (TEQ) for dioxins
- Potential hotspot areas
  - Greater than 50 ng/kg TEQ for dioxins.

Based on these criteria, the potential remedial footprint identified in the FFS was 22.31 acres in size and the potential hotspot areas for the site are 4.42 acres in size.

Tabulated Site data can be found in the 2015 RI and 2017 FFS. Bioaccumulation data from 2019 are presented in the *Evaluation of Sediments from Mud Lake for Bioaccumulation in Lumbriculus variegatus report* (UW Superior, 2019). The report summarizes and evaluates existing sediment chemistry data and benthic toxicity and bioaccumulation data.

Risk to human health

Exposure from contaminated sediments to the public is limited given that Mud Lake West is surrounded by marsh land, no public swimming or wading is practical, and Mud Lake West does not serve as a public water supply. All information to date indicates that the proposed future use of Mud Lake West is consistent with the current use as an undeveloped area with limited public access. The major contaminant, dioxin, is non-volatile and not emitted from the waters of Mud Lake West; therefore, the only remaining pathway for human exposure to contamination from Mud Lake West is fish consumption. Even though there is a potential that dioxins within the potential remedial footprint and limited dioxin hot spot areas in Mud Lake West are contributing bioaccumulative contaminants into the fish food chain, the overall risk to human receptors from consumption of the fish or from contaminated sediments identified in Mud Lake West is low. In addition, the comparison to the background threshold values for dioxins, the limited extent of the dioxin hotspots, and the high levels of organic carbon in the system suggest the COCs in Mud Lake West are not contributing to the overall impaired use in the SLRAOC. No human health risk based levels for dioxins/furans in sediment in the St. Louis River are developed at this time.

Ecological risks

There are limited pathways by which ecological receptors might be exposed to contaminants in the sediments at Mud Lake West. Direct environmental exposure pathways include direct contact with contaminated sediments, porewater, or surface water by benthic invertebrates, fish, and other wildlife, and ingestion of sediments by sediment dwelling organisms, fish, and other wildlife, which feed on invertebrates living in sediment. Indirect exposure pathways include ingestion of invertebrates by fish and other wildlife or fish that have accumulated sediment contaminants in their tissues.

The limited screening ecological risk assessment prepared for the detailed investigation was conducted by comparing the sediment chemistry results with the Level 1 and Level 2 SQTs (Crane et al, 2000). SQTs are contaminant values that represent a level of protection of sediment-dwelling organisms. Level 1 SQTs identify chemical concentrations, which will provide a high level of protection for designated water uses, specifically for aquatic life. By comparison, a lower level of protection for designated water uses will be provided by the Level 2 SQTs. Therefore, goals of the SQTs developed for the protection of sediment dwelling organisms are:

- Level 1 SQTs are intended to identify contaminant concentrations below which harmful effects on sediment dwelling organisms are unlikely to be observed.
- Level 2 SQTs are intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms are likely to be frequently or always observed.

At most sediment remediation sites in the SLRAOC, contaminants detected in the top meter of sediment that exceed the mid-point between Level I or Level 2 SQT, or exceed Level II SQT values are considered a potential risk to the benthic community and the larger ecological environment. However, further analysis of additional benthic toxicity and bioaccumulation studies for Mud Lake, development of BTVs, organic carbon analysis, and limited extent of dioxin hot spots indicate the overall risk to ecological receptors from contaminated sediments identified in Mud Lake West is low.

DESCRIPTION OF REMEDY ALTERNATIVES

A Focused Feasibility Study (FFS) was completed in 2017 and followed with a Focused Feasibility Study Addendum in August 2019 to evaluate alternatives to remediate contaminated sediments that represent a potential risk to the aquatic community that were identified in the 2015 Remedial Investigation. The following alternatives were evaluated in the 2017 FFS and 2019 FFS Addendum:

Alternative 1: No Action. This alternative remains unchanged from the 2017 FFS to the 2019 FFS addendum. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at Title 40 Code of Federal Regulations (CFR) provides that a No Action Alternative should be considered at every site. A No Action Alternative should reflect the site conditions described in the baseline risk assessment and remedial investigation. The No Action Alternative included within this FFS does not include any treatment or engineering controls, institutional controls (ICs), or monitoring. The No Action Alternative could potentially be a viable alternative if future toxicity/bioaccumulation studies indicate that concentrations of Site COCs in sediments pose no significant detrimental effects to aquatic life (i.e., benthics and fish) or human health. There are no costs associated with the No Action Alternative.

Alternative 2: Monitored Natural Recovery. This alternative was not evaluated in the 2017 FFS, but was evaluated in the 2019 FFS addendum. Monitored Natural Recovery (MNR) would consist of a monitoring and evaluation period of 30 years and implementation of Institutional Controls (ICs). The objective of this alternative is to provide data to determine the potential for natural recovery processes at the Site. Based on the relatively low concentrations of COCs in sediment resulting in a lower probability of toxic/bioaccumulative effects in marine organisms (i.e., benthics and fish), MNR may be a viable remedial alternative. MNR would include collection of Site data to monitor reduction trends in sediment toxicity to benthic organisms and COC bioaccumulation in benthic and fish tissue; and to ensure that ICs continue to be enforced as long as COCs remain in sediments above the cleanup level (CUL). MNR data collection would be conducted periodically for an indefinite period of time or until concentrations of COCs in sediments attenuate to levels below the CULs and are deemed protective of human health and the environment.

ICs considered for this alternative include those that would protect against direct human contact with contaminated sediments and ingestion of contaminants through fish consumption. Warnings of contaminated sediments would be posted near potential Site access locations and would be modified according to changes in Site use (e.g., placed along walking/biking paths if developed in the future). The approximate 2019 value cost associated with Alternative 2 is $225,000.

Alternative 3: Enhanced Monitored Natural Recovery with Broadcast Amendment and Thin-Layer Amended Cover. This alternative combines Alternative 2 and Alternative 3 from the 2017 FFS and would consist of constructing a 0.15-meter (0.5-foot) amended sand thin-layer cover in open water areas and broadcasting amendment in wetland areas (31 tons per acre, or approximately 1 centimeter in thickness) over sediments with COC concentrations exceeding the CULs. The objective of this alternative is to reduce the availability of Site COCs to aquatic organisms through addition of an amendment material and subsequent sequestration of contaminants, and to provide some immediate isolation of contaminated sediments in open water areas through construction of 0.15 meters of clean amended substrate. Construction of the Alternative 3 would take place in both open water and wetland areas of the Site. Implementation of this alternative assumes that approximately 13,400 cubic yards of sand and 1,200 cubic yards of amendment would be applied over a 22.3-acre area. ICs would be implemented and long-term monitoring (LTM) would commence following construction of the amended covers. The approximate 2019 value cost associated with Alternative 3 is $5,551,000.

Alternative 4: Dredging and Off-site Disposal. This alternative remains unchanged from 2017 FFS to the 2019 FFS addendum with the exception of the name and remedial footprint. This alternative would consist of complete removal of all sediments with COC concentrations exceeding the CULs, totaling 85,900 cubic yards of sediment. Removal of contaminated sediments would mitigate exposure of aquatic and human receptors to sediment contaminants, thus allowing for achievement of RAOs. The dredged sediments would be slurried and pumped via pipeline to a sediment dewatering area, stabilized over a period of several months, excavated, loaded onto trucks, and disposed of at an off-site landfill. Dredging would take place in both open water and wetland areas of the Site. Following sediment removal, a sand cover would be placed to reduce the surface concentration of dredge residuals through mixing of the upper sediment layer and to restore wetland areas. Approximately 26,100 cubic yards of sand would be required following dredging. ICs and a LTM program would not be implemented following completion of remedy construction if complete removal of contaminated sediments is achieved. Complete removal was assumed for the purposes of this FFS and, therefore, IC/LTM costs are not incorporated into the cost analysis. The approximate 2019 value cost associated with Alternative 4 is $16,172,000.

Alternative 5: Dredge Hot Spot Areas/Enhanced Monitored Natural Recovery in Wetland and Open Water Areas. This alternative was presented similarly in the 2017 FFS and the 2019 FFS addendum, presenting a hybrid approach utilizing dredging elements from Alternative 4 in hotspot areas only and EMNR elements from the revised Alternative 3 within the updated remedial footprint. This alternative would consist of complete removal of all sediments with COC concentrations exceeding the hotspot criteria using similar technology as was proposed for Alternative 4, totaling 13,400 cubic yards. Removal of contaminated sediments in hotspot areas would mitigate exposure of aquatic and human receptors to the most contaminated sediment. Sediment removal would not be conducted within open water areas and wetland areas outside the hotspot area in order to minimize intrusive construction activities. Instead, an EMNR approach would be utilized within these areas and would consist of constructing a 0.15-meter (0.5-foot) amended sand thin-layer cover in open water areas and broadcasting amendment in wetland areas (31 tons per acre, or approximately 1 centimeter in thickness) over sediments with COC concentrations exceeding the CULs, as was proposed for Alternative 3. The objective of the EMNR portion of this alternative is to reduce the availability of Site COCs to aquatic organisms through addition of an amendment material and subsequent sequestration of contaminants, and to provide some immediate isolation of contaminated sediments in open water areas through construction of 0.15 meters of clean amended substrate. The approximate 2019 value cost associated with Alternative 5 is $11,955,000.

The FFS Addendum included a comparative analysis to identify and compare advantages and disadvantages of each of the alternatives. This evaluation was done using the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) remedy selection criteria in general accordance with United States Environmental Protection Agency (EPA) guidelines for feasibility studies (EPA, 1990) which divides criteria into three groups.

Threshold Criteria, which relate to federal statutory requirements that each alternative must satisfy in order to be eligible for selection and including:

- Overall protection of human health and the environment in both short and long term

- Compliance with applicable or relevant and appropriate requirements (ARARs) under federal, state, or local environmental laws and regulations.

The selected No-Action alternative is protective of human health and the environment in both the short and long term. Levels of contamination found in the sediment at the Site are similar to background levels found throughout the SLR Estuary; therefore, remediation is not necessary. All ARARs were taken into consideration with the Selected Remedy of No-Action. ARARs are listed in the in the 2017 Focused Feasibility Study (FFS).

Primary Balancing Criteria, which are the technical criteria upon which the detailed analysis is based on, including:

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

The selected No-Action remedial alternative is effective and meets the goals of permanence, short-term and long-term effectiveness. No reduction of toxicity, mobility, or volume through treatment of contaminated sediments is needed because the levels of contamination in the sediment are at the same level as background levels throughout the SLR Estuary. The No-Action remedial Selection is implementable and is the lowest cost action.

Modifying Criteria, based on state agency and community acceptance.

The state agency and public reviewed the proposed alternative, discussed it at a public meeting, and accept the No- Action Alternative as protective of human health, welfare, and the environment.

A detailed description of the other potential remedies to the NCP criteria was discussed in the FFS Addendum. This comparison was reviewed by the MPCA with No Action selected as the Remedial Alternative based upon this analysis and other factors. The No Action alternative selected by the MPCA meets the criteria listed above.

DESCRIPTION OF SELECTED REMEDIAL ALTERNATIVE 1: No Action

The No Action Alternative does not include any treatment or engineering controls, institutional controls (ICs), or monitoring. This alternative was selected based on the fact that although limited areas with surface sediment concentrations above COC background levels are present at the site, the limited human exposure as well as elevated site-wide total organic carbon likely prevent unacceptable risk to human health or the environment from site sediments contaminated with dioxins/furans. In addition, The Minnesota Department of Natural Resources (MNDNR) is proposing a habitat restoration project in Mud Lake West to support SLRAOC restoration goals. The MPCA Remediation Division staff will work with the MNDNR to insure the restoration activities do not increase the risk of exposure to COC's remaining at the site. And, if feasible, further reduce any potential exposure risk.

PUBLIC COMMENTS AND RESPONSES

On August 22, 2019, the MPCA held an open house for public review and comment on Mud Lake West's five cleanup alternatives. The MPCA published a request for comments on August 15, 2019, and accepted public comments through September 16, 2019. The MPCA received one comment. The summarized comment and response is provided below.

Summary of Public Comments and MPCA Responses

Comment: "Options are well laid out. Appears MPCA has a good approach + Alternatives to this situation. Please let public know of selection. Why selection was made."

Response: This Mud Lake West Decision Summary provides the commenter and the public the communication requested regarding the remedial alternative selection and the basis for the selection.

MPCA site decision

The selected remedial alternative is consistent with the Minnesota Environmental Response and Liability Act, Minn. Stat. §§ 115B.01 to .18, and is not inconsistent with the Federal Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 et. seq. and the National Contingency Plan, 40 C.F.R Part 300. I have determined the selected remedial alternative is protective of public health, welfare, and the environment.

By typing/signing my name below, *I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.*

Signature: Kathy Sather Date (mm/dd/yyyy): 11/20/2020

(This document has been electronically signed.)

Kathy Sather
Division Director
Remediation Division