McCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM

DRAFT

LONG TERM DREDGE MATERIAL DISPOSAL PLAN
(2003 - 2023)
POOL 18 TO POOL 13

DEPARTMENT OF THE ARMY
TULSA DISTRICT CORPS OF ENGINEERS
OKLAHOMA

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers' (USACE) navigation mission is to provide safe, reliable, efficient and environmentally sustainable waterborne transportation systems (channels, harbors, and waterways) for the movement of commerce, national security needs, and recreation.

This section of the Dredged Material Disposal Plan report is intended to provide a brief introduction and overview of a long term dredging and disposal plan and of the dredging process at the problem areas for the McClellan-Kerr Arkansas River Navigation System (MKARNS), including types of dredges, transportation systems, and alternatives for the placement or disposal practices commonly used in navigation dredging projects (see Long Term Dredge Material Disposal Plan Summary). There is a degree of uncertainty in river dynamics and will require a reassessment and review of plans relative to current conditions in the future. References throughout this part provide more detailed discussion and explanation of different kinds of dredges, transport equipment, and disposal practices.

The removal or excavation, transport, and placement of dredged sediments are the primary components of the "dredging process". After the sediment has been excavated, it is transported from the dredging site to the designated disposal area. This transport operation is accomplished by the dredge itself or by using additional equipment such as barges or pipelines with booster pumps. The collected

and transported dredged material is placed in either open-water, islands or upland locations as described in the report. The choice of disposal alternatives involves a variety of factors related to the dredging process including environmental acceptability, technical feasibility and economic feasibility of the chosen alternative. The dredging and disposal sites were analyzed using technical guidance presented in the EPA and USACE *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Testing Manual* commonly referred to as the Inland Testing Manual, EPA regulation 40 CFR Part 230, *Guidelines for Specification of Disposal Sites for Dredge or Fill Material* (section 404 of the Clean Water Act) and the USACE operation and maintenance regulations 33CFR Part 335-338. The manual contains technical guidance for determining the potential for contaminant-related impacts associated with the discharge of dredge material in waters regulated under Section 404 of the CWA through chemical, physical, and biological evaluations. The manual uses a tiered process for analysis of dredge sites. At some sites sediment sampling and analysis for chemical containments has been or will be performed where the guidance indicated the need for such sampling.

This plan is intended to be updated periodically with revised quantities of dredged materials, remaining capacities of existing disposal sites and additional analysis of existing and future sites if required. Also, progress made in obtaining permits, real estate, or preparing of designs for future needs can be tracked. For the purposes of a planning horizon, the plan includes a 50 year planning horizon, but it should be thoroughly reviewed within at least 20 years as part of a long term adaptive management strategy.

Long Term Dredge Disposal Plan Summary

Site #	Navigation Mile	Dredging Method	Disposal Options	Design Capacity (CY x 1000)	Real Estate Acquisition	EIS Approved Site	Site Design Complete	Const Completed	Estimated Cost ($ x 1000)
18A	444.6 L	Hydraulic/Clamshell	CD	300	Not Req.	Yes	Yes	Yes	300
18B	444.6 R	Hydraulic/Clamshell	CD	300	Not Req.	Yes	Yes	Yes	300
18C	422 L	Hydraulic/Clamshell	UOB	300	Not Req.	Yes	N/A	N/A	0
17A	421 L	Hydraulic/Clamshell	CD	600	Not Req.	Yes	Yes	Yes	600
17B	402 R	Hydraulic/Clamshell	CD	300	Not Req.	Yes	Yes	Yes	300
16A & A-1	400.8 L & 400.2 L	Hydraulic/Clamshell	CD	300 & 300	Not Req.	Yes	Yes	Yes	600
16B	395 R	Hydraulic/Clamshell	CD	400	Not Req.	Yes	Yes	Yes	400
16C	395 R	Hydraulic/Clamshell	UOB	300	Not Req.	Yes	N/A	N/A	0
16D	394.3 R	Hydraulic/Clamshell	UOB	300	Not Req.	Yes	N/A	N/A	0
16E	393.6 L	Hydraulic/Clamshell	CD	1,500	Not Req.	No	No	No	1,500
16F	393 R	Hydraulic/Clamshell	CD	500	Not Req.	No	No	No	500
16G	393.5 L	Hydraulic/Clamshell	CD, OW	600	Not Req.	Yes	Yes	Yes	0
15A & A-1	355 & 353.7	Hydraulic/Clamshell	CI	500 & 300	Not Req.	Yes	No	No	200
15B & B-1	349 & 350	Hydraulic/Clamshell	OW, CI	300 & 300	Not Req.	No	N/A, No	N/A, No	100
15C & C-1	6.8 & 7.2 SBC	Hydraulic/Clamshell	OW, CI	150 & 150	Not Req.	Yes	N/A, No	N/A, No	50
15D	9 SBC	Hydraulic/Clamshell	OW, CI	150	Not Req.	Yes	N/A, No	N/A, No	25
15E	9.9 SBC	Hydraulic/Clamshell	OW, CI	150	Not Req.	Yes	N/A, No	N/A, No	25

Long Term Dredge Disposal Plan Summary

Site #	Navigation Mile	Dredging Method	Disposal Options	Design Capacity (CY x 1000)	Real Estate Acquisition	EIS Approved Site	Site Design Complete	Const Completed	Estimated Cost ($ x 1000)
15F	10.5 SBC	Hydraulic/Clamshell	OW, CI	300	Not Req.	Yes	N/A, No	N/A, No	50
13A	319 R	Hydraulic/Clamshell	CD	500	Not Req.	No	No	No	500
13B	316 R	Hydraulic/Clamshell	UOB	1,000	Not Req.	Yes	N/A	N/A	0
13C	312.5 R	Hydraulic/Clamshell	UOB	1,000	Not Req.	Yes	N/A	N/A	0
13D	309 R	Hydraulic/Clamshell	UOB	1,000	Not Req.	Yes	N/A	N/A	0
13E	2 L, Poteau River	Hydraulic/Clamshell	CD	300	Req.	Yes	No	No	300

L/R Left / Right
CD Confined Dike
UI Unconfined Island
EIS Env. Imp Stmt
UOB Unconfined Overbank
OW Open Water
CI Confined Island
SBC San Bois Creek

MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM, OK

Long Term Dredge Material Disposal Plan
(2003 – 2053)

1. Project Name and Description

The McClellan-Kerr Arkansas River Navigation System (MKARNS), Oklahoma project is located within the Arkansas River Basin in northeastern Oklahoma (see general plan drawing). The 445-mile Navigation System begins at the confluence of the White River and the Mississippi River, proceeds 10 miles upstream on the White River to the manmade Arkansas Post Canal, and then 9 miles through the canal to the Arkansas River. The Navigation System then crosses the State of Arkansas into Oklahoma on the Arkansas River at Ft. Smith, Arkansas to the mouth of the Verdigris River at Muskogee, Oklahoma. The Navigation System terminates 51 miles upstream on the Verdigris River at the Port of Catoosa near Tulsa, Oklahoma.

The Oklahoma portion of the Navigation System includes approximately 150 navigation miles of channel. Channel widths vary throughout, including 250 feet along the Arkansas River, 150 feet along the Verdigris and Poteau Rivers and 225 feet along the Sans Bois Creek. A minimum 9-foot channel depth is maintained throughout the Navigation System with many areas in excess of the authorized 9-foot channel depth. There are 5 locks and Dams within Oklahoma along the Navigation System and 6 Navigation pools maintained by the Tulsa District. These are: Pool 13 from the Arkansas/Oklahoma border to W. D. Mayo L&D 14, W. D. Mayo L&D 14, Pool 14, Robert S. Kerr L&D 15, Pool 15, Webbers Falls L&D 16, Pool 16, Chouteau L&D 17, Pool 17, Newt Graham L&D 18 and Pool 18 to the Port of Catoosa.

2. Authority

The project was authorized by Congress in the River and Harbor Act of July 24, 1946 and construction of the 9 feet deep Oklahoma portion of the Navigation System occurred during the 1960s with the system being declared open to commercial traffic in December 2, 1970. Public Law 91-649, passed by Congress in 1971, designated it as the McClellan –Kerr Arkansas River Navigation System.

3. Purpose of Long Term 9-foot Maintenance Plan and Analysis Methodology

The purpose of this plan is to evaluate the future long term needs relevant to dredging operations for the McClellan-Kerr Arkansas River Navigation System within the State of Oklahoma. Historical data, current and past dredging operations, site availability and access, governing regulations and environmental considerations were evaluated to determine the most feasible locations for disposal areas. Dredge disposal sites were located as close as possible to areas along the navigation channel currently identified and/or expected to be dredging locations within the fifty year term time frame of this plan. Detailed designs and dredging operations are not included in this document. The dredging and disposal sites were analyzed using technical guidance provided in the EPA and USACE *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Testing Manual* commonly referred to as the Inland Testing Manual, the U.S. Environmental Protection Agency's (EPA) regulation 40 CFR Part 230, *Guidelines for Specification of Disposal Sites for Dredge or Fill Material* (section 404 of the Clean Water Act) and the USACE operation and maintenance regulations 33CFR Part 335-338. The manual contains technical guidance for determining the potential for contaminant-related impacts associated with the discharge of dredge material in waters regulated under Section 404 of the CWA through chemical, physical, and biological evaluations.

Subpart G of the Section 404(b)(1) guideline requires the use of available information to make a preliminary determination concerning the need for testing of the material proposed for dredging. The principle is commonly known as "reason to believe principle". The decision not to perform testing based on prior information must be documented in order to provide a reasonable assurance that the proposed discharge material is not a carrier of contaminants. The reason to believe that no testing is required is based on the type of material to be dredged and/or its potential to be contaminated. As an example, dredge material is most likely to be free of contaminants if the material is composed primarily of sand, gravel, or other such materials and is found in areas of high current or wave action. In addition, knowledge of the proposed dredging sites proximity to sources of contamination, as well as knowledge gained from previous testing or through experience and knowledge of the area to be dredged, may be utilized to conclude that there is no reasonable reason to believe that contaminants are present and, therefore, no need for testing. This general evaluation comprises the procedures found in Tier I of the Inland Testing Manual's tiered-testing process. The tiered testing process allows optimal use of resources by focusing the least effort on disposal operations where the potential for unacceptable adverse impact is low or non-existent, and expending the most effort on operations requiring more extensive investigation to determine the potential for impact. Evaluation at successive tiers is based on more extensive and specific information about the potential impact of the dredged material, that may be more time-consuming and expensive to generate, but that allows more and more comprehensive evaluations of the potential for environmental effects. It is necessary to proceed through the tiers only until information sufficient to make factual determinations has been obtained. If the available information is sufficient to make a positive factual determination, no further testing is required.

This plan is intended to be review and revised within a twenty years. While the plan intend to capture future needs in the next 50-years, the uncertainties of river and channel

dynamics merits a thorough review and revision of this plan to insure it relevance to future conditions.

Tier I is a comprehensive analysis of all existing and readily available information on the proposed dredging site, including all previously collected physical, chemical, and biological data for both the proposed dredging and disposal sites. Tier II is concerned with the chemical analysis of the water column assuming total release of the contaminants in the dredged material during the discharge operation and an evaluation of the potential for benthic impact using calculations of theoretical bioaccumulation potential (TBP). If the numerical model predicts that the concentrations of all contaminants of concern after consideration of mixing are less than the available, applicable state water quality standard (WQS), then the dredged material complies with state WQS.

Sediment sampling and analysis has been performed for all dredge disposal sites in pools 16,17 and 18 and will be performed in the other pools of the McClellan-Kerr Arkansas River Navigation System within the State of Oklahoma in the near future. The existing sediment analysis data for the above referenced pools was used in the tiered evaluation process for dredging and disposal sites and is listed in paragraph 5 of the plan.

4. Current Pre-Dredging Procedures

A. River Mile 444 to 445 (Site 18A & 18B):

- *History*: Deposits from the Verdigris River and Bird Creek cause shoaling and narrowing of the Navigation channel and at the mouth of and into the Port of Catoosa maintained area. The channel becomes partially blocked after heavy flows from one or both of Bird Creek or Verdigris River. Port traffic is heavy in this area, which creates a serious situation when the tows start reporting they are bumping.
- *Procedures:*
  - After determining that shoaling is impeding navigation, immediately request a deviation in pool elevation from SWD.
  - Initiate dredging procedures after surveys confirm the channel has narrowed to 125 ft or less of 9 ft depth along a substantial portion of the Navigation Channel and port approach.

B. River Mile 421.8 to 422 (Site 18C):

- *History*: River Mile 421.8 to 422 (Site 18C): This area is located on the left descending bank immediately upstream of L&D 18 and includes the government wharf area. Large debris and trees deposit in the wharf area restricting government fleet activities. On occasion, the shoaling also impedes navigation by impairing the ability for tow passage during double lockages.
- *Procedures:*
  - Clamming/dredging operations in this area will be initiated as needed for dock access, or when shoaling impedes double lockages.
  - Clammed or dredged material is deposited on the left descending bank.. A dozer on the bank moves the material into dikes and piles.

C. River Mile 421 to 421.5 (Site17A):

- *History*: This area is located immediately downstream of L&D 18 extending approximately 2000 feet downstream. Shoaling occurs on the left descending bank and interferes with proper alignment of tows entering and leaving the lock.
- *Procedures:*
  - The dredge should be mobilized when the design channel is reduced to 125 ft of 9 ft depth.
  - In the interim period of dredge mobilization, the buoy line can be moved toward the center of the channel to allow navigation to continue, however this will cause tows to be misaligned for entering or leaving the lock and should not be continued for long periods of time.

D. River Mile 401.5 to 403.5 (Site 17B):

- *History*: This area extends from L&D 17 to upstream about 1-½ miles. Shoaling in this area creates a hazard to tows entering and leaving the lock approach channel due to outdraft generated by tainter gates.

- *Procedures:*

- After confirming that shoaling has developed and is impeding navigation, immediately request a deviation from SWD to raise pool.
- Mobilize the dredge after determining that the channel width is less than 125 ft of 9 ft depth.

E. River Mile 400 to 401.5 (Site16A):

- *History*: This area is located immediately downstream of L&D 17 to approximate river mile 400. Sediments, which are carried through the tainter gates on the outlet channel during high flows, deposit in this area, causing shoaling.
- *Procedures:*
  - Immediately request a deviation in pool elevation from SWD after determining that shoaling is impeding navigation.
  - Initiate dredging procedures when the channel is reduced to 125 ft width of 9 ft depth.

F. River Mile 393 to 395 Three Forks Area (Site 16B/16C/16D/16E & 16G):

- *History*: This area is located in the Three Forks area. Shoaling occurs as a result of sustained high flows on the Arkansas River, which deposits sediments throughout the reach, normally on the right descending bank and mouth of the Verdigris River confluence.
- *Procedures:*
  - Standard operating procedures include holding sufficient water in Oologah Lake to maintain a flow of 15,000 cfs for 3 days down the Verdigris River, immediately following high flows on the Arkansas, to flush deposited sediments through the reach.
  - If navigation is impeded, and flushing doesn't work or is not available, ask for a pool elevation deviation from SWD.
  - When the channel is reduced to 150 ft of 9 ft depth in the approach area to the Verdigris River, initiate dredging procedures.

G. River Mile 392 to 393 Hwy 62 Bridge (Site 16F & 16G):

- *History*: This area is located upstream of the Hwy. 62 bridge. Shoaling usually occurs after sustained high flows down the Arkansas River or Grand River. Shoaling usually develops on the right descending side of the Navigation Channel.
- *Procedures:*
  - Request a pool elevation deviation from SWD when it is determined that shoaling is impeding navigation.
  - Initiate dredging procedures when the channel width is reduced to 150 ft of 9 ft depth.

H. River Mile 353 to 356 Confluence of Canadian River (Site 15A &15A-1):

- *History*: Maintenance dredging has not been required in this area, since operations commenced in 1970. The Canadian River deposits continue to extend the delta further into the reach. This continued delta growth may result in future dredging being required.
- *Procedures:*
  - Request a pool deviation from SWD when it is determined that shoaling is impeding navigation.
  - Initiate dredging procedures when the channel width is reduced to 150 ft of 9 ft depth.

I. River Mile 348-349.5 Sandtown Bottoms/Tamaha (Site 15B & 15B-1):

- *History*: Maintenance dredging has not been required in this reach of the channel. Deposits from high flows on the Canadian and Arkansas Rivers have continued to grow in the area. Continued shoaling may result in future dredging of the area.
- *Procedures:*
  - Request a pool elevation deviation from SWD when it is determined that shoaling is impeding navigation.
  - Initiate dredging procedures when the channel width is reduced to 150 ft of 9 ft depth.

J. Sans Bois Creek Mile 6.5 to 7.5 (Site 15C & 15 C-1):

- *History*: Maintenance dredging is currently needed in this area. Surface runoff, prop wash and high flows down the Sans Bois Creek have result in a very slow build-up of deposits in the channel.
- *Procedures:*
  - Request a pool elevation deviation from SWD when it is determined that shoaling is impeding navigation.
  - Initiate dredging procedures when the channel width is reduced to 125 ft of 9 ft depth.

K. Sans Bois Creek Mile 8.0 to 11.0 (Site15D/15E &15F):

- *History*: Maintenance dredging has not been required in this area. Surface runoff, prop wash and high flows down the Sans Bois Creek result in a very slow build-up of deposits in the channel. Continued shoaling in the area may result in future dredging being required.
- *Procedures:*
  - Request a pool elevation deviation from SWD when it is determined that shoaling is impeding navigation.
  - Initiate dredging procedures when the channel width is reduced to 125 ft of 9 ft depth.

L. River Mile 311 to 319.6 Camp Creek, Peno Point Area to Lock 14 (Site13A/13B & 13C):

- *History*: River Mile 311 to 319.6 (Site13A - Lock 14, Site 13B – Peno Point, Site 13C - Camp Creek): This area shoals after sustained high flows of 75,000 cfs or more – after high flows subside, power flows usually clear the channel.
- *Procedures:*
  - Survey this area immediately following high flows to determine if shoaling has occurred and restricted the channel.
  - If shoaling has occurred, monitor the area for 30 days to determine if shoaling is being reduced by power flows.
  - If shoaling is not reduced after 30 days of power flows and the channel is reduced to 150 ft width or less of 9 ft. depth, initiate dredging procedures.

M. Poteau River Mile 0 to 2.0 &Turing Basin(Site 13D & 13E):

- *History*: The Port of Fort Smith and other smaller facilities use this reach.
- *Procedures:*
  - Initiate dredging procedures when the channel width is reduced to 125 ft of 9 ft depth and/or the turning basin becomes unusable.

5. Maintenance Dredging History

The following is a list of estimated dredged quantities for the Navigation System from 1972 to 2003. The Dredging Activity Summary is located in Appendix B and lists each site that has been dredged in detail.

Verdigris River

Nav. Mile:	Site No.	Quantities (cy):	Location:
444.6 - 445	18A	957,050	Bird Creek/Verdigris River & Port of Catoosa Area NM 444 to 445
444 - 445	18B		Bird Creek/Verdigris River & Port of Catoosa Area NM 444 to 445
421.6 - 422.2	18C	61,570	Above L&D 18, NM 421 to 422
420.8 -421.6	17A	387,400	Below L&D 18 Good Hope Area, NM 420 to 421
401.6 - 402.6	17B	292,960	Above L&D 17, NM 401 to 403
400.5 - 401	16A & A-1	384,720	Below L&D 17 & Confluence of Spillway Channel, NM 400 to 401
395 - 395.5	16B & C	621,950	Three Forks, Verdigris River Area

Arkansas River

Nav. Mile:	Site No.	Quantities (cy):	Location:
394 - 395	16B, C & 16D	392,410	Three Forks, Arkansas River Area
393 - 395	16E & G	-------	Three Forks, Arkansas River Area
392.8 - 393.3	16F & G	104,892	Three Forks, Highway 62 Bridge Area
353 - 356	15A & A-1	117,210	Stoney Point & Confluence of Canadian River Area, NM 353 to 357
348 - 349.5	15B & B-1	-------	Sandtown Bottom, Tamaha Area, NM 348 to 350
6.5 - 7.5 SBC	15C & C-1	-------	Sans Bois Creek
8 - 11 SBC	15D, E & 15F	-------	Sans Bois Creek
318.3 - 319.1	13A	379,445	Below L&D 14, NM 318 to 319
315 - 317.2	13B		Pool 13 Peno Point Area, NM 315 to 317
311.8 - 313.9	13C	513,227	Pool 13 Camp Creek Area, NM 312 to 314
308.8 - 311	13D	288,400	Right descending Ark Riv @ Poteau Riv
0.0 – 2.0 PR	13E	-------	Adjacent to Poteau River Turning Basin

Anticipated Dredging

The following is a list of estimated quantities for the Navigation System to be dredged from the date of this plan to the year 2023.

Verdigris River

Nav. Mile:	Site No.	Quantities (cy):	Location:
444.6 - 445	18A	600,000	Bird Creek/Verdigris River & Port of Catoosa Area
444 - 445	18B		Bird Creek/Verdigris River & Port of Catoosa Area
421.6 - 422.2	18C	100,000	Above L&D 18
420.8 -421.6	17A	500,000	Below L&D 18 Good Hope
401.6 - 402.6	17B	300,000	Above L&D 17
400.5 - 401	16A & A-1	400,000	Below L&D 17 & Confluence of Spillway Channel
395 - 395.5	16B & C	900,000	Three Forks, Verdigris River Area

Arkansas River

Nav. Mile:	Site No.	Quantities (cy):	Location:
393 - 395	16D & E	1,300,000	Three Forks, Arkansas River Area
393 – 395	16G		Three Forks, Arkansas River Area
392.8 – 393.3	16F & G	500,000	Three Forks, Highway 62 Bridge Area
353 - 356	15A & A-1	100,000	Stoney Point & Confluence of Canadian River Area
348 - 349.5	15B & B-1	100,000	Sandtown Bottom, Tamaha Area
6.9 - 7.4 SBC	15C & C-1	200,000	Sans Bois Creek
8 - 11 SBC	15D, E & 15F	300,000	Sans Bois Creek
318.3 - 319.1	13A	200,000	Below L&D 14
315 - 317.2	13B	500,000	Pool 13 Peno Point Area
311.8 - 313.9	13C	500,000	Pool 13 Camp Creek Area
308.6 - 312	13D	300,000	Right descending Ark Riv @ Poteau Riv
0.0 – 2.0 Poteau Rv	13E	200,000	Adjacent to Poteau River Turning Basin

Beginning dredging in or around any areas described in this document depends on actual conditions. Unexpected high flows may dictate when actual dredging is required for any given

site. Sediment load varies and bed load displacement may actually require dredging sooner than anticipated.

6. Beneficial Uses of Dredge Material

Beneficial use dredged material includes a wide variety of options which utilize the material for some productive purpose. Ten broad categories, as described in EM 1110-2-5026, of beneficial uses have been identified, based on the functional use of the dredged material or site. They are:

- Habitat restoration/enhancement (wetland, upland, island, and aquatic sites including use by waterfowl and other birds).
- Beach nourishment.
- Aquaculture.
- Parks and recreation (commercial and noncommercial).
- Agriculture, forestry, and horticulture.
- Strip mine reclamation and landfill cover for solid waste management.
- Shoreline stabilization and erosion control (fills, artificial reefs, submerged berms, etc.).
- Construction and industrial use (including port development, airports, urban, and residential).
- Material transfer (fill, dikes, levees, parking lots, and roads).
- Multiple purpose.

This plan utilizes use of dredge material under three of the above categories. They are: Habitat, Construction and Industrial and Material transfer.

7. Dredging Equipment and Method Selection

Selection of dredging equipment and method used to perform the dredging, as described in EM1110-2-5025 “Engineering and Design – Dredging and Dredged Material Disposal”, depends on the following factors:

- Physical characteristics of material to be dredged.
- Quantities of material to be dredged.
- Dredging depth.
- Distance to disposal area.
- Physical environment of the dredging and disposal areas.
- Contamination level of sediments.
- Method of disposal.
- Production required.
- Type of dredges available.
- Cost.

Dredging is accomplished basically by two mechanisms:

- Hydraulic dredging--Removal of loosely compacted materials by cutterheads, dustpans, hoppers, hydraulic pipeline plain suction, and sidecasters, usually for maintenance dredging projects.
- Mechanical dredging--Removal of loose or hard, compacted materials by clamshell, dipper, or ladder dredges, either for maintenance or new-work projects.

Hydraulic dredges remove and transport sediment in liquid slurry form. They are usually barge mounted and carry diesel or electric-powered centrifugal pumps with discharge pipes ranging from 6 to 48 in. in diameter. The pump produces a vacuum on its intake side, and atmospheric pressure forces water and sediments through the suction pipe. The slurry is transported by pipeline to a disposal area. Hopper dredges are included in the category of hydraulic dredges for this report even though the dredged material is simply pumped into the self-contained hopper on the dredge rather than through a pipeline. It is often advantageous to overflow hopper dredges to increase the load; however, this may not always be acceptable due to water quality concerns near the dredging site.

Mechanical dredges remove bottom sediment through the direct application of mechanical force to dislodge and excavate the material at almost in situ densities. Backhoe, bucket (such as clamshell, orange-peel, and dragline), bucket ladder, bucket wheel, and dipper dredges are types of mechanical dredges. Sediments excavated with a mechanical dredge are generally placed into a barge or scow for transportation to the disposal site.

8. Transportation of Dredged Material

Transportation methods generally used to move dredged material include pipelines, barges or scows, and hopper dredges. Pipeline transport is the method most commonly associated with cutter head, dustpan, and other hydraulic dredges. Dredged material may be directly transported by hydraulic dredges through pipelines for distances of up to several miles, depending on a number of conditions. Longer pipeline pumping distances are feasible with the addition of booster pumps, but the cost of transport greatly increases. Barges and scows, used in conjunction with mechanical dredges, has been one of the most widely used methods of transporting large quantities of dredged material over long distances. Hopper dredges are capable of transporting the material for long distances in a self-contained hopper. Hopper dredges normally discharge the material from the bottom of the vessel by opening the hopper doors; however, some hopper dredges are equipped to pump out the material from the hopper much like a hydraulic pipeline dredge.

Description of Open-Water Disposal

Open water disposal is the placement of dredged material at designated sites in rivers, lakes, estuaries, or oceans via pipeline or release from hopper dredges or barges. Such disposal may also involve appropriate management actions or controls such as capping. Dredged material can be placed in open-water sites using direct pipeline discharge, direct mechanical placement, or release from hopper dredges or scows. Pipeline dredges are commonly used for open water disposal adjacent to channels. Material from this dredging operation consists of a slurry with a solids concentration ranging from a few grams per liter to several hundred grams per liter. The characteristics and operation of hopper dredges result in a mixture of water and solids stored in the hopper for transport to the disposal site. At the disposal site, hopper doors in the bottom of the ship's hull are opened, and the entire hopper contents are emptied in a manner of minutes; the dredge then returns to the dredging site to reload. Bucket or clamshell dredges remove the sediment being dredged at nearly its *in situ* density and place it on a barge or scow for transport to the disposal area. An illustration of open-water disposal can be found in Figure 1. Plume Shapes by Dredge Types.

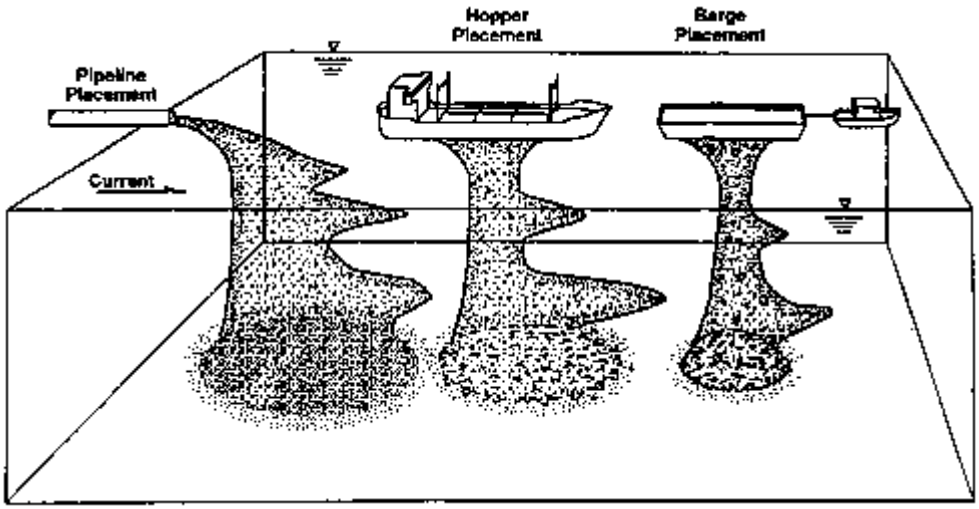

Figure 1. Plume Shapes by Dredge Types

Description of Confined Disposal

Confined disposal is placement of dredged material within diked nearshore or upland confined disposal facilities (CDFs) via pipeline or other means. CDFs may be constructed as upland sites, nearshore sites with one or more sides in water (sometimes called intertidal sites), or as island containment areas. Hydraulic dredging adds several volumes of water for each volume of sediment removed, and this excess water is normally discharged as effluent from the CDF during the filling operation. The amount of water added depends on the design of the dredge, physical characteristics of the sediment, and operational factors such as pumping distance. When the dredged material is initially deposited in the CDF, it may occupy several times its original volume. The settling process is a function of time, but the sediment will eventually consolidate to its *in situ* volume or less if desiccation (drying) occurs. Adequate volume must be provided during the dredging operation to contain both the original volume of sediment to be dredged and any water added during dredging and placement. An illustration of confined disposal areas can be found in Figure 2. Types of Confined Disposal Facilities.

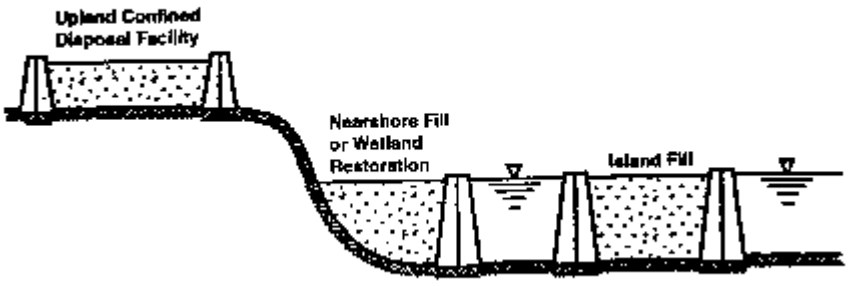

Figure 2. Types of Confined Disposal Facilities

9. Dredged Material Disposal Site Capacities, Analyses and Usage

Material dredged in maintaining the channel to its authorized dimensions will be placed as part of a Long Term disposal plan in the 27designated disposal sites shown on drawings 1 to 12. A description and analysis of each site is provided below. The dredging and disposal sites were analyzed using technical guidance provided in the EPA and USACE *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Testing Manual* commonly referred to as the Inland Testing Manual, the U.S. Environmental Protection Agency's (EPA) regulation 40 CFR Part 230, *Guidelines for Specification of Disposal Sites for Dredge or Fill Material* (section 404 of the Clean Water Act) and the USACE operation and maintenance regulations 33CFR Part 335-338. The Inland Testing Manual provides a tiered analysis process to determine the potential for contaminant-related impacts associated with the of dredge discharge material.

- **Site 18A:** Is located in Pool 18 on the left descending bank to the navigation channel between miles 444.6 and 445 down stream of Port of Catoosa (drawing 2). This is an existing **approved EIS disposal site** with a constructed confined disposal dike with a minimum anticipated capacity of 300,000 C.Y. for Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that Hydraulic dredging with discharge pipes ranging from 18 to 24 inch in diameter will be utilized to remove and transport sediment in liquid slurry form through pipeline to the confined site. The quantity of estimated dredged material from the problem area (Bird creek area mile 444.4 to 445) to the year 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. These findings were utilized to conclude that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 18B:** Is located in Pool 18 on the right descending bank to the navigation channel between miles 444 and 445 down stream of Port of Catoosa (drawing 2). This is an existing **approved EIS disposal site** with a constructed confined disposal dike with a minimum anticipated capacity of 300,000 C.Y. for Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that Hydraulic dredging with discharge pipes ranging from 18 to 24 inch in diameter will be utilized to remove and transport sediment in liquid slurry form through pipeline to the confined site. The quantity of estimated dredged material from the problem area (Bird creek area mile 444.4 to 445) to the year 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. These findings were utilized to conclude that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 18C:** Is located in Pool 18 on the left descending bank to the navigation channel between miles 421.6 and 422.2 above Lock 18 (drawing 3). This site is an existing

unconfined **approved EIS disposal site**. It is projected that this site will be used for future disposal activities and that mechanical dredging such as Hydraulic/ Clamshell or Dragline dredging will be utilized to remove debris and sediment and dispose of it into a unconfined disposal site adjacent to the channel. The estimated quantity of dredged material from the problem area (Wharf area at Lock 18) through the year 2023 is anticipated to be approximately 100,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 17A:** Is located in Pool 17 on the left descending bank to the navigation channel between miles 420.8 and 421.6 below Lock 18 (drawing 3). This site is an **EIS approved disposal site** and consists of a confined disposal dike with two outlets and a minimum anticipated capacity 600,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 420.7 to 421.4) through the year 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 17B:** Is located in Pool 17 on the right descending bank to the navigation channel between miles 401.6 and 402.6 above Lock 17 (drawing 4). This is an existing **approved EIS disposal site** with a confined disposal dike with one single outlet and has an anticipated minimum capacity of 300,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 401.6 to 403.5) through the year 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 16A & 16A-1:** Are located in Pool 16 on the left descending bank to the navigation channel between miles 400.5 and 401 below Lock 17 (drawing 4). These

are existing **approved EIS disposal sites** with two confined disposal dikes, each with a single outlet and a combined anticipated minimum capacity of 600,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal sites. The estimated dredged material quantity from the problem area (mile 400 to Lock 17) through the year 2023 is anticipated to be approximately 400,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 16B:** Is located in Pool 16 on the right descending bank to the navigation channel between miles 395 and 395.5 in the Three Forks area (drawing 5). This is an existing **approved EIS site** with a confined disposal dike with a single outlet and an anticipated minimum capacity of 400,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal sites. The estimated dredged quantity of material from the problem area (mile 395 to 395.5) through the year 2023 is anticipated to be approximately 600,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminates in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed.**

- **Site 16C:** Is located in Pool 16 on the right descending bank of the Arkansas River at miles 395 in the Three Forks area (drawing 5). **This is an existing approved EIS disposal site**. This is an unconfined disposal site with an anticipated minimum capacity of 100,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the unconfined disposal site. The estimated quantity of dredged material from the problem area (mile 394 to 395) through the year 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminates in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. **No real estate acquisition is needed.**

- **Site 16D:** Is located in Pool 16 on the right descending bank to the navigation channel between miles 394 to 394.7 in the Three Forks area (drawing 5). **This is an existing approved EIS disposal site**. This is an unconfined disposal site with an anticipated minimum capacity of 100,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the unconfined disposal site. The estimated quantity of dredged material from the problem area (mile 394 to 394.7) through the year 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminates in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. **No real estate acquisition is needed.**

- **Site 16E:** Is located in Pool 16 on the left descending bank to the navigation channel between miles 393 and 394 in the Three forks area (drawing 5). **This is a new site not constructed and is not an approved EIS site**. This site will be constructed as a confined dike disposal site and will handle a capacity of 1,500,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 393 to 394) through the year 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminates in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. **No real estate acquisition is needed.**

- **Site 16F:** Is located in Pool 16 on the right descending bank to the navigation channel between miles 392.8 and 393.3 at the Hwy 62 Bridge (drawing 5). **This new, yet to be constructed site, is not an approved EIS site**. This site will be constructed as a confined dike disposal site and will handle a capacity of 600,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 392.8 to 393.3) through the year 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminates in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. **This site is jointly owned by the Port of Muskogee and the USACE. The total area is approximately 20 acres and Real estate action may be required to design this site. The design of the confined disposal site and EIS approval will be required. The Port of Muskogee foresees beneficial use of the dredged material for future expansion of the port.**

- **Site 16G:** Is located in Pool 16 on the left descending bank to the navigation channel between miles 393 and 394 in Three forks area (drawing 5). **This is an existing approved EIS disposal site**. This site is a confined rock dike disposal site with an anticipated minimum capacity of 600,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 393 to 394) to the year 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminates in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. **No real estate acquisition is needed.**

- **Site 15A & 15A-1:** Are located in Pool 15 between miles 353 and 356 Canadian River Confluence and Stoney Point (drawing 6). **The two existing islands are EIS approved sites**. It is projected that these sites will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing islands**.** Each island is to be an oval or teardrop shape, approximately four acres in area with the length greater than the width, and about 6' above the normal high water mark.. Each island will contain approximately 50,000 C.Y. of dredging materials and be used for Least Tern Habitats. The estimated quantity of dredged material from the problem area (mile 353 to 356) through the year 2023 is anticipated to be approximately 100,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. **No real estate acquisition is needed. Design of confined islands with silt fences for Least Tern Habitats may be required and hydrographic surveys may be needed.**

- **Site 15B & 15B-1: This site is to be investigated as a designated Open Water Dredged Disposal Site (OWDDS).** This site is located in Pool 15 between miles 348 and 349.5 at Sandtown Bottom area (drawing 7). **This site is not an approved EIS site**. It is projected that this site will be used for future disposal activities and that hydraulic dredging using direct pipeline discharge will be utilized to place dredged material in the designated open water site. The estimated quantity of dredged material from the problem area (mile 348 to 349.5) through the year 2023 is anticipated to be approximately 100,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to

be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. **No real estate acquisition is needed.**

- **Site 15C & 15C1:** Are located in Pool 15 between miles 6.8SBC and 7.4SBC at Sans Bois Creek Channel (drawing 8). The two existing islands are **EIS approved sites**. It is projected that these sites will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing islands. The estimated quantity of dredged material from the problem area (mile 6.9SBC to 7.4SBC) through the year 2023 is anticipated to be approximately 200,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. **No real estate acquisition is needed.**

- **Site 15D & 15E &15F:** Are located in Pool 15 between miles 8SBC and 11SBC upstream of HWY 9 to Turning Basin on Sans Bois Creek Channel (drawing 9). The three existing islands are **EIS approved sites**. It is projected that these sites will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing adjacent islands The estimated quantity of dredged material from the problem area (mile 8BC to 11SBC) to the year 2023 is anticipated to be approximately 300,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. **No real estate acquisition is needed.**

- **Site 13A:** Is located in Pool 13 on the right bank adjacent to the navigation channel between miles 318.3 and 319.1 below Lock 14 (drawing 10). **This new, yet to be constructed site, is not an approved EIS site**. This site will be constructed as a confined disposal site to handle a minimum capacity of 500,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The existing sites are full and the estimated quantity of dredged material from the problem area (mile 317.2 to 319.6) to

the year 2023 is anticipated to be approximately 200,000 C.Y. Analysis of the site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites **No real estate acquisition is needed. Design of the confined dike and EIS approval will be required.**

- **Site 13B:** Is located in Pool 13 on the right descending bank to the navigation channel between miles 315 and 317.2 Peno Point below lock 14 (drawing 11**).** This is an existing **approved EIS** unconfined disposal site. The dredged materials in this area are heavy sand and gravel and can be disposed of over the bank without use of dikes. The existing contours provide adequate containment. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing unconfined disposal site. The estimated dredged material quantity from the problem area (mile 315 to 317.2) to the year 2023 is anticipated to be approximately 500,000 C.Y. Analysis of the site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites **No real estate acquisition is needed.**

- **Site 13C:** Is located in Pool 13 on the right descending bank to the navigation channel between miles 311.5 and 313.9 in the Camp Creek area (drawing 11**).** This is an existing **approved EIS** unconfined disposal site. The dredged materials in this area are heavy sand and gravel and can be disposed of over the bank without use of dikes. The existing contours provide adequate containment. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing site over the banks into the existing unconfined disposal site. The estimated quantity of dredged material from the problem area (mile 311.8 to 313.5) to the year 2023 is anticipated to be approximately 500,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to is anticipated to be approximately 500,000 C.Y be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that

contaminants are present. Therefore, there is no need for further testing of the sites **No real estate acquisition is needed.**

- **Site 13D:** Is located in Pool 13 on the right descending bank to the navigational channel at mile 308.8 to 310 at the confluence of the Poteau River (drawing 12). **This is an existing approved EIS site**. This site will handle a minimum capacity of 300,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the adjacent existing disposal site. The estimated quantity of dredged material from the problem area (from the confluence of the Poteau River to the Turning Basin, PR mile 0.0 to 2.0) through the year 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Therefore, there is no need for further testing of the site. **No real estate acquisition is needed. Real estate easement may be needed for the use of dredge discharge pipelines across private land.**

- **Site 13E:** Is located in Pool 13 on the left descending bank to Poteau River Turning Basin PR mile 1.7 to 2.0 (drawing 12). **This new, yet to be constructed site, is not an approved EIS site**. . This site will be constructed as a confined disposal site to handle a minimum capacity of 300,000 C.Y. for the Long Term 9-foot Maintenance Plan . It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inch diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 1.7 to 2.0) through the year 2023 is anticipated to be approximately 200,000 C.Y. Analysis of the site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Therefore, there is no need for further testing of the sites **No real estate acquisition is needed. Design of the confined dike and EIS approval will be required.**

10. Future Site Development

Future methods of dredging will be investigated in the following areas:

- Investigate non-dredge alternative such as flushing in area between Hwy 62 Bridge mile 392.5 and 393 (proposed site 16E)
- Between mile 400 to Lock 17 Chouteau (between site 16A and 17B).
- Investigate enlarging existing islands and use maintenance dredged material to create new Least Tern nesting islands adjacent to channel in the Canadian River Confluence area mile 353 to 356, in the Sandtown Bottom area mile 348.5 to 349.5 and in the Sans Bois Creek channel area mile 6.9SBC to 11SBC.

Plans to construct these sites should be considered in the next couple years. There is evidence of some sites filling up and new sites will need to be constructed to ensure that dredging can occur when needed.

In accordance with EM111-2-5025 "Engineering and Design – Dredging and Dredge Material Disposal", the development of a dredging project involves the study and evaluation of many factors to assure that dredging and disposal is carried out in an efficient, economical and environmentally compatible manner. The following are some of the factors that should be considered in the planning and design phase:

- Analysis of dredging locations and quantities.
- Dredging environment; i.e., depths, waves, currents, distance to potential disposal area, etc.
- Evaluation of physical, chemical and biological characteristics of sediments to be dredged.
- Identification of social, environmental and institutional factors.
- Evaluation of dredge plant requirements.
- Evaluation of potential disposal alternatives.
- Hydrographic surveys of proposed project.
- Field investigations of sediments to be dredged.
- Performance of required laboratory tests; i.e., chemical characterization, sedimentation, engineering properties, bioassay, bioaccumulation, etc.
- Evaluation of in situ density of sediments to be dredged.
- Evaluation of long-term dredging and disposal requirements for project.
- Coordination of project plans with engineering, construction, operation and planning elements of District.
- Evaluation of potential productive uses of dredge material.
- Coordination of project plans with other agencies, public and private groups.
- Evaluation of proposed project to determine potential environmental impact.

The above factors should be considered when detailing the plans and specifications for dredging and disposal areas including those stated earlier in this document.

11. Environmental Considerations

A Final Environmental Statement for Operation and Maintenance Program on the McClellan-Kerr Arkansas River Navigation System Oklahoma was prepared and filed by Tulsa District Corps of Engineers on September 1974.

Three new dredged material disposal sites will require future environmental assessments as well as cultural resources documentation: Sites 16D, 15B, and 13A as described in section 4. **The open water discharge of dredged material and the return water from upland disposal areas will require applying the Inland Testing Manual and CFR 33 in order to have a 402(NPDES) permit for the Long Term 9-foot Maintenance Plan .**

Addressing Possible Contamination

If evaluation of sediment quality (including any testing data) shows that there is the potential for unacceptable adverse effects at the proposed placement site, control measures can be considered for reducing or eliminating the risk. If potential control measures would not be effective in adequately reducing the risk of adverse contaminant-related effects, an alternative disposal option must be selected if the sediments must be dredged. Two popular methods of dredging with possible contaminated sediments are Confined Aquatic Disposal and Confined Upland Disposal.

Confined Aquatic Disposal

Confined Aquatic Disposal (CAD) is a term used to describe the general category of options that relate to the sequestering of contaminated sediments in the aquatic environment, so that they are physically isolated from aquatic organisms and so that they remain in a saturated and chemically reduced state. In the CAD process, contaminated material is sequestered (usually by placing it in an environment that is low energy, or "depositional") and then capping the contaminated material with clean material so that it is isolated and aquatic organisms are not exposed to it. Various types of CAD include reuse as non-cover material in wetland creation/restoration projects, disposal into a confined site such as a submerged pit, depression, or other lateral confinement, level bottom capping and the creation of nearshore structures such as marine terminals, harbors, parks, or other fill projects where the sediments to be isolated will remain saturated and reduced.

Confined Upland Disposal

Confined upland disposal is a term used to describe the general category of options that relate to the sequestering of contaminated sediments in the upland environment. Material is removed from the aquatic environment and sequestered in an upland site that is designed to manage the physical and chemical pathways associated with the material. The appropriate design for an upland disposal site depends on the extent of the contamination in the dredge material, the material's physical properties, and the location of the upland disposal site.

12. Recommendations and Conclusions

Dredging locations and the quantities of material to be dredged are two of the most important considerations in planning dredging projects. Records of quantities dredged and maintenance intervals (Appendix B) are used to forecast future dredging and disposal requirements.

Continued maintenance of the McClellan-Kerr Arkansas River Navigation System (MKARNS), Oklahoma project is of major importance and clearly economically justified. Twelve Dredged Material Disposal sites (18A, 18B, 18C, 17A, 17B, 16A, 16B, 16C, 15A, 15C, 15D, 13B, 13C and 13D) are EIS approved sites. **Three Dredged Material Disposal sites (16D, 15B and 13A) will require EIS/EA and ODEQ approval.**

A general permit will be required to use these sites for dredge material. To obtain a general permit, the following steps will be required to get approval for the disposal sites:

- Write a letter to Oklahoma Department of Environmental Quality (ODEQ) stating the intent to obtain a general permit for dredging activities along the Oklahoma portion of the navigation system. Request ODEQ provide a list of information they need to issue a general permit for this purpose.
- Write up the text of the general permit incorporating the comments made by ODEQ.
- Collect and test sediment along the system.
- Send the application for general permit out to ODEQ along with results of sediment samples to verify that the proposed sites will not be contaminated.
- Initiate the required environmental assessment and related activities.
- Send out a public notice to residents in the area of the sites so they are aware of the activity proposed.
- Request a Water Quality Certification letter from ODEQ that gives approval for dredging.
- Obtain comments from ODEQ for the general permit.
- Construct the EA based off the comments from ODEQ.

nav15pl1.dgn	Dredge Disposal - Site 15A	Dwg. 9
nav15pl2.dgn	Dredge Disposal - Site 15B	Dwg. 10
nav15pl3.dgn	Dredge Disposal - Site 15C	Dwg. 11
nav15pl4.dgn	Dredge Disposal - Site 15D	Dwg. 12
nav16pl1.dgn	Dredge Disposal - Sites 16B, 16C, 16D & 16E	Dwg. 7
nav16pl2.dgn	Dredge Disposal - Site 16 F	Dwg. 8
navchopl1.dgn	Dredge Disposal - Sites 17B, & 16A	Dwg. 5
navngpl1.dgn	Dredge Disposal - Sites 18A & 18B	Dwg. 2
navngpl2.dgn	Dredge Disposal - Sites 18C & 17A	Dwg. 3
navwdmpl1.dgn	Dredge Disposal Site 13A	Dwg. 14
navwdmpl2.dgn	Dredge Disposal - Sites 13B & 13C	Dwg. 15
navwdmpl3.dgn	Dredge Disposal - Site 13D	Dwg. 16

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navchopl1.dgn	Dredge Disposal - Sites 17B, & 16A	Dwg. 5
nav16pl1.dgn	Dredge Disposal - Sites 16B, 16C, 16D & 16E	Dwg. 7
nav15pl1.dgn	Dredge Disposal - Site 15A	Dwg. 9
nav15pl2.dgn	Dredge Disposal - Site 15B	Dwg. 10
nav15pl3.dgn	Dredge Disposal - Site 15C	Dwg. 11
nav15pl4.dgn	Dredge Disposal - Site 15D	Dwg. 12
navwdmpl1.dgn	Dredge Disposal Site 13A	Dwg. 14
navwdmpl2.dgn	Dredge Disposal - Sites 13B & 13C	Dwg. 15
navwdmpl3.dgn	Dredge Disposal - Site 13D	Dwg. 16

* Note The yellow files did not have changes to be made.