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John J. Prusiecki, Jr.
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Via Electronic Transmittal

December 23, 2015

Ms. Erin Endsley
Site Remediation & Redevelopment Section
Minnesota Pollution Control Agency
525 Lake Avenue South, Suite 400
Duluth, MN 55802

Mr. Michael Bryant
US EPA Region 5
Great Lakes National Program Office
77 West Jackson Blvd, G-17J
Chicago, IL 60604-3507

Subject: **Addendum to Revised Feasibility Study**
Former Duluth Works and Spirit Lake Sediment Site
St. Louis River, Duluth, Minnesota

Dear Ms. Endsley and Mr. Bryant:

Enclosed please find an Addendum to our revised Feasibility Study (FS) report for the Former Duluth Works – Spirit Lake Sediment Site (Site). This addendum is the result of our collaboration with the US Environmental Protection Agency – Great Lakes National Program Office (GLNPO), to plan for a sediment remediation and restoration project at the Site.

We look forward to continuing to work with you in moving this important remediation/restoration project forward into design, permitting and implementation. If you have any questions or comments regarding this document, please contact me at (219) 888-4400.

Sincerely,

John J. Prusiecki, Jr.

cc: M. Bares (MPCA)
S. Cieniawski (GLNPO)
J. Beaver (EA)
M. Rupnow (USS)
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R. Casselberry (USS)
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T. Renville (AECOM)

Addendum to Feasibility Study

Former Duluth Works and Spirit Lake Sediment Site

Prepared for
Great Lakes Legacy Act Partnership between
United States Steel Corporation,
United States, Environmental Protection Agency, Great Lakes National Program Office, and
Minnesota Pollution Control Agency

In consultation with
EA Engineering, Science, and Technology, Inc.

Prepared by
Barr Engineering Company
AECOM (formerly URS Corporation)

December 2015

Addendum to Feasibility Study

Former Duluth Works and Spirit Lake Sediment Site

December 2015

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1.0 Introduction

1.1 Background

This addendum is prepared to update the *Revised Feasibility Study: Former Duluth Works and Spirit Lake Sediment Site* (Barr, AECOM, 2015), which was completed in July 2015 (hereafter referred to as the FS). The FS was conducted to develop and then evaluate alternatives to address potential risks to human health and the environment posed by impacts present at both the Duluth Works Site and the Estuary Site as described in Section 1.0 of the FS.

Upon completion of the FS, multiple meetings with stakeholders and resource managers occurred to review and discuss the FS report information. The Minnesota Pollution Control Agency (MPCA) and Great Lakes National Program Office (GLNPO) of Region V, United States Environmental Protection Agency (USEPA) sought feedback and input regarding the alternatives presented in Sections 5.5 through 5.6 of the FS. These discussions, occurring during the period August through October 2015; resulted in identifying further refinements to aspects shared by the detailed alternatives presented in the FS.

1.2 Purpose

The purpose of this Addendum is to present the results of additional discussions amongst the project partners, stakeholder and resource manager groups to modify the presented FS alternatives, and to communicate that alternative 8b is recommended by U. S. Steel and USEPA. These discussions identified a "hybrid" alternative that would achieve greater consensus from the stakeholders, and will be evaluated in this document.

1.2.1 Remedial Elements Discussed by Feedback Group

Stakeholders and resource managers provided feedback on the detailed alternatives presented in the FS. Suggested modifications were developed to address the concerns that were highlighted; following which, the stakeholders and resource managers provided further feedback and input that was taken into account to develop a hybrid alternative. The evolution of a hybrid alternative from the alternatives developed in Section 5.6 of the FS, required addressing and balancing competing stakeholder interests. The stakeholders and resource managers provided input and feedback throughout the multiple meetings that were facilitated by the USEPA. This Addendum describes the resulting hybrid alternative that evolved from this process and provides an updated detailed evaluation of alternatives. Below is a bulleted summary of the primary elements discussed and evaluated to develop the hybrid alternative evaluated in this FS addendum.

- Confined disposal facility (CDF) location and size
    - Upland development area concerns
    - Ordinary high water level (OHWL)/permitting concerns
    - Cultural concerns

    - Visual impacts
    - Stormwater flow concerns
    - The amount of impacted (non-native) material removed from the estuary
- Geotechnical challenges
- Water front access
    - Desire for waterfront views and access
    - Recreational opportunities
- The amount of impacted (non-native) material contained in the estuary
- Sheltered Bay Configuration
    - Size and configuration
    - Water depths of shallow sheltered bay
    - Sheltering feature (shoal)
- Future potential wild rice restoration opportunities in Spirit Lake
- Future potential fisheries restoration opportunities in Spirit Lake

Discussions led to further development of modified or hybrid alternatives – the primary alternatives that were modified were – alternatives 8 and 12. A hybrid alternative called 8B was developed, and this new hybrid alternative has been evaluated against the prior 12 alternatives in Section 2.0 of this Addendum.

The format of the following Addendum sections generally follows the FS report organization of Sections 5.6 through 5.7.

2.0 Updated Alternatives Evaluation

2.1 Description of Hybrid Alternative 8B

Alternative 8B – Shallow Sheltered Bay with Delta Sediment CDF above OHWL and Upland CDFs

Alternative 8B includes elements of Alternative 8 and Alternative 12 that are combined into this hybrid alternative (Figure 2-1). Labels for the operable units (OU) and other areas shown on Figure 2.1 are defined in the FS. Alternative 8B includes excavation of impacted soils and sediment and placement of a 2-foot thick soil cap over OU-I and the CDA. Additionally, a restored estuary will be created where impacted material will be excavated from the OU-M Delta, creating a shallow sheltered bay (average water depth of 3 to 5 feet) and a shallow open water bay that maintains the existing water depth between the shoal feature and OU-M Delta CDF (average water depth of 1 to 2 feet). The shoal feature is intended to reduce wave energy and protect constructed remedy elements, as well as focusing and increasing seiche induced water flow into and out of the sheltered bay.

Alternative 8B also includes removal of sediments that exceed PRGs from near the shoreline in the southern portion of the Wire Mill Delta and the northern portion of the Unnamed Creek Delta (identified as "Remove" in Figure 2-1). Sediment will be removed from the designated areas in the northern portion of the Unnamed Creek estuary Delta to a target elevation and a cap will be placed (identified as "Remove to Set Elevation and Cap" in Figure 2-1) to create a shallow sheltered bay (average water depth of 3 to 5 feet), which is an element included in Alternative 8. In addition, sediments will also be removed from between the shoal feature and OU-M Delta CDF to a target elevation and a cap will be placed (identified as "Remove to Set Elevation and Cap" in Figure 2-1) to create an open water bay feature that maintains existing water depth (approximate water depth of 1 to 2 feet), which is an element included in Alternative 12. The OU-M Delta CDF will be confined to an elevation greater than the ordinary high water level (OHWL). The alternative also includes placement of a cap or an enhanced natural recovery (ENR) thin cover over portions of the estuary area (same areas shown for Alternatives 8 and 12).

Storm water flow upstream of the Unnamed Creek water level control weir that is located at the entrance road to the site, would be similar to current conditions and would include similar ponding capacity of peak flows. Downstream of the weir, storm water flow would be directed to the shallow sheltered bay created in the OU-M Delta.

Removed/Excavated Material Management – The majority of the materials will be consolidated in the CDF located in the OU-L/OU-M Upland area and the CDF located in the portion of the OU-M Delta that is above the OHWL and along the spit of land. A smaller amount of excavated soil/sediment will be consolidated in the OU-J area in a manner previously described in this report section. Only estuary sediments will be placed in the OU-M Delta CDF. The CDF berm heights will range from 10 feet to 25 feet. A shoal would be constructed at the mouth of the bay to serve as an energy dissipation barrier between the bay and the greater estuary and as a remedial cap. The final configuration of the shoal will be determined during detailed design with input from resource managers.

Change in Open Water – By constructing the OU-M Delta CDF above the OHWL and creating the open water bay between the shoal and CDF, the overall net gain of open water for Alternative 8B is more than in Alternative 8, which results in a net gain in open water for the estuary (Table 2-1) of 30 acres.

2.2 Detailed Evaluation of Updated Alternatives

The FS performed a screening evaluation of Alternatives 1 through 12 that concluded by identifying five Alternatives for detailed evaluation (Barr, AECOM, 2015). This Addendum adds a sixth (hybrid) Alternative and performs a new detailed evaluation of the following Alternatives:

- Alternative 4 – CDF on OU-M Delta (within Shoreline)
- Alternative 6 – Shallow Sheltered Bay with Low CDF
- Alternative 7 – Shallow Sheltered Bay and Delta Cap Area with Upland CDFs
- Alternative 8 – Shallow Sheltered Bay with Delta Sediment CDF and Upland CDFs
- Alternative 8B - Shallow Sheltered Bay with Delta Sediment CDF above OHWL and Upland CDFs (new hybrid of 8 and 12)
- Alternative 12 – Open Water Bay with Upland CDFs

The alternatives screened in the FS addendum are presented in Table 2-2 with the addition of Alternative 8B. The information summarized about the previously screened alternatives remains the same as presented in the FS. Alternative 8B includes elements of Alternatives 8 and 12 and reflects inputs from the resource managers and stakeholders. The hybrid alternative provides more open water creation and more sheltered bay conditions through positioning of a shallow shoal at the eastern side of the Unnamed Delta shallow sheltered bay. Alternative 8B addresses permitting concerns by keeping the foot print of the estuary CDF west of the OHWL.

Tables 2-3 and 2-4 summarize the FS evaluation criteria and principles for managing contaminated sediment risks.

Tables 2-5 through 2-10 present detailed evaluations of each of the six detailed alternatives. Table 2-11 presents the detailed alternatives comparison with scoring. Table 2-12 presents cost estimate information for each of the six detailed alternatives along with estimated cost ranges for associated post-implementation operation and monitoring costs.

2.3 Recommended Alternative

Based on the discussions and evaluations which led to development of a hybrid alternative and the detailed analysis presented above, **Alternative 8B-Shallow Sheltered Bay with Delta Sediment CDF above OHWL and Upland CDFs** compares favorably to and is fully consistent with the remedy evaluation criteria of the governing Federal statute, rules and guidance [the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), CERCLA's National Contingency Plan (NCP), USEPA's

Contaminated Sediment Guidance (2004)] and the Minnesota Environmental Response and Liability Act (MERLA). In addition, Alternative 8B favorably incorporates additional habitat enhancements. Alternative 8B is a hybrid developed from Alternatives 8 and 12 and is ranked amongst the upper echelon of alternatives in the FS screening evaluation (Table 2-2) (revision of Table 5-2 from the FS) and is ranked second in the detailed evaluation (Table 2-11), with Alternatives 4 and 8 scoring the same and ranking better than Alternative 8B.

Although Alternative 8B does not have the lowest (most favorable) score, it incorporates the additional factors articulated by resource managers and stakeholders after publication of the FS. These additional factors include: keeping the estuary CDF footprint above the OHWL and providing a greater amount of open water with varied water depths and protected conditions. Based on the input received after publication of the FS and evaluations made in this FS addendum, the project partners are recommending the higher cost alternative (Alternative 8B), rather than the alternative (Alternative 8) proposed in the FS as a compromise to move the project forward.

3.0 Recommendations and Path Forward

The FS evaluated Site conditions and developed a series of Conceptual Site Models (CSMs) to provide a detailed understanding of the nature, extent, and magnitude of the constituents of interest (COIs) across the Former Operations and Estuary portions of the Site. Using the process outlined in the FS, potential Project alternatives were identified, screened, and evaluated in detail to identify a preferred alternative. Input was received at multiple stages as outlined in the preceding sections of the FS. The U.S. EPA also entered into formal tribal consultations under Section 106 of the National Historic Preservation Act (NHPA). As noted in Sections 1.0 and 5.0 of the FS, an additional alternative was identified as a result of those consultations and Alternative 12 was evaluated with four other alternatives, the results of that evaluation are set forth in Section 5.0 of the FS.

Further stakeholder discussions have occurred since July 2015, using the FS as a tool to focus on project elements of importance to the stakeholders. A hybrid alternative was developed and this FS Addendum evaluated that hybrid alternative against the five detailed alternatives presented in the FS.

This section of the FS Addendum includes a discussion of the recommended Project alternative and outlines the path forward for implementation of a Project in the Former Operations and the Estuary areas of the Site.

3.1 Recommended Project Alternative

Using the FS process, this FS Addendum compared the six alternatives retained for detailed evaluation in Section 2.0. This Section summarizes the elements of the recommended project alternative (Alternative 8B) as it compares to the criteria set forth in the FS and the input received throughout the FS process.

Alternative 8B-Shallow Sheltered Bay with Delta Sediment CDF above OHWL and Upland CDFs was identified in Section 2.3 as the acceptable overall Project alternative because it compares favorably with CERCLA and MERLA's remedy evaluation threshold criteria while incorporating stakeholder input that meet the balancing criteria. **Alternative 8B** embodies numerous key elements of the remediation and habitat goals for the Former Operations and Estuary Areas of the site. It is reflective of important priorities identified by stakeholder input such as the creation of two shallow sheltered bay habitat areas; features which are currently absent in Spirit Lake. This alternative provides more acres of sheltered bay open water than Alternative 8. The need for shallow sheltered bay habitat is discussed in the Lower St. Louis River Habitat Plan (SLR-CAC, 2002) and Lower St. Louis River Habitat Plan Strategies Implementation Planning Worksheet: Project 2.7: Sheltered Bays/Shallow Wetlands- Spirit Lake (LimnoTech, 2012). This Alternative provides betterment of the St. Louis River AOC through habitat benefits such as the creation of two shallow sheltered bay areas, creation of more locations with water depth transitions from shallow to deeper water and shoal areas that can provide future sites for floating leaf emergent vegetation establishment. This alternative focuses the footprint of the OU-M Delta CDF to the area of OU-M above the OHWL. Alternative 8B provides these features in accordance with the conceptual goals of the AOC habitat objectives set forth in the Lower St. Louis River Habitat Plan (SLR-CAC, 2002) and the Lower St. Louis River Habitat Plan Strategies Implementation Planning Worksheet: Project 2.7: Sheltered

Bays/Shallow Wetlands- Spirit Lake (LimnoTech, 2012). In addition, the recommended alternative includes important stormwater retention elements in the Unnamed Creek drainage way. This Alternative incorporates a combination of remedial technologies and was developed out of an iterative, risk-based decision-making process that sought, and included input from various groups throughout the FS development as well as recent further stakeholder and resource manager input.

Alternative 8B reflects a balance of factors with respect to how it manages sediment in separate areas- Former Operations area sediments and some estuary sediments are consolidated in upland CDFs within the Unnamed Creek ravine where the CDF facilities have lower visual impact and can take some advantage of the valley side to help contain the material. A trade-off is required, however, due to space limitations and stormwater flow needs within the upper Unnamed Creek; which means that some estuary sediments, removed to create a shallow sheltered bay in the OU-M Delta area, are consolidated along with the remainder of the in-place OU-M Delta material in a low CDF constructed against the northern side of the Spit of Land. This will result in a broad peninsula beside what will be a longer and deeper embayment on the north. In consideration of potential permitting and cultural concerns, the peninsula will not extend east past the OHWL, meaning the Alternative 8B estuary CDF has a smaller footprint than the Alternative 8 estuary CDF and does not contain impacted materials in existing open water. The full thickness of sediments exceeding the PRGs will be removed from the WM Delta shore area and OU-P and -Q. This results in partially recreating the topography of the embayment that existed in this location prior to the Duluth Works site development. This results in an increase in open water and creation of a second shallow sheltered bay habitat area. Alternative 8B increases open water area by 30 acres, which is another important goal of the AOC delisting effort for the lower St. Louis River (SLR-CAC, 2002 and LimnoTech, 2012).

Comparison of the LimnoTech (2012) Spirit Lake Conceptual (Habitat) Restoration Plan with the preferred alternative, identified that although the spit of land will remain with a broad low CDF on its northern side, the majority of the project area will be available for implementing the conceptual plan for habitat improvements in Spirit Lake. Overall the preferred remedy is consistent with the conservation goals set forth in the Restoration Concept Plan. All four of the general habitat types identified in the plan would not be precluded by Alternative 8B. Open water – shallow, mid- and deep-water areas either already exist or would not be precluded over most areas of Spirit Lake. Shallow and deep marsh area could be expanded and would not be precluded by Alternative 8B. Saturated islands could be developed as broadly outlined in the Restoration Concept Plan.

The sustainability of Alternative 8B is also consistent with the overall Vision for this Project (Section 3). This alternative is consistent with CERCLA and USEPA's National Contingency Plan (NCP) remedy evaluation criteria (40 CFR §300.430), the Minnesota Environmental Response and Liability Act (MERLA, Minn. Stat. § 115B), the USEPA Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (EPA, 2002), and the USEPA Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005).

The 11 risk management principles outlined in the EPA guidance (EPA, 2002) are summarized in Section 6.0 of the FS with a brief discussion of how each principle has been applied throughout the RI/FS

process. The application of these remedy evaluation principles discussed in the FS, are equally applicable to Alternative 8B. In fact following principles 2 - *Involve the Community Early and Often* and 3 - *Coordinate with States, Local Governments, Tribes and Natural Resource Trustees,* has been part of the process that led to the development of this hybrid alternative, which is also fully consistent with the contaminated sediment risk management principles.

Added benefits to the recommended alternative are the improvements that could occur to the shoreline and shallow water areas of the Site once the remedial work is completed. Opportunities will exist for incorporating further habitat enhancements along the reconstructed shoreline. Previously prohibited shoreline and shallow water uses such as recreational access could be improved. The post-remedy configuration of shore features will be planned in consultation with the current land owners and neighboring stakeholders during Project design.

In addition, upland areas (Former Operations area) of the site are maintained for future redevelopment opportunities.

3.2 Path Forward

U. S. Steel, GLNPO and MPCA are following an aggressive project implementation path forward for the remaining pre-implementation activities described in Section 6.2.1 of the FS (Barr, AECOM, 2015) in order to meet the goal of beginning construction of the preferred alternative during 2016.

3.2.1 Pre-Implementation Activities

To meet this desired Project implementation schedule, several tasks will need to occur in parallel. Below is a summary of the primary pre-implementation tasks that need to occur prior to Project implementation.

- FS review and approval – completed
- Stakeholder discussions and tribal consultations regarding the proposed remedy
- FS Addendum review and finalization
- Finalization of the proposed remedy
- Secure Legacy Act funding for the Project implementation phase
- EAW preparation, public comment, and expeditious EIS decision
- Design development
    - Habitat elements included in design
    - Coordination with resource managers
- Collect supplemental sediment data to refine PRG extent and determine remedy element boundaries to support design, including areas with adjacent remedy elements – in progress

- Conduct supplemental geotechnical sampling and testing to support design for Alternative 8B – in progress
- Negotiate and implement property access agreements and agreements regarding reconstruction of areas disturbed by the remedy construction, including replacement or new infrastructure
- Permitting coordination, application preparation, and agency review (Appendix G, of the FS report)
- Preparation of contractor bid documents, review contractor bids and select contractor

The MPCA will assist with the EAW and the permit review process to help meet the Project schedule.

3.2.2 Project Implementation

The recommended alternative is anticipated to require two full construction seasons to complete. Specific Project implementation schedules will be included as part of the design and will be determined based on input from the selected response action contractor.

Implementation of the recommended alternative, or any of the other alternatives retained for detailed analysis, may require full-time (24 hours per day/7 days per week) project operations at some areas of the Site. The design and associated documents, including the construction quality assurance plan, response action contractor implementation plan, Site-specific health and safety plan, and applicable permits or other regulatory requirements will determine the methods and frequency of monitoring to ensure compliance with applicable standards and guidelines, including noise, air emission quality, surface water quality and turbidity.

4.0 References

Barr, AECOM, 2015. *Revised Feasibility Study: Former Duluth Works and Spirit Lake Sediment Site*. Prepared by Barr Engineering Company and AECOM (formerly URS) for Great Lakes Legacy Act Partnership between- United States Steel Corporation, United States, Environmental Protection Agency, Great Lakes National Program Office, and Minnesota Pollution Control Agency, in consultation with EA Engineering, Science, and Technology, Inc. July 2015.

EPA, 2002. *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites*. U.S. EPA, Office of Emergency and Remedial Response, Washington D.C., OSWER Directive 928 5.6-08, February 12, 2002.

EPA, 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. U.S. EPA, Office of Emergency and Remedial Response, Washington D.C., OSWER Directive 9355.0-85, December 2005.

LimnoTech, 2012. *Lower St. Louis River Habitat Plan Strategies Implementation Planning Worksheet, Project 2.7: Sheltered Bays/Shallow Wetlands – Spirit Lake, Conceptual Restoration Plan*, prepared for the Minnesota Pollution Control Agency with funding from GLRI, October 19, 2012.

SLR-CAC, 2002. *Lower St. Louis River Habitat Plan*. Prepared by St. Louis River Citizens Action Committee (SLR CAC) with funding from U.S. EPA Grant X995385010, May, 2002.

Tables

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	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 8B	Alternative 9	Alternativ
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	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 8B	Alternative 9	Alternativ
01.1 FT LWD)	0	-48	-11	9	10	20	20	20	30	7	56

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 8B	Alternative 9	Alternativ
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Description	Effectiveness of Achieving RAOs and Considerations Upland RAOs and Considerations • Protect human health and the environment • Provide a stable water course for stormwater conveyance and discharge • Preserve areas for economic development	Effectiveness of Achieving RAOs and Considerations Estuary RAOs and Considerations • Protect human health and the environment • Reduce beneficial use impairments for St. Louis River Area of Concern • Improve habitat (betterment)	Implementability	Relative Cost Relative Rankings: #1 = lowest cost; #12 = highest cost	Screening Level Score (sum of Effectiveness, Implementability, and Cost scores)	Additional Fac
	NA - current conditions		NA	NA	NA	
olves placement of a remedial cap over portions of ned Creek would be re-routed to discharge into the ion of Wire Mill Delta.	Low-Medium - 4 - Would be effective at protection of human health and environment as a result of physical barrier, but would not remove any impacted material. - Would be effective at achieving RAOs and Considerations, with the exception that it would result in the loss of open water habitat.		Medium - 3 - Large volume of capping material is necessary; however, traditional earthwork and subaqueous capping equipment could be used. -Construction of the Wire Mill discharge structure would be possible, but challenging.	Low-Medium - 2 Relative Cost Ranking: #2	9	As a result of cap p 48 acres of open w
ediments from the Upland Site and Estuary Site with U-M Delta into the estuary. The alternative also reas on the Upland Site and placement of a remedial Estuary Site. Unnamed Creek would be allowed to harge into the former water intake area in the northern uld include construction of a small base-flow channel igh flow conditions).	Low-Medium - 4 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal, - Would be effective at achieving RAOs and Considerations, with the exception that it would result in the loss of open water habitat.		Medium - 3 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary. -Construction of the Wire Mill discharge structure would be possible, but challenging.	Low-Medium - 2 Relative Cost Ranking: #3	9	CDF located in OU CDF is placed on t Net loss of approxi water.
lternative 3 except that the extent of the CDF is al would be removed from the estuary in the area that pland Site and placement of a remedial cap or ENR uld include construction of a small base-flow channel igh flow conditions).	Medium-High - 2 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Results in a net gain of open water as a result of removal from the Wire Mill pond; however, significant habitat improvement is not a major component.		Medium - 3 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary. -Construction of the Wire Mill discharge structure would be possible, but challenging.	Low-Medium - 2 Relative Cost Ranking: #4	7	CDF is placed on t
ediments from the Upland Site and Estuary Site with a portion of OU-M Delta into the Estuary Site. The es an open water bay. A small CDF would also be pland Site and placement of a remedial cap or ENR uld include construction of a small base-flow channel igh flow conditions) and discharge of Unnamed	High - 1 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Significant habitat betterment would be achieved through creation of the open water bay.		Medium - 3 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary.	Medium - 3 Relative Cost Ranking: #6	7	Placement of excav sediments in a CDF estuary. CDFs are OU's. Open water bay (1 water depth than s 5 ft avg. depth). Less open water ar water depth than A
ediments from the Upland Site and Estuary Site with a portion of OU-M Upland and OU-M Delta and into Estuary Site would be placed in the Estuary portion of would be placed in the Upland portion of the CDF. The d bay in OU-M and the estuary. Because the footprint rnative 5. enerally the same as in Alternative 5.	High - 1 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Significant habitat betterment would be achieved through creation of a shallow sheltered bay.		Medium - 3 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary.	Medium - 3 Relative Cost Ranking: #9	7	Creation of shallow Placement of dredg constructed within estuary. CDFs are OU's.
ediments from the Upland Site and Estuary Site with entirely within the Upland site. A remedial cap would it-side of the OU-M Delta. Removal of impacted Delta would create a shallow sheltered bay. t stormwater challenges that would require additional e extensive soil stabilization, riprap channel, root e flood event that will impact the OU-I CDF and OU-J capping of impacted sediments in portions of the	High - 1 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Significant habitat betterment would be achieved through creation of a shallow sheltered bay.		Low-Medium - 4 - Dredging and traditional earthwork equipment would be necessary. - Construction of CDF in OU-I creates added stormwater management and engineering challenges - tall, steep berms and does not allow for stormwater ponding. -High flow stormwater discharge events would be difficult to accommodate in this alternative.	Medium-High - 4 Relative Cost Ranking: #11	9	Creation of shallow placement of dredg Delta or the estuar of existing OU's. Does not allow for OU-I area, creating control and bank st long-term basis.

escription	Effectiveness of Achieving RAOs and Considerations Upland RAOs and Considerations • Protect human health and the environment • Provide a stable water course for stormwater conveyance and discharge • Preserve areas for economic development	Estuary RAOs and Considerations • Protect human health and the environment • Reduce beneficial use impairments for St. Louis River Area of Concern • Improve habitat (betterment)	Implementability	Relative Cost Relative Rankings: #1 = lowest cost; #12 = highest cost	Screening Level Score (sum of Effectiveness, Implementability, and Cost scores)	Additional Fac
t that material that is removed from OU-M Delta and red bay would be consolidated on the spit-side of OU- naterial would be placed in CDFs located within OU-M management actions would be required; however, l and permitted than those in Alternative 7. reek, from OU-J to OU-M Upland would be similar to capping of impacted sediments in portions of the	High - 1 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Significant habitat betterment would be achieved through creation of a shallow sheltered bay.		Medium - 3 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary.	Medium - 3 Relative Cost Ranking: #7	7	Only material that i shallow sheltered b the OU-M Delta an is consolidated tog on top of existing C
ves 8 and 12. The OU-M Delta CDF does not extend uary sediments will be placed inthe OU-M Delta CDF. ocated within OU-M Upland and at OU-J. The berm han Alternative 8. ter Bay will be created for this alternative. reek, from OU-J to OU-M Upland would be similar to capping of impacted sediments in portions of the	High - 1 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Significant habitat betterment would be achieved through creation of a shallow sheltered bay and open water bay.		Low-Medium - 4 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary. - Consolidation of large volume of sediment in OU-M Upland results in tall berms.	Medium - 3 Relative Cost Ranking: #8	8	Only material that i shallow sheltered b the OU-M Delta CD consolidated togeth top of existing OU's
all material is consolidated in an upland CDF. F in OU-I, since less total sediment is being removed. placed throughout the OU-M Delta, eliminating the capping of impacted sediments in portions of the	Medium-High - 2 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations. - Results in a net gain of open water as a result of Upland sediment removal from the Wire Mill Delta; however, significant habitat improvement is not a major component.		Low-Medium - 4 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary.	Medium - 3 Relative Cost Ranking: #5	9	Placement of impa CDFs. CDFs are p OU's. Significant habitat i component. Cappi require wetland mit conveyance a chal Delta.
sediments from the Upland Site and Estuary Site and located in the potentially developable area of the and capping of impacted sediments in portions of the	Medium - 3 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations except for preserving areas for economic benefit (construction of large CDF in Upland Site would eliminate possibility for development). - Results in a net gain of open water as a result of Upland Site removal; however, significant habitat improvement is not a major component.		Low-Medium - 4 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary. - Large volume of sediment to remove and transport to Upland CDF. - Would cause a high degree of disruption to the Site. -Large volume of water to be treated.	High - 5 Relative Cost Ranking: #12	12	Significant habitat i component. Devel due to the construc consolidation area.
involves removal of all sediments that exceed criteria ed materials would be deposited in a nearly 80 acre rea of the Upland Site. ough the CDF will include a final cover.	Medium - 3 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Would be effective at achieving all RAOs and Considerations except for preserving areas for economic benefit (construction of large CDF in Upland Site would eliminate possibility for development).		Low - 5 - Dredging and traditional earthwork equipment would be necessary. - Very large volume of sediment to remove and transport. - Would cause a high degree of disruption to the Site. -Very large volume of water to be treated.	High - 5 Relative Cost Ranking: #13	13	Developable uplan construction of an
sediments from the Upland Site and the Estuary Site rnative 12 is unique from other alternatives for the OU-M Delta. (2) Some removed material will be n area referred to as the "Borrow Site." (3) Removal an open water bay that is larger than other alternatives capping of impacted sediments in portions of the	Medium-High - 2 - Would be effective at protection of human health and environment as a result of cap placement and impacted material removal. - Significant habitat betterment would be achieved through creation of the shallow sheltered bay. - Would be effective at achieving all RAOs and Considerations except for preserving areas for economic benefit (construction of large CDF in Upland Site would eliminate possibility for development).		Low-Medium - 4 - Dredging, subaqueous capping and traditional earthwork equipment would be necessary. - Sediment would be transported greater distances than in all alternatives except for Alternatives 10 and 11. - Consolidation of large volume of sediment in OU-M Upland CDF results in high berms.	Medium-High - 4 Relative Cost Ranking: #10	10	More area of open shallower average sheltered bays in o No placement of re Delta. CDF constructed ir site.

Screening Key:

Effectiveness	Implementability	Cost	Overall Score
Highest Effectiveness - 1 point	Highest Implementability - 1 point	Lowest Cost - 1 point	<4
Medium-High Effectiveness - 2 points	Medium-High Implementability - 2 points	Low-Medium Cost - 2 points	5-7 points
Medium Effectiveness - 3 points	Medium Implementability - 3 points	Medium Cost - 3 points	8-10 points
Low-Medium Effectiveness - 4 points	Low-Medium Implementability - 4 points	Medium-High Cost - 4 points	11-13 points

Table 2-3
(FS Addendum - Formerly Table 5-3)
EVALUATION CRITERIA
Former U. S. Steel Duluth Works - Spirit Lake Sediment Site
Saint Louis River
Duluth, Minnesota

Category	Criteria	Description	Factors Considered
Threshold Criteria	Overall Protection of Human Health and the Environment	How does the alternative achieve and maintain protection of human health and the environment?	Elimination, reduction, or control of current and potential/future risks from direct or indirect exposure to COIs by representative individuals and targeted environmental species based on site specific exposure scenarios and site specific understanding of COI fate and transport.
	Compliance with Regulatory Requirements (ARARs)	How does the alternative comply with applicable regulatory requirements and ARARs?	- Review and undertanding of the requirements for compliance with action-specific, location-specific and chemical specific ARARs. - Compliance with other criteria, advisories and guidance.
Balancing Criteria	Long Term Effectiveness and Permanence	The functional ability of the completed activities to maintain protection of human health and the environment after response actions have been implemented by removal or destruction of materials containing COIs or engineered barriers to prohibit contact with materials containing COIs.	- Magnitude of residual risk. - Adequacy and reliability of containment or control systems including: safety factors for engineered barriers; operation, maintenance, and monitoring of programs for containment systems; and institutional measures to maintain and report on long-term activities, as necessary.
	Reduction of Toxicity and Mobility (Overall Risk)	Quantitiative assessment of the mass and/or volume of material that is transformed, removed from the site, or contained in a manner that prohibits future migration of COIs or direct or indirect exposures.	- Process used and materials mitigated. - Expected reductions in toxicity, mobility and volume. - Degree to which the remedy reduces principal threats.
	Short-Term Effectiveness	Consideration of the effect of secondary impacts associated with the implementation of an alternative and their related impacts on human health and the environment near the site during construction and implementation of a remedy and continuing until the response objectives have been achieved.	- Protection of the local community during remedial actions from potential environmental impacts including dust, noise, erosion, increased traffic, or other factors. - Environmental impacts of remedial actions. - Duration of remedial actions.
	Implementability	Evaluation of the technical and administrative feasibility of completing an alternative including the availability of services, materials, equipment and skilled manpower and other resources needed to successfully complete the Project.	- Ability to construct and operate the technology. - Reliability of the technology. - Coordination with other stakeholders and agencies. - Capacity and availability of necessary equipment and specialists.
	Cost	An engineering estimate of the likely capital and O&M cost of each alternative, with appropriate contingencies to match the preliminary nature of the design work completed and the design work that will remain prior to implementing the Project.	- Capital costs. - Operating and maintenance costs. - Performance period/duration of construction. - Proportionality between the risk reduction and cost of the remedy.

agement Principle[1]	Summary
	-Identify direct and indirect sources of significant contamination to the sediments under investigation. -Assess which continuing sources can be controlled and by what mechanisms. -Evaluate the potential for future recontamination of sediments when selecting a response action.
arly and Often.	-Ensure early and meaningful community involvement by providing community members with necessary technical information for their info -Provide affected parties with the same information used by the decision makers. -Include all affected parties in the entire decision-making process to the extent possible. -Allow adequate time for evaluation and comment on the information by all parties.
ocal Governments, Tribes, and	-Communicate and coordinate early to ensure the most relevant information is considered and that these viewpoints are considered in the
nceptual Site Model that Considers	-A conceptual site model should identify all known and suspected sources of contamination. The types of contaminants and affected media pathways, and the known or potential human and ecological receptors that may be threatened. -Prepare the conceptual site model early and use it to guide site investigations and decision making. -Update conceptual site model when new information becomes available and understanding of the site increases. -Conceptual site model is especially important at sediment sites for understanding the complex interrelationships and potential for changin
n in a Risk-Based Framework.	-Use a risk-based framework or strategy for remedy evaluation and selecting response actions appropriate for the site. -Use an iterative approach that incorporates testing of hypotheses/conclusions and fosters re-evaluation of site assumptions as new inform -Consider the benefits of phasing remediation especially when early action is needed to quickly reduce risks or control the spread of contam -This framework should not be used to delay a decision at a site if sufficient information is available to make an informed decision.
sumptions and Uncertainties terization Data and Site Models.	-The amount of site specific data required and complexity of models used to support site decisions should depend on the complexity of the decision. -Clearly describe the basis for all models used and their uncertainties when using the predicted results to make a site decision.
ct-Specific, and Sediment-Specific nes that will Achieve Risk-Based	-There is no presumptive remedy for any contaminated sediment sites, regardless of the contaminant or level of risk. -Evaluate all remedies that may potentially meet the project goals/objectives prior to selecting the site remedy. -Remedies should be evaluated on a comparative basis, considering all components of the remedies, temporal and spatial aspects of the sit reduction potentially achieved. -At many sites, a combination of options will be the most effective to manage risk.
anup Levels are Clearly Tied to Risk	-While it is generally more practical to use measures such as contaminant concentrations in sediment to identify areas to be remediated, ot to ensure human health and/or ecological risk reduction goals are being met.
ss of Institutional Controls and	-Institutional controls are often used as a component of the remedial decisions at sediment sites to limit human exposures and to prevent f redistribution until remedial action objectives are met. -Institutional controls may not be effective in eliminating or significantly reducing all exposures.
imize Short-term Risks while tion.	-Consider the advantages and disadvantages of available options and balance the risks, costs and benefits of each option. -Identify and consider short-term and long-term impacts of each alternative on societal and cultural practices, as appropriate.
er Sediment Remediation to Assess ctiveness.	-Establish a physical, chemical and/or biological monitoring program to determine if risks are being mitigated and to evaluate remedy effec -Collect baseline data for use in comparing and long-term remedy effectiveness. -Identify long term monitoring indicators that are used to determine the success of a remedy in meeting broader remedial objectives.

rall Protection of Human Health and the Environment man Health Protection Mitigate the potential for direct contact with and/or incidental ingestion of, impacted soils and sediment. Addresses potential recreational and trespass user risks. vironmental Protection Reduce the potential for unacceptable risk to ecological receptors.	Implementation of Alternative 4 is anticipated to be protective of h health and the environment. The actions of excavating and dredgin impacted soils/sediment and consolidating these materials within a M delta CDF will partially cover the greatest thickness of non-native sediment and reduce the footprint of impacted materials across the The complimentary actions of remedial capping and placement of a thin cover will eliminate direct human health exposure pathways an control the risk to ecological receptors.
mpliance with Regulatory Requirements (ARARs) mpliance with Applicable Regulatory Guidance • Meets the regulatory requirements of governing agencies. mpliance with ARARs • Actions are permit-able by stakeholder agencies	Execution of Alternative 4 will address regulatory requirements by achieving Upland RAOs and Estuary SMGs.
g-Term Effectiveness and Permanence gnitude of Residual Risk • Remedy addresses residual risk to human health and the environment. equacy and Reliability of Containment or Controls • Remedy is permanent and effective in the long-term.	The combination of removal, consolidation and capping of impacted and sediment will effectively mitigate residual risk by eliminating hu health and ecological exposure pathways in the FS areas of concern remedy is permanent, but will require long-term monitoring and O& maintain effectiveness of engineering controls. Institutional contro layered over engineering controls will address the future threat of disturbance to protective measures associated with this remedy. Diversion of storm water to the former plant water intake area will require engineered energy dissipation and armoring structures that require on-going maintenance.
uction of Toxicity and Mobility (Overall Risk) ocess Used and Materials Mitigated pected Reductions in Toxicity, Mobility and Volume pe and Quantity of Materials Remaining After Implementation gree to which the Remedy Reduces Principal Threats	Alternative 4 will be effective in reducing the overall risk posed by C present in the Upland and Estuary areas of the Site. This alternative utilizes industry-proven methods for removal, consolidation and ca of impacted soil and sediment. The volume of impacted material w reduced through off-site disposal of characteristic hazardous lead-impacted soil from OU-Q. However, the future mobility of COI will eliminated through implementation of proposed engineering contr
rt-Term Effectiveness otection of Community during Remedial Actions vironmental Impacts of Remedial Actions ration of Remedial Actions	Implementation of Alternative 4 is not anticipated to have a signific adverse effect on the community or environment while constructio underway. Construction-related traffic will be moderate and proper protective measures will be implemented to eliminate exposure risk the community. Best management practices will be implemented d construction to minimize environmental impacts. The duration of Alternative 4 is consistent with Alternatives 6, 8 and 8B and is expec encompass two years.
lementability ility to Construct and Operate the Technology iability of the Technology ordination with Other Stakeholders and Agencies pacity and Availability of Equipment and Specialists	Alternative 4 is implementable and will provide a reliable remedy to address risks posed by COCs present in the Upland and Estuary area the Site. The technology associated with this alternative is proven a there are no perceived capacity or availability issues with earth mov and dredging contractors who will perform the work. Placement of within the OU-M delta presents slightly increased logistical challeng associated with longer haul routes from some removal areas.
t pital Costs ng-Term O&M Costs rformance Period	Alternative 4 is identified as the lowest cost alternative advancing t detailed analysis. Long-term O&M is projected to be slightly higher Alternatives 6 ,8 and 8B because of maintenance of the concrete stormwater structures. The O&M costs are projected to be similar t Alternative 12, but less than Alternative 7. The estimated two year duration of Alternative 4 construction is also consistent with Altern 6, 8 and 8B.

rall Protection of Human Health and the Environment man Health Protection Mitigate the potential for direct contact with and/or incidental ingestion of impacted soils and sediment. Addresses potential recreational and trespass user risks. vironmental Protection Reduce the potential for unacceptable risk to ecological receptors.	Implementation of Alternative 6 is anticipated to be protective of h health and the environment. The actions of excavating and dredgin impacted soils/sediment and consolidating these materials within C (delta and upland) CDF will partially cover the greatest thickness of native sediment and reduce the footprint of impacted materials acr the Site. The complimentary actions of remedial capping and place of an ENR thin cover will eliminate direct human health exposure pathways and control the risk to ecological receptors.
mpliance with Regulatory Requirements (ARARs) mpliance with Applicable Regulatory Guidance • Meets the regulatory requirements of governing agencies. mpliance with ARARs • Actions are permit-able by stakeholder agencies	Execution of Alternative 6 will address regulatory requirements by achieving Upland RAOs and Estuary SMGs. The portion of the CDF residing in the OU-M delta extends along the Spit of Land eastward beyond the OHWL. The open water element north of the CDF creat additional layers of permitting and compliance with ARARs will be m complicated in comparison to Alternatives 4 and 7.
g-Term Effectiveness and Permanence gnitude of Residual Risk • Remedy addresses residual risk to human health and the environment. iability of Controls • Remedy is permanent and effective in the long-term.	The combination of removal, consolidation and capping of impacted and sediment will effectively mitigate residual risk by eliminating hu health and ecological exposure pathways in the FS areas of concern remedy is permanent, but will require long-term monitoring and O& maintain effectiveness of engineering controls. Institutional contro layered over engineering controls will address the future threat of disturbance to protective measures associated with this remedy. Fu storm water conveyance will generally follow the current Unnamed alignment and discharge to the shallow sheltered bay created north the CDF. This alignment, in tandem with storm water retention and ponding components within OU-I, provides the lowest risk option fo managing storm water in the future consolidation/capping areas.
uction of Toxicity and Mobility (Overall Risk) ocess Used and Materials Mitigated pected Reductions in Toxicity, Mobility and Volume pe and Quantity of Materials Remaining After Implementation gree to which the Remedy Reduces Principal Threats	Alternative 6 will be effective in reducing the overall risk posed by C present in the Upland and Estuary areas of the Site. This alternative utilizes industry-proven methods for removal, consolidation and cap of impacted soil and sediment. The volume of impacted material w reduced through off-site disposal of characteristic hazardous lead-impacted soil from OU-Q. However, the future mobility of COCs wi eliminated through implementation of proposed engineering contro
rt-Term Effectiveness otection of Community during Remedial Actions vironmental Impacts of Remedial Actions ration of Remedial Actions	Implementation of Alternative 6 is not anticipated to have a signific adverse effect on the community or environment while constructio underway. Construction-related traffic will be moderate and proper protective measures will be implemented to eliminate exposure risk the community. Best management practices will be implemented d construction to minimize environmental impacts. The duration of Alternative 6 is consistent with Alternatives 4, 8 and 8B and is expec encompass a term of two years.
lementability ility to Construct and Operate the Alternative iability of the Alternative ordination with Other Stakeholders and Agencies pacity and Availability of Equipment and Specialists	Alternative 6 is implementable and will provide a reliable remedy to address risks posed by COCs present in the Upland and Estuary area the Site. The technology associated with this alternative is proven a there are no perceived capacity or availability issues with earth mov and dredging contractors who will perform the work. To reduce ha routes and consolidate finer grained industrial sediment close to th of original deposition, dredge material from the OU-M delta, the Unnamed Creek delta and the Wire Mill delta will be placed within a comparatively narrow CDF along the Spit of Land. Consolidation of materials within a restricted foot-print will create potential sight-lin impairments with a peak height of 29 feet above the estuary. Load soft sediment and long term berm/slope stability are unique design construction challenges for this structure. Material derived from sh storm water-related improvements in OU-I will be contained within small valley-fill CDF south of OU-J.
t pital Costs	Alternative 6 is comparatively higher in cost than Alternatives 4 and because of a larger OU-M delta CDF with more significant berms an

rall Protection of Human Health and the Environment man Health Protection Mitigate the potential for direct contact with and/or incidental ingestion of impacted soils and sediment. Addresses potential recreational and trespass user risks. vironmental Protection Reduce the potential for unacceptable risk to ecological receptors.	Implementation of Alternative 7 is anticipated to be protective of h health and the environment. The actions of excavating and dredgin impacted soils/sediment and consolidating these materials within t Unnamed Creek corridor will reduce the footprint of impacted mate across the Site. The complimentary actions of remedial capping and placement of an ENR thin cover will eliminate direct human health exposure pathways and control the risk to ecological receptors.
mpliance with Regulatory Requirements (ARARs) mpliance with Applicable Regulatory Guidance • Meets the regulatory requirements of governing agencies. mpliance with ARARs • Actions are permit-able by stakeholder agencies.	Implementation of Alternative 7 will address regulatory requiremen achieving Upland RAOs and Estuary SMGs. This alternative simplifie permitting and compliance with ARARs by eliminating placement of east of the railway tracks.
g-Term Effectiveness and Permanence gnitude of Residual Risk • Remedy addresses residual risk to human health and the environment. iability of Controls • Remedy is permanent and effective in the long-term.	The combination of removal, consolidation and capping of impacted and sediment will effectively mitigate residual risk by eliminating hu health and ecological exposure pathways in the FS areas of concern remedy is permanent, but will require long-term monitoring and O& maintain effectiveness of engineering controls. The level of effort associated with long-term O&M is anticipated to be higher compara to other alternatives as this alternative involves construction of thre challenging CDFs. Institutional controls layered over engineering co will address the future threat of disturbance to protective measures associated with this remedy. Future storm water conveyance prese the greatest challenge and risk among the alternatives advancing to detailed analysis. Consolidation of impacted media within the Unna Creek corridor will eliminate storm water retention and ponding wi OU-I and create a constricted channel for managing peak flows. Enhanced armoring of the creek channel will be necessary to mitiga berm and slope failure risks. Enhanced stabilization of CDF berms a the Unnamed Creek stream channel will be necessary to prevent CD berm and slope failure issues.
uction of Toxicity and Mobility (Overall Risk) ocess Used and Materials Mitigated pected Reductions in Toxicity, Mobility and Volume pe and Quantity of Materials Remaining After Implementation gree to which the Remedy Reduces Principal Threats	Alternative 7 will be effective in reducing the overall risk posed by C present in the Upland and Estuary areas of the Site. This alternative utilizes industry-proven methods for removal, consolidation and cap of impacted soil and sediment. The volume of impacted material w reduced through off-site disposal of characteristic hazardous lead-impacted soil from OU-Q. However, the future mobility of COCs wi eliminated through implementation of proposed engineering contro
rt-Term Effectiveness otection of Community during Remedial Actions vironmental Impacts of Remedial Actions ration of Remedial Actions	Implementation of Alternative 7 is not anticipated to have a signific adverse effect on the community or environment while constructio underway. However, this alternative presents the greatest challeng temporary storm water management during construction due to extensive filling and construction activity within the Unnamed Cree corridor. Construction-related traffic will be moderate and proper protective measures will be implemented to eliminate exposure risk the community. Best management practices will be implemented d construction to minimize environmental impacts. The duration of Alternative 7 is the longest among the alternatives advancing to det analysis and is expected to encompass a term of three years.
lementability ility to Construct and Operate the Technology iability of the Technology ordination with Other Stakeholders and Agencies pacity and Availability of Equipment and Specialists	Alternative 7, while the most challenging, is implementable and wil provide a reliable remedy to address risks posed by COIs present in Upland and Estuary areas of the Site. The technology associated wi alternative is proven and there are no perceived capacity or availab issues with earth moving and dredging contractors who will perform work. Alternative 7 will entail consolidation of all removed soil and sediment into a CDF located west of the railway tracks. Consolidati these materials within the space constraints of Unnamed Creek cor results in three high CDF structures with peak heights ranging from feet above grade (within the OU-I area to 29 feet above grade (with

rall Protection of Human Health and the Environment man Health Protection Mitigate the potential for direct contact with and/or incidental ingestion of impacted soils and sediment. Addresses potential recreational and trespass user risks. vironmental Protection Reduce the potential for unacceptable risk to ecological receptors.	Implementation of Alternative 8 is anticipated to be protective of h health and the environment. Similar to other alternatives, the actio excavating and dredging impacted soils/sediment and consolidating materials within CDF structures will partially cover residual non-nat sediment and reduce the footprint of impacted materials across the The complimentary actions of remedial capping and placement of a thin cover will eliminate direct human health exposure pathways an control the risk to ecological receptors.
mpliance with Regulatory Requirements (ARARs) mpliance with Applicable Regulatory Guidance • Meets the regulatory requirements of governing agencies. mpliance with ARARs • Actions are permit-able by stakeholder agencies	Execution of Alternative 8 will address regulatory requirements by achieving Upland RAOs and Estuary SMGs. To create a shallow shel bay habitat betterment in the OU-M delta, non-native sediment excavated during this process will be consolidated within a low prof single source CDF extending along the Spit of Land eastward beyon OHWL. This open water element creates additional layers of permi and compliance with ARARs in comparison to Alternatives 4 and 7.
g-Term Effectiveness and Permanence gnitude of Residual Risk • Remedy addresses residual risk to human health and the environment. iability of Controls • Remedy is permanent and effective in the long-term.	The combination of removal, consolidation and capping of impacted and sediment will effectively mitigate residual risk by eliminating hu health and ecological exposure pathways in the FS areas of concern remedy is permanent, but will require long-term monitoring and O& maintain effectiveness of engineering controls. The level of effort associated with long-term O&M for the three CDFs is anticipated to similar to Alternative 6 and 8B but less than Alternative 7. Institutio controls layered over engineering controls will address the future th of disturbance to protective measures associated with this remedy. Future storm water conveyance will generally follow the current Unnamed Creek alignment and discharge to the shallow sheltered b created north of the CDF. This alignment, in tandem with storm wa retention and ponding components within OU-I, provides the lowes option for managing storm water in the future consolidation/cappi areas.
uction of Toxicity and Mobility (Overall Risk) ocess Used and Materials Mitigated pected Reductions in Toxicity, Mobility and Volume pe and Quantity of Materials Remaining After Implementation gree to which the Remedy Reduces Principal Threats	Alternative 8 will be effective in reducing the overall risk posed by C present in the Upland and Estuary areas of the Site. This alternative utilizes industry-proven methods for removal, consolidation and ca of impacted soil and sediment. The volume of impacted material w reduced through off-site disposal of characteristic hazardous lead-impacted soil from OU-Q. However, the future mobility of COCs wi eliminated through implementation of proposed engineering contr
rt-Term Effectiveness otection of Community during Remedial Actions vironmental Impacts of Remedial Actions ration of Remedial Actions	Implementation of Alternative 8 is not anticipated to have a signific adverse effect on the community or environment while constructio underway. Construction-related traffic will be moderate and proper protective measures will be implemented to eliminate exposure risk the community. Best management practices will be implemented d construction to minimize environmental impacts. The duration of Alternative 8 is consistent with Alternatives 4 and 6 and 8B and is expected to encompass a term of two years.
lementability ility to Construct and Operate the Alternative iability of the Alternative ordination with Other Stakeholders and Agencies pacity and Availability of Equipment and Specialists	Alternative 8 is implementable and will provide a reliable remedy to address risks posed by COIs present in the Upland and Estuary areas the Site. The technology associated with this alternative is proven a there are no perceived capacity or availability issues with earth mov and dredging contractors who will perform the work. Consolidation non-native sediment will largely be proximal to its source area, imp construction efficiencies and simplifying staging. Material derived f the OU-M delta shallow sheltered bay removal area will be contain the same area within the delta sediment CDF. Material derived from estuary dredge areas, as well as OU-P and Q and the Unnamed Pon be contained within the OU-M upland area CDF. Material derived f shallow storm water-related improvements in OU-I will be containe within a small valley-fill CDF south of OU-J.

rall Protection of Human Health and the Environment man Health Protection Mitigate the potential for direct contact with and/or incidental ingestion of impacted soils and sediment. Addresses potential recreational and trespass user risks. vironmental Protection Reduce the potential for unacceptable risk to ecological receptors.	implementation of Alternative 8B is anticipated to be protective of human health and the environment. Similar to other alternatives, t actions of excavating and dredging impacted soils/sediment and consolidating these materials within CDF structures will partially co residual non-native sediment and reduce the footprint of impacted materials across the Site. The complimentary actions of remedial ca and placement of an ENR thin cover will eliminate direct human hea exposure pathways and control the risk to ecological receptors.
mpliance with Regulatory Requirements (ARARs) mpliance with Applicable Regulatory Guidance • Meets the regulatory requirements of governing agencies. mpliance with ARARs • Actions are permit-able by stakeholder agencies	Execution of Alternative 8B will address regulatory requirements by achieving Upland RAOs and Estuary SMGs. To create a shallow shel bay and open water bay habitat betterment in the OU-M delta, non native sediment excavated during this process will be consolidated a low profile, single source CDF along the Spit of Land. The CDF will extend eastward beyond the OHWL, resulting in less permitting requirements.
g-Term Effectiveness and Permanence gnitude of Residual Risk • Remedy addresses residual risk to human health and the environment. iability of Controls • Remedy is permanent and effective in the long-term.	The combination of removal, consolidation and capping of impacted and sediment will effectively mitigate residual risk by eliminating hu health and ecological exposure pathways in the FS areas of concern remedy is permanent, but will require long-term monitoring and O& maintain effectiveness of engineering controls. The level of effort associated with long-term O&M for the three CDFs is anticipated to similar to Alternative 6 and 8 but less than Alternative 7. Institution controls layered over engineering controls will address the future th of disturbance to protective measures associated with this remedy. Future storm water conveyance will generally follow the current Unnamed Creek alignment and discharge to the shallow sheltered b created north of the CDF. This alignment, in tandem with storm wa retention and ponding components within OU-I, provides the lowes option for managing storm water in the future consolidation/cappi areas.
uction of Toxicity and Mobility (Overall Risk) ocess Used and Materials Mitigated pected Reductions in Toxicity, Mobility and Volume pe and Quantity of Materials Remaining After Implementation gree to which the Remedy Reduces Principal Threats	Alternative 8B will be effective in reducing the overall risk posed by present in the Upland and Estuary areas of the Site. This alternative utilizes industry-proven methods for removal, consolidation and ca of impacted soil and sediment. The volume of impacted material w reduced through off-site disposal of characteristic hazardous lead-impacted soil from OU-Q. However, the future mobility of COCs wi eliminated through implementation of proposed engineering contr
rt-Term Effectiveness otection of Community during Remedial Actions vironmental Impacts of Remedial Actions ration of Remedial Actions	Implementation of Alternative 8B is not anticipated to have a signif adverse effect on the community or environment while constructio underway. Construction-related traffic will be moderate and proper protective measures will be implemented to eliminate exposure ris the community. Best management practices will be implemented d construction to minimize environmental impacts. The duration of Alternative 8B is consistent with Alternatives 4, 6 and 8 and is expe encompass a term of two years.
lementability ility to Construct and Operate the Alternative iability of the Alternative ordination with Other Stakeholders and Agencies pacity and Availability of Equipment and Specialists	Alternative 8B is implementable and will provide a reliable remedy address risks posed by COIs present in the Upland and Estuary area the Site. The technology associated with this alternative is proven a there are no perceived capacity or availability issues with earth mov and dredging contractors who will perform the work. Consolidation non-native sediment will largely be proximal to its source area, imp construction efficiencies and simplifying staging. Material derived f the OU-M delta shallow sheltered bay removal area will be split bet the area within the delta sediment CDF and the OU-M upland area The berms at the OU-M Upland CDF will be much higher than in Alternatives 6, and 8, and similar to those in Alternative 7 and 12. Material derived from the estuary dredge areas, as well as OU-P an and the Unnamed Pond will be contained within the OU-M upland a

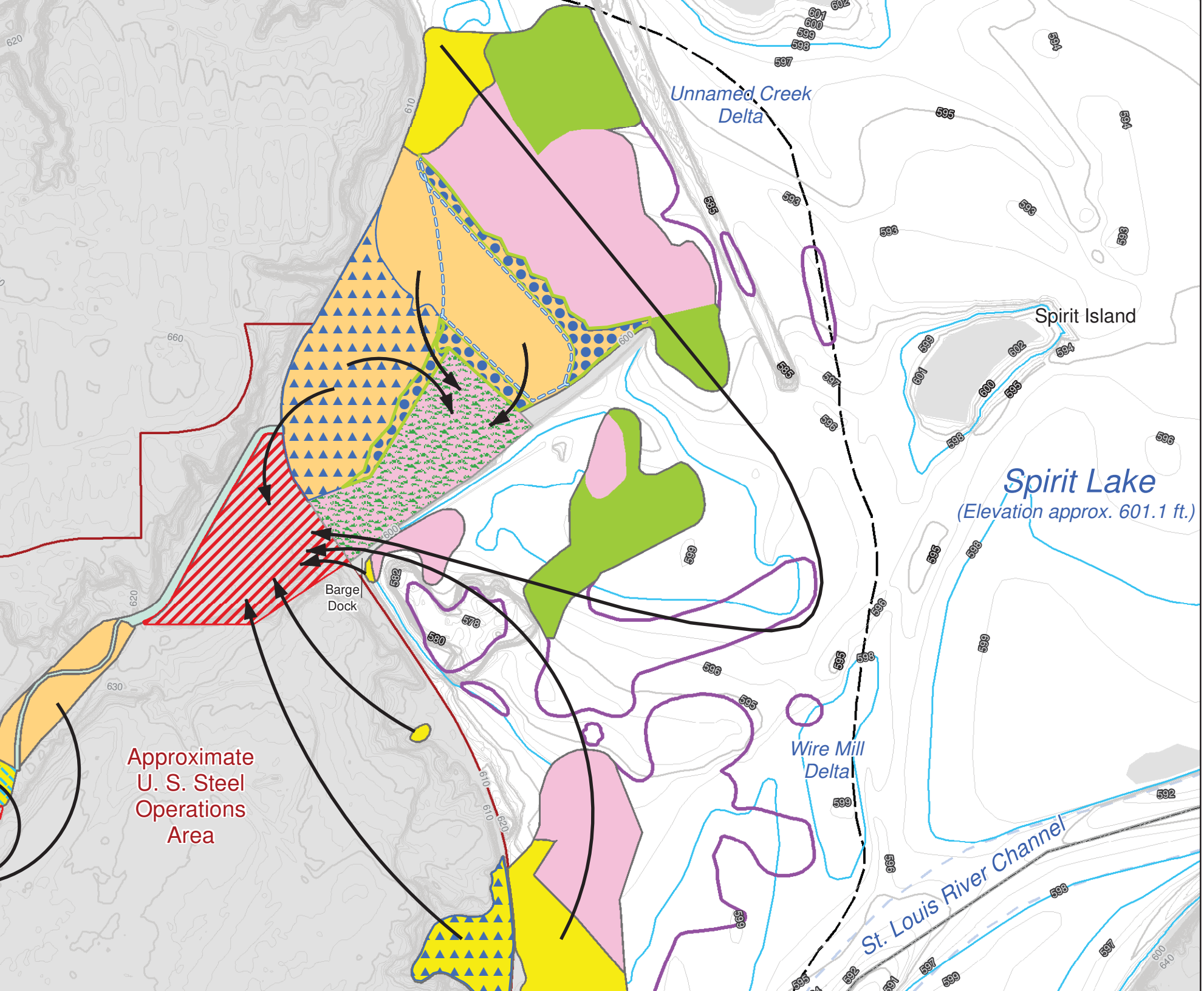
rall Protection of Human Health and the Environment man Health Protection Mitigate the potential for direct contact with and/or incidental ingestion of impacted soils and sediment. Addresses potential recreational and trespass user risks. vironmental Protection Reduce the potential for unacceptable risk to ecological receptors.	Implementation of Alternative 12 is anticipated to be protective of human he and the environment. Similar to other alternatives, the actions of excavating dredging impacted soils/sediment and consolidating these materials within C structures will partially cover residual non-native sediment and reduce the fo of impacted materials across the Site. The complimentary actions of remedi capping and placement of an ENR thin cover will eliminate direct human hea exposure pathways and control the risk to ecological receptors.
mpliance with Regulatory Requirements (ARARs) mpliance with Applicable Regulatory Guidance • Meets the regulatory requirements of governing agencies. mpliance with ARARs • Actions are permit-able by stakeholder agencies	Execution of Alternative 12 will address regulatory requirements by achievin Upland RAOs and Estuary SMGs. To create an open water bay habitat better the OU-M delta, non-native sediment excavated during this process will be r from the delta and placed in several upland CDFs. This alternative simplifies permitting by eliminating placement of a CDF east of the railway tracks but r third CDF location that requires other permitting considerations.
g-Term Effectiveness and Permanence gnitude of Residual Risk • Remedy addresses residual risk to human health and the environment. iability of Controls • Remedy is permanent and effective in the long-term.	The combination of removal, consolidation and capping of impacted soil and sediment will effectively mitigate residual risk by eliminating human health a ecological exposure pathways in the FS areas of concern. The remedy is perm but will require long-term monitoring and O&M to maintain effectiveness of engineering controls. The level of effort associated with long-term O&M for three CDFs is anticipated to be more than Alternatives 6, 8 and 8B because t CDF is located a significant distance away from the other two CDFs. However level of effort is anticipated to be less than Alternative 7. Institutional contro layered over engineering controls will address the future threat of disturban protective measures associated with this remedy. Future storm water conve will generally follow the current Unnamed Creek alignment and discharge to open water bay created north of the spit. This alignment, in tandem with sto water retention and ponding components within OU-I, provides the lowest r option for managing storm water in the future consolidation/capping areas.
uction of Toxicity and Mobility (Overall Risk) ocess Used and Materials Mitigated pected Reductions in Toxicity, Mobility and Volume pe and Quantity of Materials Remaining After lementation gree to which the Remedy Reduces Principal Threats	Alternative 12 will be effective in reducing the overall risk posed by COIs pres the Upland and Estuary areas of the Site. This alternative utilizes industry-pr methods for removal, consolidation and capping of impacted soil and sedime volume of impacted material will be reduced through off-site disposal of characteristic hazardous lead-impacted soil from OU-Q. However, the future mobility of COCs will be eliminated through implementation of proposed engineering controls.
rt-Term Effectiveness otection of Community during Remedial Actions vironmental Impacts of Remedial Actions ration of Remedial Actions	Implementation of Alternative 12 is not anticipated to have a significant adv effect on the community or environment while construction is underway. Construction-related traffic will be moderate but likely less than the other op advancing to detailed analysis because material generated from excavation o borrow site CDF will be utilized for earthwork, reducing the volume of impor material required. However, more on-site transportation will be required be the haul distance to the CDFs. Proper protective measures will be implement eliminate exposure risk to the community. Best management practices will b implemented during construction to minimize environmental impacts. Becau the additional volume removed from the OU-M Delta, construction of tall be the OU-M Upland CDF, and excavation of the Borrow Site CDF, the construct duration is expected to encompass a term of three years, which is longer tha Alternatives 4, 6, 8 and 8B and consistent with Alternative 7.
lementability ility to Construct and Operate the Alternative iability of the Alternative ordination with Other Stakeholders and Agencies pacity and Availability of Equipment and Specialists	Alternative 12 is implementable and will provide a reliable remedy to addres posed by COIs present in the Upland and Estuary areas of the Site. The techn associated with this alternative is proven and there are no perceived capacit availability issues with earth moving and dredging contractors who will perfo work. Although consolidation of non-native material will be proximal to its s area where feasible, on average it will require greater travel distances than Alternatives 8 and 8B, reducing construction efficiencies and complicating st The OU-M Upland CDF will be filled with material generated from the Unnam Creek dredge area and the open water bay removal area. The berms at the C Upland CDF will be much higher than in Alternatives 4, 6, and 8, and similar t in Alternative 7 and 8B. Additionally, because of the limited capacity of the C Upland CDF, a significant volume of material from the open water bay remov

Alternative 4 CDF on OU-M Delta (within shoreline)	Alternative 6 Shallow Sheltered Bay with CDF	Alternative 7 Shallow Sheltered Bay and Delta Cap Area with Upland CDFs	Alternative 8 Shallow Sheltered Bay with Delta Sediment CDF and Upland CDFs	Alternative 8B Shallow Sheltered Bay with Delta Sediment CDF above OHWL and Upland CDFs	C
ore: 1 otective	Score: 1 Protective	Score: 1 Protective	Score: 1 Protective	Score: 1 Protective	Sc Pr
ore: 1 mpliant	Score: 2 Compliant. Requires additional permit considerations as part of CDF is located within assumed OHWL.	Score: 1 Compliant	Score: 2 Compliant. Requires additional permit considerations as part of CDF is located within assumed OHWL.	Score: 1 Compliant. CDF footprint entirely west of the OHWL results in less permitting requirements.	Sc Co
ore: 2 ore stormwater structures to aintain.	Score: 1 Effective	Score: 3 Stormwater management and three CDFs would require more O&M than other alternatives and would be more likely to result in greater potential risk of short and long-term failure than the other alternatives.	Score: 2 Effective. Three CDFs would require more O&M than other alternatives.	Score: 2 Effective. Three CDFs would require more O&M than other alternatives.	Sc Ef m
ore: 1 fective at reducing overall risk	Score: 1 Effective at reducing overall risk	Score: 1 Effective at reducing overall risk	Score: 1 Effective at reducing overall risk	Score: 1 Effective at reducing overall risk	Sc Ef
ore: 2 fective. Stormwater diversion uth of spit.	Score: 1 Effective.	Score: 3 Stormwater management presents risks during construction. Less effective than other alternatives because of longer construction duration.	Score: 1 Effective	Score: 1 Effective	Sc Le be du
ore: 3 plementable; however, Upland aterial must be moved longer stance to CDF.	Score: 5 Implementable; however, height of delta CDF creates potential sight-line impairments and geotechnical loading concerns. In addition, elimination of the LS&M Railroad is required.	Score: 5 Implementable; however, has the most uncertainty because of the complications of stormwater management in a confined channel, and CDF construction, which includes steeper berms and requires soil stabilization, is more complicated than other alternatives. Height of OU-M Delta CDF has potential to create view-shed impacts. Longer construction schedule than other alternatives.	Score: 2 Implementable. Consolidation areas are proximal to source removal areas.	Score: 4 Implementable. Consolidation areas are proximal to source removal areas. Height of OU-M Upland CDF and its berms requires soil stabilization and has the potential to create view-shed impacts.	Sc Im m di re of sc po im sc
ore: 2 west cost of the alternatives tained for detailed analysis	Score: 3 Moderate cost, more than Alternatives 4 and 8, but less than Alternatives 7 and 12	Score: 5 Most expensive of the alternatives retained for detailed analysis	Score: 3 Moderate cost	Score: 3 Moderate cost	Sc Se al ar
ore: 1 mpliant	Score: 1 Compliant	Score: 1 Compliant	Score: 1 Compliant	Score: 1 Compliant	Sc Co

	$21,400,000	**$26,000,000**	**$29,800,000**	**$26,100,000**	**$26,300,000**
queous	$4,790,000	$4,790,000	$4,790,000	$4,790,000	$4,790,000
	$3,080,000	$5,080,000	$5,590,000	$5,080,000	$5,730,000
	$11,200,000	$10,830,000	$10,830,000	$10,830,000	$10,990,000
ion - Dry	$2,310,000	$5,250,000	$8,480,000	$5,300,000	$4,710,000
	$70,000	$70,000	$70,000	$70,000	$70,000
	$10,000,000	**$5,500,000**	**$10,700,000**	**$5,100,000**	**$5,100,000**
	$910,000	$750,000	$500,000	$750,000	$750,000
	$5,850,000	$2,000,000	$8,680,000	$2,000,000	$2,000,000
	$3,270,000	$2,770,000	$1,560,000	$2,380,000	$2,380,000
	$9,100,000	**$14,300,000**	**$16,000,000**	**$12,500,000**	**$15,200,000**
peration	$9,150,000	$14,290,000	$15,980,000	$12,480,000	$15,110,000
	$5,000,000	**$5,000,000**	**$5,000,000**	**$5,000,000**	**$5,000,000**
toration	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
reatment	**$2,600,000**	**$3,400,000**	**$5,240,000**	**$3,650,000**	**$3,650,000**
tion	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
Management	$1,490,000	$2,290,000	$4,130,000	$2,540,000	$2,540,000
ration	**$6,200,000**	**$6,800,000**	**$8,400,000**	**$6,600,000**	**$6,900,000**
	$6,150,000	$6,840,000	$8,410,000	$6,580,000	$6,910,000
obilization, and Demobilization	**$6,900,000**	**$7,200,000**	**$8,500,000**	**$6,600,000**	**$6,900,000**
ilization, Demobilization	$6,860,000	$7,160,000	$8,500,000	$6,600,000	$6,950,000
	$61,000,000	**$68,000,000**	**$84,000,000**	**$66,000,000**	**$69,000,000**

ce - 30 Year Life Cycle Costs Range	**Alternative 4**			**Alternative 6**			**Alternative 7**			**Alternative 8**			**Alternative 8B**			
	Low	**-**	**High**	**Low**	**-**	**High**	**Low**	**-**	**High**	**Low**	**-**	**High**	**Low**	**-**	**High**	
	$1,400,000	-	$3,300,000	$1,400,000	-	$3,300,000	$1,600,000	-	$3,600,000	$1,600,000	-	$3,600,000	$1,600,000	-	$3,600,000	$
	$6,200,000	-	$9,600,000	$3,400,000	-	$7,000,000	$9,300,000	-	$13,400,000	$4,100,000	-	$8,000,000	$4,100,000	-	$8,000,000	$
	$7,600,000	**-**	**$12,900,000**	**$4,800,000**	**-**	**$10,300,000**	**$10,900,000**	**-**	**$17,000,000**	**$5,700,000**	**-**	**$11,600,000**	**$5,700,000**	**-**	**$11,600,000**	**$6**

Figures


Unnamed Creek Delta
Spirit Island
Spirit Lake
(Elevation approx. 601.1 ft.)
Barge Dock
Approximate U. S. Steel Operations Area
Wire Mill Delta
St. Louis River Channel