AGENDA REPORT

To: Mayor Pat Humphrey and the Clare City Commission
From: Ken Hibl, City Manager
Date: November 17, 2016
Regarding: City Manager's Report

For the Agenda of November 21, 2016

Clare Chamber of Commerce Grant. The Clare Area Chamber of Commerce applied for and received an international grant award for the advancement of the arts in Clare – in particular with the Art Alley Project.

City Hall Closure. City offices will be closed on Nov 24th & 25th for the Thanksgiving Holidays.

Planning Commission. The Commission will convene a special meeting on Wednesday, November 30th to consider a request for a change of zoning of the former Beard Property from Residential to Commercial for use as an Events Center. The request will be scheduled for consideration by the City Commission on Dec 5th (1st Reading of Ordinance Change) and Dec 19th (2nd Reading).

Lake Board Meeting. Due to a scheduling conflict, the Lake Board meeting originally scheduled for Nov 14th was rescheduled for Nov 21st at 7pm. A public notice (copy att'd) regarding the meeting was published and postcard mailings to all Lake Shamrock residents has been completed. A copy of the Engineering Study is attached for information.

Absence. I will be attending an MML insurance conference in Plymouth on Dec 1st & 2nd; I will subsequently be out of the state on vacation thru Dec 13th. Steve will be the Acting CM during my vacation period.

Attachments.

1. Public Notice.
2. Lake Shamrock Engineer Study.

PUBLIC NOTICE

The Lake Shamrock Improvement Board will convene on Monday, Nov 21, 2016 @ 7pm @ the Pere Marquette District Library, 185 East 4th Street, Clare, MI. The primary purpose of the meeting is to receive the Engineer Report for the Feasibility Study and Preliminary Cost Options to dredge Lake Shamrock and make a determination whether to proceed with the process to establish an assessment district to finance a dredging project. All Lake Shamrock residents and other interested parties are welcome and encouraged to attend.

Dredging Feasibility

Lake Shamrock
Preliminary Dredging Feasibility Study

Prepared for:
Lake Shamrock Improvement Board
202 West Fifth Street
Clare, MI 48617

Prepared by:
Progressive AE
1811 4 Mile Road, NE
Grand Rapids, MI 49525-2442
616/361-2664

November 2016

Project No: 51946001

progressive|ae

Lake Shamrock
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Introduction

In 2016, the Lake Shamrock Improvement Board retained Progressive AE to conduct a preliminary feasibility study of dredging Lake Shamrock. As part of the study, historical data available for Lake Shamrock were reviewed, the lake bottom was mapped, sediment samples were collected and analyzed, and evaluations were made of various dredging alternatives. For each dredging alternative, estimates of probable construction costs were developed and alternatives to organize and finance a dredging project on Lake Shamrock were evaluated. This report contains a summary of study findings, conclusions, and recommendations.

Lake Shamrock is located in the City of Clare in Clare County, Michigan (T17N, R4W). The lake was formed in the early 1960s via the construction of a dam that impounded the waters of the South Branch Tobacco River. Prior to the construction of the dam, much of what is now bottomland in Lake Shamrock appears to have been low-lying wetlands (Figure 1).

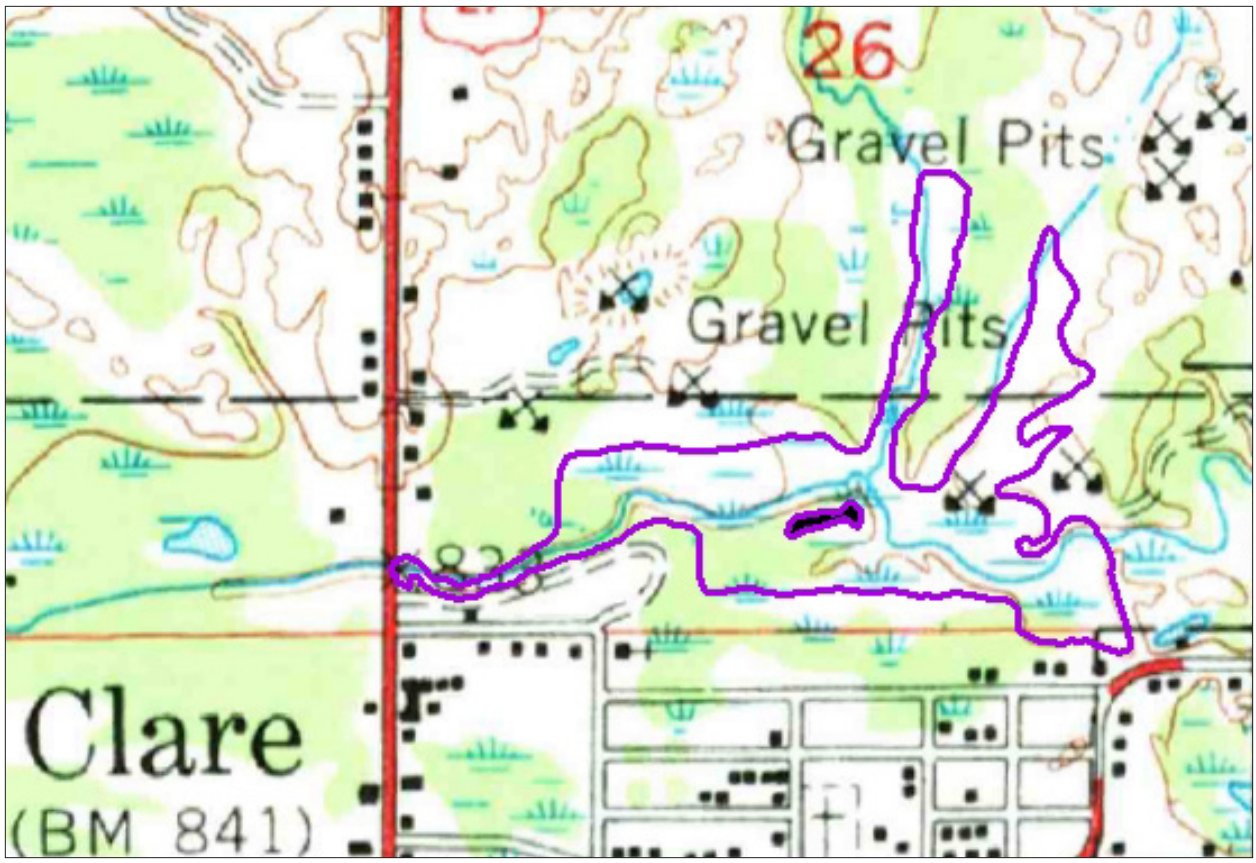


Figure 1. South Branch Tobacco River, 1958. Present-day shoreline of Lake Shamrock is shown in purple.

The dam that exists today on Lake Shamrock was constructed in 1963 (Figure 2). The current dam has approximately 11 feet of head and a three-foot of drawdown potential with all stop logs raised (Lapham Associates 2011). In 1965, a circuit court judgement required that the level of Lake Shamrock not exceed 823 feet above sea level.

Figure 2. Lake Shamrock dam.

Depths in Lake Shamrock were first mapped by the Michigan Department of Conservation in 1964 (Figure 3). In 1964, much of the bottom of Lake Shamrock was sand.

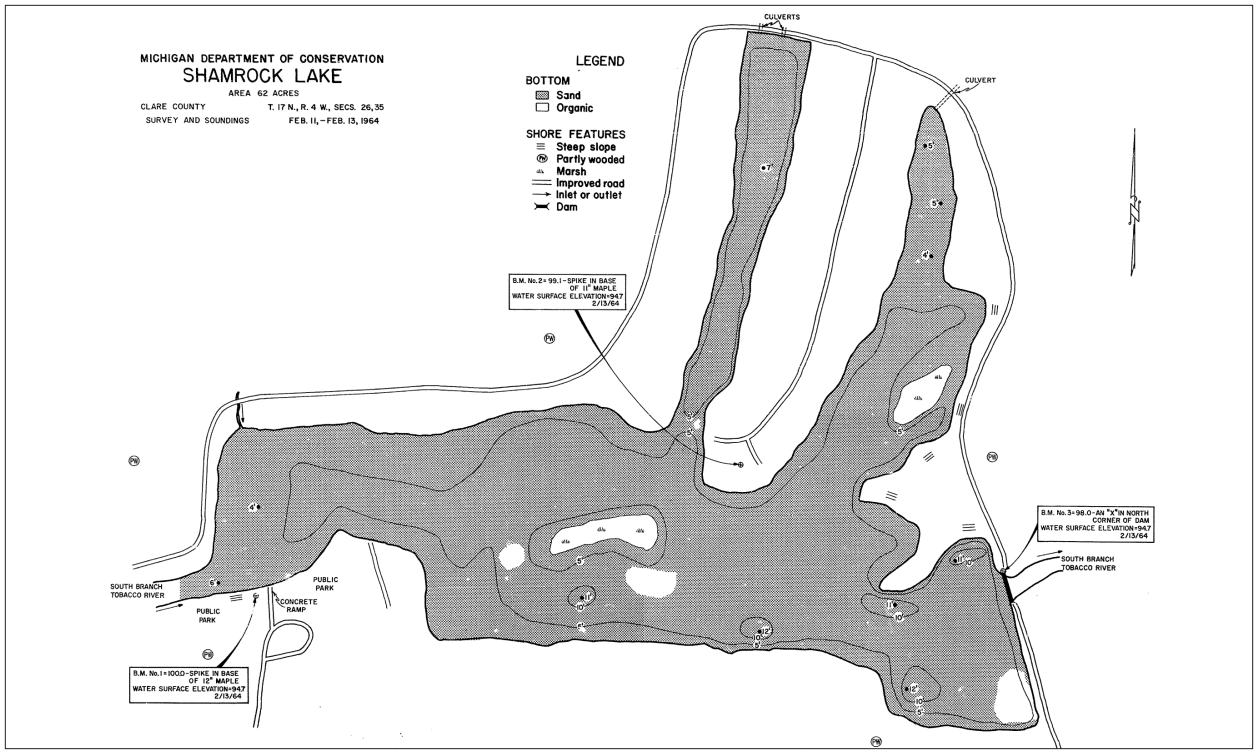


Figure 3. Lake Shamrock, 1964.

Hydro-acoustic soundings of the lake bottom conducted in April of 2016 were used to create an updated depth contour map of Lake Shamrock (Figure 4).

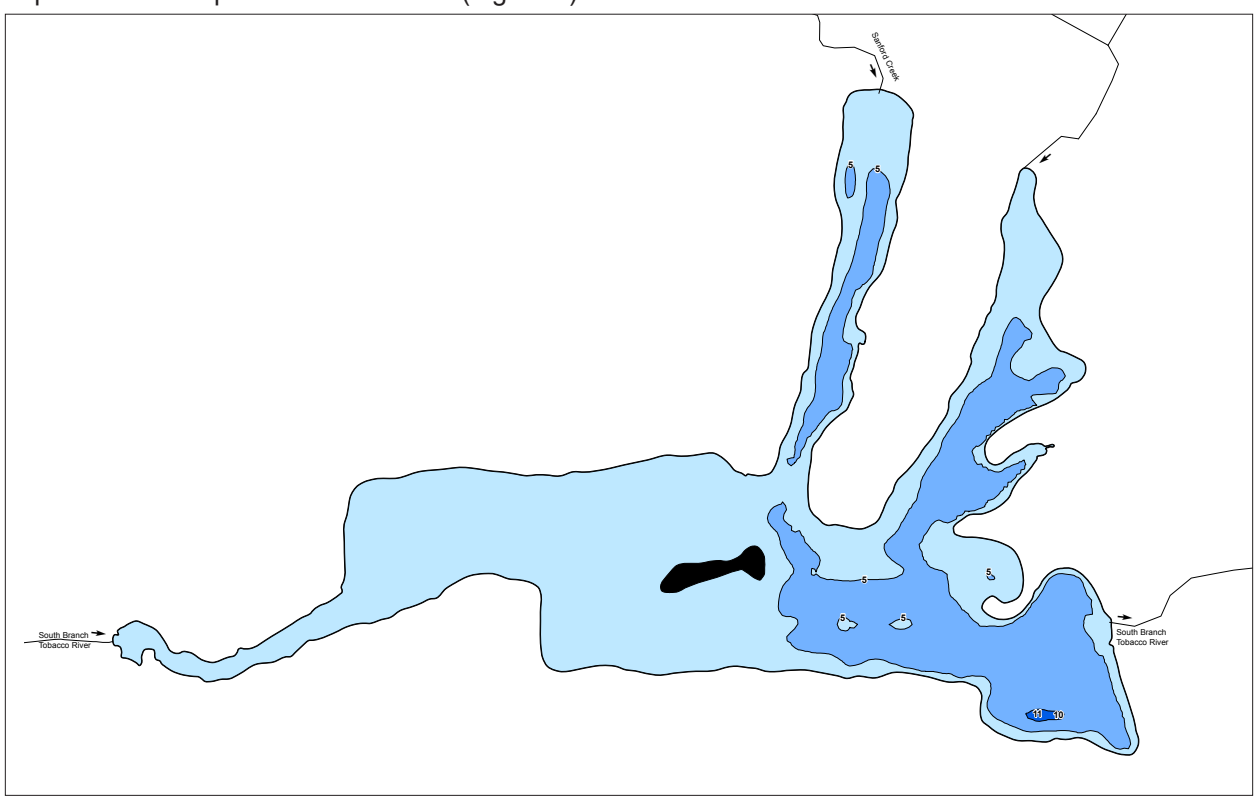


Figure 4. Lake Shamrock, 2016.

When comparing the original 1964 map with the recent depth map, it is apparent that that much of the west end of Lake Shamrock has filled in since the lake was originally mapped in 1964 (Figure 5).

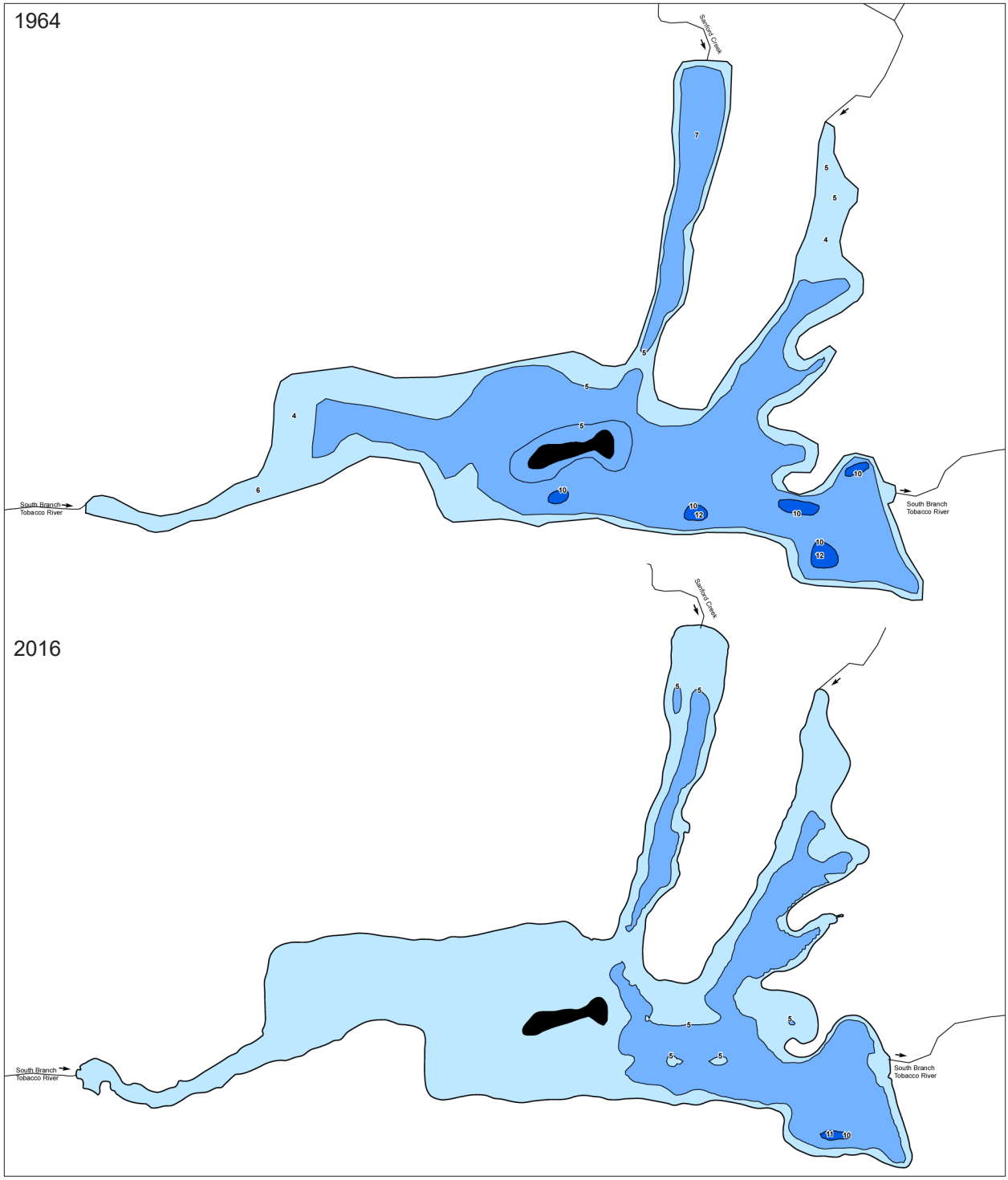


Figure 5. Lake Shamrock 1964 (top) v 2016 (bottom).

At the west end of the lake, sediment that is normally carried by the river is deposited in the lake as the water velocity at the river mouth slows. Sediment deposition is far more evident at the west end of the lake compared to other portions of the lake (Figure 6).

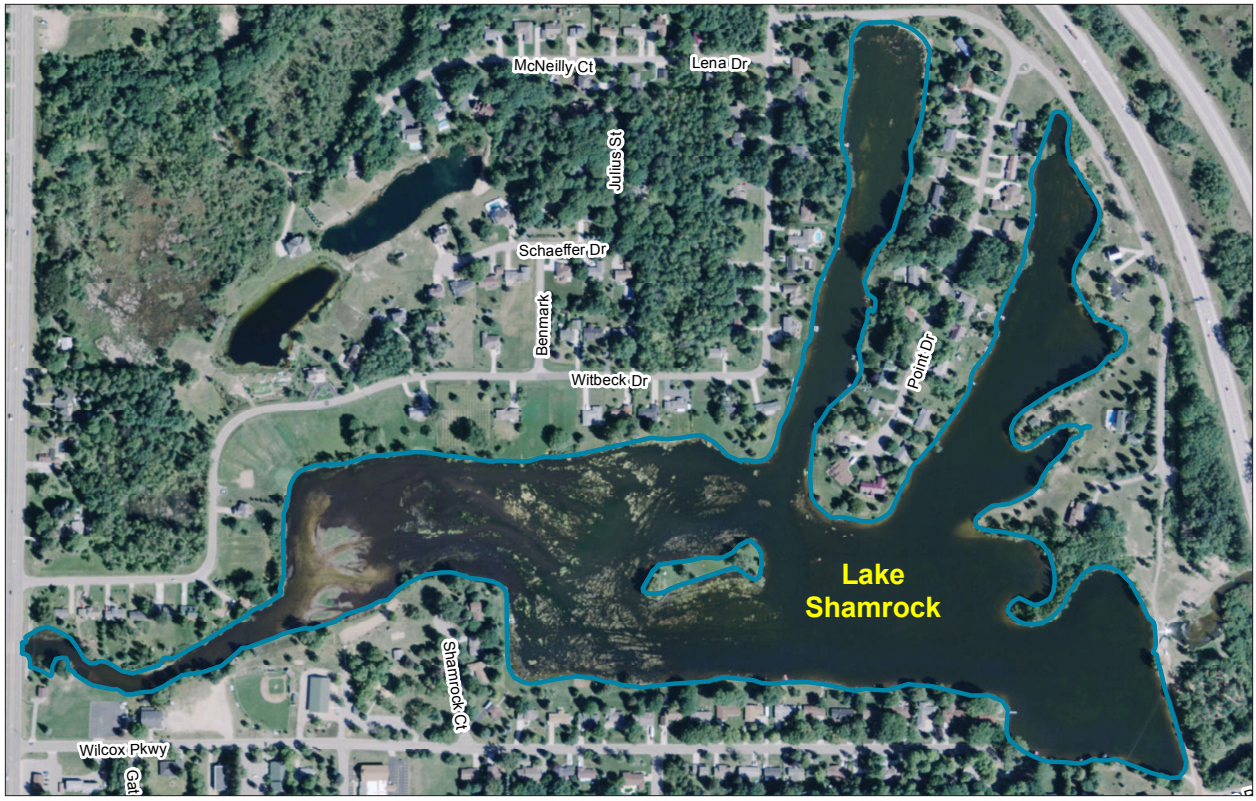


Figure 6. Lake Shamrock west end, aerial view.

Currently, shallow-water conditions at the west end of the lake severely limit navigation and recreational use and enjoyment of the lake (Figure 7).

Figure 7. Lake Shamrock west end.

Since the lake was first mapped, Lake Shamrock has lost about 25% of its volume (Table 1).

TABLE 1
LAKE SHAMROCK PHYSICAL CHARACTERISTICS 1964 AND 2016[1]

	1964	2016
Lake surface area (acres)	61	65
Maximum depth (feet)	12	11
Average depth (feet)	5	3.5
Lake volume (acre-feet)	310	231

Cross sections of the lake that depict the quantity of material that would need to be removed to restore original lake depths are shown in Figure 8.

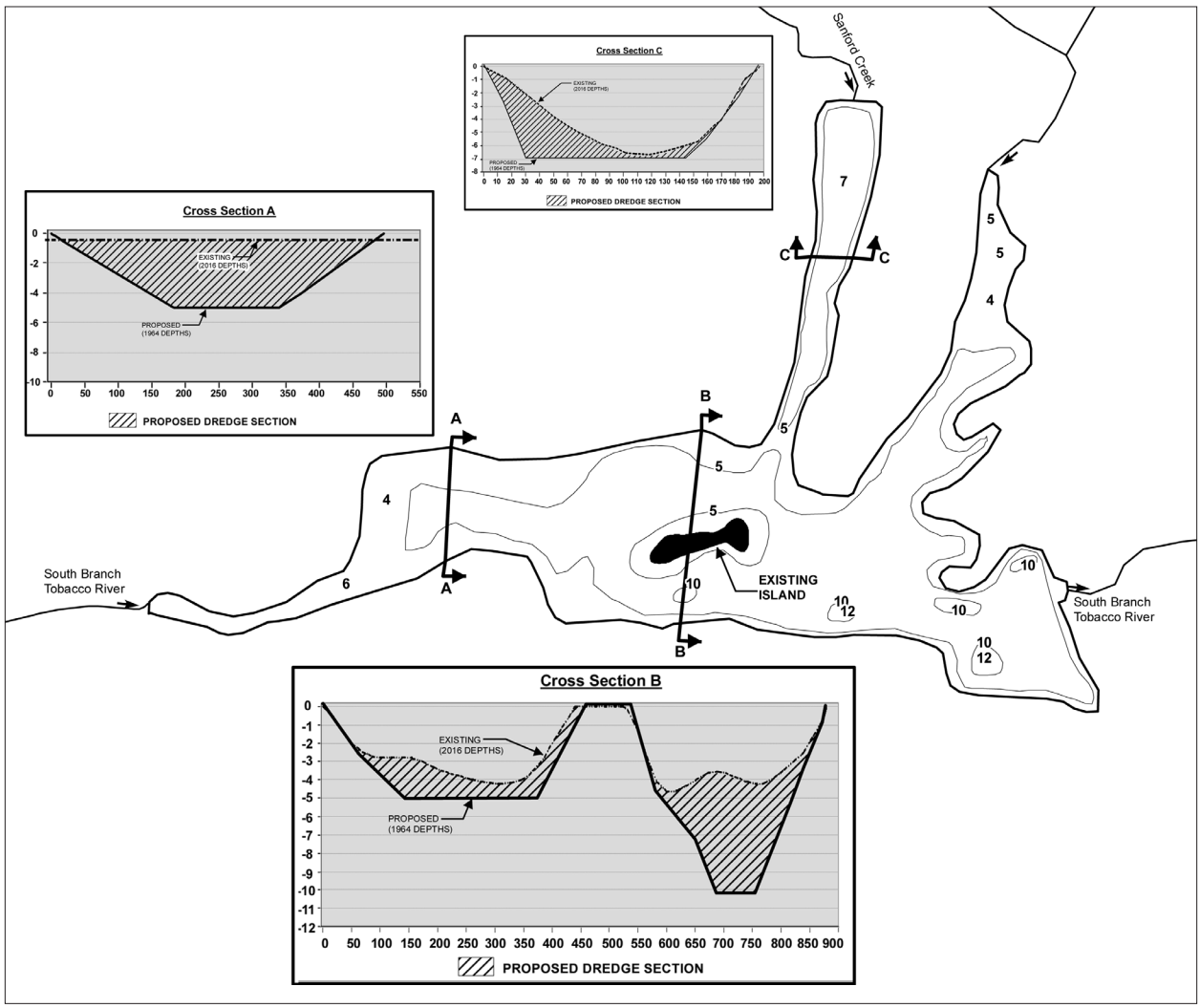


Figure 8. Lake Shamrock cross-sections.

1 Volume calculated using conical frustrum method.

In total, to return the lake to its original depths and volume, approximately 127,500 cubic yards of sediment would need to be dredged from the lake. Sediment samples collected during the course of study indicate that the sediment at the west end of the lake was composed primarily of silt and, to a lesser extent, organic material and sand. In the northwest and northeast arms of the lake, sand was more prevalent. Sediment testing results are included in the appendix.

TABLE 2
LAKE SHAMROCK SEDIMENT TEST RESULTS

	% Silt	% Organics	% Sand
West End 1	55%	17%	28%
West End 2	72%	8%	20%
Northwest Arm	22%	21%	57%
Northeast Arm	4%	0%	96%

Lake Dredging

DREDGING METHODS

There are two major dredging methods: mechanical and hydraulic. While both methods involve removing sediment from the water, the operations are quite different. Mechanical dredging involves removing lake sediments with an excavator operating from shore or from a floating barge (Figure 9).

Figure 9. Mechanical excavator.

Dredged material is disposed of on shore or contained on the barge and off-loaded for final disposal. By contrast, material excavated with a hydraulic dredge is pumped in a slurry through a floating pipeline to the point of disposal (Figure 10).

Figure 10. Hydraulic dredge.

DISPOSAL OF SEDIMENTS

Since placing dredged materials on shoreline properties is generally not feasible, a primary consideration in a lake dredging project is identifying a suitable location (or locations) for the placement of dredged material. With mechanical dredging operations, dredged materials are often trucked to the disposal site. With hydraulic dredging, disposal sites are usually constructed by excavating an area and creating an earthen dike to contain the dredged slurry (Figure 11). The disposal cell must be adequately sized to accommodate the amount of dredged material and water produced during the dredging operation. The disposal cell should be designed to maximize the settling of solids while allowing excess water to drain off-site.

Figure 11. Dredge material disposal cell.

Another method of disposal that has gained popularity in recent years is to pump dredged materials into sealed, geotextile tubes (Figure 12). The tubes are filled with dredged materials and excess water percolates though the geotextile fabric walls and can be routed off-site.

Figure 12. Geotextile tubes for disposal of dredged material.

PERMITTING

Pursuant to provisions of Part 301 (Inland Lakes and Streams) of Michigan's Natural Resource and Environmental Protection Act, a permit must be acquired from the Department of Environmental Quality (DEQ) before a dredging project on an inland lake can be initiated. As part of the approval process, DEQ may require that sediments be sampled for contaminants. Permit conditions will generally require that the dredge disposal site be located in an upland location and that steps be taken during the dredging operation to prevent excessive sediment transport to adjacent areas. The DEQ does not typically allow dredge spoils to be placed in wetland areas. As a condition of the permit, the DEQ may limit the timing of dredge operations to minimize impacts upon spawning fish and other aquatic animals.

Lake Shamrock Dredging Alternatives

DISPOSAL

As indicated above, locating a suitable dredge material disposal site is an important component in evaluating a dredging project. In terms of physical attributes, an optimum disposal site would be a relatively flat, non-wetland (i.e., "upland") area in close proximity to the lake and large enough to accommodate dredged material. In evaluating potentially suitable sites, state-designated wetlands areas around Lake Shamrock were mapped (Figure 13).

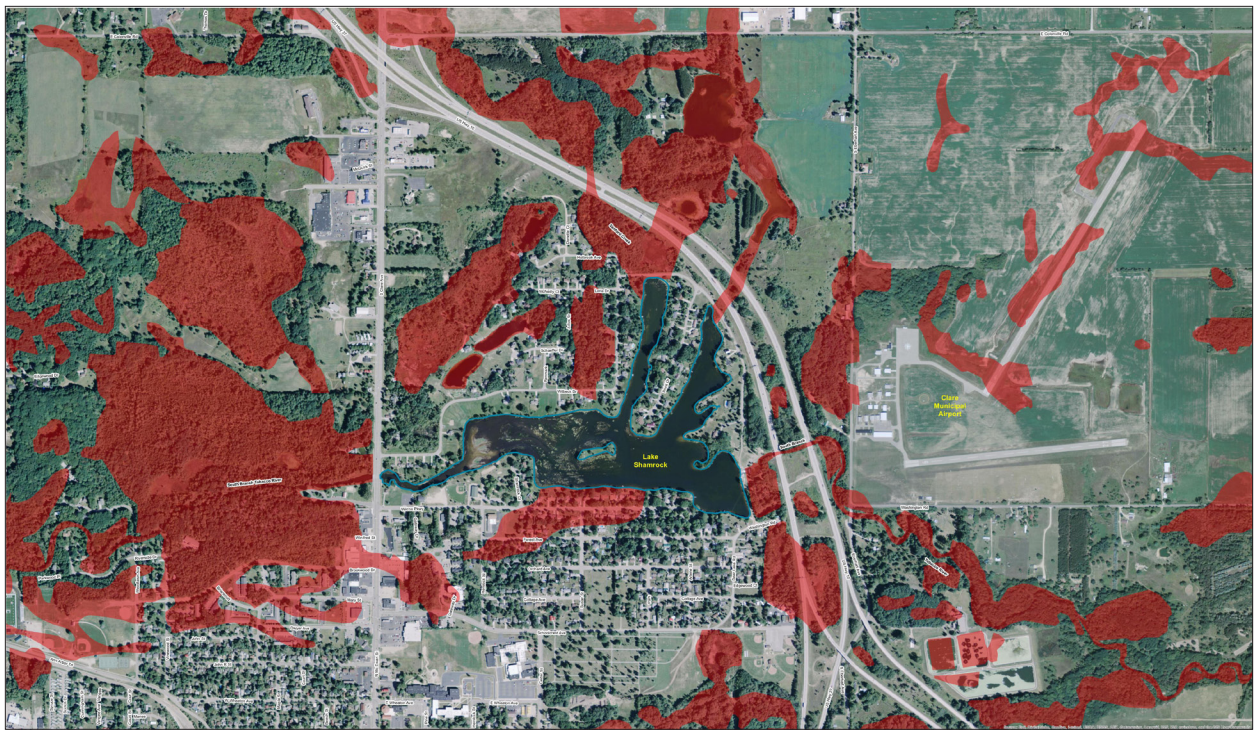


Figure 13. Lake Shamrock area wetlands map. Dredged sediments cannot be placed in wetlands.

In viewing potential non-wetland disposal site areas near Lake Shamrock, portions of the Clare Municipal Airport met the above criteria. Taking into account mandatory runway setbacks and height restrictions, two areas at the airport comprising a total of approximately 30 acres appear suitable for the placement of dredged material (Figure 14). Depending on the dredging alternative employed, 20 to 30 acres of disposal area would be needed to accommodate the quantity of material (127,500 cubic yards) that would need to be dredged to restore Lake Shamrock to its original depth.

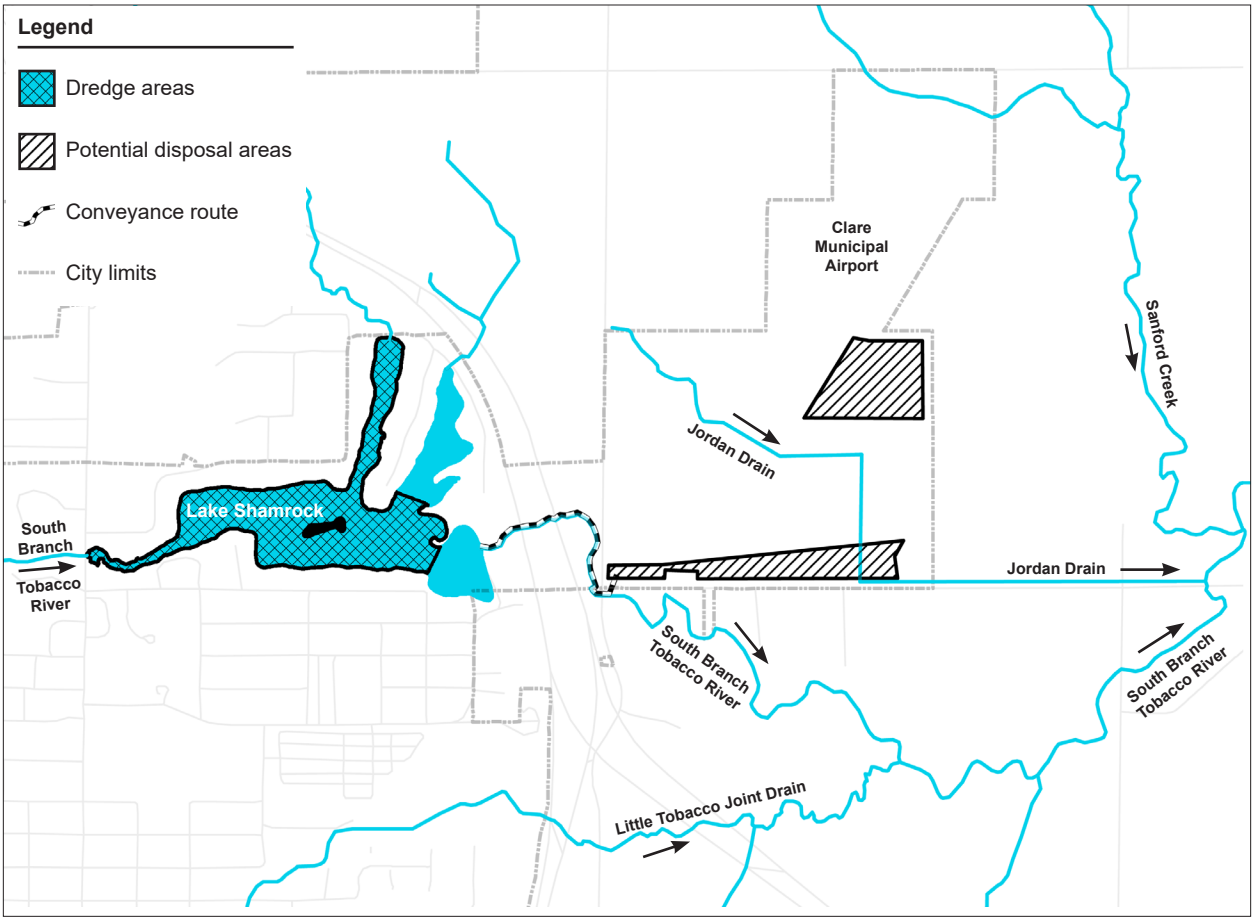


Figure 14. Hydraulic dredging schematic site plan.

ALTERNATIVE 1: HYDRAULIC DREDGING WITH GEOTEXTILE TUBE DISPOSAL

Dredged material would be pumped in a slurry through a pipeline down the South Branch Tobacco River to the airport (Figure 14). Sediment would be dewatered and disposed of in geotextile tubes. Water expelled from the geotextile tubes would be conveyed in constructed drainage swales to the Jordan Drain and ultimately back to the South Branch Tobacco River downstream of the airport. To ensure proper drainage, this approach would require a clean-out of the Jordan Drain. To facilitate compaction, coagulants would need to be added to the dredge slurry and the geotextile bags would need to be manually agitated on a regular basis to help water leach out. Final restoration of the site would require that the geotextile bags be removed once the dredging operation is complete to allow final grading and seeding of disposal areas.

ALTERNATIVE 2: HYDRAULIC DREDGING WITH OPEN HOLDING CELL DISPOSAL

Dredged material would be pumped in a slurry through a pipeline down the South Branch Tobacco River to the airport and sediment would be disposed of in open holding cells (Figure 14). This approach would require considerable earthwork at the airport to construct the holding cells and could require a re-routing of the Jordan Drain in addition to a drain clean-out. As with the previous alternative, water exiting the holding cells would be conveyed to the Jordan Drain and back to the South Branch Tobacco River downstream of the airport or discharged directly to the South Branch Tobacco River. Once the disposal cells had dewatered and dried sufficiently, the site could be final-graded and seeded. A concern with this approach is that standing water in the dredge material holding cells could attract birds and create a safety hazard for aircraft.

ALTERNATIVE 3: MECHANICAL DREDGING WITH TRUCKING OF DREDGED MATERIAL

This alternative would involve use of a mechanical excavator on a floating barge. Dredge material would be placed on the barge and transported to shore to be off-loaded into dump trucks. Dredge material would then be trucked to the airport and a bull dozer would be used to spread the material. A staging area would need to be established on the lake where dredged sediment could be continuously off-loaded. This approach would require repeated trips to shore to off-load sediment and daily trucking of material to the airport. Given the quantity of material that would need to be dredged, it is estimated that dredging operations would take five years to complete.

Practical Considerations

It is important to note that no dredging alternative is without challenges. Regardless of the dredging approach, lake dredging is inherently complex and problems will arise. In developing cost estimates for dredging work, significant contingency funds should be allotted to address unforeseen circumstances that will invariably arise during dredging operations.

During the dredging operation, boating and other activities on the lake will be impeded. For example, with all three dredging alternatives, sediment curtains would be placed in strategic locations in the lake during dredging operations to minimize downstream sediment transport. In addition, construction-related activities such as mobilizing and de-mobilizing equipment and day-to-day dredging operations will likely create localized inconveniences to area property owners, especially adjacent to equipment staging areas.

Hydraulic dredges are designed to remove relatively soft, submerged bottom sediments. Given that much of the sediment at the west end of Lake Shamrock is exposed at the surface and strewn with logs and other debris, a hydraulic dredge may need to be augmented with a mechanical dredge to facilitate removal of material. This could significantly increase costs and slow the dredging operation.

While dredging would improve navigation and enhance recreational use, dredging Lake Shamrock will not be a cure-all. In future years, maintenance dredging will likely be required as sediment begins to naturally deposit and re-accumulate in the lake. Also, aquatic plants can grow to depths of up to about 15 feet, and it is not economically feasible to dredge Lake Shamrock to this depth. Thus, efforts to control nuisance plant growth in Lake Shamrock will likely still be required after dredging although not to the extent experienced in recent years.

Estimates of Probable Costs

Estimates of probable costs for each dredging alternative are provided in Tables 3 through 5.

TABLE 3
LAKE SHAMROCK ESTIMATE OF PROBABLE COST
ALTERNATIVE 1: HYDRAULIC DREDGING WITH GEOTEXTILE TUBE DISPOSAL

Component	Probable Cost
Hydraulic Dredging (Dredge Operation, Piping, Booster Pump)	$1,500,000
Disposal Geotextile Tubes	$2,500,000
Engineering/Administration/Contingency (10%)	$400,000
Total	$4,400,000

TABLE 4
LAKE SHAMROCK ESTIMATE OF PROBABLE COST
ALTERNATIVE 2: HYDRAULIC DREDGING WITH OPEN HOLDING CELL DISPOSAL

Component	Probable Cost
Hydraulic Dredging (Dredge Operation, Piping, Booster Pump)	$1,500,000
Open Cell Disposal	$1,100,000
Engineering/Administration/Contingency (10%)	$260,000
Total	$2,860,000

TABLE 5
LAKE SHAMROCK ESTIMATE OF PROBABLE COST
ALTERNATIVE 3: MECHANICAL DREDGING WITH TRUCKING OF DREDGED MATERIAL

Component	Probable Cost
Dredging and Disposal	
Equipment	$476,000
Labor	$517,000
Dredging and Disposal Subtotal	$993,000
Engineering/Administration/Contingency (25%)	$248,250
Total	$1,241,250

Project Financing

The Lake Shamrock Improvement Board was established in accordance with provisions of Part 309 (Inland Lake Improvements) of the Natural Resources and Environmental Protection Act, PA 451 of 1994, as amended. Under this statute, the Lake Shamrock Improvement Board has established a special assessment district that includes all properties that border the lake. Currently, there are 100 parcels within the special assessment district and assessments are apportioned equally against each parcel in the assessment district. A breakdown of costs for each dredging alternative based on this approach is provided in Table 6.

TABLE 6
LAKE SHAMROCK DREDGING ALTERNATIVES APPROXIMATE ASSESSMENTS

Dredge Alternative	Cost	Total Parcel Assessment	Annual Assessment (5 Years)
Alternative 1	$4,400,000	$44,000	$8,800
Alternative 2	$2,860,000	$28,600	$5,720
Alternative 3	$1,241,250	$12,412	$2,482

Recommendations

Given cost and operational considerations, it is recommended that the community give consideration to Alternative 3, mechanical dredging and trucking of material. While this dredging approach would take longer to construct, it would be far less costly than the other dredging alternatives. In addition, Alternative 3 would address potential issues related to sediment debris and provide a mechanism for long-term maintenance dredging. Assuming there is support for Alternative 3, an application for permit should be submitted to the Michigan Department of Environmental so that the permit review process can begin.

At this time, it is recommended that study findings be disseminated to lake residents and that a public presentation of study findings and recommendations be made. The lake board may wish to consider polling of property owners within the special assessment district to determine if there is support to proceed with a dredging project on Lake Shamrock. If there is support for a project, the lake board can consider initiating formal special assessment proceedings in accordance with Part 309. Under these procedures, all lake residents would receive written notice and public hearings would be held on the practicability of the project and the special assessment roll.

References

Lapham Associates 2011. Shamrock Lake Dam Safety Inspection Report. Dam Identification No.: 00622. City of Clare, Clare County, MI. Project No.: E110160.

Appendix
Material Testing Consultants:
Lake Shamrock Sediment Testing Results

Materials Testing Consultants
www.mtc-test.com • 800.968.8378

Project No: 161071
Report Date: 05/06/16
Report No: 67146

Project: Lake Shamrock
Client: Progressive AE
Contractor:
Engineer/Architect:

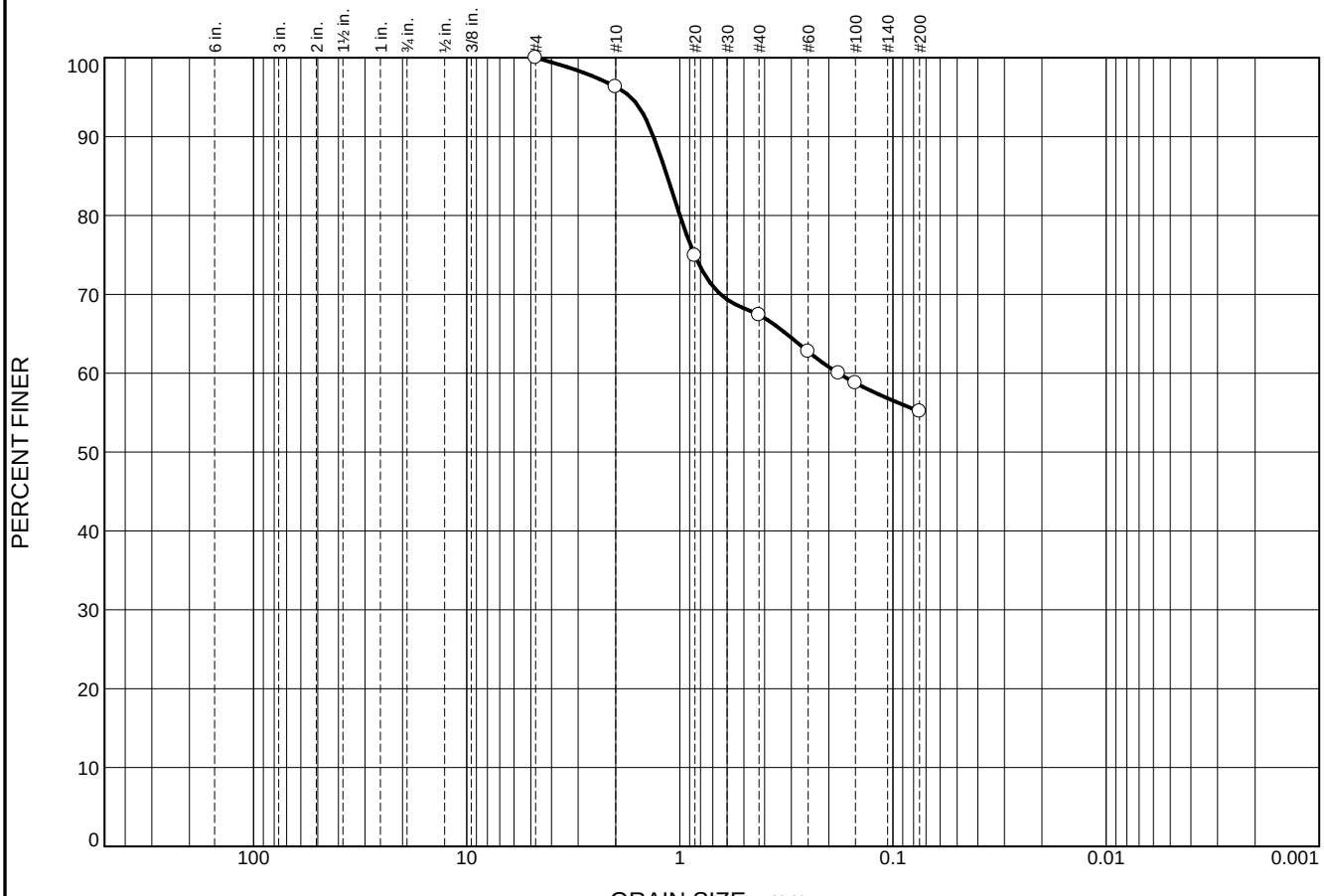
TRANSMITTAL

Remarks: Please find attached the following reports:
Reports of Particle Size Distribution and Organic Content dated 05-06-2016

05/06/2016
Timothy J. Lautenbach, P.E.

Testing was performed by qualified personnel in accordance with generally accepted industry practice, Material Testing Consultants procedures and the above referenced standards. This report is applicable only to the items listed herein. The tests performed and this report are not intended to be considered as any guarantee or warranty of suitability for service or fitness of use of items tested and it should not be relied on as such. This report has been prepared for the exclusive use of the client and any partial or whole reproduction without the consent of the client is prohibited.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	3.7	28.9	12.2	55.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.1471	0.1804						

Material Description	USCS	AASHTO
○ Dark Brown Organic Silt with Sand	OL	

Project No. 161071 **Client:** Progressive AE

Project: Lake Shamrock

○ **Location:** PT 123 **Sample Number:** 103516

Remarks:

○Organic Content - 16.6% per ASTM D2974

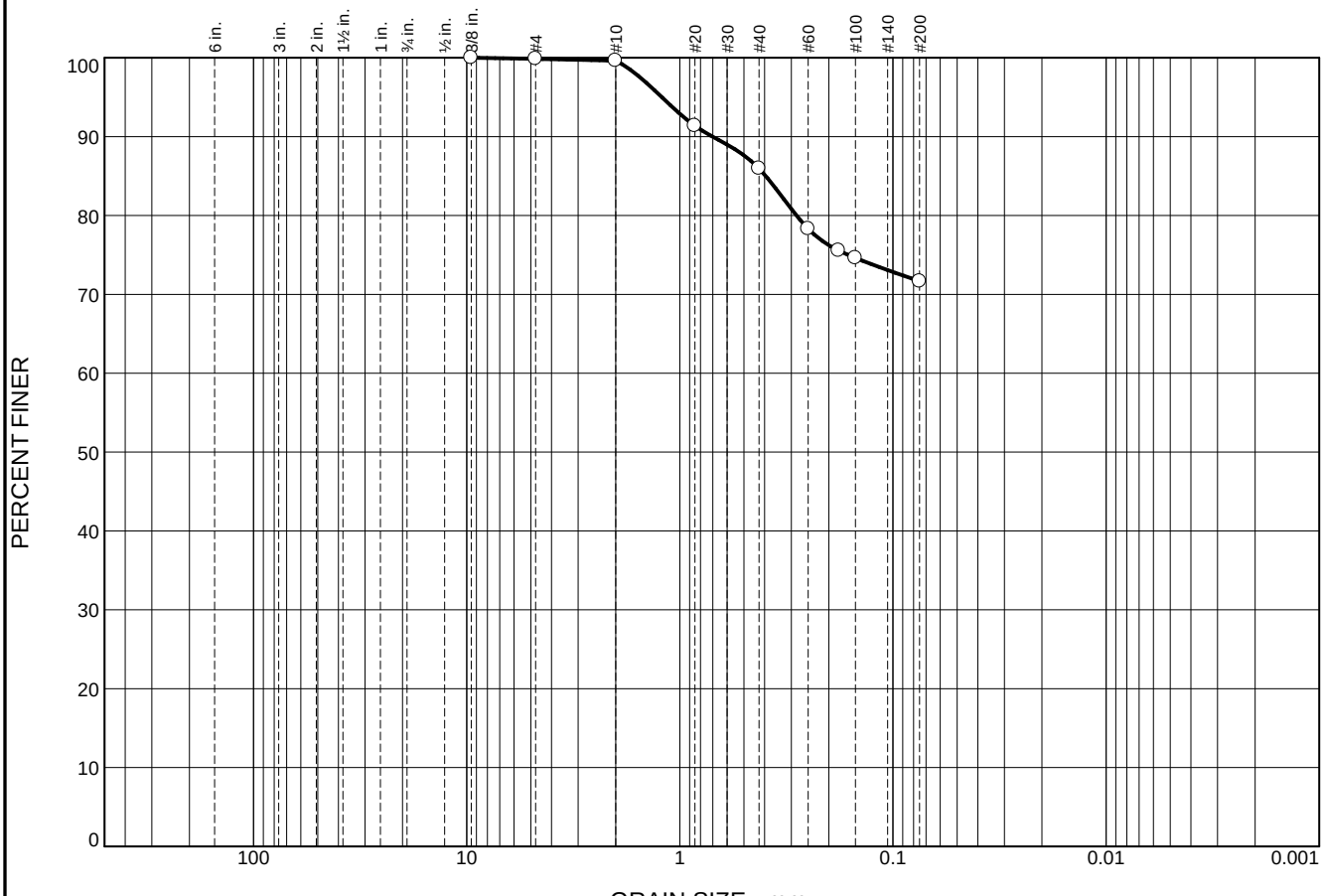
Fines Visually Classified

MATERIALS TESTING CONSULTANTS, INC.

Grand Rapids, MI

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.3	13.6	14.3	71.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3950							

Material Description	USCS	AASHTO
○ Gray Organic Silt with Sand	OL	

Project No. 161071 **Client:** Progressive AE

Project: Lake Shamrock

○ **Location:** PT 257 **Sample Number:** 103517

Remarks:

○Organic Content - 7.6% per ASTM D2974

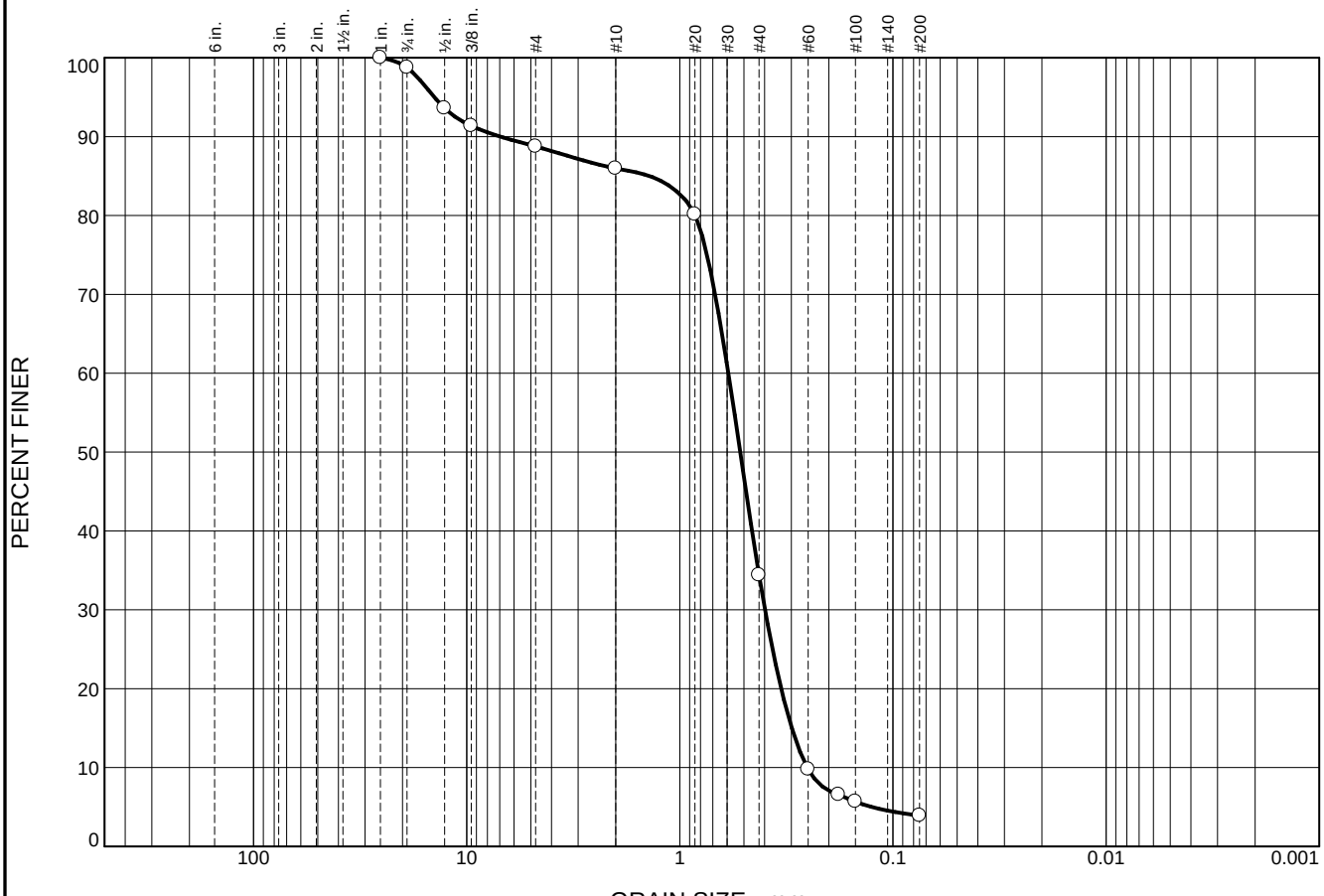
Fines Visually Classified

MATERIALS TESTING CONSULTANTS, INC.

Grand Rapids, MI

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	1.3	9.9	2.8	51.6	30.5	3.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3860	0.5919	0.5209	0.3983	0.2983	0.2526	1.06	2.34

Material Description	USCS	AASHTO
○ Gray Poorly Graded Sand	SP	

Project No. 161071 **Client:** Progressive AE

Project: Lake Shamrock

○ **Location:** PT 328 **Sample Number:** 103518

Remarks:

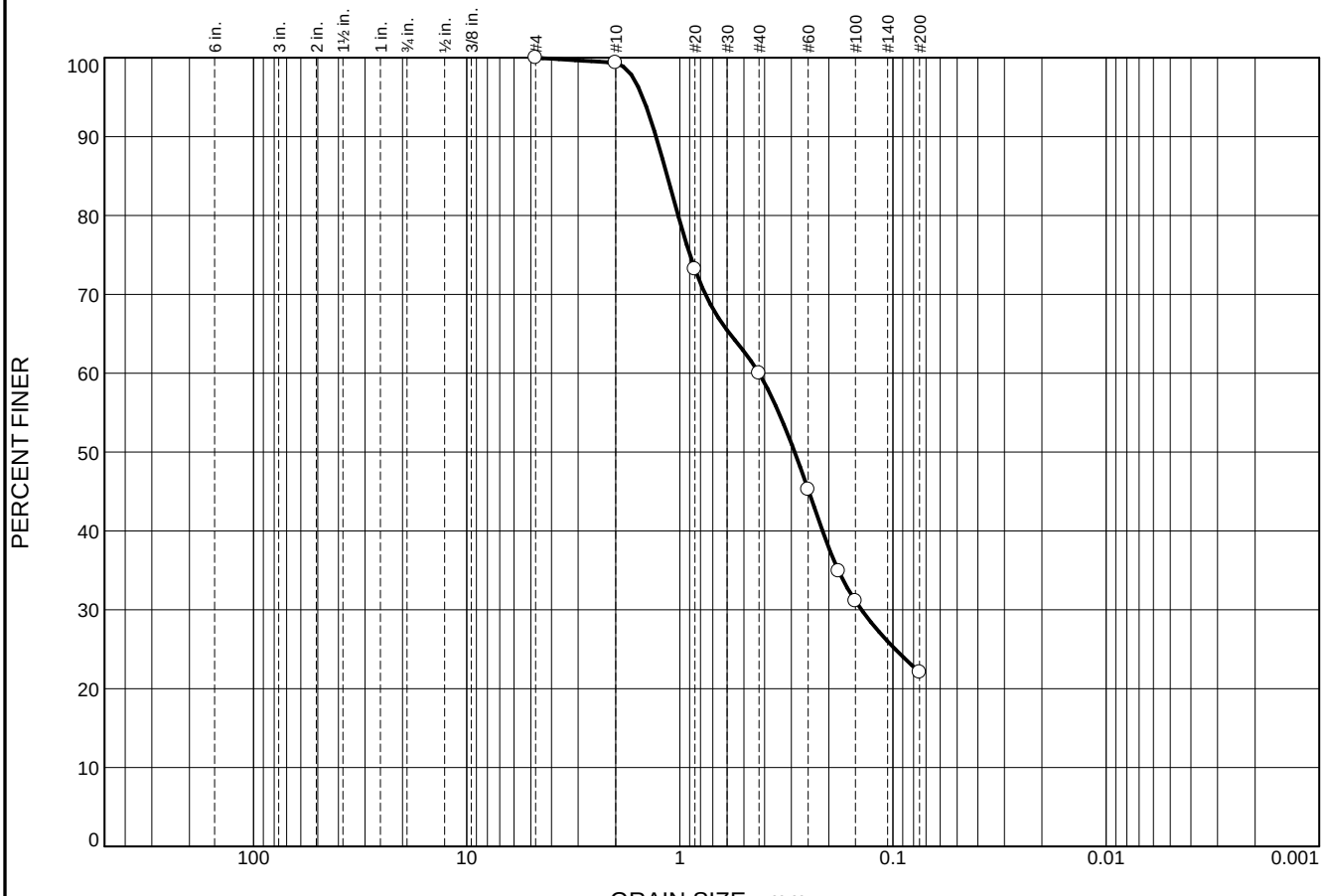
○Organic Content - 0.2% per ASTM D2974

MATERIALS TESTING CONSULTANTS, INC.

Grand Rapids, MI

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.6	39.4	37.9	22.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.1455	0.4251	0.2893	0.1404				

Material Description	USCS	AASHTO
○ Dark Brown Silty Sand	SM	

Project No. 161071 **Client:** Progressive AE

Project: Lake Shamrock

○ **Location:** PT 341 **Sample Number:** 103519

Remarks:

○Organic Content - 20.9% per ASTM D2974

Fines Visually Classified

MATERIALS TESTING CONSULTANTS, INC.

Grand Rapids, MI

Figure