GREAT PARKS OF HAMILTON COUNTY | SHARON LAKE DREDGING ASSESSMENT

PREPARED FOR

GREAT PARKS OF HAMILTON COUNTY
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Great Parks of Hamilton County

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DATE

APRIL 2018

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INTRODUCTION

SHARON WOODS

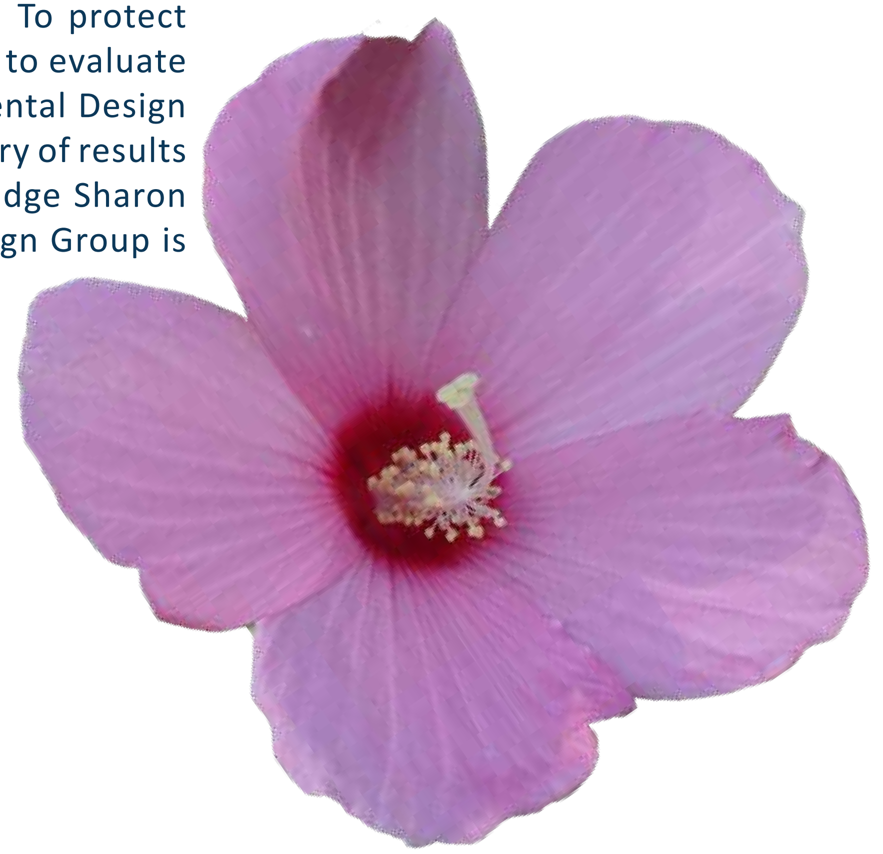
Year round, Sharon Woods attracts visitors with diverse park amenities within its 730-acres. At the heart of the park is Sharon Lake, with opportunities to boat, fish and hike the 2.6-mile multi-purpose trail that hugs the shoreline. It is no wonder that Sharon Woods is a favorite for local events and recreation.

SHARON LAKE

The 35-acre L-shaped reservoir has three tributaries - one entering at the northern most part of the lake (Sharon Creek), the second entering at a northeast section and the third flowing in at the southeastern tip. The lake discharges into Sharon Creek at the southwestern end of the lake, which flows through a gorge that is designated as a state nature preserve.

PROJECT GOAL

Balancing the health of the environment while providing recreational and educational opportunities is highly valued within the park system - making it crucial to set up a plan to protect these natural resources. Currently, high nutrient values, aggressive aquatic vegetation, and sediment accumulation are threatening the health of the lake. To protect the park's habitat and recreational value, an environmental study was conducted to evaluate the best solution to remove the sediment and improve water quality. Environmental Design Group prepared the following report, outlining the evaluation procedures, summary of results and evaluation and comparison of alternatives that may be implemented to dredge Sharon Lake. In addition to finding a solution for sediment removal, Environmental Design Group is committed to supporting the park's objective to enhance the overall park experience for future generations.



SHARON LAKE

HISTORY

SHARON WOODS

The Hamilton County Park District acquired Sharon Woods in 1932, thereby creating the county's first park. During the Great Depression, the Federal Emergency Relief Administration (FERA) and Works Progress Administration (WPA) were the backbone of the park's construction. During the years of escapism, Sharon Woods became a popular place to forget about real world issues and enjoy care-free entertainment with friends and family.

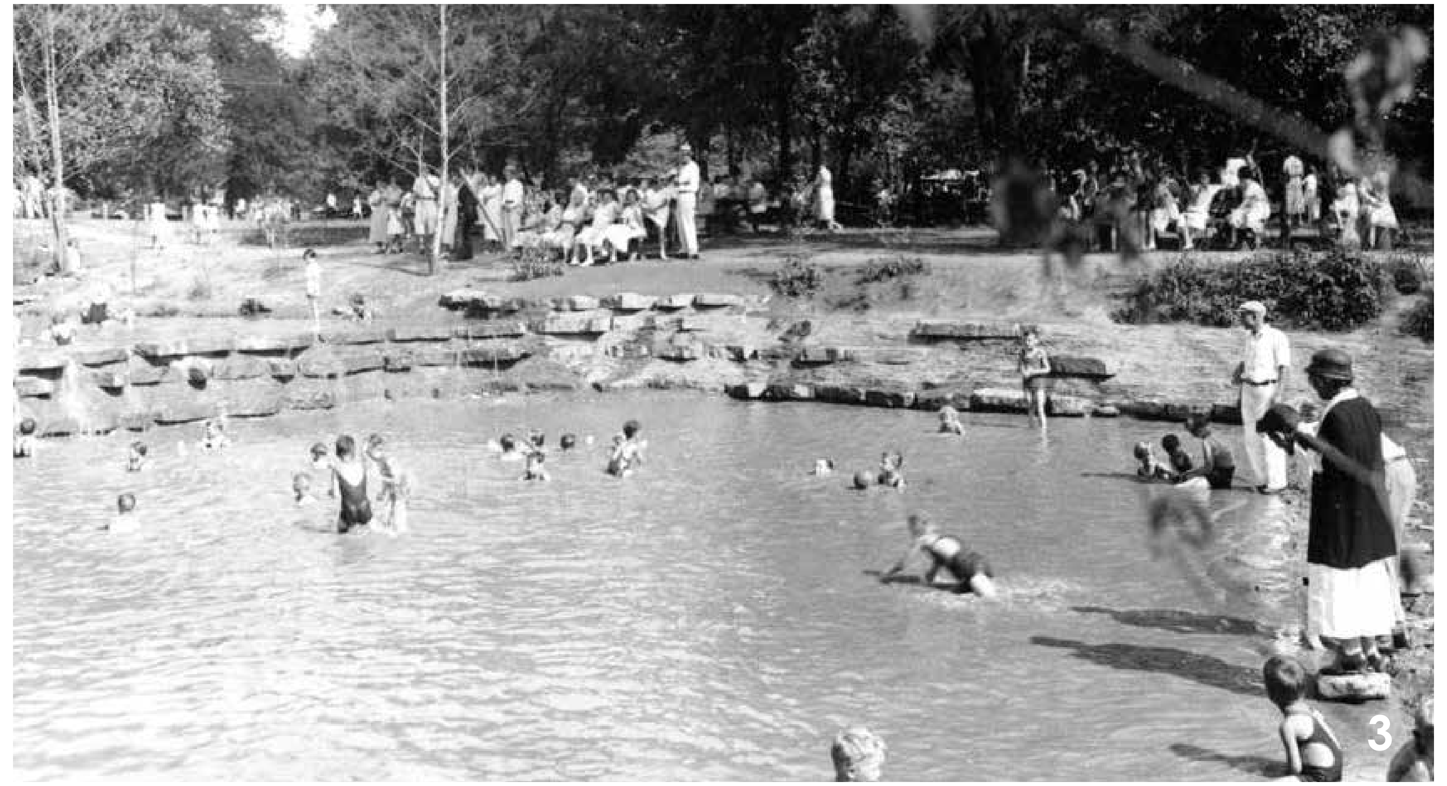
From 1934 - 1937 the Kreis dam was built, creating the 35-acre, Sharon Lake. The lake was an average of six-feet deep with over three-miles of shoreline. The boathouse and docking area were built during this time frame and the lake was stocked with fish. Lake recreation became a celebrated pastime for the community (Miller).

In an effort to continue the recreational benefits of Sharon Lake, it was mechanically dredged in 1988 to remove sediment deposits. Since that time, sediment has accumulated, threatening the health of the lake.

IMAGES (1930s) ABOVE. Stone Arch Bridge 1. Kreis Dam 2. WPA Road Construction 3. Buckeye Falls Pool 4. Lakeside Lodge

Images collected from the Great Parks of Hamilton County Facebook page
Hamilton County Parks, Ohio (Images of America Series) by Robert Earnest Miller

SHARON WOODS



PROJECT DESCRIPTION

SITE NEEDS AND OBJECTIVES

Over time, sediment and excessive nutrients collect in the lake. These conditions lead to increased water temperature and an abundance of nitrogen and phosphorous, creating a conducive environment for aggressive species and duckweed to flourish. Once the duckweed overpopulates the lake, sunlight can no longer reach native species. Oxygen depletes, and the diversity of the lake is significantly reduced.

The objective of this project includes the dredging of the lake to restore it to a healthy condition. Dredging of the lake reduces the sediment laden areas where deposits have accumulated. Removing sediment disrupts the cycle of eutrophication and allows for cooler water temperatures and a higher level of biodiversity to follow. Dredging will promote the proper operation of the weirs at the north and east ends of the lake, and that will support improved water quality by removing heavy suspended solids loads from incoming surface water. This improved flow regime may also support increased dissolved oxygen in the newly deepened waters of the lake.

DUCKWEED (Lemna minor L.) is a free-floating plant that multiplies rapidly. Duckweed grows extremely quickly and can block light from reaching other flora and fauna within a lake, threatening the diversity of other species.

SITE CHARACTERISTICS

The foundation of an alternative analysis is the data upon which the alternatives are constructed. Environmental Design Group completed characterization of sediment and surface water conditions in Sharon Lake.

SEDIMENT CHARACTERIZATION

Sediment sampling was completed as part of the assessment to evaluate the physical properties of the sediment, as well as its accumulated thickness. Sediment samples were collected at various locations around the lake during the assessment.

EVALUATION PROCEDURES

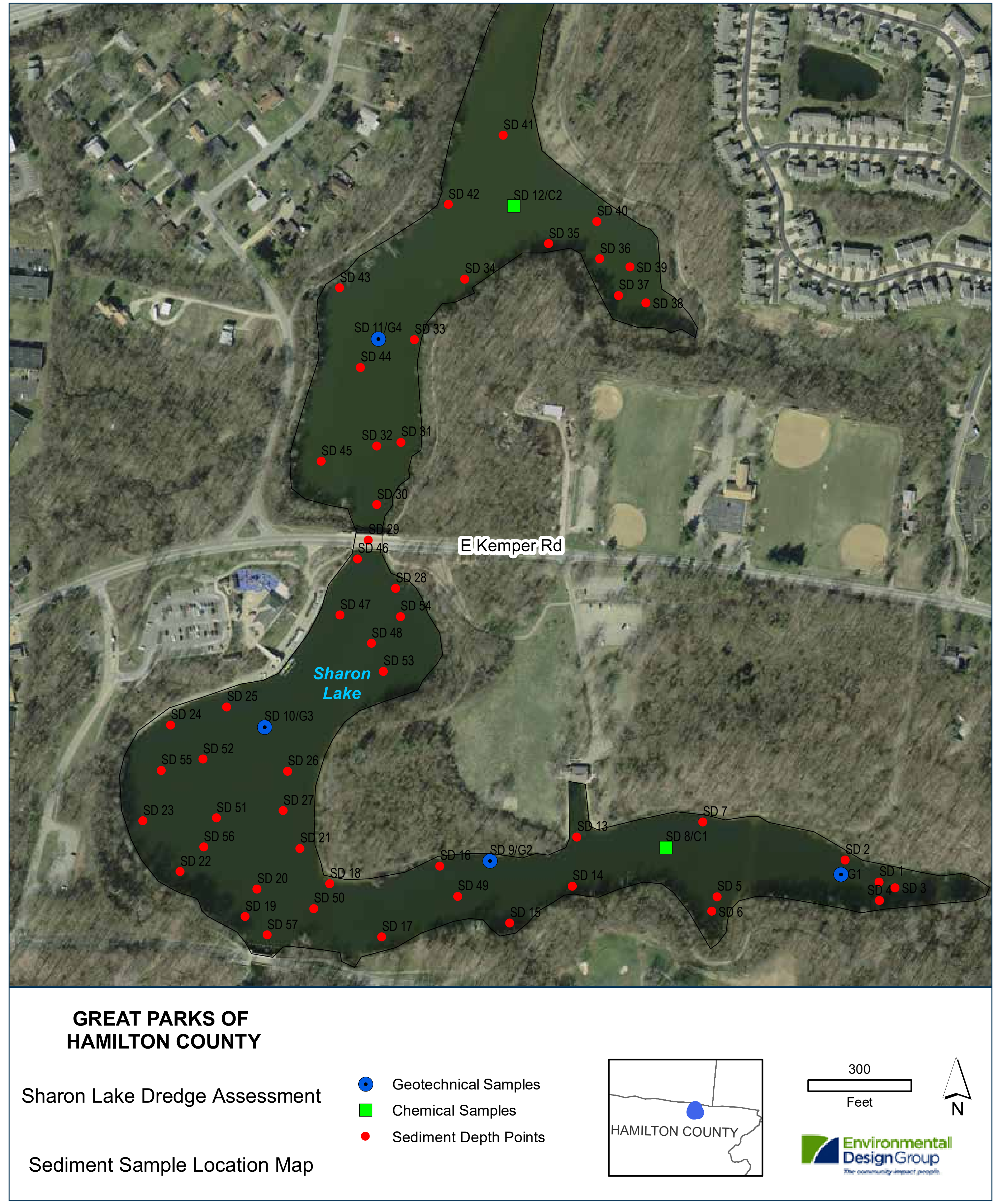
Sediment data were collected at 57 locations throughout the lake using a pontoon boat. Sediment depths were recorded at each of the 57 locations. Global Positioning System (GPS) data were collected using a Trimble Geo7X unit to gather location data so that sampling locations could be accurately recorded. The depth of the water and the depth of the sediment was determined at each location using a rod with half foot increments marked out for measurement. The rod was placed into the lake and once the bottom was reached the depth of the water was recorded. The rod was then pushed through the sediment and one resistance was perceived on native material the depth of the sediment was recorded.

Sediment samples were also collected at six locations using a stainless-steel bottom dredge sampler. The dredge sampler was lowered to the bottom of the lake using nylon rope. Once the sampler reached the bottom of the lake, the trigger was opened, closing the sampler around a discrete sample of sediment. The sampler was then retrieved and the collected sediment was placed in laboratory supplied containers. Four of the samples were analyzed for physical characteristics and two of the samples were analyzed for chemical parameters.

PHYSICAL CHARACTERISTICS

Four sediment samples (G-1 through G-4) were collected and sent to Terracon, Inc. to be analyzed for physical characteristics to include plastic limit, liquid limit, plasticity, water content, specific gravity, moisture and total organic carbon. The sediment was also classified under the unified soil classification system. The four sample locations were spread out throughout the lake.

Three of the sediment samples were described as dark gray elastic silt. The remaining sample, collected on the northern end of the lake was described as dark gray fat clay. The plastic limit of the sediment samples ranged from 29 to 41, the liquid limit ranges from 53 to 72 and the plasticity limit ranges from 24 to 31. The water content of the sediment ranged from 120.3% to 230.0% and the moisture content ranged from 34% to 42%. The specific gravity in the sediment samples ranged from 2.558 to 2.644 and the total organic carbon ranged from 2.3% to 3.1%.



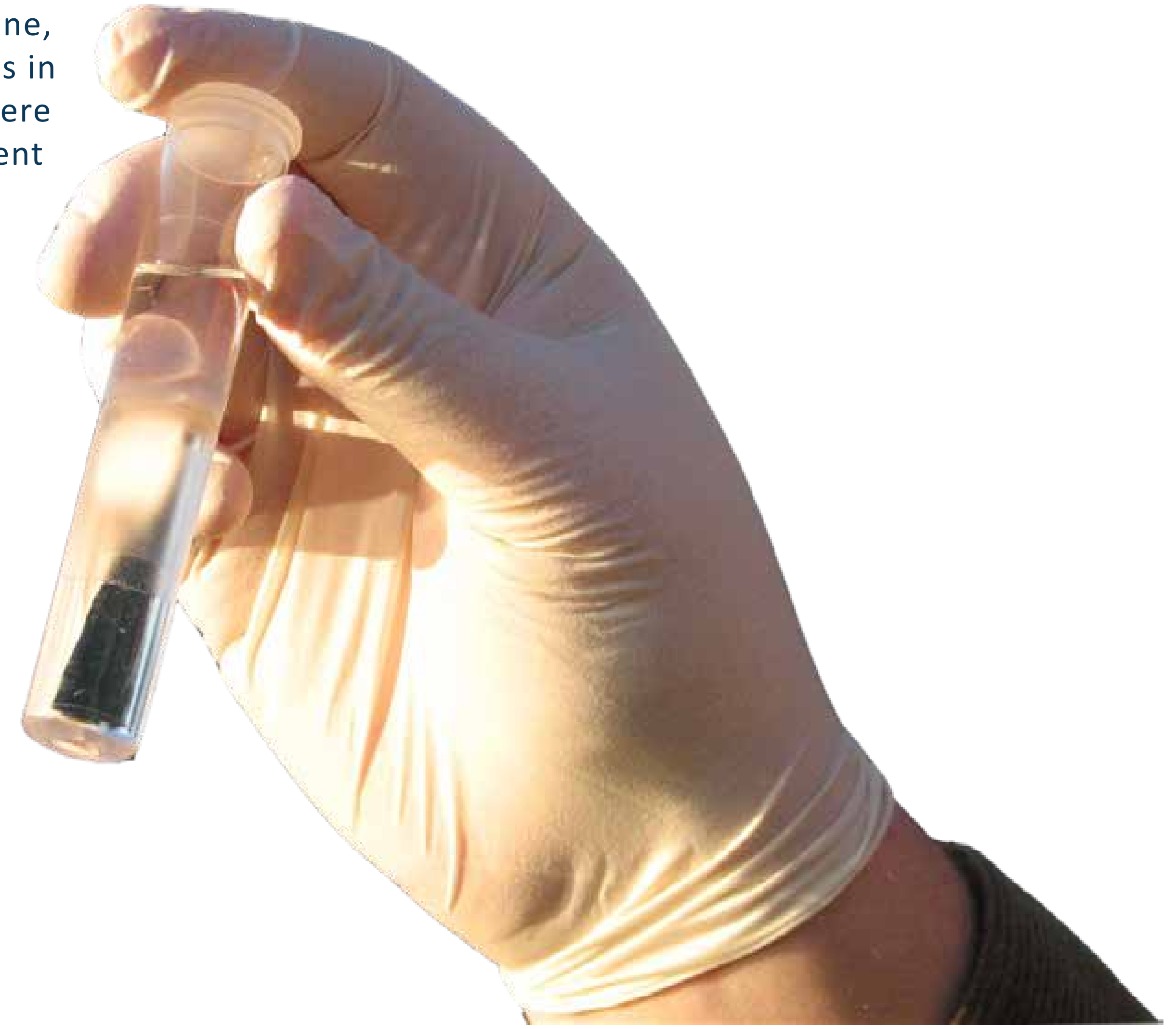
SITE CHARACTERISTICS

CHEMICAL CHARACTERISTICS

Two sediment samples were collected and sent to ALS Environmental to be analyzed for chemical parameters to include metals, PCBs, pesticides, herbicides, and other man-made organic compounds. One sample was collected from the south end of the lake and the other from the north end. Sample results were compared to the Ohio Environmental Protection Agency (EPA) soil standards. These standards are valuable so that Environmental Design Group could evaluate whether the sediment may be classified as waste, or if it could be placed on the ground. Sample results were also compared to background metals results found in the Ohio EPA May 2015, Evaluation of Background Metal Soil Concentrations in Hamilton County-Cincinnati Area, as an additional evaluation to confirm the sediment was not impacted by man-made sources.

No PCBs, pesticides, or herbicides were detected in either sample. Several metals including barium, chromium, and lead were detected in both samples at levels above the laboratory detection limits. Barium and chromium were detected at levels slightly above the background levels for the Cincinnati Area. Chromium was also detected at levels above Ohio EPA standards. This chromium result was very close to the Ohio EPA standard and likely does not indicate contamination. No other metals were detected at levels in exceedance of the Ohio EPA standards.

Several man-made compounds were detected above laboratory detection limits including; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene. Only benzo(a)pyrene in one sample was detected at levels in exceedance of the generic Ohio EPA standards for re-use. All of the man-made organic compounds that were detected are chemicals present in asphalt. This seems consistent, given that the primary source of sediment in Sharon Lake is likely runoff from urban and suburban areas where this contamination is often found.

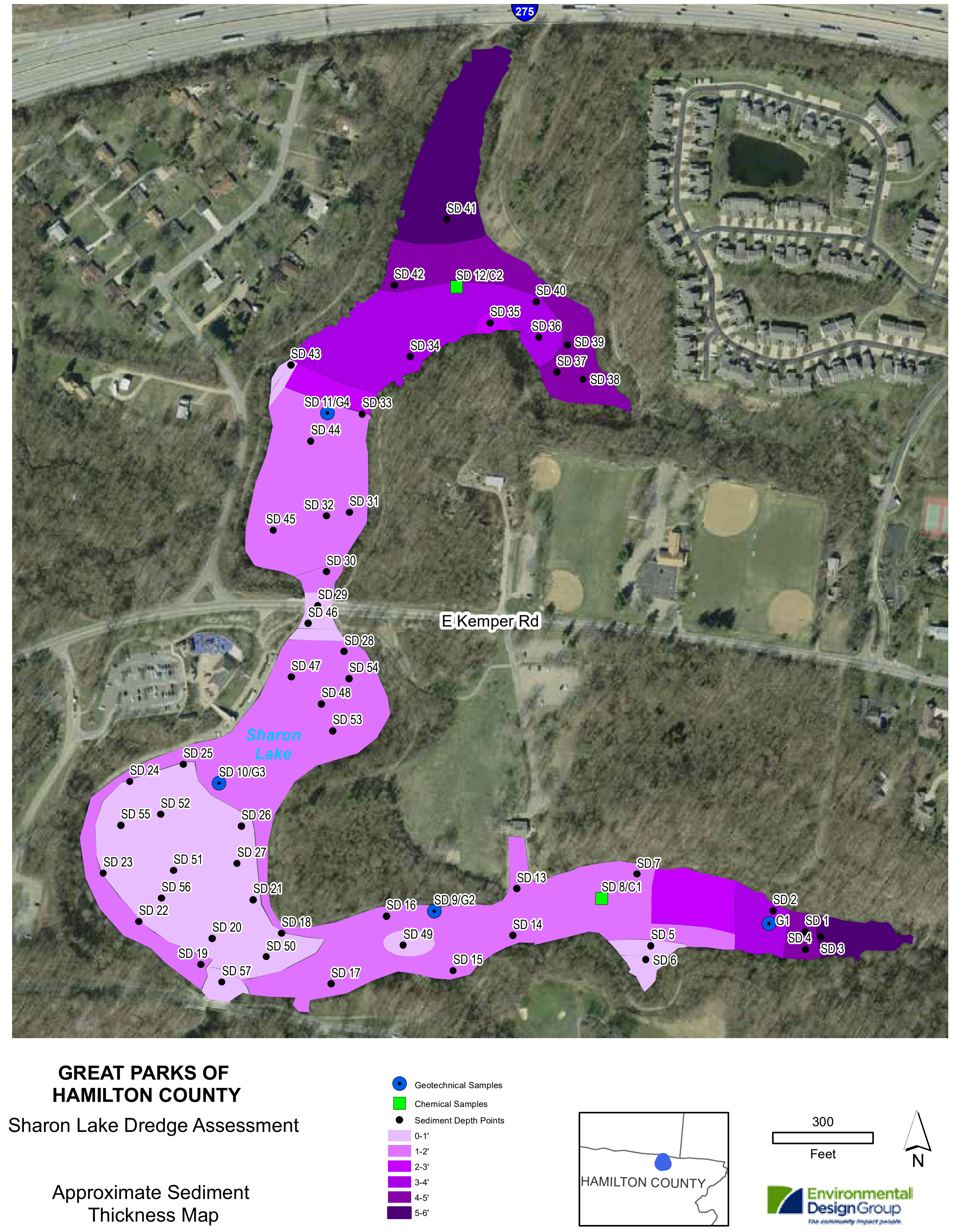


SITE CHARACTERISTICS

WATER DEPTH AND SEDIMENT THICKNESS

Water depth and sediment thickness were gauged at 57 sample locations. The water depth measurements ranged from 3 feet near the edge of the lake to 23.6 feet near the center of the lake. Water depth measurements were compared to a Sharon Lake Fishing Map provided by the Great Parks of Hamilton County which shows lake depths shaded in 3 foot increments. Water depth measurements collected during this study corresponded with depth measurements shown on this map.

Sediment thicknesses range from areas where the lake bottom was observed as being rock with little to no sediment to up to six feet thick at the southern and northern tips of the lake. Sediment was observed to be thicker near the three locations where tributaries discharge into the lake.



SITE CHARACTERISTICS

BIOLOGICAL RESOURCES

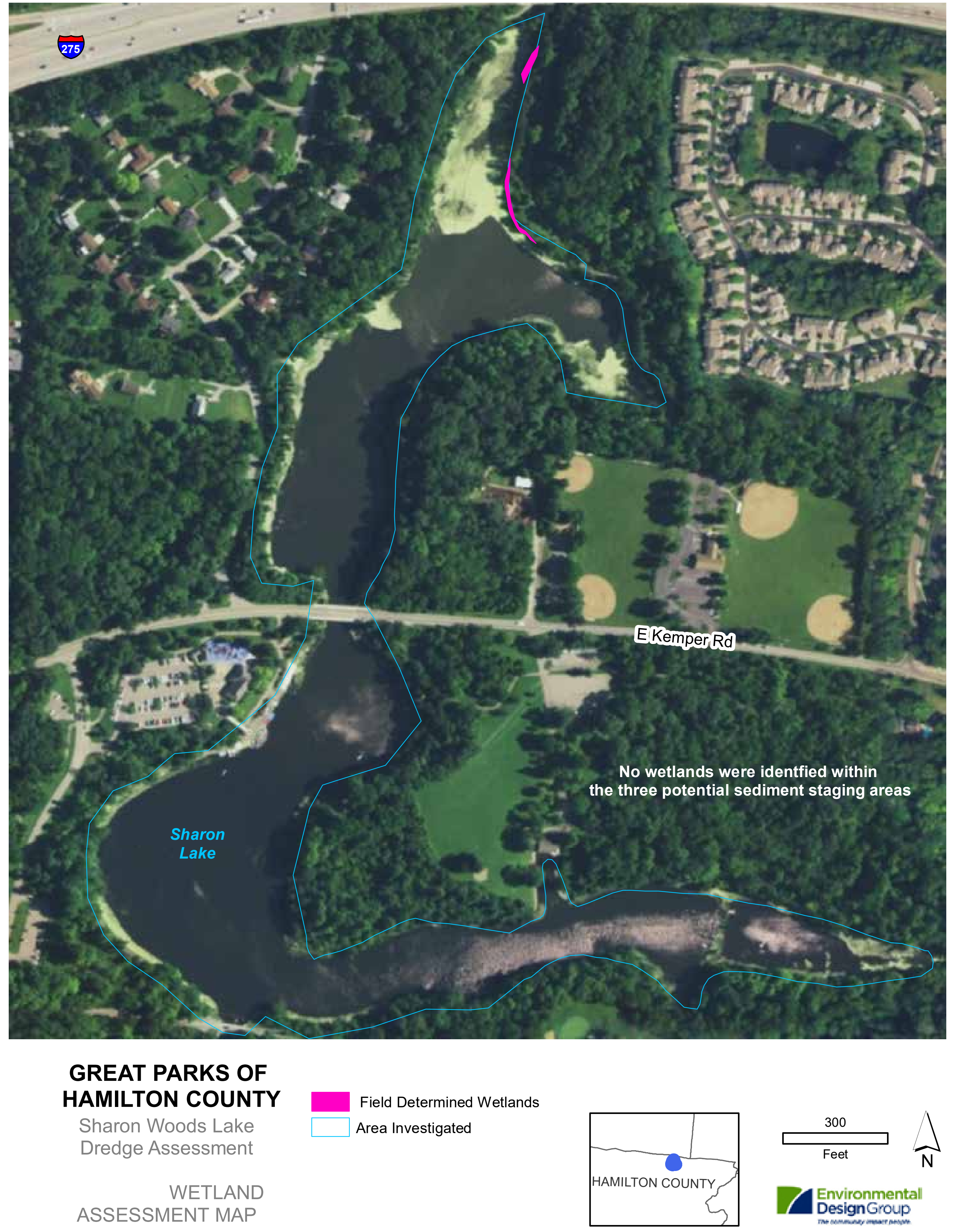
A wetland and surface water assessment was conducted as part of the site evaluation to determine the presence or absence of wetlands and other surface waters that may be subject to regulation under Section 10 of the Rivers and Harbors Act, Sections 401 and 404 of the Federal Clean Water Act and/or the Ohio Isolated Wetland Permit Program. Biological resources were also assessed within Sharon Lake and three potential staging areas in the vicinity of the lake.

The wetland and waters assessment included a review of published map data and a field assessment. Map resources reviewed included The National Wetland Inventory, the Ohio Wetland Inventory Map, and the Soil Survey for Hamilton County.

The field assessment, conducted in August 2017, revealed two narrow (approximately ten foot wide) wetlands. These were observed growing along the lake's northern end. No additional wetlands were observed immediately adjacent to the lake's banks when observing the banks from the lake's interior. The wetlands were found primarily along the banks of the lake outside of the normal shoreline.

If the fringe wetlands along the lake are planned to be impacted in a way that would materially alter the ecology of the wetland, a formal wetland delineation report would be recommended. Coordination with the United States Army Corps of Engineers would be required. Coordination may include a Jurisdictional Determination to verify the findings of the wetland delineation report, and permitting through the Section 404 process.

IMAGES 1. Floating primrose-willow; native/naturalized perennial floating aquatic
2. Crimsoneyed rose-mallow; native perennial 3. Fringed emergent wetland 4. Hydric soil



DREDGING ALTERNATIVES
4 POTENTIAL METHODS

There are numerous dredging methods to achieve similar results. Each method was evaluated and rated based on a variety of requirements, impacts, time and costs. This section will review several different methods available and compare the benefits and constraints of each one.

Four methods were deemed the most feasible to apply to Sharon Lake based on the size and characteristics. Dry dredging, mechanical dredging, hydraulic dredging were all considered. A combination alternative was also evaluated which involved a concept of putting to use both mechanical and hydraulic dredging.

ALT 1
DRY DREDGING

By opening the outlet valve at the dam, the surface elevation of the lake is lowered, and the lake bed is exposed. Heavy equipment (e.g. a drag line, excavator bulldozer, etc.) excavates the sediment from the lake bed and temporarily stockpiles it at several locations around the lake. Once the stacked material has had sufficient time to dewater, the material can be loaded into trucks and transported to a deposition site.

ALT 2
MECHANICAL DREDGING

The water level of the lake is left unchanged, and a clamshell excavator or crane is mobilized via a barge onto the lake. This equipment excavates the sediment from the lake bed through the water and loads the dredge material onto a barge. The dredge material is then pumped from the barge to a temporary dewatering site. Once the material has had sufficient time to dewater, the material can be loaded into trucks and transported to a deposition site. Alternate methods may include using barges for the initial dewatering. Then, the dredge material could be removed from the barges mechanically (e.g. with an excavator).

ALT 3
HYDRAULIC DREDGING

Hydraulic dredging also relies on lake water levels being in the 'normal' range to float a suction dredge. This hydraulic dredging equipment removes the sediment from the lake bed via suction. The dredge material is then pumped from the barge to a temporary dewatering site. Once the material has had sufficient time to dewater, the material can be transported to a deposition site. Dewatering could be accomplished in multiple ways. However, hydraulic dredging is uniquely suited for press-dewatering. This dewatering method produces a dry filter cake that can quickly be loaded into trucks and transported.

ALT 4
COMBINATION

This combination method takes advantage of both dry dredging and hydraulic dredging techniques. By opening the outlet valve at the dam, the surface elevation of the lake is lowered by 6 to 10 feet to expose the shallow areas behind (or upstream) of the two weirs. The shallow areas can then be used for dewatering hydraulically-dredged material. Then the sediment in the shallow areas can be mechanically removed once the dewatering of the hydraulically-dredged material is complete. Once the material has had sufficient time to dewater, the material can be loaded into trucks and transported to a deposition site.

EVALUATION

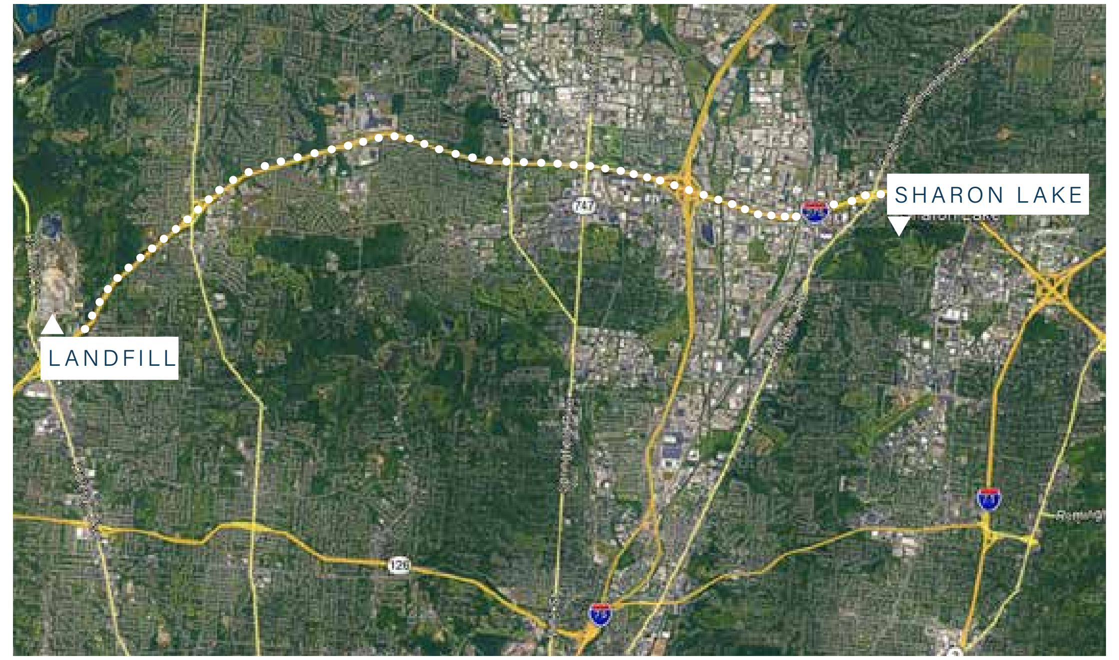
POTENTIAL DISPOSITION OF DREDGED SEDIMENT

Dredged sediment is anticipated to be clean enough to be placed on the ground surface. Final disposition of the material considered both disposal at a landfill and placement on the ground for re-use. Depending upon the dredge method selected, sediment removed from Sharon Lake may require dewatering. However, the final disposition option will be selected based on the final dredge design.

LANDFILL

DISPOSITION

Transporting the dredge waste to the landfill has the immediate benefits of 100% material removal, no ongoing liability and no maintenance. However, hauling the material by truck the 14 mile required distance may be cost prohibitive.



14 MILE DRIVE

LAND APPLICATION SITES

The locations of three possible disposition areas were assessed. No wetlands or other surface waters were identified within the potential sediment land application sites, and these areas were deemed to be feasible locations for the final disposition of Sharon Lake sediment. Criteria used to evaluate these areas included; site ownership (i.e. sites owned by the Great Parks of Hamilton County), size or availability to accommodate dredge material, proximity to Sharon Lake, potential post-project benefits, and regulatory requirements like wetlands, surface waters, etc. on the sites. Depending on the final dredge design, dewatering of the sediment may be required at these land application sites. It is anticipated that these requirements will be incorporated into final dredge design and after a site is selected.

SITE 1

GOLF COURSE AND DRIVING RANGE

This location adjacent to Sharon Lake provides an opportunity for ecological restoration as well as an opportunity to enhance the existing driving range. Slope stability would need to be addressed once placed and another site would need to be utilized to dispose of 100% of the material.

258,781 SF//5.94 AC

SITE 2

GREENSPACE NEAR FRANCIS RECREACRES PARK

This site is large enough to accommodate 100% of the dredge material without a deep fill. This provides plenty of restoration opportunities on site. However, current restoration projects underway may be disturbed by this process. This site also requires truck transportation as it is located a short distance from Sharon Lake. Final use planning of this site is still underway and may not be completed in time for the disposal of material.

2,870,390 SF//65.90 AC

SITE 3

NEAR BOAT HOUSE

Disposing of the dredge material near the boat house could lead to the ability for programming and park enhancements. It is adjacent to the dredging site, making it low cost for transport. However, this space is limited and slope stability and access remains an issue due to steep grades.

51,126 SF//1.17 AC

DREDGING ASSESSMENT

METHOD MATRIX

Dredging Method		Physical Requirements					Environmental and Permitting Requirements		Comparative Schedule to Complete		Ecological Impacts	
Alternative	Description	Anticipated Equipment [1]	Equipment Limitations	Access Needs [2]	Staging and Dewatering	Score [3]	Remarks	Score [3]	Remarks	Score [3]	Remarks	Score [3]
No-Action/ No-Build	Perform no activity to remove the sediment	None	None	None	None	2	No permits needed	2	No time required	2	Ecological resources will continue to degrade	-2
Alt. 1 Dry Dredging	Dewater the lake, allow lake bed to dry out, mechanically remove sediment	Pumps, excavators, dozers, dump trucks	None anticipated	Lake access behind weirs and at central basin areas, in-lake haul roads	Staging area, dewatering area confined to lake bed	0	NPDES	0	Higher rate of material removal and phased removal allows for drying during removal	2	High impact to aquatic species within the lake, but limited biodiversity and value in current state	0
Alt. 2 Mechanical Dredging	Mechanically remove sediment and load onto barge	Dredger, barge, crane, unloading dredger or pumps, dump trucks, dozer	Mobility limited to draft of ship and barge, dredging depth limited to boom length	Lake access required behind weirs and at central basin areas	Staging area needed	-2	NPDES	0	Minimal setup time prior to commencing excavation and not weather dependent	0	Minimal impact to aquatic species within the lake	2
Alt. 3 Hydraulic Dredging	Hydraulically remove sediment and pump onto barge or to dewatering area	Dredger, pipeline, crane, dump trucks, dewatering equipment, dozer	Mobility limited to draft of ship, dredging depth limited to suction pipe length	Lake access required behind weirs and at central basin areas	Staging area and dewatering area needed	-2	NPDES	0	Minimal setup time prior to commencing excavation and not weather dependent	0	Minimal impact to aquatic species within the lake, moderate impact at the dewatering area	0
Alt. 4 Combination	Partially dewater the lake, mechanically dredge shallow areas and hydraulically dredge deep areas	Pumps, dredger, pipeline, crane, dump trucks, dewatering equipment, dozer	Mobility limited to draft of ship, dredging depth limited to suction pipe length	Lake access behind weirs and at central basin areas, in-lake haul roads	Staging area, dewatering area confined to lake bed	0	NPDES	0	Higher rate of material removal but longer wait prior to commencing excavation and weather dependent	-2	High impact to aquatic species but only within the drained portions of the lake	0

Alternative	Comparative Costs		Community Impacts		Indirect Project Impacts		Outside Funding Potential		Aggregate Score
	Remarks	Score [3]	Remarks	Score [3]	Remarks	Score [3]	Remarks	Score [3]	
No-Action/ No-Build	No construction costs but maintenance costs will escalate	-2	Recreational usability of the lake will continue to deteriorate	-2	Lake continues to degrade to unusable condition	-2	None. Not taking action, may have negative impact on Park ability to continue to attract other revenue.	-2	-4
Alt. 1 Dry Dredging	Utilizes conventional excavation equipment	2	Water-based recreational activities will be temporarily suspended during the dredging	0	Lake access locations for construction can be transformed into permanent lake infrastructure	2	EPA Section 319 Grant; ODNR Land & Water Conservation Fund; ODNR Recreational Harbor Evaluation Program	2	8
Alt. 2 Mechanical Dredging	Utilizes conventional excavation equipment plus a crane, barge, and barge pump	0	Functionality and recreational usage of the lake can be maintained during the dredging	2	Lake access locations for construction can be transformed into permanent lake infrastructure	2	EPA Section 319 Grant; ODNR Land & Water Conservation Fund; ODNR Recreational Harbor Evaluation Program	2	6
Alt. 3 Hydraulic Dredging	Utilizes specialized equipment for dredging and pumping	-2	Functionality and recreational usage of the lake can be maintained during the dredging	2	Lake access locations for construction can be transformed into permanent lake infrastructure	2	EPA Section 319 Grant; ODNR Land & Water Conservation Fund; ODNR Recreational Harbor Evaluation Program	2	2
Alt. 4 Combination	Utilizes specialized equipment for dredging and pumping along with conventional excavation equipment	-2	Water-based recreational activities will be temporarily suspended during the dredging	0	Lake access locations for construction can be transformed into permanent lake infrastructure	2	EPA Section 319 Grant; ODNR Land & Water Conservation Fund; ODNR Recreational Harbor Evaluation Program	2	0

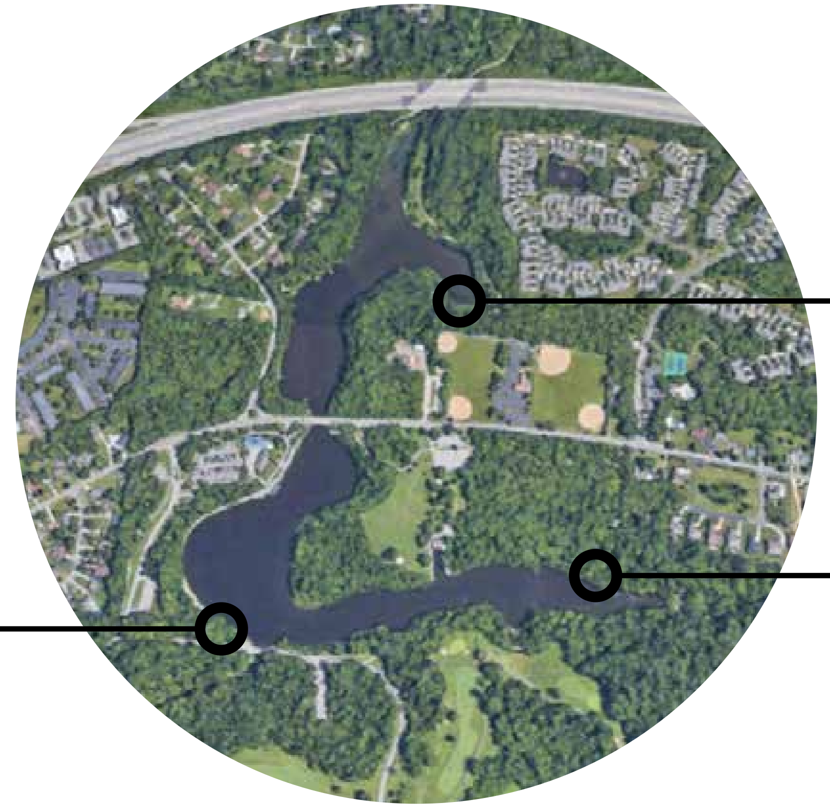
Negative = -2
Neutral or minimal = 0
Positive = 2

In order to make comparisons between the various alternatives, it was necessary to introduce certain assumptions into the evaluation 1) Dozer: Used at deposition site for dispersing material. May also be used in the lake for dry dredging. Crane: Used at the lake for mechanical and hydraulic dredging to place and remove the boats and barges into and out of the water. Dewatering Equipment: Used to separate excess water from dredge material. May consist of pumps, filter fabric, sand bags, gravel berms, etc. 2) Due to the existing weirs, the dredge boat, barges, excavators, etc. cannot access the entire lake continuously and will require removal and re-launching from several locations. Construction access drives, haul roads, lake access/launching locations will likely be similar among the various alternatives. 3) Scores are qualitative measurements of the alternatives relative to each other and to the purpose and need of the project.

BIGGER PICTURE

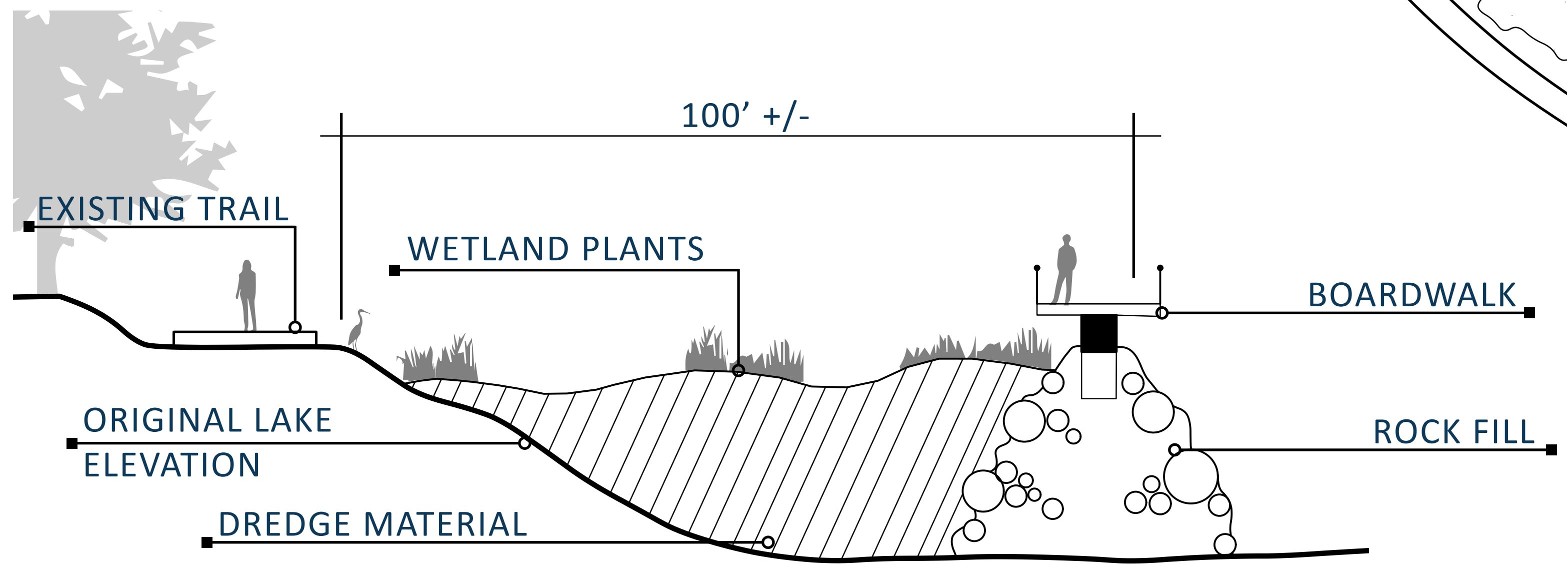
CONCEPTS FOR FUTURE PARK ENHANCEMENTS

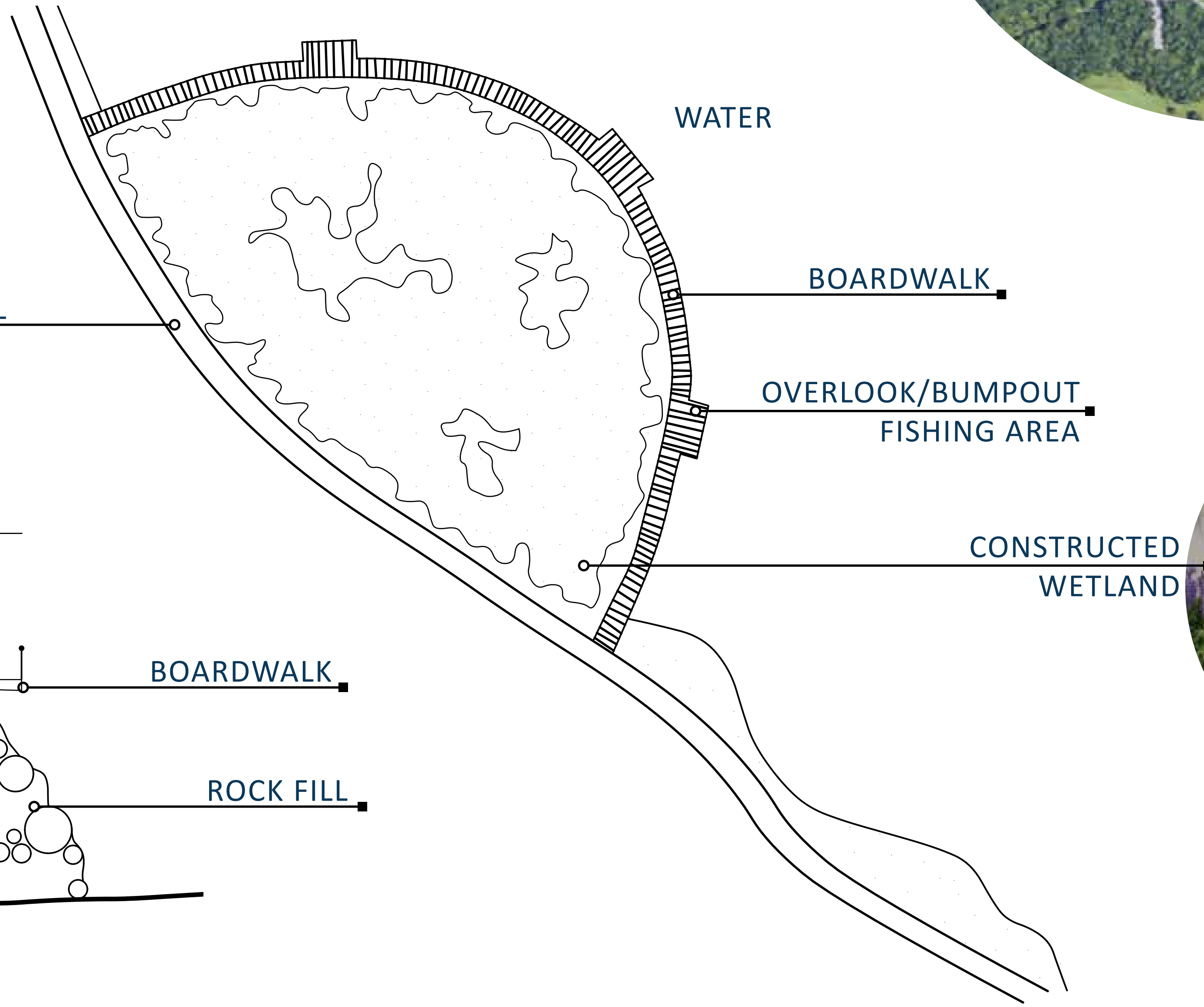
By applying creative and strategic thinking to the dredging process, Great Parks of Hamilton County can enhance the park while improving natural habitats and recreational amenities. Removing lake sediment is the primary goal, however the overall value of the park can be stimulated as a result of the dredging project.



FISHING PIER

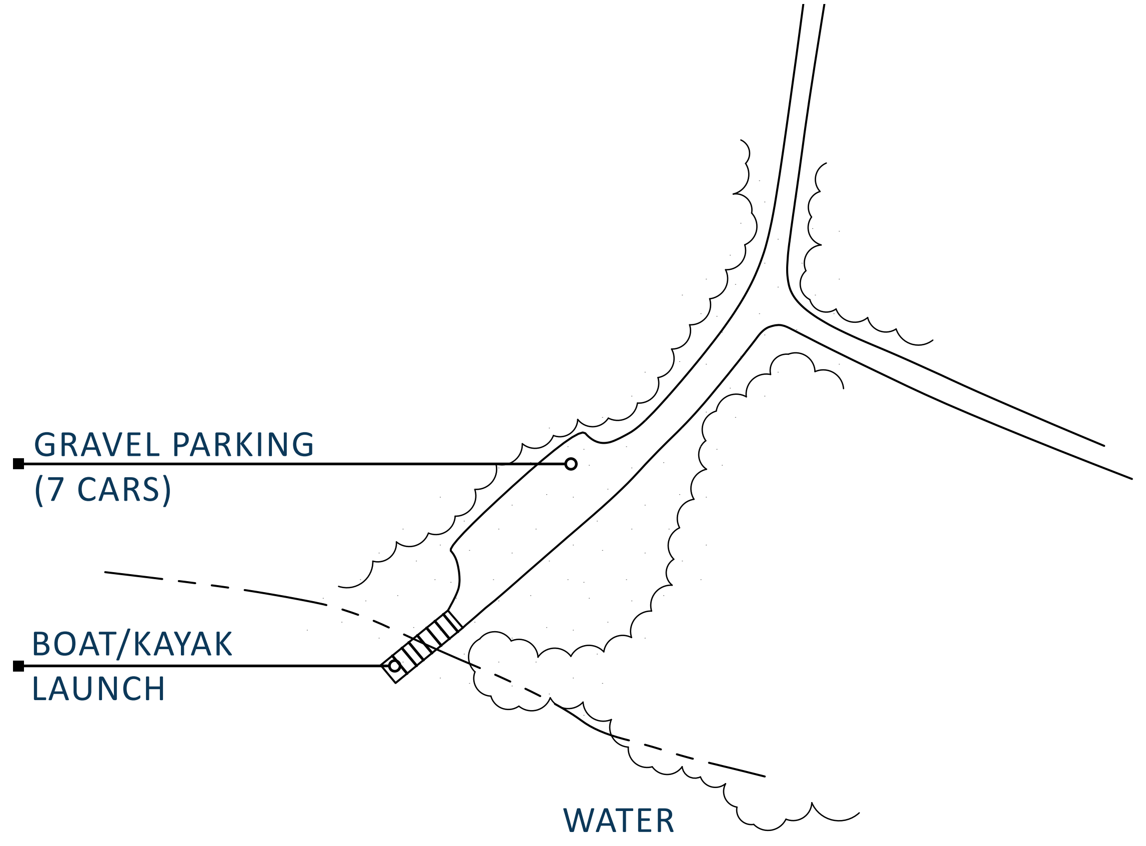
A boardwalk built off the existing trail creates a safe place for fishing. Dredge material can be used to create a sediment wetland, creating a buffer between the existing trail and fishing while increasing wildlife habitat.





KAYAK LAUNCH WITH ACCESS DRIVE AND PARKING

Temporary access drive used for dredging can be converted to permanent lake access with parking and a boat/kayak launch.



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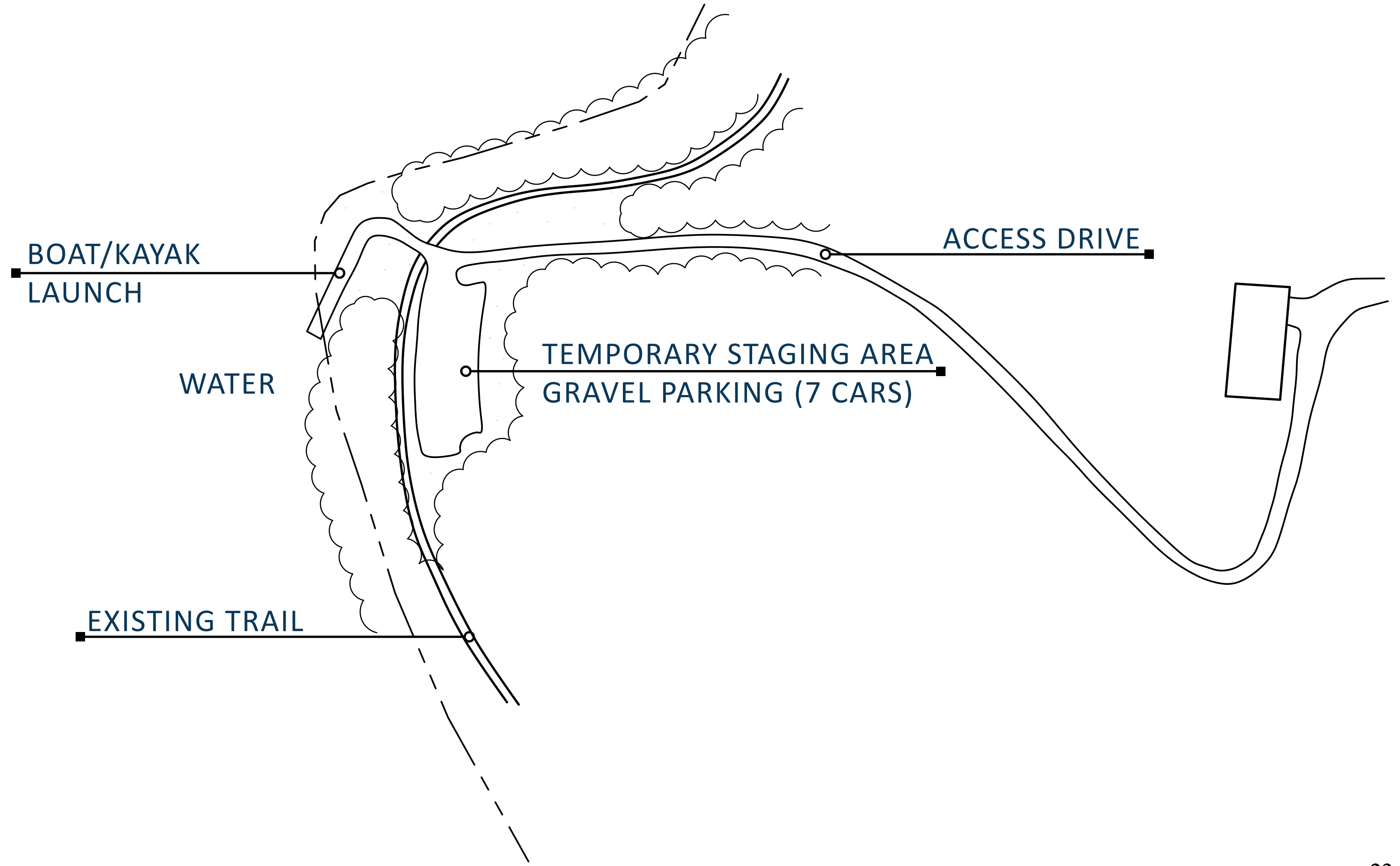

RESULTS AND RECOMMENDATIONS

DREDGING OPTION

The Evaluation of the various dredging alternatives was based on multiple criteria. Scores were developed to reflect each alternative's independent performance against those criteria. Criteria that were assessed included:

● **Physical Requirements of the Dredging Operation**
What physical assets were needed to complete the work

● **Environmental Permitting**
Would any permitting be required, and how would the need to seek those permits effect the work

● **Schedule**
How quickly could the work be completed and how much control would the owner or contractor have over various schedule variances

● **Ecological Impacts**
What kinds and what magnitude of ecological impact could be anticipated

● **Cost**
Overall cost of the design, dredging, and disposition of the sediment

● **Community Impact**
What impact would the dredging alternative have on public use of the park

● **Indirect Impacts**
What potential ancillary or otherwise unforeseen impacts (positive or negative) may result from the specific dredging alternative

● **Funding Potential**
Could additional funding support be gathered to help fund the specific dredging alternative

Environmental Design Group recommends the dry dredging method based on its performance against criteria established per the analysis. This alternative scored highest of all, weighing the benefits with the constraints. By draining the lake and dry dredging the accumulated sediment, the operator can use conventional excavation equipment to achieve a stronger visual of the final contours. This will also facilitate the evaluation of the stability of the banks of the lake and the hillsides above the slope. It also boasts the ability to remove a greater amount of dredge material in less time than the alternatives. The efficiency of the project also reduces the overall cost.

The primary concern of this method is the impact on both recreational activities and flora and fauna diversity. However, due to the current high levels of sediment and the domination of certain less desirable species, these values are at a greater risk with the no-action/ no-build alternative.