Innovative approaches
Practical results
Outstanding service

WHITE ROCK LAKE
DREDGING FEASIBILITY STUDY

Prepared for:

Dallas Park & Recreation

dallas water utilities
city of dallas

September 2020

Prepared by:

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Fort Worth, Texas 76109
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DREDGING FEASIBILITY STUDY

Prepared for:

City of Dallas Park and Recreation

and

Dallas Water Utilities

STATE OF TEXAS
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LICENSED
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09/30/2020

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DWU19688

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EXECUTIVE SUMMARY

Freese and Nichols (FNI) was hired by the City of Dallas Park and Recreation Department (DPR) and the Dallas Water Utilities Department (DWU) to perform a dredging feasibility study for White Rock Lake. White Rock Lake and White Rock Dam are owned by the City of Dallas and are operated and maintained by DWU. However, White Rock Lake Park, a 757-acre public park encompassing the shoreline and several open spaces surrounding the lake, is operated and maintained by DPR.

The purpose of this study was to evaluate in detail alternative dredging scenarios to remove accumulated excess sediment in the lake. Areas for dredging were selected based primarily on the goal to restore lake depth to allow for sailing and boating recreation in the north portion of the lake and two additional inlets on the west side used for launching boats and kayaks. The minimum water depth needed for safe passage of sailboats and other watercraft was established as 8 feet. Stakeholder input received at the initial public meeting (January 28, 2020) guided some of the delineations for areas to dredge and exclude. Input from DPR staff was used to identify other areas of maintenance concern.

Sediment survey point data was obtained from the 2015 Texas Water Development Board (TWDB) Volumetric and Sedimentation Survey. The total accumulated sediment volume in the lake at the time of the survey was calculated to be 3,550 acre-feet (5,728,000 cubic yards). An estimate of sedimentation rate was also performed based on various data points to estimate the time between dredge operations needed to establish an annual dredge volume to meet the goals of a maintenance dredging program. The sedimentation rate was estimated to be approximately 170,000 cubic yards per year.

Several dredging operations are presented in this report for comparison and consideration. Estimated project costs are demonstrated in this report as both upfront capital costs as well as annualized costs over a 50-year analysis period. The approach the City has historically taken to dredging at White Rock Lake is presented as a base scenario to compare the benefits and costs of alternative dredging scenarios. Four alternatives to this baseline scenario have been developed to demonstrate different approaches the City can take to implement a proactive dredging program to meet their goals and objectives for the lake. It is recommended that the City scale the approach to meet budget and staff resource constraints.

The City's historical approach is to dredge the lake every 20-25 years to remove accumulated sediment and restore lake depth. The estimated upfront cost of the City's baseline scenario is \$50 - \$88 million per project, with an estimated annualized cost ranging from \$3.0 to \$5.3 million. This dredging approach has historically not been enough to keep up with sedimentation and maintain the lake at the minimum 8-foot depth needed for recreation. Alternatives were developed for this report with the primary goal of restoring the recreational depth and performing dredging at a scale and frequency sufficient to maintain this threshold. The alternatives to this baseline scenario presented in this report include:

1. More frequent periodic dredging at 12-year intervals to maintain the capacity of the lake needed for boating. The upfront cost of the initial dredge operation ranges from $50 to $88 million, followed by a recurring cost ranging from $32 to $56 million every 12 years. This equates to an annualized cost between $3.6 and $6.3 million for the program over a 50-year period.

2. A single dredging capital project to restore lake depth, and annual maintenance dredging to remove additional accumulated sediment and maintain the lake level above the threshold capacity for boating. The upfront cost of the initial dredge operation ranges from $19 to $34 million, followed by a recurring cost ranging from $3.9 to $6.0 million for each of the following years. This equates to an annualized cost between $4.2 and $6.7 million for the program over a 50-year period.

3. Annual small dredging projects to restore lake depth over the course of 13 years, followed by annual maintenance dredging to remove additional accumulated sediment and maintain the lake level above threshold capacity for boating. This program assumes a cost ranging from $6.6 to $12 million for each of the first 13 years, and a cost ranging from $3.9 to $6.0 million for each year thereafter, for a total annualized cost between $4.5 and $7.4 million over the 50-year evaluation period.

4. An upfront dredging capital project to restore lake depth, followed by enhanced maintenance dredging every three years to extend the time between large dredging projects and limit impacts to recreation. Repeated capital dredging projects would need to be performed approximately every 20 years. This program assumes a cost ranging from $35-$88 million upfront and every 20 years, with a recurring cost of $7 to $12 million every 3-years, for a total annualized cost between $4.4 and $8.5 million over the 50-year evaluation period.

These alternatives are summarized below in **Table ES-1** below.

Table ES-1 : Dredging Alternatives Summary

Dredging Scenario	Years with Recreation Impacts After Initial Dredge	Total Volume Dredged (CY)	Total Cost (Millions – 2020 $)	Annualized Cost (Millions – 2020 $)	Annualized Cost per CY Sediment (2020 $)
Baseline	16	9,600,000	150 – 265	3.0 – 5.3	$0.31 – $0.55
Alternative 1	0	11,200,000	178 – 314	3.6 – 6.3	$0.32 – $0.56
Alternative 2	0	9,480,000	208 – 333	4.2 – 6.7	$0.44 – $0.70
Alternative 3	13	9,460,000	226 – 370	4.5 – 7.4	$0.48 – $0.78
Alternative 4	0	10,850,000	218—423	4.4—8.5	$0.41 – $0.78

Additionally, the installation of a sediment forebay upstream of White Rock Lake was evaluated as a potential alternative to prevent sediment accumulation in the lake itself. Based on initial estimates, the forebay would require a footprint of over 120 acres. The potential site contains protected wetlands and waters of the United States (WOTUS) in the jurisdiction of the United States Army Corps of Engineers (USACE). The environmental impacts associated with the construction of a sediment forebay over this area are likely to render the project infeasible.

Before work can begin, permits must be received from the appropriate regulatory entities. However, method of dredging, dewatering location, and a disposal site must all be identified and approved as part of the permitting process. Several options for each of these elements are presented in the report. At the time of this initial screening, the most likely dredging scenario is a hydraulic dredge operation which pumps slurry material directly to an offsite dewatering and disposal location. The alternative scenarios presented in this report are not meant to represent an exhaustive list of options for dredging operations at White Rock Lake, but the data and techniques developed for this report serve as a decision-making tool to explore implementation scenarios and determine the best use of the City’s resources as they apply to a recreational dredging operation.

Greater project definition is needed to refine the cost estimates and pursue appropriate project funding. The City may consider developing a Preliminary Engineering Report (PER) to further define the dredge project based on additional information gathered. The overall cost of dredging projects and identification of a viable funding source is the most significant obstacle that could prevent the implementation a dredging program of this magnitude at White Rock Lake. Costs of storage and disposal of dredge material is anticipated to be significant, thus the City should seek to identify a low-cost disposal option or potential reuse application.

The thoughtful implementation of a dredging program will be critical to maintain White Rock Lake as a valuable recreational destination in the City of Dallas. Public involvement has been a key component of this feasibility study largely contributed to the success of previous dredging operations. FNI recommends that the City continue to engage the appropriate stakeholders and evaluate potential funding sources during budget planning to decide on a path forward.

1.0 INTRODUCTION

Freese and Nichols (FNI) was hired by the City of Dallas Park and Recreation Department (DPR) and the Dallas Water Utilities Department (DWU) to perform a dredging feasibility study for White Rock Lake. The purpose of this study was to evaluate in detail alternative dredging scenarios to remove accumulated excess sediment in the lake. Currently, operation of watercraft is severely impacted by sediment in the north portion of the lake, and various stakeholder groups have requested that the City undertake this study as the first step towards developing a project to enhance recreation in the lake and the surrounding White Rock Lake Park.

Over the course of its century long history, sediment management in White Rock Lake has been performed through large dredge operations to remove accumulated sediments every 20-25 years. As part of this study, FNI evaluated the implementation of an annual preventative maintenance dredging program as a method to maintain effective use of the lake after the undertaking of another large dredging operation. Additionally, FNI evaluated the feasibility of the installation and operation of a sediment forebay to collect sediment from the tributary watershed and prevent deposition in the lake itself.

The overall purpose of the report is to provide a decision-making tool for DPR and DWU staff moving forward to evaluate the many costs and additional considerations associated with a dredging project of this magnitude. The cost estimates in this report are considered preliminary. This is due to many aspects of this project being undetermined at this time, particularly the identification of a location for dewatering and permanent disposal of dredge material. However, this report does provide a range of alternatives and costs given likely implementation scenarios.

2.0 BACKGROUND INFORMATION

White Rock Lake was formed by the impoundment of water on White Rock Creek, a tributary of the Trinity River, by the construction of the White Rock Dam in 1910. White Rock Lake is located in Dallas County, within the city limits of Dallas, Texas, approximately 5 miles northeast of downtown. The City of Dallas exclusively owns the water rights for the lake. The lake and dam are owned by the City of Dallas and are operated and maintained by DWU. However, White Rock Lake Park, a 757-acre public park encompassing the shoreline and several open spaces surrounding the lake, is operated and maintained by DPR. A vicinity map of White Rock Lake is provided as **Figure 2-1**. The lake was initially built for water supply storage for the City of Dallas. However, by 1926, the water demand in the city exceeded the capacity of the lake. In 1929, construction of Lewisville Lake was completed to serve as additional water supply for the city. Since that time, the primary use of White Rock Lake has been recreation.

2.1 Goals and Objectives

The lake has experienced an accumulation of sediment since it was last dredged in 1998. The 2013 Comprehensive Dredge Management Plan (CDMP) addresses 100 lakes, sumps, and detention/retention basins throughout the City of Dallas and developed a maintenance dredging program for each site. White Rock Lake was identified in the CDMP as a Medium Priority site. However, as one of the City's most heavily used parks, the health of White Rock Lake is of interest to the Dallas community at-large. Lake user groups and individuals have been petitioning the City to perform another dredge over the last few years. This dredging feasibility study was organized as a partnership between DWU and DPR in response to these concerns.

The primary goal of a dredge project for White Rock Lake would be to restore lake depth to enhance watersport recreation. Removal of sediment from the shoreline area to improve aesthetics for waterside recreation is a secondary goal. Minimizing negative impacts to aquatic habitat and other environmentally sensitive areas in the park and surrounding areas is another central objective. These goals established the framework for the development of the alternatives presented in this report. Enhanced flood control, water supply, and environmental restoration are not being considered for White Rock Lake at this time.

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White Rock Lake Vicinity Map

Dallas, Texas

FN JOB NO	DWU19688
FILE	White Rock Lake_Vicinity Map
DATE	7/2/2020
SCALE	1:19,000
DRAFTED	02537

FIGURE

2-1

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This feasibility study will analyze dredging approaches, regulatory requirements, costs, and potential funding sources. The primary goals and objectives of this feasibility study are outlined as follows:

1. Gather and review pertinent technical data regarding White Rock Lake.
2. Solicit stakeholder input regarding dredging needs and concerns.
3. Synthesize technical data and stakeholder input to prioritize areas of the lake to be dredged.
4. Evaluate conceptual dredging scenarios including total volume of dredge material; dredging, dewatering, and disposal methods; construction access, staging, and mobilization, and; regulatory requirements.
5. Evaluate the implementation of an annual maintenance dredging program or the installation and maintenance of a sediment forebay as an alternative to periodic dredging of the lake.
6. Develop conceptual project costs for engineering, permitting, and construction and evaluate potential sources of funding that may be available to the City.

2.2 Previous Dredging Projects

White Rock Lake has been dredged four times since its construction in 1910, on average every 20-25 years. The timeline of previous dredging projects is as follows:

- **1937** – The initial dredging operation was completed in 3.5 years. A total of 400,000 cubic yards of sediment was removed and 90 acres of land reclaimed.
- **1955-1956** – A total of 15,000 cubic yards of sediment was removed during the second dredge operation.
- **1974** – Approximately 1,350,000 cubic yards of sediment was redistributed to rebuild marshy areas in the lake and create Mockingbird Point.
- **1998** – The last dredge operation was completed in 1998, removing 3,000,000 cubic yards of sediment from the North portion of the lake. The 1998 project pumped dredge material over 20 miles directly to a reclamation site in Hutchins, Texas.

Similar to the current proposal, the primary objective of the 1998 dredge operation was to restore lake depth to allow functional operation of watercraft and enhance in-lake recreation. The 1998 project is widely regarded as a success, finishing ahead of schedule and under budget thanks largely in part to exceptional leadership of the Dallas Public Works Department, as well as the contributions of other City staff, stakeholders, and consultants. Additionally, several factors contributed to a vast cost-savings over the course of the project, as summarized below:

- Dredge spoils were able to be pumped directly to the disposal site during the dredge operation, and effluent water was allowed to be discharged at a weir-controlled outfall to the local drainage.
- The majority of the pumping route was able to utilize existing utility easement and public right of way, minimizing easement acquisition costs.
- The site owner was cooperative and willing to receive dredge material 24/7 as agreed by contract, at a low cost.
- The disposal site held an active mining permit and was therefore essentially exempt from United States Army Corps of Engineers (USACE) Section 10 and Section 404 environmental permitting.

While the 1998 project serves as an important benchmark, this report acknowledges that another such "silver bullet" may not be able to be identified. Project alternatives are presented as a range of costs, allowing for variability in the size, scope, and timing of the ultimate project.

2.3 Volumetric and Sedimentation Survey

The Texas Water Development Board (TWDB) completed a volumetric and sedimentation survey of White Rock Lake in 2015. Survey data was collected in March 2015. The survey measured 3,550 acre-feet (approximately 5,728,000 cubic yards) of sediment below conservation pool elevation (457.8 feet NGVD 29). The survey found that sediment accumulation is greatest where the reservoir narrows northwest of the Dallas Arboretum and other pockets throughout the reservoir. Survey data provided by TWDB was used to identify areas in need of dredging and to estimate dredge volumes in the alternatives analysis.

2.4 Site Visit Observations

FNI performed a site visit to the lake with DPR and DWU staff on January 16, 2020. The purpose of the site visit was to observe various points of interest at the lake and to receive input and institutional knowledge of lake and park usage, maintenance concerns, history of previous dredging operations, and other considerations from City staff. Several photos were taken documenting conditions of White Rock Lake and White Rock Lake Park, which are included as **Appendix A**.

2.5 Stakeholder Input

Stakeholder input was solicited in the following forums:

1. **Public Survey – January-February 2020.** Web-based survey to provide individual input was sent to targeted Homeowner's Associations and posted on the Dallas Park and Recreation website on the White Rock Lake page.

2. **Public Meeting #1 – January 28, 2020.** Meeting was held with DPR, DWU, FNI, and Brownstone & Associates, Inc. to collect preliminary input from individual lake users and area residents to identify areas of the lake to be dredged, sensitive areas, and concerns regarding use of the lake during the dredge operation.
3. **Stakeholder Meeting/White Rock Lake Task Force Meeting #1 – February 11, 2020.** Targeted meeting to collect additional input from primary user groups was facilitated by DPR, DWU, and FNI.
4. **Public Meeting #2 – July 16, 2020.** Virtual meeting to provide preliminary results on the dredging feasibility study and proposed project alternatives.
5. **Public Comment Period – July 16 through August 7, 2020.** Public was invited to provide feedback after the second public meeting through use of a Google Form.
6. **White Rock Lake Task Force Meeting #2 – August 11, 2020.** Provided summary memo discussing the results of the dredging feasibility study and public input.
7. **Parks Board Briefing – September 17, 2020.** Provided a final project update to the Parks Board in advance of providing the final report.

Stakeholder input has been tabulated and included as **Appendix B**. Stakeholders provided important input regarding usage of the lake, and shared personal experiences and knowledge of common problem areas. Many stakeholders have also been involved with the lake for years or decades and were able to provide insight into changes to the lake over time and previous dredging and maintenance projects. Overall, the lake stakeholders provided very valuable input, and continued coordination with stakeholders including both residents and user groups should be incorporated into further planning efforts.

Primary stakeholder groups who provided significant input for this study include:

- Corinthian Sailing Club
- White Rock Lake Sailing Club
- Dallas United Rowing Club
- White Rock Lake Boat Club
- SMU Crew Club
- White Rock Lake Paddle Company
- For the Love of the Lake
- White Rock Lake Foundation
- White Rock Lake Task Force

3.0 SEDIMENT STUDY RESULTS AND DISCUSSION

Sediment samples were collected from selected sites for the purpose of conducting testing to characterize the material that will be excavated during the dredging project. The purpose of the sediment testing was to determine concentrations of potential chemicals of concern (COCs) and the resulting requirements or limitation for reuse or disposal options.

3.1 Sediment Sampling Plan

The Sediment Sampling Plan was developed by Brownstone & Associates and FNI. The sampling plan outlined procedures and techniques for recommended sample collection methods and chemical analyses for the sediment samples. In total, 9 recommended sampling locations were established to be distributed evenly over the anticipated dredge footprint, with the bias towards areas of highest usage and activity. A map of the sampling locations is included as **Figure 3-1.**

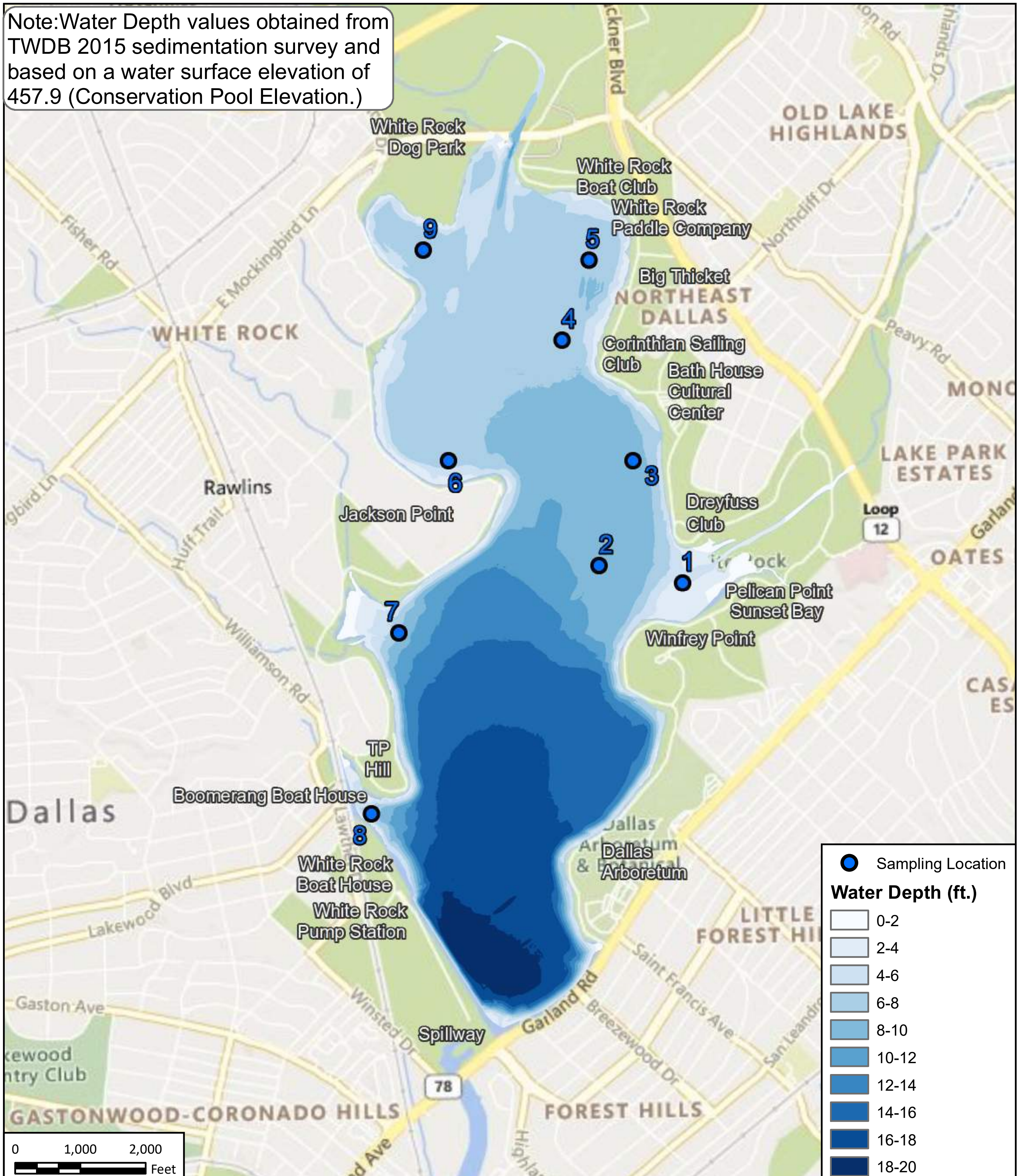
The plan was submitted to DWU and DPR in March 2020. In May 2020, City of Dallas authorized FNI to perform the sediment sampling under existing Master Services Agreement BPZ1424. The full Sediment Sampling Plan is included with this report as **Appendix C**.

3.2 Sediment Study Results

FNI performed limited environmental sampling to quantify chemicals of concern, including heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), herbicides, and pesticides, in sediment that DWU proposes to dredge from the lake bottom. No geotechnical sampling was performed, and additional shallow samples were collected in place of the geotechnical samples at the proposed sampling locations. The environmental investigation was conducted on White Rock Lake on June 16, 2020. The Environmental Investigation Summary report developed by FNI is included in this report as **Appendix D**.

Data gathered during the environmental investigation can be beneficial to design engineers to determine the chemical composition of the proposed dredged material and determine if the lake sediment:

1. Poses a health hazard to construction workers due to the presence of elevated heavy metal or other hazardous substance concentrations;
2. Contains heavy metals or hazardous substances at concentrations that could pose an environmental concern, if the chosen disposal option is land application; or
3. Requires special handling or disposal during dredging.



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White Rock Lake

Recommended Sediment Sampling Areas Overview

FN JOB NO	DWU19688
FILE NAME	Exb_4_Overall_Map_depth.mxd
DATE	3/12/2020
SCALE	1:24,000
DESIGNED	BH
DRAFTED	90207

FIGURE 3-1

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NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

All of the samples collected were submitted to Xenco Environmental Laboratories in Dallas, Texas on June 16, 2020 for laboratory analysis. Sample results were compared to protective concentration limits (PCLs) established by the Texas Commission on Environmental Quality (TCEQ) under the Texas Risk Reduction Program (TRRP) for unrestricted, residential land use. Primary results from the sampling are summarized below:

1. No VOCs, PCBs, or chlorinated herbicides were detected in any of the sediment samples. Trace concentrations of several SVOCs were detected, but at concentrations well below the respective residential PCLs for unrestricted use.
2. Trace concentrations of several organochlorine pesticides and one organophosphorus pesticide were detected in each of the sediment samples. However, the pesticide concentrations appear to be consistent with proper application of those chemicals and did not exceed any of the respective residential PCLs for unrestricted use.
3. Barium, beryllium, cadmium, chromium, copper, mercury, nickel, selenium, and silver were detected in one or more of the sediment samples at concentrations below respective residential PCLs for unrestricted use and Texas-Specific background concentrations established under TRRP.
4. Arsenic and lead were detected at concentrations slightly above the TRRP Texas-Specific background concentration, but below PCLs for sediment. None of the samples contained arsenic or lead at concentrations that exceeded the PCL for direct exposure of humans.

The samples with the highest arsenic and lead concentrations were also subjected to additional Synthetic Precipitation Leaching Procedure (SPLP) analysis to determine the likelihood of arsenic or lead to leach from dredged lake sediment to underlying soils and groundwater at potential upland disposal sites. Trace concentrations of arsenic and lead were detected in the SPLP analysis, which indicates that it is a low likelihood that arsenic or lead present in the dredged sediment would leach to the underlying groundwater zone.

FNI also evaluated the potential risks associated with the slightly elevated arsenic and lead concentration if sediments are resuspended in the lake during the proposed dredging activities. Since the maximum arsenic and lead concentrations detected in lake sediment are an order of magnitude less than the sediment PCLs, there is no indication that the resuspension of lake sediment during the proposed dredging activities will pose an environmental concern for human or ecological receptors.

Based on the data obtained during this investigation, none of the chemicals of concern detected in any of the sediment samples appear to pose a substantial risk to dredging contractors or the lake environment. Dredged sediment appears to meet the criteria for classification as a Class 2 non-hazardous waste if landfill disposal is the selected method of disposition. Additional analyses will be necessary to determine if dredged sediments can be beneficially reused on upland land application sites. This analysis will depend on the type of proposed application, which has not been identified at this time.

4.0 DREDGE VOLUME ESTIMATES

Dredge volume estimates were performed through GIS raster processing to calculate sediment volumes in individual segments of the lake at various elevations. The selection process is described below.

4.1 Areas Identified for Dredging

The lake was segmented into discrete areas based on proximity to nearby landmarks. The areas of the lake identified for dredging are shown in **Figure 4-2.** Areas for dredging were selected based primarily on the goal to restore lake depth to allow for sailing and boating recreation. The minimum water depth needed for safe passage of sailboats and other watercraft was established as 8 feet. To optimize the cost of the dredging operation, any areas where water depth exceeded 10 feet is recommended to be excluded. Watercraft operation is performed primarily in the northern portion of the lake, where the White Rock Boat Club and Corinthian Sailing Club are located. Stakeholder input received at the initial public meeting guided some of the delineations for areas to dredge and exclude. For example, additional areas near Boomerang Boat House and White Rock Boat House and a kayak launch, both located in the southwest portion of the lake, were identified by stakeholders to be included for dredging.

Input from DPR staff was used to identify other areas of maintenance concern. These areas primarily included the northernmost portion of the lake near the White Rock Dog Park and Sunset Bay located on the east side of the lake. Neither of these areas need to be dredged to the full 8-foot depth. Sunset Bay in particular has been established as a roosting area for waterfowl, which requires a water depth of approximately 1.5-2 feet.

4.2 Dredge Volume Estimates

Sediment survey point data was obtained from the 2015 TWDB survey. This data set included sediment data, as well as bathymetry data for the lake. Sediment volumes were estimated based on a conservation pool elevation of 457.9 feet NGVD.

The total accumulated sediment volume in the lake at the time of the survey was estimated to be 3,550 acre-feet (5,728,000 cubic yards). Based on the areas identified as targets for dredging, sediment volumes were calculated for each individual area at elevation increments of 0.5 feet. For the purpose of this feasibility study, it was assumed that dredging would only be performed down to the original lake bottom and no additional storage would be created. The total accumulated sediment at each increment is shown in **Figure 4-1**. A summary table for each area is included as **Table 4-1**.

Figure 4-1 : Accumulated Sediment Volume Versus Depth By Dredging Focus Area

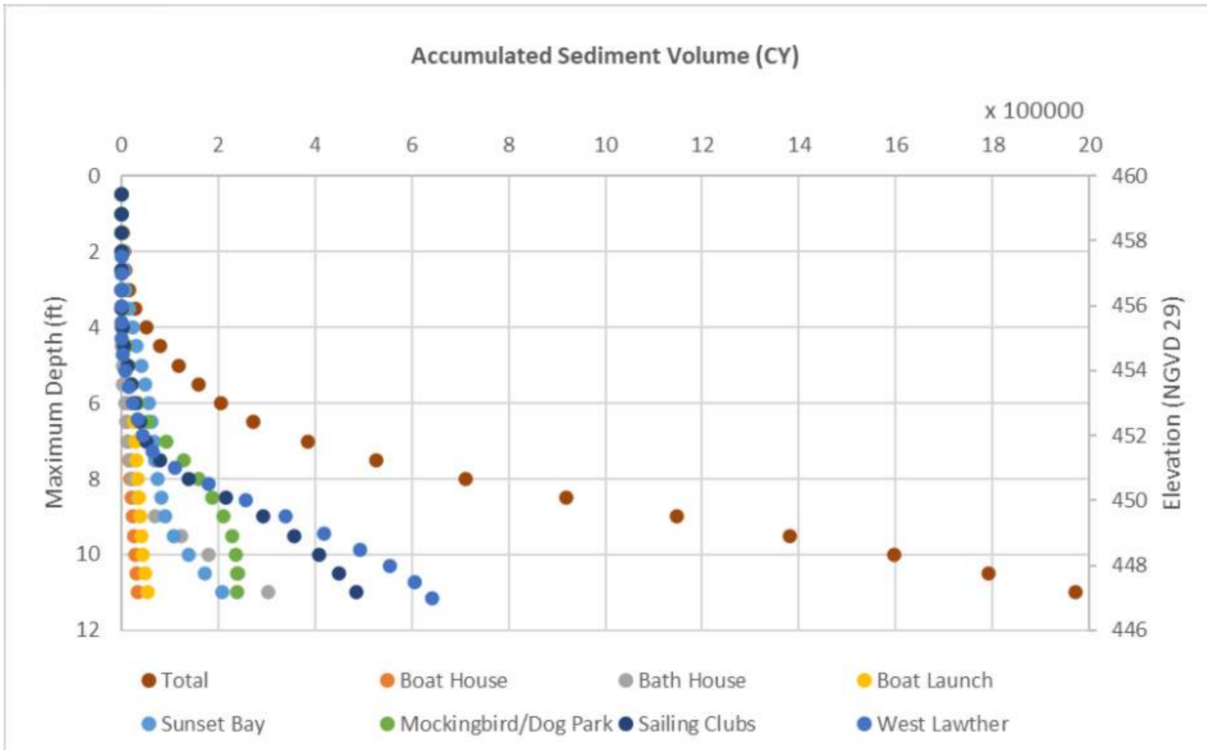
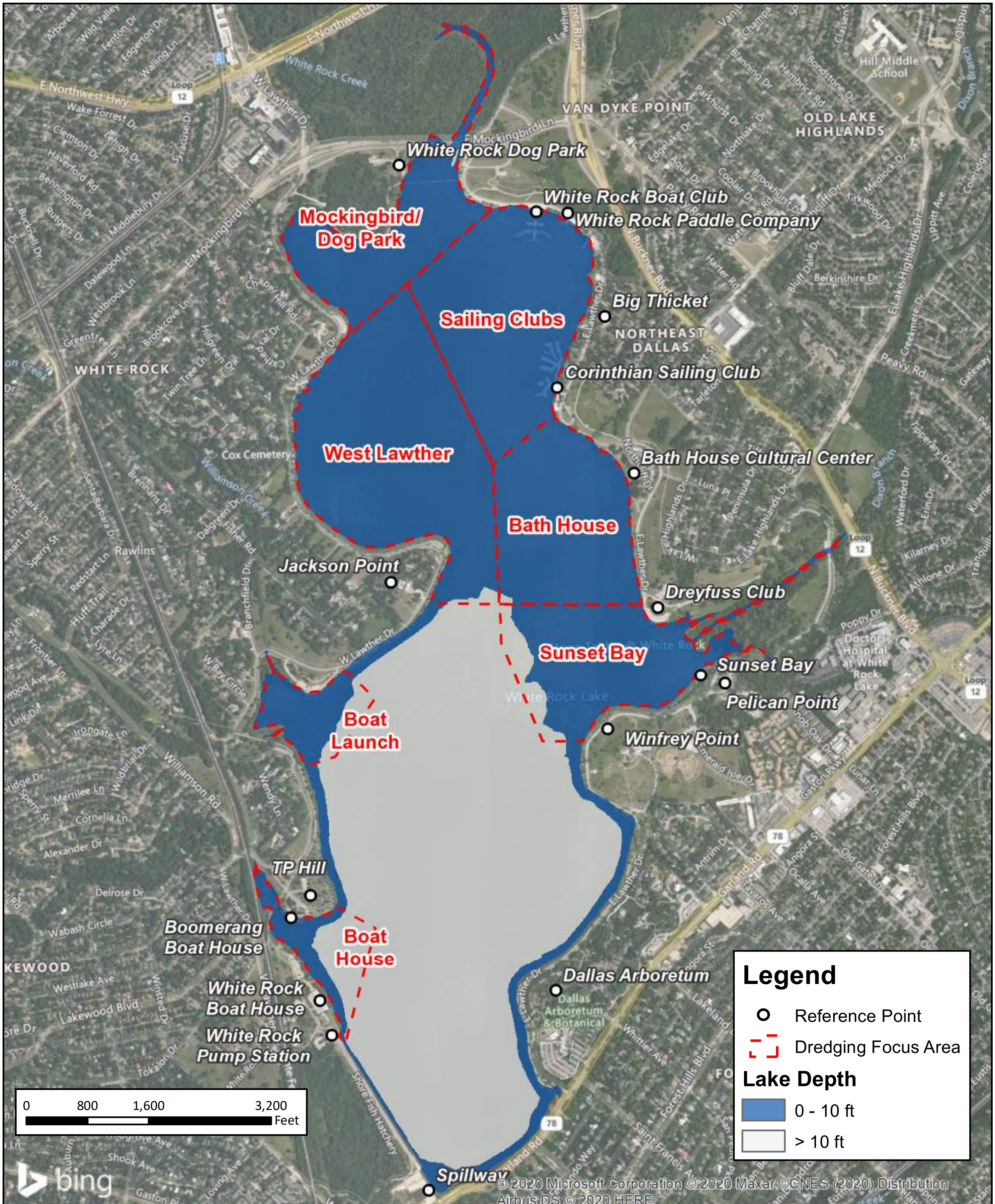


Table 4-1 : Cumulative Sediment Volume Summary By Elevation

Dredge Elevation (FT NGVD)	Water Depth (FT)	Sediment Volume (CY) by Dredging Area						
		West Lawther	Boat House	Bath House	Boat Launch	Sunset Bay	Mockingbird/ Dog Park	Sailing Clubs
457.5	0.5	---	10	---	30	90	20	---
457.0	1.0	---	20	---	300	600	50	---
456.5	1.5	---	40	---	1,100	1,500	200	---
456.0	2.0	---	100	---	2,300	2,800	300	---
455.5	2.5	30	300	---	3,600	5,100	600	---
455.0	3.0	500	400	10	5,300	9,200	1,200	20
454.5	3.5	2,900	900	70	7,300	15,600	2,500	600
454.0	4.0	7,700	1,900	400	9,900	23,900	4,800	2,500
453.5	4.5	15,500	3,300	1,200	13,300	32,700	8,300	6,600
453.0	5.0	24,800	5,300	2,600	17,300	41,700	13,400	12,800
452.5	5.5	34,400	7,600	4,800	21,500	49,500	20,900	20,700
452.0	6.0	45,100	10,100	7,700	25,100	56,200	33,300	29,400
451.5	6.5	64,300	12,500	10,900	27,700	61,900	55,900	39,400
451.0	7.0	112,400	14,800	14,500	30,100	66,600	92,800	53,400
450.5	7.5	179,300	17,100	18,400	32,100	71,200	128,900	79,800
450.0	8.0	257,600	19,500	23,300	34,200	76,300	160,800	140,200
449.5	8.5	339,300	21,900	33,100	36,300	82,600	188,500	217,600
449.0	9.0	419,500	24,200	70,700	38,800	91,500	211,300	292,200
448.5	9.5	494,300	26,600	123,300	41,800	109,400	228,800	356,500
448.0	10.0	556,000	28,900	181,500	45,400	138,400	237,800	407,600
447.5	10.5	605,100	31,100	243,000	49,400	172,600	240,000	451,000
447.0	11.0	642,800	33,500	304,900	54,000	209,300	240,500	485,100



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Dredging Focus Areas

White Rock Lake Dredging Feasibility Study

FN JOB NO	DWU19688
FILE	Dredging Focus Areas
DATE	8/18/2020
SCALE	1:20,000
DRAFTED	02537

FIGURE 4-2

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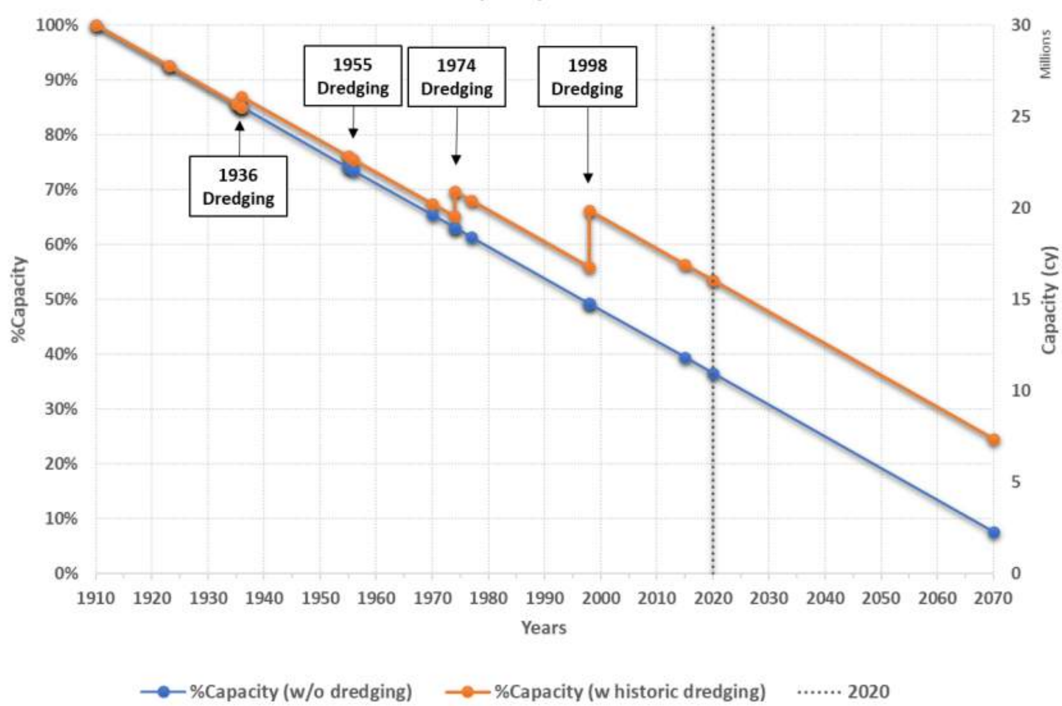
4.3 Sedimentation Rate Analysis

An estimate of sedimentation rate is useful in informing the recommendation of dredging scenarios. This information helps to estimate the time between dredge operations needed to maintain a current storage capacity in the lake or to establish an annual dredge volume to meet the goals of a maintenance dredging program. Because White Rock Lake has been dredged multiple times since its initial construction, the TWDB report was not able to provide an estimated sedimentation rate based on their preferred calculation methodology. The CDMP provided an estimated sedimentation rate of 28,500 cubic yards per year based on a typical sediment loading rate in the United States. However, the current analysis indicates this may be a significant underestimation of the actual sediment loading rate.

FNI's analysis of sedimentation rate relied on tabulating the measured capacity of the lake provided by various sources over the lake's history (1910-2015) combined with information about the amount of sediment volume removed from the lake during the four historical dredging operations to estimate lake capacity over time had no dredging been performed. The loss in capacity was estimated on a cubic yard per year and percent reservoir storage per year basis for various periods and as an overall average. Based on this analysis, White Rock Lake has lost approximately 61% of its capacity between 1910 and 2015. The results are tabulated in **Table 4-2** and shown graphically on **Figure 4-3**.

Figure 4-3 : White Rock Lake Capacity Loss Due to Sedimentation



The orange plot presented in **Figure 4-3** shows the measured lake capacity at discrete points in time including the effects of the historical dredge operations. The blue plot is a theoretical representation of lake capacity loss over time without the historical dredging operations. The slope of the curves for both plots is based on a constant average annual capacity loss, which was estimated as explained below.

Estimated average annual capacity loss was not determined to be constant over the history of White Rock Lake. Instead, values range from about 150,000 to 250,000 cubic yards per year. The capacity loss per year is shown to peak between the 1930s and 1980s. The White Rock Lake watershed had undergone rapid development during this time, which can contribute to increased sedimentation. It is likely that the lower rate calculated based on the 2015 data represents a greater percentage of build-out in the contributing watershed, as well as an increased focus on construction controls by State regulators. It is likely that the sedimentation rate will continue to decrease overtime as enhanced development standards are adopted and further build-out occurs in the upstream watershed; however, it is recognized that the City of Dallas has little control over the sedimentation rate in the lake due to a large portion of the watershed being located outside Dallas city limits.

For the purposes of this feasibility study, the sedimentation rate is estimated at 170,000 cubic yards per year (3.9 acre-feet per year). Due to the limited sample size and uncertainty with estimating techniques, this sedimentation rate is to be used for planning purposes only and may be able to be refined if more data becomes available. This rate was used to estimate the additional amount of sediment that has accumulated in the lake since the 2015 sedimentation survey was performed and to estimate additional accumulation for each year between dredge operations. The sedimentation rate analysis was also used to evaluate the potential of installing a sediment forebay upstream of the lake as part of the City's maintenance and dredge management program. This alternative is further discussed under **Section 7.0**.

Table 4-2 : Sedimentation Rate Analysis for White Rock Lake

Year	Measured Capacity (cy)	Dredged Volume (cy)	Capacity w/o Dredging (cy)	Cumulative Loss (cy)	Ave. Annual Capacity Loss (cy/yr) (1910 to Current Year)	Total % Capacity lost	% Capacity lost per year
1910	29,295,000	-	29,295,000	-	-	-	-
1923	27,259,000	-	27,259,000	2,037,000	157,000	7.0%	0.6%
1935	23,032,000	-	23,032,000	6,263,000	251,000	21.4%	0.9%
1936	-	588,000	-	-	-	-	-
1955	-	15,000	-	-	-	-	-
1956	19,733,000	-	19,131,000	10,164,000	221,000	34.7%	0.8%
1970	17,333,000	-	16,731,000	12,565,000	210,000	42.9%	0.8%
1974	-	1,351,000	-	-	-	-	-
1977	14,527,000	-	12,575,000	16,721,000	250,000	57.1%	0.9%
1998	-	3,001,000	-	-	-	-	-
2015	16,505,000	-	11,552,000	17,744,000	169,000	60.6%	0.6%

5.0 DREDGING PROCESS

Removal of sediment in White Rock Lake involves a number of steps, including:

- Planning and permitting
- Selection of a qualified contractor
- Verification of dredging depths/locations
- Physical removal of sediment from the lake bottom
- Dewatering of the dredged material and
- Disposal of the dredged material.

Each of these steps is described in more detail below. Before work can begin, permits must be received from the appropriate regulatory entities. However, method of dredging, dewatering location, and the chosen disposal site must all be identified and approved as part of the permitting process. Therefore, options for these elements of the work are discussed below prior to the actual permitting process.

5.1 General

As part of this study, potential dredging methods were evaluated for applicability to the alternatives identified for White Rock Lake. From this analysis, mechanical and hydraulic dredging methods were determined to be the most likely approaches that would be considered for the work. A brief description of each method follows.

5.1.1 Dredging Methods

Dredging systems may be classified into two primary categories: hydraulic and mechanical. The benefits and drawbacks of each methodology, as well as some additional detail about various equipment used in each dredge operation, are included in the following section.

In selecting potential dredging methods for this work, several site parameters were considered, including:

- Depth of water and sediment to be dredged
- Sediment characterization for potential environmental concerns
- Available land for disposal, containment, and dewatering
- Location, access, and distance to dewatering and disposal area
- Proposed dewatering system and time constraints
- Environmental permitting considerations, including allowable return water turbidity

5.1.2 Mechanical Dredging

Mechanical dredging consists of removing material by excavating or scooping sediment from the channel or lake bottom and placing the material on a barge, truck, or disposal area. Mechanical dredging equipment includes clamshells, draglines, backhoes or other mechanical equipment for excavating bottom sediments. To access portions of the lake away from the shoreline, mechanical dredging equipment is mounted on a barge floating freely around the lake. Excavated material is temporarily stored either on a barge or on the shoreline, before being placed in off-road trucks and hauled to the identified disposal areas.

Typical removal rates of sediment are on the order of 60-120 cy/hr. Mechanical dredges have difficulty retaining loose fine material which can wash out of the bucket as it is raised. Consequently, the system works best in consolidated material and can be used to remove rocks, timbers, stumps, and other debris that may exist at the identified sites. Historically, the 1998 dredge project, which was primarily a hydraulic dredge operation, had to utilize a mechanical dredge in areas of the lake with significant debris that was not able to be serviced by the hydraulic dredge.

Bucket Dredges

Bucket dredges may be used to excavate most types of materials except the most cohesive consolidated sediments and solid rock. The bucket dredge drops its bucket in an open position until it reaches the bottom material. The sides or jaws of the bucket are then closed using wire ropes operated from a crane. As the sides of the bucket close, material is sheared from the bottom and contained in the bucket compartment. The bucket is raised above the water surface and then released into a hopper barge.

Bucket dredges usually excavate a heaped bucket of material, but during hoisting, turbulence washes away part of the load. Once the bucket clears the water surface, additional losses may occur through rapid drainage of entrapped water. Even under ideal conditions, substantial losses of loose and fine sediments usually occur (USACE, 2015). Special buckets are available for use in dredging applications requiring reduced sedimentation resuspension rates. Compared to hydraulic dredges, bucket dredges deliver a product having low water content, but the production rate is low.

The bucket dredging process usually requires that excavated material be hauled to a placement site by barge. A hydraulic unloader is used to pump the dredged material to the placement site. As a general rule, the goal is to keep the dredging unit operational by providing a sufficient fleet of barges so the dredge does not spend any time just waiting. The ability to maintain production while increasing distances to the placement site by adding barges is a very attractive feature of mechanical dredging. The main advantages and limitations of the bucket dredge are summarized in **Table 5-1**.

Table 5-1 : Bucket Dredge Advantages and Limitations

Advantages	Limitations
Rugged machine that can remove most type of bottom materials. It can be used to pick up trash and large objects.	Difficult to retain soft, semi suspended fine-grained material.
Digging depth can be easily extended by adding wire rope.	Higher suspended sediment concentrations than hydraulic methods.
Delivers dredged material with low water content.	Low production rate compared to hydraulic methods.
Excavation is precisely controlled, so it can be safely used near foundations of docks and piers.	Loss of dredge material when barge is loaded.

Backhoe Dredges

The backhoe dredge uses a bucket that is structurally connected to the dredge by the rigid member configuration. This lets more force to be applied, allowing them to work in harder materials than cable-connected buckets. Backhoe operational characteristics provide relatively high excavation accuracy, and they can work closely around structures (USACE, 2015). However, the violent action of this type of equipment may cause considerable sediment disturbance and resuspension during maintenance digging of fine-grained material. No provision is made for dredged material containment or transport; thus backhoe dredges must work alongside the placement area or be accompanied by barges during the dredging operation. The main advantages and limitations of the backhoe dredge are summarized in **Table 5-2**.

Table 5-2 : Backhoe Dredge Advantages and Limitations

Advantages	Limitations
Rugged machine that can remove most type of bottom materials. Ideal for removal of hard and compact materials.	Difficult to retain soft, semi suspended fine-grained material.
Excavation is precisely controlled, so it can be safely used near foundations of docks and piers.	Higher suspended sediment concentrations than hydraulic methods.
It can operate with little area for maneuvering.	Low production rate compared to hydraulic methods.
Delivers dredged material with low water content.	Loss of dredge material when barge is loaded.

5.1.3 Hydraulic Dredging

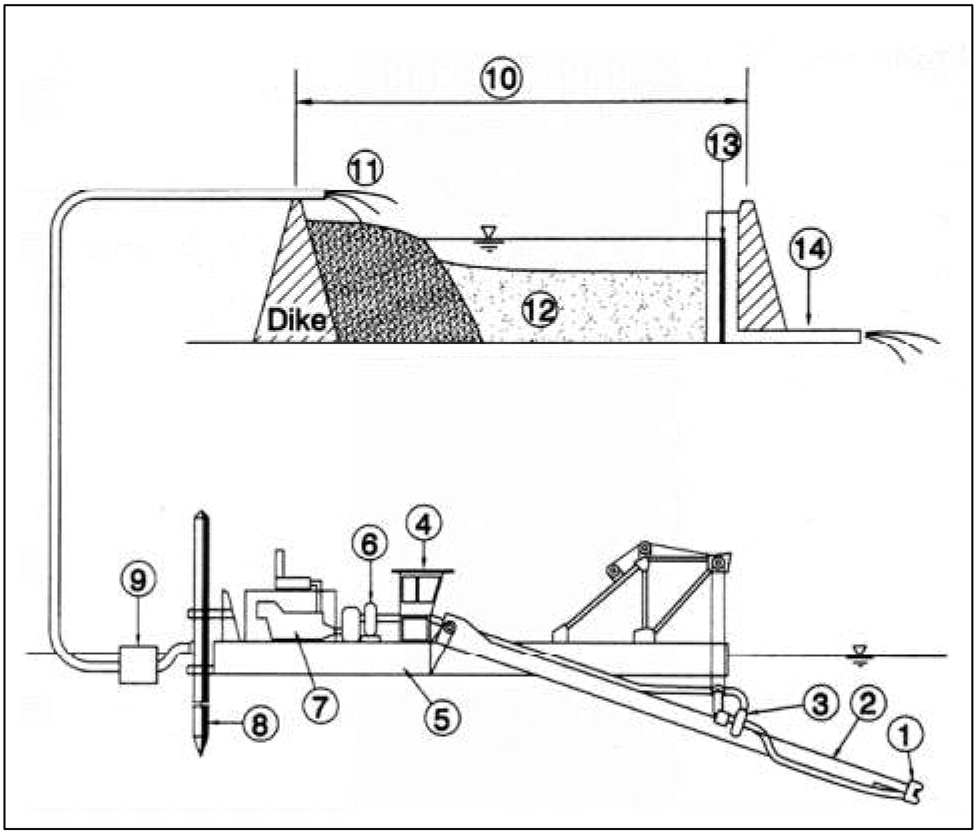
Hydraulic dredging includes the use of pumps and piping for removing (pumping) a mixture of dredged material and water from the lake bottom. A typical pipeline hydraulic dredge sucks the mixture (slurry) of sediment and water through one end and pumps the material through the discharge pipeline directly to the final disposal or dewatering area. Similar to mechanical dredging equipment, hydraulic dredging equipment is also typically mounted on a large barge. This system minimizes the area needed for staging or temporary dewatering along the lake.

Hydraulic pipeline dredges can be relatively cost efficient since they can operate continuously and pump directly to the disposal site. Typical removal rates of sediment are on the order of 120-240 cy/hr. However, if there is a lot of debris in the dredging site, the pumps can clog and impair efficiency. Hydraulic dredging is likely the most efficient and effective method for removing sediments from the lake and is likely to be the mechanism most acceptable to lake users and residents. However, hydraulic dredging generally requires greater spoils disposal area than mechanical dredging due to the high volume of water that must handled to minimize environmental impacts from return water. Dewatering and disposal considerations are discussed in subsequent sections.

Cutterhead Dredges

The hydraulic dredge with a rotating cutterhead at the end of the suction line is the most widely used type of dredge in reservoirs (Morris and Fan, 2010) and is generally the most efficient and versatile (USACE, 2015). The cutterhead dredge can excavate a wide range of materials, including clay, silt, sand, and gravel. The hydraulic dredge with a cutterhead comes in a variety of styles and sizes. This dredge uses the cutterhead to churn up the material then the suction hose removes the material. The dredge is limited by how deep its cutterhead can reach but near the shore a small dredge of this style is possible. This type of dredge has the capability of pumping material long distances to upland placement areas. A schematic diagram of a hydraulic dredge and disposal area is presented in **Figure 5-1.**

Figure 5-1 : Hydraulic Dredge and Disposal Area Schematic (Adopted from Morris and Fan, 2010)



(1) cutterhead, (2) ladder, (3) ladder pump, (4) controls, (5) hull, (6) main pump, (7) engine, (8) spud, (9) float and discharge pipeline, (10) disposal or containment area with perimeter dike, (11) inlet zone where coarse sediment tends to accumulate and mound, (12) fine sediment deposits, (13) adjustable effluent weir, (14) discharge of clarified effluent.

Slurries of 10-20% solids (by dry weight) are typical, depending upon the material being dredged, dredging depth, horsepower of dredge pumps, and pumping distance to the placement area. If no other data are available, a pipeline discharge concentration of 13% by dry weight should be used for preliminary design purposes (USACE, 2015). The main advantages and limitations of the cutterhead dredge are summarized in **Table 5-3**.

Table 5-3 : Cutterhead Dredge Advantages and Limitations

Advantages	Limitations
Capable of excavating most types of materials.	Limited capability to work in open-waters with high waves.
Slurry can be pumped through pipelines for long distances.	The suction pipeline can cause navigation problems in small waterways.
Cutterhead can be operated continuously, resulting in maximum economy and efficiency.	Conventional cutterhead dredges are not self-propelled, they require mobilization with towboats.

5.2 Sediment Dewatering

In almost all cases, it is desirable to remove excess water from the dredge material and to return this water to the lake. This helps minimize the amount of material required to be transported and/or disposed of and to maintain the pre-project water level in the lake. Return water from a sediment dewatering application must meet a Total Suspended Solids (TSS) limit of 300 mg/L established by USACE permitting requirements.

The degree of sediment dewatering is dependent upon the dredging method and disposal location selected. Depending on the dredging method selected, the water content of the sediment will range from approximately 70% to 95% (most likely 90-95% using hydraulic dredging). Methods to effectively remove the required water volume from the dredge material considered in this study are listed below:

- Staging and settling ponds on-site or near on-site – This option considers settling with or without the use of chemical additives to decrease settling time
- Mechanical dewatering on-site or near on-site – These methods include the addition of chemical additives to make dewatering more effective.
- Off-site staging and settling ponds – Slurry would be hauled or pumped to a location for dewatering and effluent water would be returned to the lake.

It is also likely that the water level in the lake will be temporarily reduced, at least during the dredging and dewatering process. Care should be taken to ensure dredging is not performed during a prolonged drought condition, and minimum allowable lake levels for a dredging operation should be employed, as was the case during previous projects.

5.2.1 Dewatering Process

Several mechanisms for dewatering exist, including geotubes, trailer mounted belt press equipment, and settling basins onshore.

Geotubes act like a large sock made of geomembrane fabric that allows the water to leak out while capturing the materials pumped into it. They tend to be better suited for smaller applications. Belt press equipment mounted to a tractor trailer removes the water from the dredge material similar to the belt presses used in the solid handlings part of sewage treatment plants. The dredge slurry goes in and a manageable solid comes out ready to be hauled off. Both of these options work best when an on-site area is available for dewatering before material is hauled off-site.

A settling basin is the most common and practical means of handling material. The material is pumped into the basin and is allowed to settle and dry. If the settling basin is located on-site, water is drained back to the lake and dried material must subsequently be hauled off for disposal. In some instances, and as was the case of the 1998 dredge project, slurry is pumped directly to the final disposal location. Return water can be pumped back to the lake or discharged to a local drainageway once the water meets the threshold turbidity limits.

5.2.2 Dewatering Site Evaluation

Because White Rock Lake is such a popular recreation destination and located within a residential area, one of the goals of the dredge operation should be to minimize disruption to lake users and residents. In addition, potential access and staging areas around the lake are further limited due to environmental sensitivity. For that reason, the optimal scenario would be to identify an off-site location that can be used for both dewatering and ultimate disposal of the dredge material.

As part of this screening analysis, FNI identified City-owned properties within 10 miles of White Rock Lake that could serve as temporary dewatering and/or permanent disposal sites, discussed in subsequent sections. A map of sites is included as **Figure 5-2**. At this time, no selection or recommendation is being made as to suitability from a community standpoint. However, the majority of City-owned properties were preliminarily ruled out during this screening analysis, due to limiting factors such as:

- Limited open space (< 10 acres)
- Prohibitive current land use (i.e. schools, municipal buildings, etc.)
- Location within a regulatory floodplain
- Location in the upstream watershed of White Rock Lake is not preferred.

Additionally, no selection or recommendation is being made as to suitability of these sites from a community standpoint. Any sites within the areas identified will require additional due diligence and input from the community in advance of being selected for temporary or permanent use for dredging purposes.

5.3 Disposal of Dredge Spoils

The final step of the disposal method includes disposal of the sediment. Sediment disposal can either be in-lake disposal at designated areas or out-of-lake disposal at a nearby site. In-lake disposal is complicated from a permitting aspect, and no potential reclamation areas have been identified at this time. Since in-lake disposal is not being considered for White Rock Lake at this time, the following sections will focus on out-of-lake disposal considerations.

The possibility of reusing the piping and other infrastructure from the prior dredging project was briefly evaluated. However, most of the infrastructure has been removed and the pieces remaining in-place have not been maintained with the purpose of performing future dredging operations. For the purpose of this report, it was assumed that the pipeline from the 1998 project could not be reused. After identifying a preferred disposal location, it may be beneficial to send crews to evaluate pieces of infrastructure that could be reused as part of a future pipeline alignment.

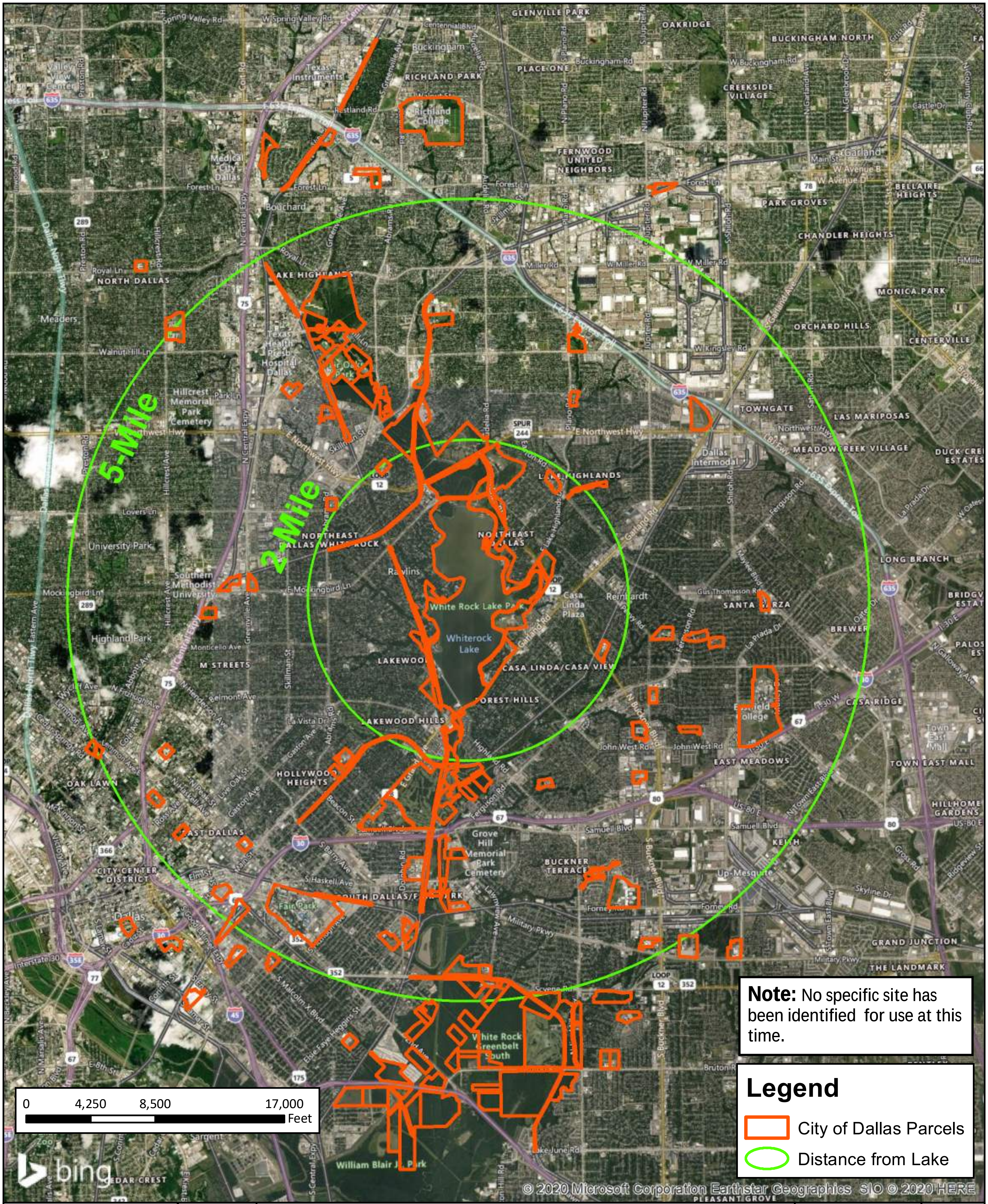
5.3.1 Disposal Options and Sites

Out-of-lake disposal options fall under two main categories: beneficial reuse applications and landfill disposal. Dredged sediment appears to meet the criteria for classification as a Class 2 non-hazardous waste if landfill disposal is the selected method of disposition. Additional analyses may be necessary to determine if dredged sediments can be beneficially reused on upland land application sites.

Identifying a potential reuse application for the removed sediment would be the most cost-effective scenario, to eliminate fees and charges associated with landfill disposal. This includes the option to identify and coordinate with a site that will accept the sediment free of charge, such as a quarry or mine that would accept the material for landfill purposes. A handful of potential sites have been identified in **Figure 5-3**. A final recommendation will require significant coordination with property owners.

Over the course of this evaluation, Glen Golf Course at Tenison Park, located approximately 2 miles south of White Rock Lake, was discussed as a beneficial fill application for the dredge spoils. The City is considering plans to update the master plan for the park to convert a portion of the golf course into a linear park or disc golf course to make way for the Trinity Forest Spine Trail. However, Glen Course is almost fully contained within the 100-year floodplain of White Rock Creek, making a fill application impractical due to floodplain management standards.

Due to the lack of available open space in the metroplex, landfill disposal is another possible scenario. The 12 closest landfills to White Rock Lake were identified based on available appraisal district information and information from the TCEQ. Hunter Ferrell Landfill (Irving) and City of Grand Prairie Landfill only accept waste from residents of each respective City. However, the City of Dallas may be able to coordinate with these other municipalities to use the site if necessary. The closest sites and the estimated disposal costs at each site are summarized in **Table 5-4**. These sites are also represented spatially on **Figure 5-3**.



FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, TX 76109-4895
817-735-7300 | www.freese.com

City of Dallas Properties

Evaluation of Potential Storage or Disposal Locations for Dredge Spoils

FN JOB NO	DWU19688
FILE	CityDallasProperties
DATE	7/13/2020
SCALE	1:100,000
DRAFTED	02271

FIGURE 5-2

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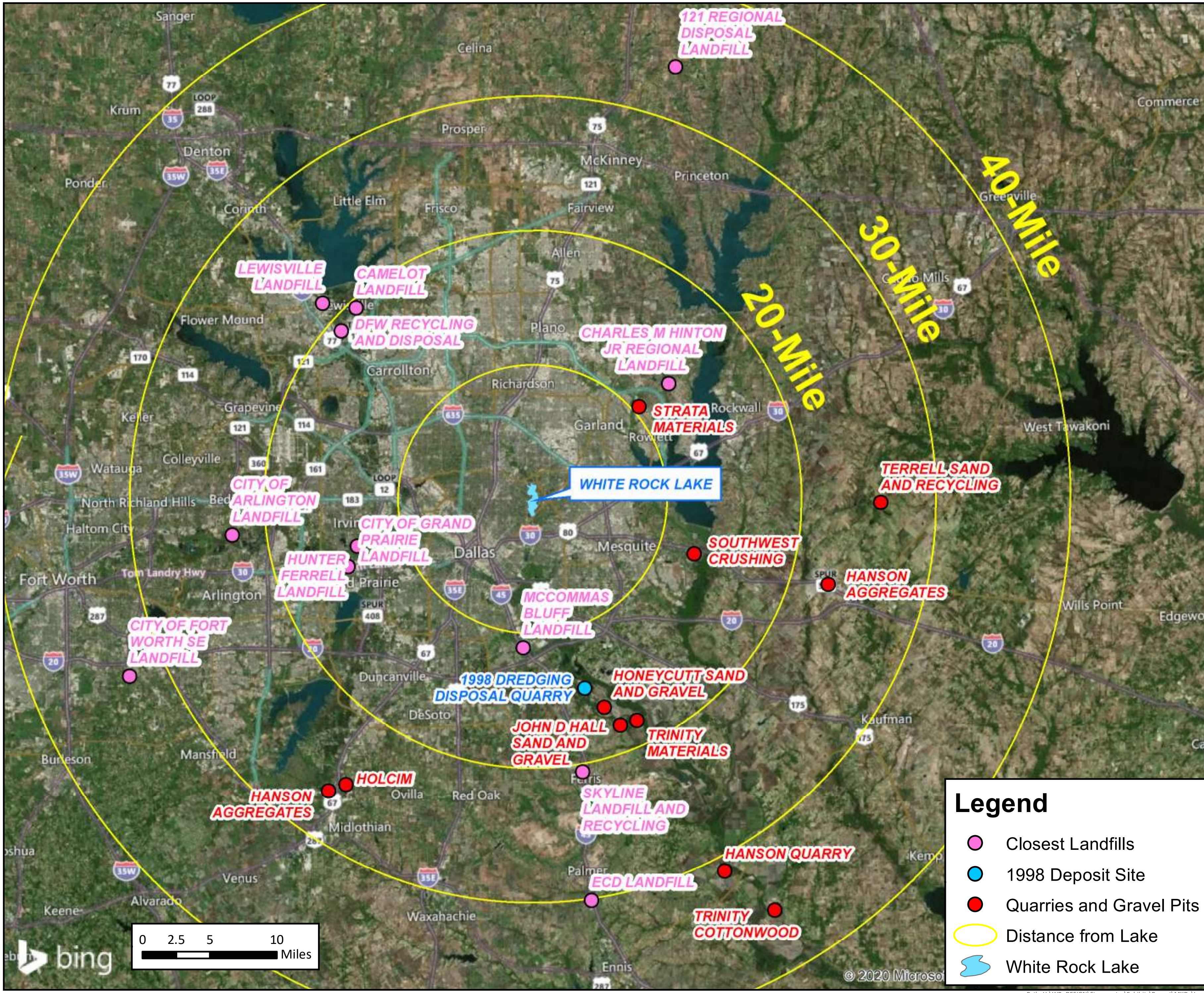

FIGURE 5-3

FN JOB NO DWU19688 | FILE Landfills_Exhibit | DATE 7/15/2020 | SCALE 1:600,000 | DRAFTED 02271

Potential Disposal Sites

White Rock Lake Dredging Feasibility Study

4055 International Plaza, Suite 200
Fort Worth, TX 76109-4895
817-735-7300 | www.freese.com

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Table 5-4 : Potential Sanitary Landfill Disposal Sites

Facility	Location	Owning Entity	Estimated Cost ($/ton)	Distance from White Rock Lake (miles)
McCommas Bluff Landfill	5100 Youngblood Rd. Dallas, TX 75241	City of Dallas	$30.50	14.5
City of Grand Prairie Landfill*	102 Macarthur Blvd. Grand Prairie, TX 75050	City of Grand Prairie	$32.00	17.8
Hunter Ferrell Landfill*	220 W. Hunter Ferrell Rd. Irving, TX 75060	City of Irving	$40.00	18.6
C.M. Hinton Jr. Regional Landfill	3175 Elm Grove Rd. Rowlett, TX 75089	City of Garland	$42.00	22.7
Skyline Landfill and Recycling	1201 N. Central Ave. Ferris, TX 75125	Waste Management Solutions	$42.50**	24.1
DFW Recycling and Disposal	1600 S. Railroad St. Lewisville, TX 75057	Waste Management Solutions	$42.50**	26.1
Arlington Landfill	800 Mosier Valley Rd. Euless, TX 76040	Republic Waste Services	$60.00	28.2
Camelot Landfill	580 Huffines Blvd. Lewisville, TX 75056	City of Lewisville	$42.50**	31.3
Lewisville Landfill	801 E. College St. Lewisville, TX 75057	Republic Waste Services	$42.50**	32.5
ECD Landfill	5703 N. IH-45 Ennis, TX 75119	Republic Waste Services	$42.50**	34.8
121 Regional Disposal Facility	3820 Sam Rayburn Hwy. Melissa, TX 75454	North Texas Municipal Water District	$38.00	37.0
Southeast	6288 Salt Rd. Fort Worth, TX 76140	City of Fort Worth	$40.00	39.9

** indicates landfill is open to residents of the respective city only.*
***information not available; presented as average of other available data.*

5.4 Construction Considerations

Additional considerations include impacts from construction to lake users and residents. These include limited use of the lake and park areas due to active construction and staging. One option that may be beneficial is to identify an area of the park to serve as construction and staging for future dredge operations that can serve in a multi-use capacity during non-dredging periods for activities such as bird-watching, event staging, or a dog park area. No specific site was identified during this evaluation.

Additionally, sensory factors such as smell, noise, and the visual of dredging equipment can also be unpleasant. During dredging, organic materials trapped in the sediment are temporarily resuspended, producing an odor. These impacts are temporary and can be reduced through the use of hydraulic dredging equipment. Through public feedback, noise from the mechanical equipment was specifically identified by stakeholders as disruptive during the last dredging project, especially due to an extended duration of daily dredging operations. Reducing the daily hours of operation of the dredging equipment can limit daily disruption to lake residents but will extend the overall duration of the dredging process. Consequently, unsightly equipment would be required to remain on-site longer.

5.5 Environmental Considerations

In addition to environmental standards and requirements for the dewatering and disposal of dredge spoils, the dredging operation is subject to several sets of additional environmental regulations that must be considered. These considerations are summarized in the following sections.

5.5.1 Permitting

The regulatory permits and authorizations associated with a dredge operation are determined based on several site-specific characteristics, including location, dredge volume, dredge material disposal methodology, potential environmental impacts, and various other requirements. At a minimum, permits to perform the dredging activity itself would likely be needed from:

- USACE
- Texas Commission on Environmental Quality (TCEQ)
- City of Dallas

The USACE is responsible for implementing Section 10 of the Rivers and Harbors Act of 1899 (Section 10), which address navigation, as well as Section 404 of the Clean Water Act (Section 404), which restores and maintains the physical, chemical, and biological integrity of waters of the United States. A Section 10 permit is required for work that occur in navigable waters of the United States. A Section 10 permit may be issued alone, or in combination with a Section 404 permit. Section 404 regulates the discharge of dredged and fill material into waters of the United States. The USACE administers and enforces requirements of Section 404 including permit decisions and determining whether the discharge of dredged or fill material is being placed into a water of the United States or a “jurisdictional” area.

The process for obtaining a Section 10 and/or Section 404 permit is similar. The applicant must identify the jurisdictional determination of the area in question and for Section 404 compliance, demonstrate that the discharge of dredged or fill material would not significantly degrade waters of the United States and that there are no practicable alternatives. The applicant will also have to describe how impacts to waters of the United States, or navigable waters in the case of Section 10, have been minimized, or for unavoidable impacts, how impacts have been mitigated.

A formal Environmental Impact Statement (EIS) is required if a major federal action is determined to significantly affect the quality of the human environment for compliance with the National Environmental Policy Act (NEPA). The regulatory requirements for an EIS are much more detailed and rigorous than the requirements for a Categorical Exclusion or Environmental Assessment (EA). Based on our preliminary evaluation an EIS is not anticipated.

There are a number of potentially applicable authorizations, including Nationwide Permits (NWP) that address maintenance dredging applications. However, due to the size and scope of any likely dredging operation, it is likely that an Individual Permit (IP) will be required by the USACE. In addition, the project is likely to require a Section 401 Water Quality Certification review of the permit application by the TCEQ. The 401 Water Quality Certification review determines whether a proposed discharge will comply with state water quality standards.

Finally, maintenance dredging must comply with all local City of Dallas regulations and requirements. This will likely include a Fill or Floodplain Alteration Permit and other development permits, including construction permitting. Projects affecting an uplands area greater than one (1) acre are required to comply with the Texas Pollution Discharge Elimination System (TPDES) Construction General Permit Number TXR150000. As part of the compliance process, a Stormwater Pollution Prevention Plan (SWPPP) and a Notice of Intent are required to be submitted to the TCEQ.

5.5.2 Aquatic Resource Relocation

Coordination with Texas Parks and Wildlife Department (TPWD) may also be required due to the presence of fish and other aquatic life in the lake. An Aquatic Resource Relocation Plan and Stocking Permit would likely need to be obtained prior to construction or fish removal. A stocking permit may be required if moving the fish from the lake to another pond or lake. It should be noted that during any dredging project, there is a risk for fish mortality. Completing the project during cooler months would help reduce mortality.

Over the past few years, TPWD has requested mussel surveys as part of aquatic resource relocation plans. TPWD may request a mussel survey to make sure none of the listed species are present. A fisheries biologist would need to be consulted prior to fish relocation.

5.5.3 Cultural Resources

Projects sponsored by public entities that affect a cumulative area greater than five acres or that disturb more than 5,000 cubic yards require advance consultation with the Texas Historical Commission (THC) according to Section 191.0525 (d) of the Antiquities Code of Texas. NWP General Condition 20, Historic Properties, requires compliance with Section 106 of the National Historic Preservation Act.

5.5.4 Threatened or Endangered Species

The U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) resource list includes information on threatened and endangered species. This list includes several species of threatened and endangered species, as well as migratory birds, potentially impacted by the project. The entire project area should be surveyed for potential habitat for threatened and endangered species and an affect determination should be made by a qualified biologist. If the habitat survey results in a "may affect" determination, then coordination with US Fish and Wildlife Service may be required.

5.5.5 Drought

A significant consideration for waterbodies in Texas is operation and maintenance during drought conditions. It is likely that lake levels will be impacted at least temporarily during a dredging operation, especially if it is decided that effluent water from dewatering operations will not be returned to the lake. Limiting dredging operation based on the water level in the lake as was done in previous projects is recommended to avoid over-dredging and extended impacts to the lake levels and usage.

5.6 Verification of Dredging/Quality Control

Since the TWDB sediment data was collected in 2015, it is recommended that a thorough study of lake depth and bathymetry data in the target areas be completed before the dredge work begins. Future coordination with TWDB to conduct more frequent bathymetric surveys would also be useful in refining the estimate for sedimentation rate and identifying areas to prioritize for more frequent dredging.

A pre-construction and post-construction survey should be performed by a qualified surveyor retained by the City for each dredging project. The pre-construction survey should be used to establish the limits of dredging and the final volume of sediment to be removed. The post-construction survey will assure that the contractor has fulfilled the required obligations.

5.7 Selection of a Qualified Engineering Consultant

For a dredging project with the scale and complexity as the alternatives provided in this report, an engineering consultant should be retained to perform the design. The firm should have experience with the design and execution of large dredging operations and should be licensed in the State of Texas to perform the work. The consultant should be expected to provide services through design, bidding, construction, and any subsequent monitoring, restoration, and mitigation work.

Selection of a firm with in-house environmental permitting expertise and a working relationship with the USACE Fort Worth District is recommended. In addition, public outreach and coordination and potentially negotiation with private landowners is expected to be a large component of the project. The selected consultant should be able to provide support through these activities.

5.8 Selection of a Qualified Contractor

Selection of a contractor will be completed after the development of plans and performance specifications. During the bidding process, evaluation of qualification and references, project experience, financial stability, etc. should be reviewed and used for selection.

6.0 ESTIMATED COST

Because a number of options exist for disposal and dredging techniques, a range of costs were developed for the dredging of White Rock Lake. Cost estimates were broken down into the following categories:

- Dredge cost
- Dewatering
- Disposal
- Engineering, bidding, permitting, and contract activities
- Quality control and monitoring

The assumed values used to develop the cost estimates were developed based on previous estimates for dredging operations at White Rock Lake, existing reports and analytical data, and past contractor bids on similar projects in the area. With the amount of uncertainty in the timing, scale, frequency, and other details of the dredging program, these costs are presented with a 30% contingency, consistent with the Association for the Advancement of Cost Engineering (AACE) Class 5 classification, appropriate for feasibility screenings and master plans. Further project definition is needed to refine these estimates and reduce the contingency and should be performed in advance of pursuing project funding.

6.1 Dredging

Costs for dredging are based on the volume of material to be removed, as well as the dredging mechanism employed. Volume estimates for each dredging operation range between 170,000 and 3,200,000 cubic yards of sediment. It is anticipated based on the scale of the scenarios presented in this report and the size of White Rock Lake that hydraulic dredging will be used to remove the material. The unit cost is estimated be between $6 and $15 per cubic yard, depending on the volume of material to be removed. These costs are summarized in **Table 6-1**. This unit is somewhat higher than normal due to the limited access to the lake from the public right-of-way, and the desire to pump material directly to an offsite dewatering and disposal location, to minimize disturbances to the park areas surrounding the lake.

Table 6-1 : Estimated Cost of Dredging Operation

Total Dredge Volume (CY)	Dredging Cost ($/CY)	
	Low	High
< 1,000,000	$10	$15
> 1,000,000	$6	$10

6.2 Dewatering

The dewatering costs were developed assuming that slurry would need to be pumped and piped to an offsite location for the dewatering operation. Dewatering and disposal sites have not been officially defined by this study.

The estimated capital cost of setting up a system to convey the dredged material was determined assuming that the slurry would be pumped to a site between 10 and 30 miles of the lake, with a piping setup and easement acquisition of $12 per linear foot. In addition, there is an initial capital cost estimated to be $75,000 to $125,000 for the system set up and then $1 - $2 per cubic yard for operation and maintenance of the dewatering operation. For the annual maintenance operations, it was assumed that the initial set up and pipeline installation costs would be incurred during the initial capital project and were not assumed to be repeated. These costs are presented in **Table 6-2**.

Table 6-2 : Estimated Cost of Dewatering Operation

Item Description	Cost	
	Low	High
Initial Set Up	$75,000	$125,000
Pipeline Installation ($12/LF)	10 miles/ $633,600	30 miles/ $1,900,800
Operation & Maintenance	$1/CY	$2/CY

6.3 Disposal

Generally, disposal costs are controlled by the distance the material must be transported to the facility and the type of facility accepting the material. For the purposes of this study, high and low costs are included for the two likely disposal scenarios: material reuse and direct landfill disposal. For both disposal scenarios, a cost was applied to account for temporary material storage and transportation to the disposal site, as well as the cost associated with permanent disposal. Total costs ranged from $15 - $30 depending on the scale of the operation and disposal method selected. These costs are presented in **Table 6-3**.

Table 6-3 : Estimated Cost of Transportation and Disposal

Cost ($/TN)	
Low	High
$15	$30

Disposal of the dredged material is anticipated to be a major cost-driver on this project since identification of an appropriate disposal site in the metroplex is so challenging. If a material reuse application is not available at the time of project initiation, it is recommended that the City engage with waste management services and potentially other municipalities to evaluate other lower cost options for material disposal. It is assumed for the purpose of this study that the costs for the commercial tipping fees identified in **Section 5.3.1** will be able to be reduced for a project of this scale; thus, a lower unit cost of disposal is reflected in the cost estimates.

6.4 Engineering, Bidding, Permitting, and Contract Activities

Mobilization and Stormwater Pollution Prevention Plan (SWPPP) implementation costs were estimated to range from 4% to 8% of the total estimated sediment removal cost, depending on the scale of the project. Engineering and permitting fees were estimated to be 6% of the total project cost but were reduced to 2% for the recurring maintenance dredging program. These costs reflect the assumption that the larger projects are likely to require an Individual Permit from the USACE and Water Quality Certification from the TCEQ. Annual dredging programs were assumed to be performed consistent with USACE NWP, so costs were reduced to a lower percentage. These costs are summarized in **Table 6-4**.

Table 6-4 : Engineering, Bidding, Permitting, and Contract Activity Costs

Item Description	Cost	
	Low	High
Mobilization and SWPPP	4%	8%
Engineering & Permitting Fees	2%	6%

6.5 Quality Control and Monitoring

The primary quality control and monitoring costs include pre- and post-construction surveys of the lake, sediment testing, and water quality monitoring. The survey costs were estimated at $100 to $250 per acre. Additional sediment core testing may also need to be conducted, depending on the method of final disposal. Sediment testing was estimated at $0.50 to $1.00 per cubic yard, and water quality monitoring was estimated as a lump sum of $100,000 for large capital projects and $10,000 for annual maintenance dredging operations.

Table 6-5 : Cost of Quality Control and Monitoring

Item Description	Cost	
	Low	High
Survey Costs	$100/ac	$250/ac
Sediment Testing	$0.50/cy	$1.00/cy
Water Quality Monitoring	(< 1,000,000 cy) $10,000	(> 1,000,000 cy) $100,000

6.6 Funding Opportunities

Identifying potential grant or loan opportunities to fund a recreational dredging project can be challenging. If the dredging activities can be related to water quality improvements, the project may qualify for funding through the EPA 319 Nonpoint Source Pollution (NPS) Program administered by the TCEQ. There is evidence in other states that communities have been able to access this fund for dredging as a form of lake restoration. However, feedback received from State regulators indicates that it would be very unlikely the TCEQ would fund a dredging project unless a compelling case was made for solving a known NPS problem in the area.

A selection of additional funding sources available to the City, along with the benefits and drawbacks of each, is presented in **Table 6-6**. During discussions with City staff, the concept to implement a lake user fee was discussed. While this is unlikely to be popular, a user fee could be an appropriate way to allocate the costs of dredging, especially a maintenance dredging program, to the main users of the lake who will benefit from the program. Even as one of the most heavily used parks in Dallas, a reasonable fee is unlikely to cover the cost of a dredge operation. However, a user fee is a possible source of additional revenue that can be used in addition to another traditional revenue source to contribute a portion of the total cost of the program. This option can be explored in future phases of the project.

Table 6-6 : Potential Funding Source Comparison

Funding Source	Benefits	Drawbacks
Certificate of Obligation (CO) Bonds	• Option to fund projects in totality • Provide flexibility when projects need to be funded quickly	• Debt obligations contribute to lack of flexibility into future decision making
General Fund	• No debt obligation • Consistent and readily available source of funding for City projects	• Competing with other City projects for funding • Limited budget • Limited use for large capital expenditures; likely available only for maintenance operations
General Obligation (GO) Bonds	• Option to fund projects in totality • Typically a high bond rating and low interest rates	• Competing with other programs for funding • Debt obligations contribute to lack of flexibility into future decision making • Could not be used for annual programmatic operations
Sales Tax Reallocation Election	• Dedicated funding source	• Diverts tax revenue away from other programs
Sales Tax/Property Taxes	• Existing funding source that can be updated to fund additional initiatives • Near immediate increase in available funds	• Not popular to raise taxes • Not a dedicated source of funding for stormwater
Special Tax Districts (PIDs) / Tax Increment Financing (TIF)	• Dedicated funding source • Localizes cost to fund projects to the area receiving the benefit • Works well for major redevelopment areas, not single infill locations	• Relies on development in the district to occur as expected to finance the project • Diverts future tax revenue to project and away from other programs • Requires broader coordination with City Planning

Funding Source	Benefits	Drawbacks
State and Federal Programs	• Different options to meet a variety of needs	• Not many options with available funds for dredging operations • Requires adherence to specific program guidelines and objectives • Staff time and resources required to apply for programs • Competing with other projects and municipalities
Stormwater Utility Fee	• Existing funding source that can be updated to fund additional initiatives • Dedicated funding for stormwater initiatives • Near immediate increase in available funds	• Not popular to raise rates to cover increased costs
User Fee	• Additional source of revenue dedicated to White Rock Lake maintenance • Places burden of cost on primary beneficiaries of the program	• Unlikely to be popular • Time to build up revenue base for projects and annual maintenance costs of this scale • Difficulty in administrating the fee / restricting access to the lake

7.0 DREDGING SCENARIOS

Dredging alternatives were developed to meet the goals and objectives outlined in **Section 2.1**. The amount of sediment to be removed in each alternative were developed considering the data from the TWDB volumetric and sedimentation survey and estimated sedimentation rate. Four alternatives to this baseline scenario have been developed for this report. It was assumed that a dredge operation would not begin until 2022 at the earliest. Each alternative was developed to include the additional sedimentation that is assumed to have occurred since the 2015 sedimentation survey up to the estimated sediment volume in 2022.

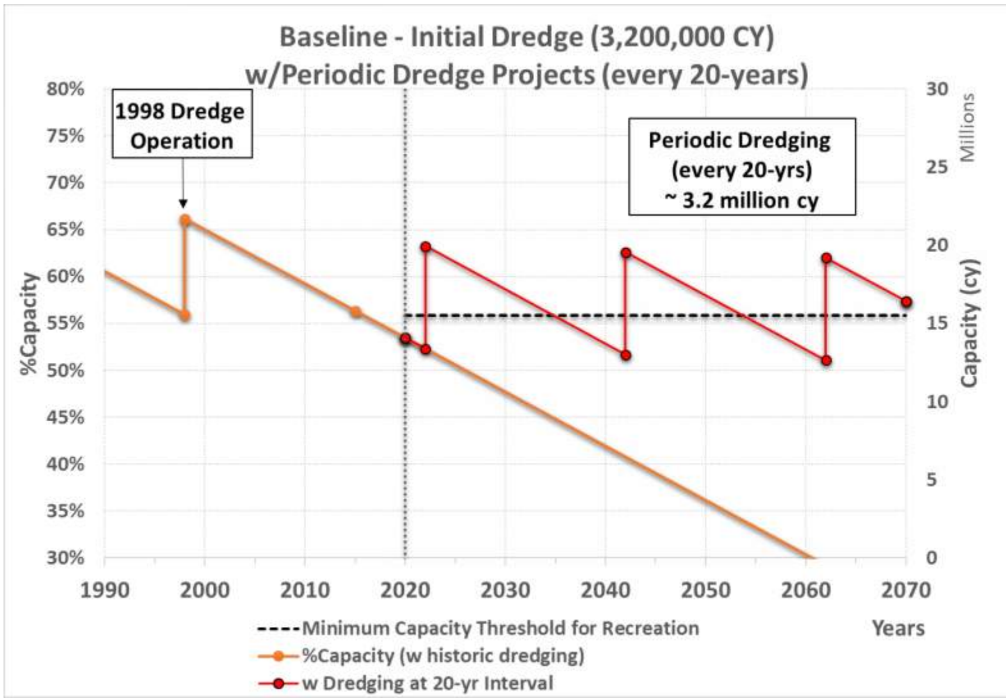
The cost estimates for each alternative were developed using the unit costs presented in **Section 6.0**. To reflect the variability in the scale and timing of the projects, cost estimates are presented as both upfront capital costs and annualized costs over a 50-year period. Annualized costs represent the net present cost of a project equally divided over the years of the project lifetime. Unless otherwise specified, capital costs and annualized expenditures are presented in 2020 dollars for simplicity.

It is evident that there are an infinite number of possible dredging scenarios that can be developed based on changes to the scale, frequency, and timing of the dredging operation. These alternatives were developed to demonstrate different approaches the City can take to implement a proactive dredging program to meet the goals and objectives outlined in this report. It is recommended that the City scale the approach to meet budget and staff resource constraints.

7.1 Baseline Scenario

The City's historical dredging approach for White Rock Lake is to dredge the lake every 20-25 years to remove accumulated sediment and restore lake depth. This option is presented as a base scenario to compare the benefits and costs of alternative dredging scenarios. Each scenario will be presented as a figure showing lake capacity over time, as influenced by sedimentation in the lake and the removal of sediment through periodic dredging operations. **Figure 7-1** demonstrates the baseline dredging scenario.

Figure 7-1 : Baseline Dredging Scenario



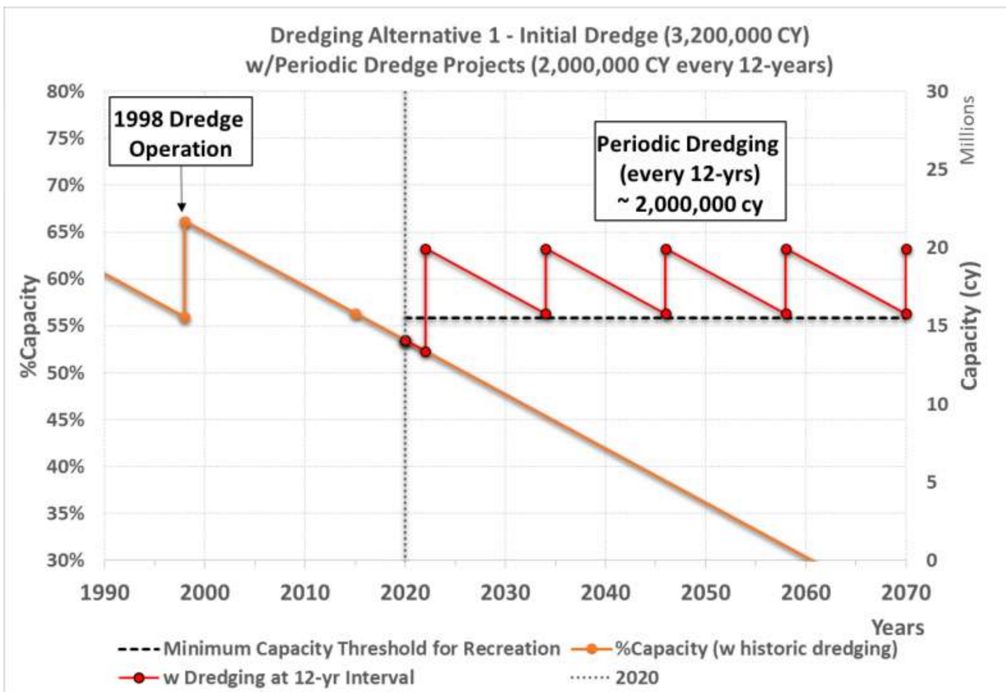
The baseline scenario assumes a periodic dredging program every 20 years to remove approximately 3.2 million cubic yards of sediment from the lake. The minimum capacity threshold for recreation was established based on the 8-foot depth in the areas of interest, and assuming that any future sedimentation will occur in these areas as a worst-case. As demonstrated by the figure, a 20-year dredge cycle restores the lake levels above this recreational threshold for a period of time (approximately 12 years) until impacts to recreation begin to be recognized.

The estimated cost of continuing this baseline scenario ranges from $50 to $88 million every 20 years, which equates to an annualized cost between $3.0 and $5.3 million over a 50-year period. More detail on the development of the cost estimates is included in **Section 6.0**. Opinions of probable construction cost (OPCC) for each alternative are included in **Appendix E**.

7.2 Dredging Alternative 1

The first alternative is presented in **Figure 7-2**. This scenario would require an initial dredge operation of 3.2 million cubic yards of sediment from the impacted areas, followed by a programmatic dredging approach every 12 years to the remove approximately 2 million cubic yards of sediment. This is similar to the City's historical approach of undertaking major dredging projects on the order of 20-25 years, but based on the estimated sedimentation rate, the dredging will be performed on a frequent enough basis to maintain an 8-foot depth in the north portions of the lake and not to see any impacts to lake recreation. The upfront cost of the initial dredge operation ranges from $50 to $88 million, followed by a recurring cost ranging from $32 to $56 million every 12 years. This equates to an annualized cost between $3.6 and $6.3 million for the program over a 50-year period.

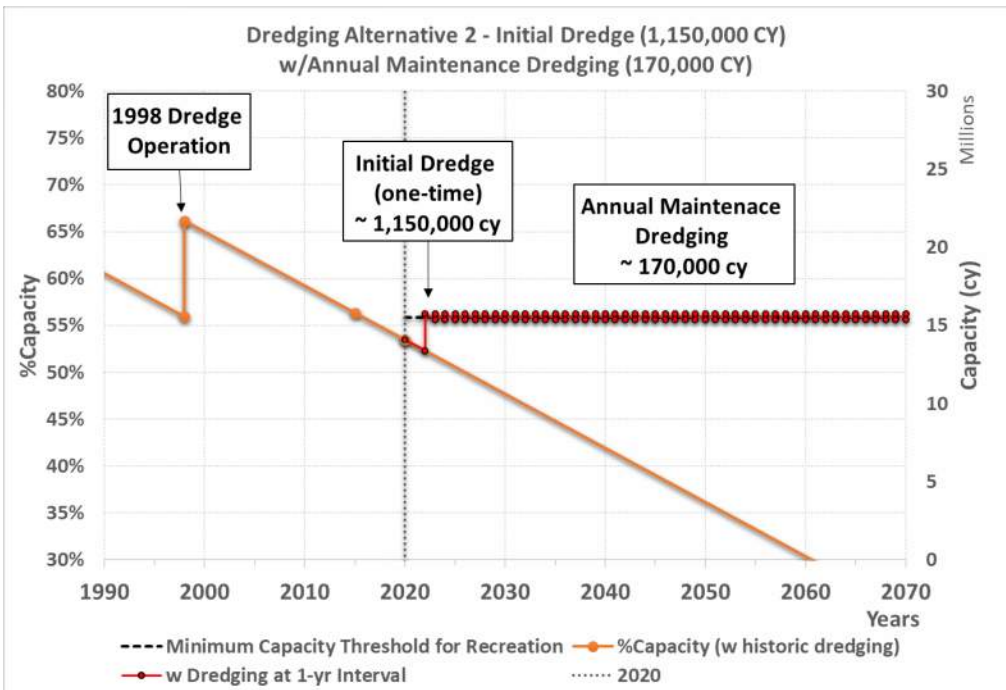
Figure 7-2 : Dredging Alternative 1



7.3 Dredging Alternative 2

The second alternative is presented in **Figure 7-3**. This alternative is presented as an option to restore lake depth immediately for recreational use and to implement an annual dredging program to maintain the lake above the recreational threshold of 8 feet. The alternative assumes an initial capital project to remove approximately 1.15 million cubic yards of sediment, with an annual dredging operation of 170,000 cubic yards to offset the additional accumulated sedimentation. The upfront cost of the initial dredge operation ranges from $19 to $34 million, followed by a recurring cost ranging from $3.9 to $6.0 million for each of the following years. This equates to an annualized cost between $4.2 and $6.7 million for the program over a 50-year period.

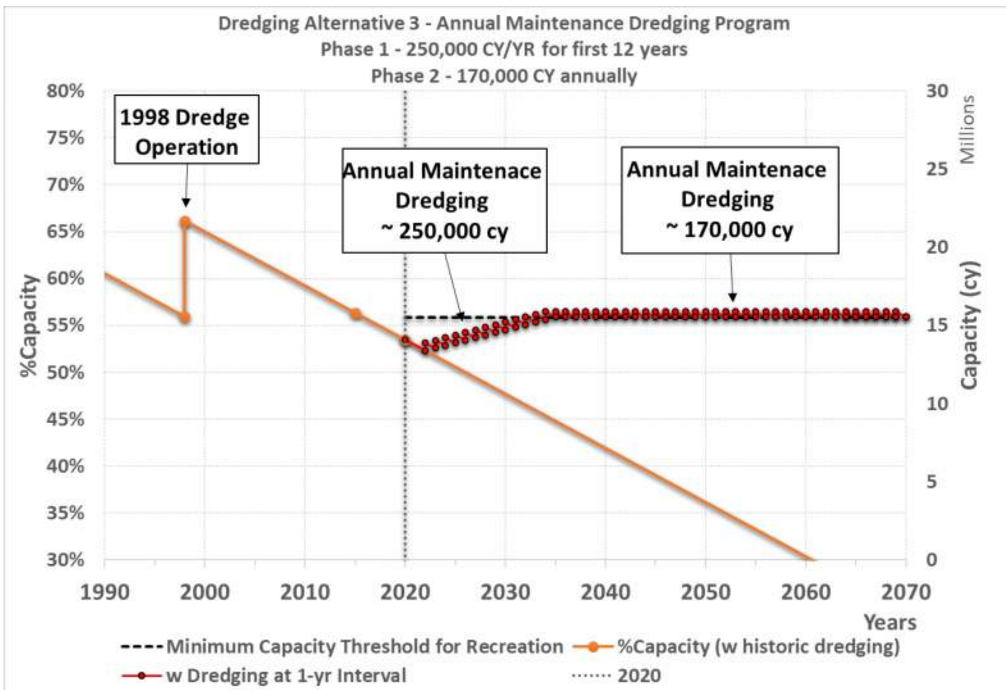
Figure 7-3 : Dredging Alternative 2



7.4 Dredging Alternative 3

Alternative 3 does not include an initial CIP project as part of the proposed strategy. Instead, this alternative relies on a more aggressive annual maintenance dredging (250,000 cubic yards per year) to gradually restore lake depth over a period of 13 years (2022-2035). After the depth meets the recreational threshold of 8 feet, the program switches to the 170,000 cubic yards per year to keep up with the estimated sedimentation rate. **Figure 7-4** demonstrates this concept. This program assumes a cost ranging from $6.6 to $12 million for each of the first 13 years, and a cost ranging from $3.9 to $6.0 million for each year thereafter, for a total annualized cost between $4.5 and $7.4 million over the 50-year evaluation period.

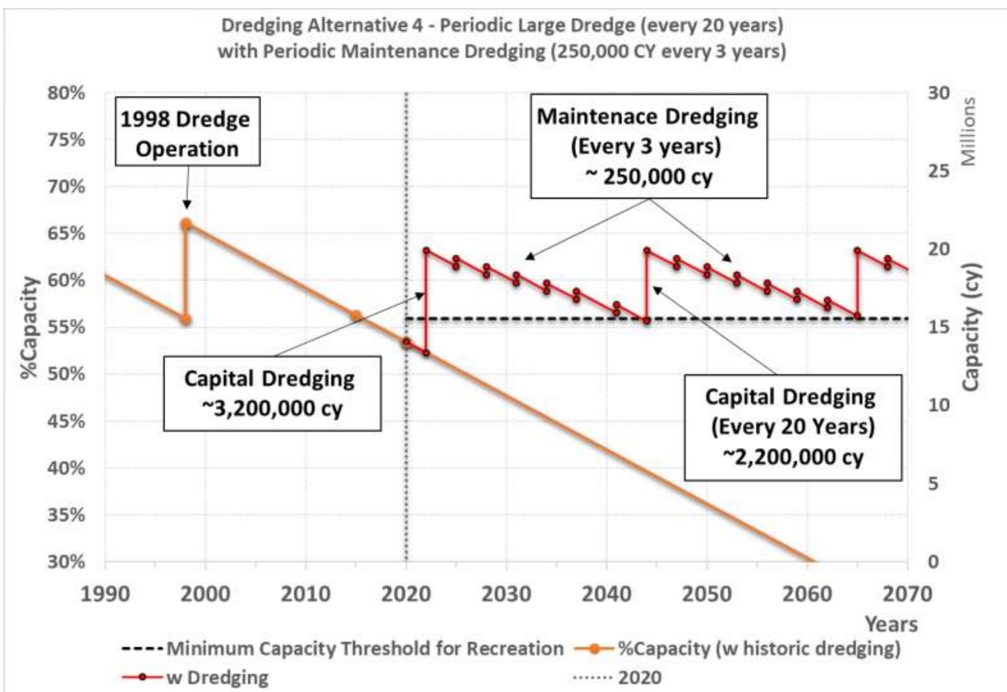
Figure 7-4 : Dredging Alternative 3



7.5 Dredging Alternative 4

Alternative 4 is a combination of a large capital dredging operation with interim maintenance dredging projects to extend the amount of time between large projects and limit impacts to recreation. This alternative assumes an upfront capital project to remove 3,200,000 cubic yards of sediment, followed by maintenance dredging of 250,000 cubic yards every 3 years. A large capital project to remove 2,000,000 cubic yards of sediment would need to be performed again every 20 years. **Figure 7-4** demonstrates this concept. This program assumes a cost ranging from $35-$88 million upfront and every 20 years, with a recurring cost of $7 to $12 million every 3-years, for a total annualized cost between $4.4 and $8.5 million over the 50-year evaluation period.

Figure 7-5 : Dredging Alternative 4



7.6 Alternative Comparison

A summary of the dredging alternatives is presented in **Table 7-1**. Overall, the City's historical approach to dredging every 20-25 years is estimated to be the cheapest scenario. However, this baseline scenario incurs periods in which accumulated sediment causes significant impacts to recreation on the lake. Switching to one of the more frequent dredging approaches presented in these alternatives is proposed to eliminate these periods of disruption. Alternative 3, which is estimated to be the most expensive operation, is estimated to require 13 years of dredging to restore lake levels, after which annual dredging will maintain the lake level for recreational use. As such, Alternative 3 is not recommended unless a large upfront dredging operation is not determined to be feasible.

Table 7-1: Comparison of Dredging Scenarios (50-Year Period)

Dredging Scenario	Years with Recreation Impacts After Initial Dredge	Total Volume Dredged (CY)	Total Cost (Millions – 2020 $)	Annualized Cost (Millions – 2020 $)	Annualized Cost per CY Sediment (2020 $)
Baseline	16	9,600,000	150 – 265	3.0 – 5.3	$0.31 – $0.55
Alternative 1	0	11,200,000	178 – 314	3.6 – 6.3	$0.32 – $0.56
Alternative 2	0	9,480,000	208 – 333	4.2 – 6.7	$0.44 – $0.70
Alternative 3	13	9,460,000	226 – 370	4.5 – 7.4	$0.48 – $0.78
Alternative 4	0	10,850,000	218—423	4.4—8.5	$0.41 – $0.78

The next consideration is if the City should continue with a periodic dredging approach or switch to an annual maintenance dredging operation. The annual maintenance dredging operations (Alternative 2 and 3) are expected to be more expensive than a periodic dredging operation (Alternative 1). However, it may be more difficult to identify a dewatering and disposal location for large dredging operations, as compared to having an established dewatering location and managing disposal for a smaller volume of sediment. A combination approach similar to Alternative 4 may be able to be optimized based on available budget.

The dredging costs were established assuming that the dredging operations would be performed by a contractor hired by the City. The City may also be able to realize some cost savings if dredging equipment is purchased and maintenance staff is augmented with a crew that is capable of performing the dredging. As a further consideration, it is possible that this equipment and crew may be able to be utilized for other dredging operations across the City as identified in the City's CDMP. However, the costs related to purchasing and renting equipment, as well as storage and maintenance and hiring staff with the training necessary to operate the equipment should be evaluated before selecting this approach.

8.0 SEDIMENT FOREBAY INSTALLATION

The installation of a sediment forebay was evaluated as a potential alternative to prevent sediment accumulation in White Rock Lake. An inquiry about this strategy was presented during the first public meeting (January 28, 2020). In general, this strategy is seen by the public as a sustainable option to reduce the frequency of major dredging projects.

Sediment forebays are designed to trap sediment prior to entering the lake and accumulating it in easily accessible areas for future removal. When properly located, sediment forebays can be an effective sediment reducing method. Used in combination with direct lake dredging, sediment forebays can help provide sediment reducing benefits over a longer-term timeframe.

A sediment forebay creates an impoundment where flow velocity and turbulence are reduced, which allows for the deposition of sediment. Accumulated sediments can then be removed as part of a regular maintenance program using land-based excavation equipment that can easily access the site. This type of maintenance operation is typically less expensive than performing underwater lake dredging.

A conceptual level sediment forebay design was prepared as part of this Feasibility Study using some basic design criteria. The goal was to determine the volume and associated forebay footprint required to capture sediments coming into White Rock Lake. It is important to note that this was a high-level exercise meant only to provide a general idea of the forebay dimension requirements and assess if a feasible location is potentially available for construction.

A typical forebay design includes three main components: 1) a water control structure, 2) sediment forebay, and 3) an outlet structure and overflow weir. The water control structure is designed to divert flows into the sediment forebay during periods of high flow and sediment transport. It may remain open during low flow periods when sediment transport is typically lower. This structure can also be used to drain the sediment forebay in preparation for drying and removal of accumulated sediments. In general, a forebay should be large enough to effectively trap a significant portion of the incoming sediment into the lake and minimize the frequency of maintenance. The outlet structure controls the forebay water level and it should allow for complete drainage of the forebay. The primary function of the overflow weir is to control the passage of high flows.

8.1 Sediment Forebay Sizing

For this conceptual level design, the sediment forebay usable volume was determined based on a general rule of thumb that establishes that the forebay should capture 70% of the estimated average annual sedimentation load. As shown in **Section 4.3**, this value was estimated at approximately 170,000 cubic yards per year for White Rock Lake. Assuming a maintenance frequency of 10 years, the sediment forebay usable volume results in approximately 1,190,000 cubic yards. With an assumed maximum operational depth of 6 feet to avoid additional requirements due to TCEQ dam safety regulations, the forebay would require a footprint of over 120 acres, depending on the actual grading of the forebay.

8.2 Sediment Forebay Location

Finding a suitable location for a sedimentation forebay of this size upstream of White Rock Lake is a challenging task. A potential forebay footprint of this size has been highlighted on **Figure 8-1** for illustrative purposes. Although other locations may be available upstream, the effectives of the forebay in trapping incoming sediments will be progressively reduced as you move upstream. FNI considers that the potential environmental impacts associated with the construction of a sedimentation forebay over this area (or adjacent areas upstream) would render the project infeasible. As seen is **Figure 8-1**, most of this area has been identified as high-quality forested wetlands in the National Wetlands Inventory. Emergent wetlands have also been identified in adjacent areas. These areas are considered Waters of the US and are regulated under Section 404 of the Clean Water Act.

The Unites States Corps of Engineers (USACE) has jurisdiction over these areas, and any project that would impact over half an acre of waters of the US requires an Individual Permit (IP) from USACE. One of the requirements for obtaining an IP is to perform an alternatives analysis that demonstrates that the proposed project is the Least Environmentally Damaging Practicable Alternative (LEDPA). USACE cannot issue a permit for anything else other than the LEDPA. Based on FNI's experience, it is highly unlikely that a sedimentation forebay in this particular area would be considered the LEDPA, as the other dredging options evaluated in this study can achieve the same project goals without incurring in significant impacts to Waters of the US. Therefore, based on this preliminary assessment, FNI does not recommend the inclusion of a sediment forebay as part of a sediment reduction strategy for White Rock Lake.

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Conceptual Sediment Forebay Footprint

White Rock Lake Dredging Feasibility Study

FN JOB NO	DWU19688
FILE	SedimentForebayArea
DATE	7/2/2020
SCALE	1:8,000
DRAFTED	02537

FIGURE 8-1

Path: H:\WR_DESIGN\Stormwater\Exhibits\Report\MXDs\SedimentForebayArea.mxd

9.0 TIMELINE

A general timeline including steps prior to actual dredging activity is included below as **Figure 9-1**.

Figure 9-1 : General Dredging Project Timeline

	Year 1				Year 2				Year 3				Year 4				Year 5			
Procure Funding (Timing TBD)																				
Engineering Design																				
Permitting (local, state, federal)																				
Public Review & Comment																				
Dredging Operations & Disposal																				

Before the dredging operation can occur, the engineering design, permitting, and public review and comment periods are anticipated to take at least two years. This schedule does not include the time it takes to procure funding, since an anticipated funding source has not been identified.

The dredging operation for any of the large capital projects is estimated to take at least a year but will scale with the final dredge volume. The dewatering process may take approximately the same amount of time, depending on the exact method to be employed. Dredge time may also be affected by the identification of an available disposal site or land application, if land application is a feasible option for disposal and dredge spoil storage availability is limited.

9.1 Potential Obstacles and Concerns

The feasibility screening identified a number of potential roadblocks that may delay or otherwise complicate dredging in White Rock Lake. The main obstacles include:

- Environmental permitting concerns
- Identification of appropriate locations for dewatering and permanent disposal of dredge material
- The overall cost of any of the likely dredge operations for White Rock Lake

The overall cost of large dredging projects and lack of available grant and loan funding for such an operation is the most significant obstacle that could prevent the implementation a dredging program of this magnitude at White Rock Lake.

Likewise, storage and disposal of dredge spoils is considered to be the most significant cost factor impacting the feasibility of performing a dredge operation at White Rock Lake. The cost of landfill disposal may singlehandedly render the project infeasible. Therefore, it is critical that the City identify a location where material can be dewatered and disposed of without incurring a substantial cost. Further testing of the sediment material will be required to evaluate potential for sediment reuse and land applications.

10.0 CONCLUSIONS AND RECOMMENDATIONS

The thoughtful implementation of a dredging program will be critical to maintain White Rock Lake as a valuable recreational destination in the City of Dallas. The overall cost of dredging projects and identification of a viable funding source is the most significant obstacle that could prevent the implementation of a dredging program of this magnitude at White Rock Lake. Costs of storage and disposal of dredge material is anticipated to be significant, thus the City should seek to identify a low-cost disposal option or potential reuse application. FNI recommends that the City continue to engage the appropriate stakeholders and evaluate potential funding sources during budget planning to decide on a path forward.

Several dredging operations are presented in this report for comparison and consideration. The approach the City has historically taken to dredging at White Rock Lake is presented as a base scenario to compare the benefits and costs of alternative dredging scenarios. Four alternatives to this baseline scenario have been developed to demonstrate different approaches the City can take to implement a proactive dredging program to meet their goals and objectives for the lake. It is recommended that the City scale the approach to meet budget and staff resource constraints.

The alternative scenarios presented in this report are not meant to represent an exhaustive list of options for dredging operations at White Rock Lake. Instead, the City should use the examples, data, and cost estimating techniques developed for this report as a decision-making tool to explore implementation scenarios and determine the best use of the City's resources as they apply to a recreational dredging operation.

A high-level summary of the outcomes and findings of this feasibility study is provided in the following sections, along with a list of recommended next steps for the near future of a potential dredging project at White Rock Lake. Understanding the implications of these findings will be critical to successful execution of the next phases of this project.

10.1 Feasibility Study Findings

The following summarizes the primary findings of the White Rock Lake Dredging Feasibility Study.

- The primary goal and purpose of a dredging program at White Rock Lake is to enhance and maintain watersport and lakeside recreational activities, as well as protect the environment of the lake. As such, a target lake depth of 8 feet was established for the purposes of this study.

- Based on observations from historic bathymetric survey data, the annual sedimentation rate over the life of White Rock Lake has ranged from 150,000 to 250,000 CY of deposited sediment per year. For the purposes of this study an average annual sedimentation rate of 170,000 CY per year was used as a working estimate.
- Sediment and elutriate sampling performed as part of this feasibility study indicate no substantial risk to dredging contractors or to the lake environment. Dredged sediment appears to meet the criteria for a Class 2 non-hazardous waste if landfill disposal is selected. However, additional analyses may be necessary to determine if dredged sediments can be beneficially reused on upland land application sites.
- Federal, state, and local regulatory permits and authorizations associated with a dredge operation are determined based on site-specific characteristics, including dredge location and volume, dredge material disposal methodology, potential environmental impacts, and various other requirements. Additional information and decision-making are necessary before determining the exact permitting process for the project.
- Identifying potential grant or loan opportunities to fund a recreational dredging project can be challenging. While some opportunities may exist, outside funding is unlikely due to the limited purpose of the dredging project.
- Four dredging scenario alternatives were evaluated ranging from large, infrequent dredging projects to annual maintenance dredging programs. For equitable comparison, the alternatives were evaluated on a 50-year life cycle. Total costs range from $180 million to $420 million, and annualized costs range from $3.6 million per year to $8.5 million per year.
- Storage and disposal of dredge spoils is considered to be the most significant factor impacting the feasibility of performing a dredge operation at White Rock Lake. Determining disposal method and location will be critical to refining cost estimates.
- The installation of a sediment forebay was evaluated as a potential alternative to prevent sediment accumulation in White Rock Lake. However, due to the large footprint required for such a facility and the significant impacts to wetland and greenspace areas, a sediment forebay would likely not be permittable and is deemed infeasible.

10.2 Recommendations for Next Steps

The following summarizes the recommended next steps for the future of a potential dredging project at White Rock Lake.

- Continue to engage the appropriate stakeholders and evaluate potential funding sources during budget planning to decide on the appropriate path forward. Public involvement has been a key component of this feasibility study and should remain so for future phases of this project.
- Further project definition – i.e., prioritized dredge locations, location-specific target lake depths, and dredge program frequency – is needed to refine cost estimates and should be performed in advance of pursuing project funding.
- Identify a viable funding source for the selected dredge program approach. With limited outside funding sources available, this may include obligation bonds, sales/property tax reallocation, special tax districts, or lake user fees.
- Investigate potential dewatering and disposal locations. If landfill disposal is pursued, consider negotiations with candidate landfills to reduce unit costs. If mine or quarry disposal is pursued, identify operators, confirm appropriate permits, and negotiate costs. Dredging frequency will likely be an important factor in this determination.
- Perform additional sediment testing at prioritized dredge locations to evaluate the sediment for beneficial reuse in upland land applications.
- Conduct an updated and detailed bathymetric survey to evaluate current sediment volumes and provide more accurate estimates of volume of material to be dredged.
- Pursue additional engineering analyses and consider a Preliminary Engineering Report (PER) to further define the dredge project based on additional information gathered. Perform detailed engineering design for the selected dredge scenario.
- Apply for appropriate state, federal, and local permits based on detailed engineering design.

11.0 REFERENCES

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APPENDIX A
White Rock Lake Site Visit Photos (January 16, 2020)


Sunset Bay


Sunset Bay


Sunset Bay


View of Lake from Dreyfuss Club


View of Lake from Dreyfuss Club


Dreyfuss Club

Dreyfuss Club

Bath House Cultural Center

Bath House Cultural Center – Old Swimming Area

Bath House Cultural Center – Old Swimming Area

Bath House Cultural Center – Old Swimming Area

Bath House Cultural Center – Park Area

Corinthian Sailing Club

Corinthian Sailing Club

Corinthian Sailing Club – Park Area

View of Lake from Corinthian Sailing Club

Mockingbird Road Bridge

Mockingbird Road Bridge

Jackson Point

Jackson Point

Jackson Point

Cyclists Parking Lot at Jackson Point

Boat Ramp

Boat Ramp

Team Meeting

Boomerang Boat House

Boomerang Boat House

Boomerang Boat House

APPENDIX B
Stakeholder Input Summary

Appendix B-1: Initial Online Public Input Survey

Available for Comment from January to February 2020

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	Race Sailboats on the Lake	Uniform dredged allow for unimpeded and safe navigation of sail/rowing vessels	
	I sail on the lake and hike around it	My main concerns are that dredging could be considered a low priority and get delayed when it is already becoming a significant issue for the lake, and that the dredging may be done again without anything being done to address or mitigate the erosion around the lake and the silt and debris washing into the lake from upstream.	
	I live near the lake, have used it since the 70's from biking to fishing. I kayak fish the lake 2-3 times per month. If something isn't done soon it will be a mud hole or creek again. Most of the lake is 4'-6' deep in the middle and less than 3' everywhere else. Please save my lake!	It needs to be done sooner than later. Our city spends millions on absurd endeavors daily, why not do something that the residents actually want!	Save White Rock Lake!
	Sailor, member Corinthian Sailing Club	When will it start? Where will the silt go? How will the dredgings be transported away?	
	Board Member of Dallas United Crew Corinthian Sailing Club member	How will the dredging effect rowing and sailing sports on the lake.	
	Live here	Needs to be done ASAP. Overdue.	There should be plans for periodic dredging.
	I have grown up at the lake and sailed there my whole life.	The lake needs to be dredged desperately due to the fact it is long over due and is becoming increasingly shallower. As a sailor I know personally just how shallow the lake is because whenever our boats capsize, they easily get stuck in the bottom sludge.	
	Race sailboats there	How soon can you start.	This is an issue with all the flooding bringing slit down and filling the lake with silt and mud
	Very.	Clean out the lake and make sure it doesn't fill up with Plano's trash	
	Frequent park visitor / paddler / sailor	The lake is in desperate need of dredging and silt control. Constant debris is visible - trees and garbage. Sunset bay is barely a paddle deep.	How is maintenance of the lake even in question. Property values around the lake are to high to abandon it.
	I walk around the lake almost everyday	It is imperative it is done. I have noticed many areas that are filled with sledge instead of water, less wildlife. Sunset Bay Area is the worst. This past summer I saw adults walking and pushing strollers on the dry sludge to get closer to the birds- all I can say on that is yuck! Please take care of Dallas's most beautiful asset.	
	Sail on the lake and bike around the lake 1-3x per week	Would love for it to happen. Always see boats (sailboats, kayaks, paddle boards be cautious about hitting logs and have seen them all hit logs). Also the water has gotten really gross.	

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	Nearby resident and park user since 1979.	Control future siltation from upstream sources. Establish ongoing maintenance/dredging so that the lake does not require a major dredge at 20 year intervals. Preserve as much of the native ecosystem as possible.	We must have a sustainable long term solution. This cycle of massive dredging then decades of neglect is bad for all aspects of the lake and the park.
	I bike around lake	It must be done if Dallas wants to preserve the lake	
	Ride a bike on lake road. Drive on W. Lake Highlands Dr. to admire the view.	It needs to be done and the lake will be ugly for the years it take for the project. There needs to be settling pools at the creek inlets to the lake that will let the sediment settle before getting to the lake proper. They can be dredged more easily than the lake.	
	Member/officer of White Rock Boat Club. Participant in sailboat racing every Saturday. Frequent hiker/biker/photographer at the Lake. Have attended a several WRL Task Force meetings.	Needed as soon as possible. Dredging contract should include incentives for early completion.	Dredging needed at White Rock Creek and Dixon Branch entrances to the lake.
	Use park every week, go out on lake in a sailboat, walk around lake.	Get it done - it is the outdoor treasure of this city. The lake will get funky in many ways as it fill with sediment (I am a retired geologist)	Work on how to actually reduce sediment influx - some of the measure you require for builders are just good intentions ...if you actually observe how it does not work
	Past President and member of White Rock Boat Club, cyclist and walker on the lake, sometime fisherman	My major concern is the specific timeline so that the boat clubs and other regular users of the lake itself can make necessary plans.	I'm very pleased that this is being undertaken in a timely fashion and appreciate all the authorities concerned and their work.
	Lochwood Neighborhood Association President. Recreational user of the lake . Member of White Rock Partners neighborhood group.	I know it's a fundamental requirement...get 'er done!	
	Resident	Ecosystem damage concerns. Survival threat to fowl, other marine life and wildlife. 85% of diversity of fowl was lost due to major habitat disturbance from last dredging with no remediation. The affect from the disturbance of decades of residual herbicides and pesticides on lake area (and downstream) marine and wildlife a large concern.	Dredging will destroy emerging wetland areas of the lake that are wildlife dependent.
	Yes	That it will not begin soon... it needs to be done, sooner rather than later.	My wife and I visit the lake nearly every day. It is a fantastic recreational resource for 5he city and home to countless birds, animals, fish and other species of life.
	I live one block from the Bath House Cultural Center. I run, ride bikes with my kids, canoe, and fish in the lake. I consistenly clean the park.	I think it's very important to protect White Rock Lake and preserve it as a park for all of Dallas to enjoy. It is very important to keep it PUBLIC, and not allow any privatization of park venues. We need to ensure that we are environmentally sensitive to its preservation. We need to maintain the facilities and have adequate traffic control. White Rock Lake supports a large number of wildlife species that also need protection. We need to be good stewards of our community	

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	For the love of the lake, monthly cleanup, cyclist, neighbor, environmentalist, naturalist	I am concerned that the cost of dredging will lead to surface concessions in the form of restaurants and other development on pro land.	I think there's a lot of opportunity to overthink what dredging looks like and get a lot of chefs in the kitchen. Dredging is very straight forward, and the materials are going to be the consolidated waste and run off from 40 years of surface drainage, but it's constantly running water over it so getting it out is a storage exercise.
	Being a nature lover and wildlife advocate	What studies have been made (ecological impact) in order to move forward in such decision?	
	My husband and I use it recreationally for biking, kayaking, running, and viewing wildlife. We got married at Winfrey Point in 2011. The lake is one of our favorite places.	I'm concerned about the impact the dredging will have on wildlife and what can be done to protect the habitat from disturbance.	
	Live nearby, sailing, general use	How soon can we do it? Can we dredge it deeper this time so it doesn't need it so often?	The sooner it's dredged the better!
	Avid kayaker and fisherwoman. I bring my dog on a walk around the lake every morning, and have spent countless hours on the shores.	Questions: 1) impact on aquatic life. I know the lake needs to be dredged or it will turn into a meadow, but will there be any efforts to replace lake bottom structures, or add new ones such as sunken trees, brush piles, or rock structures? Maybe the northern edge could have some ridges formed to give the fish something to hang around on. 2) water quality. Will dredging improve the water quality at all? 3) will you send me an email when it starts so I can come watch?	
	Biking and walking around the lake	The dredging needs to be done but please do not pile up the materials at or near the lake, can they be moved off site or maybe used to fill in low areas close to the lake. I don't think creating more land and shrinking the lake is the right answer.	Please do not interrupt the bike/walking and running traffic on the streets and paths around the lake while the dredging takes place
	My office is right next to it and I live nearby as well. I am off and walking or participating with lake activities.	Along with the dredging, is there a plan to develop a collection system for future silt at the head of the lake so as not to have to dredge it every 20 years?	
	Love in the neighborhood		
	Live <1 mile away; visit at least weekly	Timeline to complete; how long will the process take? Will the dredging affect usability of the lake during that time? Can any improvements be made to improve water quality alongside the dredging?	
	Cycling and Running at the lake and lived by the lake for 20 years before moving to Plano	How would it impact the daily routines of all the people that visit the lake.	
		Please, DO IT but tell me where the dredge material will go.	

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	I kayak and fish the entire lake. I also bike and walk the lake regularly along with taking our dog to the dog park there.	I am 100% in favor of this action. Will we engage the cities up stream to protect against litter and water contamination? Will we engage those cities to help offset the cost?	
	Use the trails frequently. Previously had a boat at the boat club.	I think that it is vital to keep the lake healthy which in this case means the necessity to dredge it. I am more than happy to vote for higher taxes or move city funds towards this project. The sooner the better.	
	Local resident	1) how will this be funded/ where will money come from 2) is there a traffic plan/how will traffic be affected 3) where will the silt go? 4) how will wildlife be affected/will it kill wildlife 5) have you benchmarked other dredge plans/I.e. Baltimore	Great idea, just please plan diligently before executing and use the RFP bid process. Residents are tired of stalled and half-ass work.
	Neighbor	Want info on it	
		Dredge the hell out of it and clean out the years of silt and garbage that have built up!!!	
	Community involvement, Birding, cycling, sailing, Fishing and kayaking	A major consideration for me is habitat for water aquatics and the ability to build underwater structure. I've noticed over the years that the ecology in the lake has become stale with minor bass and crappie habitat. What will y'all be able to do as far as leaving existing structures and or building more permanent structures? Thanks	
	I live in Little Forest Hills and frequent the lake	I lived in the Lakewood area the last time the lake was dredged so the project is clearly "feasible". Why spend the money on another expensive feasibility study and not just use the previous one. Has anything changed that dramatically? Seems like a waste of precious capital.	Definitely needs dredging
	Live 1 block from the park and use it frequently .	It's time, Consider methods that can be revisited easier, 20 years between dredging's drive the cost exponentially. possibility of filtering or dredging (deepen and widen) on the Creek? Any hope of recovering cleanliness of the water? Consideration for billing or taxing cities north that contribute to the pollution. City wide tax rate or designated fundraisers for future cleanings. Disruption and Disposal of the toxic muck is a worrisome necessity.	The Lake and Park are without a doubt an economic generator and much needed natural oasis. The condition of it is in dire straights. I am reminded of an old song "They took all trees and put them in a tree museum" . Don't let this become our mantra of " Remember when we could play in and enjoy White Rock"

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	I ride my bike at the lake twice a week. I also take my son down there and we go walking often. We live just on the other side of Buckner from the lake.	I think an environmental study on the effects of dredging MUST be required. if it in any way affects the wildlife in the park or stirs up chemicals then it should not be done. A lake is a fragile ecosystem that must be protected. I would also like to know why they are saying it needs to be dredged again when we were told last time was the last time. Also if they do dredge they obviously should not use the same vendor as last time as they obviously did not do their job correctly. I know for a fact the city always uses the lowest bidder and I do not have any confidence in anyone they would hire to dredge to the lake.	No dredging
	I'm a member of a local cycling team and do most of my training and riding for pleasure around the lake. My wife and I are also members of Corinthian Sailing Club at the lake and participate in the Sunday races, annual regattas, and social events.	I'm primarily concerned with the health of the lake - this is urban Dallas's finest public park asset. Apparently from now until the previous dredging has been the longest elapsed period during dredgings. The lake is becoming more shallow and dirtier as sediment, silt, and runoff from White Rock creek pass into the lake. I would hope that dredging be managed in a way so as to not disrupt the current level of access or activities that occur both on and around the lake.	
	I have been a regular jogger and walker at White Rock Lake since 1996	How soon can it start? What obstacles are in the path of starting the project.	The dredging in the late 1990's improved the lake's impounding capacity; the quality of its wildlife habitat; and consequently its beauty and appeal to the citizens of Dallas. I can see how much the lake has silted back up. It's time to dredge!
	I'm not.	I would like to help with the dredging please.	Thank you.
	Area resident and boater	I support any effort at any cost to make the lake safer to wade or swim in. The gains by Dallas residents of a nicer, safer lakeside area are tremendous. If this is pushes us any closer to that, then I am for it.	
	Live 3 blocks away, walk/bike there weekly	Length of dredging needs to be prompt and not drawn out, delayed, or incurring problems etc. Critical that dredging moves timely. Not fair to those thousands of us living/driving near lake daily.	Ensure WRL & trails etc remain available & recreational thru dredging process.
	I go there on a regular basis to photograph birds, other wildlife, and anything of interest that I see.	As the President of Audubon Dallas, the local chapter of the Audubon National Society, I am concerned about how dredging will affect the habitat of the wildlife, especially birds.	I look forward to attending the meeting on January 28th!
	visit several times a year photographing wildlife	upsetting the eco-environment without any studies of long-term consequences for the diverse wildlife including bald eagles	

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	I am @ WRL several times yearly for wildlife photography, esp: birds.	Environmental Assessment (a baseline reading of the lake ecosystem) needs to be required before moving forward. *** One was not done for the last dredge and as a result the lake lost over 85% of its waterfowl and bird species.***	thanks for listening...
	area resident	concern is for the best interest of the wildlife	
	I live around the lake and have participated in clean ups for it.	Last dredging of White Rock Lake resulted in a drastic loss of wildlife and fish. I understand the concept of removing silt build up in the natural channel flow of the original creeks. However, I believe that an Environmental Assessment needs to be done prior to any dredging operations.	Please consider the impact to the beauty of the lake and those that enjoy it before proceeding.
	Live there	Environmental. Please don't displace any animals	
	Cycling, sailing.	What is the time frame of the project?	
	Live one mile away	Lake should be dredged	
	I'm at the lake running or cycling a minimum of four times a week. I think the lake is a jewel of Dallas and I'm very interested in protecting the lake. I love seeing to the birds, the wildlife, the trees, and the sunsets at the lake. My wedding was at the lake. 😊	My concern is what is the impact to birds, ducks, and fish. What is the impact of the dredging?	
	Resident, FTLOTL volunteer	We need an environmental study done to ensure the strides we have made aren't rolled back. I love that my Daughter can see bald eagles and so much more right here in the heart of Dallas.	
		I am concerned about the effect the dredging of White Rock Lake will have on the wildlife in the area. The lake is developing into a sanctuary for a wide diversity of wildlife, a valuable wetland resource. Surely this is more important than the "recreational" use of the lake for the sailboat crowd. There are many other local lakes that are more suited for recreational use.	
	I live across the street and use the park regularly	At the very least there needs to be an environmental study first to assess the possible impact to the ecosystem in the park and around the lake.	The birds at the lake are a treasure and attract people to the park. They add to the beauty of the area and impact to their habitat needs to be considered.
	years of sailboat racing, wildlife viewing, blackland prairie photography, migration observation, previous monarch butterfly migration in the 100's before the city pulled out all the hemp weed out of the shoreline. Bad mistake	Concerns: Wildlife, migrations, major ecosystem distruption	Yes..unknown mistake from the parks department...pulling out all the hemp weed from the shoreline at the concrete ramp at the end of the parking lot by the pump house. 100's of migrating Monarchs used the help weed for resting and feeding every September fall migration every year.
	Frequent user	Dredging if needed restores life to the lake water	Runoff and organic material on the bottom kill life in the water.

Name	How are you involved in White Rock Lake?	Considerations, questions, or concerns you have regarding the dredging of White Rock Lake.	Any additional comments/feedback:
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	I am a resident and long time, frequent visitor to the gem of Dallas, White Rock Lake.	REQUEST an "Environmental Assessment" be done before doing the study	
	I live here	since it's an inner-city lake....it seems dredging will be needed from time to time, but I don't have all the facts and don't know the connection your making with eagles.	thank you for your work in education.
	Thoroughly enjoy cycling around the lake. I probably have 15,000 miles on my bike over the past 10 years, riding round the lake, one lap at a time.	How soon can you start?	Is the material dredged from the lake recyclable into good mulch or fertile soil?
	homeowner in area in past and our family grew up going there. Memorial bench for my father Robert Renfro is at Sunset Bay in WRL park. deeply interested in preserving habitat there	urge panel to consider Environmental Assessment before dredging planned	
	Running/Walking Dog	Duration of Operation. Traffic Implications. List of Environmental Benefits	
	I volunteer test water at the lake as a Texas Stream Team Water Quality Monitor, I teach classes at White Rock Lake as a Texas Master Naturalist, I lead bird walks at White Rock Lake as a certified Audubon Master Birder. I also live within walking distance of White Rock Lake and visited the park at least a few times a week for the last twenty years.	What department is in charge of this exercise? Will the failing issues with the dam be addressed at the same time as the dredging? What about a yet to be made public source of raw sewage entering the lake and a need to fix that? 303d status for the water in the lake is troubling. If the rate of silt deposition in the lake does not warrant dredging at this time based on acre feet of reservoir capacity will the dredging happen anyway due to political will and campaign promises?	
	Walking/jogging 5-6 days per week. Member of White Rock Lake Foundation Board.	Dredging should be accomplished with minimal to no impact on wildlife living on or near the lake. Dredging should be a permanent part of the city budget, not a two-decade afterthought that requires feasibility studies and bond proposals.	

Appendix B-2: Community Meeting #1

Held on January 28, 2020 at Winfrey Point

White Rock Lake Dredging Feasibility Study

Community Meeting

January 28, 2020

NAME	**WHO ARE YOU REPRESENTING?** *Check <u>one</u> of the following options*				
	Resident	Recreational User	Own property near the lake, and live elsewhere	Business Owner	Other *(please specify)*
	X	X			
	X	X			
	X	X	X		
	X	X			
	X		X		
	X				
	X	X			
	X	X	X		
					Staff
	X	X		X	
	X	X			
	X	X			
	X	X			
	X	X			
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS					
	X	X			
	X	X			
	X	X			
		X			
	X				
	X				
	X				
					Park Staff
	X	X	X		
	X				
	X	X	X		
	X	X			
	X	X	X	X	
	X				
	X	X	X		Sailing CSC
	X	X		X	
	X	X			

White Rock Lake Dredging Feasibility Study

Community Meeting

January 28, 2020

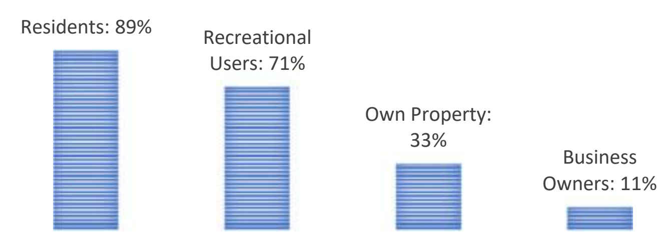
NAME	**WHO ARE YOU REPRESENTING?** *Check <u>one</u> of the following options*				
	Resident	Recreational User	Own property near the lake, and live elsewhere	Business Owner	Other *(please specify)*
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	X				
	X	X	X		
	X	X	X		WRLTF
	X	X	X		
	X	X			
	X				
	X				
			X		
	X	X	X		
	X	X	X		
	X				WEBC
	X	X		X	
	X	X			
	X	X			
	X	X			
	X	X			
	X	X		X	
					Staff
	X	X			
	X				PKR
	X		X		
	X		X		
	X	X	X		
	X	X	X		
	X	X	X		
	X	X	X		
	X	X	X		
	X	X			
	X				
	X	X			
	X	X	X		
	X	X	X	X	

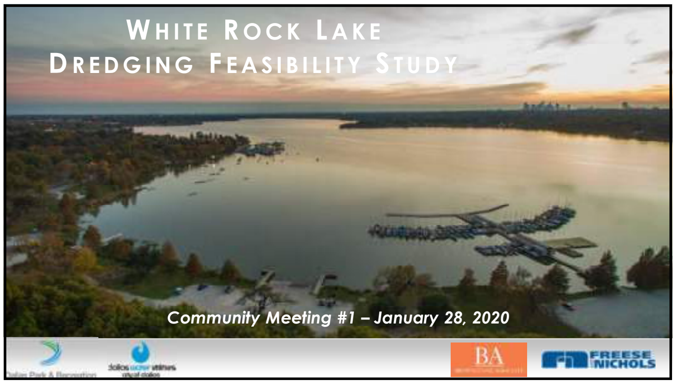
White Rock Lake Dredging Feasibility Study
Community Meeting
January 28, 2020

NAME	WHO ARE YOU REPRESENTING? *Check* <u>*one*</u> *of the following options*				
	Resident	Recreational User	Own property near the lake, and live elsewhere	Business Owner	Other *(please specify)*
ALL NAMES REMOVED FOR PRIVACY OF CITIZENS	X				
	X	X		X	
	X	X	X	X	
	X				
	X	X			
	X	X			
	X				
	X	X	X		board member
	X	X	X		
	X	X			WDF
	X	X			
	X	X			
	X		X		
		X			
	X	X			
	X	X			
	X	X			
	X	X	X		CSC
		X			
	X	X			
	X	X	X	X	
	X	X	X	X	
	X	X			

Summary of Community Meeting Attendees

Total Attendees:	89
Residents:	79
Recreational Users:	63
Own Property:	29
Business Owners:	10




WHITE ROCK LAKE
DREDGING FEASIBILITY STUDY
Community Meeting #1 – January 28, 2020
BA
FREESE NICHOLS

1


1. Provide maintenance updates from Dallas Water Utilities
2. Provide background and objectives of dredging feasibility study
3. Gather input from community and user groups
Meeting Information
Purpose of Meeting
2

2


White Rock Lake Dam Maintenance Improvements
• Decommission existing and install new piezometers
• Repair existing upstream (lake-side) dam slope protection and hardening
• Harden downstream earthen slope
• Repair dam spillway concrete cracking and spalling
Dallas Water Utilities Announcements
3

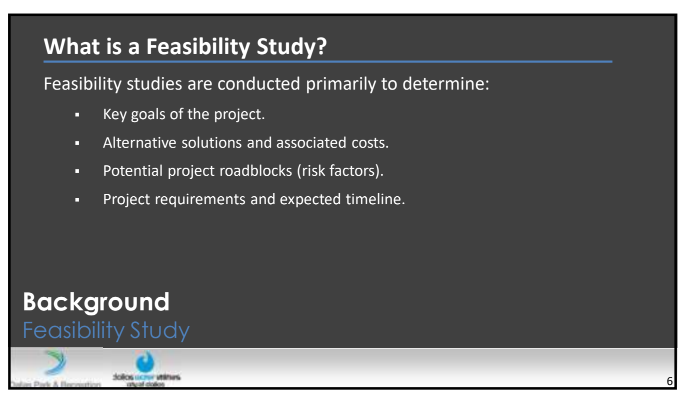
3


White Rock Lake Dam Maintenance Improvements
• Inspect existing stoplogs for repair or replacement
• Manage vegetation at multiple locations
• Address 2019 inspection observations
(minor changes since previous 5-yr inspection)
• Timeline:
– Spring 2020 - Advertise Construction
– Winter 2020/2021 – Begin Construction
– Fall 2022 - Complete Construction*
*weather dependent
Dallas Water Utilities Announcements
4

4


Background Information
5

5


What is a Feasibility Study?
Feasibility studies are conducted primarily to determine:
▪ Key goals of the project.
▪ Alternative solutions and associated costs.
▪ Potential project roadblocks (risk factors).
▪ Project requirements and expected timeline.
Background
Feasibility Study
6

6

Background
Feasibility Study

- Dallas Park & Recreation Department partnering with Dallas Water Utilities on high-level feasibility study including:
  - Approaches for dredging
  - Regulatory requirements for dredging
  - Costs associated with design and dredging activities
  - Potential funding sources for dredging projects
- Freese and Nichols hired as engineering consultant
- Brownstone providing environmental consulting

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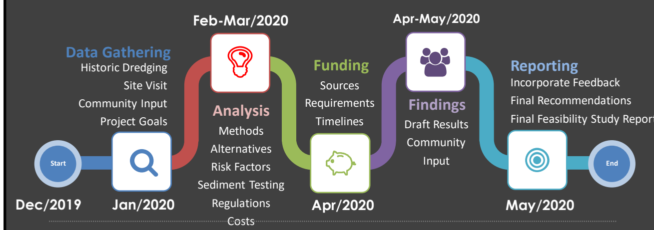
Timeline
Feasibility Study



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Summary
Feasibility Study

9

Meeting Information
Format of Meeting

1. Presentation with interactive survey questions (1 hour)
2. "Come & Go" feedback stations (1 hour)

10

Meeting Information
Opportunities for Feedback

- Online Google Form
- Comment Cards
- Interactive Survey*
- Feedback Stations

** Interactive Survey Results are from a small population sample and cannot be considered statistically significant.*

11

Meeting Information
Opportunities for Feedback

- Online Google Form
  tinyurl.com/white-rock-dredging
- Form will be active until February 11, 2020

12

- Comment Cards


White Rock Lake Dredging Feasibility Study
Community Meeting | January 28, 2020
Comment Card

Name: ____________ E-Mail: ____________

If you have any concerns or comments about the project, please let us know in the box below. Your input is valuable!

Can't stay? No problem! Please mail your comment card to: Dallas Water Utilities | Attn: David Phan
320 E. Jefferson Blvd., Room 312 | Dallas, TX 75203

dallas water utilities
city of dallas
Dallas
Park & Recreation

Meeting Information
Opportunities for Feedback

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- Interactive Survey
- Uses Your Smartphone
- Results* Displayed Real-Time

Meeting Information
What is Mentimeter?

* Interactive Survey Results are from a small population sample and cannot be considered statistically significant.

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QR Code

- Go to www.menti.com
- Use code 75 56 46

or

- Scan QR code (on screen and on FAQ card)

Meeting Information
What is Mentimeter?

* Interactive Survey Results are from a small population sample and cannot be considered statistically significant.

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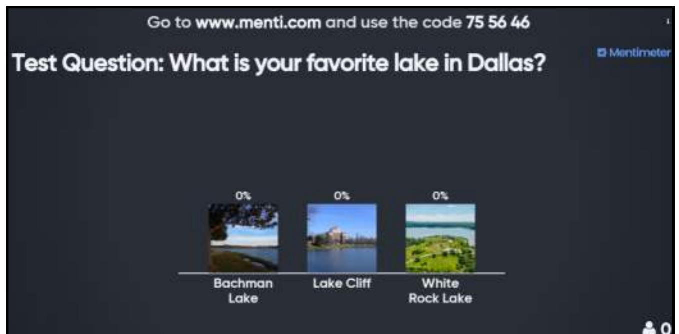

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- Feedback Stations
- City of Dallas, FNI, and Brownstone staff available to answer questions

Meeting Information
Opportunities for Feedback

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QR Code

- Go to www.menti.com
- Use code 75 56 46

or

- Scan QR code (on screen and on FAQ card)

Mentimeter Information

* Interactive Survey Results are from a small population sample and cannot be considered statistically significant.

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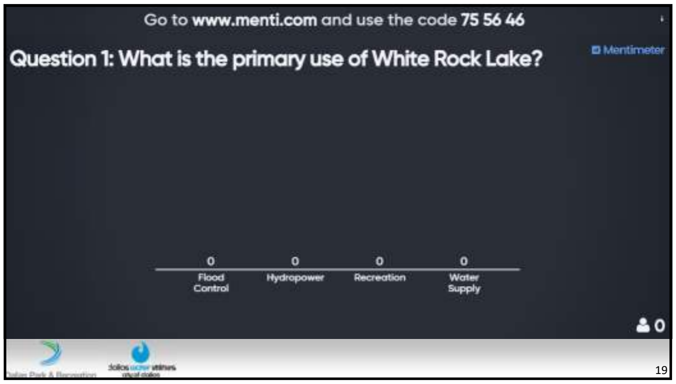

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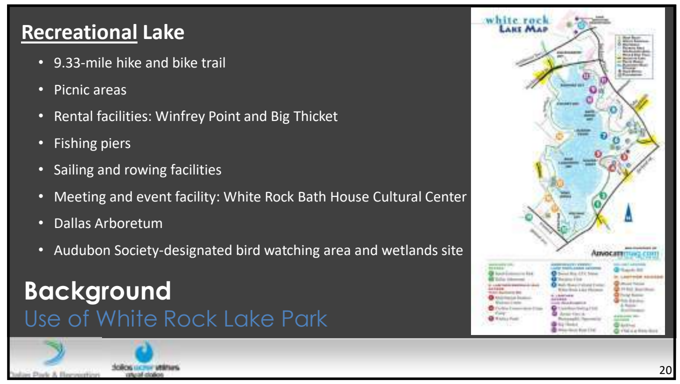

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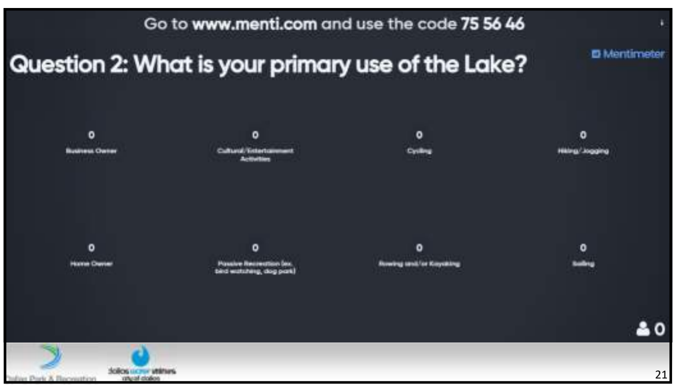

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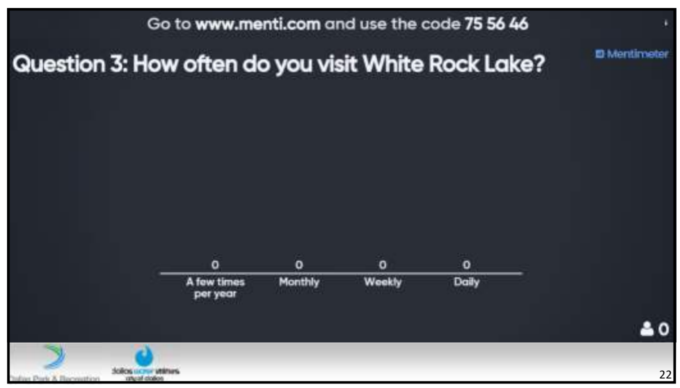

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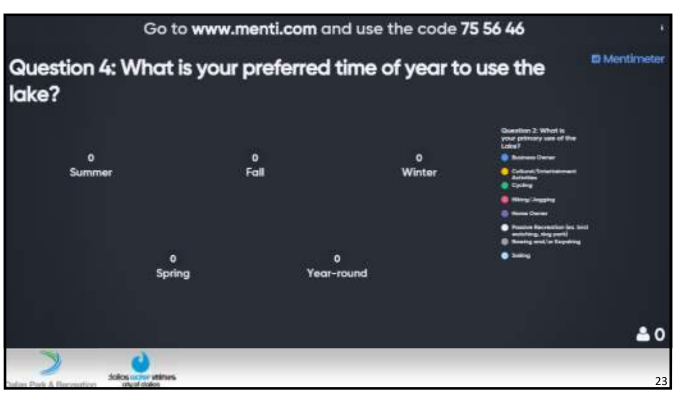

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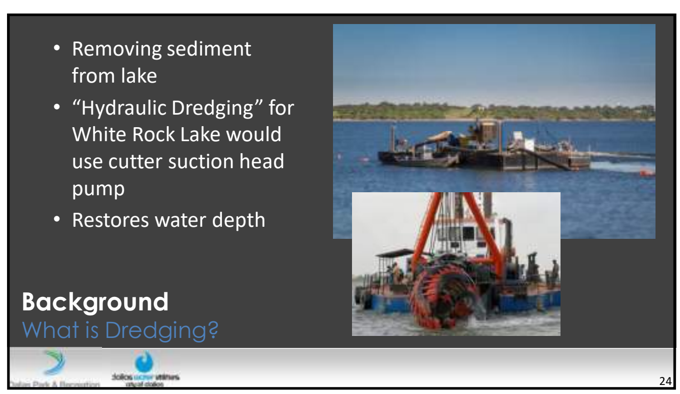


24

- Cost
- Noise
- Smell
- Water Quality
- Sediment Dewatering & Disposal
- Site Disturbances
- Temporary Closures
- Suspended Sediment
- Wildlife Impacts

Background
Construction Considerations

25

25

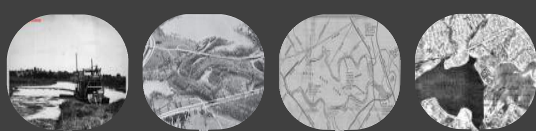
- Improve conditions for water activities
- Water quality impacts
- Improve shoreline maintenance (i.e. trash and debris)
- Project will <u>not</u> provide flood control benefits

Background
Dredging Benefits

26

26

History of White Rock Lake Dredging



1937 | 1955-56 | 1974 | 1996-98

27

27

History of White Rock Lake Dredging

- 1937
  - Completed in 3.5 years
  - 400,000 cubic yards of sediment removed
  - 90 acres of land reclaimed
- 1955-1956
  - 15,000 cubic yards of sediment removed
- 1974
  - 1,350,000 cubic yards of sediment removed
  - Sediment used to rebuild marshy areas
  - Creation of Mockingbird Point

28

28

History of White Rock Lake Dredging

1996-98

- Last dredging completed in 1998
- Last study that preceded the dredging was in 1994
  - Study found that sediment impacted oxygen levels in the summer, which could threaten the fish population
- Approximately 3,000,000 cubic yards of sediment removed

29

29

History of White Rock Lake Dredging

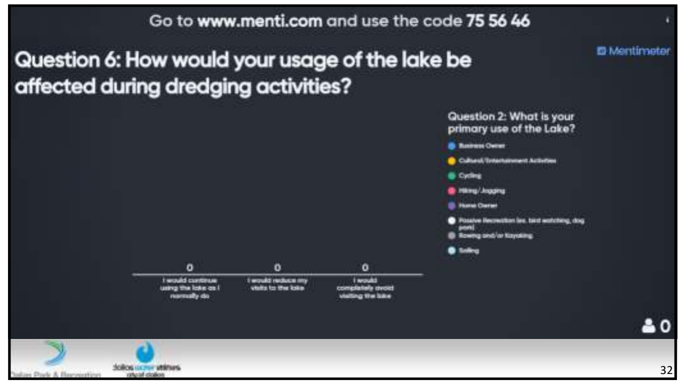
1996-98

- Bond-Funded Project
  - 1995 Bond Funds - $9M
  - DWU Revenue Bonds - $9M
    - Reimbursed with stormwater revenues
- Cost savings realized when a landowner needed his gravel pit filled in Hutchins, Texas
  - Dredge boat pumped sediment from the bottom of the lake through 24-inch pipes straight into the pit for 9 months

30

30

31



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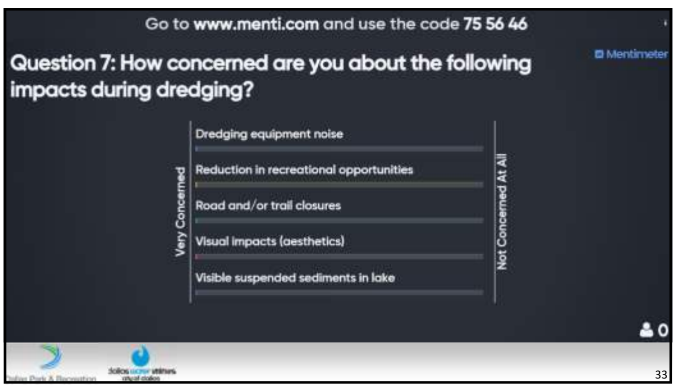

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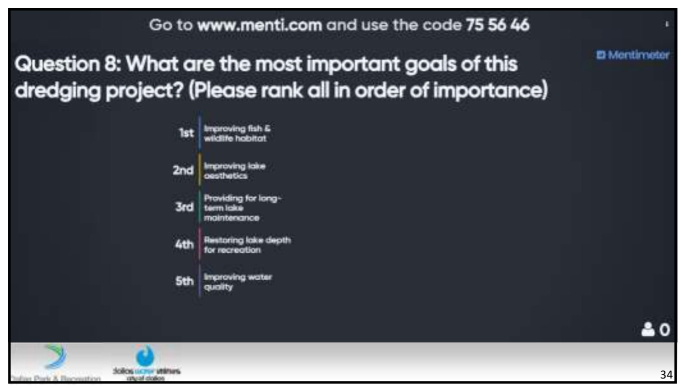

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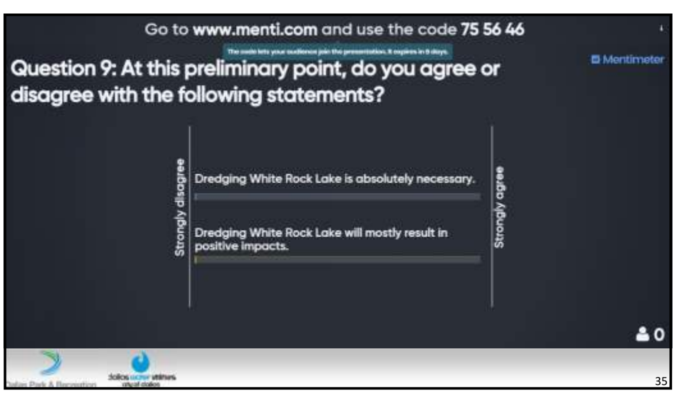

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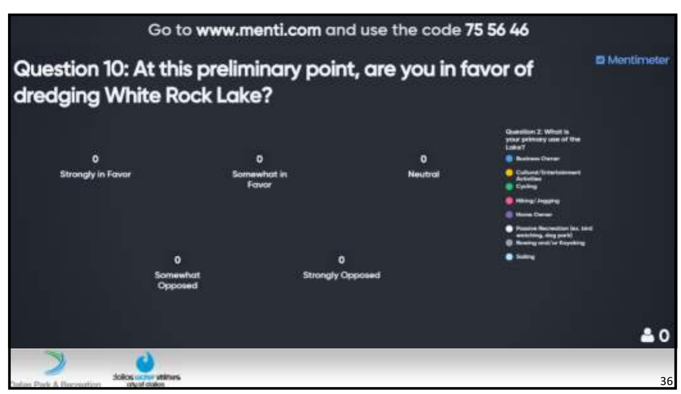
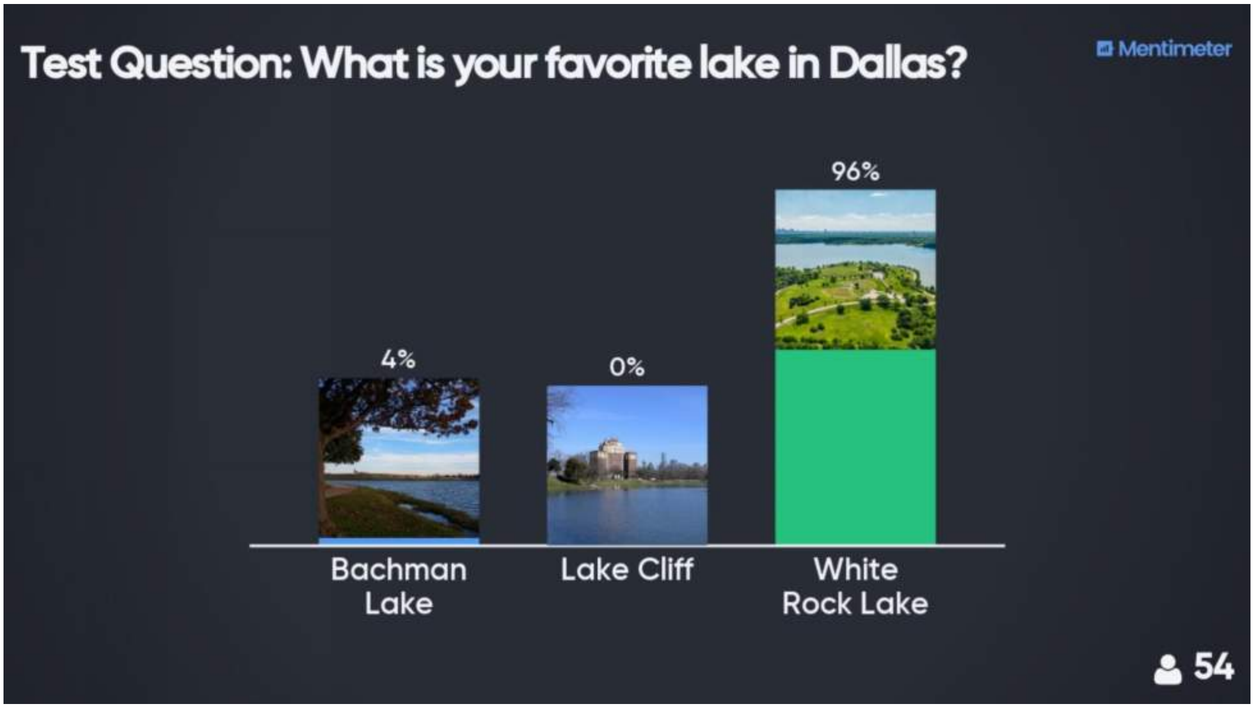
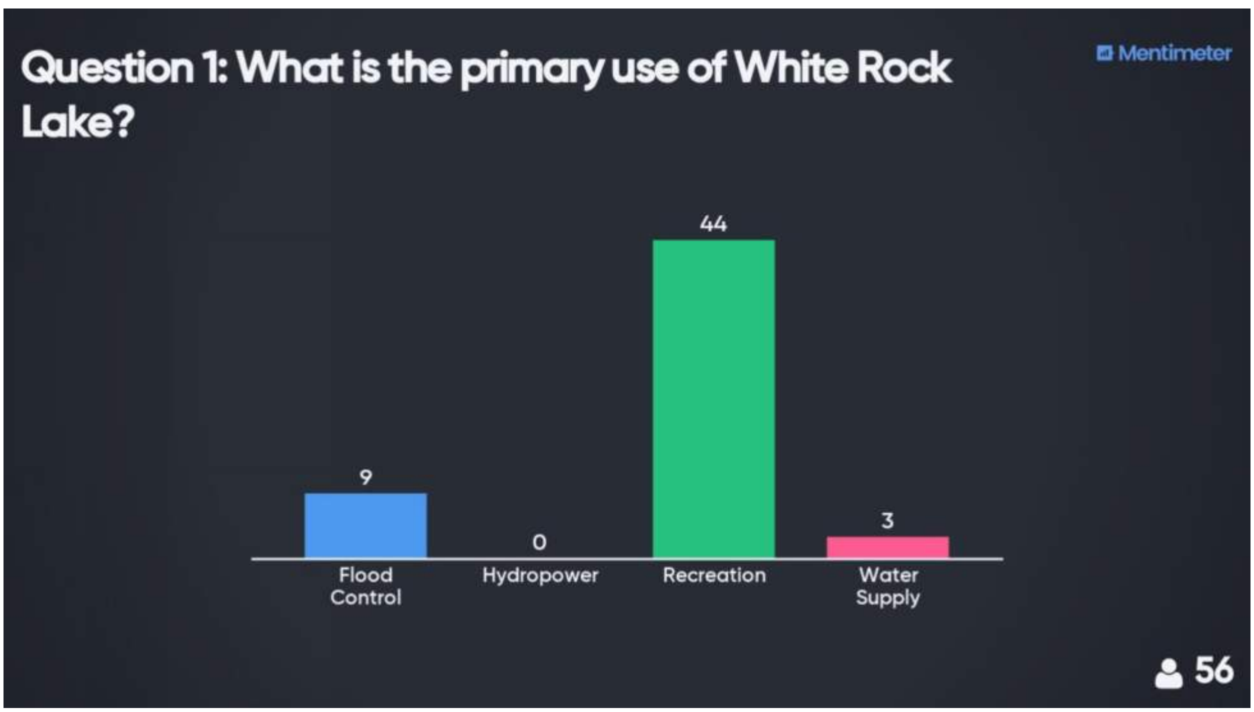
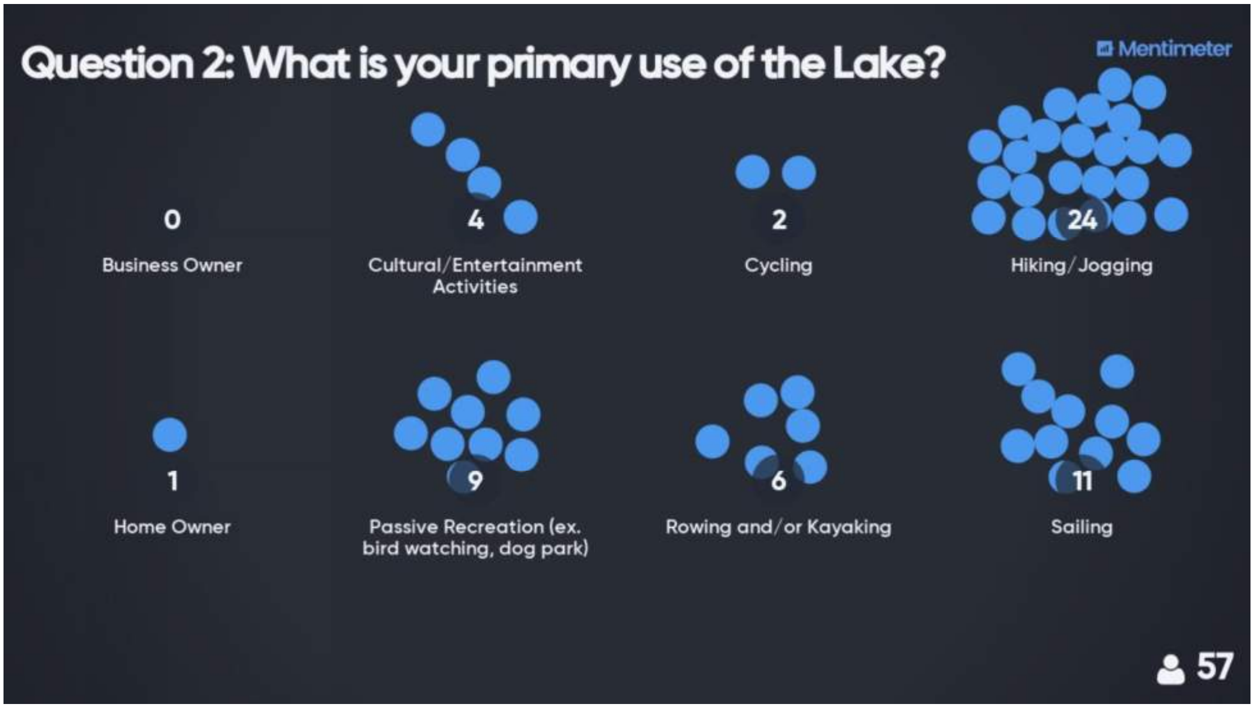


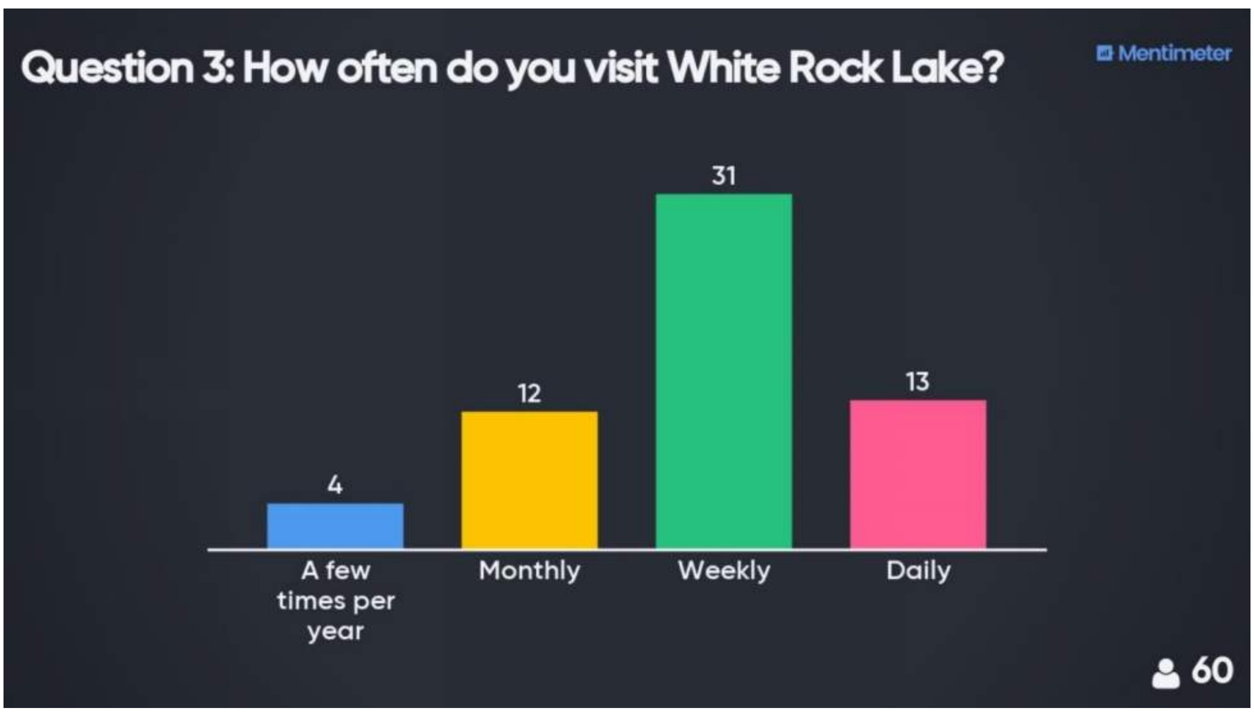
36

White Rock Dredging Feasibility Study
Community Meeting #1
Live Poll Questions Results

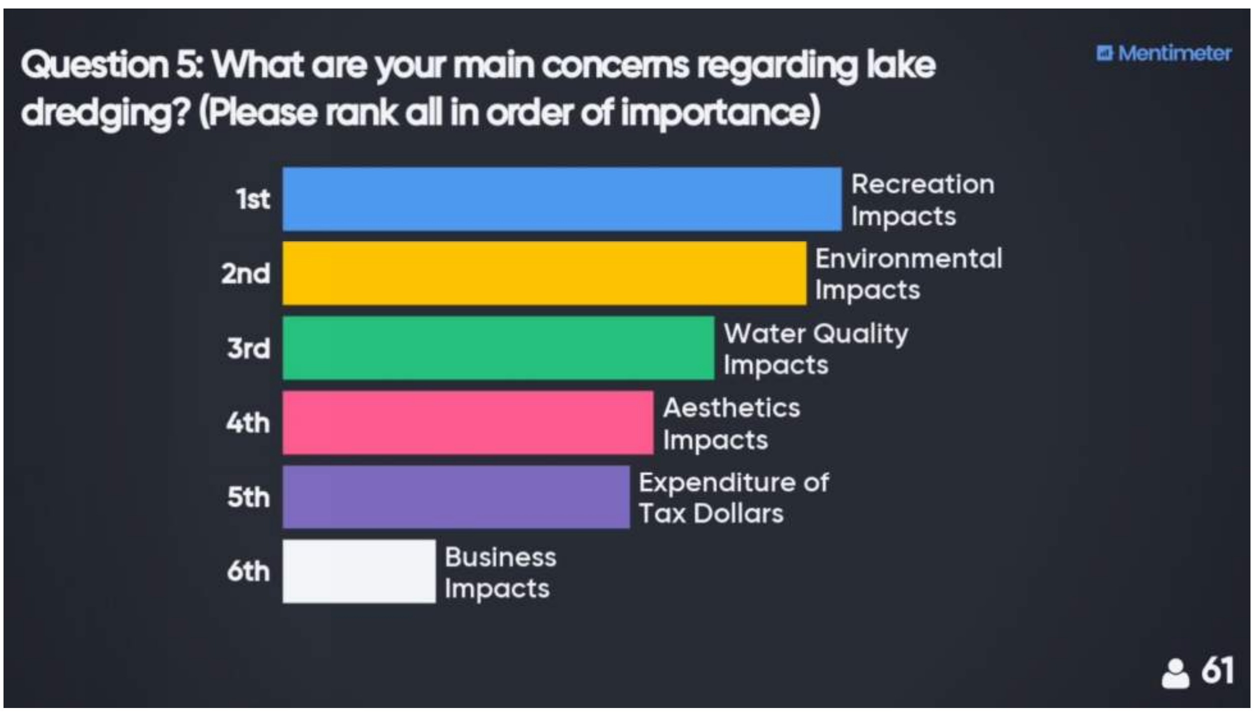


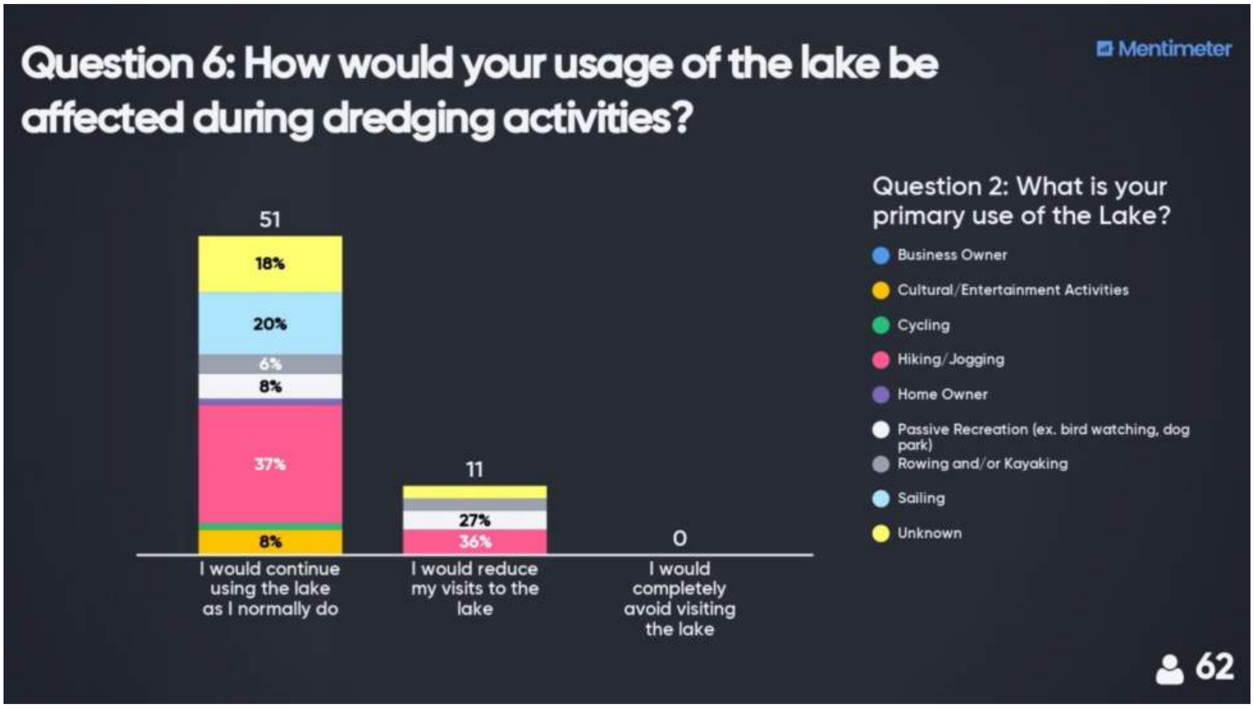


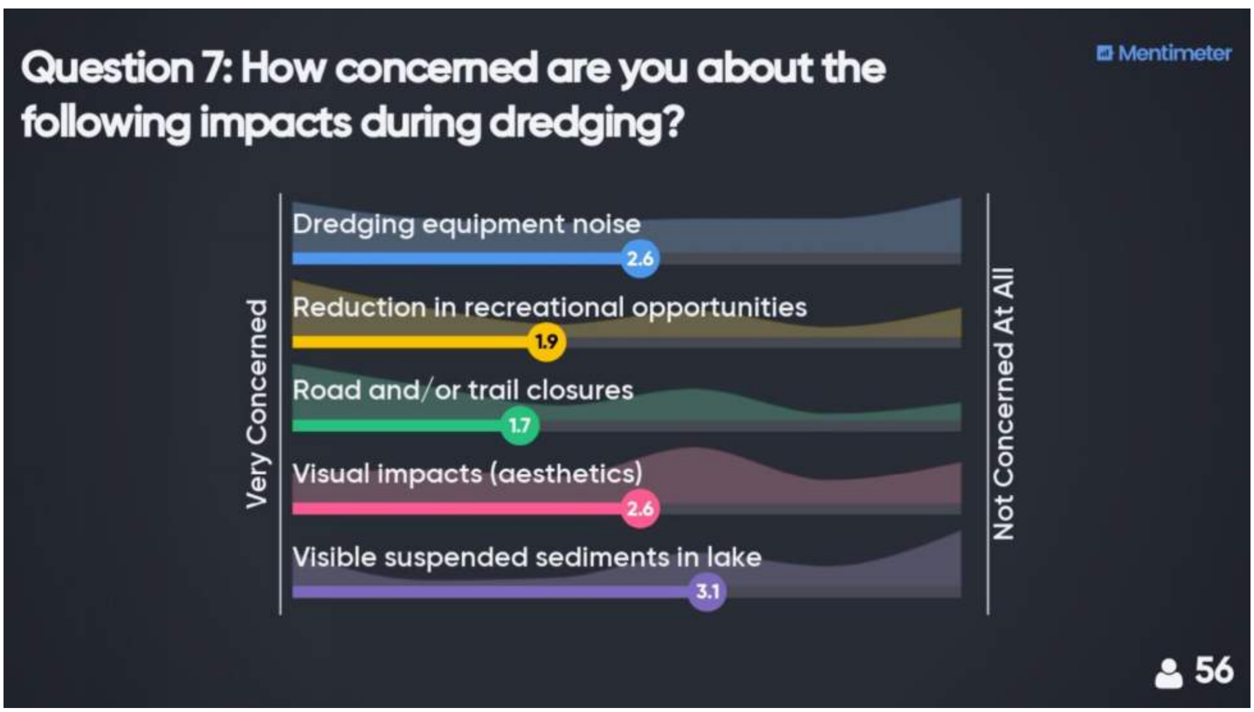

Question 2: What is your primary use of the Lake?
Mentimeter
0
Business Owner
4
Cultural/Entertainment Activities
2
Cycling
24
Hiking/Jogging
1
Home Owner
9
Passive Recreation (ex. bird watching, dog park)
6
Rowing and/or Kayaking
11
Sailing
57

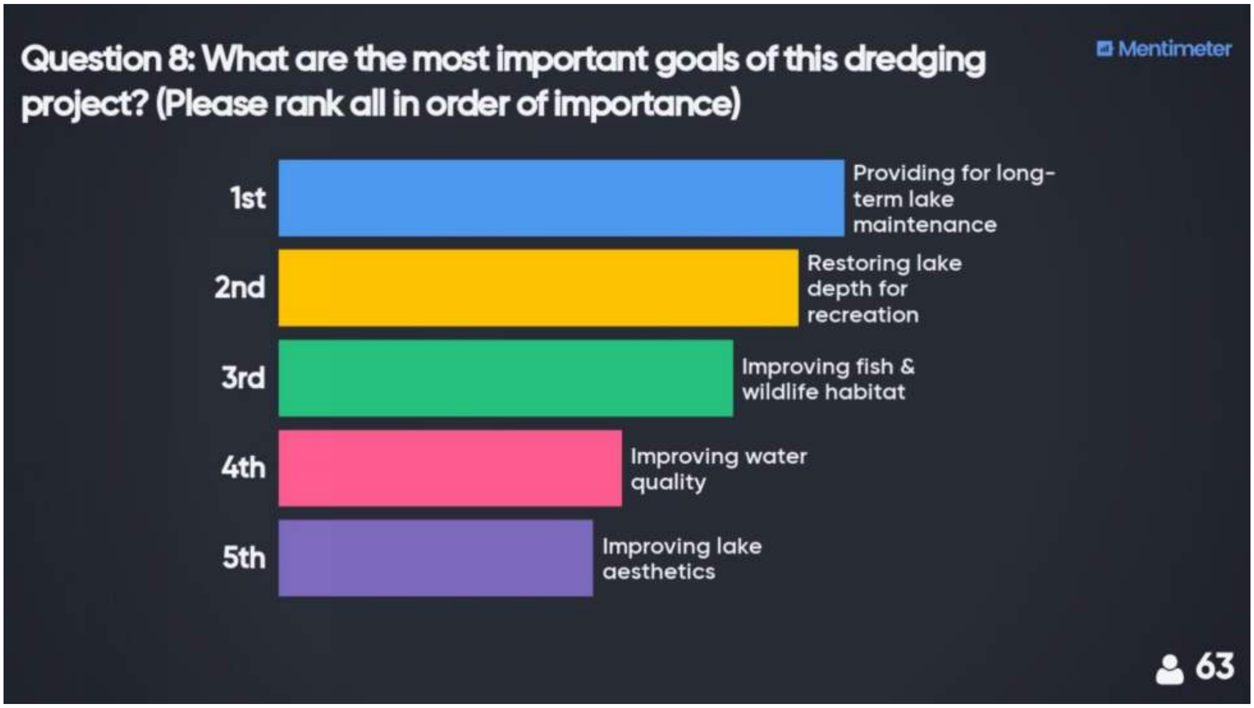

Question 3: How often do you visit White Rock Lake?
Mentimeter
4
A few times per year
12
Monthly
31
Weekly
13
Daily
60

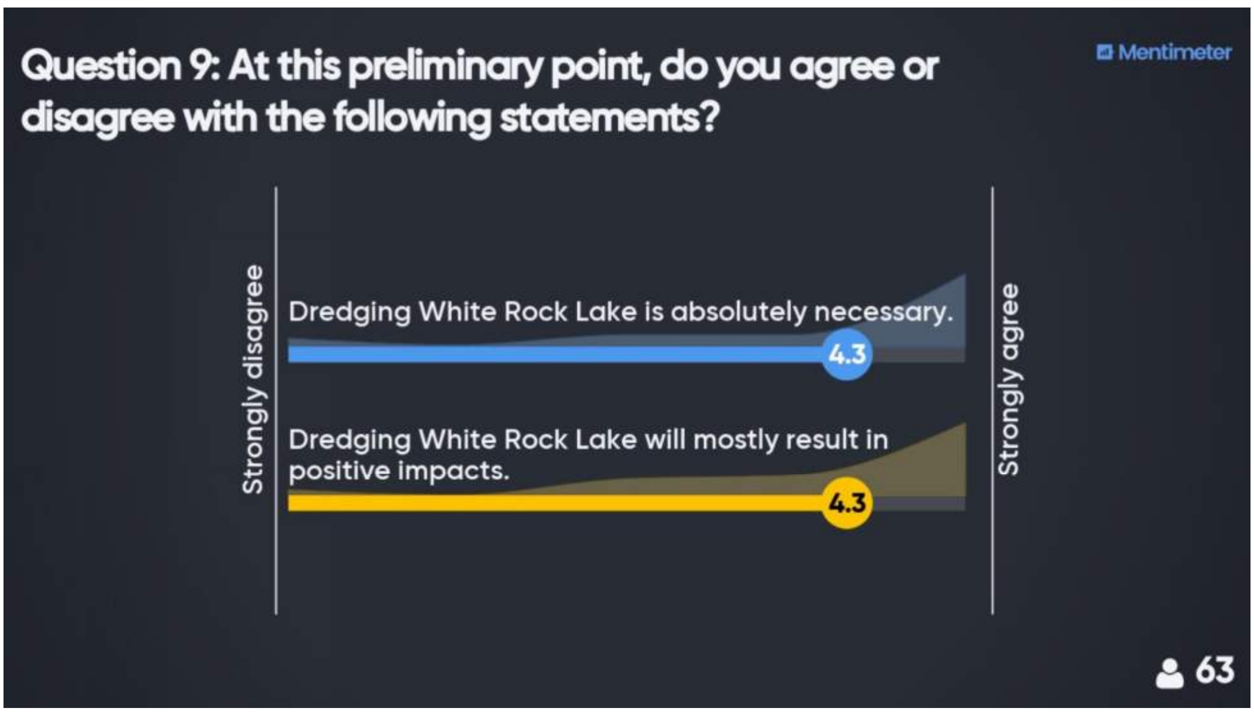

Question 4: What is your preferred time of year to use the lake?
Mentimeter
2
Summer
2
Fall
0
Winter
1
Spring
58
Year-round
Question 2: What is your primary use of the Lake?
Business Owner
Cultural/Entertainment Activities
Cycling
Hiking/Jogging
Home Owner
Passive Recreation (ex. bird watching, dog park)
Rowing and/or Kayaking
Sailing
Unknown
63

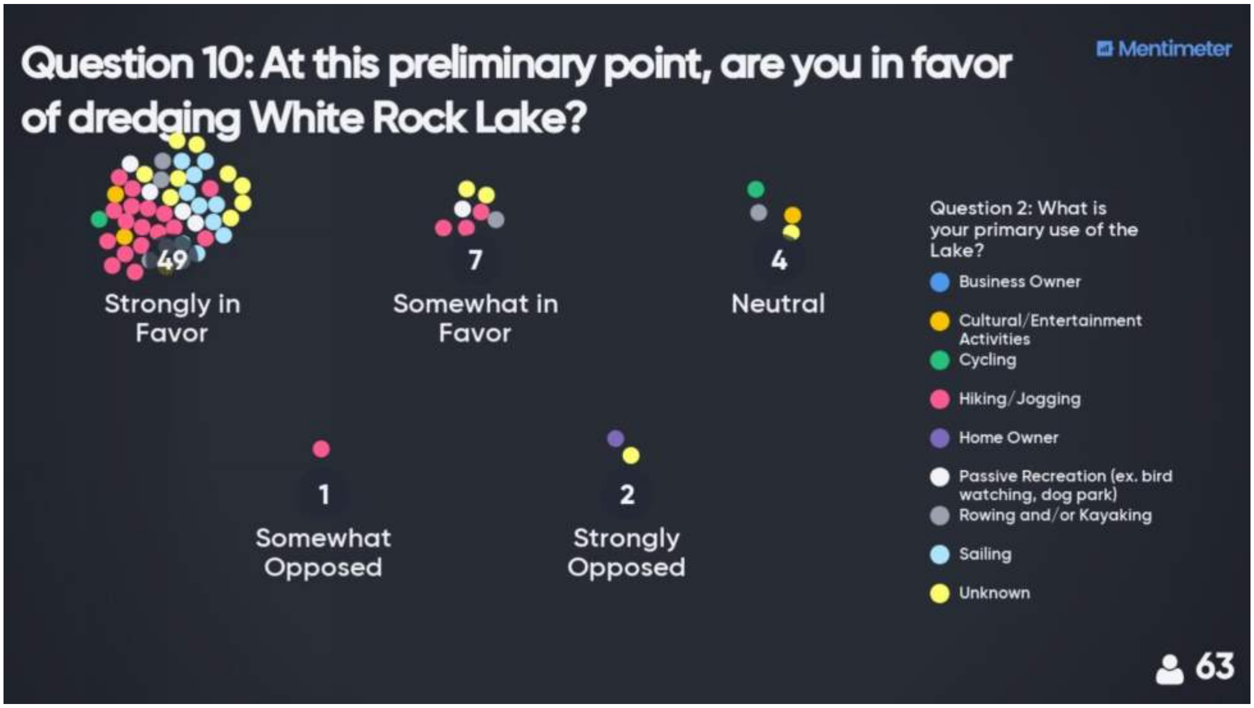

Question 5: What are your main concerns regarding lake dredging? (Please rank all in order of importance)
Mentimeter
1st
Recreation Impacts
2nd
Environmental Impacts
3rd
Water Quality Impacts
4th
Aesthetics Impacts
5th
Expenditure of Tax Dollars
6th
Business Impacts
61


Mentimeter
Question 6: How would your usage of the lake be affected during dredging activities?
51
18%
20%
6%
8%
37%
8%
11
27%
36%
0
I would continue using the lake as I normally do
I would reduce my visits to the lake
I would completely avoid visiting the lake
Question 2: What is your primary use of the Lake?
Business Owner
Cultural/Entertainment Activities
Cycling
Hiking/Jogging
Home Owner
Passive Recreation (ex. bird watching, dog park)
Rowing and/or Kayaking
Sailing
Unknown
62


Mentimeter
Question 7: How concerned are you about the following impacts during dredging?
Very Concerned
Not Concerned At All
Dredging equipment noise
2.6
Reduction in recreational opportunities
1.9
Road and/or trail closures
1.7
Visual impacts (aesthetics)
2.6
Visible suspended sediments in lake
3.1
56


Question 8: What are the most important goals of this dredging project? (Please rank all in order of importance)
Mentimeter
1st
Providing for long-term lake maintenance
2nd
Restoring lake depth for recreation
3rd
Improving fish & wildlife habitat
4th
Improving water quality
5th
Improving lake aesthetics
63

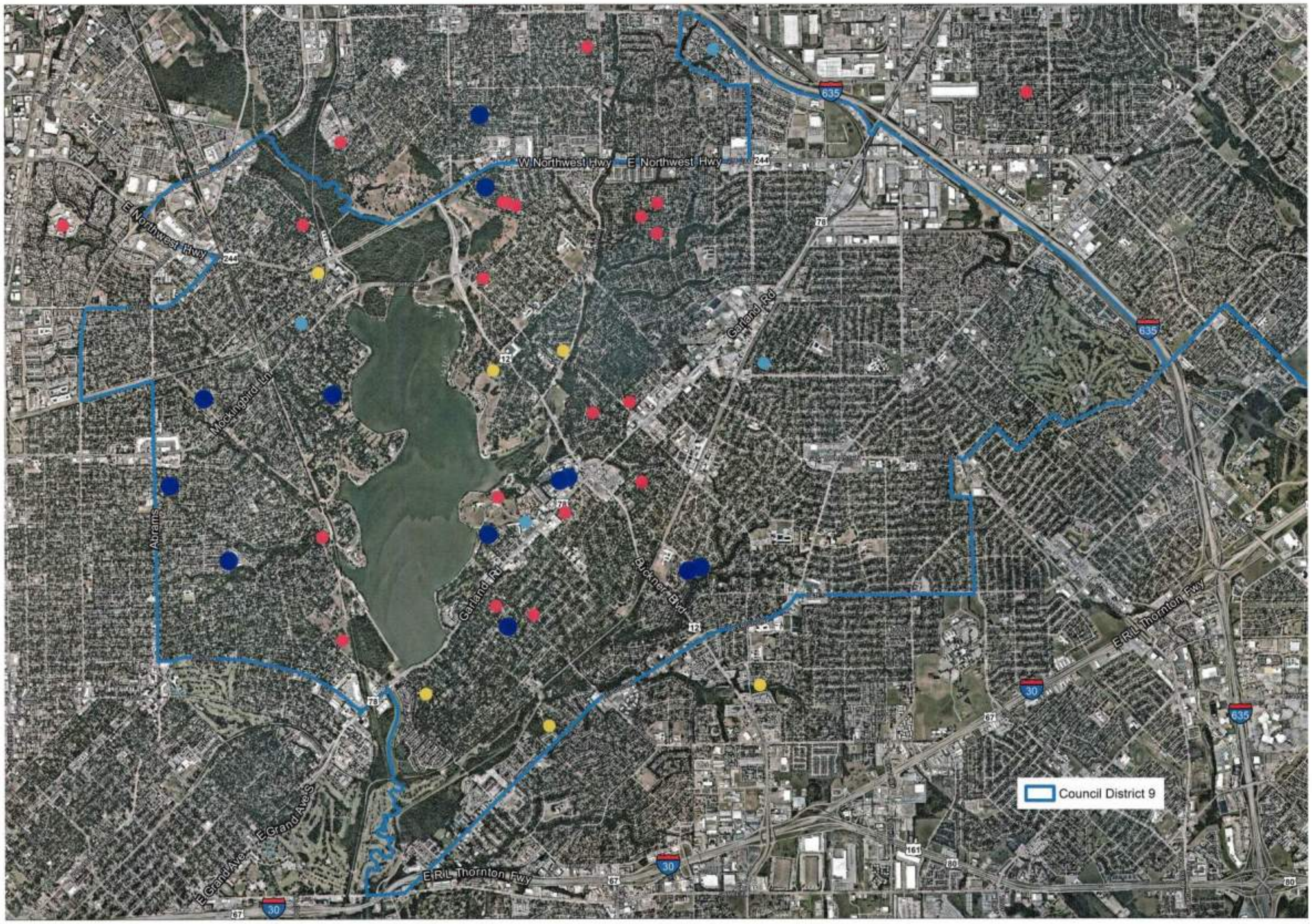

Question 9: At this preliminary point, do you agree or disagree with the following statements?
Mentimeter
Strongly disagree
Strongly agree
Dredging White Rock Lake is absolutely necessary.
4.3
Dredging White Rock Lake will mostly result in positive impacts.
4.3
63


Question 10: At this preliminary point, are you in favor of dredging White Rock Lake?
Mentimeter
49
Strongly in Favor
7
Somewhat in Favor
4
Neutral
1
Somewhat Opposed
2
Strongly Opposed
Question 2: What is your primary use of the Lake?
Business Owner
Cultural/Entertainment Activities
Cycling
Hiking/Jogging
Home Owner
Passive Recreation (ex. bird watching, dog park)
Rowing and/or Kayaking
Sailing
Unknown
63

Dallas Park and Recreation Department

WHERE DO YOU LIVE?

PLACE A STICKER ON THE MAP WHERE YOU LIVE



PLACE A STICKER IN THE BOX BELOW IF YOU LIVE OUTSIDE THE AREA SHOWN ON THE MAP

Dallas Park and Recreation Department

WHAT AREAS OF THE LAKE DO YOU COMMONLY VISIT?

SELECT ONE OR MORE AREAS YOU VISIT BY PLACING A STICKER IN THE APPROPRIATE BOX BELOW

WINFREY POINT

HIKE AND BIKE TRAILS

BIG THICKET

WHITE ROCK DOG PARK

BATH HOUSE CULTURAL CENTER

PLAYGROUNDS/SPORTS FACILITIES

Dallas Park and Recreation Department

WHAT AREAS OF THE LAKE DO YOU COMMONLY VISIT?

SELECT ONE OR MORE AREAS YOU VISIT BY PLACING A STICKER IN THE APPROPRIATE BOX BELOW

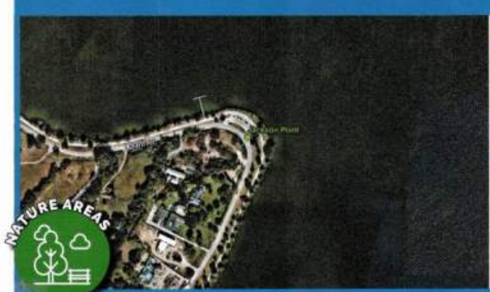
SUNSET BAY/PELICAN POINT

DALLAS ARBORETUM

DREYFUSS CLUB POINT

FISH HATCHERY NATURE AREA

JACKSON POINT



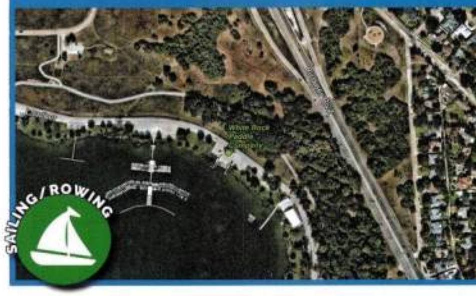
Dallas Park and Recreation Department

WHAT AREAS OF THE LAKE DO YOU COMMONLY VISIT?

SELECT ONE OR MORE AREAS YOU VISIT BY PLACING A STICKER IN THE APPROPRIATE BOX BELOW

WHITE ROCK BOAT CLUB

WHITE ROCK PADDLE CO.



BOOMERANG BOAT HOUSE

WHITE ROCK BOAT HOUSE

CORINTHIAN SAILING CLUB

DUC

Natical Zone
East Side

Dallas Park and Recreation Department

WHAT AREAS OF THE LAKE DO YOU COMMONLY VISIT?

IF YOU VISIT OTHER AREAS OF THE LAKE NOT MENTIONED LET US KNOW IN THE BOX BELOW

DUC DALLAS UNITED CREW

Sunset Bay

Creek at Mockingbird

DUC

Bath House

Filter Building

DAM

Spillway

Boyscout Hill

Bike trails

Jackson Point

TP Hill

In The  Lake

Prairies

Dog park

Dallas Park and Recreation Department

WHAT DO YOU DO WHEN YOU VISIT THE LAKE?

PICK YOUR ACTIVITIES BY PLACING A STICKER IN THE APPROPRIATE BOX BELOW

BOATING & SAILING	CYCLING	FISHING	ROWING
12 stickers	13 stickers	3 stickers	7 stickers

RUNNING & WALKING	SIGHTSEEING	BIRD WATCHING	DOG PARK & OTHER PARK FACILITIES
27 stickers	18 stickers	19 stickers	7 stickers

IF YOU USE THE LAKE FOR OTHER PURPOSES PLEASE TELL US IN THE BOX BELOW

Bath House Cultural Center

Wildflower/Blackland/Meadowland

WILDFLOWERS

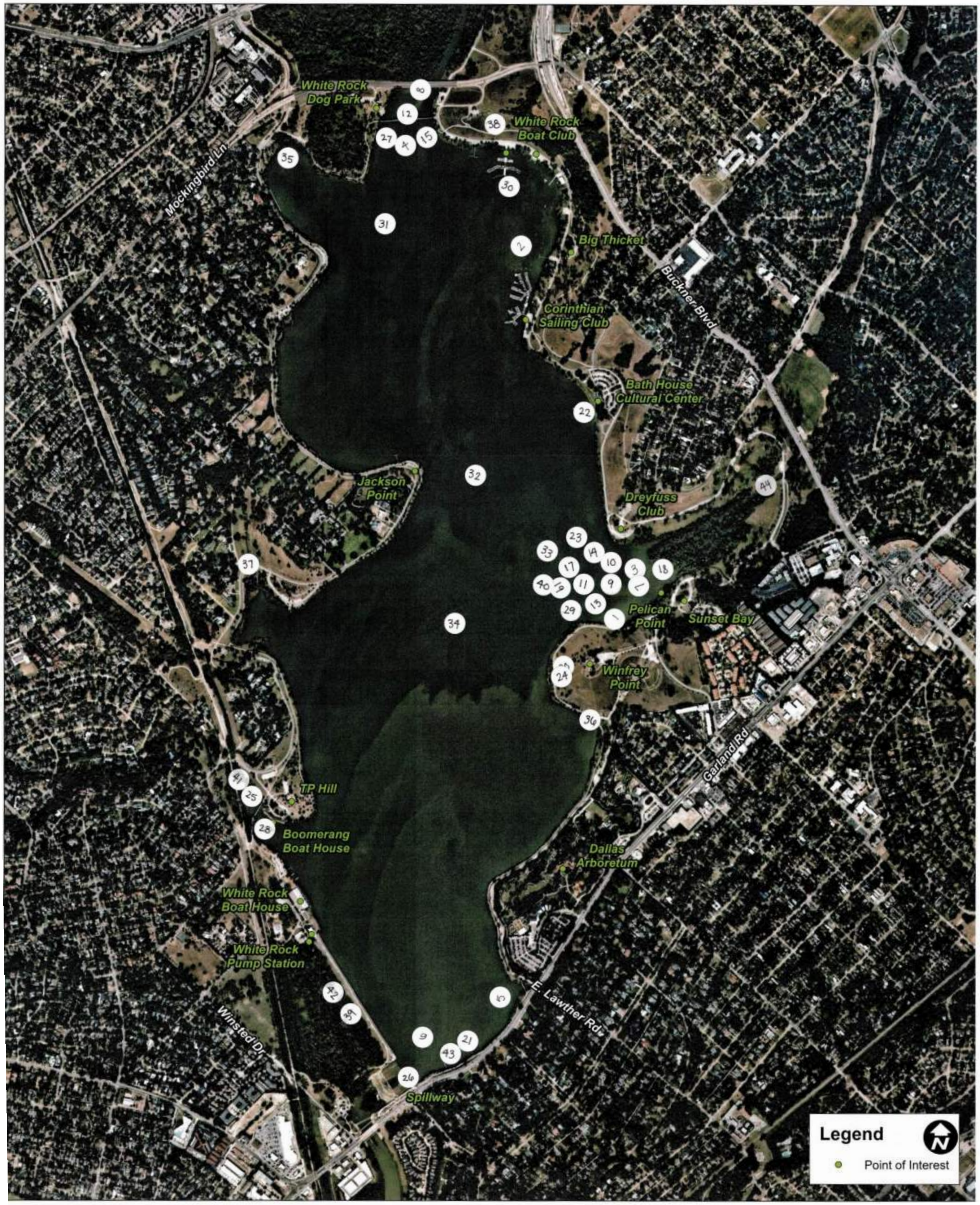
Theater Bath House

Native Blackland Prairies.

Dallas Park and Recreation Department

HELP US IDENTIFY AREAS OF CONCERN

PLACE A STICKER ON THE MAP TO IDENTIFY AREAS OF CONCERN



White Rock Lake Dredging Feasibility Study
Community Meeting #1
Help Us Identify Areas of Concern

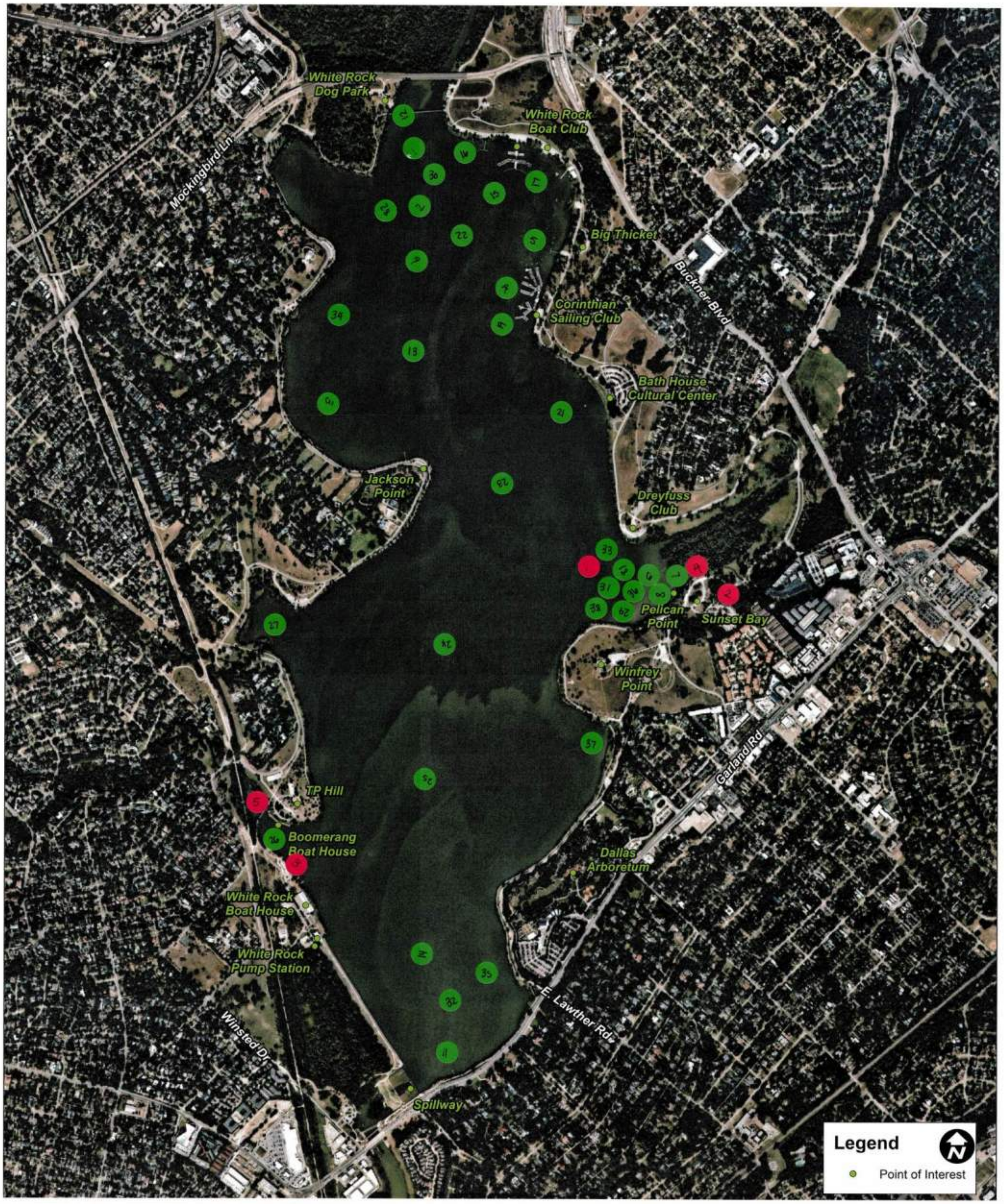
STICKER #	COMMENT
#1	The shoreline is wider than it was 5 years ago and appears to be made of a lot of grabage
#2	often full of trash but a major bird hangout, needs to be cleaned, people need to stop feeding the birds
#3	Large underwater debris (trees) shallow points in lake (centerboards on sail boats are dragging)
#5	Creek disruption to dog park
#6	Sunset Bay - disruption to Wildlife
#7	Pelican Bay is an area of concern - animal habitat
#8	Wildlife - ducks, geese, and nesting grounds
#11+12	It's increasingly difficult to dock boats and move them into the dock from the moorings to the dock.
#13	Lots of wildlife here but without the lake they wouldn't be there. Anyway to clean it up with minimal disturbance?
#14	It's disgusting in that area of the lake. It's a trash trap.
#15	trash in the spill way
#17	Wildlife impacts. A need to clean up man made debris
#18	I live on Goforth Road off white rock creek. Flooding is a concern. I realize there will be no beneifits. But can't have it get worse
#19	account for future sediment collection pools/banks so as not to have to dredge so often - also collect upstream debris/trash
#20	erosion of shore will soon undermine bike path where trial is close to Garland Road. Also there is no barrier separating bike path and side walk from Garland Road traffic!
#21	wildlife concern
#23	wild flower hill in front of building needs to be signed and protected. Its a great resourse.
#24	bird and wildlife habitat
#25	wildflowers, meadows, pollinators - Winfrey Point
#25	food supply and habitat for all wildlife especially egrets, herons, pelicans. Enviromental and wildlife birds,pollination,fish,insects, mammals. Protections including all plants and trees
#26	Pay attention to the ducks and their nests. Lots of babies in the spring - they get eaten and disappear
#27	smell
#29	Pelican Bay will dry up if it can't be dredged. It's already disappearing
#30+31	Broadly in favor of dredging, particularly at the North area of the lake to facilitate improved flow and recreational activities.
#32	This Sunset Bay area should be reclaimed as wetlands with trails and bird sanctuary
#33	How will the birds populations, nesting areas, and migration areas be affected?
#34	rookery in nesting season
#35	shore south of Winfrey Point fulling with sedement / trash and reducing size of the lake
#36	Repair to bridge - limits access to launching area on other side - sailboats, etc.
#37	Concern about nature prairie restoration to control flooding and erosion. Praries are __ too much. Wildlife areas need to be protected. Sunset Bay needs to be preserved.
#38	concern over tree removals at fish hatchery for dam work
#39	sunset bay is a migratory bird rookery. Should not be distrubed
#40	T&P bay is a wetland-is it protected?
#41	please do not disturb the fish hatchery!
#42	substructure under Garland Road is compromised/washed out
#43	Peavey, Vine Creek; Home flooding attributed to silted Dixon Branch
#44	The duck pond north of the bridge between TP Hill and Solana Plaza. My main concern is that the entire lake needs dredging more frequently and should be a part of Park & Rec and DWU funding in the City budget

Dallas Park and Recreation Department

WHERE IS DREDGING APPROPRIATE?

PLACE A COLOR COORDINATED STICKER ON THE MAP WHERE...

[●] DREDGING <u>IS</u> APPROPRIATE [●] DREDGING <u>IS NOT</u> APPROPRIATE



White Rock Lake Dredging Feasibility Study
Community Meeting #1
Where is Dredging Appropriate?

STICKER #	COLOR	COMMENT
3 & 21	**Green**	Shallow area- Debris such as logs and trees often get stuck in the mud causing hazard to navigation.
4 & 5	**Red**	Sunset Bay is a rookery for protected wildlife, migratory birds. T&P Hill Bay is wetlands now, was a bay. Would it be legal to dredge?
7	**Green**	Sunset Bay, Protecting the water fowl and nesting areas. Needs dredging with care. This is a trash accumulation area.
18 & 19	**Green**	18, 19 -Please include area under the sailing clubs facilities - Have run aground @ sunset bay
26	**Green**	The area north of the bathhouse has been allowed to fill up a lot. I think that some dredging is appropriate before this just becomes a swamp.
27	**Green**	This area where small sailboats and canoes are launched. Bridge already out, making access difficult
28	**Green**	Trees, branches, logs accumulate here after a flooding event (because of shallow depth). This area has many hazards to boaters/kayakers.
30,31,32	**Green**	The entire lake is bad and needs to be dredged as well as shoreline
36	**Green**	Sunset Bay wasn't dredged last time since it is all so close to a shoreline. The lake is receeding there so if it's not dredged it will fall in soon.
37	**Green**	37 - Sediment on shoreline south of Winfrey Point has added several feet to the shoreline. - Small Trees and brush have now encroached as well and need to be removed.
38	**Green**	38- Sunset Bay - Can walk across it - shoreline has grown into the lake
---	**Green**	Underwater obstructions - there are many large trees stuck in the mud, extending almost to surface- boating hazards
---	**Green**	Shallow neck
---	**Green**	Dredge the lake in all areas
---	**Green**	The entire lake needs to be dredged. And on a regular/ more frequent basis.
---	**---**	cannot chose a sticker because do not have enough info to know what the environmental impact will be anywhere - this info should be provided first before I would approve of any dredging at the lake.

White Rock Lake Dredging Feasibility Study
Community Meeting #1
Comment Cards

CARD #	COMMENT
1	What was distrubution list about this meeting? We barely heard in time. I have a relative who lives on the lake and didn't hear about. Please let me know. Thank you.
2	Where will the funds come from? What is the cost?
3	I think this project is a necessity, but would like to know what the consequeces are of not getting it done now, waiting. If the city, with all of the input from the engineers, can elucidate benefits vs. consequences, it'll go a long way in making the cost palatable to tax payers. Also, I think you need to prepare the public for the turmoil on & around the lake during project. It'll be really messy!
4	Spoilings must be deposited away from lake, McCommas, or area South. Please consider WR Creek embankment stabilization to reduce future sediments or other mitigation.
5	Very nice presentation! Looking forward to continuing the sport of sailing in Dallas on White Rock Lake!
6	My greatest wish would be for the dredging project to include mechanisms that would help keep from having to dredge so dramatically each time. Technological fix for this?
7	What is being done to mitigate sediment flowing into the lake from WR Greenbelt, Vickery Meadows, etc.? What about IMPACT Study.
8	What would the feasibility of stilling basins upstream & specifically at each upstream City's limits? Utilize this sailing committee boat to profile this bottom silting depth finder & GPS. Lower this lake level during rainy months to reduce flooding Buckner
9	Very well done.
10	Everywhere (Plano, Richardson, etc.) as in everything that drains to the lake, should contribute financially to dredge, b/c they contributed to build up.
11	The lake is in the watershed of the Trinity River. As such White Rock serves as an important source of water for the Trinity. Recreation is <u>not</u> the sole purpose of this lake. The water quality is not good. What would happen with flooding along White Rock Creek <u>if</u> the lake was not here.
12	public involvment consultant--need ongoing stakeholder/task force coordination
13	Lakeside neighbors not notified about meeting. Bridge being out is a problem. Not enough background on impacts. Couldn't hear
14	Need more focus & information on environmental impact, wildlife protections, locations/disruptions/closures/noise levels.
15	White Rock Boathouse/White Rock Rowing appreciates the study and care about this important issue affecting users of watercraft on our lake! Thanks! Alex-Board Member, White Rock Boathouse, Inc.
16	Long term solution? Army Corps at one time had a plan to pull the silt off the creek before it got to the lake.
17	Is Brownstone Environmental charged with the flora, fawna and wildlife aspects of the lake? If not, what provisions being made? Is Texas Parks & Wildlife involved?
18	I'm concerned about the effect on wildlife, but not so much that I don't want the lake dredge. Would dredging deeper make it last longer between dredgings?

White Rock Lake Dredging Feasibility Study – Frequently Asked Questions

What is the best way to provide feedback and stay informed about potential White Rock Lake dredging?

If you were able to attend the community meeting on January 28, please make sure to turn in your comment card before you leave. In addition, please use the QR code to join the live survey during the meeting. Additional opportunities to provide feedback are through our web-based survey or by contacting City staff.

The web-based survey is a Google Form available at **tinyurl.com/white-rock-dredging**. The Google Form will be active until February 11, 2020. Comments can also be provided to our designated City of Dallas project contact.

If you are interested in staying informed, please provide your contact information at this meeting, via the web form, or reach out to the contact provided.

David Phan, P.E., CFM
Dallas Water Utilities,
Floodplain Management
Office: 214-948-4682
E-Mail: David.Phan@dallascityhall.com

What is dredging?

Dredging is the removal of accumulated sediments in a lake. There are two different mechanisms employed to remove the sediment: hydraulic or mechanical dredging. The appropriate dredging mechanism for a project is dependent on several factors, including volume of the lake, budget, type of material to be removed, amount of material to be removed, availability of land nearby, and usage of the lake, among others.

It is anticipated that a hydraulic dredging mechanism will be employed at White Rock Lake. Hydraulic dredging involves the use of a dredge that floats on the surface of the lake, with a cutter to dislodge the sediment and a pump to suck up a mixture of water and sediment. Hydraulic dredging is faster than mechanical dredging and is typically the most cost-effective method for large dredging projects. It does not require the lake to be drained during construction.

Where would all that sediment go?

There are several factors that determine where sediment can be disposed of. In some cases, sediment can be pumped directly to the disposal site. In other cases, temporary dewatering sites are set up around the perimeter of the lake to minimize the volume of material to be hauled off-site and to allow water to be returned to the lake. Evaluating appropriate disposal mechanisms and identifying potential disposal sites is part of the feasibility study.

Why is dredging being considered for White Rock Lake?

Natural and human-influenced processes including streambank erosion, construction, and urban and agricultural runoff contribute to sediment in waterways. Over time, stormwater flows from the upstream portions of the White Rock Creek watershed have carried sediment downstream and deposited it into White Rock Lake. Since 1937, the Lake has been dredged every 20-25 years to remove portions of the sediment from the Lake.

The functions of White Rock Lake have changed over time. Currently, the only approved use of White Rock Lake is recreation. The primary purpose of dredging would be to enhance recreational use opportunities for a variety of White Rock Lake users.

Are there any other improvements that will be made to the lake?

Although one of the main purposes of dredging is to enhance recreational use of the lake, no other White Rock Lake Park improvements are anticipated to be included with the potential dredging work at this time.

What does a feasibility study seek to accomplish?

A feasibility study is a formal way to determine if a proposed action is practically achievable. In this case there are a combination of engineering considerations, stakeholder concerns, environmental regulatory requirements, and dredging operation costs that must be considered to determine a course of action. The goal of the feasibility is to evaluate these factors to help the City decide about practical near-term achievability of a project to dredge White Rock Lake.

White Rock Lake Dredging Feasibility Study – Frequently Asked Questions

What is the timeline of the feasibility study?

January 2020	February/March 2020	April 2020	April/May 2020	May 2020
Data Gathering	Analysis	Funding	Findings	Recommendations
Hold site visit and community meeting to gather input	Evaluate methods, alternatives, risk factors, regulations and costs	Research funding sources, requirements and timelines	Hold community meeting to report findings and gather input	Provide final feasibility study report

When will the dredging be done? How long does it take? How much does it cost?

The City is currently evaluating the feasibility of dredging the lake, and the decision to dredge has not yet been made. Details about a potential dredging project including schedule, cost, and construction details will be refined through the feasibility study and final design process if the City decides to pursue a dredging project.

Based on prior White Rock Lake dredging efforts, the dredging work could range from 6 to 12 months. A cost estimate is not yet available because the details associated with the amount of sediment, how the work would be performed, and permitting costs are not yet available.

What would be the aesthetic impacts during a dredging operation?

Dredging equipment and materials will be temporarily stored onsite. Increased traffic flow, including construction traffic, is also anticipated. Other temporary impacts typical of a dredging operation include noise, vibration, and smell.

Would sediment be visible in the water?

Yes, some sediment may be visible during dredging activities. However, the extent and duration of visible sediment at any time is expected to be minimal, and likely less than normally observed immediately after a storm event.

What are the environmental considerations?

The dredging process increases turbidity in the water and has the potential to impact wildlife habitats. In addition, if sediment depositions contain pollutants, the work associated with dredging may spread these pollutants throughout the waterbody. Whether contaminated or not, the appropriate disposal of dredge material is also an environmental consideration. The dredging work will include sediment testing and appropriate coordination with environmental resource agencies to prevent adverse impacts to the environment.

How would dredging affect users of the lake during construction?

The City and its engineer would work to minimize effects on lake user activities. Temporary access limitations to some locations would be expected, but no work plan with specific details has been developed yet. Specific details would be developed during the design of a dredging program.

What will happen to the shoreline and surrounding areas of the lake?

Temporary disturbances to the shoreline and surrounding areas are a part of any major lake construction project. The feasibility study will consider opportunities to minimize these disturbances and any future dredging programs should include provisions to restore preconstruction conditions and mitigate any long-term impacts.

Does dredging change the lake level?

There is no intent to permanently lower the normal water surface of the lake. However, dredging operations require water be removed with sediment, so there may be temporary impacts to the lake level. These impacts will be dependent on dredging mechanism and weather during project construction and will be considered as part of the feasibility study.

Would dredging the lake provide flood control benefits?

No. White Rock Lake does not currently function as a flood control reservoir, and dredging would not change the lake's function.

Appendix B-3: Community Meeting #2

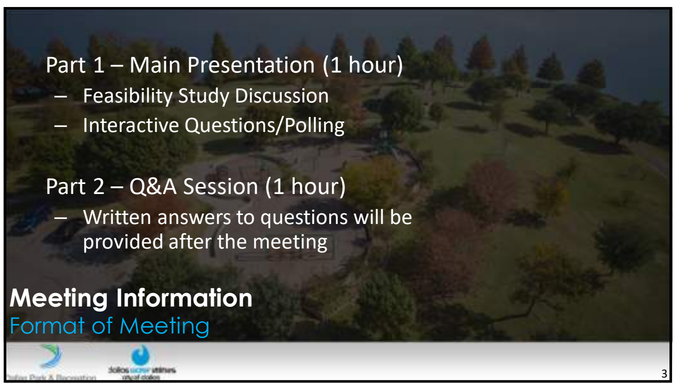
Held on July 16, 2020 via Zoom Virtual Meeting


WHITE ROCK LAKE
DREDGING FEASIBILITY STUDY
Virtual Community Meeting #2 – July 16, 2020
BA
FREESE NICHOLS

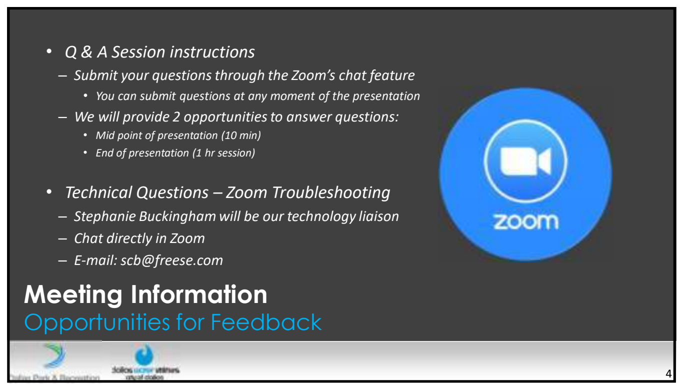
1


1. Provide update on dredging feasibility study
2. Discuss main considerations for dredging operations
3. Present potential dredging scenario alternatives
4. Gather input from community and user groups
Meeting Information
Purpose of Meeting
2

2


Part 1 – Main Presentation (1 hour)
– Feasibility Study Discussion
– Interactive Questions/Polling
Part 2 – Q&A Session (1 hour)
– Written answers to questions will be provided after the meeting
Meeting Information
Format of Meeting
3

3


• Q & A Session instructions
– Submit your questions through the Zoom's chat feature
• You can submit questions at any moment of the presentation
– We will provide 2 opportunities to answer questions:
• Mid point of presentation (10 min)
• End of presentation (1 hr session)
• Technical Questions – Zoom Troubleshooting
– Stephanie Buckingham will be our technology liaison
– Chat directly in Zoom
– E-mail: scb@freese.com
zoom
Meeting Information
Opportunities for Feedback
4

4


• Online Google Form
tinyurl.com/white-rock-2
• Form will be active until
July 31, 2020
Feedback Form
Meeting Information
Opportunities for Feedback
5

5


Poll Questions
6

6

Poll Question #1

- What is your primary use of the lake? (Select One)
  - Business Owner
  - Cultural/Entertainment Activities
  - Cycling
  - Hiking/Jogging
  - Homeowner
  - Passive Recreation (ex. bird watching, dog park)
  - Rowing and/or Kayaking
  - Sailing

7

Poll Question #2

- What are your main concerns regarding lake dredging? (Select up to Three)
  - Aesthetics Impacts
  - Business Impacts
  - Environmental Impacts
  - Expenditure of Tax Dollars
  - Recreation Impacts
  - Water Quality Impacts

8

Poll Question #3

- What are the most important goals of this dredging project? (Select up to Three)
  - Improving fish & wildlife habitat
  - Improving lake aesthetics
  - Providing for long-term lake maintenance
  - Restoring lake depth for recreation
  - Improving water quality

9

Background Information

10

Background
Feasibility Study

- Dallas Park & Recreation Department partnering with Dallas Water Utilities on high-level feasibility study including:
  - Approaches
  - Regulatory requirements
  - Costs
  - Potential funding sources
- Freese and Nichols and Brownstone Associate consulting

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Background
Feasibility Study

What is a Feasibility Study?

Feasibility studies are conducted primarily to determine:

- Key goals of the project.
- Alternative solutions and associated costs.
- Potential project roadblocks (risk factors).
- Project requirements and expected timeline.

NOT developing engineering plans, permit applications, or formal Environmental Studies.

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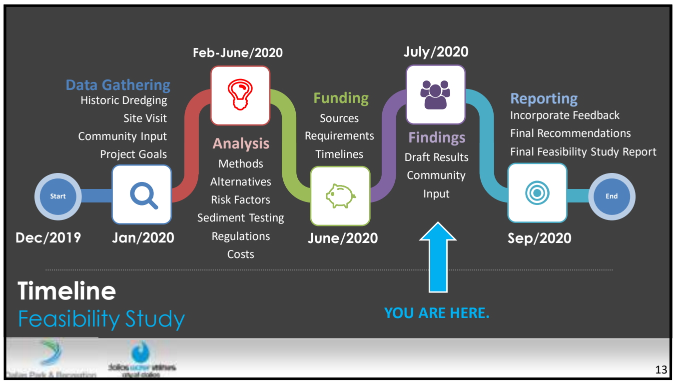

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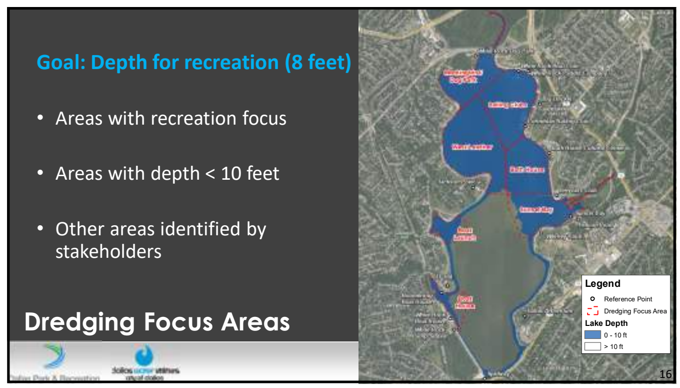

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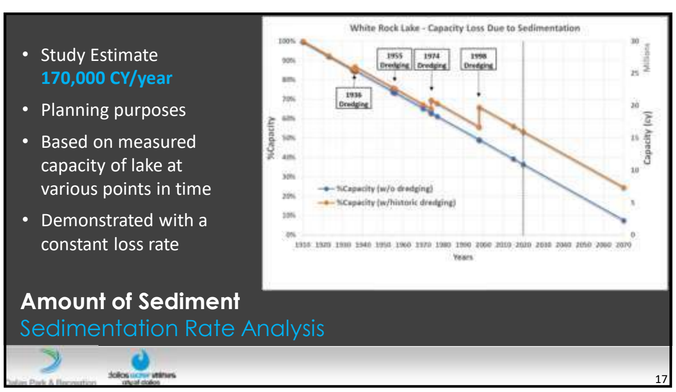

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- Collect samples in anticipated dredging areas
- Measure concentrations of Chemicals of Concern (COCs)
- Determine any special handling requirements or limitations on reuse or disposal

Sampling Plan Purpose

19

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- Trace concentrations of some COCs below allowable threshold
- Concentrations of COCs do not pose substantial risk to dredging contractors or lake environment
- Sediment appears to meet criteria for landfill disposal applications
- Additional analysis needed for reuse/land applications

Sampling Results & Conclusions

20

20

Dredging & Disposal

21

21

- Most likely a hydraulic dredge operation based on scale of project and size of lake
- Prefer to pump directly to dewatering/disposal site to minimize impacts to lakeshore
- Return water to lake
- Eliminate "double-handling" if possible

Dredging & Dewatering Method

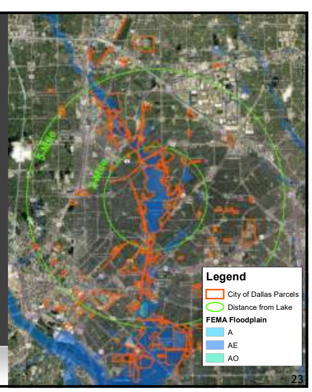
22

22

- Identify City-owned properties for potential dewatering/disposal
- Sites ruled out:
  - Lack of available open space
  - Conflicting land use
  - Location in regulatory floodplain

Dewatering Process

Site Evaluation



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- Landfill disposal costs $30.50 to $60.00/ton
- More information needed to identify potential land reclamation applications

Disposal Locations

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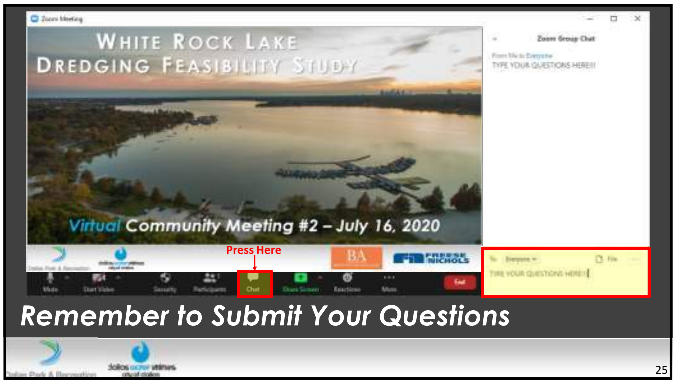

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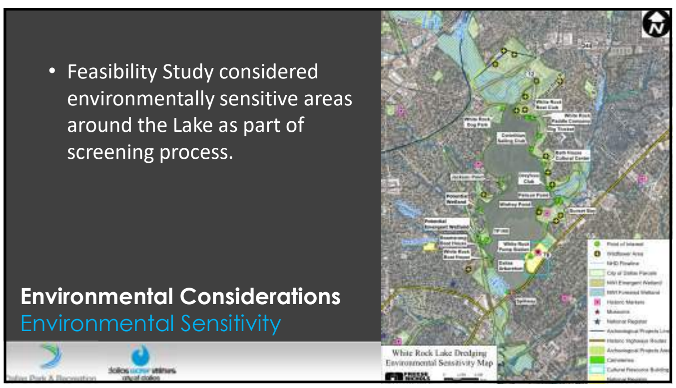

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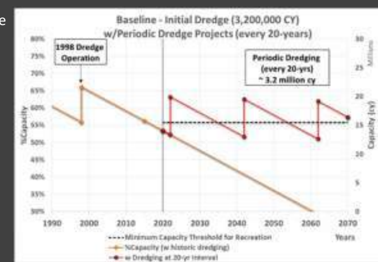
- Potential alternatives developed to restore and maintain lake level in desired areas
- Four potential alternatives
  – Data available for City interpretation
- Costs are presented as a range (low and high) including a contingency to cover unknowns

Dredging Alternatives
Overview

31

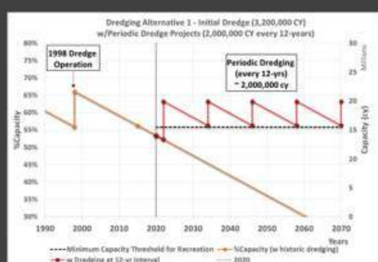
- Dredging every 20-25 years on average
- Recurrent periods with impacts to recreation
- $50 - $88 million recurring (20-year cycle)
- $3.0 - $5.3 million annualized cost over 50-yr period



Dredging Alternatives
Baseline Scenario

32

- Large initial dredge project followed by more frequent large dredge projects
- $50 - $88 million upfront
- $32 - $56 million recurring (12-year cycle)
- $3.6 - $6.3 million annualized cost over 50-yr period



Dredging Alternatives
Alternative 1

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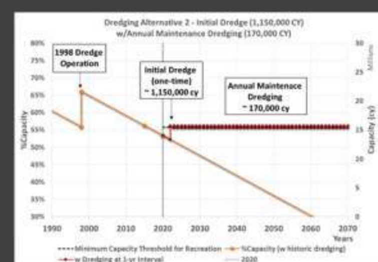
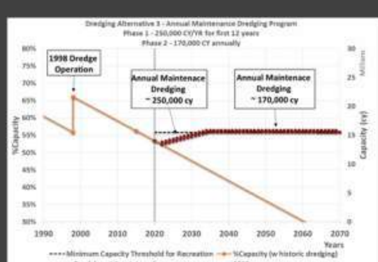
- Large initial dredge project followed by annual maintenance
- $19 - $34 million upfront
- $4 - $6 million annual maintenance
- $4.2 - $6.7 million annualized cost over 50-yr period



Dredging Alternatives
Alternative 2

34

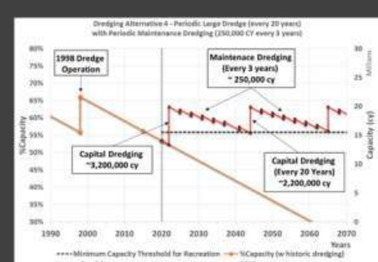
- Attain desired lake level after 13 years followed by annual maintenance
- $7 - $12 million first 12 years
- $4 - $6 million annual maintenance
- $4.5 - $7.4 million annualized cost over 50-yr period



Dredging Alternatives
Alternative 3

35

- Large periodic dredging projects with interim maintenance dredging
- $35 - $88 million upfront and every 20+ years
- $7 - $12 million recurring (3-year cycle)
- $4.4 - $8.5 million annualized cost over 50-yr period



Dredging Alternatives
Alternative 4

36

Sediment Forebay Option

- Conceptual sizing based on sediment rate analysis and 10-year maintenance schedule: 120 acres
- USACE jurisdiction (protected wetlands) – Individual Permit
- Unlikely to be a permittable sediment reduction alternative

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Dredging Alternatives Comparison

Dredging Scenario	Description	Recurring Impacts to Recreation Activities	Total Cost (Millions – 2020 $)	Annualized Cost (Millions – 2020 $)
Baseline (Historical)	Large Dredging Projects (20-25 yr cycle)	Yes	150 – 265	3.0 – 5.3
Alternative 1	Large Dredging Projects (12 yr cycle)	No	178 – 314	3.6 – 6.3
Alternative 2	One Large Dredging Project + Annual Maintenance Dredging	No	208 – 333	4.2 – 6.7
Alternative 3	Annual Maintenance Dredging Phase 1 – First 12 yrs Phase 2 – Year 13 onwards	Yes	226 – 370	4.5 – 7.4
Alternative 4	Large Dredging Projects (20-yr cycle) + Small Maintenance Dredging (3-yr cycle)	No	218 – 423	4.4 – 8.5

**All alternatives evaluated over a 50-year period*

38

Poll Questions – Dredging Alternatives

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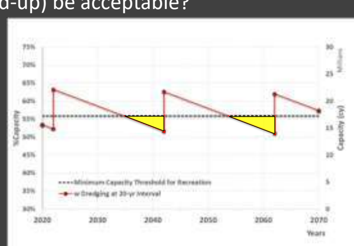
Poll Question #1

- Are temporary lake use disruptions by annual maintenance dredging activities acceptable?
  - Acceptable
  - Neutral
  - Unacceptable
  - Unsure

40

Poll Question #2

- How long would impacts to recreational activities at White Rock Lake (due to sediment build-up) be acceptable?
  - None
  - Impacts for up to 6 months
  - Impacts for up to 5 years
  - Impacts for up to 10 years



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Poll Question #3

- Considering budget constraints, which area(s) of White Rock Lake should be given priority for dredging? (Select up to Three)
  - Boat House
  - Boat Launch
  - West Lawther
  - Mockingbird/Dog Park
  - Sailing Clubs
  - Bath House
  - Sunset Bay

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- What factor(s) matter most to you when considering dredging approach? (Select up to Three)
  - Total project cost
  - Annual maintenance cost
  - Recreation impacts
  - Environmental impacts
  - Disruption of lake access
  - Sustainability of solution

Poll Question #4

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- Based on what you have seen presented today, which potential alternative is your preference?
  - Baseline – Large capital projects every 20-25 years
  - Alternative 1 – Periodic large dredge every ~12 years
  - Alternative 2 – Initial large dredge with annual maintenance dredging
  - Alternative 3 – Annual maintenance dredging only
  - Alternative 4 – Periodic large dredge (~20 yrs) & maint. dredging (~3 yrs)

Poll Question #5

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Funding & Next Steps

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- City funding likely to be through bonds
  - General Obligation (longer term)
  - Certificate of Obligation (shorter term)
- Limited to no grant/loan funding available for recreational dredging
- Potential alternative sources: Lake User Fees, Special Tax Districts

$ $ $

Funding Opportunities

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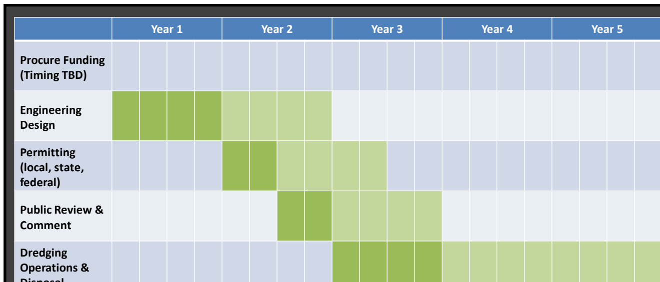

Typical Project Timeline

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1. Project Cost
2. Dewatering/Disposal Location
3. Environmental Permitting

Potential Obstacles & Concerns

48

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1. Continue coordination with stakeholder groups.
2. Identify dewatering/disposal, possible reuse opportunities.
3. Evaluate potential funding sources during budget planning.
4. Scale operation to available funding using base data developed for study.

Photo credit: Dallas Park and Recreation Department

Recommendations

49

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Questions

50

50

White Rock Dredging Feasibility Study
Community Meeting #2 (Virtual)
Live Poll Questions Results

What is your primary use of the lake? (Single Choice)

Answer 1: Business Owner (0) 0%

Answer 2: Cultural/Entertainment Activities (1) 2%

Answer 3: Cycling (9) 16%

Answer 4: Hiking/Jogging (16) 29%

Answer 5: Homeowner (17) 30%

Answer 6: Passive Recreation (ex. Bird watching, dog park) (4) 7%

Answer 7: Rowing and/or Kayaking (2) 4%

Answer 8: Sailing (7) 12%

What are your main concerns regarding lake dredging? (Multiple Choice)

Answer 1: Aesthetics Impacts (22) 39%

Answer 2: Business Impacts (2) 4%

Answer 3: Environmental Impacts (37) 65%

Answer 4: Expenditure of tax dollars (15) 26%

Answer 5: Recreation Impacts (30) 53%

Answer 6: Water Quality Impacts (32) 56%

What are the most important goals of this dredging project? (Multiple Choice)

Answer 1: Improving fish & wildlife habitat
(23) 40%

Answer 2: Improving lake aesthetics
(16) 28%

Answer 3: Providing for long-term lake maintenance
(37) 64%

Answer 4: Restoring lake depth for recreation
(22) 38%

Answer 5: Improving water quality
(17) 29%

Are temporary lake use disruptions caused by annual maintenance dredging acceptable?

Answer 1: Acceptable
(36) 62%

Answer 2: Neutral
(7) 12%

Answer 3: Unacceptable
(7) 12%

Answer 4: Unsure
(8) 14%

How long would impacts to recreational activities at White Rock Lake be acceptable?

Answer 1: No impacts are acceptable
(7) 12%

Answer 2: Impacts for up to 6 months
(33) 58%

Answer 3: Impacts for up to 5 years
(14) 25%

Answer 4: Impacts for up to 10 years
(3) 5%

Considering budget constraints, which area(s) of the lake should be given priority for dredging?

Answer 1: Boat House (17) 30%

Answer 2: Boat Launch (19) 34%

Answer 3: West Lawther (17) 30%

Answer 4: Mockingbird/Dog Park (19) 34%

Answer 5: Sailing Clubs (34) 61%

Answer 6: Bath House (24) 43%

Answer 7: Sunset Bay (21) 38%

What factor(s) matter most to you when considering dredging approach? (Select up to Three)

Answer 1: Total project cost (18) 31%

Answer 2: Annual maintenance cost (15) 25%

Answer 3: Recreational impacts (23) 39%

Answer 4: Environmental impacts (29) 49%

Answer 5: Disruption of lake access (24) 41%

Answer 6: Sustainability of solution (34) 58%


Based on what you have seen presented today, which potential alternative is your preference?
Answer 1: Baseline – Large capital projects every 20-25 years
(9) 16%
Answer 2: Alternative 1 – Periodic large dredge every ~12 years
(14) 25%
Answer 3: Alternative 2 – Initial dredge with annual maintenance dredging
(17) 30%
Answer 4: Alternative 3 – Annual maintenance dredging only
(4) 7%
Answer 5: Alternative 4 – Periodic large dredge (~20 years) & maintenance dredging (~3 years)
(13) 23%

White Rock Lake Dredging Feasibility Study

Virtual Community Meeting #2 – July 16, 2020 – Summary of Q&A

The following provides written responses to questions received and discussed during the Q&A portion of the Community Meeting held on July 16, 2020 below. If you have any additional questions about the project or would like to provide additional feedback, please utilize the web-based survey or contact City staff.

The web-based survey is a Google Form available at **tinyurl.com/white-rock-2**. The Google Form will be active until August 7, 2020. Comments can also be provided to our designated City of Dallas project contact.

Also, the *DRAFT Feasibility Study Report* has been posted to the Dallas Park and Recreation website at the following address: **https://www.dallasparks.org/235/White-Rock-Lake**. This report is available for public comment through August 7, 2020.

If you are interested in staying informed, please provide your contact information via the web form or reach out to the contact provided.

David Phan, P.E., CFM
Dallas Water Utilities |
Floodplain Management
Office: 214-948-4682
E-Mail: David.Phan@dallascityhall.com

1) *Is there a capacity issue that needs to be addressed, or is this effort mainly focused on recreation?*

The primarily focus of a dredging operation at White Rock Lake would be to enhance recreation, including activities both in and around the lake. The lake is no longer used as a water supply source and has never been used for flood protection, so flood storage and water supply capacity are not being considered in project development.

2) *What is the anticipated volume to be dredged?*

The consultant has prepared a full matrix of options for use by the City which allows a total dredging volume and cost to be calculated depending on the areas and depth selected for dredging. The City can use this tool to scale the proposed dredging operation based on available funding for the project. The scenarios presented in this report range from about 9,500,000 – 11,000,000 cubic yards over a 50-year evaluation period.

3) *What infrastructure remains from the prior dredging that can and will be used in the next dredging?*

Based on discussions with former City staff who were involved with the 1998 dredging project, as well as information from the dredging contractor, it appears that most of that infrastructure was removed and/or abandoned. There may be some physical crossings that still exist, but these have not been maintained in the 20 years since the project was completed. Additional condition assessments would be needed to evaluate the potential for reuse.

4) *Will the dredging also be done in the various creeks that also feed into the lake, carry stormwater runoff, and are also filled with dirt from the streets?*

The feasibility study has focused on dredging sediment from the lake itself.

5) *What Chemicals of Concern were found in the sediment and where were those samples taken from?*

All results of sediment sampling are included in the draft feasibility study report, which has been posted on the Dallas Park and Recreation website, and any additional information will be included in the final report. None of the chemicals that were tested for were measured at a level above the threshold that is considered safe for human exposure or what might be expected in an urbanized area. Sediment testing is part of a standard process for a dredging project development. It was undertaken early on due to public interest and to help inform the City about any special handling or disposal requirements that would impact project feasibility and cost.

6) *Has any consideration been given to address shoreline erosion, or is that later in the planning?*

Shoreline erosion was not evaluated as part of the dredging study.

7) *Is fishing a consideration here? The silt is impacting what could be a great fishery.*

Fishing is considered one of the recreational uses of the lake and was considered during concept development, but no detailed analysis was performed specifically with the goal to improve fishing opportunities.

8) Does the City own a dredge platform?

The City does not currently own a dredge barge that could be used for dredging at White Rock Lake. Costs were developed assuming that dredging would be a contracted work activity. The City could consider purchasing a barge as part of an annual dredging program. Any potential cost savings involved in performing this work in-house would need to be evaluated against the cost to acquire, maintain, and operate the equipment and to train City staff to conduct dredging activities, including the removal and disposal of dredged material.

9) How much has dredging technology changed in the last 30 - 50 years? Could future technology mean that a different solution makes the most sense in the future?

For hydraulic dredging, cutterhead efficiencies have improved making fewer impacts during construction. In terms of putting in slurry and pumping long distance, the general mechanics remain the same. It is unlikely that any major technical improvements would be made in the near future to affect decisions being made.

10) Does the dredged sediment have potential to be reused in earthen dam applications, such as the Lake Lewisville dam improvement project?

It is unlikely that the dredged sediment will be able to be reused in earthen dam applications. Compacted material for dam construction has more stringent material specifications due to safety considerations. Sediment removed from White Rock Lake is anticipated to contain silt material that is not appropriate for dam improvement projects.

11) How far along is the PGA in building its courses up in Frisco? Any chance they could use the dredged material?

Reuse of lake sediment in private land cover applications may be possible but would require additional sediment testing for pollutants. Reuse may be considered at later stages in project development when there is a clearer picture of the anticipated project timing.

12) Can the dredged material be used in whatever happens at the Tenison Glen Course, which is slated for redevelopment? Similarly, what about the Trinity Spine Trail?

The option to reuse sediment at Tenison Glen and the Trinity Spine Trail was specifically investigated based on feedback from the first public meeting. Unfortunately, these sites are located in a regulated FEMA floodplain, so adding a large volume of fill in these areas would not meet the City's floodplain management regulations.

13) Should plans be made to collect sediment upstream so future dredging will not be required? Are you considering increasing storage upstream or measures to reduce sediment entering the lake?

As part of the project, we evaluated the installation of a sediment forebay upstream of White Rock Lake to capture sediment before it enters the lake. An area of approximately 120 acres would be required for an assumed sediment removal frequency of approximately 10 years. The area immediately upstream of White Rock Lake is a wetland area under the jurisdiction of the US Army Corps of Engineers (USACE). The installation of a sediment forebay of this size would most likely be negatively impactful to this environment and is therefore unlikely to be permitted. Other options to reduce the sediment loading were not considered as part of this project. Since the majority of the contributing watershed is outside of the limits of the City of Dallas, this effort would require extensive coordination with neighboring municipalities.

14) Are there ponds upstream to intercept sediment?

This was not evaluated as part of the project. Sediment capture efficiency decreases with distance from the lake. Additionally, this concept would require coordination with neighboring municipalities and is unlikely to be a viable option.

15) Besides the large forebay scenario, has the study considered other sustainable solutions/means of reducing sediment inflow to the lake?

A program to reduce sediment loading in creeks and other waterbodies is a worthwhile regional initiative, but a comprehensive study and recommendation on this topic is beyond the scope of study. Several mechanisms exist to minimize sediment deposition in reservoirs by routing sediment around or through storage features, however these options would require a major redesign of the dam, park, and reservoir.

16) <u>Do the dredging estimates account for the impact of silt reduction environmental regulations for construction sites?</u>

The sedimentation rate was estimated based on historical data and previous surveys of the lake. That rate has not been constant over time, due to things like enhanced sediment and erosion regulations and build-out condition of the contributing watershed. These factors were considered to influence the overall measured rate. Additional information and future studies can help refine this number, but the estimated rate is appropriate for planning purposes.

17) <u>What is a "lake use disruption?" Will dredging disrupt boating activities as well as access to the trails around the lake while dredging is in process?</u>

The footprint of any lake use disruption would be focused around the dredge barge area and a transmission pipeline with a near shore area that would be temporarily restricted for construction staging. The goal is to minimize impact to lake use as much as possible. Boaters would need to steer clear of the dredge barge which would be the primary disruption. Ultimately the footprint is small considering size of lake. There are also secondary impacts such as noise from the equipment, smell, and the visibility of the dredging operation.

18) <u>What is the impact to typical recreational lake activities in an annual dredging option?</u>

Construction activities occur more frequently during annual dredging, mainly through use of a dredge barge. There is a mechanism underwater excavating and removing sediment via suction. The immediate area, transmission pipelines to disposal location, and a near shore staging area where the barge would be launched would comprise the footprint. The footprint is relatively small compared to size of lake. The dredge barge would be moving around to various locations of lake which would see local impacts and require coordination with lake users.

19) <u>What are the permit implications of annual maintenance dredging? Does annual maintenance simplify permitting? Can it all be considered part of the same permit?</u>

If a dredging alternative is selective based on an annual/bi-annual maintenance program, the goal would be to also approach permitting from a programmatic perspective. This approach is likely to involve permitting the larger dredging program as a whole and getting pre-authorizations for recurring dredging and sediment disposal.

20) <u>How will dredging material be conveyed to a disposal site?</u>

Hydraulic dredging is preferred method using a barge and pipeline that is installed from the lake to disposal site. Sediment may be pumped directly to disposal site or may be conveyed to an intermediate site for dewatering. Double-handing of sediment from a dewatering site to a disposal site is not preferable but is a possibility if an optimal disposal site cannot be identified.

21) <u>How were the cost estimates developed?</u>

The development of cost estimates considered the costs from the 1998 dredging project at White Rock Lake, estimates from previous studies including the City's Comprehensive Dredge Management Program report, and past dredging projects performed by the consultant. Additionally, the USACE performs a fair amount of dredging every year, so costs were compared to available bid tabulations from recent USACE projects.

22) <u>Why is there such a large range for the costs?</u>

The cost estimates are provided as a range because several details regarding the dredging methodology, amount of sediment to be removed, and disposal location have yet to be determined. Further refinement of the cost estimate will be part of future phases of the project.

23) <u>Which alternative is best: a periodic, large capital project, or a frequent maintenance dredging operation?</u>

Ultimately, there are a lot of variables, with pros and cons on all sides. The overall goal of this study is to present how these options would look over a long lifecycle, particularly on cost, and to use the past programs to help the City make decisions for the future. The dredging performed in the 1990s and 1970s were individual dredge operations. This may be preferable to citizens, or there may be an appetite for more of an ongoing maintenance dredging program. The overall cost of the program is a significant factor, as is the frequency of disruption from either the dredging operation or the accumulated sediment.

Appendix B-4: Public Comment Period

Available for Comment from July 16 to August 7, 2020

White Rock Lake Dredging Feasibility Study
Online Public Input Form
(Open from 7/16/2020 to 8/7/2020)

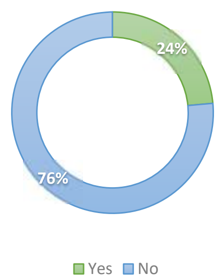
Name	Did you attend the first community meeting on January 28?	Did you attend the second community meeting on July 16?	Of the dredging scenarios presented during the July 16 meeting, do you have a preferred option(s)?	Are you comfortable with a permanent dredging/construction staging operation at White Rock Lake? (Such operation may support potential annual maintenance dredging activities.)	For how long are you willing to accept impacts to the recreational usable depth of White Rock Lake (resulting from future sediment build-up)?	Are you willing to accept a tax increase to fund a dredging program at White Rock Lake?	Are you willing to accept a lake user fee to fund a dredging program at White Rock Lake? (Dallas Park & Recreation currently administers lake user fees for several existing commercial operations on the lake.)	Do you have any concerns with the approaches provided?	In your opinion, what is the biggest challenge to perform a dredging operation at White Rock Lake?	Additional questions/feedback for City staff and consultants
[Name Removed]	Yes	Yes	Alternative 2 - Initial large dredge followed by annual maintenance dredging	Yes	Up to 1 year	Yes	No	No	Environment, recreation	
[Name Removed]	No	No	Alternative 1 - Large dredge every ~12 years	No	Up to 10 years	No	No		Disruption of the quiet nights for residents who pay higher taxes to live by the lake!	The last time the dredge was done, our entire family was disturbed to the point of much lost sleep during the night when the dredging was being done. I, for one, will never be able to get that awful sound out of my head. PLEASE DON'T DREDGE DURING THE NIGHT!!!!
[Name Removed]	No	Yes	Alternative 2 - Initial large dredge followed by annual maintenance dredging;Alternative 4 - Periodic large dredge (every ~20 years) and maintenance dredging (every ~3 years)	Depends on where it is and how invasive it is	Up to 1 year	No	Yes			
[Name Removed]	No	No	Alternative 1 - Large dredge every ~12 years	Yes, depending on where it is located.	No impacts are acceptable	No	No	I thought the city purchased the equipment used in the 1998 dredging so that it could be used in other parts of the city and reused at White Rock Lake. Did the city purchased the 1998 equipment or did I just hear it wrong? Pumping the silt to a needed landfill area south of the city via the White Rock Creek basin is the best way to move the silt out of the lake. Transporting the silt via truck is not.	Maybe the cost, but if the city has not been setting aside funds for these types of projects from my already too high property taxes then shame on them.	
[Name Removed]	No	No	Create catchment basin at north end of lake and do as-needed dredging there.	No	Build effective catchment basin and prevent the problem		Answer depends on details	All reactive, none preventative	Reactive response to preventable problem	
[Name Removed]	No	No	Alternative 2 - Initial large dredge followed by annual maintenance dredging	No	Up to 1 year	No	Yes		The biggest hurdle is having as little environment impact as possible, and keeping the lake and its surroundings usable and in good working condition.	Since the silt is from upstream runoff, the cities that feed into white rock creek and its tributaries should pay an impact fee to fund lake maintenance.
[Name Removed]	No	Yes	Alternative 1 - Large dredge every ~12 years	No	No impacts are acceptable	Yes	No		How are you going to move the silt away from the lake. What disruptions to the asthedics will there be?	Is there not a way to stop the trash, logs and silt slightly up stream and do routine maintenance to keep it cleaned as to not flow into lake?
[Name Removed]	Yes	Yes	Alternative 2 - Initial large dredge followed by annual maintenance dredging	Yes	Up to 5 years	I would like to pursue other avenues. Bonds, Water Dept etc, before raising taxes/	No		Sediment storage	
[Name Removed]	No	No	Alternative 2 - Initial large dredge followed by annual maintenance dredging	Yes	3-4 months	No	Yes		Location and siting of the permanent dredging/construction staging operation.	
[Name Removed]	No	No	Alternative 2 - Initial large dredge followed by annual maintenance dredging	Yes	Up to 5 years	Yes	Yes	Consider the wider elements of the WRL park (paths, buildings, trees, vegetation, maintain) for a comprehensive plan beyond simply dredging. (This includes Lawther road, a city street)	Effective management of the project.	Think holistically about the park, not just the actual lake.
[Name Removed]	No	Yes	Alternative 1 - Large dredge every ~12 years	No	No impacts are acceptable	Yes	No			
[Name Removed]	No	No	Alternative 4 - Periodic large dredge (every ~20 years) and maintenance dredging (every ~3 years)	Yes	Up to 1 year	Yes	Yes	No- A public improvement District or TIF could be formed to assist in paying for improvements	Set up and logistics of materials	Thanks for seeking public input but City bond elections SHOULD have created a sinking fund for dredging needs. The former City Councilman lacked vision and backbone to make any positive improvement for the long term needs of WRL

White Rock Lake Dredging Feasibility Study
Online Public Input Form
(Open from 7/16/2020 to 8/7/2020)

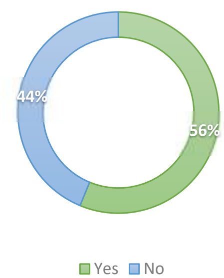
Name	Did you attend the first community meeting on January 28?	Did you attend the second community meeting on July 16?	Of the dredging scenarios presented during the July 16 meeting, do you have a preferred option(s)?	Are you comfortable with a permanent dredging/construction staging operation at White Rock Lake? (Such operation may support potential annual maintenance dredging activities.)	For how long are you willing to accept impacts to the recreational usable depth of White Rock Lake (resulting from future sediment build-up)?	Are you willing to accept a tax increase to fund a dredging program at White Rock Lake?	Are you willing to accept a lake user fee to fund a dredging program at White Rock Lake? (Dallas Park & Recreation currently administers lake user fees for several existing commercial operations on the lake.)	Do you have any concerns with the approaches provided?	In your opinion, what is the biggest challenge to perform a dredging operation at White Rock Lake?	Additional questions/feedback for City staff and consultants
[Name Removed]	Yes	Yes		No		No	No	Yes.	Avoiding ecosystem imbalance, ecological impact and deep longterm costs to Dallas citizens.	1) How deep and what diameter of sediment were the samples taken for COCs in the green triangles shown in the presentation, and why was the deepest sediment areas (according to the TWDB 2015 Study not tested, for example the dam area? 2) What accredited lab was used for analyzing samples? 3) What were the class of chemicals tested and what COCs were identified. 4) What tCEQ, EPA concentration thresholds were used, for example for adults, children, wildlife, marinelife? 4) What chlorinated lawn pesticides were tested? Or other metals or contaminants? 5) Where any sample screening for 2,4-D lawn products (and breakdown of 2,4-D), Glyphosate lawn products, MCPP (Mecoprop), Pendimethalin, Dicamba made?
[Name Removed]	Yes	Yes	Alternative 2 - Initial large dredge followed by annual maintenance dredging	Yes	No impacts are acceptable	Yes	Yes	The presentation showed an estimated trend line for the progress of sedimentation in the lake. Some of the dredging options seemed to be designed to adhere closely to a target line. I would suggest that the trend line is not that precise and that options should be designed with a "factor of safety" above the target line. In the case of dredging "more is better" (and not too expensive on a unit basis once you have set up an operation).	Disposal in an economic and minimally intrusive manner.	I suggest that some form of maintenance dredging be established. These periodic studies, followed by permitting, bond sales and contracting are not dependable for ensuring the lake remains healthy on a regular basis (or managing to a target line).
[Name Removed]	No	No	A 6 ft. high channel wall to guide sediment travel, with yearly maintence.	Yes	more than 10	No	Yes	The Core of Engineers has restricted approach to shore, which greatly altered the efficacy of previous dredging efforts. Remnants quickly silt out what is dredged.	the removal of sediment: where to find it; and how it leaves	maybe the creation of an eastern channel wall, to guide routine dredging, following a natural boundary of sediment accumulation; (The top of this, at 8' deep), and placed at a marginal distance to the eastern edge of the lake? This might naturally collect debris headed for Pelican Bay, for instance. Then, Keeping this flow channel open for the sediment to follow, may reduce routine cost, and affect a desired motion for pervasive soil movement, from all directions.
[Name Removed]	No	Yes	Alternative 2 - Initial large dredge followed by annual maintenance dredging	Yes	Up to 1 year	Yes	Yes	Odor and impediments to the running trails.	Funding	
[Name Removed]	No	No	Install retaining screen or other material at each municipality so they can pay for their own clean up.	No	Up to 1 year	No	Yes	Yes, the approaches never address the root cause of why we continually have to dredge. The municipalities north of Dallas need to retain their own trash and sediment with some kind of screening material. Why should the residents of Dallas continually pay for material from all the other municipalities?	Disruption of lake use and time duration.	what would happen if nothing were done?

White Rock Lake Dredging Feasibility Study
Online Public Input Form
Summary of Responses

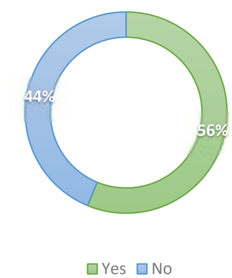
Did you attend the first community meeting on January 28th?



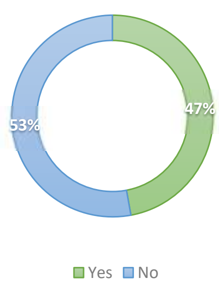
Are you comfortable with a permanent dredge staging operation?



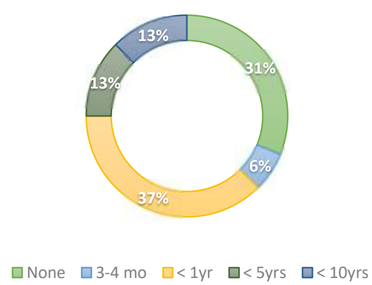
Are you willing to accept a lake user fee to fund a dredging program?



Did you attend the second community meeting on July 16th?



For how long are you willing to accept recreational useable depth impacts?

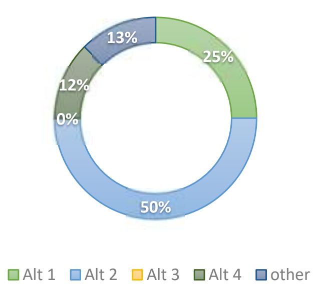


Open to Public from 7/16/2020 to 8/7/2020
via Google Forms platform

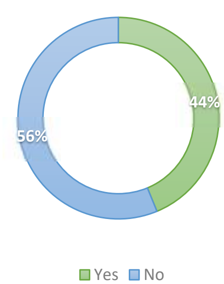
Total Responses: 17

Questions added to Q&A Document: 10
(posted to Park & Recreation website)

Based on what was presented, what is your preferred dredging scenario?



Are you willing to accept a tax increase to fund a dredging program?



White Rock Lake Dredging Feasibility Study

Summary of Q&A from Public Comment Period

The following provides written responses to questions received during the open public comment period between July 16 and August 7, 2020. Questions were gathered through a web-based survey via Google Forms and through email communications with City of Dallas staff.

Additional Q&A was provided previously following the Virtual Community Meeting held on July 16, 2020. Please refer to the Dallas Park and Recreation website for further details: **https://www.dallasparks.org/235/White-Rock-Lake**.

If you are interested in staying informed, please provide your contact information and reach out to the contact provided.

David Phan, P.E., CFM
Dallas Water Utilities |
Floodplain Management
Office: 214-948-4682
E-Mail: David.Phan@dallascityhall.com

1) Did the City purchase the dredging equipment used in the 1998 dredging project?

No, the 1998 dredge was performed by a contractor and dredging equipment was not retained by the City. It appears that most of the dredge pipeline infrastructure was also removed and/or abandoned. There may be some physical crossings that still exist, but these have not been maintained in the 20 years since the project was completed and the condition is unknown.

2) How will dredged materials be removed from the lake? What will be the disruptions to lake aesthetics?

The most likely dredge method will be hydraulic dredging, which pumps slurry (dredge materials and water) via pipeline to the disposal site. This is the same method that was utilized in the 1998 dredging project. The footprint of any disruption would be focused around the dredge barge area and transmission pipeline with a near shore area that would be temporarily restricted for construction staging. Ultimately the footprint is small considering size of lake. There are also secondary impacts such as noise from the equipment, smell, and the visibility of the dredging operation.

3) Is it possible to capture silt, trash, and debris prior to entering the lake and perform routine maintenance there?

As part of the project, we evaluated the installation of a sediment forebay upstream of White Rock Lake to capture sediment before it enters the lake. An area of approximately 120 acres would be required for an assumed sediment removal frequency of approximately 10 years. The area immediately upstream of White Rock Lake is a wetland area under the jurisdiction of the US Army Corps of Engineers (USACE). The installation of a sediment forebay of this size would most likely be negatively impactful to this environment and is therefore unlikely to be permitted.

4) How deep and what diameter were the samples taken for Chemicals of Concern (COCs)? Why were deeper sediment areas not tested, for example near the dam?

Samples were collected two to four feet deep into the deposited sediment layer within water depths from five to ten feet. The hand corer collects samples with a diameter of approximately two inches. The purpose of the sediment sampling was to provide preliminary data for the dredging feasibility study. More extensive sampling will likely be required prior to construction of a dredging project. With the assumption that dredging will not need to be performed in areas of the lake deeper than 8-10 feet, no sediment sampling was performed in these areas. Additional details have been made available in the *White Rock Lake Dredging Feasibility Study Report*, where the sediment sampling results are both summarized and provided in detail via an appendix.

5) Which laboratory was used for analyzing sampling results?

Sediment samples were analyzed by Xenco Environmental Laboratories, which is NELAC accredited under the Texas Laboratory Accreditation Program.

6) What class of chemicals were tested? Which COCs were identified? And what TCEQ/EPA thresholds were used (adults, children, wildlife, marine life)?

Complete details of the chemicals tested and resulting levels have been made available in the *White Rock Lake Dredging Feasibility Study Report*, where the sediment sampling results are both summarized and provided in detail via an appendix. None of the COCs identified appear to exceed thresholds that would pose a substantial risk to dredging contractors (direct human contact), the lake environment (aquatic life protection), or groundwater.

7) ***Were any lawn products tested (2,4-D, glyphosate, MCPP, pendimethalin, dicamba, etc.)?***

Complete details of the chemicals tested and resulting levels have been made available in the *White Rock Lake Dredging Feasibility Study Report*, where the sediment sampling results are both summarized and provided in detail via an appendix. While several pesticides and herbicides were tested, none exceeded TCEQ thresholds.

8) ***Would it be feasible to place a channel wall within the lake to serve as a boundary to sediment accumulation, possibly at the 8-feet depth limits?***

Such a structure was not considered as part of this feasibility study.

9) ***Why should the residents of Dallas continually pay to remove material from upstream municipalities? Couldn't these other entities retain their own trash and sediment with some kind of screening material?***

A program to reduce sediment loading in creeks and other waterbodies is a worthwhile regional initiative, but a comprehensive study and recommendation on this topic is beyond the scope of study. Several mechanisms exist to minimize sediment deposition in reservoirs by routing sediment around or through storage features, however these options would require a major redesign of the dam, park, and reservoir.

10) ***What would happen if nothing were done?***

While the estimated annual sedimentation rate has not been constant over the history of White Rock Lake, values range from about 150,000 to 250,000 cubic yards per year. For the purposes of this feasibility study, the sedimentation rate is estimated at 170,000 cubic yards per year (3.9 acre-feet per year). With a current total storage capacity of approximately 16.5 million cubic yards (10,200 acre-feet), the lake may eventually fill in with sediment over the course of 60 to 100 years, depending on actual sedimentation rates over the next several decades.

11) ***Will dredging White Rock Lake provide any flood control benefits?***

All lakes and dams do affect flood elevations upstream and downstream of their location. The proposed dredging activities will occur below the normal pool elevation of the lake. Any sediment removed from the lake bottom will be immediately occupied by water. From a flood control perspective, only the capacity above the normal pool elevation is important. Flood control dams, like the one at Lake Lewisville, have the vertical capacity to safely store flood waters. As heavy rains occur, the dam embankments hold back flood waters and the lake level will safely rise. After the rains subside, controlled releases of flood waters would be conducted to safely lower lake levels. White Rock Lake was never designed for flood control and doesn't have that capability to safely store floodwaters. In order for White Rock Lake to provide flood control capabilities, the City would have to modify the White Rock Dam and construct embankments along low lying areas of the lake and its tributaries. That is an entirely separate effort that is outside the project scope of this dredging feasibility study.

12) ***Will an Environmental Impact Statement (EIS) be prepared for this project?***

The dredging project will need to address impacts on cultural resources, federally listed threatened or endangered species, water quality, environmental impacts, and aquatic life to meet state and federal permitting requirements. These permits must be obtained before any dredging construction activity can begin. The need for an Environmental Impact Study (Environmental Assessment) is primarily dependent on the size of the dredging operation, which determines the type of approval when the City applies for the Section 404 Clean Water Act permitting. In order to apply for Section 404 Clean Water Act permitting, the City will need to submit preliminary engineering plans to the US Army Corps of Engineers (USACE). If the USACE determines that the dredging project qualifies under a nationwide permit or regional general permit, then an Environmental Assessment may not be needed. Most likely, this dredging project will require an Individual Permit or Letter of Permission from the USACE. The application process for an Individual Permit or Letter of Permission will require an Environmental Assessment to be performed. The permit application will then be available for some time for comments from the public and other state/federal agencies. Once the USACE has determined that the City has sufficiently addressed the comments, an Individual Permit or Letter of Permission will be granted. There are currently too many unknown factors to adequately conduct an Environmental Assessment. The City still needs to determine the dredging removal quantities and removal locations. Funding for the engineering design and permitting process needs to be secured as well.

13) <u>Are there any water quality or wetlands improvements that could be done at the same time of the dredging and qualify for grants or mitigation banking?</u>

Detailed evaluation of water quality benefits may be a component of future studies but is beyond the scope of the current study. Removing deposited sediment from the lake may provide some ancillary water quality benefits. However, a wetlands mitigation project would be much more extensive and have much higher requirements and associated costs. The proposed dredging scenarios have evaluated a dredging project that does not appear to qualify for grant/funding opportunities.

14) <u>Because White Rock Creek is part of the Trinity River Basin, what involvement will the Trinity River Authority (TRA) have in the permitting process?</u>

The TRA would have opportunity to provide comments during the public and/or agency review period for a 404 permit application, but based on current information, TRA does not have any specific jurisdiction over this project.

15) <u>Would raising the wooden stoplogs in the dam be of any help in moving water during flood events?</u>

Modifying the stoplogs to raise or lower the normal pool elevation of White Rock Lake would have little impact to the flood control benefits. While unrelated to the dredging feasibility study, the City is currently evaluating the spillway configuration via an engineering study. The purpose of that study, however, is to bring the dam into compliance with TCEQ dam safety regulations, not to improve flood control capacity.

APPENDIX C
Sediment Sampling Plan

Innovative approaches
Practical results
Outstanding service

SEDIMENT SAMPLING PLAN

WHITE ROCK LAKE DREDGING FEASIBILITY STUDY

Prepared for:

DALLAS WATER UTILITIES
DALLAS PARK AND RECREATION

MARCH 2020

Prepared by:

BROWNSTONE ASSOCIATES
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APPENDICES

1.0 GENERAL

The City of Dallas plans to dredge sediment from White Rock Lake to improve recreation, aesthetics, and water quality of the reservoir. Sediment samples will be collected from selected sites for the purpose of conducting testing to characterize the material that will be excavated during the dredging project. Sampling locations will be selected such that the sediment collection locations are evenly distributed over the dredge footprint, with the bias towards areas of highest usage and activity. Testing requirements will depend on the history of the site, the surrounding area, past dredging information and the placement options selected by the City of Dallas. Data needed for the evaluation will consist of chemical analyses of sediment, water and elutriate samples. Collection of physical parameters will include grain size analyses, percent solids, pH, temperature and salinity. In some instance, bioassays such as toxicity, survival and bioaccumulation will be needed to determine suitability of material prior to placement. The US Army Corps of Engineers (USACE) may assist in determining whether special requirements exist for this project area and if modifications to this testing protocol may be needed. Sampling of dredged material will be required prior to start of every dredging event. A dredging event is the actual removal of silt and other material from the bottom of bodies of water. Data will be valid for a two-year period from the time of sampling unless otherwise stated by the USACE. The dredged material will be characterized to determine concentrations of potential chemicals of concern (COCs) and the resulting requirements or limitation for reuse or disposal options. The following sampling plan provides the recommended sampling locations and describes sample collection methods and recommended chemical analyses for sediment samples.

2.0 TIER 1 INVESTIGATION – HISTORICAL DATA EVALUATION

2.1 HISTORICAL ENVIRONMENTAL INVESTIGATION SUMMARY

The initial tier (Tier I) uses readily available, existing information (including all previous testing). Prior to field investigation, a review of available data from previous sediment characterization studies, such as, the Report on Investigations for Improvement Program for White Rock Lake Park dated August 1971, White Rock Lake Diagnostic/Feasibility Study dated December 1996, and Texas Water Development Board Volumetric and Sedimentation Survey of White Rock dated February 2016, was conducted to evaluate the presence of potential COCs including: polychlorinated biphenyls (PCBs), priority pollutant metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), herbicides and pesticides.

White Rock Lake is a reservoir located in the Northwest side of Dallas County. The lake covers over 1,000 acres which is fed by nine tributaries including White Rock Creek. The lake was created as a reservoir for the City of Dallas, due to a water shortage in Dallas. The reservoir was formed by damming White Rock Creek, which today, widens into the lake before continuing south out of the spillway and emptying into the Trinity River. The dam controls a drainage area of approximately 100 square miles. Historically, the lake has been dredged or undergone silt removal approximately every 18-24 years (**Table 2-1**).

Table 2-1: Historic Dredging at White Rock Lake

Year	Amount of Sediment Removed	Land Use
1937	400,000 cubic yards	90 acres reclaimed
1955	15,000 cubic yards	Unknown acres reclaimed
1974	1,350,000 cubic yards	Rebuilt marshy areas; Mockingbird Point was created
1998	3,000,000 cubic yards	Filled a gravel pit in Hutchins, Texas

In March 2015, the Texas Water Development Board (TWDB) conducted a survey of Lakewood/ East Dallas and found that sediment was approximately six to eight feet in some places throughout the lake, especially in the southern and western areas of the lake. At the current silt rate, without dredging the lake could possibly fill with sediment by the year 2034 which will impact recreational activities and wildlife at the lake.

As required by the Clean Lake Program, a limnological study of the lake was conducted in 1994 through 1995. The White Rock Lake Diagnostic/Feasibility Study dated December 1996 was reviewed for the detail of the results. The following parameters were analyzed by the laboratory.

- Biochemical Oxygen Demand (BOD)
- Alkalinity
- Turbidity
- Total Suspended Solids (TSS)
- Conductivity
- Nitrate
- Total Kjeldahl Nitrogen (TKN)
- Ammonia
- Total Phosphorus (TP)

- Total Dissolved Phosphorus (TDP)
- Fecal Coliform Bacteria
- Chlorophyll a

The sampling locations are listed below (**Table 2-2**).

Table 2-2: Sampling Station Locations – Limnological Study (1994-1995)

Location	Description
Lower Lake (L)	This sampling station was centered between the east and west shores of the lake and located approximately 500 feet north of the White Rock Lake Dam. The water was sampled at depths of two, seven, 12 and 17 feet.
Middle Lake (M)	This sampling station was centered between the east and west shores of the lake, and located approximately 6,000 feet north of the White Rock Dam Spillway. Winfrey Point was located to the east of the station and Lily Pad Bay was located to the west of the station. The water was sampled at two foot and seven foot depths.
Dixon Branch (DB)	This sampling station was located approximately 30 feet southwest of the mouth of Dixon Branch and centered in the creek channel where the mouth empties into White Rock Lake. The water was sampled at two foot depth.
Upper Lake (U)	This sampling station was centered between the east and west shores of the lake, and located approximately 3,100 feet south of the Mockingbird Lane Bridge. The Corinthian Sailing Club was located to the east of the station and a large stone house was located to the west of the station. The water was sampled at two foot depth.
White Rock Creek (WRC)	This sampling station was located approximately 100 feet south of the Mockingbird Lane Bridge and centered in the creek channel where the mouth of White Rock Creek empties into White Rock Lake. The water was sampled at a two foot depth.

Statistical analysis was conducted on the results and compared to the criteria set for Segment 0827 (White Rock Lake) of the Trinity River Basin.

From October 10 to October 14, 1994, sediment sampling was conducted at 21 stations on the lake using a 24-foot motorized pontoon barge. The sediment sampling was conducted as using a WILDCO Ekman Bottom Grab Sampler Model 196-B12. The deeper sediment samples (one, two, four, and eight-foot sediment cores) were collected using either a ten-foot-long (depending on the depth of water above the lake bottom), two-inch diameter PVC pipe. The sediment sampling identification numbers, stations, and sampling depths are listed below (**Table 2-3**). **Exhibit 1** in **Appendix A** provides approximated sampling station locations based on the descriptions provided in **Tables 2-2** and **2-3**.

Table 2-3: Sampling Station Locations and Sampling Type – Limnological Study (1994-1995)

Section	Stations	Description
1	A, B, & C	These three sampling stations were located approximately 500 feet north of the White Rock Lake Dam and were spaced approximately 800 feet apart. Only surface sediment was sampled at these stations.
2	A, B, C, & D	These four sampling stations were located approximately 6,000 feet north of the White Rock Dam Spillway and were spaced approximately 700 feet apart Winfrey Point was located to the east of the stations and Lily Pad Bay was located to the west of the stations. Only surface sediment was sampled at these stations.
3	A, B, C, & D	These four sampling stations were located approximately 6,500 feet south of the Mockingbird Lane Bridge and were spaced approximately 700 feet apart. The Dreyfuss Club was located to the east of the stations and Jackson Point was located to the west of the stations. Sediment was sampled at the surface, four- foot and eight-foot depths.
4	A, B, C, D, & E	These five sampling stations were located approximately 3,000 feet south of the Mockingbird Lane Bridge and were spaced approximately 700 feet apart. The Corinthian Sailing Club was located to the east of the stations and a pier was located to the west of the site. Stations A, B, and C were sampled at the surface, four-foot and eight-foot depths. Station D was sampled at the surface, one-foot, two-foot, four-foot and eight-foot depths; Station E was sampled at four foot and eight-foot depths.
5	A, B, C, D, & E	These five sampling stations were located approximately 1,700 feet south of the Mockingbird Lane Bridge and were spaced approximately 700 feet apart. Stations A, B, D and E were sampled at the surface, four foot, and eight-foot depths. Station C was sampled at four foot and eight-foot depths.

The composited sediment samples were analyzed for acid extractable organics, base neutral extractable organics, herbicides, nitrogen compounds (Nitrate, nitrite and total Kjeldahl nitrogen), pesticides, total phosphorus, EPA priority pollutant metals, percent solids, total petroleum hydrocarbons (TPH), volatiles and percent volatile solids. The results were as follows (**Table 2-4** and **2-5**):

Table 2-4: Sediment Sample Analysis Results – Limnological Study (1994-1995)

Nutrients, Solids and TPH Parameters Detected in White Rock Lake Sediment Samples									
Parameters[1]	Sediment Section 1	Sediment Section 2	Sediment Section 3	Sediment Section 4	Sediment Section 5	Average	Median	Minimum	Maximum
Nitrate	26	12.8	9.4	16.4	5.8	14.08	12.8	5.8	26
Nitrite	15.7	5.8	10.5	20.7	0.9	10.72	10.5	0.9	20.7
Total Kjeldahl	563	580	634	624	378	555.82	580	378	634
Total Phosphorus	243	223	176	269	206	223.4	223	176	269
Percent Solids	25.8	28.5	35.2	40	25.6	31.02	28.5	25.6	40
Percent Volatile Solids	2.53	2.38	2.53	2.75	3.07	2.65	2.53	2.36	3.07
TPH[2]	44	58	53	63	59	55.4	58	44	63

1 All values except percent solids and percent volatile solids are reported in milligrams per kilogram (mg.kg).

Percent solids and volatile solids are reported as a percentage.

2 TPH = Total petroleum hydrocarbons

Table 2-5: Sediment Sample Analysis Results – Limnological Study (1994-1995)

Priority Pollutant Values of White Rock Lake Sediment Samples

Priority Pollutant	Lab Detection Limits[1]	Total Permissible Limit[1]	Sediment Section 1	Sediment Section 2	Sediment Section 3	Sediment Section 4	Sediment Section 5	Mean	Med.[2]	Min.[3]	Max.[4]
Antimony	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA[5]	NA	NA
Arsenic	0.1	100	2.5	2.4	2.1	2.1	2.3	2.28	2.3	2.1	2.5
Beryllium	0.05	-	0.32	0.33	0.45	0.46	0.39	0.392	0.39	0.32	0.46
Cadmium	0.1	20	1.6	1.5	2.2	2.2	1.8	1.86	1.8	1.5	2.2
Chromium	0.2	100	5.8	5.7	8.3	8.3	6.1	6.84	6.1	5.7	8.3
Copper	0.2	-	4.9	5.5	6.5	7	5.9	5.96	5.9	4.9	7.0
Lead	1.0	100	13.5	14.8	18.2	21.1	16.2	16.76	16.2	13.5	21.1
Mercury	0.01	4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	NA
Nickel	0.5	-	5.4	5.5	8.4	7.9	6.7	6.78	6.7	5.4	8.4
Selenium	0.1	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	NA
Silver	1.0	100	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	NA
Thallium	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	NA
Zinc	0.5	-	23.3	26.3	27.7	30.4	24.2	26.4	26.3	23.3	30.4

1All values were reported in milligrams per kilogram (mg.kg).

2Median

3Minimum

4Maximum

5Not applicable

The sampling results for nitrate, nitrite, total Kjeldahl nitrogen, total phosphorus, percent solids, percent volatile solids and total petroleum hydrocarbons were considered low based on other values statewide.

The metal antimony, mercury, selenium, silver and thallium were below detection limits in all samples. Arsenic, beryllium cadmium, chromium, copper, lead, nickel, and zinc were lower than statewide values and/or acceptable.

The volatile compounds analyzed in the sediment samples were all below detection limits, which were set below any level of concern. All composited sediment samples had levels of acid extractable organics that were less than the detection limits, which were set below levels of concern. The acid extractable organics were not found in high enough quantities to adversely affect the sediment quality of White Rock Lake or use of material after dredging. All base neutral extractable organic compounds except forbis (2-ethylthexyl) phthalate were below detection limits. Several studies on the presence of this substance in wastewater effluent have shown it to be very common. The elevated levels did not impose any adversely affect the sediment quality of the White Rock Lake. The herbicides and pesticides analyzed in the sediment sample were all below detection limits.

The analytical results of the sediment samples listed above could be used as background levels for the next sediment sampling event at White Rock Lake upon approval from the USACE.

In addition to the studies listed above, some other studies and documents were reviewed for this evaluation. The list of reports includes:

- Report on Investigations for Improvement Program for White Rock Lake Park dated August 1971
- Sampling and Analysis Plan – Private Dredging USACE Galveston District
- The regulatory citation for the Texas Risk Reduction Program (TRRP) Rule is Title 30 Texas Administrative Code (TAC) Chapter 350.
- TCEQ Regulatory Guidance Determining Protective Concentration Levels (PCLs) for Surface Water and Sediment
- Section 404 of the Clean Water Act
- Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual

3.0 TIER 2 INVESTIGATION – SEDIMENT SAMPLING

Based on the review of historical investigations conducted for White Rock Lake, it is recommended that one round of sediment sampling be conducted to determine the required handling and/or disposal of dredged material. However, based on the analytical results, a second round of sampling may be necessary to clarify any results and determine the required handling and/or disposal of the dredged material. The Tier 2 investigation will include shallow sediment sampling at proposed dredged sites and subsequent depth-specific sampling at proposed geotechnical sampling locations.

3.1 SHALLOW SEDIMENT SAMPLING

Sample collection must be accomplished by qualified staff at the locations selected by the City of Dallas. The samples should be taken at representative locations evenly distributed over the dredge footprint to obtain a representative sample.. A bathymetry survey data should be utilized in choosing the sampling locations. The sampling frequency and sampling technique will be determined by the volume of dredged material. Below is an example of the sampling frequency (**Table 3-1**).

Table 3-1: Sampling Frequency

Amount of Sediment (cubic yards)	Number of Samples to be Collected
30,000	Three grab samples; one surface water and one elutriate sample
50,000	Four grab samples; two surface water and two elutriate samples
70,000	Five grab samples; three surface water and three elutriate samples
90,000	Six grab samples; four surface water and four elutriate samples

Projects larger than 100,000 cubic yards of sediment removal will be dealt with on a case by case basis and may require coordination with the USACE to determine the most appropriate sample frequency.

The collection of grab samples of lake sediment will be taken to a maximum depth of two feet from the recommended sampling areas (Section 3.3) using a boat furnished by the City of Dallas or a contractor. A core 3-1/2" (8.9 cm) in diameter is extracted and held in a brass cylinder. Global Position System (GPS) equipment will be used to locate the specific sampling points shown in this work plan. Samples will be collected using a hand corer from each location. The corer will be advanced up to a maximum of two feet into the lake sediment depending on compaction. The hand corer will be pushed into lake sediment using handles in the head assembly and extension rods to reach in desired depth. A composite sample will be collected from the core tube such as a sludge and sediment sampler. If sample collection is not practical using the hand corer, a lightweight bottom dredge sampler, such as an Echman or Ponar dredge, will used to collect a sediment sample at each location.

The sediment samples will be analyzed for priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc) by EPA Method 6020, herbicides by EPA Method 8260, pesticides by EPA Method 1699, volatiles organic compounds by EPA Method 8260, semi-volatile organic compounds by EPA Method 8270, and polychlorinated biphenyls by EPA Method 8310.

Laboratory analytical results will be evaluated to identify sampling locations where additional sampling is recommended in conjunction with planned geotechnical activities.

3.2 GEOTECHNICAL BORING SEDIMENT SAMPLING

A geotechnical investigation will be conducted to characterize the engineering properties of the lake sediment to be dredged. Sediment samples will be collected at 1-foot depth interval from up to twelve (12) borings with up to ten (10) samples per boring. Samples will be collected from accumulated sediment not native soils. All sediment samples will be analyzed for PCBs and priority pollutant metals. During this phase 25 percent of the sediment samples will be analyzed for VOCs, SVOCs, herbicides, and pesticides. These samples may be selected at random or be based on preliminary findings from the shallow sediment samplings. In addition, a waste characterization will be performed on selected samples using the toxicity characteristic leaching procedure (TCLP) for samples with total COC concentrations potentially exceeding waste disposal thresholds. Laboratory analytical results will be evaluated to determine available beneficial reuse or disposal options for the dredged materials.

3.3 RECOMMENDED SEDIMENT SAMPLING AREAS

Several criteria were evaluated to recommend sediment sampling areas on White Rock Lake. The recommended sampling areas were selected considering that the overarching goal of the dredging project is to provide improvements to recreational activities in the lake. It is important to note that additional samples will likely be required in the future as part of the design phase and for environmental permitting compliance. The following is a description of each criteria utilized in the evaluation and the information it provided for the selection process.

A. Public Interest – The White Rock Lake Feasibility Study public meeting, held on January 28, 2020, provided a series of public input opportunities including maps and comment cards where participants could express their goals and concerns regarding the dredging project. One of the public input stations requested participants to place a color-coded sticker on areas they considered to be appropriate/not appropriate to dredge the lake (see **Exhibit 2** in **Appendix A**). Participants wrote numbers on each sticker which were associated with comment cards where they provided additional notes, questions, clarifications, etc. This information was used to identify areas where there was an evident public interest in dredging or not dredging that particular lake area.

B. White Rock Lake Diagnostic/Feasibility Study (1996) – The location of the sampling sites discussed in **Section 2.1** was approximated based on the descriptions provided in **Tables 2-2** and **2-3** (see **Exhibit 1** in **Appendix A**). The main intent of using this data was to determine if the recommended sampling areas would be located close to these sampling sites, which would allow for general comparison of results.

C. Lake Depth – The White Rock Lake depth data obtained from the TWDB Volumetric and Sedimentation Survey (TWDB, 2015) was used to identify the areas where current water depth is less than 10 feet and focusing on potential dredge area candidates. No substantial benefits would be obtained by dredging deeper areas from a recreational standpoint.

D. Lake Sediment Thickness - The White Rock Lake sediment thickness data was obtained from the TWDB Volumetric and Sedimentation Survey (TWDB, 2015). A fundamental assumption of the dredging feasibility study is that dredging would only occur in deposited sediment areas; over-dredging of the native lake bottom would not be considered. Therefore, dredging areas with a thin sediment layer will not create a significantly deeper area for the lake. However, it is recognized that some areas may benefit from dredging even if it only results in relatively shallow depths.

The data provided by each of the above criteria was combined using ArcGIS and evaluated simultaneously to find correlations and identify the recommended sampling areas. Areas with sediment thickness greater than 2 feet, lake depth less than 10 feet, and evident public interest were considered the areas with the greatest potential for sediment dredging. Once these general areas were identified a sampling area center point was selected and a sampling area was generated based on a 250 feet radius. The recommended sampling locations are shown on **Exhibits 3** and **4** in **Appendix A** and listed on **Table 3-2**. **Exhibits 5** to **13** in **Appendix A** provide a zoomed in view of each sampling area and associated information.

Table 3-2 provides detailed data for each sampling area including its ID, general location, coordinates, sediment thickness range, sample type, and number of samples per sampling area. A description of the sampling requirements for each sample type (Shallow or Geotechnical Boring) is provided in **Sections 3.1** and **3.2**. The number of samples to be collected was determined based on **Table 3-1** (sampling frequency table). The sediment volume for each sampling area was calculated in ArcGIS based on the sediment thickness beneath each sampling area.

Table 3-2: Recommended Sediment Sampling Areas

Sampling Area ID	General Location	Latitude	Longitude	Area of Public Interest?	Near Previous Sampling Site?	Sediment Thickness Range (ft)*	Sample Type	Number of Samples per Area
1	North of Pelican Point, South of Dreyfuss Club. Mouth of Dixon Branch.	32.833789	-96.71462	Yes	Yes	1.5-3	Shallow	3
2	West of Dreyfuss Club, East of Jackson Point.	32.834582	-96.718778	Yes	Yes	3.5-5.5	Geotechnical Boring	4
3	West of Bath House Cultural Center.	32.838967	-96.71699	Yes	No	4-6	Geotechnical Boring	4
4	West of Corinthian Sailing Club.	32.844101	-96.720436	Yes	Yes	2-5	Shallow	3
5	South of White Rock Boat Club.	32.847458	-96.719016	Yes	Yes	3-4.5	Geotechnical Boring	3
6	North of Jackson Point.	32.839106	-96.726201	Yes	No	3-6.5	Geotechnical Boring	4
7	Cove at mouth of Williamson Branch.	32.83188	-96.728812	Yes	Yes	1-4	Shallow	3
8	Cove at mouth of Beards Branch.	32.824289	-96.730343	Yes	No	1-3.5	Shallow	3
9	South of White Rock Lake Dog Park.	32.84799	-96.727281	No	Yes	2.5-4.5	Shallow	3

* Source Data: TWDB Volumetric and Sedimentation Survey, 2015.

4.0 TIER 3 INVESTIGATION – COMPREHENSIVE SEDIMENT SAMPLING

During the Tier III investigation, a comprehensive investigation may be necessary based on laboratory results from the Tier 1 and Tier 2 investigations to determine the lateral and vertical extent of impacted sediment of area where dredged material would require specific handling and waste disposal. This additional sediment sampling is not part of the scope of services at this time. In the event that the need for a Tier 3 investigation is identified, Freese and Nichols will contact the client to discuss sample results and recommended options to proceed with additional investigations as necessary.

5.0 SAMPLE HANDLING

All sampling equipment including augers, split spoons, shovels, knives and bowls will be properly decontaminated prior to and following use at each sample location. Decontamination will be accomplished using an Alconox or Liquinox solution. Following washing with soap solutions, equipment will be rinsed using tap water followed by a final rinse using distilled or deionized water.

Sample containers and appropriate container lids will be provided by the analytical laboratory. The laboratory will add any necessary chemical preservatives prior to shipping the containers to the contractor conducting the sampling. Samples must be properly transported to the analytical laboratory by placing the samples in a cooler containing ice to maintain a shipping temperature of approximately 2oC to 4oC, never frozen. Samples collected will be identified by a specific nomenclature.

Sample labels will be placed firmly on each sampling container with the following information legibly and indelibly written on the label:

- Facility name and location;
- Sample Identification;
- Sample type (water, soil, etc.);
- Sampling date;
- Sampling time;
- Preservatives added; and
- Sampler's initials.

5.1 CHAIN-OF-CUSTODY CONTROL

After the samples are collected, chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory. Each sample container will be identified on the chain-of-custody form in triplicate by the sampling personnel. The chain-of-custody forms will contain the following information:

- Unique sample identification number;
- Sample collector's printed name and signature;

- Date and time of sample collection;
- Sample location;
- Sample matrix;
- Sample size and container;
- Chemical preservatives added;
- Analyses requested;
- Signatures of individuals involved in the chain of possession; and
- Inclusive dates of possession.

The chain-of-custody documentation will be placed inside the shipping container so that it will be immediately apparent to the laboratory personnel receiving the cooler container. The shipping cooler container must be sealed so that it will be obvious if the seal has been tampered with or broken. One copy of the form will be kept by the sampler after sample delivery to the laboratory; the other two copies will be retained at the laboratory. One of the laboratory copies will become part of the official laboratory analytical report.

5.2 SAMPLE SHIPMENT

After the samples are sealed and labeled, they will be packaged for transport to the laboratory. The packaged samples will either be picked up from the site or from Freese and Nichols' offices by laboratory representatives or will be hand delivered to the laboratory at the end of each sampling day.

The analytical lab receiving the samples must be accredited under the National Environmental Laboratory Accreditation Conference (NELAC) standard for matrices, methods, and parameters of analysis.

5.3 FIELD DOCUMENTATION

In order to provide complete documentation of the sample events, detailed records will be maintained by Freese and Nichols in a site dedicated field log book. At a minimum, the entries in the field log book will include the following information:

- Sample location;
- Sample identification;
- Sample location map or detailed sketch;
- Date and time of sampling;

- Sampling method;
- Field observation regarding physical characteristics of the materials sampled;
- Weather conditions;
- Depth of water;
- Sample depth;
- Sampler's name;
- Name of any subcontractor personnel present;
- Any other relevant information.

6.0 DATA EVALUATION

Sediment characterizations testing will be performed utilizing methods and procedures accepted by TCEQ, USEPA, and the U.S. Army Corps of Engineers including procedures for Tier 1 and Tier 2 evaluations described in *Evaluation of Dredged Material Proposed for Discharge into Waters of the U.S.* (EPA/USACE, 1998).

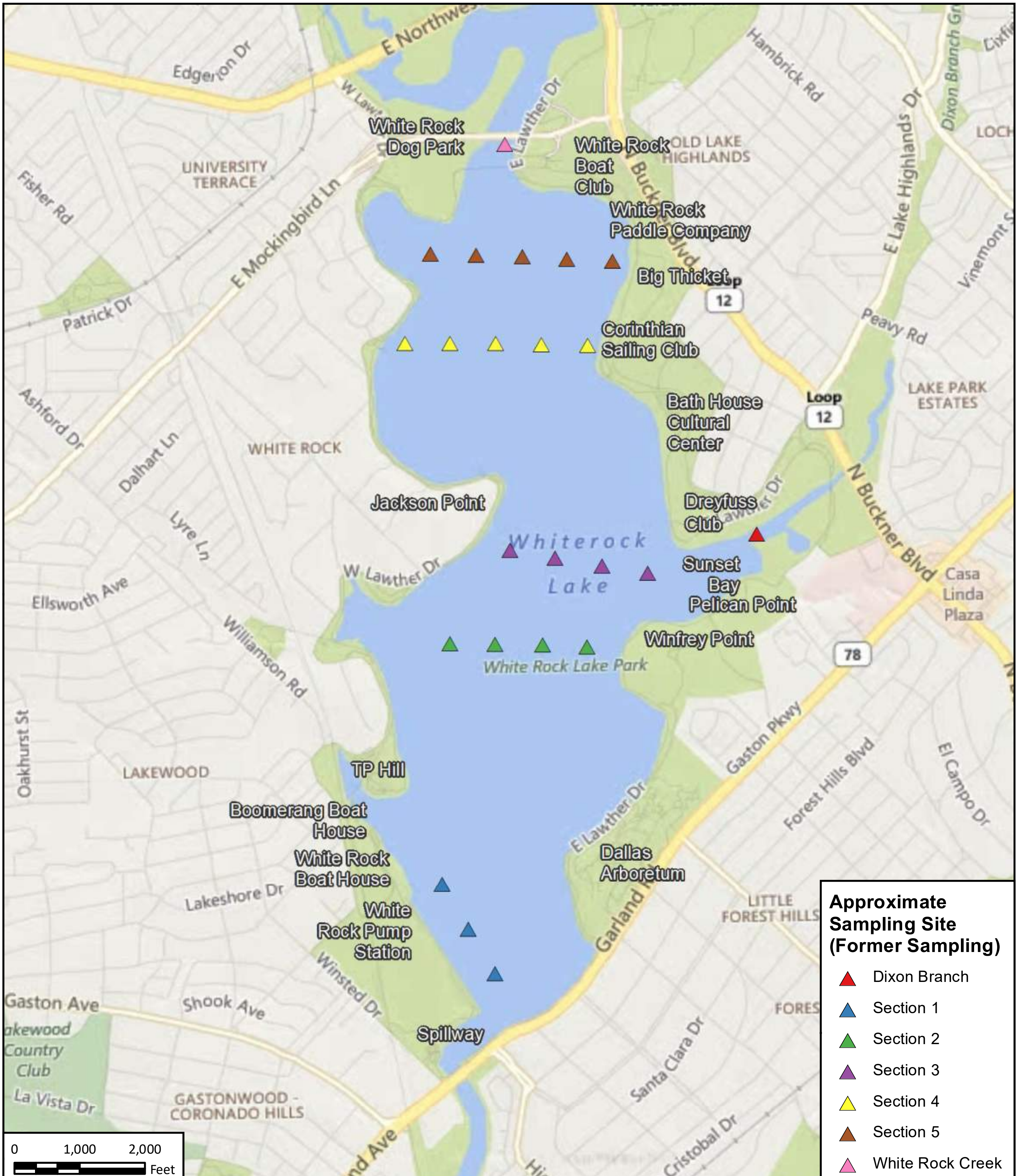
The TCEQ outlines specific procedures, as provided in the guidance document "Determining Which Releases are Subject to TRRP", that must be followed to determine if a release or contaminated area is subject to TRRP (Title 30 of the Texas Administrative Code, Chapter 350 [30 TAC §350]) regulations. The TRRP rule also allows for relocation of soils for reuse purposes in §350.36 which sets standards for this purpose when the soil contains COCs at concentrations above naturally occurring background concentrations. This document establishes criteria by which preliminary environmental site investigations such as the one conducted on the subject properties can be evaluated to determine future actions that may be required by the TCEQ.

Sample results will be compared to PCLs for direct exposure ($^{Tot}SOIL_{Comb}$) and sediment ($^{Tot}SED_{Comb}$) established by the TCEQ under the Texas Risk Reduction Program (TRRP, Title 30 of the Texas Administrative Code, Chapter 350) and TCEQ hazardous waste classification limits provided in Title 30 of the Texas Administrative Code, Sections 335.501-.521 for classifying hazardous waste for a municipal generator.

Table 6-1: Protective Concentration Levels

Chemicals of Concern	TRRP Tier 1 Residential PCLs		Waste Classification	
Total Metals (mg/kg)	$^{Tot}SOIL_{Comb}$	$^{Tot}SED_{Comb}$	Total Permissible Limit	TCLP Regulatory Level (mg/l) (For Hazardous Waste Determination)
Antimony	15	83	20	-
Arsenic	24	110	36	5
Barium	7800	23000	2000	100
Beryllium	38	27	1.6	-
Cadmium	52	1100	10	1
Chromium	23000	36000	100	5
Copper	550	21000	-	-
Lead	500	500	30	5
Mercury	2.1	34	4	0.2
Nickel	830	1400	1400	-
Selenium	310	2700	20	1
Silver	95	350	100	5
Thallium	6.3	43	-	-
Zinc	9900	76000	-	-
Polychlorinated biphenyls (mg.kg)				
PCB	1.1	2.3	50	>50

APPENDIX A



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Approximate Sampling Locations

Limnilogical Study 1994

FN JOB NO	DWU19688
FILE NAME	Exb_1_Historical_Points.mxd
DATE	3/20/2020
SCALE	1:24,000
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DRAFTED	02271

EXHIBIT 1

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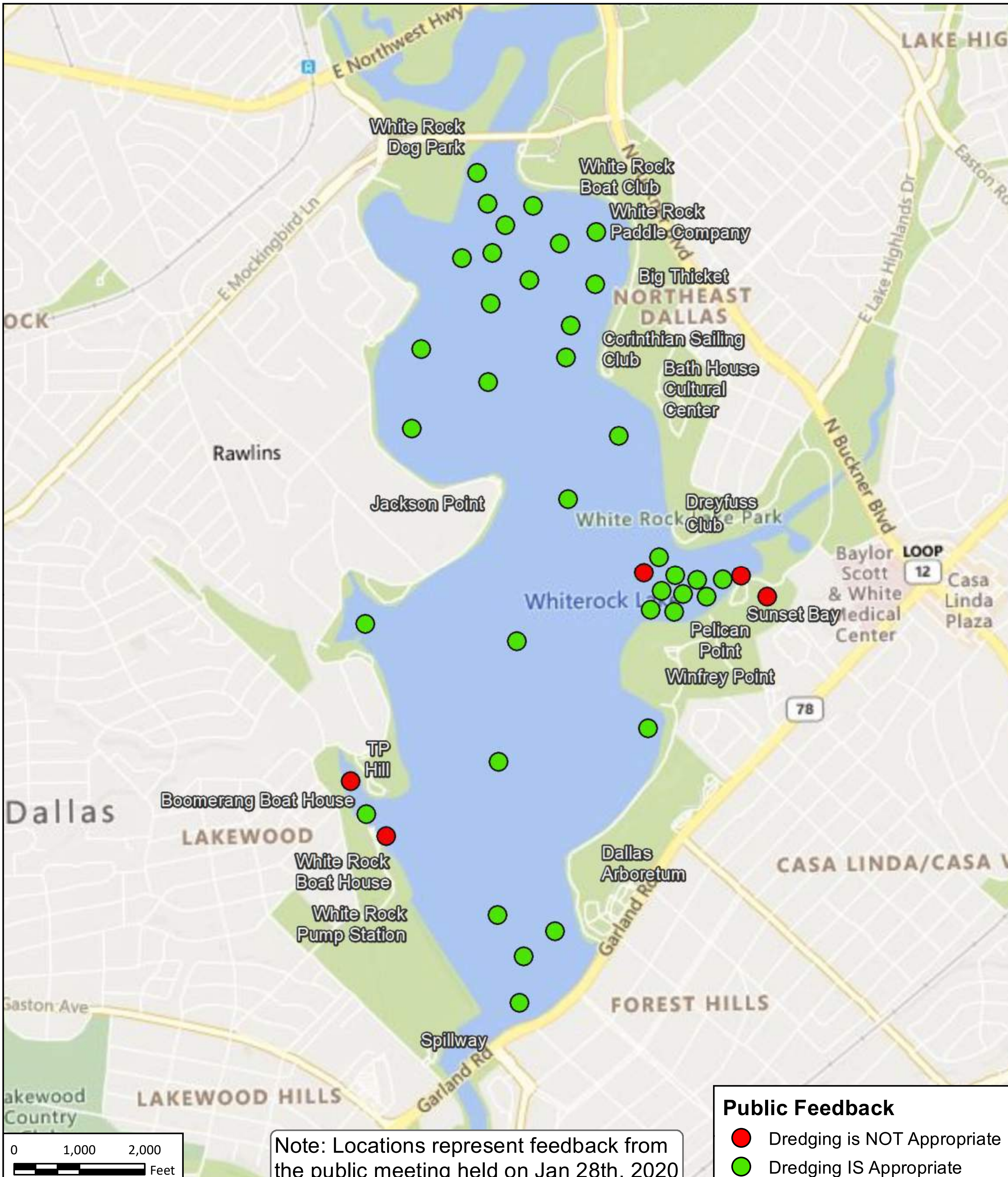

Note: Locations represent feedback from the public meeting held on Jan 28th, 2020

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Public Meeting Input

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EXHIBIT

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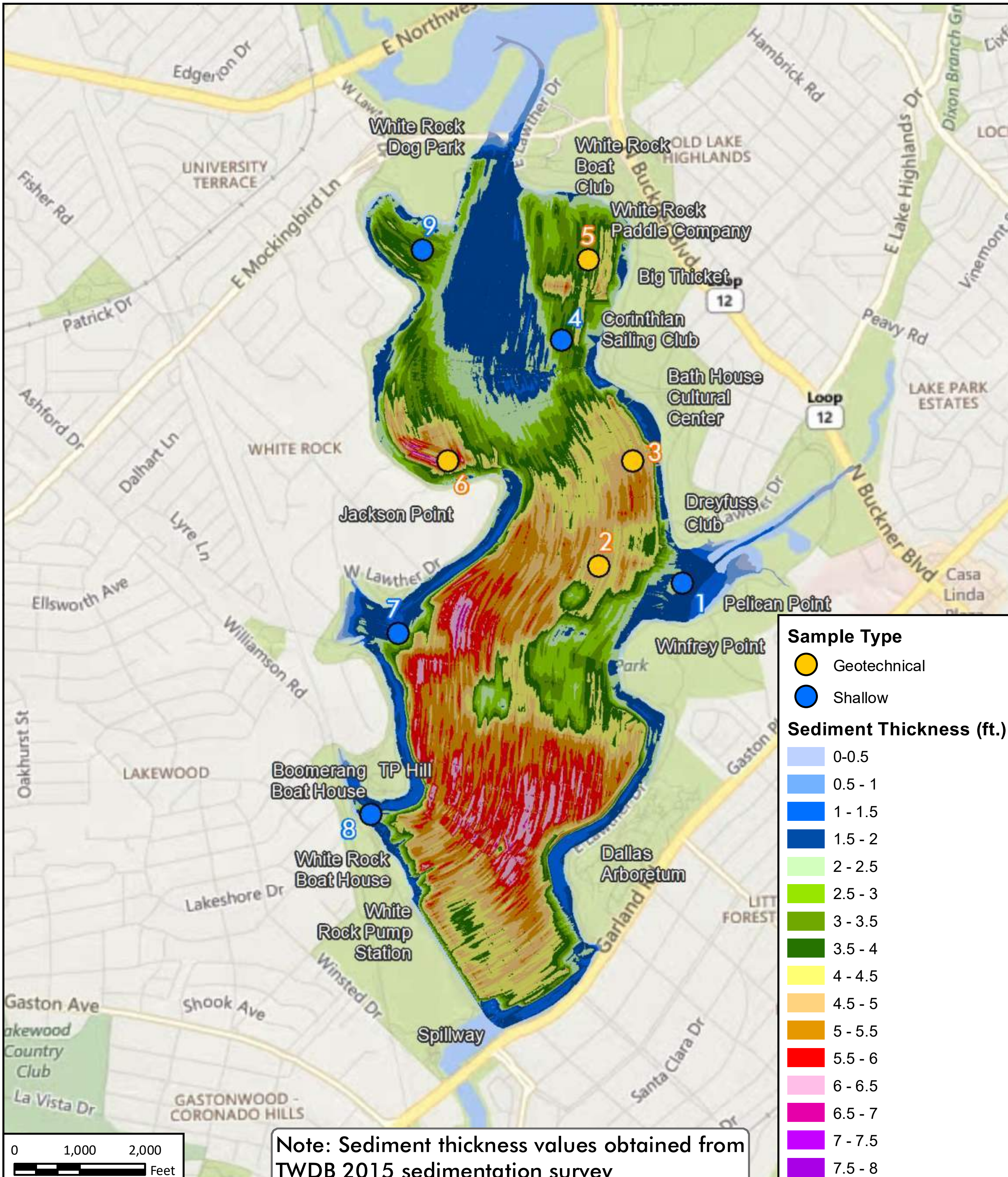

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Recommended Sediment Sampling Areas Overview

FN JOB NO	DWU19688
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DATE	3/12/2020
SCALE	1:24,000
DESIGNED	BH
DRAFTED	02271

EXHIBIT

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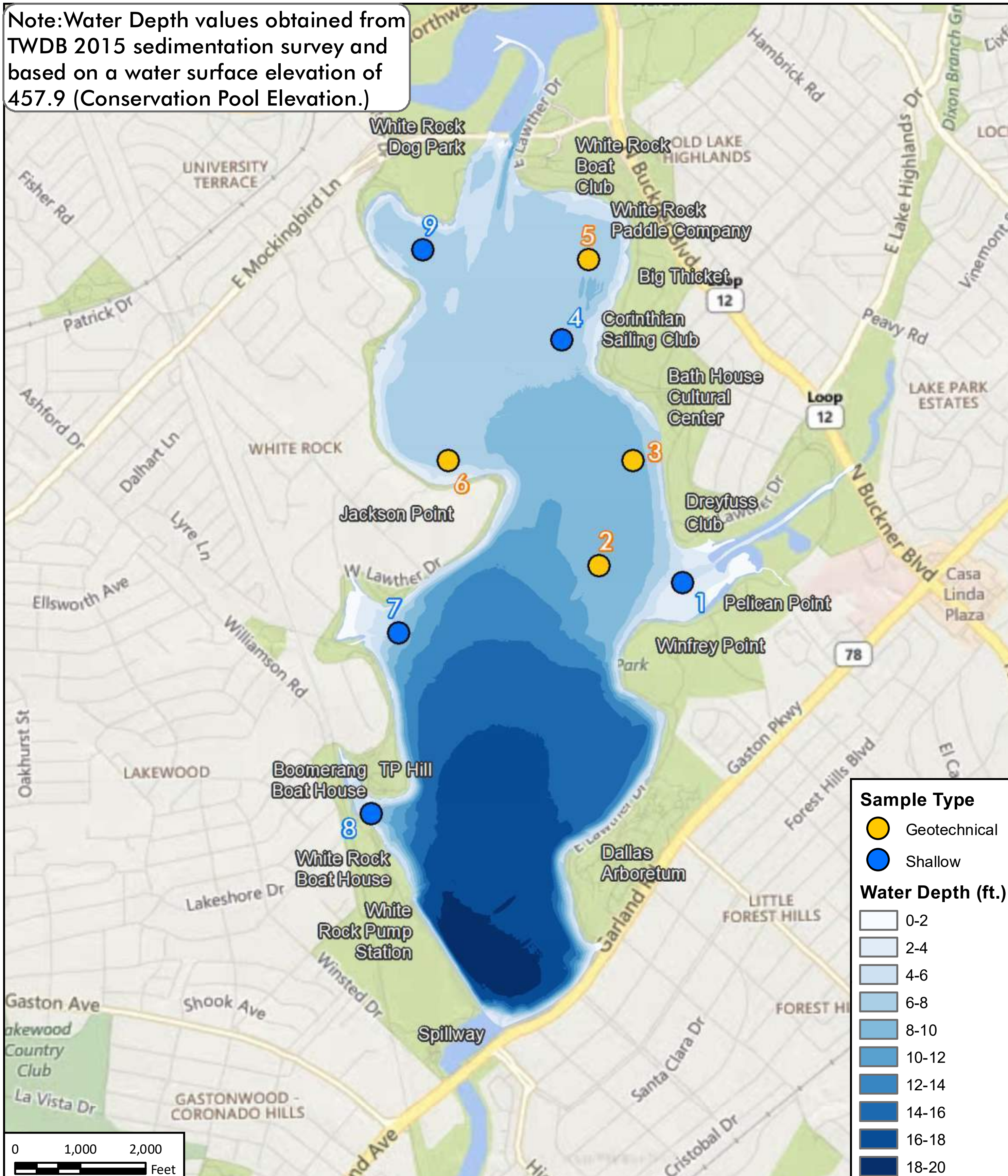

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Recommended Sediment Sampling Areas Overview

FN JOB NO	DWU19688
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DATE	3/12/2020
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DESIGNED	BH
DRAFTED	02271

EXHIBIT

4

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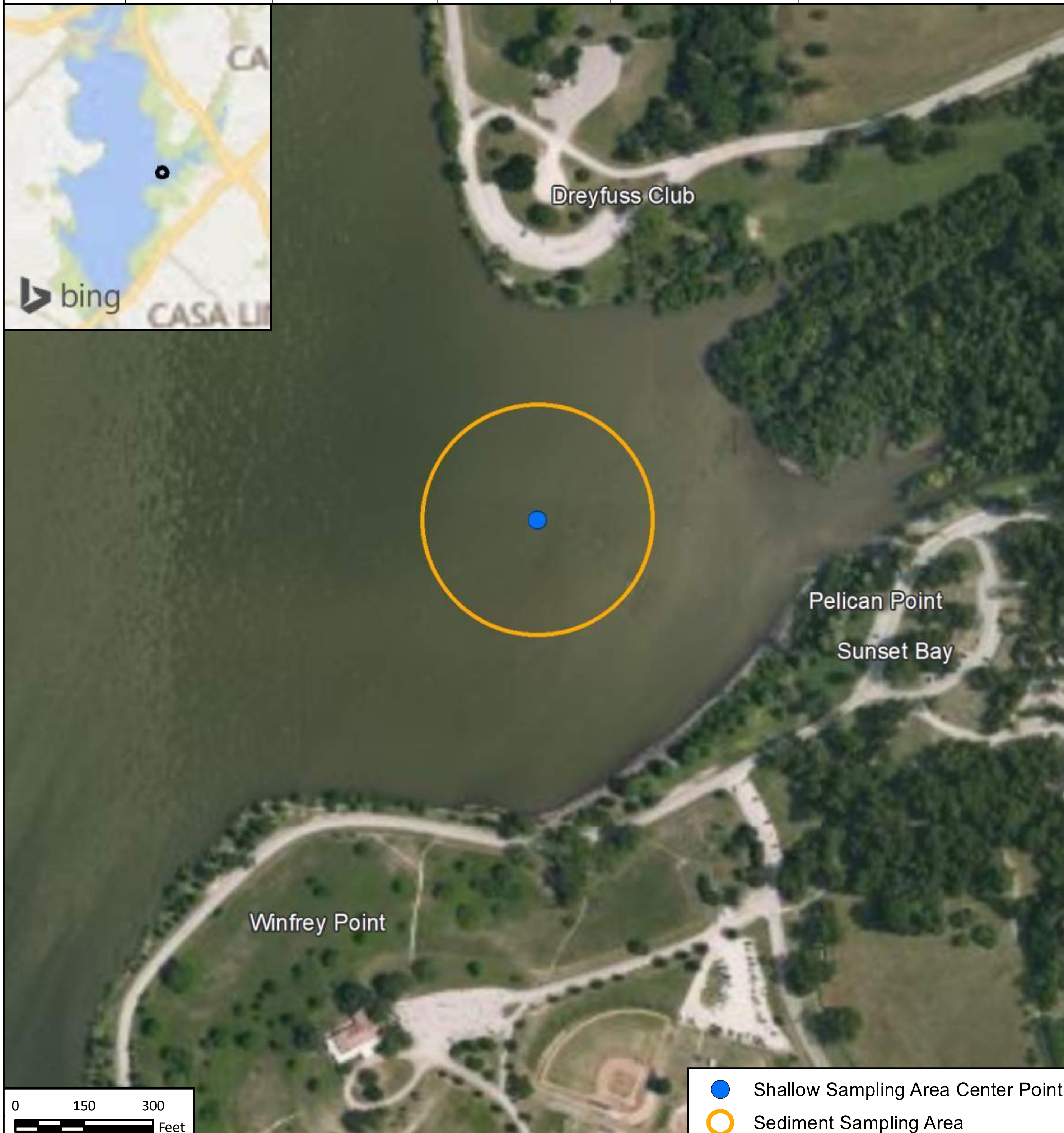
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
1	32.833789	-96.71462	Shallow	3	1.5-3



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Recommended Sediment Sampling Area #1

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DATE 3/20/2020
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DESIGNED BH
DRAFTED 02271

EXHIBIT 5

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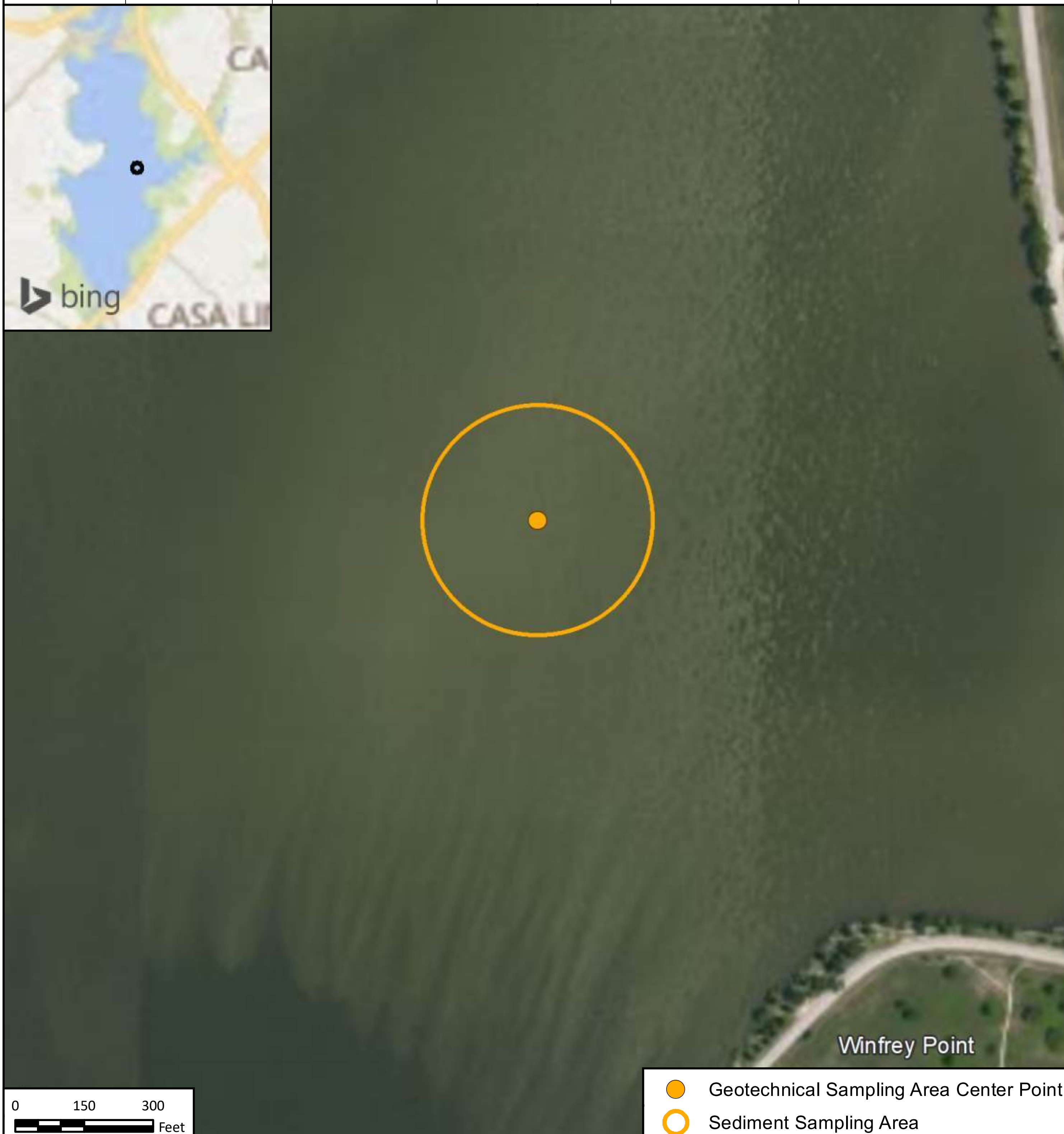
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
2	32.834582	-96.718778	Geotechnical	4	3.5-5.5



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Recommended Sediment Sampling Area #2

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FILE NAME	Exb_5_DDP_SamplePoints104.mxd
DATE	3/20/2020
SCALE	1:3,600
DESIGNED	BH
DRAFTED	02271

EXHIBIT 6

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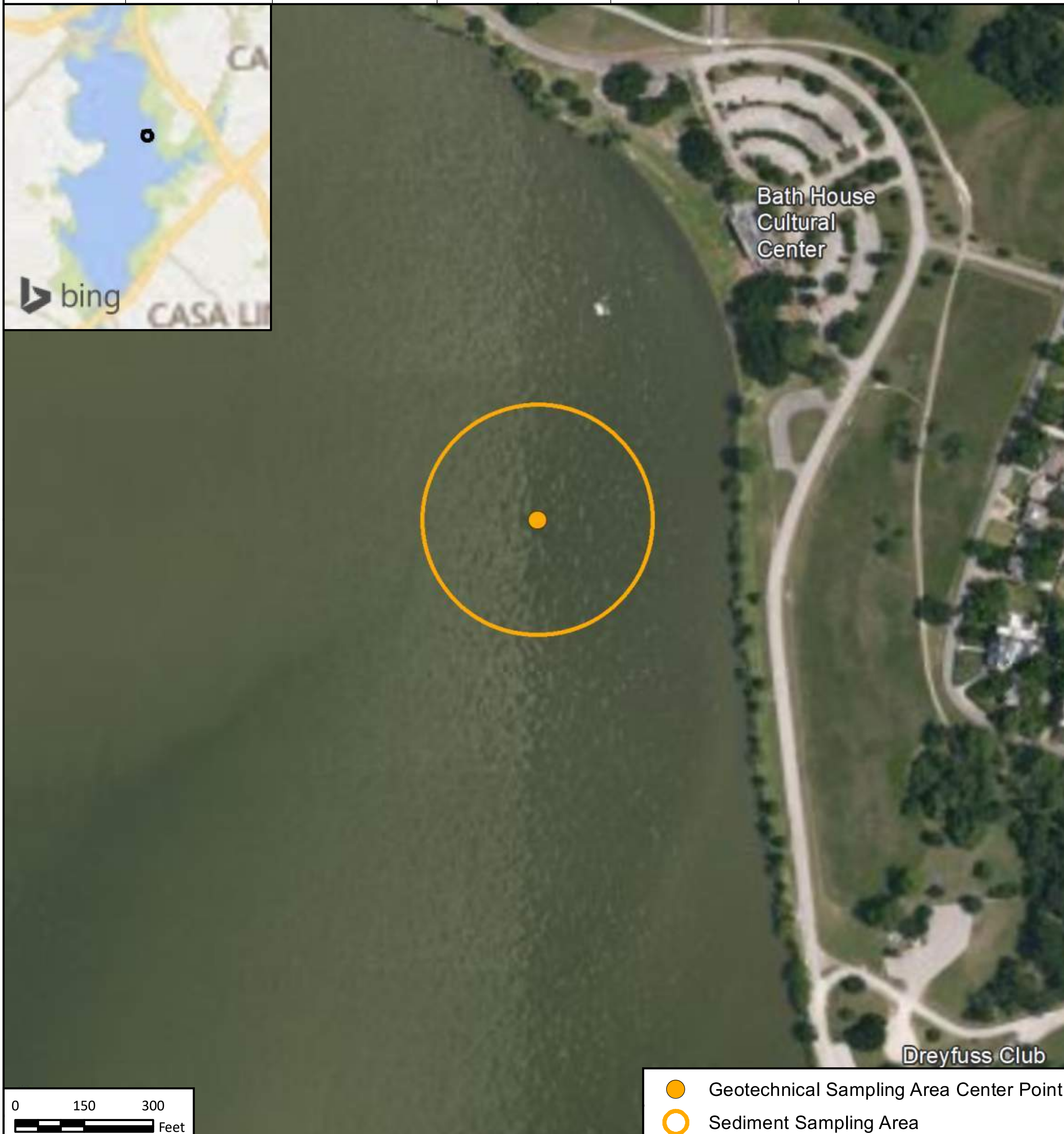
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
3	32.838967	-96.71699	Geotechnical	4	4-6



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Recommended Sediment Sampling Area #3

FN JOB NO DWU19688
FILE NAME Exb_5_DDP_SamplePoints104.mxd
DATE 3/20/2020
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DESIGNED BH
DRAFTED 02271

EXHIBIT 7

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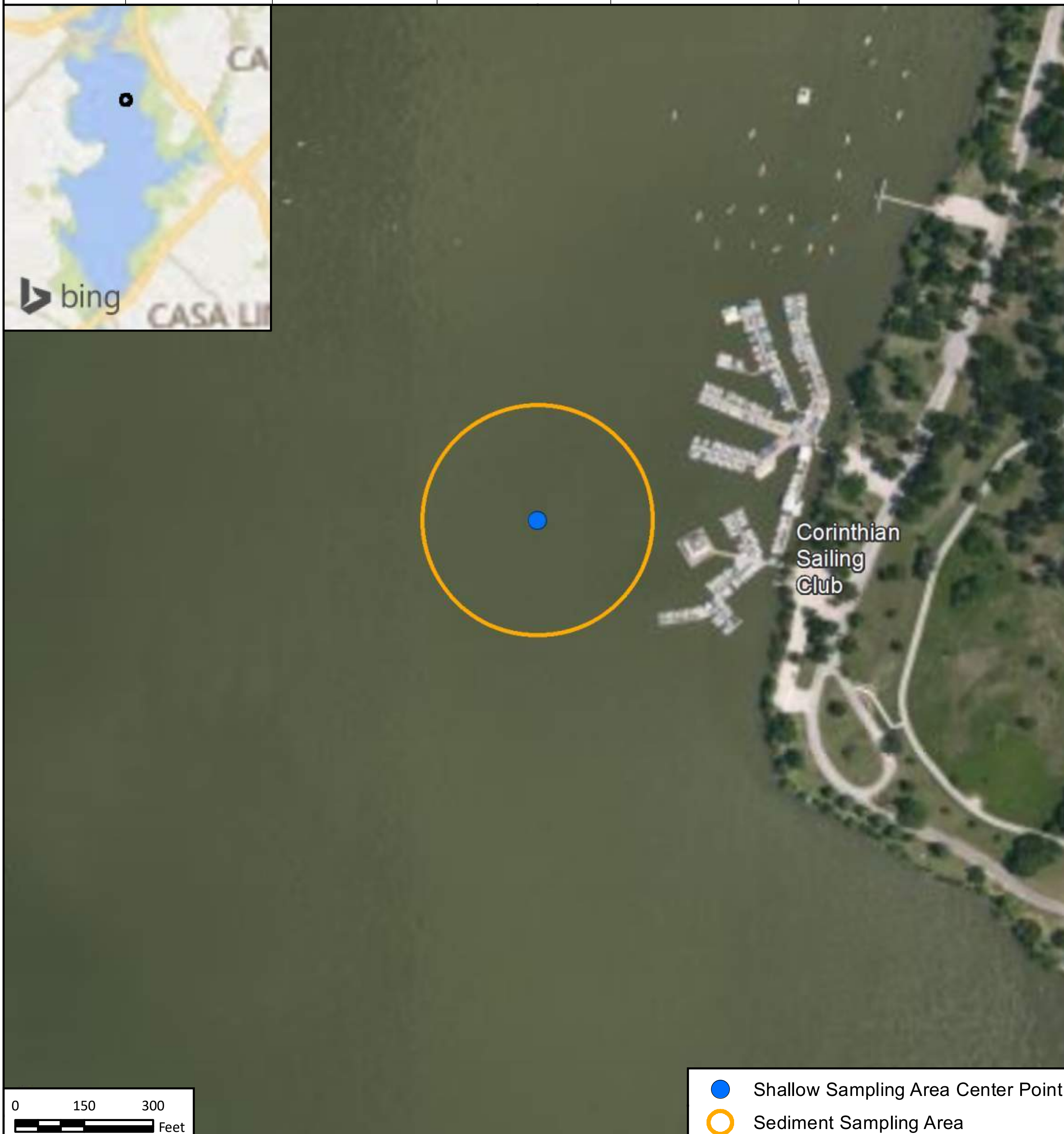
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
4	32.844101	-96.720436	Shallow	3	2-5



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White Rock Lake

Recommended Sediment Sampling Area #4

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DESIGNED	BH
DRAFTED	02271

EXHIBIT
8

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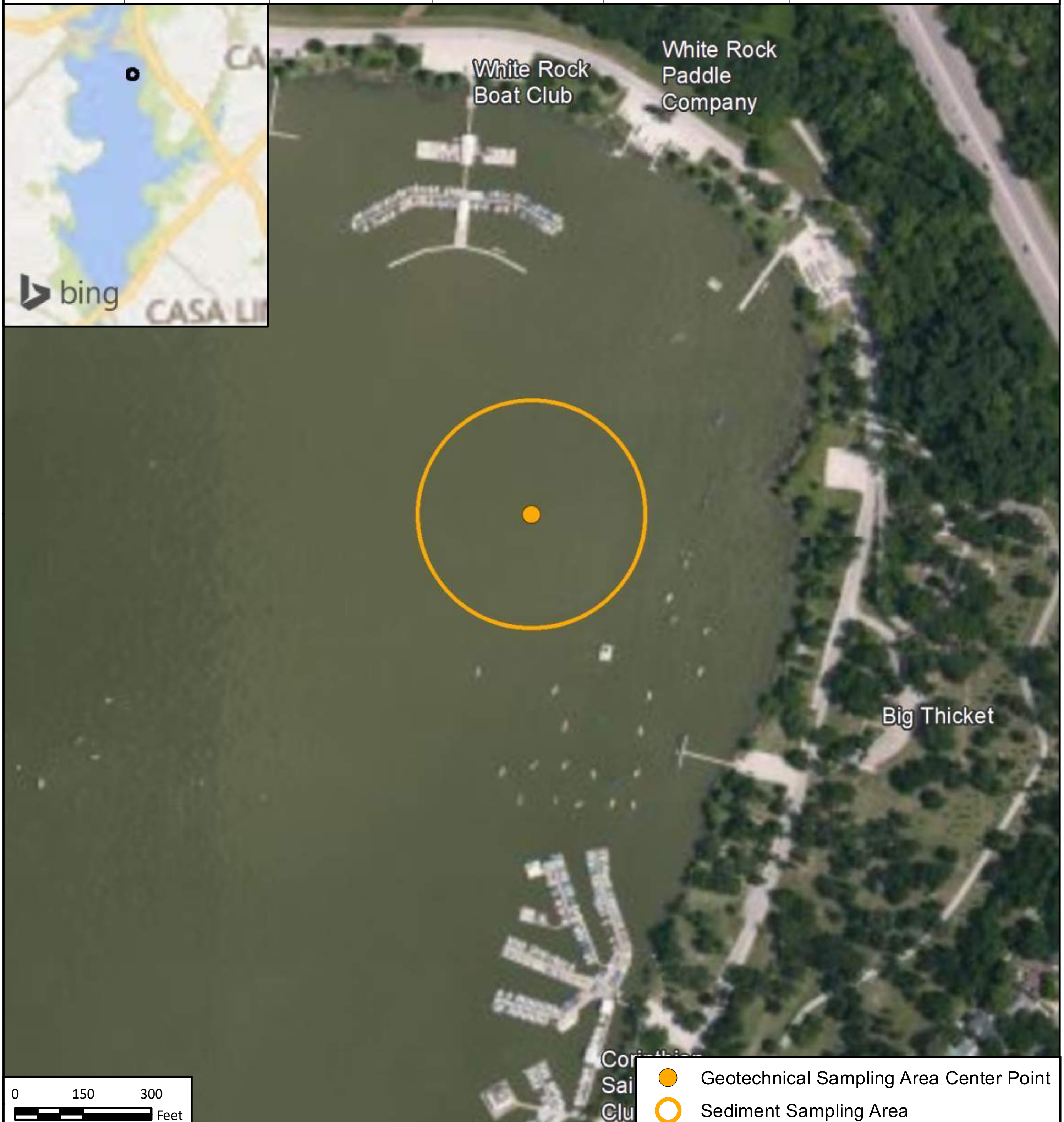
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
5	32.847458	-96.719016	Geotechnical	3	3-4.5



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White Rock Lake

Recommended Sediment Sampling Area #5

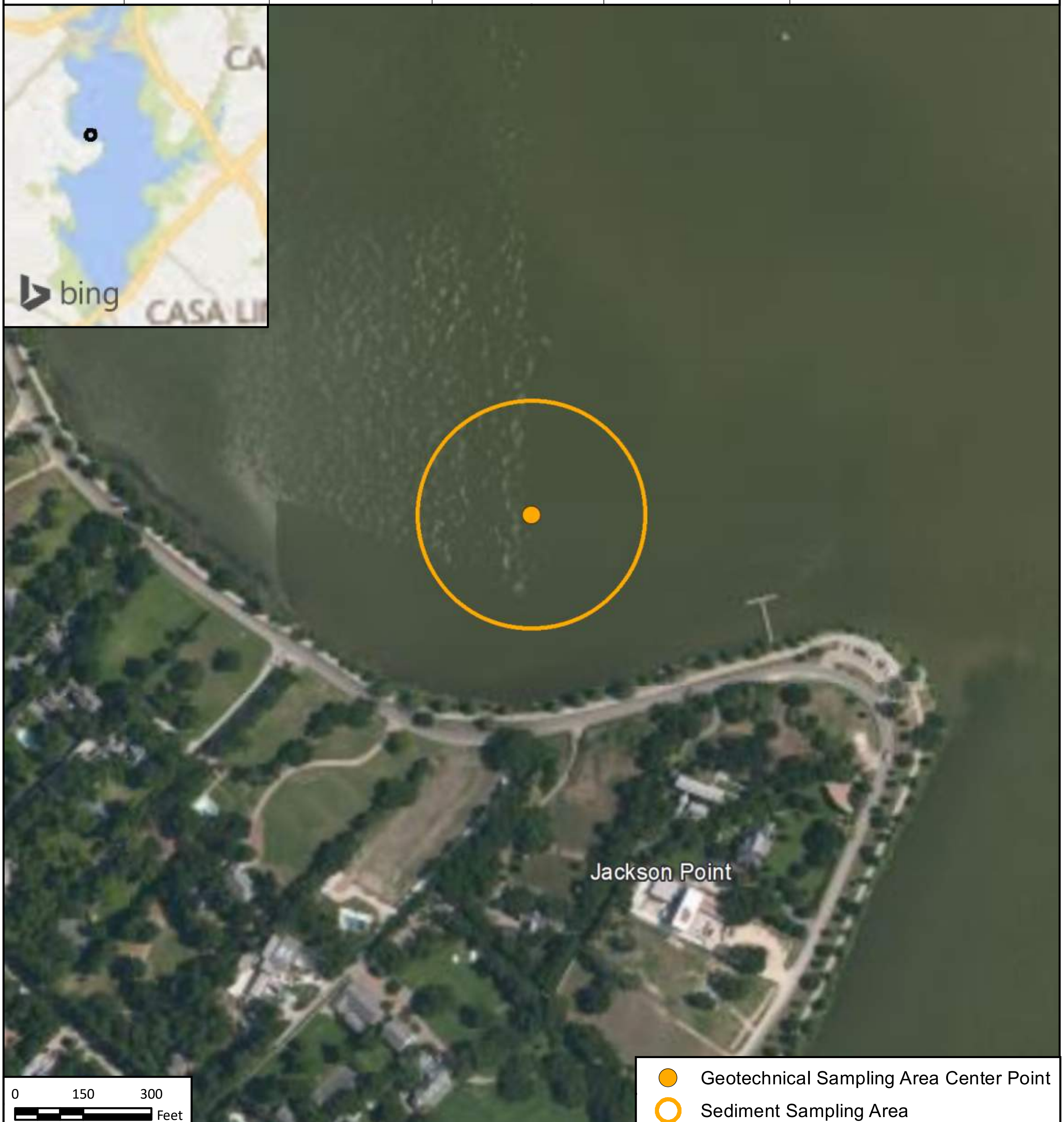
FN JOB NO	DWU19688
FILE NAME	Exb_5_DDP_SamplePoints104.mxd
DATE	3/20/2020
SCALE	1:3,600
DESIGNED	BH
DRAFTED	02271

EXHIBIT 9

Path: H:\WR_DESIGN\Stormwater\Working\2020_03_04 Sediment Volumes\Exb_5_DDP_SamplePoints104.mxd

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
6	32.839106	-96.726201	Geotechnical	4	3-6.5



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Dallas, Texas 75204
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N

White Rock Lake

Recommended Sediment Sampling Area #6

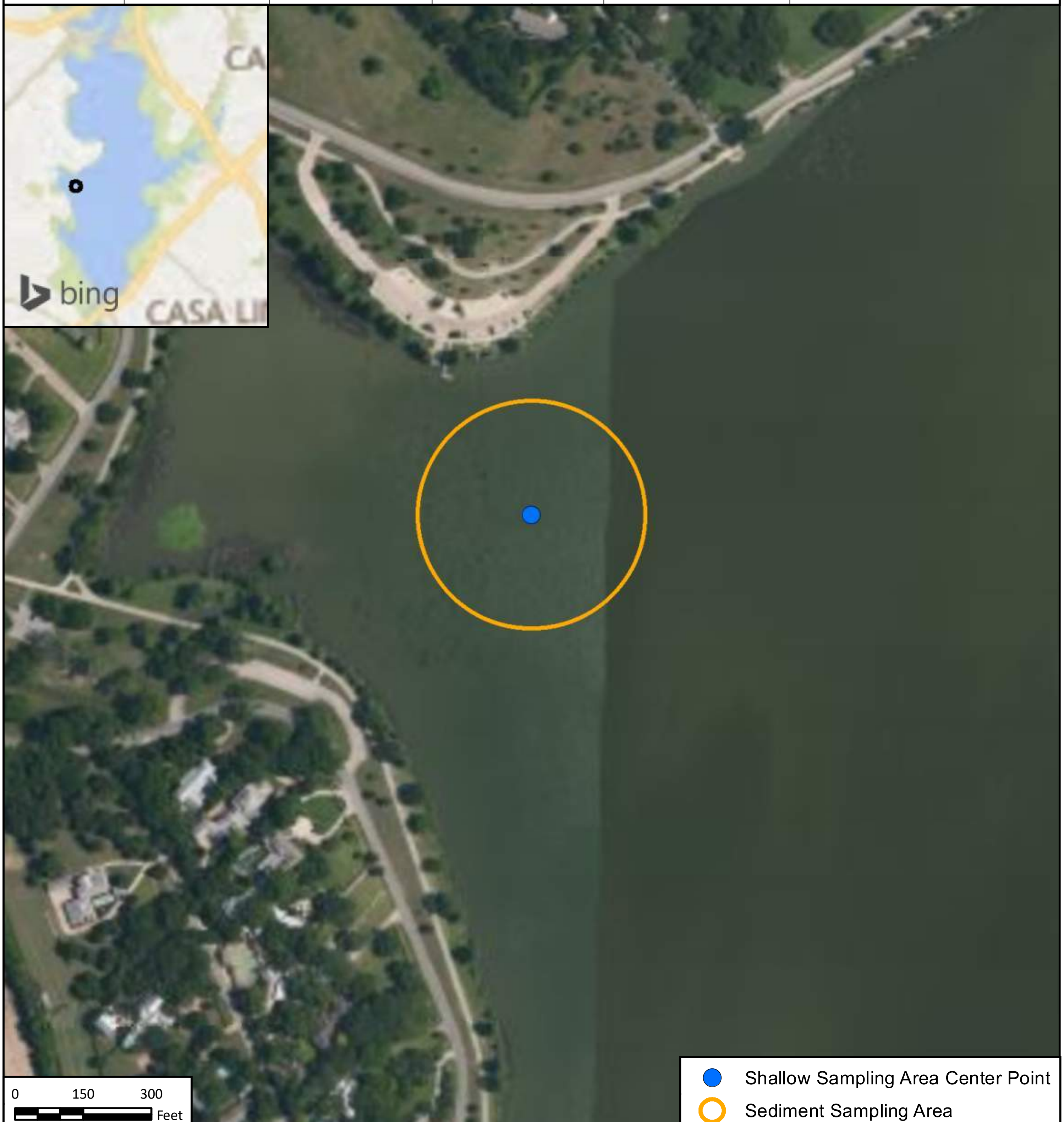
FN JOB NO	DWU19688
FILE NAME	Exb_5_DDP_SamplePoints104.mxd
DATE	3/20/2020
SCALE	1:3,600
DESIGNED	BH
DRAFTED	02271

EXHIBIT 10

Path: H:\WR_DESIGN\Stormwater\Working\2020_03_04 Sediment Volumes\Exb_5_DDP_SamplePoints104.mxd

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
7	32.83188	-96.728812	Shallow	3	1-4



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White Rock Lake

Recommended Sediment Sampling Area #7

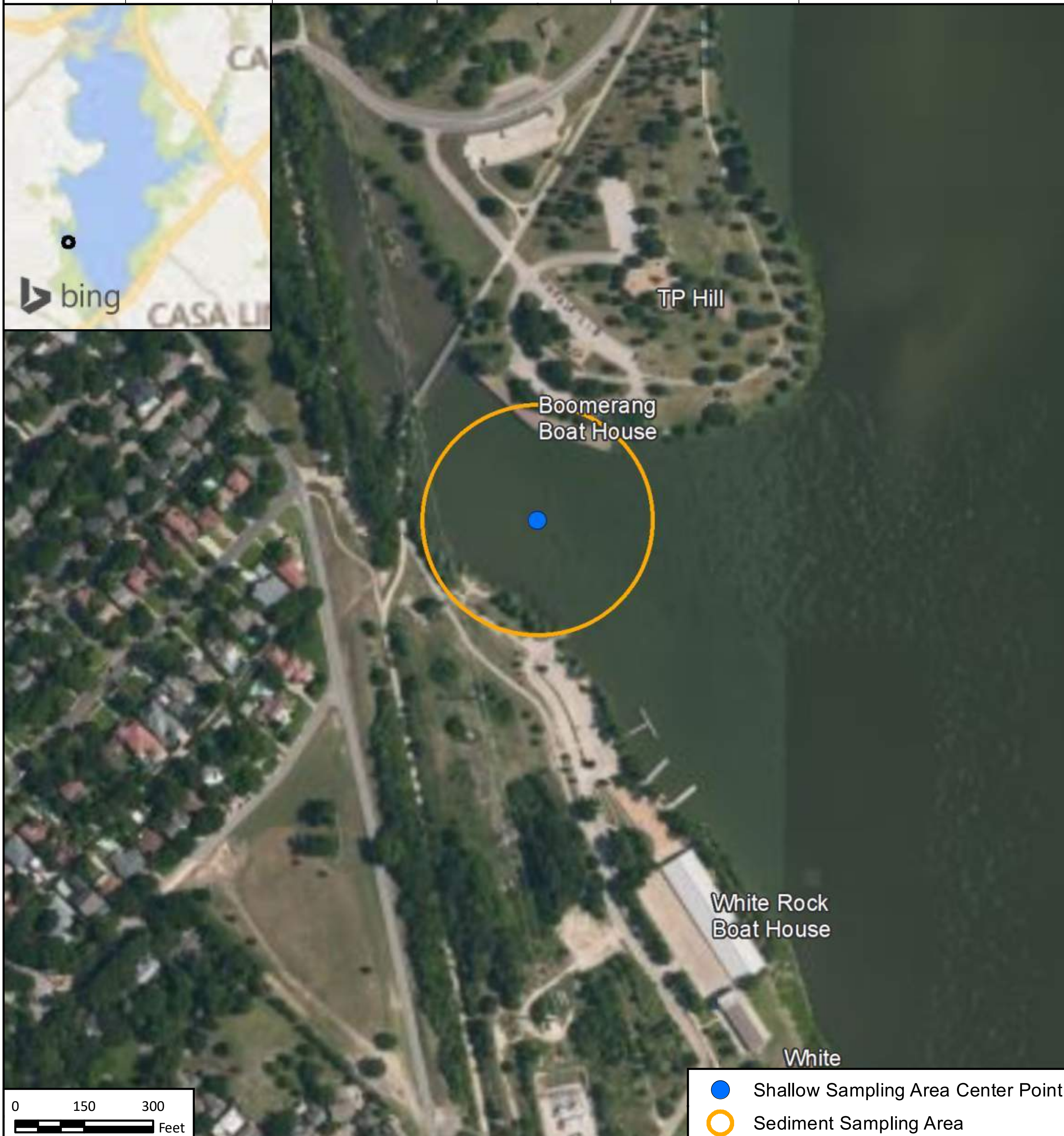
FN JOB NO DWU19688
FILE NAME Exb_5_DDP_SamplePoints104.mxd
DATE 3/20/2020
SCALE 1:3,600
DESIGNED BH
DRAFTED 02271

EXHIBIT 11

Path: H:\WR_DESIGN\Stormwater\Working\2020_03_04 Sediment Volumes\Exb_5_DDP_SamplePoints104.mxd

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
8	32.824289	-96.730343	Shallow	3	1-3.5



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White Rock Lake

Recommended Sediment Sampling Area #8

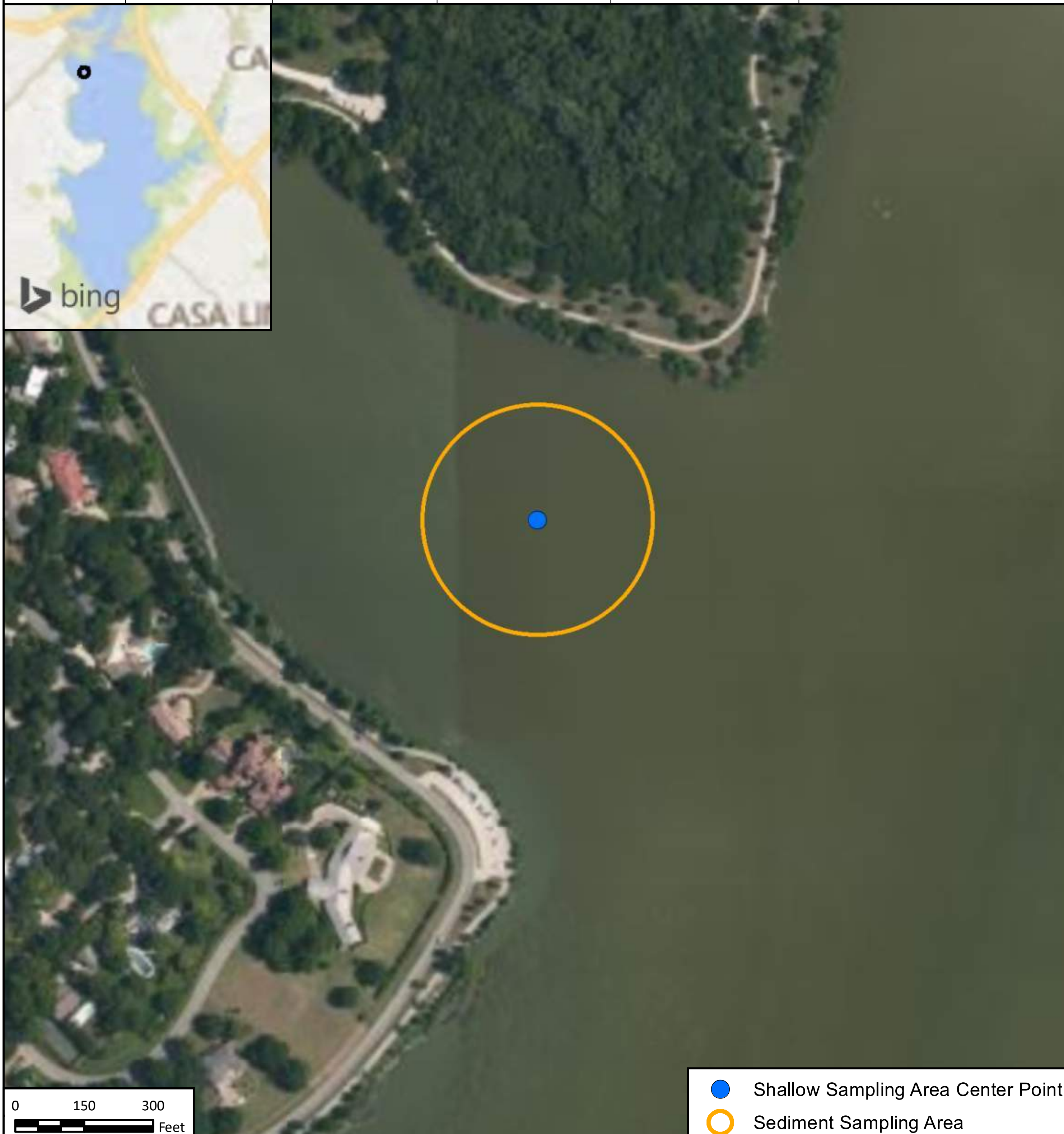
FN JOB NO	DWU19688
FILE NAME	Exb_5_DDP_SamplePoints104.mxd
DATE	3/20/2020
SCALE	1:3,600
DESIGNED	BH
DRAFTED	02271

EXHIBIT 12

Path: H:\WR_DESIGN\Stormwater\Working\2020_03_04 Sediment Volumes\Exb_5_DDP_SamplePoints104.mxd

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Sample Area ID	Latitude	Longitude	Sample Type	Number of Samples	Sediment Thickness Range (ft.)
9	32.84799	-96.727281	Shallow	3	2.5-4.5



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White Rock Lake

Recommended Sediment Sampling Area #9

FN JOB NO	DWU19688
FILE NAME	Exb_5_DDP_SamplePoints104.mxd
DATE	3/20/2020
SCALE	1:3,600
DESIGNED	BH
DRAFTED	02271

EXHIBIT 13

Path: H:\WR_DESIGN\Stormwater\Working\2020_03_04 Sediment Volumes\Exb_5_DDP_SamplePoints104.mxd

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

APPENDIX D

Environmental Investigation –
Sediment and Elutriate Sampling Summary Report

TECHNICAL MEMORANDUM

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TO: David Phan, PE, CFM, Dallas Water Utilities

CC: David Rivera, PhD, PE, CFM and Patrick Miles, PE, Freese and Nichols Inc.

FROM: Kimberly Buckley, PG, Freese and Nichols Inc.

SUBJECT: Environmental Investigation - Sediment and Elutriate Sampling Summary Report
White Rock Lake Dredging Feasibility Study Project, Dallas, Texas

DATE: July 1, 2020

Freese and Nichols, Inc. (FNI) is pleased to present this technical memorandum to Dallas Water Utilities (DWU) related to the environmental sampling conducted at White Rock Lake to supplement the White Rock Lake Dredging Feasibility Study Project. FNI performed limited environmental sampling to quantify chemicals of concern, including heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), herbicides, and pesticides, in sediment that DWU proposes to dredge from the lake bottom. The environmental investigation was conducted on White Rock Lake on June 16, 2020.

Background

It is our understanding that the City of Dallas plans to dredge accumulated sediment from White Rock Lake to improve recreation, aesthetics, and water quality of the reservoir. FNI, under a separate contract, is working with DWU and City of Dallas Parks and Recreation to evaluate several dredging alternatives within the footprint of White Rock Lake. This environmental investigation evaluated sediments in the following proposed dredging focus areas:

- Proposed Dredging Area #1/2: Sunset Bay
- Proposed Dredging Area #4: Sailing Clubs
- Proposed Dredging Area #7: Boat Launch
- Proposed Dredging Area #8: Boat House
- Proposed Dredging Area #9: Mockingbird/Dog Park

The remaining focus areas, Proposed Dredging Area #3: Bath House and Proposed Dredging Area #6: West Lawther, were considered for geotechnical evaluation but not included in the sediment characterization. The dredging will likely be accomplished using hydraulic dredging equipment; however, the final disposition of the dredged material is unknown. DWU is currently evaluating several disposal alternatives for the dredged sediment.

Data gathered during the environmental investigation can be beneficial to design engineers to determine the chemical composition of the proposed dredged material and determine if the lake sediment proposed for dredging:

1. Poses a health hazard to construction workers due to the presence of elevated heavy metal or other hazardous substance concentrations;

2. Contains heavy metals or hazardous substances at concentrations that could pose an environmental concern, if the chosen disposal option is land application; or
3. Requires special handling or disposal during dredging.

Environmental Investigation

FNI collected sediment samples from White Rock Lake on June 16, 2020. Three sediment samples, one water sample and one elutriate sample were collected from each of the five proposed dredging areas under investigation as shown in Figure 1, with the exception of Proposed Dredging Area #8: Boat House. Proposed Dredging Area #8: Boat House is located in a cove where a stream carries sediment and organic debris into the lake. The organic debris formed a thick mat above the lake bottom. The underlying lake bottom was predominantly gravel that made collection of sediment for testing difficult. FNI was able to retrieve enough sediment to run one sediment sample and one elutriate sample for analysis.

Samples were collected at each location from the platform of a pontoon boat using a Wildco hand corer. The corer was advanced two to four feet into the lake sediment, depending on compaction. The sediment sample was retrieved from the corer and a sample was collected for laboratory analysis. Samples were collected in water depths ranging from five to ten feet.

Current and historical land uses around the reservoir are primarily urban and residential. As a result, each sample was analyzed for priority pollutant heavy metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc) by EPA Methods 6020 and 7471, VOCs by EPA Method 8260, SVOCs by EPA Method 8270, and PCBs by EPA Method 8082. In addition, due to current and historical agricultural and residential land uses in the watershed of White Rock Lake, each sample was analyzed chlorinated herbicides by EPA Method 8151, organochlorine pesticides by EPA Method 8081, and organophosphate pesticides by EPA Method 8141.

All of the samples collected were submitted to Xenco Environmental Laboratories in Dallas, Texas on June 16, 2020 for laboratory analysis. Laboratory results for these samples are summarized in Table 1 and Table 2 and included as Attachment A. Sample results were compared to protective concentration limits (PCLs) established by the Texas Commission on Environmental Quality (TCEQ) under the Texas Risk Reduction Program (TRRP, Title 30 of the Texas Administrative Code, Chapter 350) for unrestricted, residential land use.

No VOCs, PCBs, or chlorinated herbicides were detected in any of the sediment samples. Trace concentrations of several SVOCs were also detected in each of the sediment samples. However, the SVOC concentrations detected were well below the respective residential PCLs for unrestricted use.

Trace concentrations of several organochlorine pesticides and one organophosphorus pesticide were detected in each of the sediment samples. However, the pesticide concentrations appear to be consistent with proper application of those chemicals and did not exceed any of the respective residential PCLs for unrestricted use.

Barium, beryllium, cadmium, chromium, copper, mercury, nickel, selenium, and silver were detected in one or more of the sediment samples at concentrations below respective residential PCLs for unrestricted use and Texas-Specific background concentrations established under TRRP. Antimony and silver were not detected in any of the sediment samples.

Arsenic and lead were detected at concentrations slightly above the TRRP Texas-Specific background concentration. The detected arsenic and lead concentrations were below PCLs for sediment. None of the samples contained arsenic or lead at concentrations that exceeded the PCL for direct exposure of humans.

The samples with the highest arsenic and lead concentrations were also subjected to additional Synthetic Precipitation Leaching Procedure (SPLP) analysis to determine the likelihood of arsenic or lead to leach from dredged lake sediment to underlying soils and groundwater at potential upland disposal sites. Trace concentrations of arsenic and lead were detected in the SPLP analysis, which indicates that it is a low likelihood that arsenic or lead present in the dredged sediment would leach to the underlying groundwater zone.

Resuspension of Sediment During Dredging

FNI also evaluated the potential risks associated with the slightly elevated arsenic and lead concentration if sediments are resuspended in the lake during the proposed dredging activities. The TCEQ has developed sediment PCLs that are intended to take into account potential exposure pathways associated with sediment. Specifically, the sediment PCLs apply to the following situations:

> *"With sediment contamination, the following human health exposure pathways are assumed to be potentially relevant: incidental ingestion of sediment, dermal contact with sediment, and transfer of [chemicals of concern (COCs)] from sediment to the tissue of finfish/shellfish within a water body."*

Based on this information, the sediment PCL appears to be protective of both recreational users and aquatic life that may come in contact with the resuspended sediment during dredging activities or for alternatives involving in-lake disposal. In addition, the resuspension of sediment from dredging activities is expected to be a short-term condition.

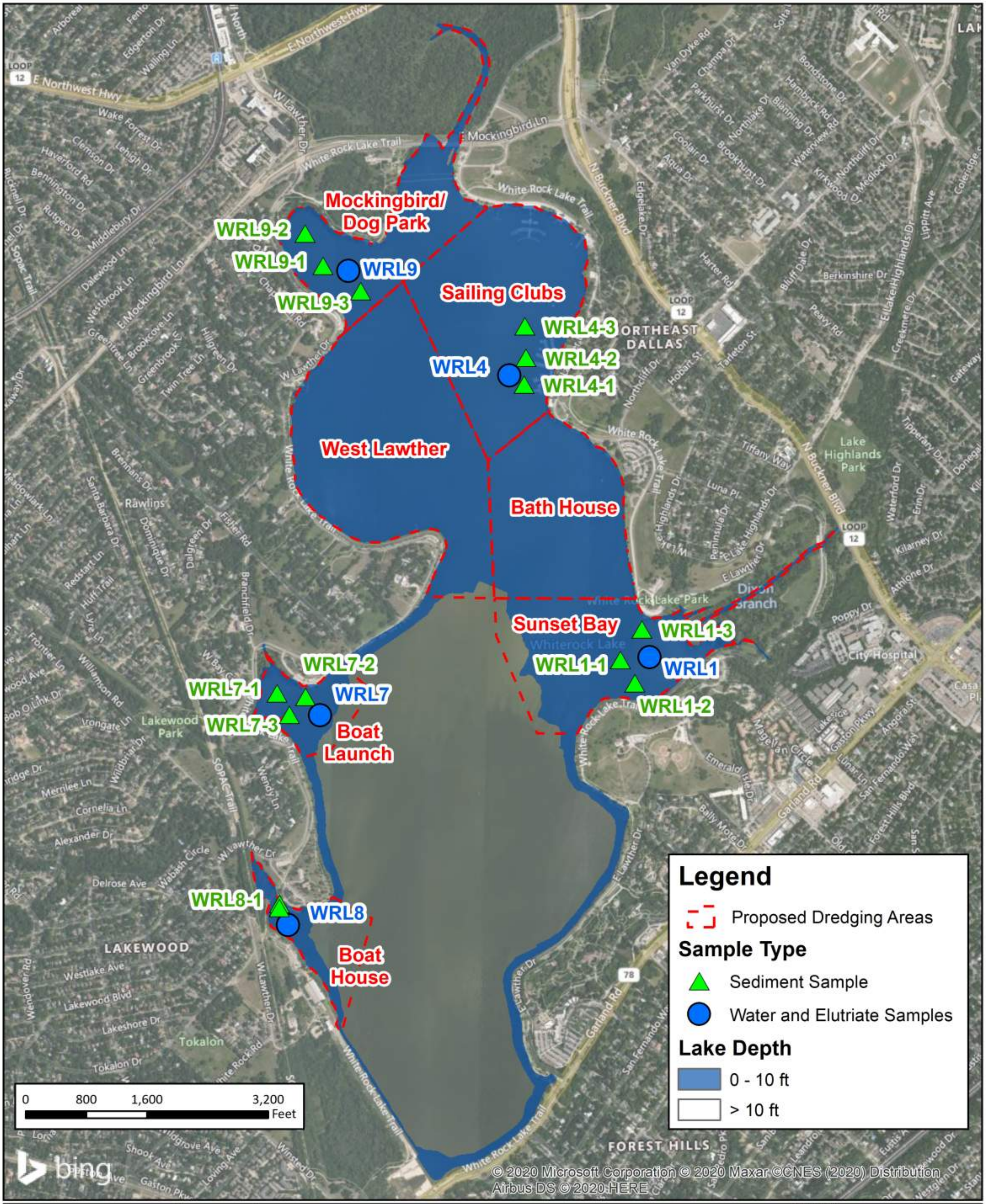
The maximum arsenic concentration detected in sediment was 6.02 milligrams per kilogram (mg/kg). The sediment PCL for arsenic is 110 mg/kg. The maximum lead concentration detected in sediment was 22.3 mg/kg. The sediment PCL for lead is 500 mg/kg. Since the maximum arsenic and lead concentrations detected in lake sediment are an order of magnitude less than the sediment PCLs, there is no indication that the resuspension of lake sediment during the proposed dredging activities will pose an environmental concern for human or ecological receptors.

FNI further evaluated the resuspension of sediment during dredging by collecting elutriate samples. Elutriate samples were collected to evaluate the potential release or the mobility of chemicals of concern from dredged sediment during dredging operations. Slightly elevated concentrations of mercury and lead were detected in elutriate samples in comparison to the water samples collected from the same area (Table 2). This may indicate that trace concentrations of lead and mercury may be resuspended temporarily during dredging operations; however, all elutriate sample concentrations were well below drinking water standards.

Conclusions

Based on the data obtained during this investigation, none of the chemicals of concern detected in any of the sediment samples appear to pose a substantial risk to dredging contractors or the lake environment.

Based on the findings of this environmental investigation, dredged sediment appears to meet the criteria for classification as a Class 2 non-hazardous waste if landfill disposal is the selected method of disposition. Additional analyses may be necessary to determine if dredged sediments can be beneficially reused on upland land application sites. Dredged sediment should not be reused as “clean” fill without further investigation.



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Sediment Sampling Locations

White Rock Lake Sediment Characterization - Dredging Feasibility Study

FN JOB NO	DWU19688
FILE	Figure 1. Sample Locations
DATE	7/1/2020
SCALE	1:20,000
DRAFTED	kmb

FIGURE 1

Path: C:\Users\kmb\OneDrive - Freese and Nichols, Inc\Desktop\Figure 1. Sample Locations.mxd

Table 1. White Rock Lake Sediment Characterization Project
Sediment Sampling
Summary of Analytical Results

Chemical of Concern	TCEQ Sediment PCL	TCEQ Tier 1 Residential PCLs: Direct Human Exposure $^{Tot}Soil_{Comb}$	TCEQ Tier 1 Residential PCLs: Groundwater Protection $^{GW}Soil_{Ing}$	TCEQ Tier 1 Residential PCLs: Texas Specific Background Concentration	Class I Waste Limits	Potential Dredging Area No. 1			Potential Dredging Area No. 4			Potential Dredging Area No. 7			Potential Dredging Area No. 8	Potential Dredging Area No. 9			Maximum
						WRL1-1	WRL1-2	WRL1-3	WRL4-1	WRL4-2	WRL4-3	WRL7-1	WRL7-2	WRL7-3	WRL8-1	WRL9-1	WRL9-2	WRL9-3	
						0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	
						Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	
Priority Pollutant Metals (mg/kg)					20x TCLP														
Antimony	83	15	5.4	1	20	<0.117	<0.112	<0.117	<0.114	<0.106	<0.103	<0.110	<0.117	<0.108	<0.112	<0.112	<0.119	<0.119	ND
Arsenic	110	24	5	5.9	36	3.57	3.44	4.64	3.72	3.21	4.16	3.8	6.02	3.52	4.33	4.39	5.12	3.83	6.02
Barium	23000	8100	220	300	2000	38.2	37.6	57.5	47.3	43	56	30.4	33.7	26.6	31.2	58.7	75.7	48.9	75.7
Beryllium	27	38	1.8	1.5	1.6	0.287	0.29	0.488	0.375	0.369	0.486	0.223	0.288	0.247	0.27	1.07	0.685	0.395	1.07
Cadmium	1100	52	1.5	--	10	0.174	0.173	0.203	0.161	0.17	0.143	0.146	0.141	<0.105	0.226	0.16	0.233	0.133	0.233
Chromium	36000	33000	2400	30	100	7.99	8.45	12.4	10.6	10.9	15.6	6.28	8.6	6.69	6.42	13.9	19.1	10.7	19.1
Copper	21000	1300	1000	15	--	8.75	9.31	10.3	10.4	11	10.1	5.33	5.22	4.25	8	10.1	11.3	10.7	11.3
Lead	500	500	3	15	30	14.8	13.7	17.1	12	10.2	11.6	20.9	13.7	10.4	22.3	14.2	16.5	12	22.3
Mercury	34	3.6	0.0078	0.04	4	0.0264	0.0201	0.0316	0.0198	0.0157	0.0176	0.0214	0.0267	0.0136	0.0286	0.0173	0.015	0.0224	0.0316
Nickel	1400	840	160	10	1400	8.55	8.15	11.6	9.14	8.62	11.2	6.88	11	7.23	9.41	11.4	14.9	9.42	14.9
Selenium	2700	310	2.3	0.3	20	0.531	<0.468	0.596	0.579	0.532	0.544	<0.459	0.571	0.46	0.556	0.601	0.59	<0.496	0.601
Silver	350	97	0.48	--	100	<0.156	<0.150	<0.156	<0.153	<0.142	<0.137	<0.147	<0.156	<0.144	<0.150	<0.150	<0.159	<0.159	ND
Thallium	43	5.3	1.7	--	--	<0.234	<0.225	<0.234	<0.23	<0.213	0.216	<0.221	<0.234	<0.217	<0.225	<0.225	0.279	<0.239	0.279
SPLP Metals (mg/L)			$^{GW}GW_{Ing}$																
Arsenic	--	--	0.01	--	--	NA	NA	NA	NA	NA	NA	NA	0.00197	NA	NA	NA	NA	NA	0.00197
Lead	--	--	0.015	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00252	NA	NA	NA	0.00252
PCBs (mg/kg)																			
No PCBs detected.	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VOCs (mg/kg)																			
No VOCs detected.	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SVOCs (mg/kg)					20x TCLP														
Benzo(a)anthracene	16	41	130	--	--	0.222	0.174	0.137	<0.0836	<0.0839	<0.0849	<0.0847	0.0893	0.0875	<0.0839	<0.0844	<0.0842	<0.0847	0.222
Benzo(a)pyrene	1.6	4.1	7.6	--	--	0.268	0.234	0.189	<0.102	<0.103	<0.104	<0.104	<0.102	<0.103	<0.103	<0.103	<0.103	<0.104	0.268
Benzo(b)fluoranthene	16	42	440	--	--	0.427	0.396	0.332	0.149	0.0835	0.111	0.0924	0.131	0.137	0.0895	<0.0754	0.0998	<0.0757	0.427
Benzo(g,h,i)perylene	3700	1800	46000	--	--	0.266	0.22	0.199	0.105	<0.0916	<0.0927	<0.0925	<0.0904	<0.0916	<0.0916	<0.0921	<0.0919	<0.0925	0.266
Benzo(k)fluoranthene	160	420	4500	--	--	0.169	0.14	<0.115	<0.115	<0.115	<0.117	<0.117	<0.115	<0.115	<0.115	<0.116	<0.116	<0.117	0.169
bis(2-ethylhexyl) phthalate	240	43	160	--	600	<0.992	<1.00	<0.994	<0.99	<0.994	<1.01	<1.00	<0.992	<0.994	7.28	<1.00	<0.998	<1.00	7.28
Chrysene	1600	4100	11000	--	--	0.329	0.296	0.231	<0.0982	<0.0985	<0.0997	<0.0995	0.103	0.105	<0.0985	<0.0991	<0.0989	<0.0995	0.329
Fluoranthene	4900	2300	1900	--	2800	0.419	0.366	0.284	0.103	<0.0876	<0.0886	0.118	0.141	0.133	0.0934	<0.0881	<0.0879	<0.0885	0.419
Indeno(1,2,3-c,d)Pyrene	16	42	1300	--	--	0.22	0.182	0.143	<0.0798	<0.0801	<0.0811	<0.0809	<0.0800	<0.0801	<0.0801	<0.0806	<0.0804	<0.0809	0.22
Phenanthrene	3700	1700	420	--	--	0.113	<0.0994	<0.0989	<0.0985	<0.0989	<0.100	<0.0998	<0.0987	<0.0989	<0.0989	<0.0994	<0.0992	<0.0998	0.113
Pyrene	3700	1700	1100	--	118	0.476	0.384	0.304	0.119	<0.0871	0.0885	0.127	0.137	0.131	0.0895	<0.0876	<0.0874	<0.088	0.476
No other SVOCs detected.	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Organochlorine Pesticides (mg/kg)					20x TCLP														
4,4-DDD	120	14	13	--	20	<0.00154	<0.00307	<0.00308	<0.00154	<0.00154	<0.00155	<0.00154	<0.00309	0.00481	0.0057	<0.00155	<0.00154	<0.00155	0.0057
4,4-DDE	87	10	12	--	20	0.0036	<0.00332	<0.00332	0.00471	0.00197	0.00208	0.00275	<0.00334	0.0082	<0.00532	0.0047	0.00471	0.00274	0.0082
4,4-DDT	87	5.4	15	--	20	<0.000506	<0.00101	<0.00101	<0.000505	<0.000505	<0.000509	0.00408	<0.00102	<0.000506	<0.00162	<0.000508	<0.000507	<0.000508	0.00408
Alpha Chlordane	41	13	740	--	--	0.00173	0.00261	<0.00227	<0.00114	<0.00114	<0.00114	<0.00114	<0.00228	<0.00114	<0.00364	<0.00114	<0.00114	<0.00114	0.00261
Dieldrin	0.89	0.15	0.049	--	0.4	<0.000338	<0.000674	<0.000675	<0.000337	<0.000337	<0.000339	<0.000338	<0.000678	0.000522	<0.00108	<0.000339	<0.000339	<0.000339	0.000522
No other Organochlorine Pesticides detected.	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Organophosphorus Pesticides (mg/kg)					20x TCLP														
Tokuthion	15	6.6	2400	--	--	0.003	0.00467	0.00266	0.003	0.00787	0.00166	<0.00165	<0.00166	<0.00163	<0.00163	0.00198	0.00227	<0.00165	0.00787
No other Organophosphorus Pesticides detected.	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorinated Herbicides (mg/kg)																			
No Chlorinated Herbicides detected.	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not detected; NA = Not analyzed

Exceeds TCEQ TRRP Tier 1 Residential PCLs for Unrestricted Use - Placement on upland area may be restricted. SPLP testing requested.

Exceeds Class I Waste Limit (TCLP x20) - Potentially exceeds criteria for classification as a Class 2 nonhazardous waste.

Exceeds TCEQ TRRP Sediment PCLs - Poses a human health concern to recreational users in lake.

Table 2. White Rock Lake Sediment Characterization Project
Water and Elutriate Sampling
Summary of Analytical Results

Chemical of Concern	Texas Surface Water Quality Standards - Human Health Protection	Texas Surface Water Quality Standards - Aquatic Life Protection	Drinking Water Maximum Contaminant Levels (MCLs)	TCEQ Tier 1 Residential Groundwater Protection PCL $^{GW}GW_{Ing}$	Class I Waste Limits	Potential Dredging Area No. 1		Potential Dredging Area No. 4		Potential Dredging Area No. 7		Potential Dredging Area No. 8		Potential Dredging Area No. 9		Maximum
						WRL1 Grab	WRL1 Elutriate	WRL4 Grab	WRL4 Elutriate	WRL7 Grab	WRL7 Elutriate	WRL8 Grab	WRL8 Elutriate	WRL9 Grab	WRL9 Elutriate	
Priority Pollutant Metals (mg/L)																
Antimony	*0.006*	--	*0.006*	*0.006*	*1*	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	ND
Arsenic	*0.01*	*0.34*	*0.01*	*0.01*	*1.8*	**0.00288**	**0.0026**	**0.00268**	**0.00313**	**0.00257**	**0.00223**	**0.00247**	**0.00238**	**0.00261**	**0.00484**	**0.00484**
Barium	*2*	--	*2*	*2*	*100*	**0.0352**	**0.055**	**0.0368**	**0.048**	**0.0386**	**0.0544**	**0.0334**	**0.0674**	**0.0375**	**0.0517**	**0.0674**
Beryllium	--	--	*0.004*	*0.004*	*0.08*	<0.000131	<0.000131	<0.000131	<0.000131	<0.000131	<0.000131	<0.000131	<0.000131	<0.000131	<0.000131	ND
Cadmium	*0.005*	--	*0.005*	*0.005*	*0.5*	<0.000147	<0.000147	<0.000147	<0.000147	<0.000147	<0.000147	<0.000147	<0.000147	<0.000147	<0.000147	ND
Chromium	--	--	*0.1*	*0.1*	*5*	**0.000701**	**0.000545**	**0.000929**	**0.000714**	**0.000988**	<0.000525	<0.000525	<0.000525	**0.000902**	**0.000543**	**0.000988**
Copper	*1.3*	--	*1*	*1.3*	--	**0.00108**	**0.00118**	**0.00149**	**0.00109**	**0.00133**	**0.00103**	<0.000747	**0.000988**	**0.00135**	**0.00159**	**0.00159**
Lead	*0.00115*	--	*0.015*	*0.015*	*1.5*	**0.000459**	**0.000842**	**0.000586**	**0.000825**	**0.000962**	**0.000796**	**0.000284**	**0.000777**	**0.000626**	**0.00131**	**0.00131**
Mercury	*0.0000122*	*0.0024*	*0.002*	*0.002*	*0.2*	<0.0000263	**0.000032**	<0.0000263	**0.000031**	<0.0000263	**0.000031**	<0.0000263	<0.0000263	<0.0000263	**0.00004**	**0.00004**
Nickel	*0.332*	--	--	*0.49*	*70*	**0.00177**	**0.00156**	**0.00177**	**0.00162**	**0.00175**	**0.00142**	**0.0015**	**0.00119**	**0.0018**	**0.0021**	**0.0021**
Selenium	*0.05*	*0.02*	*0.002*	*0.05*	*1*	<0.000454	<0.000454	<0.000454	<0.000454	<0.000454	<0.00454	<0.000454	<0.000454	<0.000454	<0.000454	ND
Silver	--	*0.0008*	*0.1*	*0.12*	*5*	<0.000251	<0.000251	<0.000251	<0.000251	<0.000251	<0.000251	<0.000251	<0.000251	<0.000251	<0.000251	ND
Thallium	*0.00012*	--	*0.002*	*0.002*	--	<0.000332	<0.000332	<0.000332	<0.000332	<0.000332	<0.000332	<0.000332	<0.000332	<0.000332	<0.000332	ND
Zinc	*7.4*	--	*5*	*7.3*	--	**0.0136**	**0.00675**	**0.0184**	**0.00928**	**0.0171**	**0.00501**	**0.00664**	**0.00729**	**0.0127**	**0.00729**	**0.0184**
PCBs (mg/L)																
PCB-1260	*0.00000064*	*0.0002*	*0.0005*	*0.0005*	--	**0.000397**	<0.0000390	<0.0000390	<0.0000390	<0.0000390	<0.0000390	<0.0000390	<0.0000390	<0.0000390	<0.0000390	**0.000397**
No other PCBs detected.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs (mg/L)																
No VOCs detected.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs (mg/L)																
No SVOCs detected.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Organochlorine Pesticides (mg/L)																
Endosulfan I	*0.02*	*0.22*		*0.049*	*0.2*	**0.0000069**	**0.0000065**	<0.00000536	<0.00000536	**0.00000675**	**0.00000555**	**0.00000655**	**0.0000055**	<0.00000536	<0.00000536	**0.0000069**
Heptachlor Epoxide	*0.00000029*	--	*0.0002*	*0.0002*	*0.04*	<0.00000672	<0.00000672	<0.00000672	<0.00000672	**0.0000927**	<0.00000672	<0.00000672	<0.00000672	<0.00000672	<0.00000672	**0.0000927**
No other Organochlorine Pesticides detected.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Organophosphorus Pesticides (mg/L)																
No Organophosphorus Pesticides detected.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorinated Herbicides (mg/L)																
2,4-D	*0.07*	--	*0.07*	*0.07*	*10*	<0.0000453	<0.0000453	<0.0000453	<0.0000453	<0.0000453	<0.0000453	<0.0000453	**0.0000461**	<0.0000453	<0.0000453	**0.0000461**
No other Chlorinated Herbicides detected.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

ND = Not detected

Exceeds TCEQ Drinking Water Standards Maximum Contaminant Levels (MCLs)

Exceeds Class I Waste Limit (TCLP x20) - Potentially exceeds criteria for classification as a Class 2 nonhazardous waste.

Exceeds Texas Surface Water Quality Standards for Human Health/Aquatic Life Protection - Potential temporary exceedance during dredging operations.

Note: *Lab results attachment provided with full memorandum.*

APPENDIX E

Conceptual Opinions of Probable Construction Cost

OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Baseline Scenario (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	3,200,000	CY	$ 10.00	$ 32,000,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	3,200,000	CY	$ 2.00	$ 6,400,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	734,400	TN	$ 25.00	$ 18,360,000
6	SEDIMENT TESTING	640,000	CY	$ 1.00	$ 640,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 59,838,300**
		MOBILIZATION & SWPP		7%	$ 4,188,700
		SUBTOTAL			**$ 64,027,000**
		ENGINEERING & PERMITTING		6%	$ 3,841,700
		SUBTOTAL			**$ 67,868,700**
		CONTINGENCY		30%	$ 20,360,700
PROJECT TOTAL (2020 COSTS)					**$ 88,229,400**

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

NOTES:

1 FNI OPCC classified as an AACE Class 5 Estimate with accuracy range or -30 to + 50.

OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Baseline Scenario (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	3,200,000	CY	$ 6.00	$ 19,200,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	3,200,000	CY	$ 1.00	$ 3,200,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	734,400	TN	$ 15.00	$ 11,016,000
6	SEDIMENT TESTING	640,000	CY	$ 0.50	$ 320,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 34,669,600**
		MOBILIZATION & SWPP		5%	$ 1,733,500
		SUBTOTAL			**$ 36,403,100**
		ENGINEERING & PERMITTING		6%	$ 2,184,200
		SUBTOTAL			**$ 38,587,300**
		CONTINGENCY		30%	$ 11,576,200
PROJECT TOTAL (2020 COSTS)					**$ 50,163,500**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 1 - Initial (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	3,200,000	CY	$ 10.00	$ 32,000,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	3,200,000	CY	$ 2.00	$ 6,400,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	734,400	TN	$ 25.00	$ 18,360,000
6	SEDIMENT TESTING	640,000	CY	$ 1.00	$ 640,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 59,838,300**
		MOBILIZATION & SWPP		7%	$ 4,188,700
		SUBTOTAL			**$ 64,027,000**
		ENGINEERING & PERMITTING		6%	$ 3,841,700
		SUBTOTAL			**$ 67,868,700**
		CONTINGENCY		30%	$ 20,360,700
PROJECT TOTAL (2020 COSTS)					**$ 88,229,400**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 1 - Initial (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	3,200,000	CY	$ 6.00	$ 19,200,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	3,200,000	CY	$ 1.00	$ 3,200,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	734,400	TN	$ 15.00	$ 11,016,000
6	SEDIMENT TESTING	640,000	CY	$ 0.50	$ 320,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 34,669,600**
		MOBILIZATION & SWPP		5%	$ 1,733,500
		SUBTOTAL			**$ 36,403,100**
		ENGINEERING & PERMITTING		6%	$ 2,184,200
		SUBTOTAL			**$ 38,587,300**
		CONTINGENCY		30%	$ 11,576,200
PROJECT TOTAL (2020 COSTS)					**$ 50,163,500**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 1 - Recurring (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	2,000,000	CY	$ 10.00	$ 20,000,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	2,000,000	CY	$ 2.00	$ 4,000,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	459,000	TN	$ 25.00	$ 11,475,000
6	SEDIMENT TESTING	400,000	CY	$ 1.00	$ 400,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 38,313,300**
		MOBILIZATION & SWPP		7%	$ 2,682,000
		SUBTOTAL			**$ 40,995,300**
		ENGINEERING & PERMITTING		6%	$ 2,459,800
		SUBTOTAL			**$ 43,455,100**
		CONTINGENCY		30%	$ 13,036,600
PROJECT TOTAL (2020 COSTS)					**$ 56,491,700**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 1 - Recurring (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	2,000,000	CY	$ 6.00	$ 12,000,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	2,000,000	CY	$ 1.00	$ 2,000,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	459,000	TN	$ 15.00	$ 6,885,000
6	SEDIMENT TESTING	400,000	CY	$ 0.50	$ 200,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 22,018,600**
		MOBILIZATION & SWPP		5%	$ 1,101,000
		SUBTOTAL			**$ 23,119,600**
		ENGINEERING & PERMITTING		6%	$ 1,387,200
		SUBTOTAL			**$ 24,506,800**
		CONTINGENCY		30%	$ 7,352,100
PROJECT TOTAL (2020 COSTS)					**$ 31,858,900**

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NOTES:

1 FNI OPCC classified as an AACE Class 5 Estimate with accuracy range or -30 to + 50.

OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alterative 2 - Initial (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	1,150,000	CY	$ 10.00	$ 11,500,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	1,150,000	CY	$ 2.00	$ 2,300,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	263,930	TN	$ 25.00	$ 6,598,250
6	SEDIMENT TESTING	230,000	CY	$ 1.00	$ 230,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 23,066,600**
		MOBILIZATION & SWPP		8%	$ 1,845,400
		SUBTOTAL			**$ 24,912,000**
		ENGINEERING & PERMITTING		6%	$ 1,494,800
		SUBTOTAL			**$ 26,406,800**
		CONTINGENCY		30%	$ 7,922,100
PROJECT TOTAL (2020 COSTS)					**$ 34,328,900**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 2 - Initial (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	1,150,000	CY	$ 6.00	$ 6,900,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	1,150,000	CY	$ 1.00	$ 1,150,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	263,930	TN	$ 15.00	$ 3,958,950
6	SEDIMENT TESTING	230,000	CY	$ 0.50	$ 115,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 13,057,600**
		MOBILIZATION & SWPP		6%	$ 783,500
		SUBTOTAL			**$ 13,841,100**
		ENGINEERING & PERMITTING		6%	$ 830,500
		SUBTOTAL			**$ 14,671,600**
		CONTINGENCY		30%	$ 4,401,500
PROJECT TOTAL (2020 COSTS)					**$ 19,073,100**

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NOTES:

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 3 - Initial (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	250,000	CY	$ 15.00	$ 3,750,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	250,000	CY	$ 2.00	$ 500,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	57,380	TN	$ 30.00	$ 1,721,400
6	SEDIMENT TESTING	50,000	CY	$ 1.00	$ 50,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 10,000.00	$ 10,000
		SUBTOTAL			**$ 8,369,700**
		MOBILIZATION & SWPP		4%	$ 334,800
		SUBTOTAL			**$ 8,704,500**
		ENGINEERING & PERMITTING		2%	$ 174,100
		SUBTOTAL			**$ 8,878,600**
		CONTINGENCY		30%	$ 2,663,600
PROJECT TOTAL (2020 COSTS)					**$ 11,542,200**

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NOTES:

1 FNI OPCC classified as an AACE Class 5 Estimate with accuracy range or -30 to + 50.

OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 3 - Initial (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	250,000	CY	$ 10.00	$ 2,500,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	250,000	CY	$ 1.00	$ 250,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	57,380	TN	$ 20.00	$ 1,147,600
6	SEDIMENT TESTING	50,000	CY	$ 0.50	$ 25,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 10,000.00	$ 10,000
		SUBTOTAL			**$ 4,766,200**
		MOBILIZATION & SWPP		4%	$ 190,700
		SUBTOTAL			**$ 4,956,900**
		ENGINEERING & PERMITTING		2%	$ 99,200
		SUBTOTAL			**$ 5,056,100**
		CONTINGENCY		30%	$ 1,516,900
PROJECT TOTAL (2020 COSTS)					**$ 6,573,000**

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NOTES:

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Innovative approaches
Practical results
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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Annual Dredging (High Estiamte)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	170,000	CY	$ 15.00	$ 2,550,000
2	DEWATERING OPERATION	170,000	CY	$ 2.00	$ 340,000
3	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	39,020	TN	$ 30.00	$ 1,170,600
4	SEDIMENT TESTING	34,000	CY	$ 1.00	$ 34,000
5	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
6	WATER QUALITY MONITORING	1	LS	$ 10,000.00	$ 10,000
		SUBTOTAL			**$ 4,417,100**
		MOBILIZATION & SWPP		4%	$ 176,700
		SUBTOTAL			**$ 4,593,800**
		ENGINEERING & PERMITTING		2%	$ 91,900
		SUBTOTAL			**$ 4,685,700**
		CONTINGENCY		30%	$ 1,405,800
PROJECT TOTAL (2020 COSTS)					**$ 6,091,500**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Annual Dredging (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	170,000	CY	$ 10.00	$ 1,700,000
2	DEWATERING OPERATION	170,000	CY	$ 1.00	$ 170,000
3	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	39,020	TN	$ 20.00	$ 780,400
4	SEDIMENT TESTING	34,000	CY	$ 0.50	$ 17,000
5	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
6	WATER QUALITY MONITORING	1	LS	$ 10,000.00	$ 10,000
		SUBTOTAL			**$ 2,802,400**
		MOBILIZATION & SWPP		4%	$ 112,100
		SUBTOTAL			**$ 2,914,500**
		ENGINEERING & PERMITTING		2%	$ 58,300
		SUBTOTAL			**$ 2,972,800**
		CONTINGENCY		30%	$ 891,900
PROJECT TOTAL (2020 COSTS)					**$ 3,864,700**

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NOTES:

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 4 - Initial (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	3,200,000	CY	$ 10.00	$ 32,000,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	3,200,000	CY	$ 2.00	$ 6,400,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	734,400	TN	$ 25.00	$ 18,360,000
6	SEDIMENT TESTING	640,000	CY	$ 1.00	$ 640,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 59,838,300**
		MOBILIZATION & SWPP		7%	$ 4,188,700
		SUBTOTAL			**$ 64,027,000**
		ENGINEERING & PERMITTING		6%	$ 3,841,700
		SUBTOTAL			**$ 67,868,700**
		CONTINGENCY		30%	$ 20,360,700
PROJECT TOTAL (2020 COSTS)					**$ 88,229,400**

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NOTES:

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 4 - Initial (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	3,200,000	CY	$ 6.00	$ 19,200,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	3,200,000	CY	$ 1.00	$ 3,200,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	734,400	TN	$ 15.00	$ 11,016,000
6	SEDIMENT TESTING	640,000	CY	$ 0.50	$ 320,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 34,669,600**
		MOBILIZATION & SWPP		5%	$ 1,733,500
		SUBTOTAL			**$ 36,403,100**
		ENGINEERING & PERMITTING		6%	$ 2,184,200
		SUBTOTAL			**$ 38,587,300**
		CONTINGENCY		30%	$ 11,576,200
PROJECT TOTAL (2020 COSTS)					**$ 50,163,500**

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NOTES:

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 4 - Periodic Large Dredge (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	2,200,000	CY	$ 10.00	$ 22,000,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	2,200,000	CY	$ 2.00	$ 4,400,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	504,900	TN	$ 25.00	$ 12,622,500
6	SEDIMENT TESTING	440,000	CY	$ 1.00	$ 440,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 41,900,800**
		MOBILIZATION & SWPP		7%	$ 2,933,100
		SUBTOTAL			**$ 44,833,900**
		ENGINEERING & PERMITTING		6%	$ 2,690,100
		SUBTOTAL			**$ 47,524,000**
		CONTINGENCY		30%	$ 14,257,200
PROJECT TOTAL (2020 COSTS)					**$ 61,781,200**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 4 - Periodic Large Dredge (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	2,200,000	CY	$ 6.00	$ 13,200,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	2,200,000	CY	$ 1.00	$ 2,200,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	504,900	TN	$ 15.00	$ 7,573,500
6	SEDIMENT TESTING	440,000	CY	$ 0.50	$ 220,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 100,000.00	$ 100,000
		SUBTOTAL			**$ 24,127,100**
		MOBILIZATION & SWPP		5%	$ 1,206,400
		SUBTOTAL			**$ 25,333,500**
		ENGINEERING & PERMITTING		6%	$ 1,520,100
		SUBTOTAL			**$ 26,853,600**
		CONTINGENCY		30%	$ 8,056,100
PROJECT TOTAL (2020 COSTS)					**$ 34,909,700**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 4 - Recurring Maintenance (High Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	250,000	CY	$ 15.00	$ 3,750,000
2	DEWATERING SET UP	1	LS	$ 125,000.00	$ 125,000
3	DEWATERING OPERATION	250,000	CY	$ 2.00	$ 500,000
4	PIPELINE INSTALLATION	158,400	LF	$ 12.00	$ 1,900,800
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	57,380	TN	$ 30.00	$ 1,721,400
6	SEDIMENT TESTING	50,000	CY	$ 1.00	$ 50,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 250.00	$ 312,500
8	WATER QUALITY MONITORING	1	LS	$ 10,000.00	$ 10,000
		SUBTOTAL			**$ 8,369,700**
		MOBILIZATION & SWPP		4%	$ 334,800
		SUBTOTAL			**$ 8,704,500**
		ENGINEERING & PERMITTING		2%	$ 174,100
		SUBTOTAL			**$ 8,878,600**
		CONTINGENCY		30%	$ 2,663,600
PROJECT TOTAL (2020 COSTS)					**$ 11,542,200**

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OPINION OF PROBABLE CONSTRUCTION COST

PROJECT NAME	White Rock Lake Dredging Feasibility Study	DATE	8/28/2020
CLIENT	Dallas Water Utilities / Dallas Park and Recreation	GROUP	1110
ALTERNATIVE	Alternative 4 - Recurring Maintenance (Low Estimate)	PM	Patrick Miles

ESTIMATED BY	QC CHECKED BY	FNI PROJECT NUMBER
Wylie Gorup	Murphy Parks	DWU19688

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	DREDGING OPERATION	250,000	CY	$ 10.00	$ 2,500,000
2	DEWATERING SET UP	1	LS	$ 75,000.00	$ 75,000
3	DEWATERING OPERATION	250,000	CY	$ 1.00	$ 250,000
4	PIPELINE INSTALLATION	52,800	LF	$ 12.00	$ 633,600
5	TRANSPORTATION AND DISPOSAL OF DREDGE MATERIAL	57,380	TN	$ 20.00	$ 1,147,600
6	SEDIMENT TESTING	50,000	CY	$ 0.50	$ 25,000
7	SURVEY AND BATHYMETRY	1,250	AC	$ 100.00	$ 125,000
8	WATER QUALITY MONITORING	1	LS	$ 10,000.00	$ 10,000
		SUBTOTAL			**$ 4,766,200**
		MOBILIZATION & SWPP		4%	$ 190,700
		SUBTOTAL			**$ 4,956,900**
		ENGINEERING & PERMITTING		2%	$ 99,200
		SUBTOTAL			**$ 5,056,100**
		CONTINGENCY		30%	$ 1,516,900
PROJECT TOTAL (2020 COSTS)					**$ 6,573,000**

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APPENDIX F
Enlarged Report Figures

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Fort Worth, TX 76109-4895
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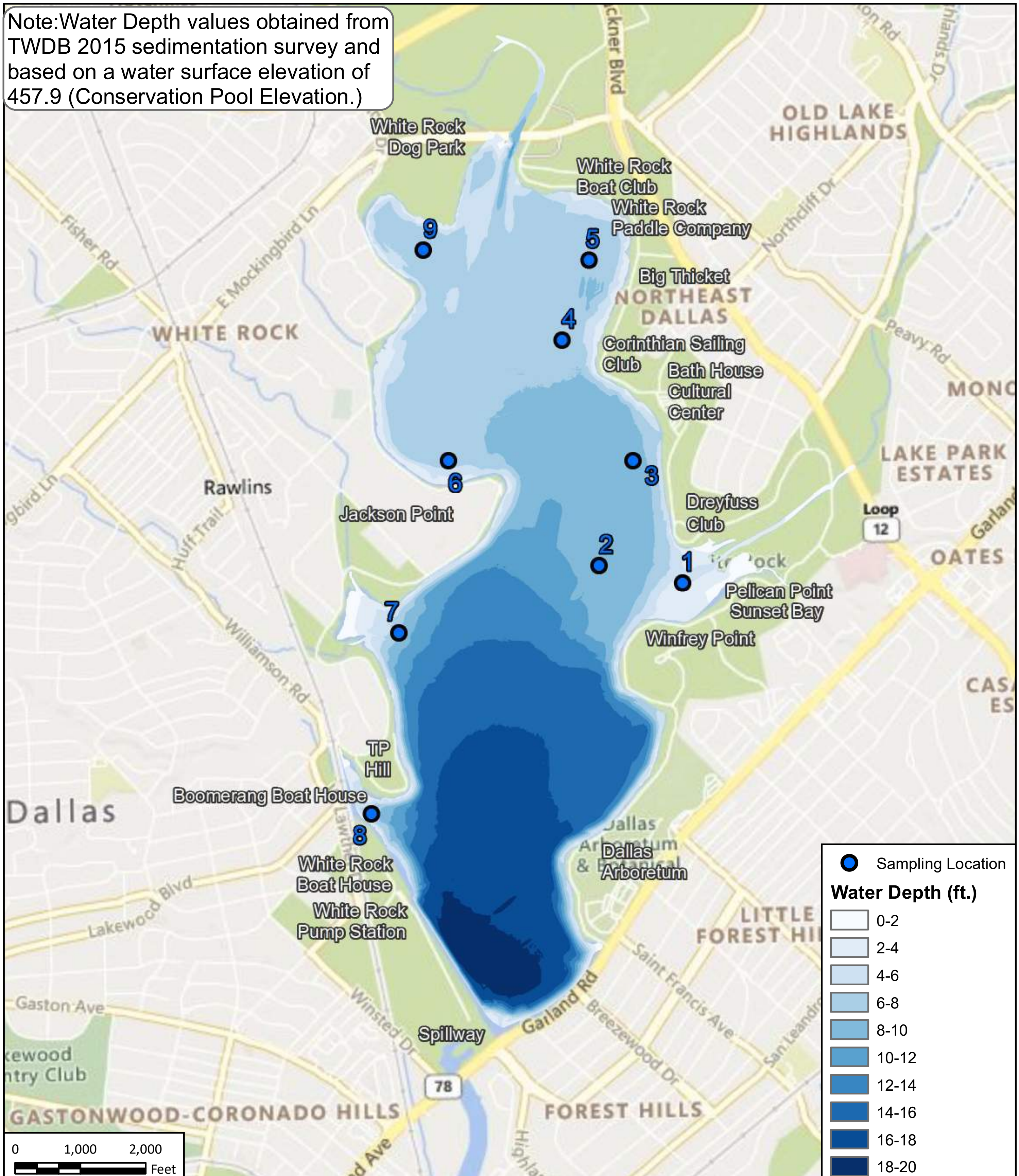
White Rock Lake Vicinity Map

Dallas, Texas

FN JOB NO	DWU19688
FILE	White Rock Lake_Vicinity Map
DATE	7/2/2020
SCALE	1:19,000
DRAFTED	02537

FIGURE 2-1

Path: H:\WR_DESIGN\Stormwater\Exhibits\Report\MXDs\White Rock Lake_Vicinity Map.mxd



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Suite 3300
Dallas, Texas 75204
P: 214-217-2200

White Rock Lake

Recommended Sediment Sampling Areas Overview

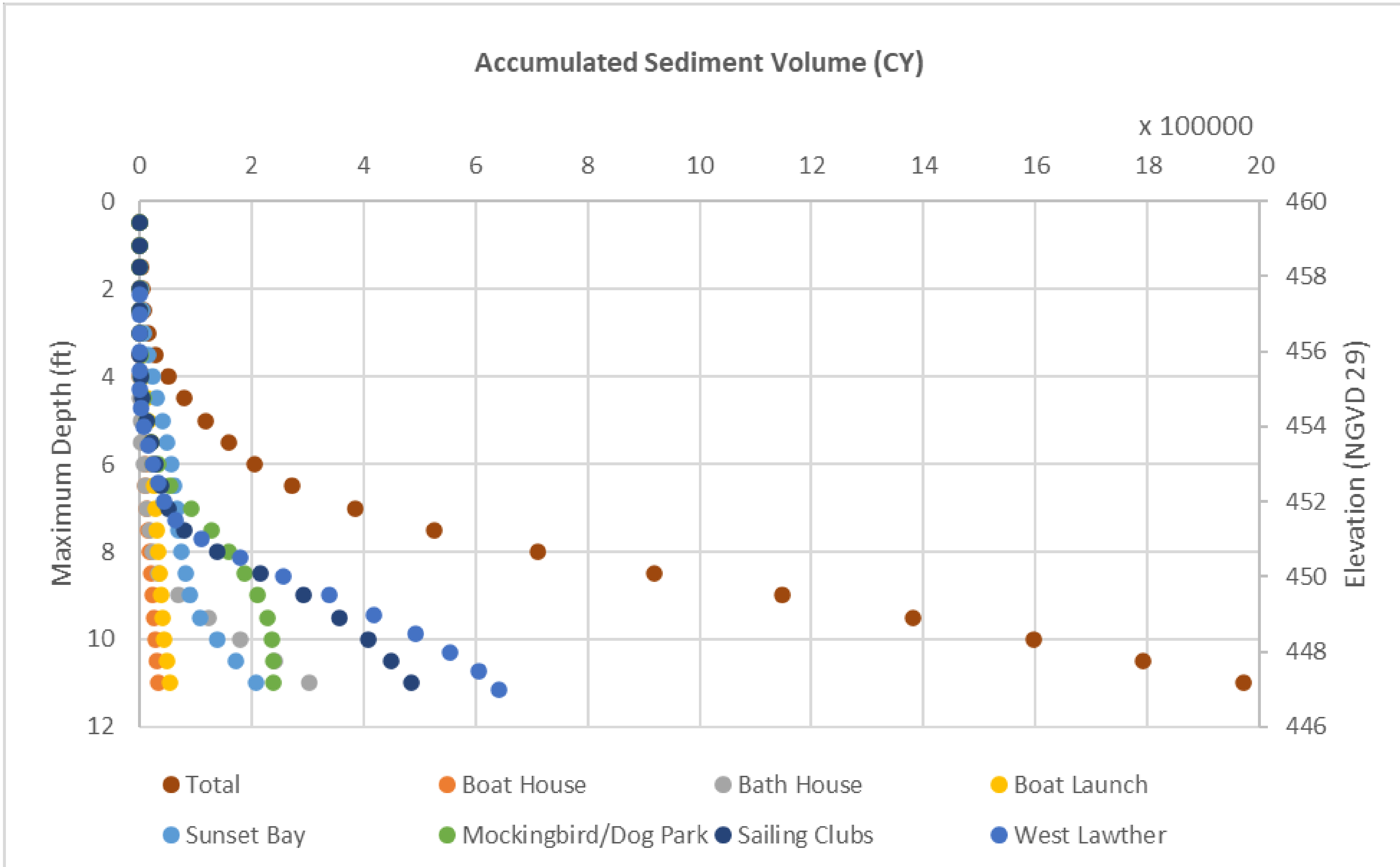
FN JOB NO	DWU19688
FILE NAME	Exb_4_Overall_Map_depth.mxd
DATE	3/12/2020
SCALE	1:24,000
DESIGNED	BH
DRAFTED	90207

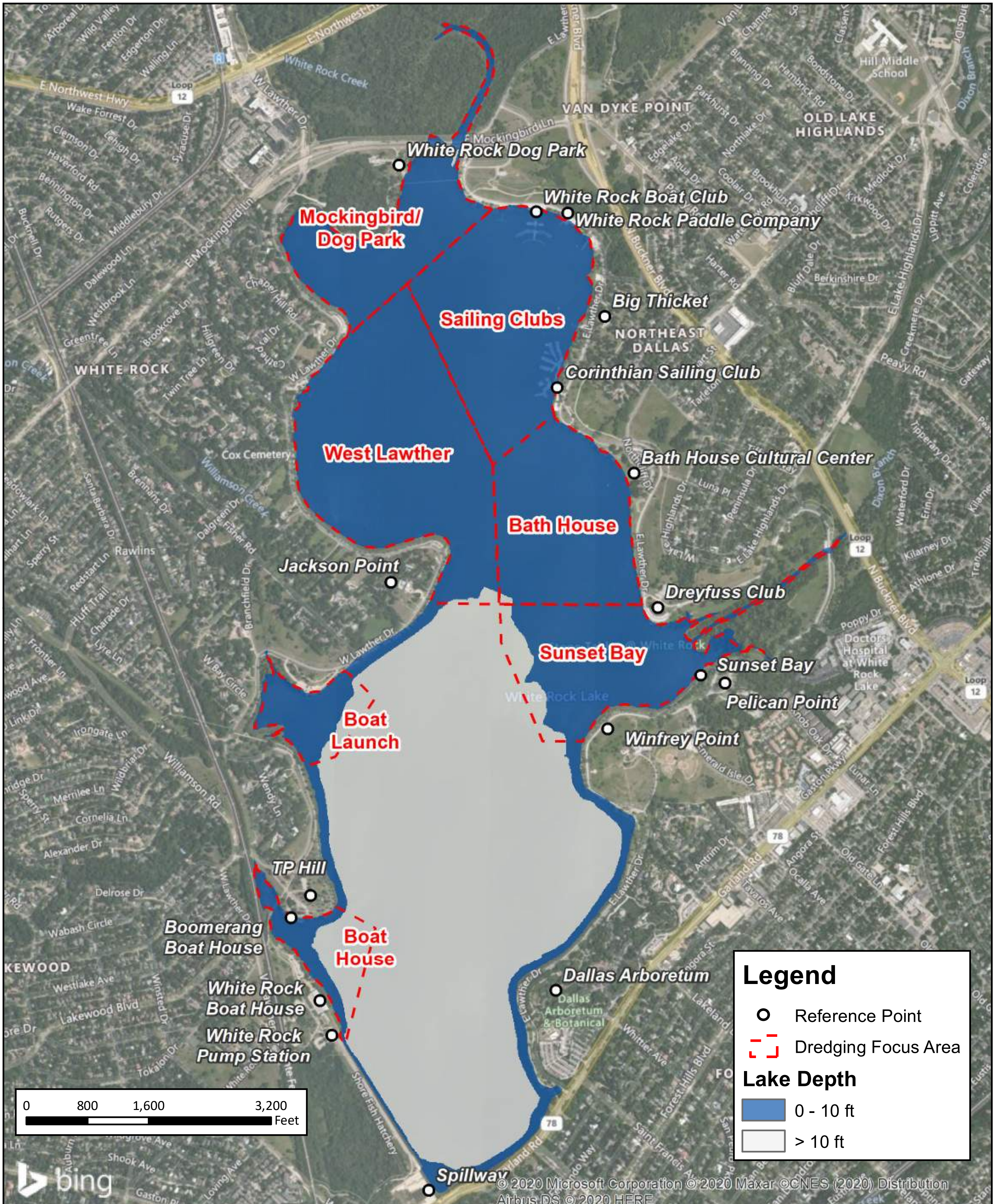
FIGURE 3-1

Path: H:\WR_DESIGN\Stormwater\Working\2020_03_04 Sediment Volumes\Exb_4_Overall_Map_depth.mxd

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Figure 4-1 : Accumulated Sediment Volume Versus Depth By Dredging Focus Area





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Dredging Focus Areas

White Rock Lake Dredging Feasibility Study

FN JOB NO	DWU19688
FILE	Dredging Focus Areas
DATE	8/18/2020
SCALE	1:20,000
DRAFTED	02537

FIGURE 4-2

Path: H:\WR_DESIGN\Stormwater\Exhibits\Report\MXDs\Dredging Focus Areas.mxd

Figure 4-3 : White Rock Lake Capacity Loss Due to Sedimentation

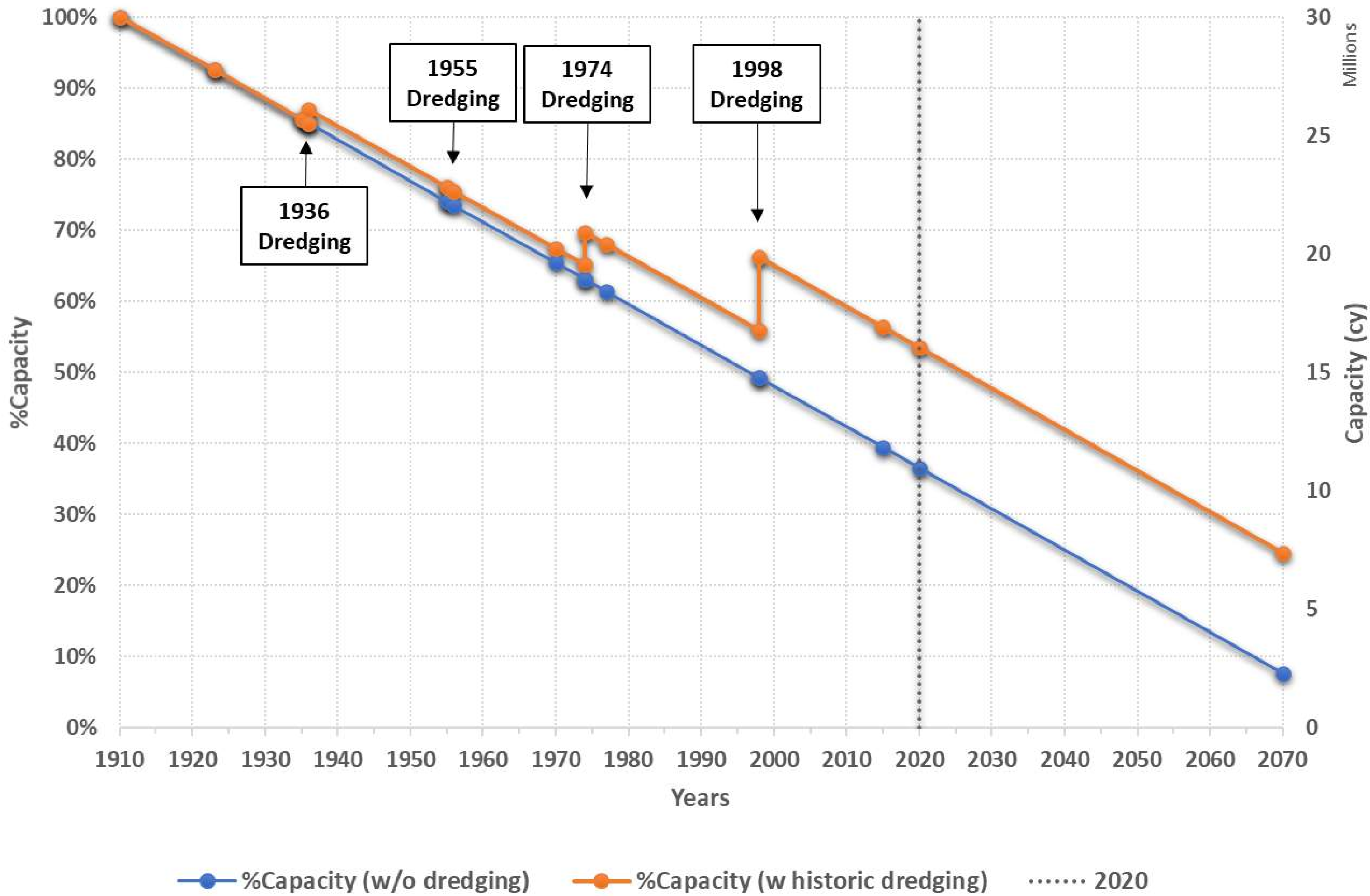
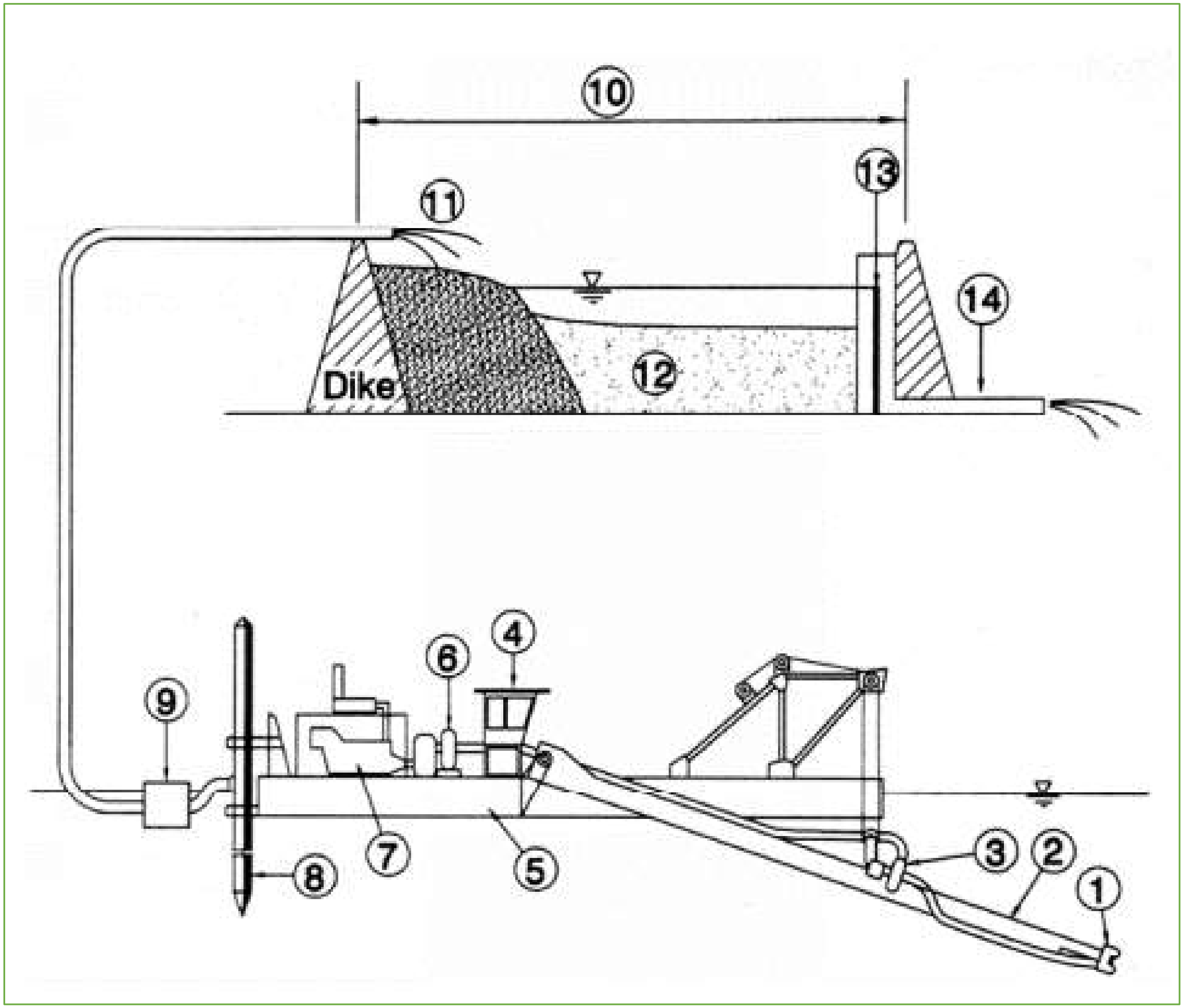
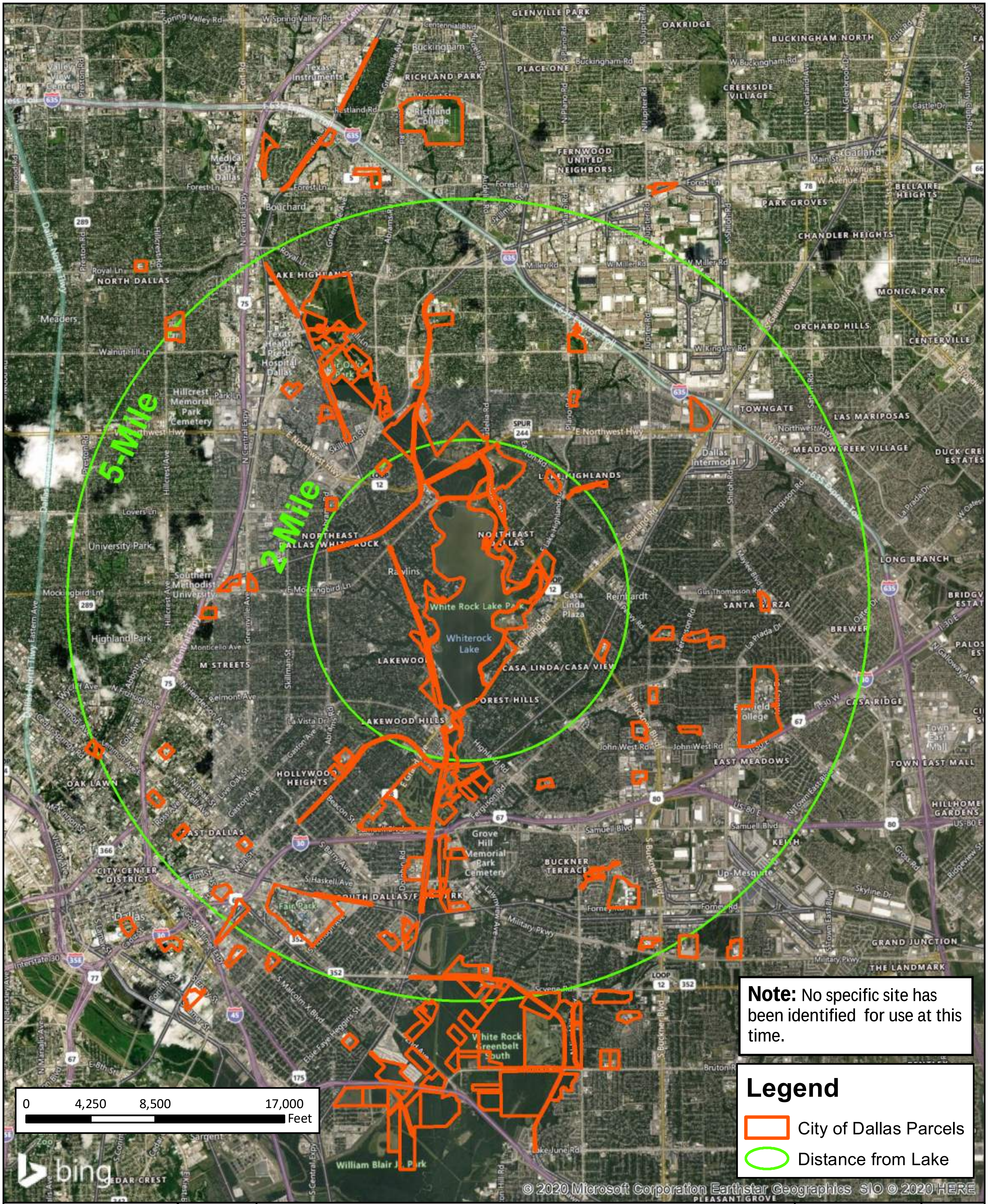


Figure 5-1: Hydraulic Dredge and Disposal Area Schematic



(1) cutterhead, (2) ladder, (3) ladder pump, (4) controls, (5) hull, (6) main pump, (7) engine, (8) spud, (9) float and discharge pipeline, (10) disposal or containment area with perimeter dike, (11) inlet zone where coarse sediment tends to accumulate and mound, (12) fine sediment deposits, (13) adjustable effluent weir, (14) discharge of clarified effluent.



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City of Dallas Properties

Evaluation of Potential Storage or Disposal Locations for Dredge Spoils

FN JOB NO	DWU19688
FILE	CityDallasProperties
DATE	7/13/2020
SCALE	1:100,000
DRAFTED	02271

FIGURE 5-2

Path: H:\WR_DESIGN\Stormwater\Exhibits\Report\MXDs\CityDallasProperties.mxd

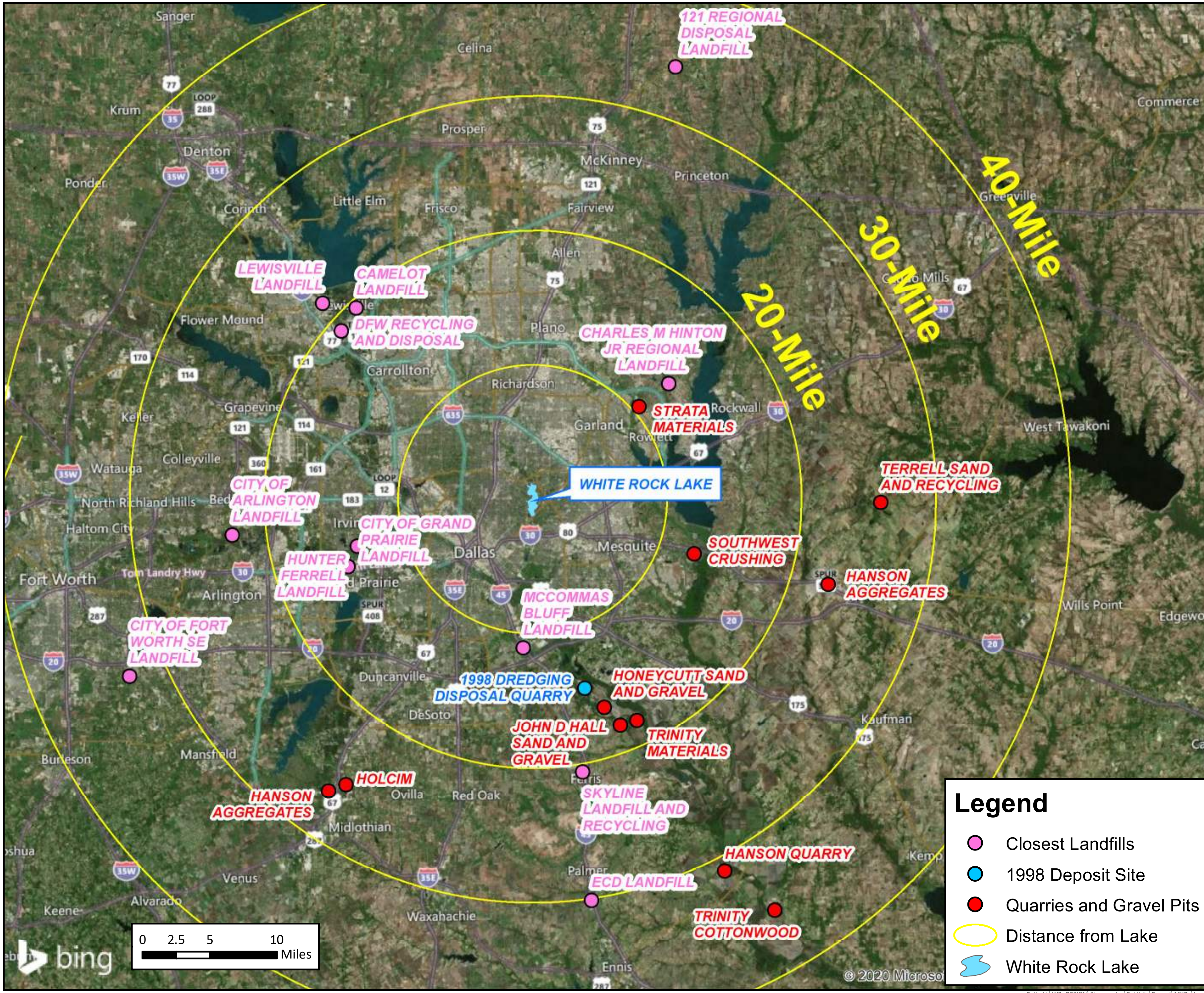

FIGURE 5-3

FN JOB NO DWU19688
FILE Landfills_Exhibit
DATE 7/15/2020
SCALE 1:600,000
DRAFTED 02271

Potential Disposal Sites

White Rock Lake Dredging Feasibility Study

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Path: H:\WR_DESIGN\Stormwater\Exhibits\Report\MXDs\Landfills_Exhibit_WJG.mxd

Figure 7-1 : Baseline Dredging Scenario

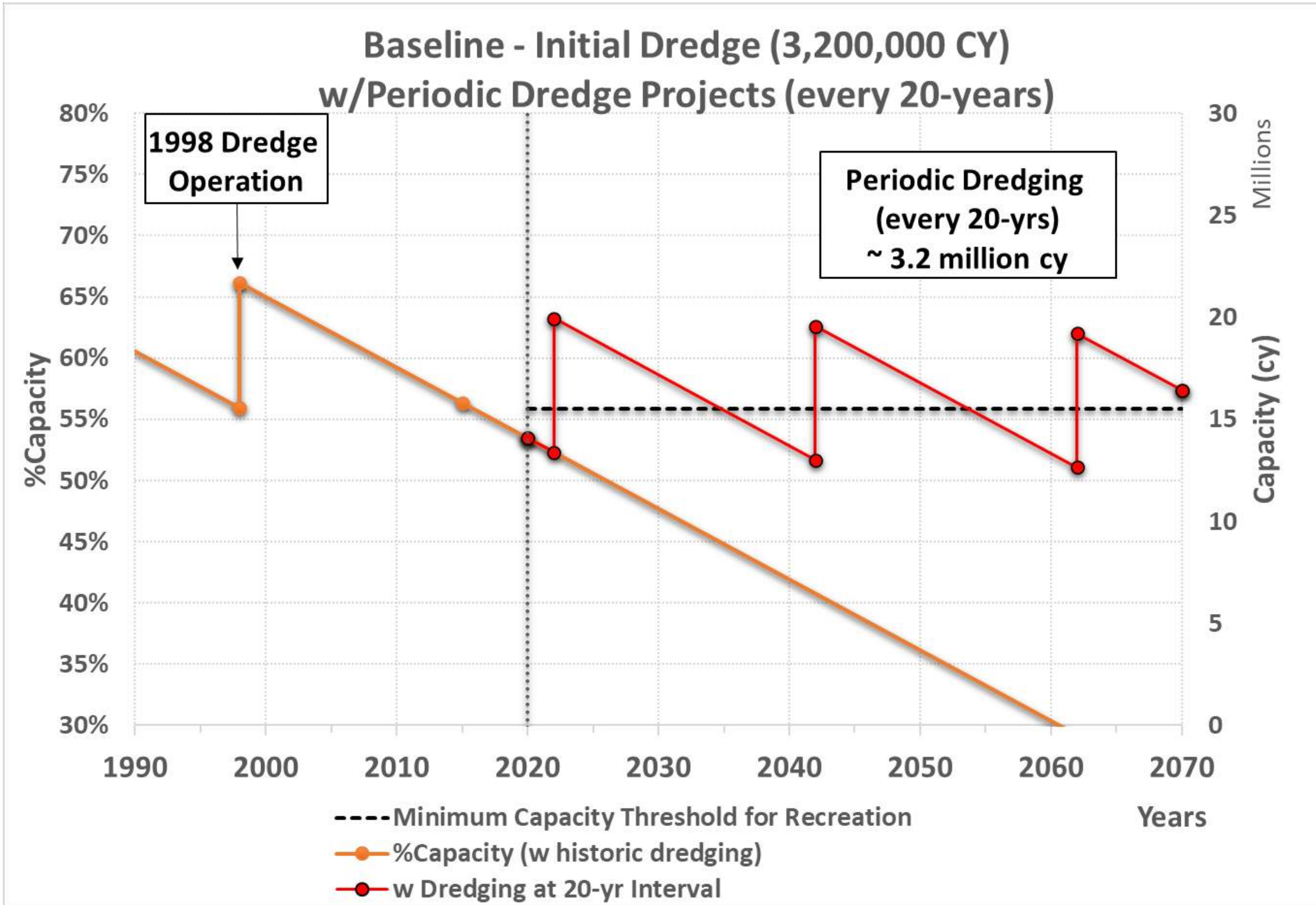


Figure 7-2 : Dredging Alternative 1

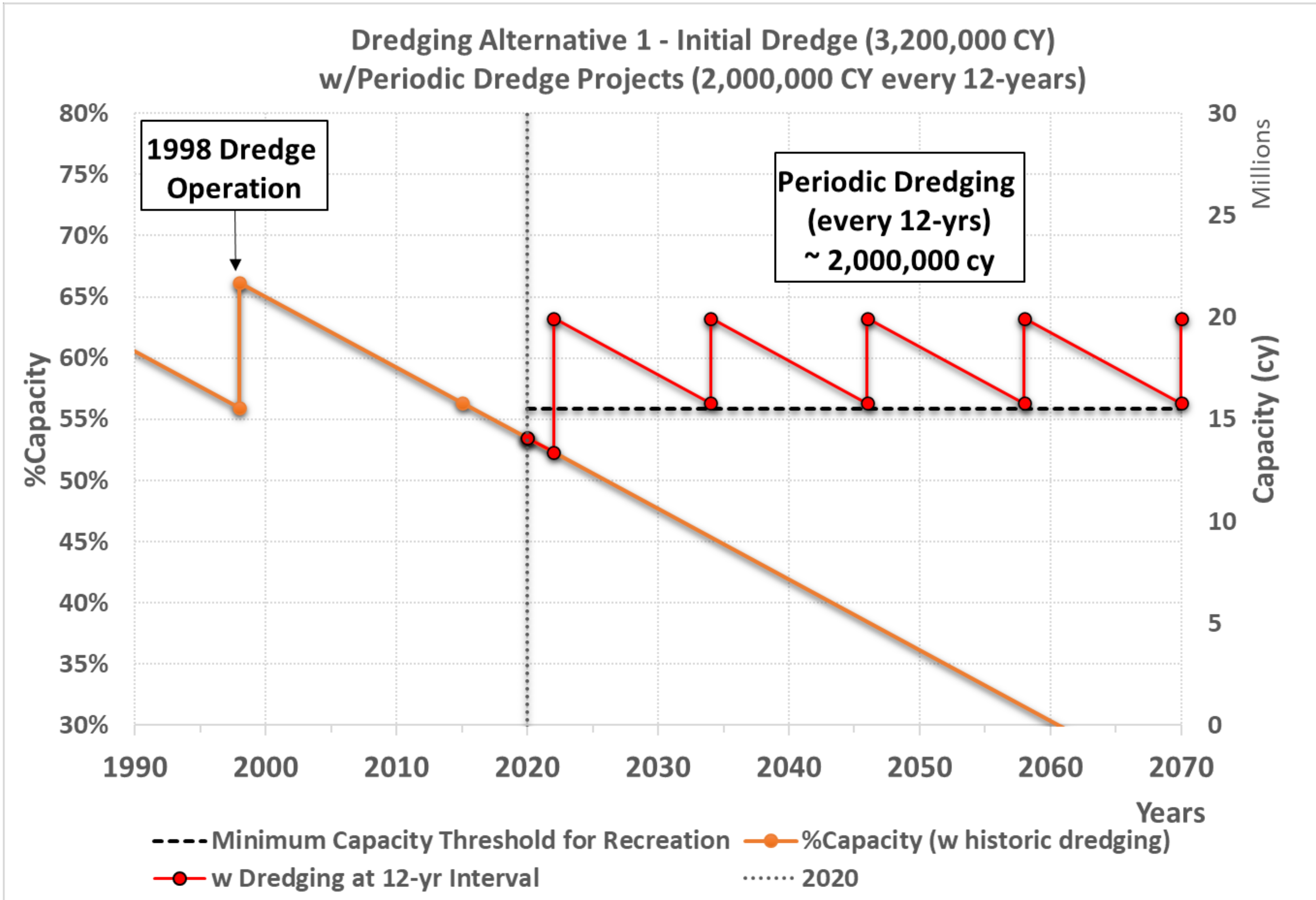


Figure 7-3 : Dredging Alternative 2

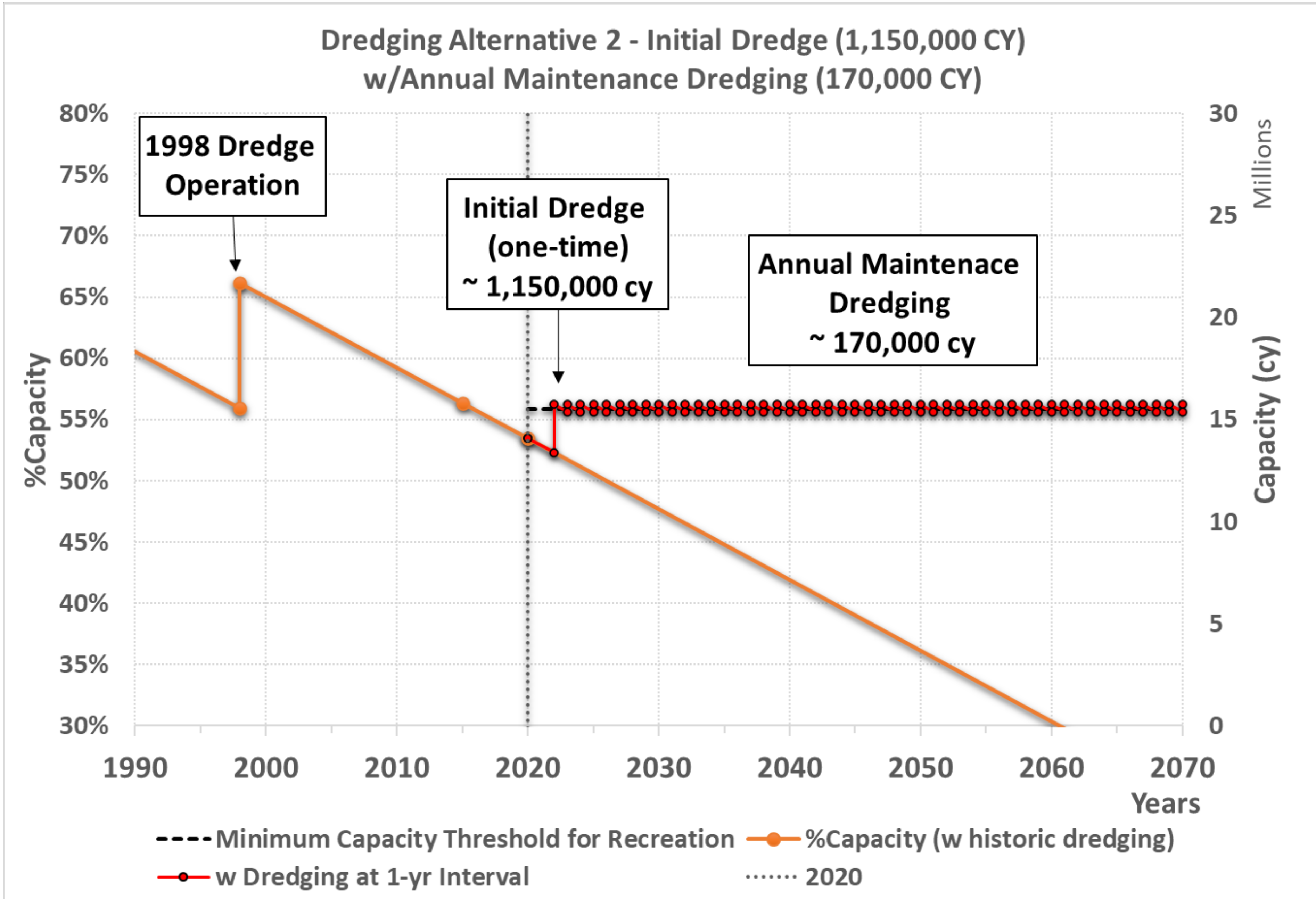


Figure 7-4 : Dredging Alternative 3

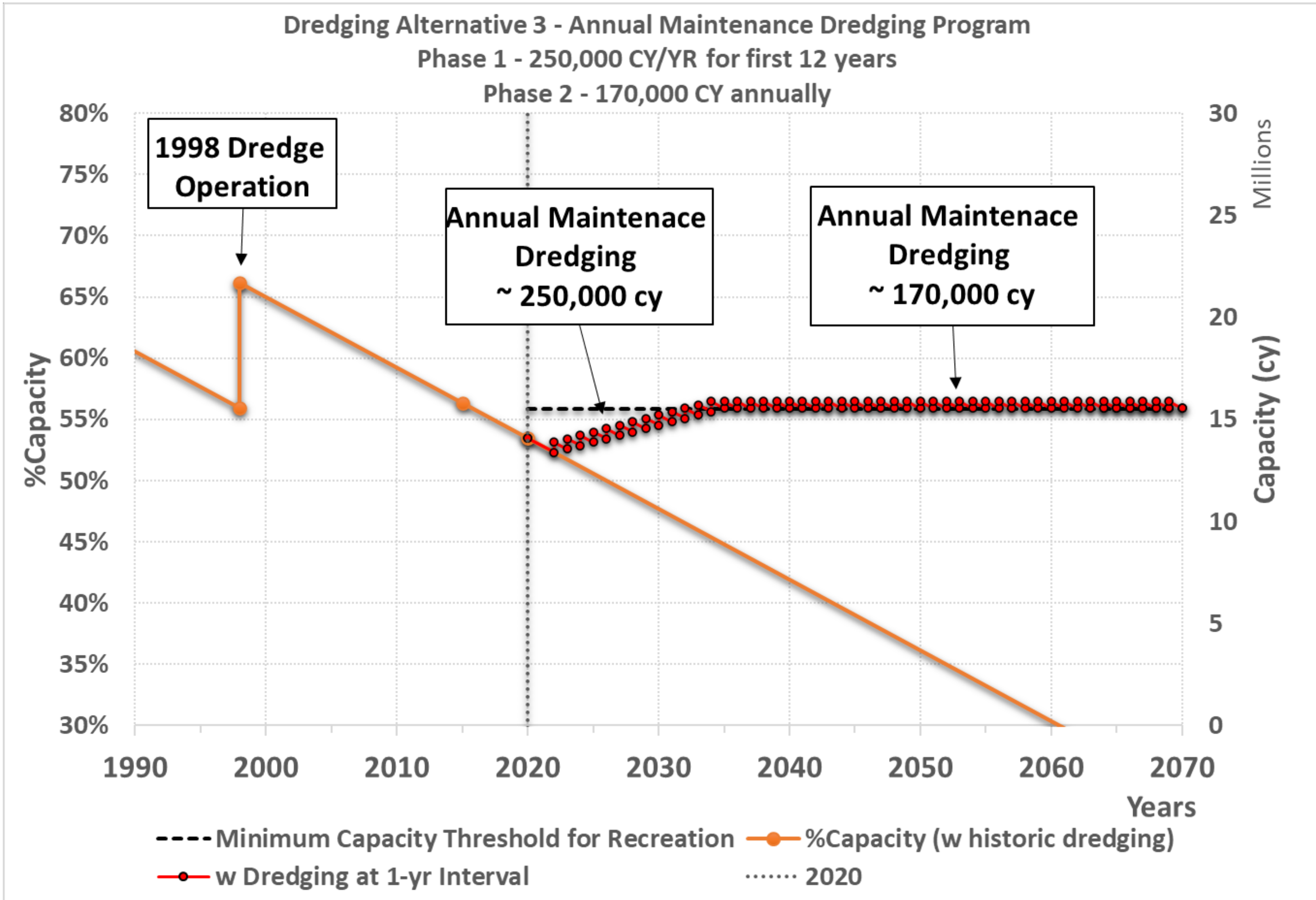
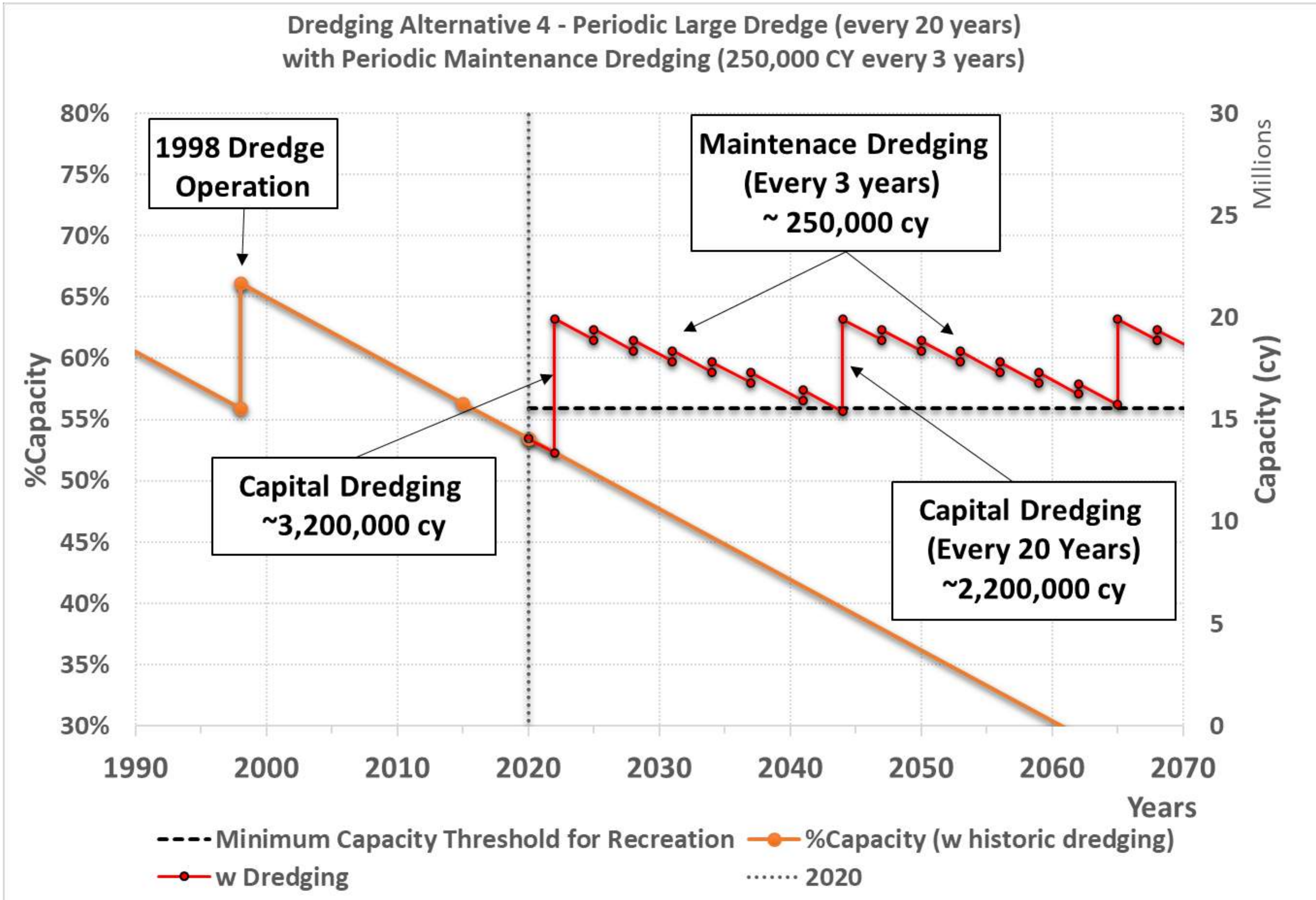


Figure 7-5 : Dredging Alternative 4



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Conceptual Sediment Forebay Footprint

White Rock Lake Dredging Feasibility Study

FN JOB NO	DWU19688
FILE	SedimentForebayArea
DATE	7/2/2020
SCALE	1:8,000
DRAFTED	02537

FIGURE 8-1

Path: H:\WR_DESIGN\Stormwater\Exhibits\Report\MXDs\SedimentForebayArea.mxd

Figure 9-1 : General Dredging Project Timeline

	Year 1				Year 2				Year 3				Year 4				Year 5			
Procure Funding (Timing TBD)																				
Engineering Design																				
Permitting (local, state, federal)																				
Public Review & Comment																				
Dredging Operations & Disposal																				