Appendix A – Civil Engineering

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1 PROJECT DESCRIPTION

1.1 STUDY PURPOSE AND SCOPE

Shallow depths are impacting the efficient use of the river oxbow and channel on which KRPD#2 is situated (the south oxbow). The major problem at the site is delays caused by difficulty of transiting the oxbow due to shallow depth and maneuvering in this narrow channel condition, resulting in decreased efficiency and economic loss. In order to mitigate this problem, river industry reduces the number of barges transported to the dock and minimizes the volume of cargo placed onto the barge to lighten the load and reduce the vessel draft. The existing transloading delays would continue to impact Port operations in the future without project (FWOP) condition.

KRPD#2 has experienced a significant increase in tonnage over its history. Future increases in demand are expected (per KRPD projections and the 2020 KRPD#2 Master Plan). KRPD requested this study to evaluate needed navigation improvements to support growing demands and increased capacity of the multi-modal facility.

1.2 LOCATION

KRPD#2 is located west of Baldwin, Illinois, in Randolph County, Illinois near river mile (RM) 18 on the Kaskaskia River, approximately 45 miles southeast of St. Louis, Missouri. The port terminal is located on an oxbow on the west side (right descending bank) of the Kaskaskia River. The terminal currently hosts four tenants (Gateway FS, The Material Works (TMW), Kaskaskia Shipyard, and Southern Illinois Transfer Company) and facilitates the movement of products such as dry bulk commodities like fertilizer and gypsum, and heavy manufactured goods like steel and aluminum. Freight is moved between the waterway, highway, and railroads at the facility.

KRPD has seen and supported an increase in tonnage shipped on the Kaskaskia River and expects an increase in tonnage at KRPD#2 (per interviews with KRPD). KRPD requested this study to evaluate needed navigation improvements to support growing demands and increased capacity of the multi-modal facility.

The study area includes two oxbows of the Kaskaskia River. These oxbows are U-shaped meanders of the river that were cut off from the main river channel at one end when the river was straightened for the Kaskaskia River Navigation Project. The south ends of both oxbows remain open to the river.

The oxbow on which the KRPD#2 port terminal is located is called the south oxbow in this report. In the south oxbow, shallow depths (sedimentation) in the oxbow channel impact efficient use of the channel, causing delays resulting from the difficulty of transiting the oxbow, resulting in decreased efficiency and economic loss.

The oxbow directly north of the south oxbow, approximately 1,200 feet from the existing port terminal on the north side of IL-154, is called the north oxbow in this report.
The north oxbow is not currently used for shipping. KRPD plans to expand its operations to include road and rail development on land adjacent to the north oxbow (Thouvenot, Wade & Moerchen, Inc., 2020).

The authority for this study is Section 107 of the River and Harbor Act of 1960, as amended, which permits USACE to undertake the investigation, design, and construction of small navigation projects.

1.3 DATUM

All horizontal survey data used for the study is in North American Datum of 1983 (NAD83) State Plane Illinois West.

All vertical survey data for the study is in North American Vertical Datum of 1988 (NAVD88)

1.4 DESIGN SOFTWARE

Bentley OpenRoads Designer was used for modeling, design, and quantity takeoffs.

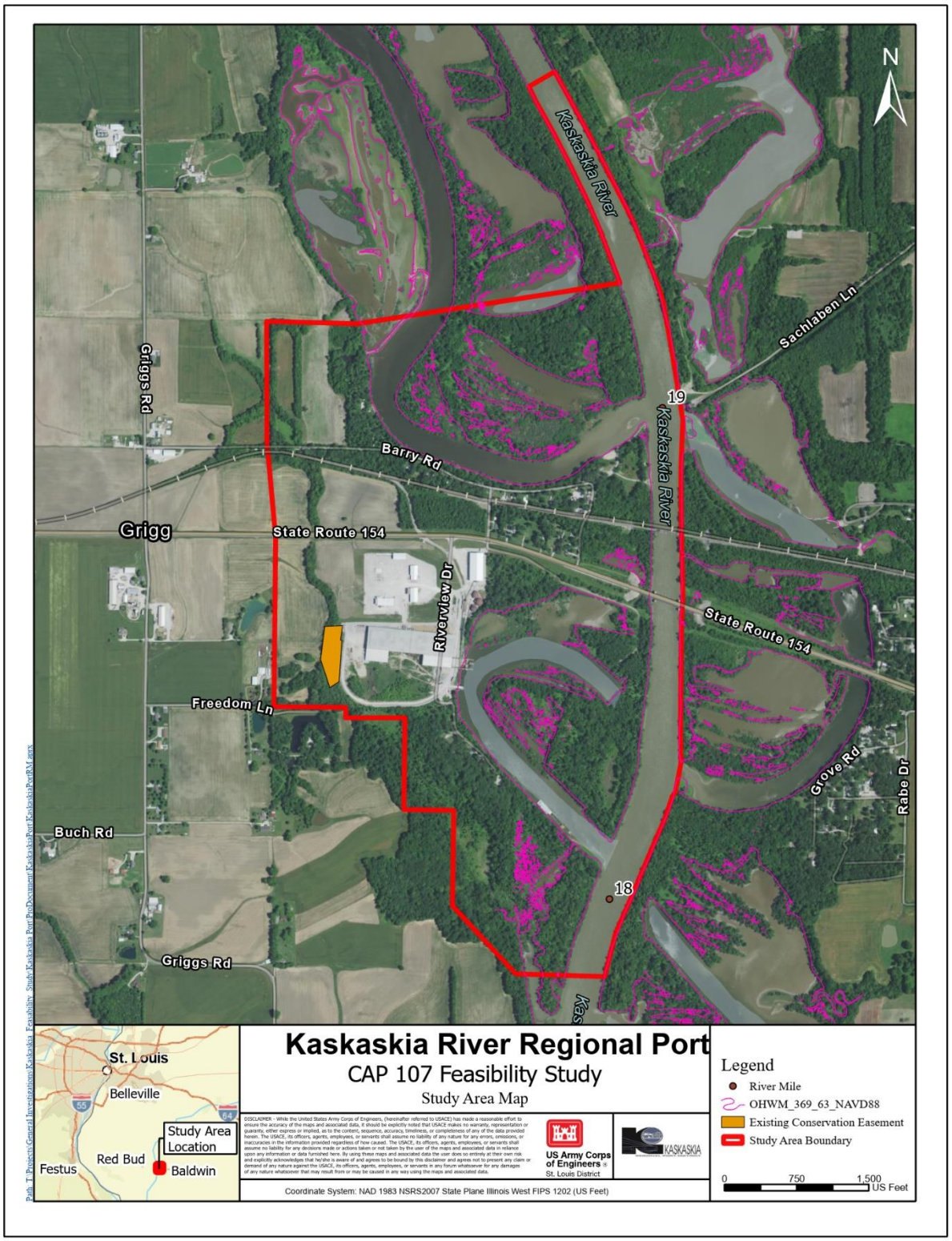

Figure A-1. Study Area

Figure A-2. Aerial View of KRPD#2 Terminal (Photo: KRPD)

1.5 EXISTING CONDITIONS

The existing width of the navigation channel inside the south oxbow at the KRPD#2 facility is approximately 45 feet wide and existing depths range from approximately 4 feet to 17 feet deep. The Kaskaskia River and oxbows are prone to sedimentation and KRPD has dredged the oxbows at approximately ten-year intervals, with most of the dredged material quantity taken from the mouth of the oxbow and other shallow problem areas.

There are two dredge disposal areas currently in use at KRPD#2, identified as DD-1 and DD-2 in this study. Approximate locations of DD-1 and DD-2 can be seen in **Figure A-3**

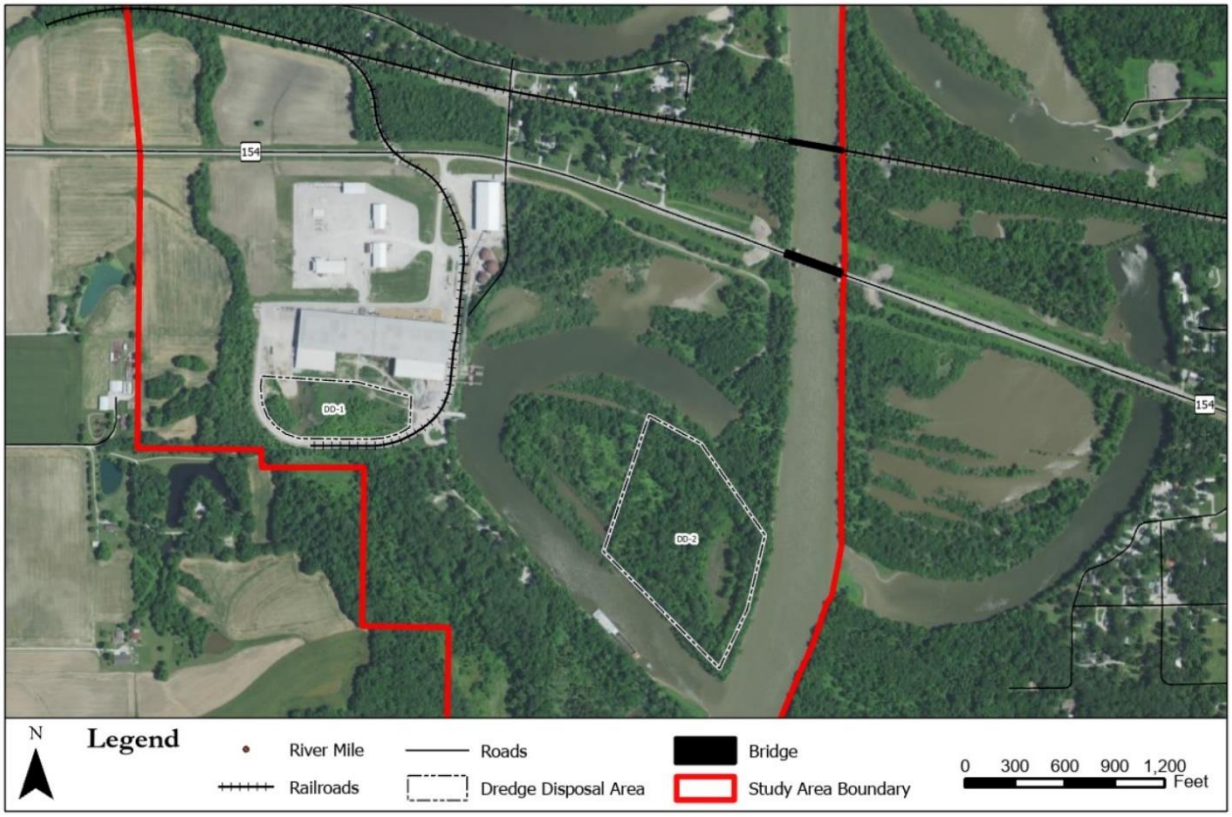

Figure A-3. Dredge disposal areas 1 and 2 (DD-1 and DD-2)

2 MEASURES

As described in Section 3.3 of the main report, the following measures, shown in **Figure A-4,** were retained in the initial array of alternatives, and evaluated further:

South oxbow:

- Channel dredging, to one-or two-way traffic width
- Turning area
- Fleeting area 1 (FL-1)
- Fleeting area 2 (FL-2)
- Dredge disposal area 1 (DD-1)
- Dredge disposal area 2 (DD-2)

North oxbow:

- New dock
- Channel dredging, to one-or two-way traffic width
- Fleeting area 4 (FL-4)
- Fleeting area 5 (FL-5)
- Mouth widening
- Dredge disposal area 3 (DD-3)

Either or both oxbows:

- Dredge disposal area 4 (DD-4)

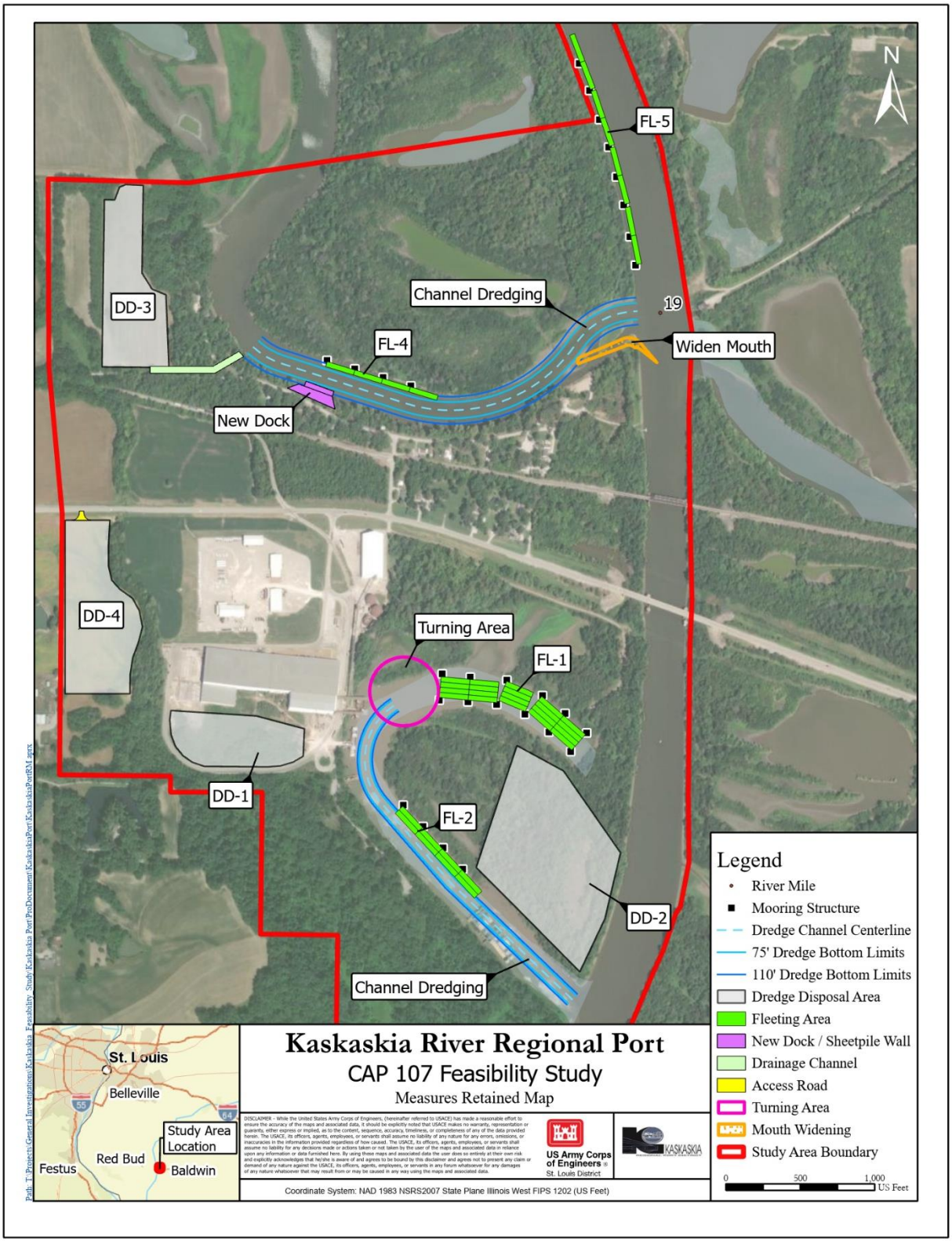

Figure A-4. Measures Retained in the Initial Array of Alternatives

2.1 SOUTH OXBOW MEASURES

The south oxbow is the port channel that is currently in use by the KRPD#2 facility. The following information is provided for measures in the south oxbow in addition to information provided in the main report.

2.1.1 ACCESS AND STAGING

The approximate construction staging area for the alternatives is shown below in **Figure A-5** and construction access to all materials needed for construction from land would be transported via the existing KRPD#2 loading dock.

Figure A-5: Construction Staging Area

Access to DD-2 will be from floating plant as land-based access is not acceptable, as it would require additional tree clearing and associated mitigation.

2.1.2 CHANNEL DREDGING

The channel dredging measures for the south oxbow were analyzed at 75-foot bottom width and 110-foot bottom width to a depth of 12 feet. The 75- and 110-foot figures provide the necessary width for one-way and two-way traffic, respectively. The depth of 12 feet allows the port to heavily load barges to a deeper draft, resulting in a more efficient shipping operation.

KRPD#2 currently maintains the south oxbow channel for use, conducting maintenance dredging as needed when siltation from the Kaskaskia River builds up at the mouth of the oxbow. The previous maintenance dredging was done via mechanical dredging and the dredged material deposited in the nearby dredge disposal area DD-1 (see Section 2.4 in the main report). It is assumed that the dredging done for this project will be done with a hydraulic cutterhead dredge. The cutterhead dredge assumption was chosen to enable the removal of potentially dense, clay-like material in the oxbow channel bed that has not previously been dredged.

Quantities

The estimated volumes of dredged material for the different measures in the south oxbow can be found in **Table A-1** for the 75-foot (one-way) channel and **Table A-2** for the 110-foot (two-way) channel. The dredged material quantities were derived using ArcGIS Pro to create dredge prisms and calculate the volume between the existing channel terrain and the proposed channel terrain.

Table A-1. 75-foot Channel Width Dredging Quantities

Alternative	Dredged Material Quantity (CY)
3b – Channel	29,000
2b – Channel and Turning Area	91,000
1b – Channel, Turning Area, FL-1, and FL-2	134,000

Table A-2. 110-foot Channel Width Dredging Quantities

Alternative	Dredged Material Quantity (CY)
3a – Channel	45,000
2a – Channel and Turning Area	107,000
1a – Channel, Turning Area, FL-1, and FL-2	143,000

2.1.3 DREDGED MATERIAL PLACEMENT AREAS

Placement Area 1 (DD-1)

DD-1 is a dredge disposal site just south of the KRPD#2 terminal building. The site has been used to receive material from maintenance dredging near the port and is currently covered with non-woody vegetation. The approximate original footprint for DD-1 is shown in **Figure A-3** but the capacity has been reduced for the analysis in this study due to previous use of the site. The estimated capacity of DD-1 is approximately 9,000 CY.

Placement Area 2 (DD-2)

DD-2 is a dredge disposal site that has been out of use for at least the last 20 years. It has several openings in the containment berm that allow for natural drainage as opposed to relying

only on seepage and evaporation. The current capacity remaining in DD-2 is approximately 105,000 CY. The east side of the disposal area is nearly filled to the top of the berm at 380 ft elevation (NAVD88), while the west side of the disposal area has more capacity and drops to an elevation of approximately 370 ft. The existing terrain for DD-2 can be seen in **Figure A-6.**

Modifications to DD-2 that would increase its capacity were modeled. The quantities in **Table A-3** below reflect a modification to the containment berm that raises the top elevation to 385 ft (NAVD88). This modification would add roughly 90,000 CY of capacity, however, due to the close proximity of the Kaskaskia River and south oxbow, the berm would need to be built up and in, with the internal side slopes of the berm migrating further into the interior of the dredge disposal area. This migration of the berm centerline inwards effectively provides less area for disposal as the elevation of the berm increases, resulting in diminishing returns as the berm is built up. The estimated capacity of DD-2 with the raised berm is approximately 212,000 CY.

Figure A-6. DD-2 Terrain View

Quantities

The estimated earthwork quantities for DD-2 are shown in **Table A-3**.

Table A-3. DD-2 Earthwork Quantities

Action	Quantity
Earthwork (CY)	21,361
Clearing & Grubbing (AC)	17.84
Geotextile Fabric (SF)	297,430
Seeding (AC)	18.00

Material containment was assumed to not require a spillway or filtration system for safe material dewatering. Analysis during PED will determine if such systems are required, and design of these systems will be designed appropriately.

Placement Area 4 (DD-4)

DD-4 is a proposed dredge disposal area that would have been required for the maximum alternatives for the north and south oxbows to provide the necessary volume for dredged material storage. This site sits just south of Illinois Highway 154 and west of the drainage ditch that runs along the west side of KRPD#2. The estimated capacity for DD-4 is approximately 132,000 CY.

The DD-4 site sits at an elevation well above the south oxbow. The distance the material would have to be pumped and the head difference due to elevation would not allow for hydraulic dredging to be used to fill DD-4. Mechanical dredging would be required instead, which would involve multiple handlings such as temporary stockpiling on the barge(s), then loading into dump trucks for hauling to the disposal site for final placement.

It is assumed that the dredged material would be suitable for use as the fill material for the berms enclosing the DD-4 site. This use of the dredged material would reduce costs for the construction of DD-4.

Quantities

The estimated earthwork quantities for DD-4 can be found in **Table A-4**.

Table A-4. DD-4 Earthwork Quantities

Earthwork Action	Quantity
Berm Length (FT)	3,000
Berm Height (FT)	12
Berm XS Area (SF)	408
Berm Volume (Cu Ft)	1,224,000
Berm Volume (CY)	45,333
Clearing & Grubbing (AC)	10.76
Seeding (AC)	10.76

Note: Geotextile containers, also known as geotubes (commercial name), have previously been used along the Kaskaskia River at locations where dredging is needed but no spoil site is available. According to USACE Operations personnel, they are not a simple or efficient method for dredged material disposal. Often, two or three tubes must be set up at once and the contractor will switch back and forth between containers in order to let the water drain out of them before more material can be added. The study team will evaluate the potential use of

geotextile containers in dredge disposal at KRPD2 during Preconstruction Engineering and Design (PED).

Many other features are being developed and implemented to aid in dewatering the dredged material, all of which will be evaluated for potential use during the PED phase.

2.1.4 TURNING AREA

The turning area shown in **Figure A-4** is designed to allow a vessel with one barge attached to turn around within the oxbow, thereby increasing the efficiency of movement within the oxbow. Currently, vessels must come in and out of the oxbow facing the same direction, reducing the speed of travel on the route that requires the vessel to move in reverse.

A diameter of 460 ft was determined for the turning area, based on conversations between the study team and shipping industry personnel, USACE Operations personnel, and the Japanese Port and Harbor Facilities Technical Standards.. The entirety of the turning area would be dredged to the same depth as the rest of the oxbow channel and the dredge material quantities for this measure can be seen above in **Table A-1 and Table A-2**.

2.1.5 FLEETING AREAS

Fleeting areas provide space for the port operators to place barges that are either empty and waiting to be loaded or loaded and waiting to be taken by a shipping vessel out of the oxbow. There are currently no fleeting areas on the south oxbow; although one fleeting area has been permitted, it is not in use (potentially due to sedimentation issues, though no reason has been provided). Two fleeting areas were included in the initial array of alternatives.

<u>Fleeting Area 1 (FL-1)</u>

Fleeting Area 1 sits in the upper end of the south oxbow and requires dredging of the oxbow channel from the current dock location to the end of the oxbow. An estimated 20 fleeting spaces would be created with 12 mooring structures installed for the attachment of barges. **Figure A-7** shows an example mooring structure detail that was used for the design in all fleeting areas for the project.

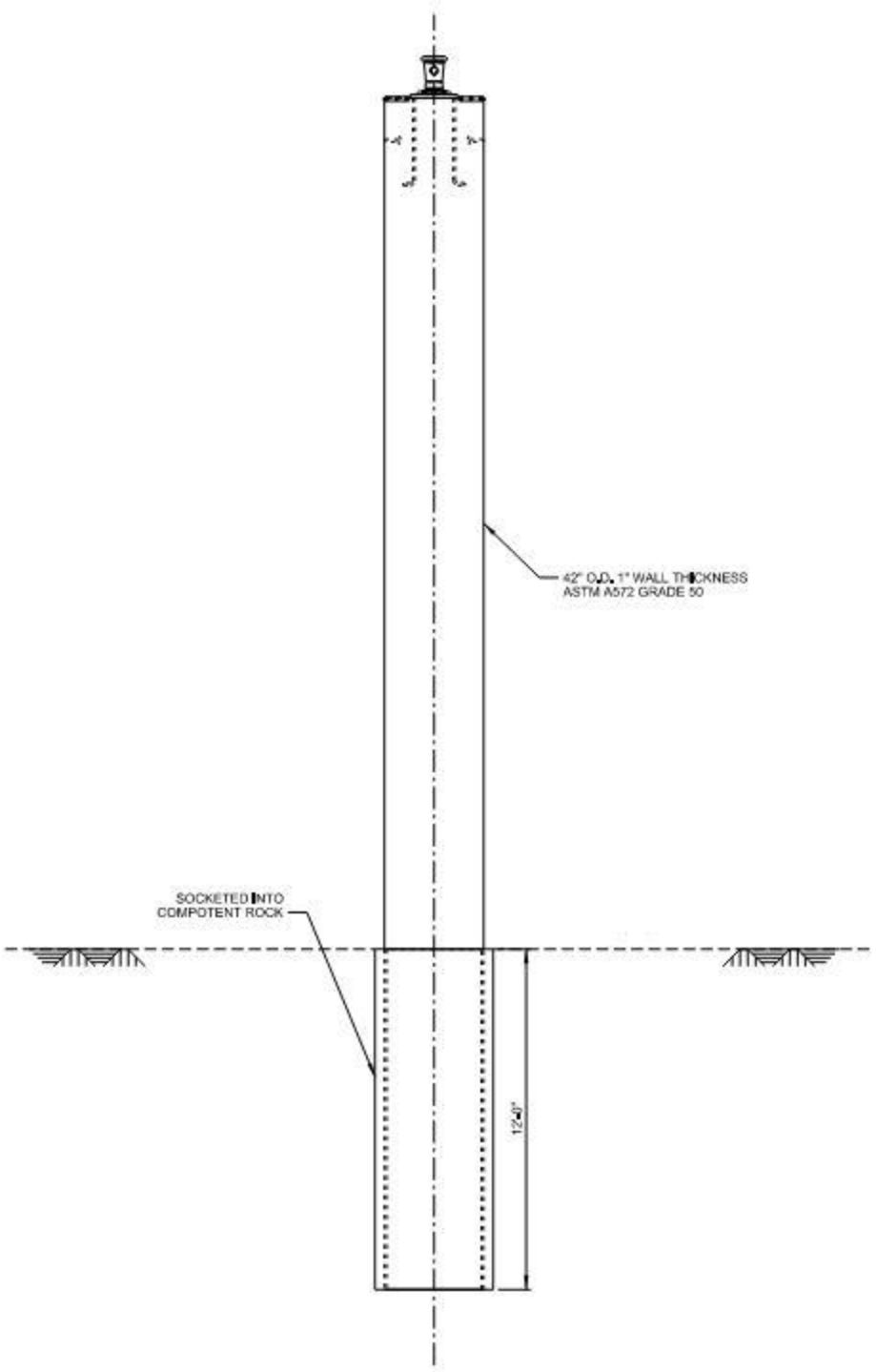

Figure A-7. Mooring Structure Detail

The fleeting areas require revetment of the shoreline adjacent to the fleeting spaces. **Figure A-8** shows a section view of the revetment design that was used for all fleeting areas in for the project.

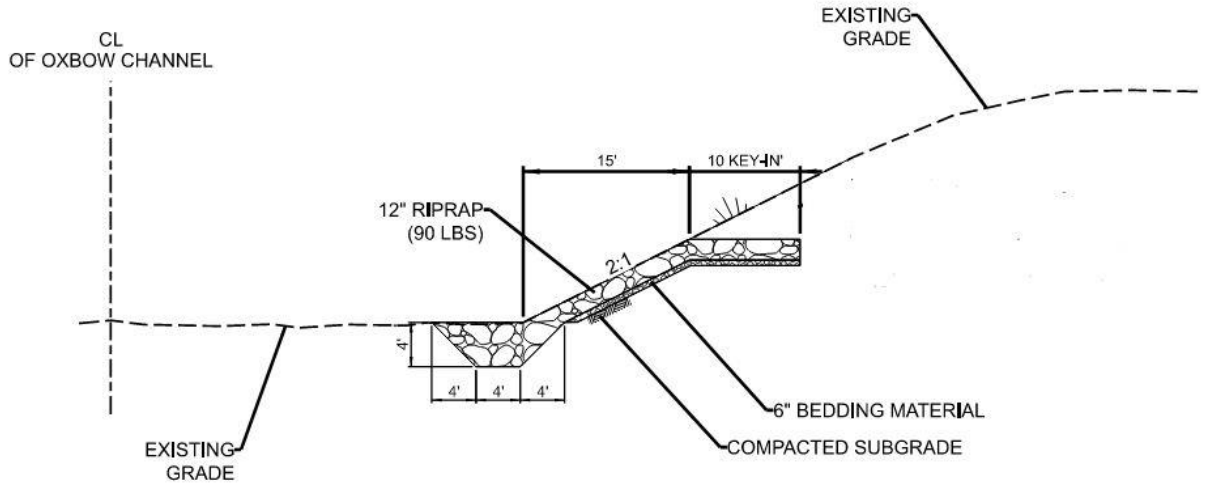

Figure A-8. Revetment Section Detail

Quantities

The estimated quantities for the FL-1 mooring structures, based on the typical detail shown in **Figure A-7**can be found in **Table A-5** and the FL-1 revetment quantities can be found in **Table A-6**. Volumetric and weight Quantities were estimated using average end-area method with appropriate conversion factors.

Table A-5. Fleeting Area 1 Mooring Structure Quantities

Material	Single Structure	Total
Volume of Concrete (CY)	8.55	102.63
Length of Steel Casing (LF)	24	288
Excavation for Casing (CY)	2.85	34.21
Mooring Tie-off Structure (EA)	1	12

Table A-6. Fleeting Area 1 Revetment Quantities

Action/Material	Quantity
R-90 Stone (CY)	1,110
R-90 Stone (TONS)	1,887
Bedding Material (CY)	361
Excavation for Toe (CY)	385

Action/Material	Quantity
Excavation for Key-in (CY)	361

Fleeting Area 2 (FL-2)

Fleeting Area 2 sits on the north shoreline of the south oxbow along the section of the channel that is currently in use for the port. This area has been permitted in the past for use as a fleeting area but has not been operated as one in the recent past. An estimated 8 fleeting spaces would be created with four mooring structures installed for the attachment of barges. Details for the mooring structures and the necessary shoreline revetment can be seen above in **Figure A-7** and **Figure A-8**, respectively.

Quantities

The estimated quantities for the FL-2 mooring structures can be found in **Table A-7** and the FL-2 revetment quantities can be found in **Table A-8**.

Table A-7. Fleeting Area 2 Mooring Structure Quantities

Material	Single Structure	Total
Volume of Concrete (CY)	8.55	34.21
Length of Steel Casing (LF)	24	96
Excavation for Casing (CY)	2.85	11.40
Mooring Tie-off Structure (EA)	1	4

Table A-8. Fleeting Area 2 Revetment Quantities

Action/Material	Quantity
R-90 Stone (CY)	690
R-90 Stone (TONS)	1,173
Bedding Material (CY)	222
Excavation for Toe (CY)	237
Excavation for Key-in (CY)	222

2.2 NORTH OXBOW MEASURES

2.2.1 NEW DOCK

The north oxbow has never been dredged and does not have any shipping infrastructure in place. A new dock would need to be built and the costs associated with that construction were included in the economic analysis. The cost estimate for the new dock was provided by KRPD.

2.2.2 CHANNEL DREDGING

A variety of channel widths and configurations were considered for the expansion of KRDP#2 into the nearby north oxbow. Each proposed configuration included a dredge cut depth up to 12 ft and a dredge cut width of 75 ft or 110 ft. Sediment samples were taken from the north oxbow at 2 locations in the proposed dredge cut areas in October 2023 to determine the

material properties. Due to the high concentration of fine materials, hydraulic dredging was eliminated as a method of dredging. Mechanical dredging was selected as the method of extracting sediment in the north oxbow as it does not require as long of a residence time for dewatering.

Alternative 4a represents a maximum configuration of a 12 ft deep and 110 ft wide channel for two-way traffic in the north oxbow. Alternative 4b captures a 12 ft deep and 75 ft wide channel for one-way traffic. Additionally, both alternatives 4a and 4b include widening the mouth of the oxbow and building a fleeting area within the north oxbow to increase shipping and navigation efficiencies. Subsequent alternatives include variations of this configuration. Alternatives 5a and 5b include a fleeting area in the north oxbow for both one-way and two-way traffic but do not include mouth widening as the existing mouth has greater than the required space for a channel with 110 ft width and 3H:1V side slopes below the OHWM. Alternatives 6a and 6b consider an alternative that includes the mouth widening to improve navigation and provide more area to turn through the mouth of the oxbow, however, these alternatives do not include a fleeting area. Alternatives 7a and 7b include a two-way and one-way navigation channel respectively; they do not include mouth widening nor fleeting areas within the oxbow.

As the north oxbow has never been dredged for navigation purposes, the initial dredging required by any of the alternatives would significantly increase the cross-sectional interface between the north oxbow and the main navigational channel of the Kaskaskia River. This increased interface would result in a higher rate of sediment deposition within the oxbow and would require maintenance dredging at regular intervals similar to that of the south oxbow.

Quantities

Table A-9. North Oxbow Channel Dredging Quantities

Alternative Name	Dredged Material (CY)
Alt. 4a - Maximum (Two-Way)	142,000
Alt. 4b - Maximum (One-Way)	114,000
Alt. 5a - Fleeting + Two-Way	128,000
Alt. 5b - Fleeting + One-Way	97,000
Alt. 6a - Mouth Cut + Two-Way	131,000
Alt. 6b - Mouth Cut + One-Way	104,000
Alt. 7a - Minimum (Two-Way)	118,000
Alt. 7b - Minimum (One-Way)	88,000

2.2.3 DREDGE DISPOSAL AREAS

<u>Dredge Disposal Area 3 (DD-3)</u>

DD-3 is a proposed disposal site to the west of the north oxbow channel and north of Illinois Highway 154. The area is currently used as farmland and would provide an area that requires no tree clearing to turn into a dredged material disposal site. Twelve-foot tall berms surrounding the perimeter of the DD-3 footprint would be built. It is assumed that the mechanically dredged material taken from the north oxbow could be hauled to the site and laid out to dry, then used for construction of the berms. The estimated capacity of DD-3 is approximately 180,000 CY.

In order to get the water from the dredged material back to the north oxbow channel, an outflow drainage ditch would need to be constructed. This addition to DD-3 is necessary due to the fact that the footprint of this measure has not ever been prepared or used as a dredge disposal site (unlike sites DD-1 and DD-2) and drainage paths would need to be established so existing recreational facilities near the north oxbow are not impacted.

Quantities

The estimated earthwork quantities for DD-3 are shown in **Table A-10** and the quantities for the DD-3 outflow drainage ditch are shown in **Table A-11**.

Table A-10. DD-3 Earthwork Quantities

Material/Action	Quantity
Berm Length (FT)	3,000
Berm Height (FT)	12
Berm XS Area (SF)	408
Berm Volume (Cu Ft)	1,224,000
Berm Volume (CY)	45,333
Clearing & Grubbing (AC)	9.27
Seeding (AC)	9.27

Table A-11. DD-3 Outflow Drainage Ditch Quantities

Material/Action	Quantity
Length (FT)	650
Ditch Depth (FT)	3
Ditch XS Area (SF)	84
Ditch Volume (Cu Ft)	54,600
Ditch Volume (CY)	2,022
Clearing & Grubbing (AC)	0.67
Erosion Control Blanket (SF)	33,280
Riprap (CY) (12" Depth, R-50)	1,233
Five 24" Dia. RCP Culverts (LF)	60
Bedding Material (CY) (6" Layer)	616

Dredge Disposal Area 4 (DD-4)
See section 2.1.4 of this appendix for information on Dredge Disposal Area 4.

2.2.4 FLEETING AREAS

Fleeting Area 4 (FL-4)
Fleeting Area 4 sits on the north shoreline of the north oxbow channel, the opposite side of the new dock facility. An estimated four fleeting spaces would be created with four mooring structures installed for the attachment of barges. Details for the mooring structures and the necessary shoreline revetment can be seen above in Figure A-7 and Figure A-8 respectively.

Quantities
The estimated quantities for the FL-4 mooring structures can be found in **Table A-12** and the FL-4 revetment quantities can be found in **Table A-13**.

Table A-12. Fleeting Area 4 Mooring Structure Quantities

Material	Single Structure	Total
Volume of Concrete (CY)	8.55	17.10
Length of Steel Casing (LF)	24	48
Excavation for Casing (CY)	2.85	5.70
Mooring Tie-off Structure (EA)	1	2

Table A-13. Fleeting Area 4 Revetment Quantities

Material/Action	Quantity
R-90 Stone (CY)	690
R-90 Stone (TONS)	1,173
Bedding Material (CY)	222
Excavation for Toe (CY)	237
Excavation for Key-in (CY)	222

Fleeting Area 5 (FL-5)
Fleeting Area 5 sits along the right descending bank of the Kaskaskia River, just north of the opening of the north oxbow channel. The design of this fleeting area limited to one space wide so as to not impede the Kaskaskia River navigation channel. An estimated eight fleeting spaces would be created with eight mooring structures installed for the attachment of barges. Details for the mooring structures and the necessary shoreline revetment can be seen above in Figure A-7 and Figure A-8 respectively.

Quantities

The estimated quantities for the FL-5 mooring structures can be found in **Table A-14** and the FL-5 revetment quantities can be found in **Table A-15**.

Table A-14. Fleeting Area Mooring Structure Quantities

Material	Single Structure	Total
Volume of Concrete (CY)	8.55	34.21
Length of Steel Casing (LF)	24	96
Excavation for Casing (CY)	2.85	11.40
Mooring Tie-off Structure (EA)	1	4

Table A-15. Fleeting Area 5 Revetment Quantities

Material/Action	Quantity
R-90 Stone (CY)	1,370
R-90 Stone (TONS)	2,329
Bedding Material (CY)	444
Excavation for Toe (CY)	474
Excavation for Key-in (CY)	444

2.2.5 MOUTH WIDENING

The turning radius of a barge tow is highly dependent on the length and width of the tow, the skill of the captain, and the characteristics of the river at the bend. Assuming manageable tows are used to navigate the north oxbow, the existing mouth is sufficient to provide the 110ft channel for two-way traffic within the oxbow. However, barges approaching the north oxbow from the south (downstream) would have a sharp turn to enter the north oxbow. Therefore, widening the mouth of the oxbow would make navigating through the north oxbow easier and provide increased safety and shipping benefits. With a navigable width of over 200 ft and 3H:1V side slopes, the widening of the oxbow mouth would impact approximately 0.14 acres of land above the OHWM. This impact would require a fast land policy waiver from HQ USACE that approves acquisition of land above the OHWM; approval is not guaranteed.

Quantities

The dredging quantities for the oxbow mouth cut can be seen above in **Table A-9**. The associated shoreline revetment quantities for the oxbow mouth cut can be found in **Table A-16**.

Table A-16. Oxbow Mouth Cut Area Revetment Quantities

Material/Action	Quantity
R-90 Stone (CY)	560
R-90 Stone (TONS)	952
Bedding Material (CY)	181
Excavation for Toe (CY)	193
Excavation for Key-in (CY)	181

3 OPERATIONS, MAINTENANCE, REPAIR, REPLACEMENT, & REHABILITATION (OMRR&R)

3.1 PERIODIC MAINTENANCE DREDGING

The alternatives include management of dredged material associated with the construction and maintenance "for the established project economic life" including all material that would need to be dredged to realize project benefits (including the LSFs, which are not Federal responsibilities), per ER 1105-2-100, Paragraph E-15.i. The O&M dredging quantity over the 50-year timeframe was estimated at 100% of the initial dredge material quantity as shown in the components of **Table A-17** and **Table A-18** below. O&M maintenance dredging would be done via hydraulic dredging. Maintenance dredging would be done on the following schedule with percentages corresponding to that amount of the original project dredge quantity removed during each cycle:

- Year 5, and subsequently every 10 years: 5%
- Year 10, and subsequently every 10 years: 15%

Table A-17. O&M Dredging Schedule and Costs for the South Oxbow Initial Array of Alternatives

Alternative 1A **GNF** - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$153,435
	$345,635

Alternative 1A **GNF**- Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$460,305
	$652,505

Alternative 1A **LSF** - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$53,558
	$245,758

Alternative 1A **LSF** - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$160,673
	$352,873

Alternative 1B **GNF** - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$131,723
	$323,923

Alternative 1B **GNF**- Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$395,168
	$587,368

Alternative 1B **LSF** - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$62,243
	$254,443

Alternative 1B **LSF** - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$186,728
	$378,928

Alternative 2A - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$154,883
	$347,083

Alternative 2A - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$464,648
	$656,848

Alternative 2B - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$131,723
	$323,923

Alternative 2B - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$395,168
	$587,368

Alternative 3A - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$65,138
	$257,338

Alternative 3A - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$195,413
	$387,613

Alternative 3B - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$41,978
	$234,178

Alternative 3B - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$192,200
Dredging	$125,933
	$318,133

Table A-18. O&M Dredging Schedule and Costs for the North Oxbow Initial Array of Alternatives

Alternative 4A - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$365,261
	$503,361

Alternative 4A - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$1,095,782
	$1,233,882

Alternative 4B - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$293,139
	$431,239

Alternative 4B - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$879,417
	$1,017,517

Alternative 5A - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$330,622
	$468,722

Alternative 5A - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$991,865
	$1,129,965

Alternative 5B - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$250,487
	$388,587

Alternative 5B - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$751,460
	$889,560

Alternative 6A - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$337,343
	$475,443

Alternative 6A - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$1,012,028
	$1,150,128

Alternative 6B - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$268,840
	$406,940

Alternative 6B - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$806,520
	$944,620

Alternative 7A - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$302,704
	$440,804

Alternative 7A - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$908,111
	$1,046,211

Alternative 7B - Every 5 years, 5% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$226,188
	$364,288

Alternative 7B - Every 10 years, 15% of initial dredged material.

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$138,100
Dredging	$678,563
	$816,663

4 RISKS AND UNCERTAINTY

4.1 HYDRAULIC & HYDROLOGIC ENGINEERING

Multiple H&H risks were identified that could impact the civil design and quantities presented in this appendix. See Appendix B for more details.

4.2 GEOTECHNICAL ENGINEERING

4.2.1 GEOTECHNICAL INVESTIGATIONS

No geotechnical investigations were done during the study phase, and this leaves the possibility that the actual geotechnical conditions will not support the current design of the project. Geotechnical exploration will be done during the PED phase to confirm the feasibility level design. The investigations will include all necessary for the Confined Disposal Facility (CDF) design and assessment of the existing material within the DD-2 containment area for potential use for berm raising.

4.2.2 BORROW MATERIAL

Borrow material for the construction of the berms for DD-2 may not be readily available and thus could cause cost increases for the project.

4.3 CIVIL ENGINEERING

4.3.1 BENEFICIAL USE OF DREDGED MATERIAL

The study team made a conservative assumption that no beneficial use of dredged material is possible. This could be revisited in the PED phase.

4.3.2 RECREATION OPPORTUNITIES AT DREDGE DISPOSAL AREAS

The study team made a conservative assumption that use of the dredge disposal areas for wildlife or waterfowl management is not possible. This could be revisited in the PED phase.

4.3.3 USE OF ALTERNATE CONTAINMENT FOR DD-2 CONSTRUCTION

The study team made a conservative assumption that use of geotextile containers and other containment/dewatering methods as replacement for standard berm construction for DD-2 would not be economically feasible. This could be revisited in the PED phase.

4.4 OMRR&R

4.4.1 MAINTENANCE DREDGING ASSUMPTIONS

The study team worked to find past dredging quantities for the south oxbow and was successful in finding some data. This data, however, often times included dredging data for other sections of the Kaskaskia River channel and other oxbows that were dredged under the same contracts as the KRPD#2 oxbow. The maintenance dredging shown in Section 3 of this appendix could be an overestimate or an underestimate of the actual amount of material that will be dredged to maintain navigation in the oxbow channel.

5 REFERENCES

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