US Army Corps of Engineers
Seattle District

NOTICE OF PREPARATION

Planning, Environmental and Cultural Resources Branch
CENWS-PMP
4735 East Marginal Way South, Bldg. 1202
Seattle, WA 98134

Public Notice Date: August 9, 2022
Expiration Date: August 24, 2022
Reference: PMP-22-05
Name: Clark Fork Authorized Area V Federal Levee Repair

Interested parties are hereby notified that the U.S. Army Corps of Engineers, Seattle District (Corps) plans to prepare, pursuant to the National Environmental Policy Act (NEPA), an Environmental Assessment (EA) for a proposed levee repair to the Clark Fork Authorized Area V Federal Levee (Clark Fork Levee) in the city of Missoula, Missoula County, Montana. Repairs are intended to address damage caused by flooding in late spring 2020. The purpose of this Notice is to solicit comments from interested persons, groups, and agencies on the Corps' proposed action under NEPA.

AUTHORITY

Public Law (PL) 84-99 (33 U.S. Code [U.S.C.] § 701n) provides the Corps the authority for "the repair or restoration of any flood control work threatened or destroyed by flood, including the strengthening, raising, extending, realigning, or other modification thereof as may be necessary in the discretion of the Chief of Engineers for the adequate functioning of the work for flood control and subject to the condition that the Chief of Engineers may include modifications to the structure or project, or in implementation of nonstructural alternatives." The Corps' repair work under this authority is limited to the repair of flood control works damaged or destroyed by floods. The statute authorizes rehabilitation to the level of protection exhibited by the flood control work prior to the damaging event. This authority is delegated to Seattle District through 33 CFR, Part 203 and Engineer Regulation (ER) 500-1-1. From ER 500-1-1: "Improvements to design and equipment (e.g., geomembranes) that are a result of state-of-the-art technology, and are commonly incorporated into current designs in accordance with sound engineering principles, are permissible, and are not considered betterments." The city of Missoula is the local non-federal sponsor for the proposed Clark Fork Levee repair.

PROJECT LOCATION AND DESCRIPTION

The Clark Fork Levee extends along the right bank of the Clark Fork River though the city of Missoula. Construction of the Clark Fork Levee was authorized by the 1950 Flood Control Act, approved May 17, 1950, 81st Congress, 2nd Session, Public Law 81-516. Construction was completed between June 1963 and January 1964. The levee provides a 500-year flood (0.2 percent annual exceedance probability [AEP]) level of protection to 312 people, 120 buildings, and $36.4 million worth of property. The levee is approximately 1,200 feet long and ties into the California Street Bridge at the downstream end and the Russell Street Bridge at the upstream end. The levee embankment is constructed out of sandy gravel fill and is typically 5 to 10 feet tall. The crest is surfaced with a paved multi-use recreational trail that varies between

12 to 16 feet wide. Riverward levee slopes are roughly 2 horizontal to 1 vertical (2H:1V), while landward slopes are typically 2.5H:1V. As-built documents indicate a 2-foot-thick blanket of slope armor with a buried key toe, though information collected during a recent site visit suggests a thicker riprap layer was placed during construction. Field measurements of the most common rocks observed in the damaged area during the site visit ranged from 16 to 22 inches, which corresponds to Class IV to V riprap.

FLOOD EVENT

In late spring 2020, high water and flooding occurred over the course of 15 days (May 19 – June 4) during a storm event that included both rain and snowmelt. On May 15, 2020, rainfall accumulation measured at 0.69 inches, and by May 21, a total of 2.5 inches had fallen. Snowmelt added to the resulting channel flows. Flows peaked at 21,100 cubic feet per second (cfs) and a stage height of 10.56 feet (gage height) at the Clark Fork above the city of Missoula (U.S. Geological Survey Gage 12340500) on May 21, 2020. The National Weather Service has established flood stage at this location to be 7.5 feet with moderate flood stage at 11.0 feet and a major flood stage at 13.0 feet.

During the flood, riprap was scoured from the riverward slope across approximately 260 feet of the levee (Figure 1). In portions of the damaged area, much of the slope armor has been lost above the ordinary high water elevation and embankment material is exposed. Thick silt deposits occur along the length of the damaged area below the ordinary high water mark (OHWM). The levee toe and slope below the OHWM are intact. In the damaged state, the levee's level of flood protection went from a 500-year (0.2 percent AEP) to a 3-year (33 percent AEP) flood event. Photos of the damaged levee are provided in Appendix A.

Figure 1. Location of the damaged Clark Fork Levee. Circled in red.

PURPOSE AND NEED

The purpose of the project is to repair the Clark Fork Levee to the 500-year level of protection. The repairs are needed because the levee was damaged by the flooding described above and no longer provides the designed level of protection. Repairs would restore adequate and reliable flood protection to the same level provided by the levee prior to the damaging flood event. If the levee was to fail, there would be an increased risk to human safety, improved property, and public infrastructure. Per PL 84-99, the Corps is authorized to repair damaged flood control works to the pre-flood level of protection.

ACTIONS ADDRESSED UNDER NEPA

The Corps proposes to repair the Clark Fork Levee back to its 500-year level of protection. In accordance with NEPA, the Corps is preparing an environmental assessment to evaluate the environmental effects of the proposed repair. For the proposed levee repair, four alternatives are being considered as follows:

- **Alternative 1 – No Action Alternative**

Under the No Action Alternative, the levee would remain in its damaged condition. This alternative would not meet the project purpose because the levee would likely be further damaged in future flood events and could fail, which would endanger protected homes, businesses, and public infrastructure. During any flood event that threatens the integrity of the levee system, the Corps or other federal and non-federal agencies may act under emergency authorities to preserve the levee system and, to the extent possible, maintain protection of life and property behind the levee. Any response to damages during a flood event would be temporary, less certain of success, potentially more expensive, and could be less protective of environmental and cultural resources. A response would also take time to activate and execute, so there is risk that it would not prevent levee failure, such as overtopping or breaching.

The No Action Alternative is not recommended because it would maintain the increased likelihood of damages or breaching of the levee, presenting a risk property. It does not meet the project purpose and need. While the No Action Alternative is not recommended, it is carried forward for further evaluation to serve as a base condition for evaluation of other alternatives.

- **Alternative 2 – Nonstructural Alternative**

This alternative consists of floodplain management strategies that are offered by other federal and state programs and generally involve changes in land use. Such strategies would include zoning, easements, flood-warning procedures, floodplain evacuation, and flood insurance. Nonstructural strategies involve acquiring, relocating, elevating, and flood-proofing existing structures. The cost and timeframe for implementing this alternative make it impractical. The participation of the non-federal sponsors would be required to implement a nonstructural alternative, and the City of Missoula has not agreed to meet its various obligations in executing a nonstructural alternative. Therefore, this alternative is not carried forward for detailed consideration.

- **Alternative 3 – Levee Setback Alternative**

This alternative would shift the alignment of the levee embankment landward to avoid or minimize direct contact with the river and provide additional space for water conveyance. Typically, the setback would involve construction of a new earthen embankment structure and abandonment of the existing levee located on the riverbank. In this instance, a setback levee may be more costly than other alternatives due to the need for more embankment material and real estate requirements. This approach could also encroach on existing structures, privately-owned land, and public infrastructure. Implementing this alternative would also require participation of the non-federal sponsor. While a setback levee would meet the project purpose, the City of Missoula has not agreed to meet its obligations, including land acquisition and additional cost-share funding, to execute a setback alternative. Therefore, this alternative is not carried forward for detailed consideration.

- **Alternative 4 – Repair In-Place Alternative (Preferred Alternative)**

This alternative would repair the Clark Fork Levee within the horizontal and vertical profile as it was designed and built. Repairing the levee in-place is recommended to restore it to its pre-damaged level of protection. No work is proposed below the OHWM (i.e., no in-water work). Repair activities for this alternative are summarized below and shown in the enclosed design plans (Appendix B):

- Sloughed material would be excavated from and reincorporated into the scoured area in the levee slope. Silty sand material that has been deposited over the levee slope higher than 1 foot above the OHWM shall be removed. The damaged slope would be re-armored with a 4-foot-thick blanket of Class V riprap backed by a 12-inch-thick layer of 4- to 8-inch quarry spalls. Riprap would be placed at a 2H:1V slope to achieve good compaction and tight interlocking. The upstream and downstream ends would be smoothly transitioned into existing slopes. Total construction length is approximately 260 feet, including any necessary transitions.
- A 12-inch lift of topsoil would be placed over the riprap blanket, starting one foot above the OHWM and extending upslope to the levee crest. Topsoil would be hydroseeded with a native plant mix provided by the sponsor. The rebuilt riprap layer would end two feet below the existing crest and topped by a 2-foot-thick layer of quarry spalls. The design maintains the Ron's River Trail, a paved recreational path located on top of the levee. Once construction is complete, the paved path would be repaired or replaced.
- A 6-foot-tall chain link fence located 5 feet from the landward edge of the paved path shall be removed during construction and shall be replaced once work is completed.

The Corps proposes implementing the Repair In-Place Alternative. Design plans for the repair under this alternative are in Appendix B.

Equipment to be utilized would be similar to those employed during previous repair projects and includes a hydraulic excavator, dump truck, and bulldozer. Construction is expected to take approximately 4 weeks and must be completed by the end of October 2022 to avoid cold weather conditions that would prevent repairs in time for the upcoming 2023 spring flood

season. Cold weather can adversely affect construction activities (e.g., snow, ice, frozen ground) and increase risk (e.g., visibility, cold stress, dangerous surface conditions). The window of time closing at the end of October is the last opportunity to execute a four-week course of construction prior to the spring 2023 flood season which typically coincides with snowmelt. Construction vehicles would access the site by existing levee access ramps and the levee crown, which are accessible from public rights-of-way. Excavated materials would be staged within the levee footprint and the designated staging area. Best management practices would be employed to minimize project impacts.

ENVIRONMENTAL MITIGATION MEASURES

To offset habitat impacts under this alternative willow stakes and shrubs would be planted just above the OHWM and just below the placed riprap. Plants would be spaced every 6 feet along the slope, alternating between willow bundles and shrubs. In accordance with recommendations by the local sponsor, sandbar willow (*Salix exigua*) cuttings are proposed. Each willow bundle consists of six willow stakes planted within a 12-inch diameter and 3-foot-deep pocket of topsoil. Willow bundles are spaced every 12 feet on center. One gallon size shrubs would also be planted 12 feet on center, in between the willow bundles. Shrub species include red osier dogwood (*Cornus sericea*), Wood's rose (*Rosa woodsii*), and snowberry (*Symphoricarpos albus*). Additionally, the staging and vehicle areas would be restored using hydroseeding with soil, tackifier and native seed. See the design plans for additional planting details.

IMPACTS OF THE PROJECT

The Corps' preliminary analyses of the principal effects of the prospective Clark Fork Levee permanent repairs are summarized below.

Wetlands: The proposed repair would have no effect on wetlands.

Water Quality: Impacts to water quality are not expected because all work will be in the dry, above the OHWM. Additionally, best management practices, including silt fencing and restrictions on fueling, would be in place to prevent discharge of pollutants into the river. No contaminants are known or suspected to be present in the construction materials or in the construction footprint. The proposed repair would have no effect on water quality.

Vegetation: The damaged section of the levee is sparsely vegetated with a mix of grasses and weeds, with an estimated 50-60% of the riverward face in the project area bare ground. Vegetation observed along the levee included reed canary grass (*Phalaris arundinacea),* quack grass (*Elymus repens*), common tansy (*Tanacetum vulgare*), common dandelion (*Taraxacum officinale*), tall hedge mustard (*Sisymbruim loeselii*), buttercup (*Clematis*), and common mullein (*Verbascum thapsus*). This vegetation would be removed to complete the proposed repairs, decreasing organic input to the Clark Fork River. Scattered coyote willows are located below the OHWM along the levee toe, riverward of the proposed repair footprint, and will thus not be affected by construction. To offset temporary impacts, the Corps would install plantings along the repair as described above. Effects on vegetation would be negligible.

Fish and Wildlife: Repair work would cause short-term impacts to fish and wildlife. Impacts include a temporary increase in noise, vibration, dust, and human activity caused by heavy equipment use and planting activities. These may displace fish and wildlife during construction. Project repairs shall require clearing vegetation along the levee slope above OHW within the project footprint. To offset temporary impacts, the Corps would install plantings along the repair as described above. The levee repair work will be performed in the dry, above the OHWM. Effects on fish and wildlife would be negligible.

Threatened and Endangered Species: Potential effects of the work on threatened or endangered species and critical habitat protected under the Endangered Species Act will be addressed through Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS). As warranted, the Corps may incorporate additional impact minimization measures recommended by the USFWS during ESA consultation. The species in Table 1 are listed under the ESA as threatened or endangered and may occur within the action area.

Table 1. ESA-listed species and designated or proposed critical habitat found in the project area.

Species (Common Name and Scientific Name)	Distinct Population Segment (DPS) or Evolutionary Unit	Federal Listing	Year	CH in Action Area	Potential Occurrence (Likely, Unlikely, or Absent)
Bull Trout (*Salvelinus confluentus*)	Columbia River DPS	Threatened; CH Designated	1998 2010	Yes	Unlikely
Yellow-billed cuckoo (*Coccyzus americanus*)	Western DPS	Threatened; CH Designated	2014 2021	No	Unlikely
Canada lynx (*Lynx canadensis*)	United States DPS	Threatened; CH Designated	2000 2014	No	Unlikely
Grizzly Bear (*Ursus arctos horribilis*)	N/A	Threatened; CH Proposed	1975 1976	No	Unlikely

Air Quality: Construction vehicles and heavy equipment during the proposed repairs would temporarily and locally generate increased gasoline and diesel exhaust fumes. The small area of construction and the short duration of the work would limit the impact to air quality. The activity would constitute routine repair of an existing facility, generating an increase in direct emissions of a criteria pollutant or its precursors that would be *de minimis*, and would therefore be exempted by 40 CFR Section 93.153(c)(2)(iv) from the conformity determination requirements. Emissions generated by the construction activity are expected to be minor, short-term, and well below the *de minimis* threshold. Unquantifiable but insignificant exacerbation of effects of carbon dioxide emissions on global climate change would be anticipated. Effects on air quality would be negligible.

Noise: Proposed repairs would generate localized and temporary increased ambient noise levels at the project area similar to what is present in the urban environment. No long-term change in noise would occur from the repairs. Effects on noise would be negligible.

Cultural Resources: Two historic properties are located within the repair's area of potential affect (APE), the levee itself and the Flynn-Lowney Ditch. After reviewing the project specifications, location, and documentation describing previous archaeological surveys and recorded archaeological sites in the vicinity of the project, and given that the proposed repair does not alter the proposed alignment or character defining qualities of the levee, the Corps determined that implementation of the project would have no adverse effect to the Clark Fork Levee. In addition, there would be no adverse effect to the Flynn-Lowney Ditch as it is located on the landward side of the levee outside the APE. Effects on cultural resources would be negligible.

Land Use, Utilities, and Infrastructure: Land use in the project footprint would be temporarily disrupted during construction activities but would be restored after repairs are completed. Construction equipment could cause temporary and minor disruption to traffic on roads and bridges in the area. Flaggers and signs would be used, as needed, to direct traffic safely around the construction site. Before work is started, a utility locate would be completed to ensure that no utilities are impacted by the repairs. Existing infrastructure like public roads and the levee itself would not be altered to prevent their intended purpose and use. Infrastructure and utilities damaged by repair activities would be replaced or repaired as necessary, including Ron's River Trail. Effects to land use, utilities, and infrastructure would be negligible.

Recreation: There would be minor and temporary impacts to recreation. Construction activities would disrupt recreational use of Ron's River Trail on the levee crest within the repair footprint. After repairs are completed, the paved path would be repaired as necessary and access restored. No lasting impacts to recreation would occur. Effects to recreation would be negligible.

EVALUATION

The Corps has made a preliminary determination that the environmental impacts of the proposal can be adequately evaluated under the NEPA through preparation of an EA. Preparation of an EA addressing potential environmental impacts associated with the levee repair project is currently underway.

The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.) is more commonly referred to as the Clean Water Act (CWA). This act is the primary legislative vehicle for federal water pollution control programs and the basic structure for regulating discharges of pollutants into waters of the U.S. The Corps has determined that the proposed Clark Fork Levee repair is not subject to regulation under Sections 401 and 404 of the CWA because no discharge is proposed below the OHWM. Therefore, Section 404 of the CWA is not applicable. The proposed project does not include fill requiring consideration under Section 404. Since the project does not result in any discharge into waters of the U.S., Section 401 Water Quality Certification is not required.

The Corps will coordinate the proposed action with the USFWS concerning effects of the proposed repair on threatened species and their critical habitat, and submit a Biological Assessment pursuant to Section 7(a)(2) of the ESA.

The Corps is consulting with the Montana State Historic Preservation Officer, Indian tribes, and other stakeholder parties about the project in accordance with Section 106 of the National Historic Preservation Act as implemented in the regulations at 36 CFR Part 800.

In preparation of the environmental documentation for this project, coordination has been conducted or is ongoing with the following public agencies:

- USFWS
- State Historic Preservation Officer

No significant unmitigated impact to Tribal Treaty Rights is expected as a result of the proposed activities. The proposed repairs will be analyzed with respect to its effects on the Tribal Treaty Rights or rights reserved to tribes through Executive Order or other legal instrument. The proposed action area is within the area of interest for the following tribes and they will be coordinated and consulted with prior to making a final decision:

- Blackfeet Nation
- Coeur d'Alene Tribe
- Confederated Salish and Kootenai Tribes
- Kalispel Tribe of Indians
- Kootenai Tribe of Idaho
- Nez Perce Tribe

COMMENT AND REVIEW PERIOD

The Corps invites submission of comments on the environmental impact of the proposed action. The Corps will consider all submissions received before the expiration date of this notice. The nature or scope of the proposal may be changed upon consideration of the comments received. If significant effects on the quality of the human environment are identified and cannot be mitigated for, the Corps would initiate an Environmental Impact Statement (EIS) and afford all the appropriate public participation opportunities attendant to an EIS.

COMMENTS TO THE U.S. ARMY CORPS OF ENGINEERS

Submit comments to this office, Attn: Planning, Environmental, and Cultural Resources Branch, CENWS-PMP, 4735 East Marginal Way South, Bldg. 1202, Seattle, WA 98134, no later than 15 days after the posting of this notice to ensure consideration.

In addition to sending comments via mail to the above address, comments may be e-mailed to zachary.m.wilson@usace.army.mil. This Notice and the Draft EA/FONSI can be found online at the link below.

Project Name: Clark Fork Authorized Area V Federal Levee Repair
http://www.nws.usace.army.mil/Missions/Environmental/Environmental-Documents/

Posting Date: August 9, 2022 End of Comment Period: August 24, 2022

APPENDIX A – PHOTOS

Photo 1. Looking downstream along damaged area from California Street Bridge.

Photo 2. Looking upstream through damage area along silt bench deposits.

Photo 3. Looking upstream in damage area.

Photo 4. Looking downstream in damage area along base of exposed riprap.

Photo 5. Looking upslope from silt bench in damaged area.

Photo 6. Existing chain link fence to be removed and replaced at staging area.

APPENDIX B – DESIGN PLANS

US Army Corps
of Engineers ®
Seattle District

FY20 P2-492636 CLARK
CLARK FORK
2020 LEVEE REHAB
MISSOULA MT

SHEET ID	TITLE
	GENERAL
G-001	TITLE, VICINITY MAP, PROJECT MAP, AND INDEX
	CIVIL
CS100	ACCESS AND HAUL ROUTE
CS101	PROPOSED SITE PLAN
C-301	CROSS SECTIONS

PROJECT VICINITY MAP
NTS

PROJECT LOCATION MAP
NTS

SAFETY PAYS

IF SHEET MEASURES LESS THAN 22" X 34" IT IS
A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

US Army Corps
of Engineers ®
Seattle District

Date: XX MAR 2021	
File No.: E-6-7-59	Solicitation No.: -

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT
SEATTLE, WASHINGTON

Prepared by:
Chief, Preparing Section — Date

Submitted by: AARON MEADOWS-HILLS
Project Manager — Date

Reviewed by: ANIL L. NISARGAND, P.E.
Chief, Specs. and Tech Review — Date

Recommended by: GUY L. GREEN, P.E.
Chief, Design Branch — Date

Approved by: JOANN T. WALLS, P.E.
Chief, Engineering Div. — Date

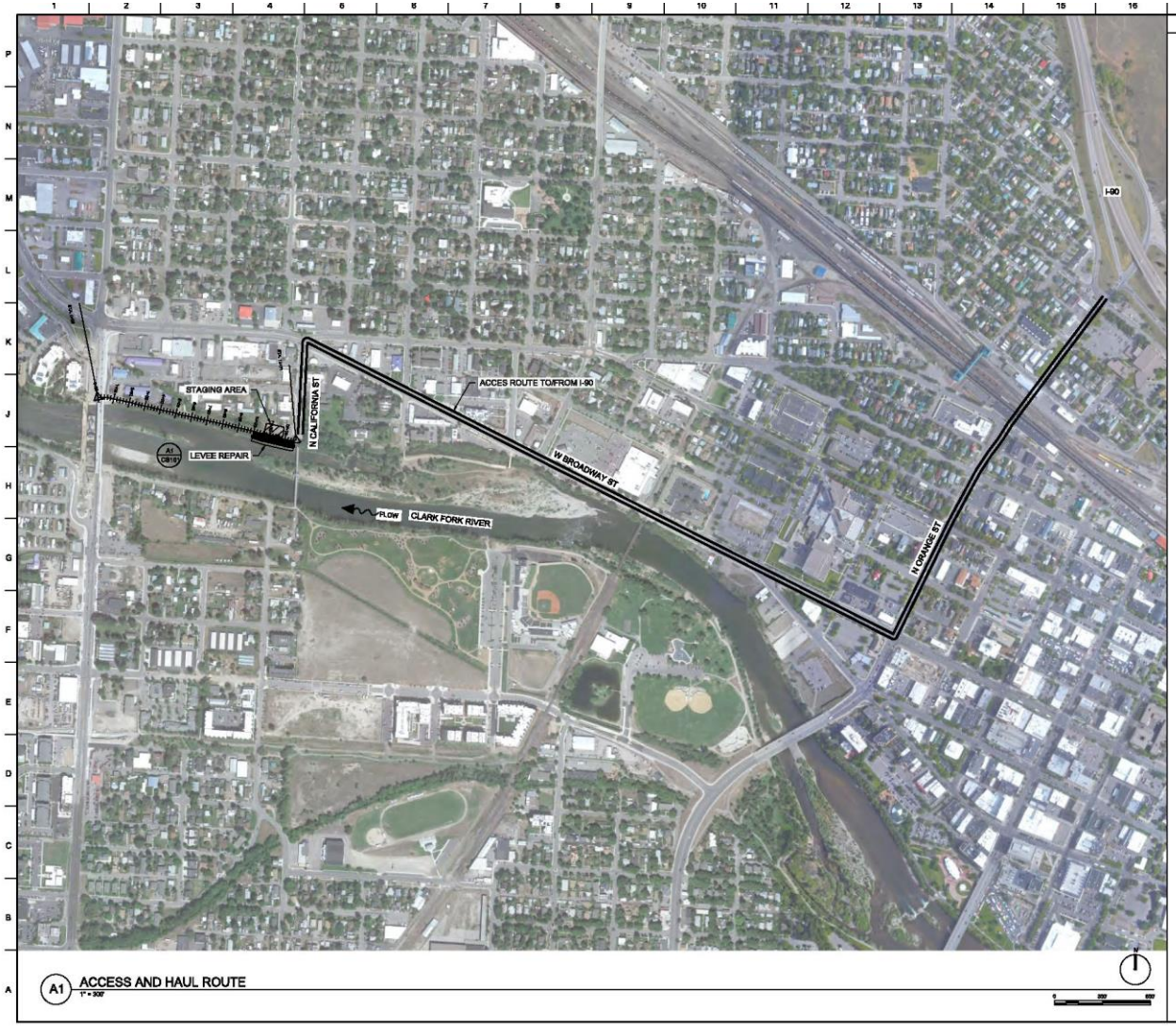
FY20 P2-492636 CLARK
CLARK FORK
MISSOULA, MT
2020 LEVEE REHAB

COVER SHEET

SHEET ID
CLARK
G-001

DATE AND TIME PLOTTED: $$$DATE$$$$

DESIGN FILE: $$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$



GENERAL NOTES:

1. USE EXISTING ROADS FOR SITE ACCESS.
2. N ORANGE ST OVERPASS CLEARANCE 13'-0".
3. UPON PROJECT COMPLETION, STAGING AREAS WILL BE RESTORED TO MATCH EXISTING PRE-CONSTRUCTION CONDITIONS.

US Army Corps of Engineers

MARK	DESCRIPTION	DATE

DESIGNED BY: K. BROWN
DRAWN BY: C. BRADY
CHECKED BY: G. KATO
QUALITY CHECKED BY: A. MEADOWHILLS
RMD

ISSUE DATE: 30 MAY 2025
SOLICITATION NO.:
CONTRACT NO.:
CONTRACT #:
DRAWING NUMBER: 6-8-7-09

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT
4735 E MARGINAL WAY SOUTH
SEATTLE, WASHINGTON 98134

File Name: KMSDrawings\P2\SS_P2-482858_CLARK\Civil_Cloud\CAD_Sheets\CAD\P2SS_P2-482858_CS100 - ACCESS AND HAUL ROUTE.dgn
File Date: 5/30/2025 8:57:48 AM

Fy25 P2-482858 CLARK
CLARK FORK
MISSOULA, MT
2025 LEVEE REPAIR

ACCESS AND HAUL ROUTE

SHEET ID
CLARK
CS100

95% DESIGN SUBMITTAL

A1 SITE PLAN

GENERAL NOTES:

1. STATIONING DERIVED FROM THE NATIONAL LEVEE DATABASE (NLD).
2. LEVEE REPAIR SPANS FROM 10+00 TO 12+00 AS SHOWN.
3. NO IN-WATER WORK.
4. TRANSITION UPSTREAM AND DOWNSTREAM ENDS OF REPAIR TO SMOOTHLY TIE INTO EXISTING SLOPES AND ELEVATIONS.

LEGEND

- STAGING AREA
- ASPHALT
- QUARRY SPALLS
- TOPSOIL AND HYDROSEED
- ALTERNATING WILLOW AND SHRUB PLANTINGS AT 5' OC
- CLASS V RIPRAP

US Army Corps of Engineers

MARK	DESCRIPTION	DATE

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT
4735 EAST MARGINAL WAY SOUTH
SEATTLE, WASHINGTON 98134

DESIGNED BY: M. KATO
DRAWN BY: M. KATO
CHECKED BY: C. BENDER
QUALITY CHECKED BY: A. MEADOWS-HILLS
APPROVED BY: PMSD

ISSUE DATE: 30 SEPTEMBER 2021
SOLICITATION NO.:
DACW67-01-R-0001
CONTRACT NO.:
CONTRACT #
AWARD DATE:
04-1-09

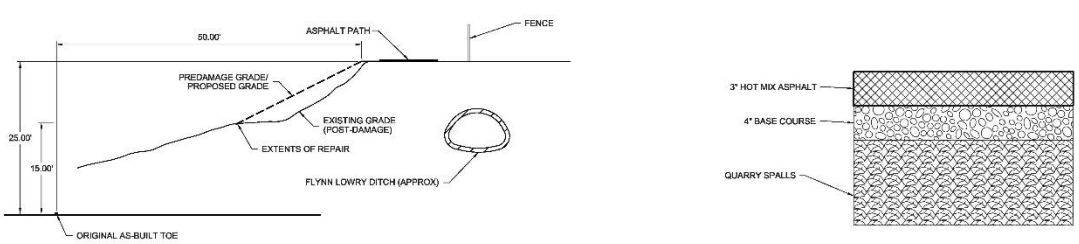
File Name: I:\MCD\design\P705_P2-482668_CLARK\Civil_Drawings\CAD_Sheets\CAD\P705_P2-482668_CS101 - SITE PLAN.dgn
File Date: 8/24/2021 8:19:48

P705 P2-482668 CLARK
CLARK FORK
MISSOULA, MT
2020 LEVEE REHAB

SITE PLAN

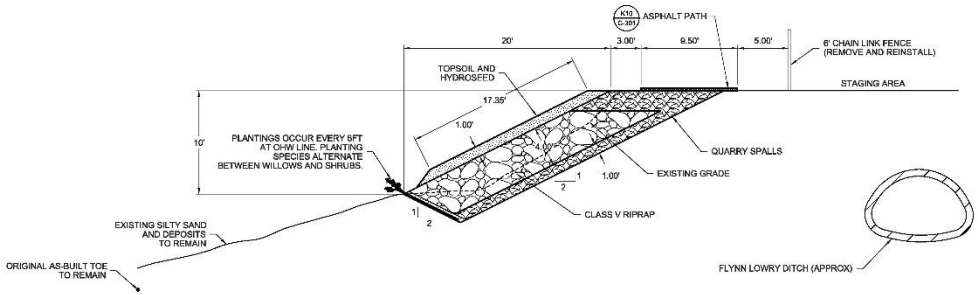
SHEET ID
CLARK
CS101

95% DESIGN SUBMITTAL



K1 EXISTING/PREDAMAGE/PROPOSED GRADE LINES
NTS

K10 ASPHALT PATH
NTS



F1 PROPOSED WATERWARD LEVEE
NTS

GENERAL NOTES:

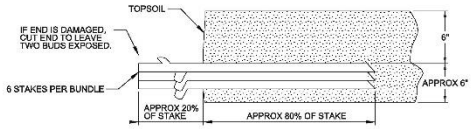
1. NO IN-WATER WORK REQUIRED.
2. PROJECT SITE EXTENDS FOR 200 LINEAR FEET FROM STATION 10+00 TO STATION 12+00. ACTUAL STATION OF CROSS SECTIONS WILL VARY DEPENDING ON FIELD CONDITIONS.
3. USACE SHALL BE RESPONSIBLE FOR LOCATING UNDERGROUND AND OVERHEAD UTILITIES AS APPLICABLE PRIOR TO COMMENCING WORK.
4. QUARRY SPALLS SHALL CONFORM TO THE GRADATIONS IN TABLE 1 ON C-301 AND SHALL CONSIST OF CLEAN, ANGULAR, SCREENED AND CRUSHED ROCK.
5. CLASS VI RIPRAP SHALL CONFORM TO THE GRADATIONS IN TABLE 2 ON C-301. STONE SHALL BE HARD, SOUND, AND DURABLE MATERIAL, FREE FROM SEAMS, CRACKS AND OTHER DEFECTS TENDING TO LEAD TO PREMATURE WEATHERING.
6. SOIL FROM EXISTING LEVEE EMBANKMENT TO BE REUSED WHERE PRACTICABLE.
7. TOPSOIL PLANTING MATRIX SHALL CONSIST OF A 75/25 MIXTURE OF SOIL AND ORGANIC COMPOST. ENGINEERED TOPSOIL SHALL CONFORM TO GRADATION IN TABLE 3 ON C-301 AND SHALL BE FREE OF ROOTS, CHEMICALS GARBAGE AND DEBRIS.
8. LIMIT CONSTRUCTION ACTIVITIES TO WORK AREAS SHOWN.
9. ANY WOODY DEBRIS OR SHRUBS REMOVED AS A RESULT OF THE REPAIR SHALL BE PLACED ON THE COMPLETED LEVEE AT OHW. REMOVE INVASIVE VEGETATION SUCH AS JAPANESE KNOTWEED OR HIMALAYAN BLACKBERRY, BEFORE PLACING WOODY DEBRIS. DO NOT PLACE VEGETATION ON WILLOW STAKES OR SHRUBS.
10. HYDROSEED MIXTURE SHALL CONSIST OF THE FOLLOWING MINIMUM STANDARDS: 40-60 LBS TACKIFIER PER AC, 2000 LBS MULCH PER AC, 400 LBS FERTILIZER PER AC, 200 LBS SEED PER AC WITH 40% BLUEBUNCH WHEATGRASS (PSEUDOROEGNERIA SPICATUM), 40% WESTERN WHEATGRASS (PASCOPYRUM SMITHII), 19% IDAHO FESCUE (FESTUCA IDAHOENSIS), 1% BLANKET FLOWER (GAILLARDIA ARISTATE), 0.5% CURLY TOP GUMWEED (GRINDELIA SQUARROSA), 0.3% HAIRY GOLDEN ASTER (HETEROTHECA VILLOSA), 0.05% YARROW (ACHILLEA MILLEFOLIUM), 0.05% CANADA GOLDENROD (SOLIDAGO CANADENSIS), 0.05% HOLBOELL'S ROCKCRESS (ARABIS HOLBELLII), 0.04% WESTERN MUGWORT (ARTEMESIA LUDOVICIANA), AND 0.01% FIREWEED (CHAMERION ANGUSTIFOLIUM). SUITABLE SUBSTITUTES MAY BE USED AFTER REVIEW AND APPROVAL BY THE PROJECT BIOLOGIST.

REPAIR STEPS

1. PREPARE STAGING AREA AND REMOVE EXISTING CHAINLINK FENCE TO FACILITATE LEVEE ACCESS. RETAIN FENCING TO BE REINSTALLED AT PROJECT CONCLUSION.
2. CLEAR AND PREPARE REPAIR SITE AS NECESSARY. INVASIVE VEGETATION, INCLUDING JAPANESE KNOTWEED AND HIMALAYAN BLACKBERRY, WILL BE DISPOSED OF PROPERLY AND IN A MANNER TO PREVENT THE SPREAD OF INVASIVE VEGETATION.
3. EXCAVATE SLOUGHED MATERIAL FROM REPAIR AREA. REMOVE EXISTING RIPRAP AND RETAIN AS PRACTICABLE. NO WORK TO BE PERFORMED BELOW THE OHW.
4. REGRADE AS NEEDED BEFORE PLACEMENT OF SPALLS AND RIPRAP LAYERS.
5. INSTALL BLANKETS OF CLASS V RIPRAP OVER A SPALL LAYER TO THE TOP OF SLOPE.
6. INSTALL WILLOW BUNDLES AND SHRUBS ALTERNATING EVERY 6' AT 0.5' ABOVE OHW.
7. TRANSITION UPSTREAM AND DOWNSTREAM ENDS OF REPAIR TO SMOOTHLY TIE INTO EXISTING SLOPES AND/OR GROUND ELEVATIONS.
8. INSTALL AND COMPACT BLANKET OF TOPSOIL AND HYDROSEED, COVERING THE UPPER PORTION OF THE NEWLY CONSTRUCTED LEVEE.
9. RESTORE ASPHALT PATH.
10. REINSTALL FENCING AROUND THE STAGING AREA AND RESTORE SITE.

WILLOW PLANTING STEPS:

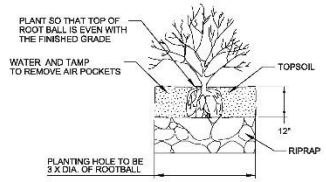
1. WILLOW STAKES SHALL BE CUT TO 4' IN LENGTH WITH AN ANGLE CUT (45 DEGREES) BASAL END OF 0.5" TO 1.5" IN DIAMETER AND PERPENDICULAR CUT JUST ABOVE A NODE (BUD) AT THE TOP.
2. WILLOW BUNDLES CONSIST OF SIX (6) 4-FOOT LONG WILLOW STAKES PLANTED IN A SOIL MATRIX CONSISTING OF TOPSOIL 12 INCHES IN DIAMETER AND 3 FEET DEEP, SPACED 12 FEET ON CENTER.
3. INSTALL WILLOW BUNDLES AT THE PRE-EXISTING VEGETATION LINE (ORDINARY HIGH WATER). PLANT BUNDLES BY HAND.
4. LAY DOWN A 6" THICK, 3' DEEP LAYER OF TOPSOIL ALIGNED IN TRENCH.
5. PLACE WILLOW BUNDLE IN TRENCH AT THE CENTER OF THE LAYER SO THAT APPROXIMATELY 80% WILL BE EMBEDDED. AVOID STRIPPING BARK OR BRUISING STAKES DURING INSTALLATION.
6. PLACE REMAINING 6" OF TOPSOIL ON TOP AND CONTINUE ROCK PLACEMENT.
7. INSTALL VEGITATION EVERY 6' ALONG SITE, ALTERNATING BETWEEN WILLOWS AND SHRUBS.



A1 WILLOW BUNDLE PLANTING CROSS SECTION
NTS

SHRUB PLANTING STEPS:

1. SHRUBS SHALL CONSIST OF 1-GAL PLANTINGS OF THE FOLLOWING THREE VARIETIES: RED OSIER DOGWOOD (CORNUS SERICEA); WOOD'S ROSE (ROSA WOODSII); AND, SNOWBERRY (SYMPHORICARPOS ALBUS).
2. INSTALL SHRUBS AT THE PRE-EXISTING VEGETATION LINE SPACED 12 FEET ON CENTER. (ORDINARY HIGH WATER), PLANT BY HAND.
3. SURROUND THE SHRUBS WITH 1 FOOT DEEP TOPSOIL LAYER. ROOT BALL IS TO BE EVEN WITH FINISHED GRADE. SOIL SHALL BE WATERED AND TAMPED LIGHTLY TO REMOVE AIR POCKETS.
4. INSTALL VEGITATION EVERY 6' ALONG SITE, ALTERNATING BETWEEN WILLOWS AND SHRUBS.



A9 SHRUB PLANTING CROSS SECTION
NTS

TABLE 1: QUARRY SPALL GRADATION

SIEVE SIZE	PRECENT PASSING
8"	100
4"	0

TABLE 2: CLASS V RIPRAP GRADATIONS (ASSUMED SG = 2.60)

DISTRIBUTION	WEIGHT (LB)	DIAMETER (IN)
100% SMALLER THAN	3000	34
50%	750	21
10%	188	13
Cu		2.2

TABLE 3: ENGINEERED TOPSOIL GRADATION

SIEVE SIZE	PRECENT PASSING BY WEIGHT
1/2"	100
NO. 4	75-100
NO. 10	40-75
NO. 16	25-55
NO. 40	25-50
NO. 200	10-20

TABLE 4: MATERIAL QUANTITIES

SITE	CLASS V RIPRAP (CY)	FILTER SPALLS (CY)	ASPHALT (CY)	BASE (CY)	TOPSOIL (CY)	HYDROSEED (SY)
TOTAL	690	991	23	31	185	823

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

File Path: I:\AECOM\aplan\P2\0 75-192858 CLARK\Dgn\P2\0 75-192858 C-301 - CROSS SECTIONS.dgn
Plot Date: 8/24/21 8:37 AM

DESIGNED BY: J. DOMINICK
DRAWN BY: C. SIMON
CHECKED BY: K. WEBB
SUBMITTED BY: A. MEYERHOLZ
SCP: ARB 1.2

ISSUE DATE: 95% AUGUST 2021
PROJECT NO.: P2 0 75-192858
CONTRACT NO.: W912DQ-20-D-4004
FILE NUMBER: LRP-2019-00

US ARMY CORPS OF ENGINEERS SEATTLE DISTRICT
4735 EAST MARGINAL WAY SOUTH SEATTLE, WASHINGTON 98134

FY20 PHASE IV CLARK CLARK FORK MISSOULA, MT 2500 LEVEE REHAB

CROSS SECTIONS

SHEET ID
CLARK
C-301

95% DESIGN SUBMITTAL