US Army Corps of Engineers®
Savannah District

DRAFT SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

SAVANNAH HARBOR EXPANSION PROJECT

(Excavation and Placement of Cadmium-Laden Sediments)

Chatham County, Georgia and Jasper County, South Carolina

December 2016

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1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Savannah District (SAS), has prepared this Draft Supplemental Environmental Assessment (SEA) to evaluate the potential impacts of placing cadmium-laden dredged sediments in Dredged Material Containment Areas (DMCAs) 14A and 14B in a moist (inundated) but not flooded condition as part of the Savannah Harbor Expansion Project (SHEP). This SEA supplements July 2012 Final Environmental Impact Statement (FEIS) for the Savannah Harbor Expansion Project (SHEP) and signed Record of Decision (ROD) dated October 26, 2012. The FEIS and ROD are incorporated herein by reference. These documents and the General Revelation Report (GRR) can be found at: (http://www.sas.usace.army.mil/Missions/Civil-Works/Savannah-Harbor-Expansion/)

This SEA covers the placement of cadmium-laden sediments only and not the dredging activity which is covered in the FEIS and has not changed[1]. The thresholds to identify sediments that require this special handling would not change from those described in the FEIS.

This SEA has been prepared in accordance with the National Environmental Policy Act of 1969, Council on Environmental Quality's Regulations (40 CFR 1500-1508), USACE Engineering Regulation ER 200-2-2. This SEA provides sufficient information on the potential adverse and beneficial environmental effects to allow the District Commander, U.S. Army Corps of Engineers, Savannah District, to make an informed decision on the appropriateness of preparing an Environmental Impact Statement (EIS) or signing a Finding of No Significant Impact (FONSI).

1.1 Proposed Action.

There would be no change in the method or timing of the dredging and DMCA 14A will be flooded after placement of any deposited sediment until covering/capping occurs as described in the FEIS. The placement of the cadmium-laden sediments may require multiple contracts over multiple years. The requirement to perform special handling of sediments with cadmium concentrations that exceed 14 mg/kg will not change.

This proposed action modifies what is described in the FEIS Section 5.04.2.2, and Appendix M Section 7.3.1.The changes fall into two categories (1) refining the channel reaches that contain naturally-occurring cadmium at levels that require special handling, and (2) keeping the deposited cadmium-laden sediments moist in DMCAs 14A and 14B

[1] Items in red box highlight Items from 2012 SHEP FEIS that will not change with this EA.

by maintaining the water height in the DMCA just below the elevation of the deposited dredged sediment (limited to 6”-12”) rather than flooded. The proposed action (Alternative 10 in table 10) consists of placing approximately 4.4 million cubic yards (CY) bulked of cadmium-laden sediments in DMCA 14A in a moist (inundated) but not flooded condition, with the effluent passing through DMCA 14B, if needed. It includes a reduction in the quantity of sediment (11.7 MCY to 4.4 MCY) that require special handling as of cadmium-laden sediment; Low Level Inundation during placement, rather than a flooded state; and Mitigation (bird abatement) during placement of sediments in DMCAs 14A and 14B. The reduced volume of cadmium-laden sediments should allow for these sediments to be placed within one DMCA. If the quantities of cadmium-laden sediment is greater than approximately 5 million CY bulked, both DMCAs 14A and a portion of 14B would be required.

1.1.1 Placement

The cadmium-laden sediments would be kept moist in the DMCA (Figure 1) by placing stop logs in the cross dike weirs between DMCAs 14A and 14B to maintain the water height just below the height to which the dredged material is placed (limited to 6”-12”). This saturation level will limit the drying of the sediments, and thereby the mobility of the cadmium, while still allowing the sediments to be worked with equipment as it is placed. This approach would limit wildlife exposure to the deposited cadmium-laden sediments. As the material is pumped into the DMCA, it would be pushed into the flooded portion of the DMCA similar to the procedure used in beach nourishment and island creation projects. The earth-moving equipment used will be required to have GPS to provide an accurate elevation to be compared with a post cadmium-laden material placement survey (ground-truthed LIDAR or photogrammetry).

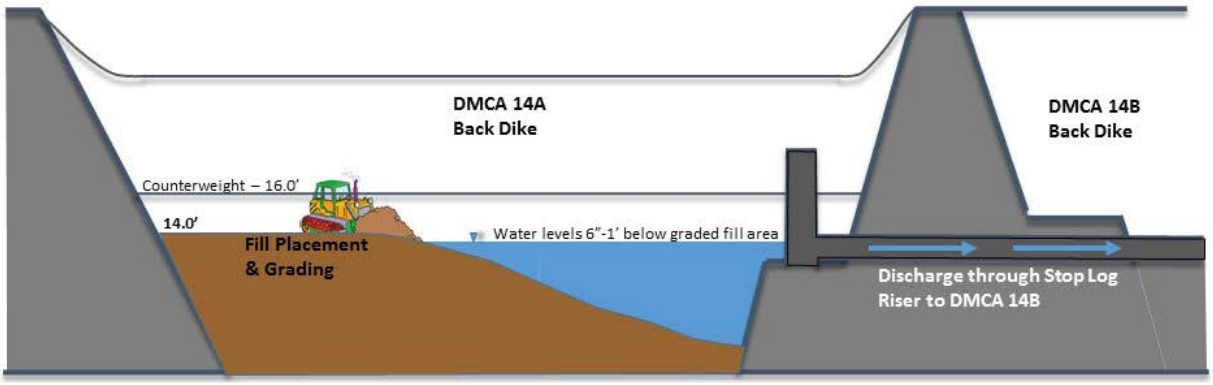


Figure 1: Moist placement of Cadmium Laden Sediments

1.1.2 Wildlife/Bird abatement

Wildlife/Bird abatement would be performed in the DMCAs to reduce the wildlife use of an individual DMCA during the construction period. This would minimize their risk of potential exposure to cadmium. Several methods could be employed, as follows:

1. Using noise makers to keep birds off the areas where cadmium-laden sediments have been deposited and distributed until a permanent covering/capping can occur.

2. Use of scarecrows, streamers, fake owls, giant eyes, live raptors, or other visual bird deterrents.

3. Active human abatement. This would include a person riding an ATV around the placement site on a daily basis during daylight hours using all appropriate means to prevent birds from feeding and nesting in the placement area. The use of noise makers, and visual deterrents would be expected. The use of a drone to harass the birds over larger area could be evaluated for success.

4. Holding water over the DMCA surface limits the types of species that could potentially be exposed to the cadmium-laden sediments.

5. Spraying herbicides to limit the growth of plants.

USACE would use a multi-pronged approach, initially relying on water inundation (#4) and active human abatement (#3). USACE would employ the other identified methods as it deems necessary.

1.1.3 Water Level/Quality Control

The method and standards for water quality testing in the DMCA and at the outfalls will not change from what is described in the FEIS.

Pipeline dredging results in water accumulating at the sediment deposition site. As sediments are deposited in the DMCA, water is decanted once it meets state standards for acceptability. Water in the DMCA will be first decanted through the weirs on the Savannah River side of DMCA 14A. Flow through those weirs are controlled by wooden stop logs. This method is currently used during the recurring maintenance dredging contracts. The sediments should settle within DMCA 14A without issue, as typically occurs during normal O&M dredging. If water quality testing shows that the water is not suitable for discharge, the water flow will be shifted (Figure 2) to flow from DMCA 14A through newly constructed weirs in the cross dike between DMCAs 14A and 14B and then through the weirs in 14B to the discharge point at Fields Cut on the Atlantic Intracoastal Waterway (AIWW). This approach, with its longer flow path, would provide the decanted water with a longer residence time to enable further settling of suspended materials through DMCA 14B before being discharged into Fields Cut. If flow is rerouted through DMCA 14B, the flooded portion of that DMCA would also be covered/capped unless testing shows that the flow path did not contain water with cadmium over the state standard during the construction period.

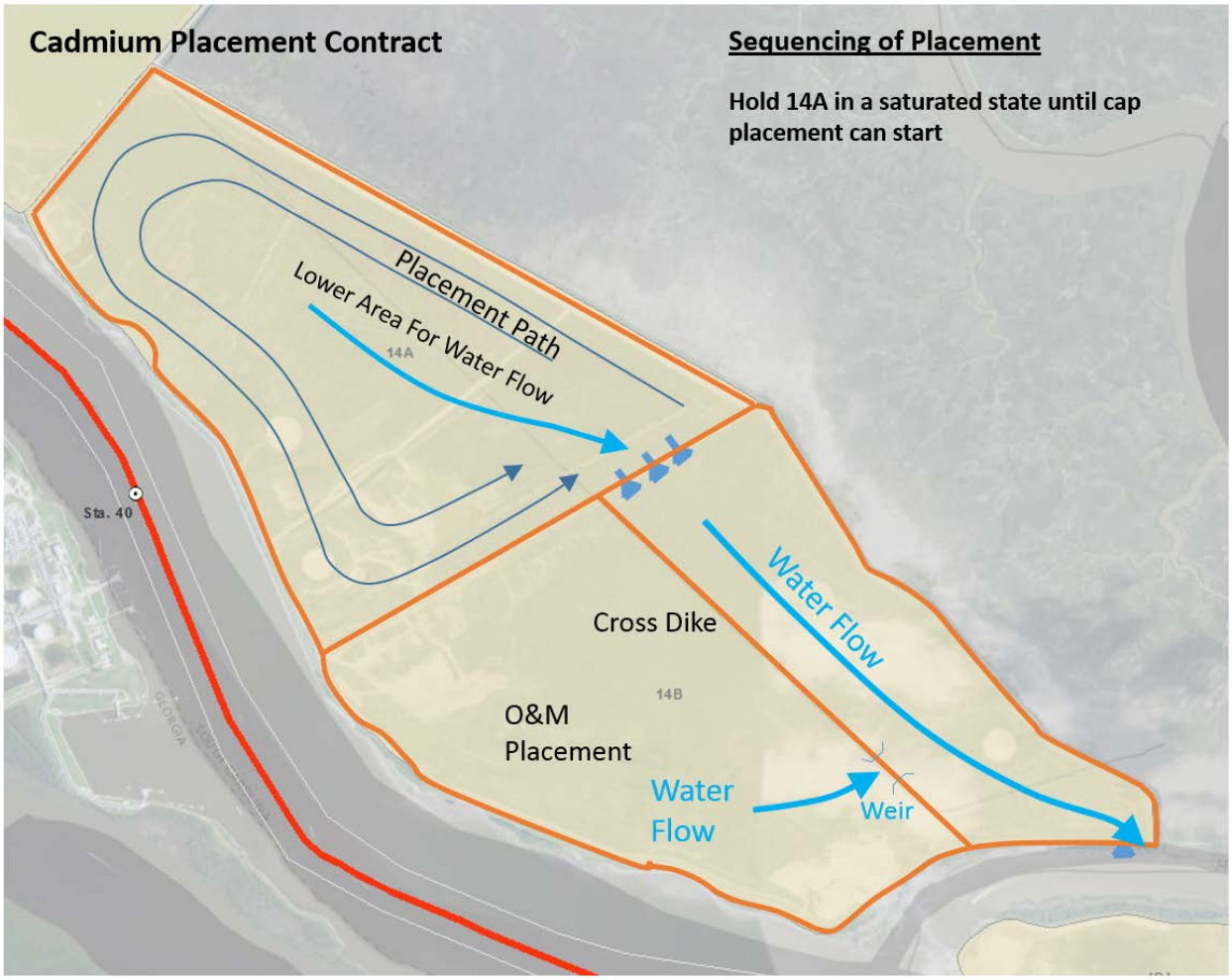


Figure 2: Alternative Water Flow Path

1.1.4 Flooding DMCA after Placement

After placement of cadmium-laden sediments in DMCA 14A, the height of the stop logs would be increased to flood the site (Figure 3) while awaiting placement of additional cadmium-laden sediments or the cover/cap described in the FEIS.

Note the elevation of the cadmium-laden sediments and the water will be below the height of the counterweight to maintain the stability of the dike. Pumps or other methods may be required to maintain the water level in the DMCA to compensate for any evaporation or leakage.

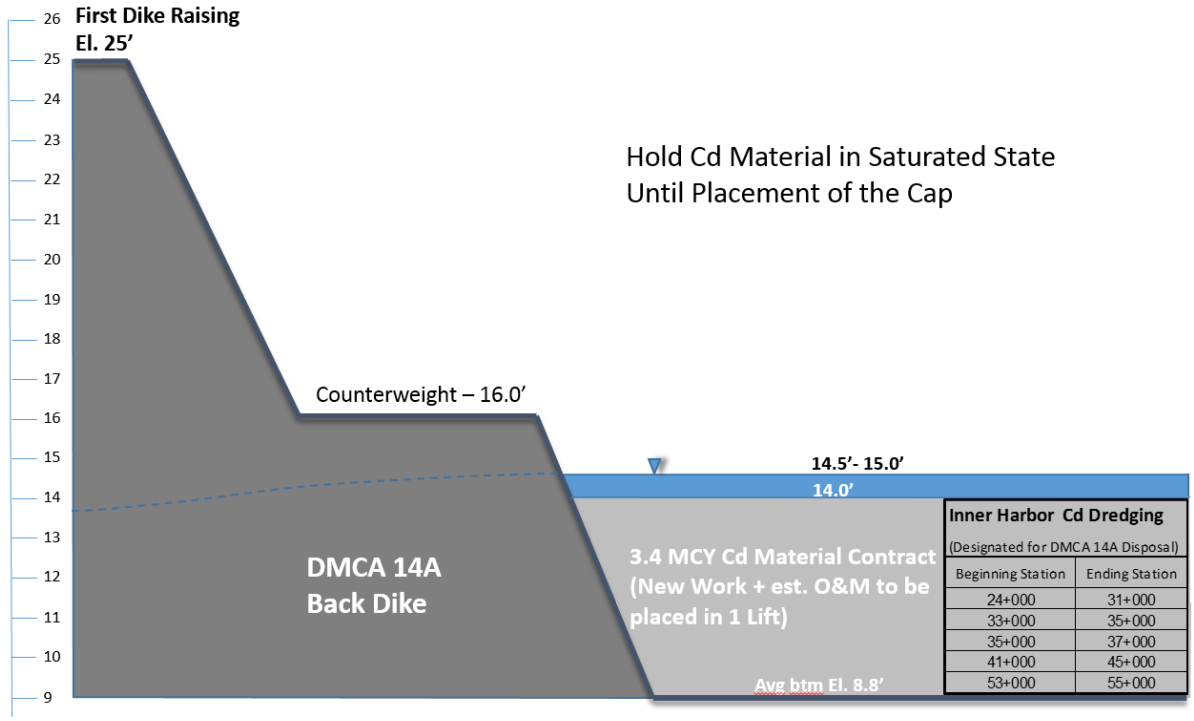


Figure 3: Flooded State of DMCA after Placement of Material

1.1.5 Capping Cadmium-laden sediment

The cadmium-laden sediments would then be covered/capped (Figure 4) with a clean (below 4.0 ppm) two-foot layer of sediments, as described in the FEIS (Section 5.04.2.2). The requirements for the cover material and the required testing would not change.

The volume of sediment required for the initial cover/cap is approximately 2 MCY. The cover will come from excavated SHEP new work sediments. If insufficient suitable new work sediments are available, sediments from the next O&M dredging cycle could be used. Those sediments would be deposited within 18 months. New work sediments from Stations 0+000 to 24+000 have been identified as a suitable source for the cover/cap material. Note the elevation of the cover/cap will be the height of the existing counterweight. The post placement survey would be used to determine the final elevation of the two-foot cover. The earth-moving equipment used will be required to have GPS to provide an accurate elevation to be compared with post placement survey and LIDAR or photogrammetry.

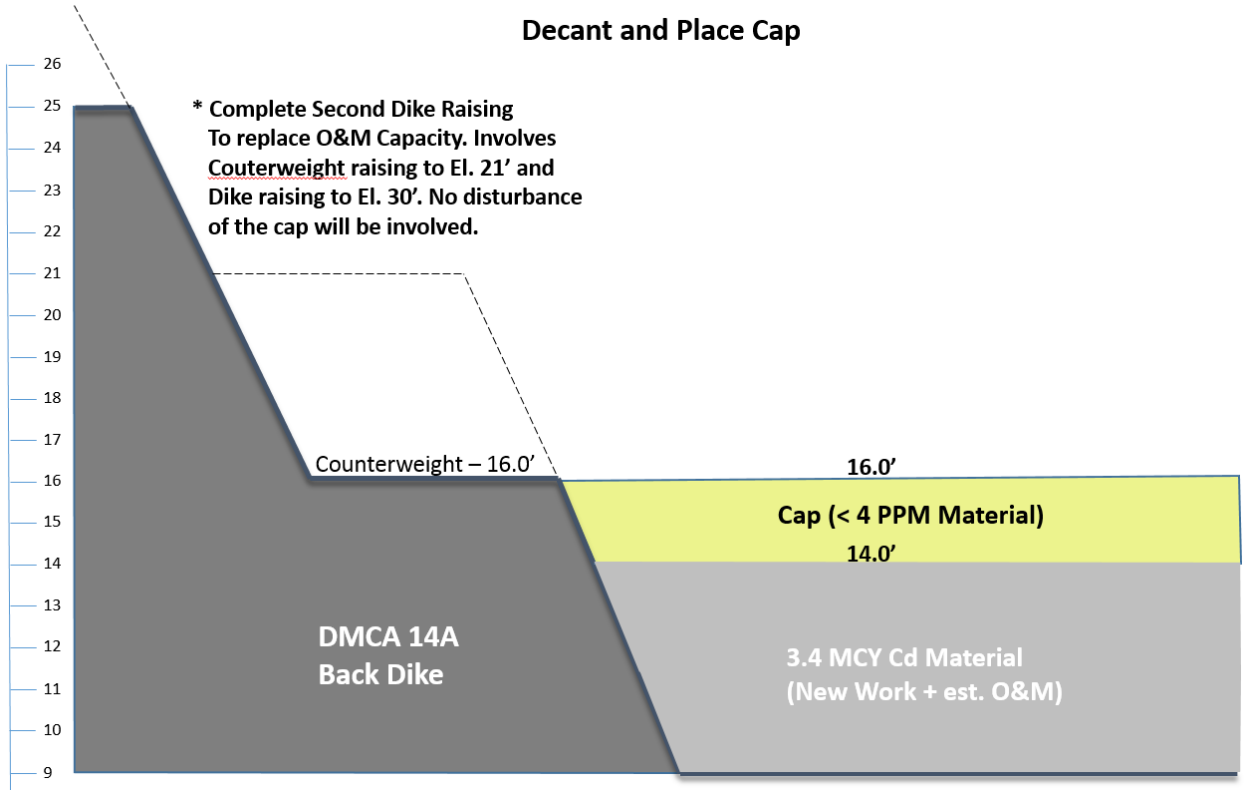


Figure 4: DMCA after Cap*

1.1.6 Restriction of Future Use of Material from DMCA 14A

A restriction on future construction activities using sediments deposited in DMCA 14A would be required as described in Appendix M - Section 7.2 of the FEIS. The deposited cadmium-laden sediments would not be excavated in the future, to ensure they do not become mobile and available to wildlife after the covering/capping operation is complete.

In lieu of a visible marker placed across the disposal areas, a georeferenced elevation would be determined to identify the depth not to be disturbed. There will be two Lidar or photogrammetry surveys (with ground-truthing) taken across the DMCAs, once after placement of the cadmium-laden sediment (prior to the cover/cap) and again after placement of the cover/cap material. In addition, there will be a requirement for the construction equipment to have GPS for elevation control and a post construction survey will be performed. From these three data sources, USACE will identify an elevation and all future construction contracts for that site will stipulate that no excavation would occur below that elevation. It is anticipated that sediments within the DMCA will settle as these materials and additional material are subsequently placed on top of the underlying unconsolidated soft organic soils. With time, this settling (consolidation) will function as an additional factor of safety since the cadmium-laden sediments and cover/cap would have settled below the elevation surveyed. If excavation is ever required below this depth, a protocol to prevent wildlife exposure to the sediment and re-capping of the site would be included in the work plan.

1.2 Purpose and Need for the Proposed Action.

The purpose and need for SHEP can be found in Section 2.02 of the FEIS.

1.2.1 Purpose of the Action

The purpose of the proposed action is to place cadmium-laden dredged material as part of SHEP in a manner that reduces risk to wildlife without causing dike failure. The location of the proposed action is DMCAs 14A and 14B (Figure 5).

Figure 5: Location of DMCAs 14A and 14B

Cadmium has been found to occur naturally in high levels within Miocene soils that would be excavated during the SHEP dredging. Evaluation of the laboratory results indicated that adverse impacts to birds were likely from normal placement of sediments with elevated cadmium levels into the DMCAs. Studies found that sediments with a cadmium concentration of about 29.8 ppm could potentially produce environmental impacts to birds feeding 100 percent of the time in these sediments. When these wet sediments are dried, cadmium becomes much more mobile, with cadmium concentrations as low as 14.0 ppm potentially causing adverse environmental impacts. Details of this analysis can be found in the FEIS and its appendices.

In 1996, the District developed the Savannah Harbor Long Term Management Strategy and began to hold water in the Dredged Material Containment Areas (DMCAs) to create bird habitats. This approach served as mitigation to compensate for wetland losses that

resulted from diking DMCA 14A and miscellaneous disposal area operations in South Carolina. The DMCAs now provide nesting habitat for shorebirds and colonial nesting birds and are highly used by wildlife.

The SHEP FEIS states that all cadmium-laden sediments requiring special handling would be placed in DMCA 14A (if sufficient capacity) or DMCAs 14A and 14B. The sediment would be deposited so that it remains covered with water until after placement of the cover/cap is completed. This material would not be allowed to dewater and/or desiccate until after placement of the cover is complete and cadmium levels in the surface sediments of the DMCA test less than 4 mg/kg.

1.2.2 Need for Action

After the GRR was completed, CESAS began detailed design work on this project feature. In 2012, CESAS issued a Request for Information (RFI) to the dredging industry to obtain their views on how they would perform the construction to comply with the FEIS requirements. Industry proposed methods included filling the DMCA with enough water to float a barge (4 to 6 feet) inside the containment area to more efficiently isolate and place the sediments prior to application of the two-foot layer of clean covering sediments.

Using 2011, 2014, and 2015 subsurface investigation data (which was not available when the GRR and FEIS were prepared), Savannah District performed engineering analyses of DMCAs 14A and 14B using the industry's approach. The analysis revealed that the containment dikes would exhibit severe stability issues and likely fail during placement of water to create the ponded area. The back dike of DMCA 14A was identified as a particularly vulnerable site. The 2014 investigation identified the low strength of the underlying soil and poor foundation conditions, which limit the ability to raise dikes and pond water to a substantial depth.

The result of the detailed engineering work conducted after the GRR and FEIS were prepared is that CESAS has recognized that the foundation and dikes at DMCAs 14A and 14B do not have sufficient strength to be able to implement the sediment placement plan identified in the FEIS and GRR. Therefore, some revision to the sediment placement plan is required.

1.3 Authority.

The proposed action would be a modification to the previously-approved Savannah Harbor Expansion Project (SHEP). That project was initially authorized as part of Water Resources Development Act of 1999 (Public Law 106-53, Section 102(b)(9)). The wording of the authorization can be found in Section 2.04 of the FEIS. The project was subsequently reauthorized in Water Resources Reform and Development Act (WRRDA) (Public Law 113-121, Section 7002) at FY2014 price levels.

1.4 Prior Reports

Dredging and sediment disposal methods for the Savannah Harbor Expansion Project have been addressed in previous environmental documents which were circulated for

public and environmental agency review. A list can be found in the FEIS Section 1.05. The following reports have been completed since the above list was prepared:

USACE, Savannah District. January 2012. Savannah Harbor Expansion Project, General Reevaluation Report and Final Environmental Impact Statement (http://tinyurl.com/j8fhuhp). In 2012, the U.S. Army Corps of Engineers, Savannah District, published the final GRR and EIS on a proposed deepening of Savannah Harbor. The study resulted in a project to deepen the inner harbor from the existing depths to 47 feet. Dredged sediment from the channel is being placed in the existing ocean dredged material disposal site and upland disposal areas. This report is herein incorporated by reference.

USACE, Savannah District. September 2013. Savannah Harbor Expansion Project, Environmental Assessment for Modifications to the Raw Water Storage Impoundment (http://tinyurl.com/hvo9lgd). This EA evaluated impacts due to modifications that were needed to the location and design of the Raw Water Storage Impoundment. During the detailed design process, several alternate sites were considered to identify the location that best meets the overall project needs. A parcel near Interstate Highway 95 and the City of Savannah's raw water pipeline was identified as the best location. Engineering and environmental studies were then performed on that site. Construction of this feature is now underway.

2.0 Formulation of Alternatives

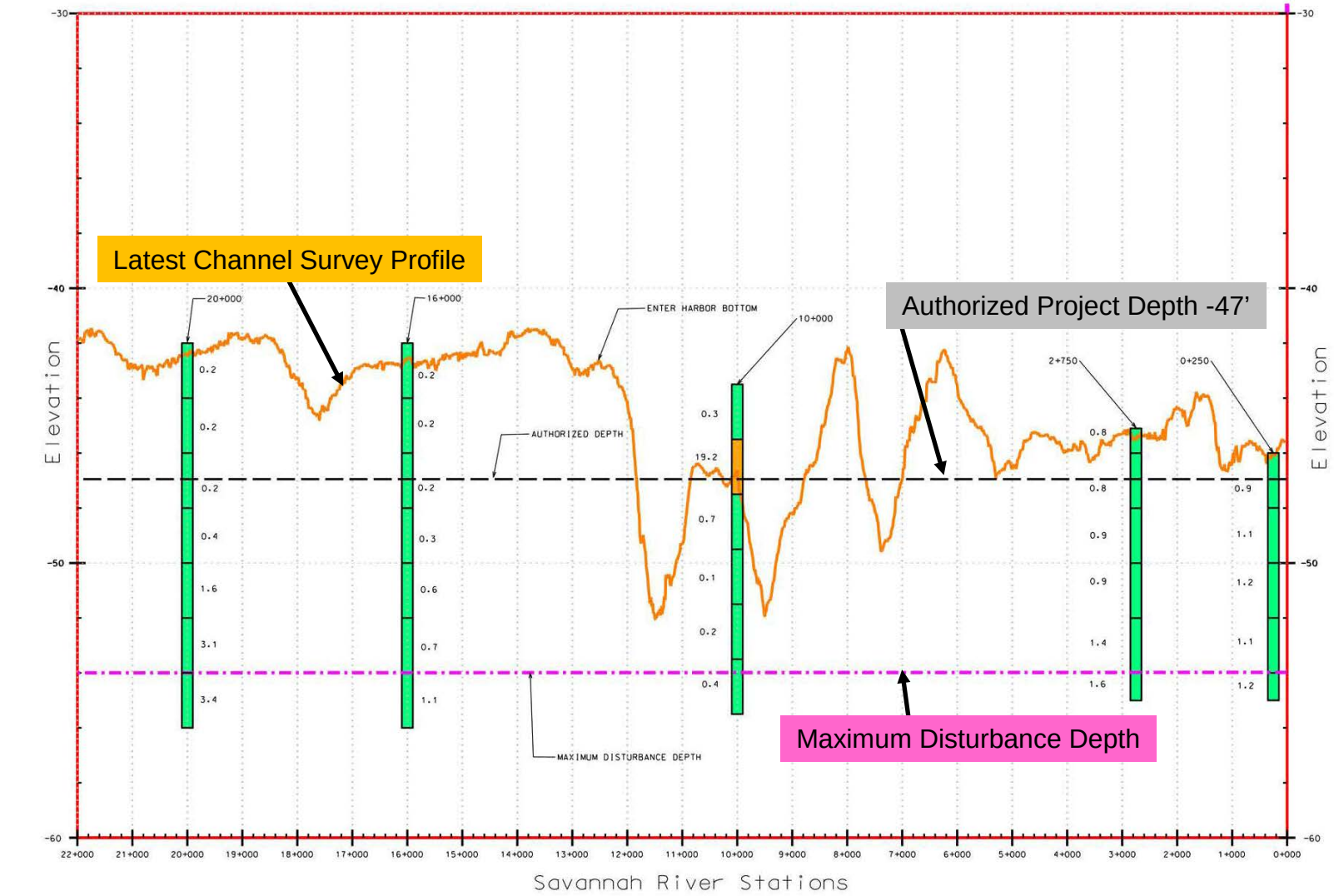
Two types of measures were examined as part of plan formulation for this proposed action. They were:

1. Measures that examined the quantity of cadmium-laden sediments that is in the dredging profile.
2. Measures that examined methods of handling and placing the cadmium-laden sediments.

2.1 Quantity Measures

During the SHEP GRR, a subsurface and laboratory investigation identified the levels of cadmium within specific areas in the new work channel deepening sediments. Thirty-eight inner harbor locations were sampled as part of the sediment quality studies presented within Appendix M of the FEIS. Two additional locations have been sampled since these studies; these were collected in August 2015. Borings (Figure 6 through Figure 9) were taken at specific locations and samples were selected at a specific depths.

Samples were collected from each boring and tested for cadmium levels. Multiple samples were collected through the vertical extent of the boring. Samples were collected from approximately 2-foot intervals. For the FEIS, the methodology for determining which sediments would require special handling was based on the cadmium concentrations in the samples. If any measurement within a sediment column (boring) exceed the threshold, the entire vertical column and reach along the length of the river was considered to exceed threshold levels and would require special handling.



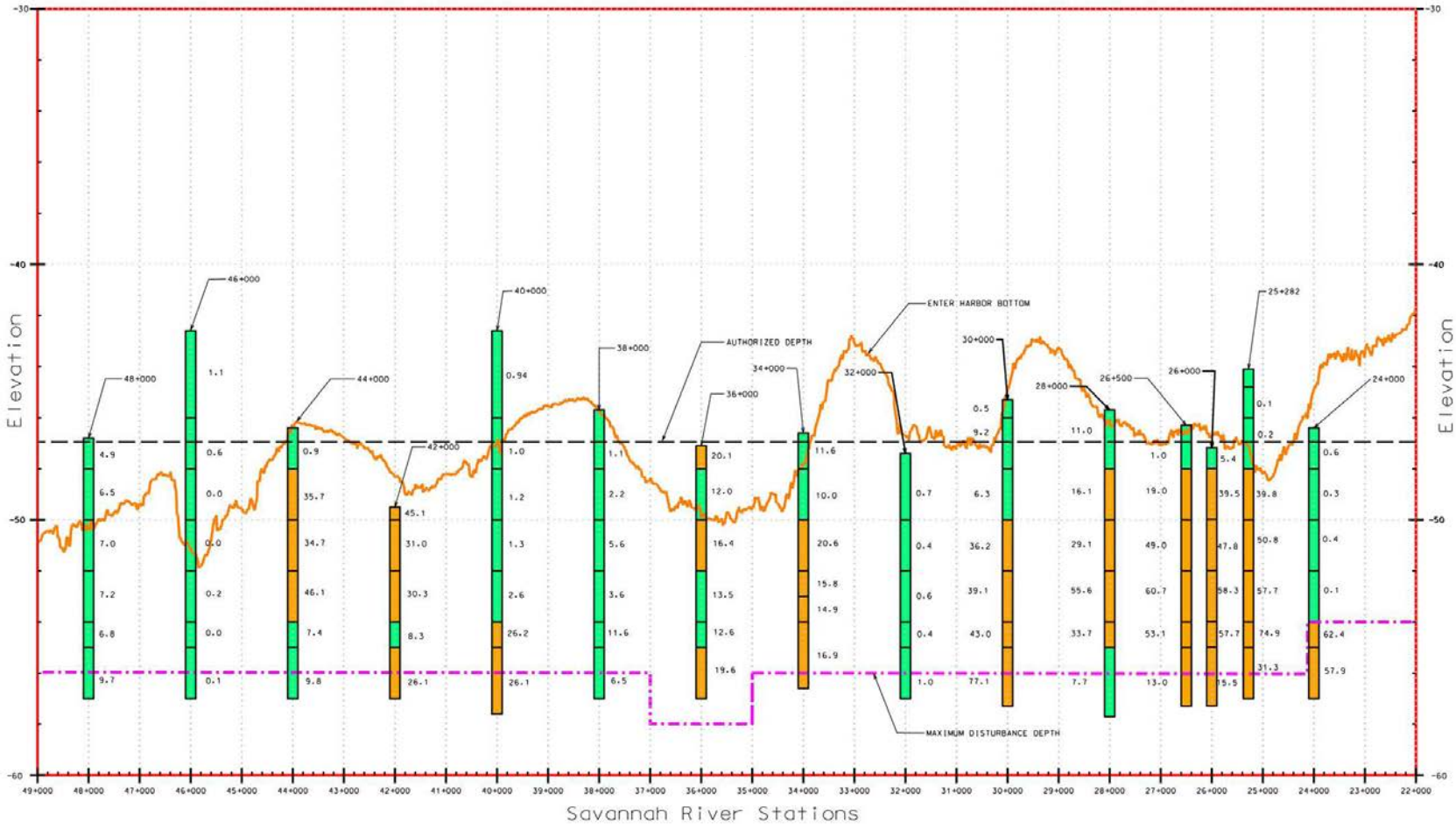
PROFILE SHOWING CADMIUM CONCENTRATIONS BASED ON CUT STA 0-22

LEGEND:

Sediment with Cd below 14.0 ppm

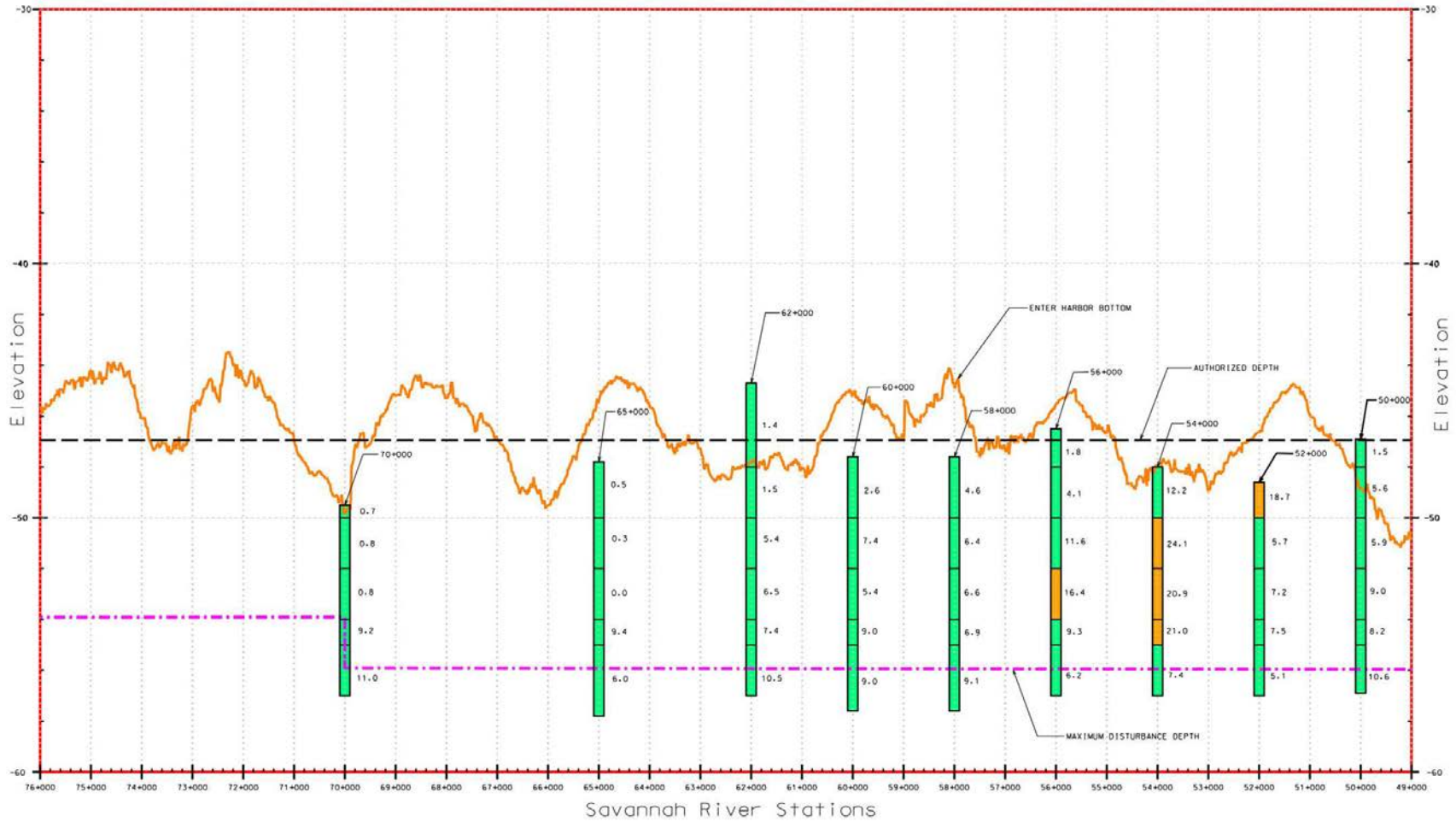
Sediment with Cd above 14.0 ppm

Figure 6: Cadmium in Sediment Samples from Stations 0+000 to 22+000



PROFILE SHOWING CADMIUM CONCENTRATIONS BASED ON CUT STA. 22-49

Figure 7: Cadmium in Sediment Samples from Stations 22+000 to 49+000



PROFILE SHOWING CADMIUM CONCENTRATIONS BASED ON CUT STA. 49-76

LEGEND:

Sediment with Cd below 14.0 ppm

Sediment with Cd above 14.0 ppm

Figure 8: Cadmium in Sediment Samples from Stations 49+000 to 76+000

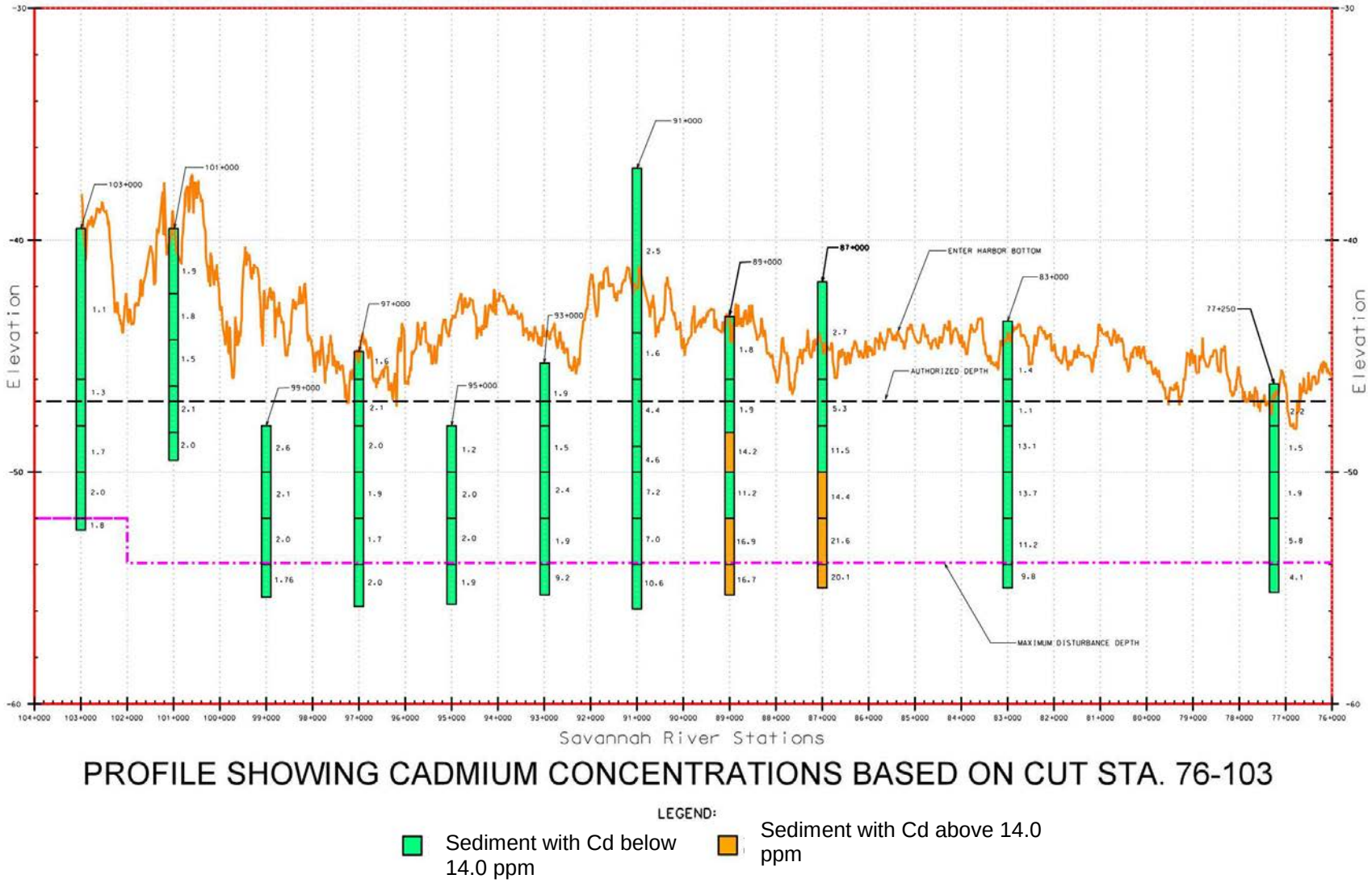


Figure 9: Cadmium in Sediment Samples from Stations 76+000 to 104+000

This approach was used in recognition that the sediments from the entire column would likely be removed at the same time when a hydraulic cutterhead dredge deepens the channel.

In Table 1, channel stations where sediment samples contain cadmium at 14.0 ppm or greater are shaded in orange. The analysis in the FEIS assumed that a boring represents the content of the sediments for a reach of the channel that extends 50% of the distance to the next boring upstream and 50% of the distance to the next boring downstream.

Table 1: SHEP Inner Harbor Sampling Locations			
0+250	30+000	50+000	83+000
2+750	32+000	52+000	87+000
10+000	34+000	54+000	89+000
16+000*	36+000	56+000	91+000
20+000*	38+000	58+000	93+000
24+000	40+000	60+000	95+000
25+282	42+000	62+000	97+000
26+000	44+000	65+000	99+000
26+500	46+000	70+000	101+000
28+000	48+000	77+250	103+000
* Additional locations sampled in August 2015. Boring locations that had at least one layer with Cadmium levels found to be ≥14.0 ppm			

The SHEP GRR/FEIS contained two separate estimates on the volume of sediment that would need to be managed for exposure to cadmium that exceed the risk-based criteria within the DMCAs:
1. The 2006 evaluations determined that sediments from Channel Stations 17+000 to 45+000 (28,000 channel feet, 4.5 million cubic yards (MCY) in situ) would require special management based on the average cadmium concentrations at each sampling station.
2. Appendix M of the 2012 FEIS determined that sediments from Stations 6+375 to 45+000, 51+000 to 57+000, and 80+125 to 90+000 (54,500 channel feet, 9 MCY in situ) would require special management based on including the sediments within the "disturbed" layers and the potential for deposition of cadmium-laden clay balls that may result from incomplete mixing of sediments during the dredging process at those sample locations that average less than 14 mg/kg but contain a layer that exceeds this limit. This quantity was based on the -48.0 feet MLLW alternative. The depth in the final selected plan was the -47.0 feet MLLW alternative.

During PED, CESAS reexamined the quantity of cadmium-laden sediments that would be dredged and require special handling using the most recent channel bathymetry/survey and information on the project. Additionally, alternate approaches were considered to verify the logic behind the identification of reaches where the

sediments would need special handling. These approaches are described in the following sections.

2.1.1 Authorized Channel Depth

The quantities in the SHEP EIS Appendix M (Sediment Quality Evaluation) were based on the 48-foot project alternative. The project design was refined after the bulk of that analysis was prepared and the 47-foot depth alternative was selected and authorized for construction. This EA uses the authorized depth of 47 feet below MLLW. Using the 48-foot depth overstates the quantity of cadmium-laden sediments that require special handling.

Determining Depth of Disturbance for Authorized Project:
The total required dredging depth within each reach of the channel is comprised of the following increments (Figure 10):

- Authorized navigation depth of channel: -47.0 feet MLLW
- Advance maintenance: varies based on reach (0, 2, 4, or 6 feet)
- Allowable overdepth: 2 feet (allowed for dredging inaccuracies)
- Depth of disturbance: non-pay sediments disturbed but not removed. This depth (approximately 3 feet when using a 30-inch dredge) is calculated based on a mixing zone below the cut depth that may become entrained with cadmium-laden sediments and, therefore, be deposited in a DMCA.

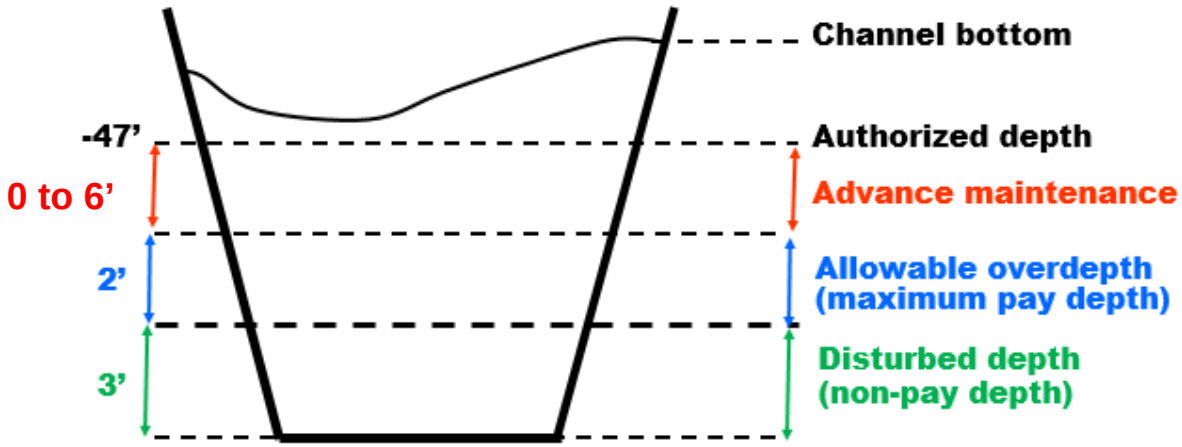


Figure 10: SHEP Inner Harbor Dredging Depth Increments

Table 2 shows the total depth for each reach of the inner harbor as authorized for construction.

Table 2: SHEP Inner Harbor Dredging Total Depth by Reach					
Reaches	**Authorized Depth***	**Advanced Maintenance#**	**Allowable Overdepth#**	**Depth of Disturbance#**	**Total Depth* of Impact**
0+000 to 24+000	47	2	2	3	54
24+000 to 35+000		4			56
35+000 to 37+000		6			58
37+000 to 70+000		4			56
70+000 to 102+000		2			54
102+000 to 103+000		0			52
*feet at MLLW, #in feet					

Figure 11 shows the updated dredging quantities based on the ranges identified in the GRR and FEIS (Stations 6+375 to 45+000, 51+000 to 57+000, and 80+125 to 90+000) that required special handling. Using the 47-foot depth and the 2014 survey, the revised quantity is 12.6 MCY bulked.

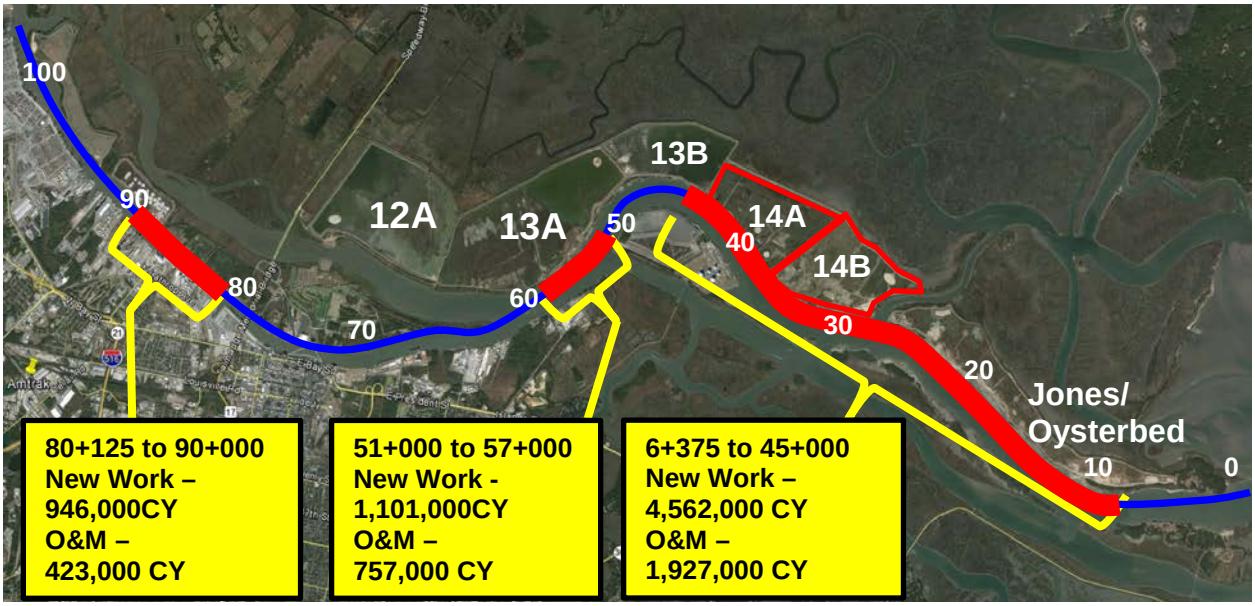


Figure 11: Location of Cadmium-Laden Sediment (CY in situ based on -47 foot and 2011 survey: New Work 6,609,000 & O&M 3,107,000 Total 9,716,000 in situ or 12,630,800 bulked)

A review of the channel geometry with respect to total disturbance depths shows that at Station 24+000 there is an allowable-overdepth transition. From Station 0+000 to 24+000, the allowable overdepth is 2.0 feet. At Station 24+000, the allowable overdepth increases to 4.0 feet upstream to Station 35+000. This transition was not considered in determining the initial ranges that require management; however, the 2015 re-evaluations (including new laboratory data at Stations 20+000 and 16+000) indicate that cadmium-laden sediments will not be encountered downstream of Station

24+000. This data (along with additional analyses discussed later in this EDR) supports the conclusion that the materials from Station 6+375 to 24+000 do not require to be placed in DMCA 14A and managed as cadmium-laden.

2.1.2 Mathematical Averaging vs. Weighted Averaging

The SHEP EIS Appendix M used mathematical averages to determine the channel reaches that have average cadmium concentrations above 14.0 mg/kg. To determine a more representative bulk concentration consistent with mechanical compositing, weighted averages for each location were developed.

- Mathematical averaging of concentrations considers all sample sizes equal and leads to under-representation of thicker layers of soil and over-represents thinner layers.
- Weighting concentrations of portions of the sediment core to reflect the volume of sediment that each sample represents adjusts each sample interval as a percentage of the overall dredging prism; totaling the intervals results in a weighted average.
- Weighting results in an overall bulk concentration that is more representative of a fully homogenized sample from the full dredging prism. Since the sediments mix when excavated by a cutterhead dredge, this measurement more accurately reflects what is pumped into a DMCA.

CESAS calculated both mathematical average and bulk weighted average concentrations for the 47-foot project depth project for all 40 sediment sample locations in the Inner Harbor. A comparison between the mathematical averages and the weighted averages shows close correlation (Table 3). The mathematical average for the 48 and 47 foot channel depths show 11 samples that average over 14.0 mg/kg of cadmium.

Table 3: Mathematical Averaging vs. Weighted Averaging of Samples

Sample Location	Appendix M Mathematical Average (-48 foot)	Mathematical Average (-47 foot)	Weighted Average (-47 foot)
SH000+250	1.07	1.05	1.05
SH002+750	1.03	0.97	0.98
SH010+000	3.78	3.46	3.90
SH016+000*	0.46	0.35	0.46
SH020+000*	1.30	0.95	1.30
SH024+000	16.85	0.34/20.27**	0.33/12.785**
SH025+282	36.76	36.44	33.86
SH026+000	39.37	37.38	41.91
SH026+500	34.42	32.63	33.53
SH028+000	27.15	25.53	26.04
SH030+000	26.60	30.20	28.23
SH032+000	0.58	0.62	0.61
SH034+000	14.77	14.94	14.86
SH036+000	15.69	15.69	15.53

Table 3: Mathematical Averaging vs. Weighted Averaging of Samples			
Sample Location	**Appendix M Mathematical Average (-48 foot)**	**Mathematical Average (-47 foot)**	**Weighted Average (-47 foot)**
SH038+000	4.98	5.11	4.22
SH040+000	7.10	8.46	5.03
SH042+000	28.39	28.15	27.61
SH044+000	23.57	22.42	26.19
SH046+000	0.32	0.30	0.42
SH048+000	6.76	7.01	6.92
SH050+000	6.45	6.80	6.75
SH052+000	9.25	8.84	8.72
SH054+000	18.18	17.10	17.83
SH056+000	8.42	8.23	8.68
SH058+000	6.46	6.72	6.33
SH060+000	6.44	6.70	5.95
SH062+000	5.00	5.45	4.37
SH065+000	2.94	3.24	2.09
SH070+000	3.78	4.50	3.66
SH077+250	2.99	2.85	2.87
SH083+000	8.25	8.10	7.78
SH087+000	11.91	11.09	9.59
SH089+000	9.89	9.21	8.38
SH091+000	5.02	2.06	3.91
SH093+000	2.71	1.90	1.90
SH095+000	1.77	1.74	1.74
SH097+000	1.88	1.87	1.89
SH099+000	2.16	2.22	2.22
SH101+000	1.84	1.82	1.83
SH103+000	1.57	0.95	1.39
* Additional locations sampled in August 2015. **This location corresponds to a depth of disturbance transition. The first number is for the 54 foot depth the 2nd number is for a 56 foot disturbance.			

The use of mathematical average or bulk weighted average has no effect on the quantity of sediments that warrant special handling.

2.1.3 Clay Balls/Sediment Cohesion

Highly plastic clay sediments may form a ball shape (Figure 12) during the dredging and pipeline transportation process. During the SHEP EIS development, the following concerns were raised:

- Materials would be placed in the DMCA as “clay balls”.
- Cadmium is more strongly associated with the high-clay sediments.
- Clay balls would predominantly exceed the 14 mg/kg cadmium threshold.

Figure 12: Deposition of clay balls in 1994 during placement of channel deepening sediments on Tybee Island

In the GRR and FEIS, sediments at five locations (Stations 10+000, 52+000, 56+000, 87+000, and 89+000) did not exceed the 14 ppm cadmium threshold when averaged over the entire boring, but were included for special handling because an individual layer exceeds the 14.0 ppm threshold and was thought to possess the potential to form cadmium-rich clay balls within a DMCA.

The 2012 GRR/EIS included Station 83+000 in this group, but the District's 2015 reexamination of the cadmium concentration data identified an error in our previous analysis. Cadmium is not present over 14.0 ppm in any layer at that station. As a result, CESAS eliminated this station as requiring special handling in the analysis described in this EA.

The District examined individual core samples (Table 4) and assigned a general sediment type to the sample based on the percent that passed through certain sieve sizes. Clay is defined as sediment finer than 0.002 mm. Sediment samples from Stations 10+000, 52+000, and 56+000 are made up of material that is less than 15% clays; therefore, they are not expected to form clay balls. Sediments samples from Stations 87+000 and 89+000 have layers that are more than 25% clay and could still require special handling based on the possibility of producing clay balls with a cadmium

concentration above 14.0 ppm. No data is available on the sediment type for Station 24+000, so the District continued to include that location in the group that require special handling.

Table 4: Potential Clay Ball Formation Location and Sediment Type							
Location	**Sample Interval (feet mllw)**	**Cadmium Concentration (ppm)**	**Natural Water %**	**Percent Fines (finer than 200 sieve - 0.075mm)**	**Percent Finer than 0.005 mm**	**Percent Finer than 0.002 mm (clay)**	**General Soil Type**
SH010+000	-46.4 to -48	19.200	21.8	21.7	13.6	13.0	Sand
SH024+000	-52 to -54	62.399	No Soil Data Available				
SH024+000	-54 to -55	57.852					
SH052+000	-48 to -50	18.714	53.5	40.9	11.6	7.5	Sand
SH056+000	-52 to -54	16.433	46.8	39.5	11.7	7.5	Sand
SH087+000	-50 to -52	14.408	57.5	57.3	33.2	29.0	Clay
SH087+000	-52 to -54	21.580	53.9	41.9	23.9	21.0	Sand
SH087+000	-54 to - 55	20.140	57.2	41.8	26.3	22.0	Sand
SH089+000	-48 to -50	14.172	47.4	88.2	44.4	38.0	Clay
SH089+000	-52 to -54	16.883	55.5	41.6	23.7	19.0	Sand
SH089+000	-54 to -55	16.683	55.4	59.4	25.5	22.5	Clay

Atterberg limit testing: Members of the project delivery team (PDT) continued to express concerns with the potential formation of clay balls and subsequent deposition within a DMCA as a clay ball (not as a fully slurried material), particularly from sediments between Stations 87+000 and 89+000. These concerns are based on observations during the 1994 harbor deepening. The new work sediments deposited on a beach during the 1994 project were from locations that contained high liquid-limit clays per USCS classification, were pumped relatively short distances (5,000 feet to 10,000 feet), and were not subject to mechanical handling by earth-moving equipment (prior to being photographed).

The new work sediments at Stations 87+000 (-50.0 feet to -52.0 feet) and 89+000 (-48.3 feet to -50.0 feet) exceed 25% clays based on the hydrometer analyses and the District continues to include them for special handling. In order to get a better understanding of behavior of sediment from these two locations, samples were submitted for determination of Atterberg limits. The samples submitted for analysis in 2015 were the same samples used for the initial analyses. The District retrieved them from storage at the Engineers Depot on Hutchison Island, Savannah Georgia and shipped them to the Environmental and Materials Unit (EMU) in Marietta, Georgia for analyses.

As shown in Table 5, four samples were analyzed for their Atterberg limits: Stations 87+000(E), 87+000(G), 89+000(D), and 89+000(F). Samples from Stations 87+000(E) and 89+000(D) were classified as MH (Sandy Clayey Inorganic Silt High liquid-limit); samples from Stations 87+000(G) and 89+000(F) were classified as SM-H (silty sand with high liquid-limit).

Table 5: Atterberg Limits Determination Results												
		ASTM D422 Percent Passing Sieve								Atterberg Limits		
Boring	Sample	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200	LL	PL	PI
SH087 (E)	446	100	99.6	98.4	97.8	96.5	92.2	75.5	57.3	172	62	110
SH087 (G)	448	100	99.9	99.4	98.8	98.0	92.4	68.5	41.8	92	45	46
SH089 (D)	439	100	98.2	97.4	97.2	96.8	95.5	92.4	88.2	176	75	101
SH089 (F)	441	100	99.9	99.0	98.1	99.6	89.2	66.0	41.6	102	48	54
Atterberg Limits: LL – Liquid Limit, PL – Plastic Limit, PI – Plastic Index												

During analyses of these samples, the materials Subject Matter Expert made the following observations:

> *"The jars were leftover samples from previous testing and contained some residual moisture within the specimens. The wet method of preparation was conducted by using the USACE blenderized technique. When blenderized, the samples dispersed and processed over the No. 40 sieve relatively easy. Clumping was not a problem with sample processing. When the slurry sample that passed the No. 40 sieve was placed on a Buchner funnel, it was pumped over a high density filter paper within a matter of hours. More difficult or fatter clay soils tend to take a complete day or multiple days to process over the filter paper, yet these samples processed faster than expected.*
>
> *Given the Silty classification of the soil, it should be relatively easy to fluidize, pump, and settle out these materials. The MH soils do hold some significant moisture; note the liquid limits. The as-received moisture of the samples was likely below that of the natural moisture due to long term storage, yet any drop in the collected moisture of these soils would not have affected the testing results."*

The results of these analyses, along with the behavior of the soils during test preparation, led to the conclusion that these soils should easily fluidize and mix during the dredging, pumping, and disposal process.

Predictive Modeling: After these results were presented to the PDT, the team examined a 1994 report on a study performed by the U.S. Army Engineer Waterways Experiment Station (currently known as the Engineer Research and Development Center (ERDC)). This report, titled "Hydraulically Transported Clay Balls," documented a study using manufactured soils and simulated testing to determine pertinent characteristics of soils in order to predict the rate of degradation of clay balls during pipeline transport. The researchers used manufactured laboratory samples to test the behavior of materials with different geotechnical properties and develop a predictive model of how sediments can be expected to respond during the process of hydraulic dredging.

The PDT observed that the materials used in the laboratory study are somewhat different from the SHEP in-situ samples (manufactured vs. in-situ), but it believes they possess sufficiently similar geotechnical properties that the predictive models can be useful to understand how the SHEP sediments are likely to behave.

The District applied ERDC's predictive models, to SHEP sample 87+000(E), which exhibits the highest plasticity index (PI) of the four sediment samples recently tested. Using ERDC's predictive models, the PDT believes that the SHEP sediments represented by sample 87+000(E) will fully slurrify during their transport through a dredge pipeline and would not deposit in the DMCA as a clay ball. The District's analysis is summarized in Table 6.

Table 6: Predictive Model for Rates of Degradation (from "Hydraulically Transported Clay Balls")

Line	Explanation of data	SHEP Sample		Study Samples	
		E-1	E-2	Example 1	Example 2
a.1	in-situ dry density	65.4	65.4	68	85
a.2	plasticity index	110	110	30	50
b.	maximum dry density (estimated)	94	94	85.2	85
c.	relative compaction [(a.1/b)*100]	69.574	69.574	78.812	100
d.1	pipe size (feet)	2.5	2.5	1.33	1.33
d.2	effluent pumping rate (fluid and solid - gal/min)	26,480	26,480	4,000	4,000
d.3	convert gal/min to cf/sec	59.00627	59.00627	8.913333	8.913333
d.4	material production (cy/hr)	1,708	1,708	200	200
e.1	pipe area (square feet)	4.909	4.909	1.389	1.389
e.2	effluent average velocity	12.02066	12.02066	6.415745	6.415745
e.3	material average velocity	2.609632	2.609632	1.079688	1.079688
f.	relative velocity	9.411028	9.411028	5.336057	5.336057
g.	degradation rate by PI, (%/min)	12.38	4.79	13	2.2
h.1	Pipeline length (feet)	23,000	23,000	1,000	600
h.2	pipe length divided by material velocity	8,813.502	8,813.502	926.1937	555.7162
i.	total material transport time, minutes	146.8917	146.8917	15.43656	9.261937
j.	total material degradation, % of initial mass	**1,819**	**704**	**201**	**20**

This analysis indicates that any clay balls within the SHEP sediments represented by sample 87+000(E) should degrade from 700 to 1,800% of their initial mass during their expected 23,000-foot transport to the DMCA.

As part of a risk assessment, the team used these formulas to calculate the minimum distance that these sediments could be pumped before 100% degradation occurs. That distance was determined to range between 1,264 and 3,268 feet, depending on the parameters used. This risk assessment show that clay balls would deteriorate in a much shorter pipe length, thus creating a significant safety factor in the expected 23,000 foot transport to the DMCA.

In addition, some characteristics of dredging that would lead to clay ball degradation are not included in ERDC's 1994 study: destructive actions of a chisel-toothed cutterhead, impacts with the impeller blades on the ladder pump, impacts with the pipeline due to bends and elbows, additional impacts with impeller blades on booster pumps, additional impacts with other materials within the pipe slurry, dragging of clay balls along the bottom of the pipeline, and the erosive effects of a sediment-laden fluid moving faster than the clay balls. Each of these phenomena would lead to greater degradation rates of any clay balls that may be excavated from the river bottom and pumped to a DMCA.

Table 7 summarizes key parameters for the SHEP samples that could be expected to lead to under estimation of degradation rates.

Table 7: Comparison of Parameters that Under Estimate Degradation

Parameter	SHEP Samples	Study Samples
Sample purity (% clay)	41.6 – 88.2	100
Sample density, relative compaction (%)	56 - 82 (Rc of 70 evaluated in predictive model due to highest PI)	80, 100
Natural moisture content (%)	47.4, 55.5, 57.2, 57.5	28.9, 30.5
Sample condition and shape	Hackly, random	Smooth, consistent
Simulation parameters	Will experience cutterhead, main pump, booster pump, pipeline bends, pipeline elbows, and slurry surge effects.	Evaluated degradation due to linear pipeline transport only.
Accumulative effects	Will be experienced throughout the dredging process.	Not experienced in predictive model.

Based on these additional levels of underestimation of degradation rates, there is a significant level of assurance that cadmium-laden clay balls from channel Stations 85+000 to 90+000 would not deposit in a DMCA as long as the pipe distance is more than 4,000 feet.[2]

2.1.4 Conclusion of Sediment Quantity Analysis

Table 8 and Table 9 present the conclusions of the District's recent Sediment Quantity Analysis. These evaluations conclude that 4.4 million CY bulked of cadmium-laden sediments from Station 24+000 to 31+000, 33+000 to 37+000, 41+000 to 45+00, and 53+000 to 55+000 (17,000 feet) should be disposed under the special management procedures (Figure 13).

If the quantity of cadmium-laden sediments is greater than approximately 5 million CY bulked, DMCA 14A and a portion of DMCA 14B would be required.

[2] Blue box stresses the importance of this items and it risk level.

Table 8: Conclusion of Sediment Quantity Analysis		
Method	**Conclusion**	**Recommendation**
Use 47 foot Authorized Channel Depth and 2014 survey	Using the 48-foot depth vs. 47-foot depth overstates the quantities. Use updated surveys.	District would use the dredging quantities based on the authorized 47-foot channel and updated channel surveys.
Use Weighted Averaging	Station 24+000 drops below the 14.0 ppm trigger, but still has a potential issue with clay ball production.	District proposes to use, but no effect on the quantity of sediments for special handling
Reduce level of Advanced Maintenance	There are two sample locations (Station 24+000 and 40+000) where reducing the advanced maintenance by 2 feet would eliminate sediment layers containing cadmium above 14.0 ppm.	District proposes to partially use. No Advance Maintenance depths would be changed because high shoaling rates require use of advance maintenance to effectively maintain navigation depths. Reexamination of the transition at Station 24+000 shows that downstream sediments would not need special handling
Reduction of Depth of Mixing	There are two sample locations (Stations 24+000 and 40+000) where reducing this disturbance depth would reduce the amount of cadmium-laden sediments that would be mixed with the cleaner upper layers. If the lower layer were not disturbed, the weighted average cadmium concentration for the whole sample may be below the 14.0 ppm threshold.	District proposes not to use. District Construction and Operations staff believe that a contract that limits the size of the dredge to below a 30-inch dredge is likely to result in significantly higher construction costs.
Clay Ball Analysis	Sediment samples from Stations 10+000, 52+000, and 56+000 are comprised of material that is less than 15% clays; therefore, they are not expected to form clay balls. Sediment samples from Stations 87+000 and 89+000 have layers that are more than 25% clay, but using the formula in the report titled “Hydraulically Transported Clay Balls” any clay balls that form would degrade over the 23,000 foot pumping distance.	District proposes to use. With the identification of Station 10+000, 52+000, and 56+000 as not likely to produce clay balls; Stations 87+000 and 89+000 as degrading any clay balls that may form if they are pumped more than 4,000 feet; and reexamination of the transition at Station 24+000, sediments between Stations 6+375 to 24+000 are identified as not requiring special handling
Reexamination of Stations 80+125 to 85+000	Station 83+000 was originally included as a site from which clay balls could have high cadmium levels. A reexamination of the cadmium concentration data eliminated this station because there is no layer over 14.0 ppm.	District proposes to eliminate this range from requiring special handling. Since the weighted average of this station is above 4.0 ppm, it would not be used as cover/cap material.

Table 9: Inner Harbor Cadmium Dredging (Designated for DMCA 14A Disposal)						
Beginning Station	**Ending Station**	**Length (feet)**	**Volume of Cadmium Sediments (cy)**	**Volume of O&M Sediments (cy)**	**Total Volume (cy)**	**Total Bulked Volume (cy)**
24+000	31+000	7,000	1,018,067	424,203	1,442,270	1,874,951
33+000	35+000	2,000	222,134	86,535	308,669	401,270
35+000	37+000	2,000	228,791	156,950	385,741	501,463
41+000	45+000	4,000	531,988	219,211	751,199	976,559
53+000	55+000	2,000	396,830	115,048	511,877	665,440
Total		**17,000**	**2,397,810**	**1,001,947**	**3,399,756**	**4,419,683**

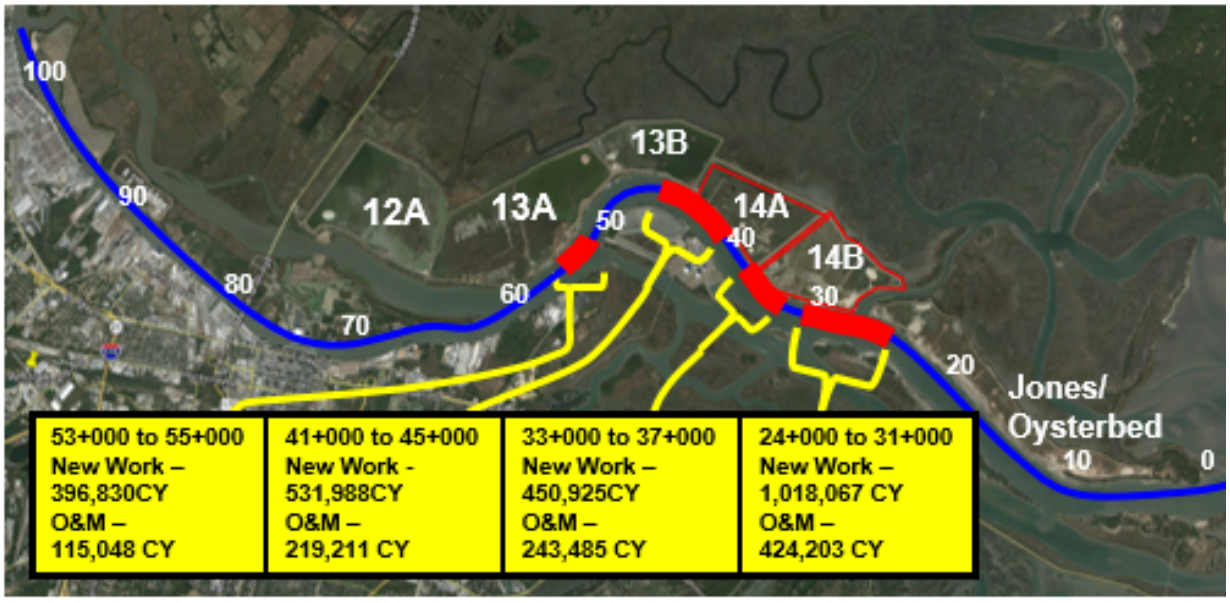


Figure 13: Approximate Location of Cadmium-laden Material Requiring Special Handling.

2.2 Cadmium Placement and Handling Measures

In response to the findings described in Section 1.2, a series of alternatives were developed that would either modify the sediment placement plan or strengthen the DMCA dikes. The overall goal of all the plans was to continue to meet the intent of isolating the cadmium-laden new work deposited sediments from contact with bird populations. This includes keeping the deposited sediment from drying until it is covered with cleaner sediments.

2.2.1 Initial Array of Alternatives

Table 10 describes ten alternatives the District considered in its initial array, as well as the rational for eliminating or carrying each alternative forward.

Table 10: Initial Screening of Alternatives			
Alternative	**Description**	**Eliminated**	**Rational**
Alternative 1 – No Special Handling	This alternative would use typical dredging and handling techniques for placement of all the SHEP new work sediments, including the cadmium-laden materials. The sediments would be placed in the closest DMCA. The deposited sediments would be allowed to dry out and would not be capped. Compensatory mitigation would be required for impacts to wildlife exposed to the cadmium-laden sediment.	Yes	This alternative does not meet the intent of the GRR/FEIS to limit contact with wildlife and would require compensatory mitigation. Larger numbers of wildlife would be exposed to the cadmium-laden sediments for a longer duration if they are not handled in a special manner and reused for dike raising material in all DMCAs. The cost of the mitigation has not been calculated at this time. This alternative was screened out based on the continued exposure of wildlife to cadmium and the expected high cost of mitigation.
Alternative 2/NAA – 2012 SHEP GRR/FEIS Selected Plan	This alternative is the sediment placement plan described in the 2012 SHEP GRR and FEIS and would place all cadmium-laden sediments in DMCAs 14A and 14B. The sediment would be deposited so that it remains covered with water until after placement of the cover/cap is complete. The cadmium-laden sediments would not be allowed to dewater and/or desiccate until after placement of the cover/cap.	No	After coordination with the dredging industry and additional information became available on the foundation and stability of the DMCA 14A and 14B dikes, CESAS Engineering determined that there would be a very high risk of dike failure if the new work sediments are deposited in the DMCAs as described in the GRR and FEIS. That failure risk is primarily the result of stability issues associated with the dike foundation. If this predicted failure occurs, cadmium-laden sediments would either flow into adjacent wetlands or into a river. This would violate existing environmental clearances for SHEP, as well as potentially flowing onto non-project lands. This alternative has a high risk of failure based on updated engineering analyses. If the failure occurs, there is a high potential for environmental and real estate damage to occur. This alternative is carried forward because it is the authorized alternative (No Action alternative).

Table 10: Initial Screening of Alternatives			
Alternative	**Description**	**Eliminated**	**Rational**
Alternative 3 – Modified DMCAs 14A and 14B Dike Design to Comply with GRR/FEIS	This alternative would place all cadmium-laden sediments in DMCAs 14A and 14B. The sediment would be deposited so that it remains covered with water until after placement of the cover/cap is complete. The cadmium-laden sediments would not be allowed to dewater and/or desiccate until after placement of the cover/cap. This alternative includes actions to improve the strength of the dike foundations. Due to the present low foundation strength, the dikes would have to be modified to be able to hold the required depth of water. This could be done by using staged construction to increase the width of the counterweight to the inside of the dike in combination with multi-layer geotextile. This would be followed by the dike raising using soil admixtures to improve strength. A geomembrane would be used on the inside slope of the dike and counterweight to stop erosion due to wave action and increase the seepage path. An alternative method to strengthen the dike would be the use of soil replacement methods for the unsuitable foundation materials. The method envisioned would be cased replacement due to issues with excavation of the existing foundation material. This would be followed by reconstruction of the dike/raising.	Yes	An initial cost for complete foundation improvements of DMCA 14A is $351M. The cost to improve the foundations at both DMCA 14A and 14B is estimated at $627M. The cost to perform this work at DMCA 14A is close to half the approved cost of the entire SHEP project. The cost would approach that of the entire project if work at both DMCA 14A and 14B are included. If only the back dike of DMCA 14A is strengthened and risk is assumed for the cross and front dikes, the cost would be reduced to $58M. The partial dike improvement alternative cost is approximately an order of magnitude above the originally estimated cost to raise the DMCA 14A dikes. The risk due to environmental impacts from failure of the cross and front dikes was determined to be lower and more than acceptable. This alternative should be screened out as not being viable due to cost, but is kept as a baseline for costs to implement inundation method described in the GRR/FEIS.
Alternative 4 - Pump Cd Material into Modified Geo-Textile Tubes	This alternative would use oversized geotextile tubes to contain all cadmium-laden sediments. The tubes would be located in DMCA 14A and would not require a cap due to the isolation provided by the geotextile. This alternative is based on a project by ERDC to contain contaminated sediments.	Yes	The geotube alternative was estimated to cost $283M for 8 mcy bulked of sediments and $600M for 17 mcy sediment bulked. This alternative was screened out as not being viable due to cost.

Table 10: Initial Screening of Alternatives			
Alternative	**Description**	**Eliminated**	**Rational**
Alternative 5 – Alternative Disposal Site – LNG or other sites not subject to mitigation	This alternative would use the LNG sediment disposal sites (Figure 1) across the Savannah River channel from DMCA 14A. The LNG facility has two disposal cells that total approximately 220 acres. The volume that could feasibly be placed in one cycle at LNG would be approximately 1.6-1.8 mcy bulked. Capping of the LNG cells or compensatory mitigation would not be required for impacts to wildlife because the LNG disposal areas are drained as soon as possible and are not operated to provide bird habitats.	Yes	Due to the small size of LNG sediment disposal sites, there would be limited sediment storage capacity. To fit all SHEP new work sediments material in the LNG site would require between 4 and 10 dike raises. That effort would far exceed the time line of the project and would significantly raise dredging costs. This alternative was screened out as not being viable due to the size of the area and cost.
Alternative 6 – Combination of LNG site and DMCAs 14A and 14B (to reduce quantity in DMCAs)	This alternative would use the LNG disposal sites as a supplemental site to reduce the sediment storage volume requirements at DMCAs 14A and 14B. Because of the low DMCA dike foundation strengths, Savannah District typically limits the height of a dike raising to 5 feet. Due to the desired limited construction time frame, performing the dredging and sediment deposition over many years to allow multiple dike raisings is not acceptable. Therefore, a scenario is needed that allows the dredging and sediment deposition to occur within a limited time frame. This alternative may allow for use of just DMCA 14A with only 2 dike raisings. Compensatory mitigation may be required for impacts to wildlife that are exposed to the cadmium-laden sediments that is not capped.	Yes	Use of the LNG sediment disposal sites may be viable if there is less than a million cubic yards of sediment remaining to be deposited after a first filling cycle of DMCA 14A or if DMCA 14A could be limited to one raising. Depending on the actual placement method (Alternative 1, 9 or 10) in the DMCAs mitigation, may or may not be needed. Fewer wildlife resources use the LNG disposal sites and those sites are drained as soon as sediments are deposited, resulting in minimal value of that site to birds. Therefore, no mitigation costs would be expected for SHEP use of those sites. Water quality standards require turbid water within a DMCA to be held until the clarity improves and any contaminants drop out. Due to the size and configuration of the LNG sediment disposal sites, the residence time of the water is short. Meeting the water quality standards with use of a 30-inch pipeline dredge may limit their productivity caused by periodic shutdowns to allow the sediments to sufficiently clarify. These shutdowns would significantly drive up the price of dredging the cadmium-laden sediments. This alternative was screened out due to potential water quality issues and cost.

Table 10: Initial Screening of Alternatives			
Alternative	**Description**	**Eliminated**	**Rational**
Alternative 7 – Offshore disposal (ODMDS)	This alternative would place the cadmium-laden sediments in the Savannah Ocean Dredged Material Disposal Site instead of in DMCAs 14A and 14B.	Yes	The placement of inner harbor new work sediments in the ODMDS was deemed unacceptable due to level of cadmium (0.04 ppm) in those materials. This alternative was screened out as not being viable due to environmental factors.
Alternative 8 – Placement in the Sediment Basin upstream of the weir and DMCAs 14A and 14B	This alternative would be to place the cadmium-laden sediments from Station 80+125 to 90+000 in the Sediment Basin instead of placing them in DMCAs 14A and 14B. A rock weir and fill area are planned as part of the Sediment Basin component of SHEP. Some sediments were already planned for placement in the area just upstream of the rock sill as part of SHEP and the remainder of the Sediment Basin would be allowed to fill through natural processes. This alternative would allow for the deposition of approximately 1.37 mcy bulked of the cadmium-laden sediments.	Yes	The sediments to be used as fill for the submerged berm in the Sediment Basin under SHEP are required to be 75% sand with cadmium levels below 0.04 ppm. Of the cadmium-laden sediments, only those near Station 10+000 meet the grain size standard. The placement of cadmium-laden sediments in the Sediment Basin was deemed unacceptable due both the percent grain size and their level of cadmium. This alternative was screened out as not being viable due to environmental factors.

Alternative 9 – Finger Dikes inside DMCAs 14A and 14B (Place and Cap by specified locations)	This alternative would use traditional dredging methods to place cadmium-laden sediments in the DMCA, but use finger dikes to keep the deposited sediment in specified areas that can be covered relatively quickly and kept wet. This approach would use a combination of geotextiles and earth fill to create 'finger dikes' within the DMCA as part of the 2nd required dike rising. These areas would essentially create smaller impoundment areas within the DMCA that could be worked and covered in smaller increments of time to limit exposure to the birds. Based on average production rates of the expected 30-inch pipeline dredge, 50-acre areas would require about two weeks to fill 5 feet deep and a 75-acre area would require about 3 weeks to fill to a 5 foot depth. Based upon the size of DMCA 14A, this alternative breaks the site into 10 cells, which would average 60-65 acres in size. These cells would be capped with clean sediment material as soon as possible. This alternative uses one dredge that would alternate between the cadmium-laden sediment the clean cap sediments. This alternative requires 2 moves of the dredge for each cell. The use of two dredges simultaneously one for the cadmium-laden sediment and one for the cap was considered, but determined to be too costly because one would be on standby for significant time. No bird abatement plan is included with this alternative. The PDT examined refinement opportunities to reduce overall exposure to the cadmium-laden sediments. The following methodologies were discussed: 1. Use low ground pressure bulldozers with GPS to allow movement of sediments deposited at the head section to minimize the time between pumping and leveling the sediments. 2. Use sprinklers on the areas where the sediments have been leveled until a permanent cover/cap can be placed. 3. Use a membrane over the leveled areas until a permanent cover/cap can be placed.	No	This alternative meets the intent of the GRR/FEIS to limit contact with wildlife. No additional mitigation (No Bird Abatement Plan) should be needed depending on the final construction methodologies selected. This alternative will be carried forward for further analysis.

Table 10: Initial Screening of Alternatives			
Alternative	**Description**	**Eliminated**	**Rational**
Alternative 10 – No Finger Dikes, Low Level Inundation, then Cover/Cap, with Wildlife Mitigation	This alternative would use typical dredging and handling techniques for placement of the cadmium-laden sediments in DMCAs 14A and 14B. The deposited sediments would be placed in single layers and be kept moist by placing stop logs in the weirs to maintain the water height just below the placement height of the dredged material. After sediment placement is finished within a DMCA, the height of the stop logs would be increased to entirely flood the site. This layer would then be capped with a clean (below 4.0 ppm) two foot cover/cap of material per the FEIS. Compensatory mitigation could be required for the impact to wildlife exposed to the deposited sediments during placement of the cadmium-laden sediment until flooding or covering occurs. If it is determined that flooding of the site after placement and before covering/capping cannot occur, the amount of compensatory mitigation would be greater due to the increased duration of impacts. During this process and prior to final covering/capping, various methods to reduce uptake of the cadmium by wildlife (Bird Abatement Plan) will be used. The cover/cap will come from new work material if available, but O&M sediments from the next dredging cycle (expected within 24 months) could supplement the new work cover.	No	This alternative meets the intent of the placement design approved in the GRR/FEIS to limit contact with wildlife. This approach provides the most efficient engineering placement methods without risking dike failure. Mitigation actions (Bird Abatement Plan) would be needed to minimize potential impacts to birds. The costs for that mitigation would depend on the amount of time the deposited sediments are available to wildlife. This alternative will be carried forward for further analysis.

2.2.2 Final Array of Alternatives

Two alternatives to the proposed action (Alternative 10) were considered in detail. These alternatives are: No-action (FEIS Plan), and the use of finger dikes (Alternative 9) to keep the deposited sediment in specified areas that can be covered relatively quickly and kept wet. The proposed action is Alternative 10 and is described in detail in Section 1.1 of this document.

2.3 No Action Alternative (FEIS Plan).

The NAA is the sediment placement plan described in the 2012 SHEP GRR and FEIS (FEIS Plan) in Section 5.04.2.2 of the FEIS, and Appendix M Section 7. The FEIS Plan would place all cadmium-laden sediments in DMCAs 14A and 14B. The sediment would be deposited so that it remains covered with water until after placement of the cover/cap is complete. The cadmium-laden sediments would not be allowed to dewater and/or desiccate until after placement of the cover/cap.

Due to the draft of the floating barge and its discharge equipment onboard, there is a need to hold 4-6 feet of water in the DMCA above the level of sediment placement. Both DMCAs 14A and 14B would have to be used in an attempt to reduce the risk of dike failure. In DMCA 14A, the counter weight, and back dike would have to be elevated. In DMCA 14B, the back dike would have to be elevated. The risk of dike failure would shift in time from when the cadmium sediments are deposited to when the covering/capping sediments are deposited stage if four feet of water is used. That shift would occur when the sediment and water level needed to float the barge for the head section reaches the top of the dike's counter weight. If the contractor uses six feet of water, the risk of failure would remain during placement of the cadmium-laden sediments.

2.4 Finger Dike Alternative (Alternative 9).

Under this alternative, finger dikes would be constructed to keep the sediment in specified areas that can be covered relatively quickly and kept wet. This approach would use a combination of geotextiles and earth fill to create 'finger dikes' within the DMCAs 14A and 14B as part of the 2nd required dike rising. These areas would essentially create smaller impoundment areas within the DMCAs that could be worked and covered in smaller increments of time to limit exposure to the birds. Based on average production rates of the expected 30-inch pipeline dredge, 50-acre areas would require about two weeks to fill 5-feet deep and a 75-acre area would require about 3 weeks to fill to a 5-foot depth. Based upon the size of DMCA 14A, this alternative would break the site into 10 cells, which would average 60-65 acres in size. These cells would be covered/capped with clean sediment material as soon as possible. This alternative assumes one dredge that would alternate between the cadmium-laden sediment and the clean covering/cap sediments. This alternative requires 2 dredge moves for each cell. No bird abatement plan is included with this alternative.

If sufficient sediment material is mined from inside DMCA 14A to build the finger dikes, there may be enough capacity for all of the cadmium-laden material to be placed in DMCA 14A. If not, both DMCAs will have to be used and covered/capped.

3.0 Affected Environment

3.1 General

The affected environment is described in detail in Section 4.0 of the FEIS. The method of dredging has not changed, therefore this document does not describe any of the resources that could be affected by the dredging operation.

Seven existing upland Confined Disposal Facilities (CDFs) are located along the northern border of the channel along much of its length. All of the CDFs are diked for deposition of dredged sediments; therefore, most of their terrestrial habitats are maintained in an early stage of succession. Salt marsh borders most of these CDFs and mainland in the project area. Additional information in this section describes the resources that could be affected by placement of sediments in DMCAs 14A and 14B (Figure 5) only. DMCA 14A and 14B are 815 and 765 acres in size, respectively.

3.2 Relevant Resources

This section contains a description of relevant resources that could be impacted by the project. The important resources described in this section are those recognized by laws, executive orders, regulations, and other standards of National, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. The following resources have been considered and found to not be affected by the alternatives under consideration: Bottomland Hardwood Forest, Water Bodies, Socio-Economic, Environmental Justice, and Recreational Resources.

3.2.1 Wetlands

Section 4.08 of the FEIS describes the wetlands found in the SHEP area. Estuarine emergent wetlands can be found adjacent to, but outside the northern dike of DMCAs 14A and 14B. Because of the use and management of DMCAs 14A and 14B, wetlands do not form on the inside of the dikes.

3.2.2 Aquatic Resources /Fisheries

The habitat for aquatic resources in DMCAs 14A and 14B are very limited and transient by the nature of what the area is used for and how it is managed. The benthic communities are early successional and typically do not develop into a productive and diverse community before they are dried out. The water column is primarily used by insect larvae. Reptiles (turtles and alligators) and amphibians (frogs and salamanders) can be found using flooded areas.

3.2.3 Essential Fish Habitat

Section 4.05 of the FEIS describes the Essential Fish Habitat (EFH) found in the SHEP area. EFH adjacent to DMCAs 14A and 14B are estuarine emergent wetlands, intertidal flats, and estuarine water column.

3.2.4 Terrestrial Resources

Section 4.07.4.1 of the FEIS describes the flora of the DMCAS. These are dominated by common reed (*Phragmites communis*), broundsel (*Baccharis halimifolia*), *Tamarisk* species, and other early successional species.

3.2.5 Wildlife

Section 4.07.4.2 to 4.07.4.7 of the FEIS describes the flora including birds of the DMCAS. The following is an updated list of migratory birds that have been seen in the DMCAs: American kestrel, American bittern, bald eagle, black rail, black skimmer, Chuck-will's-widow, common ground-dove, gull-billed tern, Henslow's sparrow, LeConte's sparrow, least bittern, lesser, yellow legs, loggerhead shrike, marbled, godwit, Mississippi kite, Nelson's sparrow, painted bunting, peregrine falcon, prairie warbler, prothonotary warbler, red knot, saltmarsh sparrow, seaside sparrow, sedge wren, short-billed dowitcher, short-eared owl, wallow-tailed kite, wimbrel, Wilson's plover, and wood thrush.

3.2.6 Threatened And Endangered Species

Section 4.09 of the FEIS describes the threatened and endangered (T&E) species that could be found in SHEP area. An updated list (Table 11) for DMCAs 14A and 14B was generated using the Information for Planning and Conservation (IPAC) website (https://ecos.fws.gov/ipac/). For information on the species visit the species profile in Table 11.

3.2.7 Cultural Resources

Section 4.10 of the SHEP FEIS defines the Area of Potential Effects for SHEP and also identifies previously disturbed areas that require no additional investigation. The existing dredged sediment placement sites are listed as previously disturbed requiring no further investigation. Justification for eliminating further work is based on the depth of overburden, which may be 30 feet or more.

Six historic sites have been recorded in the riverbank near DMCAs 14A and 14B. One site, a small flat boat, was determined potentially eligible for the National Register of Historic Places. There are no recorded sites within DMCA 14A or 14B, but the sites have high probability (Keith et al, 2010) to contain historic and prehistoric intact buried cultural horizons below the deposited dredged material based on research conducted for GA DOT in 2009. Researchers reviewed a 1937 aerial photograph of what is now DMCAs 14A and 14B and identified several possible hammocks across the area. Features within the disposal areas are similar to those where prehistoric sites have been recorded and DMCAs 14A and 14B are classified as having a high probability to contain historic and prehistoric intact buried cultural horizons below the deposited dredged material.

3.2.8 Air Quality

Section 4.03 of the FEIS describes the air quality found in the SHEP area. Jasper County, the location of DMCAs 14A and 14B, is in compliance with the National Ambient Air Quality Standard based on South Carolina Department of Health and Environmental Controls air quality website.

3.2.9 Water Quality

Section 4.02 of the FEIS describes the water resources found in the SHEP area.

Table 11: **Threatened and Endangered**					
Common Name	**Scientific Name**	**Status**	**Critical Habitat Designated**	**Species Profile**	**Found in or adjacent to DMCAs 14A and 14B**
Frosted Flatwoods Salamander	*Ambystoma cingulatum*	T	Y	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D013	Not documented in or adjacent to DMCA
Kirtland's Warbler	*Setophaga kirtlandii*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B03I	Not documented in or adjacent to DMCA
Pipping Plover	*Charadrius melodus*	T	Y	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B03I	Rare
Red-cockaded Woodpecker	*Picoides borealis*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B04F	Not documented in or adjacent to DMCA
Wood Stork	*Mycteria American*	T	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06O	Seasonally
Shortnose Sturgeon	*Acipenser brevirostrum*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E00B	In river adjacent to DMCAs
Atlantic Sturgeon	*Acipenser Oxyrinchus oxyrinchus*	E	Proposed	http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E0A7	Not documented in or adjacent to DMCA
American Chaffseed	*Schwalbea americana*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2I4	Not documented in or adjacent to DMCA
Canby's Dropwort	*Oxypolis canbyi*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2EL	Not documented in or adjacent to DMCA
Pondberry	*Lindera melissifolia*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2CO	Not documented in or adjacent to DMCA
West Indian Manatee	*Trichechus manatus*	E	Y	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A007	In river adjacent to DMCAs
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	N	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C00O	Not documented in or adjacent to DMCA
Leatherback seat turtle	*Dermochelys coriacea*	E	Y	http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C00F	Not documented in or adjacent to DMCA

4.0 ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of SHEP are described in Section 5.00 of the FEIS. There are no change in impacts from dredging, placement of non-cadmium-laden sediments or any of the approved mitigation features.

4.1 Wetlands

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), there is a high risk of direct impact to adjacent wetlands if the dike fails due to the method of placement. Up to 4.4 MCY of cadmium-laden sediments and approximately 2,000 acre feet of water would flood out of the DMCAs and cover existing wetlands. Approximately 250 acres of wetlands could be covered with sediment, ranging in thickness from a few inches up to 5 feet. This is a change from what is in Section 5.01 of the FEIS where the placement of dredged sediments in a DMCA did not impact wetlands. If recovery of the cadmium-laden sediments is deemed necessary, additional impacts to wetlands could occur during clean up.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of either the Finger Dike Alternative or the proposed action, no additional impact to wetlands will occur. This is consistent with the impacts that were described for the plan selected in the FEIS.

4.2 Aquatic Resources/Fisheries

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), there is a high risk of direct impact and indirect impacts to aquatic resources using the wetlands next to the dike if that dike fails as a result of the sediment placement. Some aquatic species would be buried, while others would be displaced. The temporary turbidity plume would impact filter feeding mollusks and sight feeding fish. This is a change from what is in Sections 5.03 and 5.17 of the FEIS, where the placement of dredged sediments in a DMCA was not expected to adversely impact aquatic resources and fisheries.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of the Finger Dike Alternative or the proposed action, the impact to aquatic resources would be the same as those described for plan selected in the FEIS. There is a low risk of direct or indirect impacts to aquatic resources using the wetlands next to the dike since dike failure is not expected.

4.3 Essential Fish Habitat

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS (NAA), there is a high risk of direct impact to adjacent EFH (Estuarine Emergent Wetlands, Intertidal Flats, and Estuarine Water Column). The existing estuarine Emergent Wetland and Intertidal Flats could have an additional 5 feet of sediment placed on them if a dike fails. The existing marsh elevation adjacent to the back dike of DMCA 14A and 14B ranges in height from approximately 5 feet to -2 feet Mean Low Water (MLW). Depending on the amount and volume of sediments that escape, and where it settles, some of the wetlands could be above the normal high tide (8 feet MLW), but would be expected to be below the Spring High tide (10 feet MLW). This could reduce the amount of EFH long term. The impact to Estuarine Water Column from the turbidity plume would be temporary and would last only a few tidal cycles. This is a change from what is in Section 5.14 of the FEIS, where the placement of dredged sediments in a DMCA was not expected to adversely impact EFH.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of the Finger Dike Alternative or the proposed action, the impact to EFH would be the same as those described originally for the plan selected in the FEIS (Table 4-7 and Section 5.14). There would be a low risk of direct or indirect impacts to EFH using the wetlands next to the dike, since dike failure is not expected.

4.4 Terrestrial Resources

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), there are no expected impacts to terrestrial resources since the area adjacent to the northern dikes are is wetlands.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of the Finger Dike Alternative or the proposed action, the impact to Terrestrial Resources would be the same as those described for the NAA.

4.5 Wildlife

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), wildlife using the northern dikes or adjacent wetlands could be directly impacted if water and sediment is released from a DMCA suddenly through a breach. They could also be impacted indirectly in the short term if they are temporary displaced from the wetlands adjacent to the dike. There could be a long term impact to wildlife from species feeding on the released cadmium-laden sediments. This is a change from what is in Sections 5.04 and 5.08 of the FEIS where the placement of dredged sediments in a DMCA was expected to have minimal impact on wildlife.

Future Conditions with the Finger Dike Alternative

With implementation of the Finger Dike Alternative, the impact to wildlife would be similar to those described for the plan selected in the FEIS (Section 5.11). There is a slightly higher risk that wildlife could bioaccumulate cadmium in their system since the entire area will not be flooded and each cell would be covered/capped after filling. These impacts will be mitigated by keeping the area moist.

Future Conditions with the Proposed Action

With implementation of the proposed action, the impact to Wildlife would be the similar to those described for the plan selected in the FEIS (Section 5.08.4.2 and 5.08.4.3). There is a slightly higher risk that wildlife could bioaccumulate cadmium in their system since the area would not be fully flooded until after completion of the sediment placement. These impacts would be mitigated by keeping the DMCA moist, and using bird abatement during the sediment placement operations. After the initial placement of the cadmium-laden sediments, the deposition area would be flooded with a small amount of water, which will reduce the risk to wildlife back down to the level described in FEIS.

4.6 Threatened and Endangered Species

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), T&E species (piping plover and wood stork) using the northern dikes or adjacent wetlands could be directly impacted if water and sediment are released suddenly from a DMCA through a breach. They could also be indirectly impacted in the short term if they are temporary displaced from wetlands adjacent to the dike. There would be a long term adverse impact to T&E species that feed on the (uncovered) released cadmium-laden sediment. There would be a high potential to bioaccumulate the cadmium in to their system. This alternative would require formal consultation with the U.S. Fish and Wildlife service. This is a change from what is in Section 5.11 of the FEIS where the placement of dredged sediments in a DMCA resulted in a determination that the project “may affect, but is not likely to adversely affect” T&E Species or their critical habitat.

Future Conditions with the Finger Dike Alternative

With implementation of the Finger Dike Alternative, the impact to T&E Species (piping plover and wood stork) would be the similar to those described for the original Selected Plan in the FEIS (Section 5.11). There is a slightly higher risk that these birds could bioaccumulate cadmium in their system since the DMCA would not be flooded and each cell would be covered/capped after filling. These impacts will be mitigated by keeping the DMCA moist. This document serves as an update to the existing Biological Assessment (Appendix B of the FEIS). This updated assessment concludes that this

alternative, “may affect, but is not likely to adversely affect” Piping plover, Wood stork, or their critical habitat.

No change is expected in impacts to T&E Species or their critical habitat that are under the jurisdiction of the National Marine Fisheries Service.

Future Conditions with the Proposed Action

With implementation of the proposed action, the impact to T&E Species (piping plover and wood stork) would be the similar to those described for the plan selected in the FEIS (Section 5.11). There is a slightly higher risk that these birds could bioaccumulate cadmium in their system since the DMCA would not be fully flooded until after completion of the sediment placement. These impacts would be mitigated by keeping the DMCA moist, and using bird abatement during the sediment placement operations. After the initial placement of the cadmium-laden sediments, the DMCA would be flooded with a small amount of water, which will reduce the risk back down to the level described for the selected plan in FEIS. The risk to wildlife would be lower than for the finger dike alternative.

This document serves as an update to the existing Biological Assessment (Appendix B of the FEIS). This updated assessment concludes that this alternative as currently proposed, “may affect, but is not likely to adversely affect” Piping plover, Wood stork, or their critical habitat.

No change is expected in impacts to T&E Species or their critical habitat that are under the jurisdiction of the National Marine Fisheries Service.

4.7 Cultural Resources

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), there are no expected impacts to cultural resources if a breach occurs since there are no known cultural sites adjacent to the northern dike of DMCAs 14A or 14B.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of the Finger Dike Alternative or the proposed action, the impact to cultural resources would be the same as those described for the Selected Plan in the FEIS (Section 5.12). The dredge pipe will be placed outside of the site boundary on the riverbank to avoid impacting the site discussed in Section 3.2.7 (small boat). The 2009 Research recommended conducting archival research to find evidence of historic structures and then conducting geoprobe coring to identify buried surfaces. Archaeological monitoring of ground-disturbing activities was recommended in addition to conducting annual bank surveys.

Placement of cadmium sediments within DMCA 14A would not preclude the use of a geoprobe. The sediment recovered with the probe would be placed in a sealed tube which would prevent contact with wildlife. If the hole does not self-seal, then adjacent sediments would have to be placed in it.

4.8 Air Quality

Future Conditions with No Action (FEIS Plan), the Finger Dike Alternative, and the Proposed Action

With implementation of the any of the final three alternatives, the impact to Air Quality would be the same as those described for the plan selected in the FEIS (Section 5.06). None of these alternatives would cause an increase in greenhouse gases.

4.9 Water Quality

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), there is a high risk of direct adverse impact to water quality if a breach in a dike occurs. Impacts to water columns from the turbidity plume would be temporary and would only last through a few tidal cycles. Violation of a Dissolved Oxygen or other water quality standard could occur, depending on conditions in the DMCA and receiving waters at the time of the breach. This is a change from what is in Section 5.02 of the FEIS where the placement of dredged sediments in a DMCA was not expected to impact water quality.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of the Finger Dike Alternative or the proposed action, the impact to water quality would be the same as those described for the plan selected in the FEIS (Section 5.02).

4.10 Cumulative Impacts

The Council on Environmental Quality's (CEQ) regulations (40 CFR 1500-1508) implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.) define cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7)". Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time."

Future Conditions with No Action (FEIS Plan)

With implementation of the FEIS Plan (NAA), there could be an increase in cumulative impacts if a breach in a dike occurs, beyond those described in the FEIS. The release of cadmium into the ecosystem would add to the existing cadmium that can be found in the surrounding area. Cadmium found in blood, gizzard contents and on-site potential

prey (preconstruction monitoring http://www.shep.uga.edu) indicate that cadmium is currently bioavailable to birds that forage at the DMCAs and nearby sites. Analyses of kidney and liver tissues from avifauna at the DMCAs indicate that these species are being exposed to and accumulating cadmium from some location used in their life history.

Future Conditions with the Finger Dike Alternative or the Proposed Action

With implementation of the Finger Dike Alternative or the proposed action, there should be no change in cumulative impacts from those described for the plan selected in the FEIS (Appendix L of FEIS).

5.0 COORDINATION (Relevant agencies)

Preparation of this EA and draft Finding of No Significant Impact (FONSI) is being coordinated with appropriate Federal, state, and local interests, as well as environmental groups and other interested parties. Federal and state agencies and NGO's that will be contacted during the evaluation or that will receive a copy of the EA for review follows:

U.S. Department of Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. Department of Commerce, National Marine Fisheries Service
Natural Resources Conservation Service, State Conservationist
Advisory Council on Historic Preservation
S.C. Department of Health and Environmental Control
S.C. Department of Natural Resources
S.C. Historic Preservation Officer

Recommendations of the U.S. Fish and Wildlife Service that are received in accordance with the Fish and Wildlife Coordination Act will be considered and addressed in the final EA.

6.0 MITIGATION

The appropriate application of mitigation is to formulate an alternative that first avoids adverse impacts, then minimizes adverse impacts, and lastly, compensates for unavoidable impacts.

The proposed action (Alternative 10) avoids adverse impacts by:

1. Requiring pumping distance to be greater than 4,000 feet to allow for 100% degradation of any clay balls from certain reaches of the channel.
2. Keeping the DMCA flooded between sediment placements and final covering/capping.
3. Capping the deposited cadmium-laden sediments with clean sediment.

4. Restricting future use of the cadmium-laden sediments (and covering/capping sediments) that are deposited in DMCAs 14A and 14B.

The proposed action minimizes adverse impacts by:

1. Reducing the risk of dike failure.
2. Keeping the cadmium-laden sediments moist until they are covered/capped to reduce bioavailability.
3. Using bird abatement to reduce the time that birds feeding in DMCA 14A and 14B during sediment placement could be exposed to sediments with elevated cadmium levels.

Compensatory mitigation is not warranted for the potential impacts to wildlife that may be exposed to the deposited cadmium-laden sediments until those sediments are flooded and covering/capping occurs. If it is determined that flooding of the site immediately after sediment placement and before covering/capping cannot occur, compensatory mitigation would be required. During the sediment deposition process and prior to final covering/capping, the District would use various methods (Bird Abatement Plan) to reduce the potential uptake of cadmium by wildlife.

7.0 COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

7.1 Existing Environmental Evaluations and Approvals That Do Not Require An Update

The following environmental evaluations and compliances would not change from what is in the FEIS due to the proposed action and do not require an update:

1. The Section 404(b)(1) (Appendix H of the FEIS) - no additional fill would be placed in the waters of the US.
2. Air Quality (Appendix K of the FEIS) – no significant change in equipment would be used or an increase in their hours of operation.
3. Section 401(Appendix Z of the FEIS) - no additional fill would be placed in the waters of the US, no additional dredging, the method to control water quality in DMCA would not change.
4. Coastal Zone Management Act (Appendix J of FEIS) - no additional fill would be placed in the waters of the US, no additional dredging, dredged material placement would still occur with the existing DMCAs.

7.2 Environmental Compliances Requiring An Update

Environmental compliance for the proposed action would be achieved upon the following actions:

- Coordination of this EA and draft Finding of No Significant Impact (FONSI) with appropriate agencies, organizations, and individuals for their review and comments;

- U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) confirmation that the proposed action would not be likely to adversely affect any endangered or threatened species or their critical habitat;
- Receipt from the State Historic Preservation Officer in their concurrence in the District's Determination of No Effect on cultural resources;
- Receipt and acceptance or resolution of all USFWS Fish and Wildlife Coordination Act recommendations; and
- Receipt and acceptance or resolution of all NMFS Essential Fish Habitat recommendations.

The proposed action would not be implemented until the action achieves full environmental compliance with applicable laws and regulations, as described above.

Table 12: Compliance of the Proposed Action with Executive Orders

Executive Orders	Number	Compliance Status
Equal Opportunity	11246	In Compliance
Protection and Enhancement of Environmental Quality	11514/11991	In Compliance
Protection and Enhancement of the Cultural Environment	11593	In Compliance
Convict Labor	11755	In Compliance
Floodplain Management	11988	In Compliance
Protection of Wetlands	11990	In Compliance
Federal Compliance with Pollution Control Standards	12088	In Compliance
Environmental Effects Abroad of Major Federal Actions	12114	In Compliance
Federal Compliance with Right-To-Know Laws and Pollution Prevention	12856	In Compliance
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	12898	In Compliance
Implementation of the North American Free Trade Agreement	12889	In Compliance

Table 12: Compliance of the Proposed Action with Executive Orders		
Executive Orders	**Number**	**Compliance Status**
Energy Efficiency and Water Conservation at Federal Facilities	12902	In Compliance
Federal Acquisition and Community Right-To-Know	12969	In Compliance
Protection Of Children from Environmental Health Risks and Safety Risks	13045	In Compliance
Environmental Justice	12898	In Compliance
National Invasive Species Council	13112	In Compliance
Responsibilities of Federal Agencies to Protect Migratory Birds	13186	In Compliance

8.0 CONCLUSION

The proposed action (Alternative 10) consists of (1) refining the channel reaches that contain naturally-occurring cadmium at levels that require special handling, and (2) keeping the deposited cadmium-laden sediments moist in DMCAs 14A and 14B by maintaining the water height in the DMCA just below the elevation of the deposited dredged sediment (limited to 6”-12”). Savannah District has assessed the environmental impacts of the proposed action and determined that the proposed action would have no additional impact to wetlands, aquatic resources, EFH, terrestrial resources, air quality, cultural resources, water quality, or cumulative impacts than those described for the plan selected in the FEIS. The impacts to wildlife and T&E species would be the similar to those described in the FEIS. There is a slightly higher risk that wildlife could bioaccumulate cadmium in their system since the DMCA will not be fully flooded until after completion of the sediment placement. These impacts will be mitigated through bird abatement. This updated assessment concludes that the proposed alternative, “may affect, but is not likely to adversely affect” Piping plover, Wood stork, or their critical habitat.

9.0 PREPARED BY

This EA and the associated draft FONSI were prepared by Nathan Dayan, biologist, with relevant sections prepared by: Julie Morgan - Cultural Resources; Laurie Sattler - Project Manager; Laura Williams and Tracy Hendren – Engineering; and Matthew Delano – Geology. The address of the preparers is: Savannah District, U.S. Army Corps of Engineers, 100 West Oglethorpe Avenue, Savannah, Georgia 31401-0889

10.0 REFERENCES

Seramur, Keith C., Daphne Owens, Daniel E. Battle, Michael O'Driscoll, Anthony Love, John T. Thacker, and Jim Pomfret 2010 Archival Research and Geoarchaeology Investigation to Prepare a Cultural Resource Management Plan for 12,000 Acres Between Wright River and the Mouth of the Savannah River, Jasper County, South Carolina. Report prepared for Georgia Department of Transportation.

DRAFT FINDING OF NO SIGNIFICANT IMPACT (FONSI)
SAVANNAH HARBOR EXPANSION PROJECT
(Excavation and Placement of Cadmium-Laden Sediments)

Chatham County, Georgia and Jasper County, South Carolina

1. Description of Proposed Action: The Savanah District, U.S. Army Corps of Engineers, Savannah District (CESAS), proposes placement of approximately 4.4 million cubic yards (CY) bulked of cadmium-laden sediments in Dredged Material Containment Area (DMCA) 14A in a moist (inundated) but not flooded condition, with additional placement in DMCA 14B if needed, as part of the Savannah Harbor Expansion Project (SHEP). This proposed action modifies what is described in the July 2012 Final Environmental Impact Statement (FEIS) for SHEP and the October 2012 Record of Decision (ROD). The FEIS and ROD are incorporated herein by reference. There would be no change in the 14 mg/kg criteria to be used for special handling of cadmium-laden sediments, or the method or timing of the dredging. DMCA 14A would be flooded after placement of any excavated sediments until they are subsequently covered, as described in the FEIS. The placement of the cadmium-laden sediments may require multiple contracts over multiple years. The cadmium-laden sediments would be kept moist by placing stop logs in the cross dike weirs between DMCAs 14A and 14B to maintain the water height just below the height of the deposited dredged sediments (limited to 6”-12”). This saturation level will limit the cadmium mobility, while allowing the sediments to be worked with equipment as it is placed, and limiting wildlife exposure. As the sediment material is pumped into the DMCA, it will be pushed into the flooded portion of the site, similar to beach nourishment or island creation projects. Several methods could be employed to reduce the use of an individual DMCA by wildlife during the construction period in order to reduce their risk of exposure. These measures are described in the Supplemental Environmental Assessment (SEA). The volume of sediments required for the initial cover/cap is approximately 2 MCY. The cover/cap will come from new work sediments. If additional sediments are required for the cover/cap, sediment could be obtained from the next O&M cycle which is expected within 24 months. New work sediments from Stations 0+000 to 24+000 have been identified as a suitable source for cover/cap material. In lieu of a visible marker placed across the DMCA, a georeferenced elevation would be determined to identify the depth below which no future disturbance would be allowed. If work is ever required below this depth, a protocol to prevent wildlife exposure to the sediment and a method to re-cap the site would have to be included in the work plan.

2. Factors Considered in Determination: CESAS has assessed the impacts of the proposed action on important resources, including wetlands and aquatic resources/fisheries, terrestrial resources, wildlife, threatened, endangered and protected species, cultural, air quality, and water quality. No significant adverse impacts were identified for any of the important resources with the proposed placement design. The risk of encountering HTRW is low. No impacts were identified that would require compensatory mitigation. The proposed action does not change the impact on the

Coastal Zone, air quality, and water quality from those described in the FEIS. No additional fill would be placed in the waters of the US, therefore, an update to the Section 404(b)(1) Evaluation and existing Section 401 approvals are not required. CESAS will concur with, or resolve, all Fish and Wildlife Coordination Act recommendations. The District will concur with, or resolve, all comments provided by Federal and state agencies and the public. The impact to Essential Fish Habitat would be the same as those described for the Selected Plan described in the FEIS.

3. Environmental Design Commitments. The following commitments are an integral part of the proposed action:

1. If the proposed action is changed significantly or is not implemented within one year, Savanah District will reassess potential impacts to Federally-listed threatened or endangered species, and their critical habitat to ensure no adverse impacts would occur.

2. If any unrecorded cultural resources are determined to exist within the proposed project boundaries and ground disturbance is required, no excavation would occur at the site containing the cultural resource until a Savanah District staff archeologist has been notified and additional coordination with the State Historic Preservation Officer has been completed.

3. The minimum distance that the cadmium-laden sediments from Stations 85+000 to 90+000 will be pumped is 4,000 feet to allow for 100% degradation of any clay balls.

4. Bird abatement will be used to reduce the time that birds feed in DMCA 14A and 14B during sediment placement.

5. The site will be kept moist during sediment placement to reduce the bioavailability of the cadmium.

6. Water quality testing would still be performed as described in the FEIS.

7. After placement of the cadmium-laden sediments, the DMCA would be flooded (the deposited cadmium-laden sediments would be covered) while awaiting placement of additional cadmium-laden sediments or the cover/cap.

8. The deposited cadmium-laden sediments would be capped with a clean (below 4.0 ppm) two-foot cover/cap of sediment materials. The requirements for the cover/cap material and the required testing would be performed as described in the FEIS.

9. A restriction would be in placed on future construction activities using material from DMCA 14A.

4. Public Involvement. An interagency meeting was held on 25 October 2016. During this meeting, the natural resource agencies were briefed on the alternative placement concept described herein. The proposed action will also be coordinated with other appropriate Federal, state, and local agencies and businesses, organizations, and individuals through distribution of a draft SEA for their review and comment.

5. Conclusion. CESAS has assessed the potential environmental impacts of the proposed action. Based on this assessment, a review of the comments made on the SEA, and implementation of the environmental design commitments listed above, CESAS could concluded that the proposed action would not result in a significant impact on the human environment. Therefore, an Environmental Impact Statement will not be prepared.

Draft

Date

Marvin L. Griffin
Colonel, U.S. Army
Commanding