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February 5, 2018

Ms. Karen Segars
City Administrator/City Clerk
City of Mountain Park
118 Lakeshore Drive
Roswell, GA 30075-1128

RE: ***Submission of Report: Identification of Sediment Removal Options and Costs for Lake Garrett, Mountain Park, Georgia***

Dear Ms. Segars:

Cardno is pleased to present the City of Mountain Park with 4 hard copies and one electronic copy of the report entitled, "Identification of Sediment Removal Options and Costs for Lake Garrett", dated February 5, 2018. This report provides a thorough summary of a series of sediment removal options and presents/discusses permitting, engineering, and planning considerations for each option. In addition, a cost summary for each option is provided. This report also provides a summary of peripheral factors, including a preliminary assessment of Lake Cherful, rate of sedimentation/useful life of Lake Garrett, a funding resources summary, and a preliminary evaluation of the spillways and dams.

It was Cardno's understanding that the City of Mountain Park's goal is to maintain a viable lake as a natural and community resource that can sustain fish and beneficial wildlife and aquatic vegetation, is safe for recreational use and enjoyment, and most importantly, provides a community asset for enjoyment by future generations. As such Cardno has attempted to develop and present a series of solutions/options in the subject report.

The City of Mountain Park initially requested that options be developed and presented in keeping with three cost tiers, 1) up to $500,000, 2) up to $1,500,000, and 3) above $1,500,000. In order to provide the City of Mountain Park with all potential options, a more thorough assessment was conducted beyond the initially requested ranges. Specifically, implementation costs range between a minimum of $5,000 per year for on-going maintenance under Option 1 (No Action) to a maximum of upwards of $4,690,000 for the removal and off-site disposal of 80,000 cubic yards of sediment under Option 3.

The following table summarizes the costs associated with the sediment removal/management options presented and discussed in this report. It should be noted that for Options 3-6, two costs are provided. The first is for the removal of two feet, or ~40,000 cubic yard of sediment across the lake, the second cost includes the removal of four feet, or ~80,000 cubic yard of sediment across Lake Garrett.

Option	Summary	USACE Permit Type	Removal Amount	Cost Estimate
1	No Action	None	None	$5,000 per year for maintenance
2	Install weir on incoming Rocky Creek	Individual	None	$229,000 - $589,000

Option	Summary	USACE Permit Type	Removal Amount	Cost Estimate
3	Dredge and haul sediment off-site	Nationwide	40,000 cubic yards	$2,904,000
			80,000 cubic yards	$4,690,000
4	Dredge and haul sediment to adjacent wetland and install weir	Individual	40,000 cubic yards	$2,389,000
			80,000 cubic yards	$3,539,000
5	Dredge and haul sediment on north-slope	Individual	40,000 cubic yards	$2,229,000
			80,000 cubic yards	$3,189,000
6	Dredge and haul sediment into geotubes in adjacent wetland and install weir	Individual	40,000 cubic yards	$817,000
			80,000 cubic yards	$1,475,000

When the useful life evaluation presented in Section 5.1 of the report is considered, it is evident that some action should be taken to both minimize the flow of sediment into Lake Garrett, and remove some amount of sediment. In reviewing the options presented herein, Option 6, "Dredge and transfer sediment into geotubes in the adjacent wetland and install a weir" provides maximum benefit at the lowest cost.

Next Steps

As to next steps, the Cardno team is prepared to present our findings to Mayor Still and the City Council as well as the community. If and when the City elects to move forward with one of the alternatives, Cardno would be happy to provide a proposal to first provide permitting services, design, and construction-related services.

Relative to permitting, we would first meet with the appropriate regulatory agencies to present the preferred alternative in an attempt to streamline the permitting process. It has been our experience that pre-applications meetings and correspondence serve to shorten the duration of the permitting process. A preliminary (likely 50%) design would be completed during the permitting process as a basis for the application.

Once the project is permitted, the project could be executed as a "design-bid-build" project, or as a design/build venture depending upon the City's procurement policies.

If you have any questions regarding this submission, don't hesitate to contact either of the undersigned. Thank you for the opportunity to submit this proposal. We look forward to hearing from you soon.

Sincerely,

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cc: Mayor and City Council – 4 hard copies and one electronic copy provided

Identification of Sediment Removal Options and Costs for Lake Garrett

Lake Garrett
Mountain Park, Fulton County, Georgia

February 5, 2018

Prepared for:
The City of Mountain Park

Cardno
Shaping the Future

Identification of Sediment Removal Options and Costs for Lake Garrett

Prepared for: City of Mountain Park
118 Lakeshore Drive
Mountain Park, Georgia 30337

Project Name: **Identification of Sediment Removal Options and Costs**
Lake Garrett
Mountain Park, Fulton County, Georgia

Date: February 5, 2018

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1 Introduction / Project Understanding

Cardno has completed the Identification of Sediment Removal Options and Costs for Lake Garrett located in Mountain Park, Fulton County, Georgia. This report provides a thorough summary of sediment removal options and presents/discusses permitting, engineering, and planning considerations for each option. In addition, a cost analysis for each option is provided. This report also provides a summary of peripheral factors, including a preliminary assessment of Lake Cherful, rate of sedimentation, useful life of both lakes, funding resources, and evaluation of the spillway and dams.

The study area is the eastern portion of what is known as Lake Garrett and is herein referred to as "the subject site/property" or "the site." According to information provided by the City of Mountain Park and the Fulton County Tax Assessor, Lake Garrett is a 17-acre manmade lake created by the impoundment of Rocky Creek. A site location map and tax map are included as **Figures 1** and **2**, respectively.

Historically, Lake Garrett was created circa 1920 by the impoundment of Rocky Creek. The lake has reportedly slowly filled in with silt in its upper reaches, significantly reducing the open water portions and resulting in reduction of the overall depth of the lake. Currently the lake has an average depth of approximately 9.5 feet across the lake with the upper half of the lake being very shallow with dense aquatic vegetation. The depth of sediment varies, but averages around approximately 3 feet across the lake. The lake is adjoined to the east by a wetland area as identified by the United States Fish and Wildlife Service (FWS) National Wetlands Inventory (NWI) map. The NWI map is included as **Figure 3**.

The City's goal is to maintain a viable lake as a natural and community resource that can sustain fish and beneficial wildlife and aquatic vegetation, is safe for recreational use and enjoyment, and most importantly, provides a community asset for enjoyment by future generations. As such Cardno's team consisting of internal and external resources has provided a goal of developing optimized solutions that combine design, permitting, and construction costs to evaluate multiple alternatives to remove the benthic sediment and/or control sediment deposits.

In addition to Cardno' in-house engineering and natural resource permitting specialists, our team includes Roswell-based representatives from Great Lakes Environmental & Infrastructure (GLE&I). GLE&I is one of the largest dredging and marine infrastructure contractors in the country. Finally, our team consists of civil and geotechnical Engineers of Record registered with the Georgia Environmental Protection Division's (GA EPD) Safe Dams Program.

More specifically, our permitting review is presented in Section 2 of this report, a sediment review in Section 3, an options analysis is included in Section 4, the peripheral factors addressed in association with the City's lakes are presented in Section 5, and our summary conclusions are presented in Section 6.

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2 Permitting Review

2.1 Preliminary Environmental Assessment (Existing Environment)

Cardno conducted a preliminary desktop evaluation of the study area based on reviewing historical and current topographic maps, aerial imagery, and wetland inventory maps to identify potential occurrences of United States Army Corps of Engineers (USACE) jurisdictional waters of the United States (WOUS) (wetlands and waterbodies), waterbodies regulated by the Georgia Department of Natural Resources (GA DNR) and requiring buffers, and potential habitat for federally and state listed species. Cardno has also conducted a preliminary evaluation for cultural resources.

A field review was conducted on December 6, 2017 to verify the results of the desktop evaluation. Although a field review was conducted, this was a visual presence/absence review only. Should the project move forward, additional field efforts will be necessary to determine the jurisdictional limits of environmental features.

2.2 Waterbodies

The Project is located within the Rocky Creek-Little River watershed (Hydrologic Unit Code [HUC] 0315010408). Rocky Creek drains into Little River which is a tributary of Lake Allatoona (Etowah River) and then eventually drains into the Coosa River. Lake Garrett is an impoundment of Rocky Creek, and upstream and abutting Lake Cherful which is also owned and maintained by the City of Mountain Park.

Waterbodies can be classified as the following:

- Traditional Navigable Water (TNW) - All those waters that are subject to the ebb and flow of the tide, and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. For the purposes of this Project, TNWs are those identified in USACE Savannah District Regional General Permit 84, Appendix B;
- Perennial Stream/Pond – A waterbody expected to have continuous year-round flow, with a well-defined OHWM, and sometimes (but not always) indicated on the United States Geological Survey (USGS) Quadrangle as a solid blue line;
- Intermittent Stream/Pond – A waterbody expected to have seasonal flow with seasonal flow defined as continuous flow for a consecutive period of at least three months, with a defined OHWM, and sometimes (but not always) indicated on the USGS Quadrangle as a dashed blue line;
- Ephemeral Stream – A waterbody expected to only have flow of short duration after a rainfall event, often with an ill-defined OHWM and channel, usually not indicated on the USGS Quadrangles; and
- Pond/Surface Water – A basin or area of non-flowing water where water is expected to pool on at least a seasonal basis defined as pooling for a consecutive period of at least three months, with a well-defined OHWM, hydrophilic vegetation may be present, in some cases man-made or altered, and may be indicated on the USGS Quadrangles.
    - Perennial – water pools year round.
    - Intermittent – water pools at least seasonally, with seasonal pooling defined as a consecutive period of at least three months.

- Ephemeral – water pools only during a short duration after a rainfall event.

In the state of Georgia, a Stream Buffer Variance (SBV) must be obtained from the GA DNR for land disturbing activities occurring within the designated 25-foot vegetated buffer along the banks of all state waters or within the designated 50-foot buffer of any state waters classified as "trout-streams" pursuant to Article 2 of Chapter 5 of the Georgia Code.

Lake Garrett would be considered a jurisdictional perennial surface water of the U.S. and the state of Georgia. Therefore, USACE and GA DNR permitting may be necessary depending upon the design of Lake Garrett maintenance and enhancement methods.

Additional ephemeral/intermittent stream channels that flow into the City's lakes may be present that were not identified by desktop or during the field review.

Section 303(d) of the Clean Water Act (CWA) establishes that states are to list waters for which technology-based limits alone do not ensure attainment of applicable water quality standards. These waters are considered "impaired waterbodies" and are listed on the 303(d) list for each state. Based on a review of the GA EPD 2014 Final 303(d) list for Georgia, the segment of Rocky Creek from Lake Garrett to Little River (GAR031501040815) is listed as Not Supporting due to Biota (fish community) impacts with likely causes of nonpoint source pollution and urban runoff. A review of the draft 2016 303(d) listed that a Total Maximum Daily Load for the Rocky Creek within the Coosa River basin indicate the Total Maximum Daily Load (TMDL for biota impact was approximately 456.3 tons per day.

2.3 Protected Species

A desktop review was conducted for available known and/or potential species occurrences within the analysis corridor of the Project components. **Table 1** provides listing status and habitat requirements of potential protected species occurrences. It is important to note that these are only potential occurrences, as this analysis is limited to publically available desktop data. GIS information and datasets obtained from publically available sources (and used in this desktop analysis) are considered informational and are not to be used as a singular tool for determining the frequency of occurrence of protected species. Some of the limitations of the available data include dated or incomplete information, sometimes vague descriptions of observations, and gaps in the datasets labeled as "data sensitive". Therefore, the information should be considered an initial planning tool. If required, field assessments would be conducted of identified species locations, or confirmation of prime habitat. These surveys would be done simultaneous with wetland and waterbody surveys. However, based upon the habitats that are encountered, species-specific surveys may also be required as a follow-up in certain areas. *Lake Garrett does not contain any designated critical habitat for any protected species.*

Table 1: Potential Protected Species Occurrences

Common Name	Scientific Name	Federal Status	State Status	Habitat Requirement	Potential Effect
Mammals					
Gray Bat	*Myotis grisescens*	Endangered	Endangered	Caves with flowing water or with large creeks or bodies of water nearby, also storm sewers and artificial caves in other	No effect. Caves to support gray bats are not located near Lake Garrett.

Table 1: Potential Protected Species Occurrences

Common Name	Scientific Name	Federal Status	State Status	Habitat Requirement	Potential Effect
				states. Unknown summer roosts.	
Indiana Bat	*Myotis sodalis*	Endangered	Endangered	Limestone caves with pools; wooded areas near streams, upland forests, large snags in open areas including ridge tops	Not likely to adversely affect. The limited amount of tree clearing should not affect populations of Indiana bat.
Fishes					
Cherokee Darter	*Etheostoma scotti*	Threatened	Threatened	Small to medium-sized creeks with moderate current and rocky substrates	No effect. Lake Garrett is not suitable habitat.
Plants					
Michaux's sumac	*Rhus michauxii*	Endangered	Endangered	Open forests over ultramafic rock	No effect. Suitable habitat not present.
Pink Ladyslipper	*Cypripedium acaule*	Unusual		Upland oak-hickory-pine forests; piney woods.	Potential presence in forested areas surrounding Lake Garrett.
Source: USFWS IPAC System. NatureServe, 2018, GA DNR, 2018.					

2.4 Permitting

Cardno has developed a list of permits and consultations expected to be required for the removal of sediment from Lake Garrett by dredging or other means based on prior project experience and consultations with agencies. The list of expected permits is provided in **Table 2**.

In order to complete permitting and agency consultation, it is likely that field surveys would be required. During the site visit, the ecologists would determine if any jurisdictional WOUS (e.g., wetlands and/or waterbodies) are present within the study area in accordance with the USACE's 1987 Wetland Delineation Manual and 2012 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). The ecologists would collect data on wetland and waterbody features at the site consistent with USACE Savannah District requirements.

The ecologists would evaluate habitats to determine if any habitats present are suitable for the support of federally and/or state listed species. The ecologist would describe the vegetation communities in the study area and areas immediately adjacent. The ecologist would also note wildlife observations (e.g., calls, tracks, scat, visual siting) made during the site reconnaissance. If species specific surveys are warranted, these services would need to be conducted by persons with the appropriate expertise and permits.

Cultural resource specialists would also likely need to conduct field surveys to verify that cultural resources are not present.

Table 2 Major Permits, Licenses, Authorizations, and Consultations

Permit / Clearance / Approval	Agency	NOTES
Federal		
Clean Water Act (CWA), Section 404	U.S. Army Corps of Engineers (USACE) Savannah District	Depending upon method selected for sediment removal, the project could be covered under a Nationwide Permit or Individual Permit.
Consultation under Section 7 Endangered Species Act and Migratory Bird Treaty Act (MBTA)	U.S. Department of Interior, U.S. Fish and Wildlife Service (USFWS), Georgia Ecological Services Field Office	Consultation concurrent with USACE permit.
State		
State Listed Species Consultation	Georgia Department of Natural Resources (GA DNR), Wildlife Resources Division (WRD)	Consultation concurrent with USACE permit.
CWA Section 401 Water Quality Certification	GA DNR, Environmental Protection Division (GA EPD)	Consultation concurrent with USACE permit.
CWA Section 402 NPDES Construction Storm Water General Permit	GA DNR Watershed Protection Branch	Coverage under General Permit GAR100001 for Stand Alone Projects.
Stream Buffer Variance	GA DNR Watershed Protection Branch	Determination of Stream Buffer would need to be coordinated with the Local Issuing Authority (City of Mountain Park)
NHPA, Section 106 Consultation	GA DNR, Historic Preservation Division	Consultation concurrent with USACE permit.

2.4.1 USACE Permitting (Clean Water Act)

The Project would require an authorization from the USACE under Sections 404 of the Clean Water Act and the GA EPD for Section 401 Water Quality Certification. The GA EPD may also require a Georgia Stream Buffer Variance. Depending upon the course of action, authorization from the USACE would be provided under the Nationwide Permit Program or an Individual Permit. The GA EPD issued Section 401 Water Quality Certification would be issued concurrent with the USACE permit. Compensatory mitigation (e.g., purchase of mitigation credits) is also required if permanent impacts in waters or wetlands will occur. Assuming there are no outstanding issues with regards to mitigation, federal endangered species, or cultural resources, the Savannah District typically processes NWPs within 45-90 days; however, an Individual Permit could take a year or more to process. There is also the chance that an Individual Permit request could be denied by the USACE during the review process.

The GA EPD issued a conditional Water Quality Certification for use of all Nationwide Permits in the Savannah District. A separate application to GA EPD is not required to receive Section 401 Water Quality Certification unless an Individual Permit is requested from the USACE. If a separate application is required, this review is concurrent with the USACE review.

2.4.2 Georgia Stream Buffer Variance

In the state of Georgia, a Stream Buffer Variance (SBV) must be obtained from the GA DNR, Environmental Protection Division for land disturbing activities occurring within the designated 25-foot vegetated buffer along the banks of all state waters or within the designated 50-foot buffer of any state

waters classified as "trout-streams" pursuant to Article 2 of Chapter 5 of the Georgia Code. This variance requires a 30-day public comment period with the applicant responsible for addressing any comments received during this period. The permitting process typically takes 4 to 6 months from applicant to permit issuance.

SBV applications will be reviewed by GA EPD only where the applicant provides reasonable evidence and strong justification that impacts to the buffer have been avoided or minimized to the fullest extent practicable and only for disturbances that fall into one of ten specific categories. Cardno would need to conduct field surveys, evaluate work areas, and consult with the Local Issuing Authority (in this case the City) before it can be determine which waterbodies would have applicable stream buffers and which will need a stream buffer variance issued.

We assume a stream buffer would be placed on Lake Garrett since it's an impoundment of Rocky Creek and some work would occur within the riparian edge for all scenarios.

2.4.3 Protected Species

Georgia has enacted specific state protected species legislation. Legal protection for state protected species is provided under the Georgia Endangered Wildlife Act of 1973 and the Georgia Wildflower Preservation Act of 1973; however, Georgia law specifically states that rules and regulations related to the protection of the species shall not be impeded by construction of any nature. The Georgia Wildlife Resources Division routinely makes recommendations to guide more environmentally friendly development in areas where state protected plant and animal species are known to occur.

Coordination with the USFWS and GA DNR may be required in order to assess potential effects of federally listed species in conjunction with the USACE permit for all scenarios.

2.4.4 NPDES Permitting

The GA EPD regulates storm water discharge via NPDES permitting programs. The GA EPD has developed and issued a General NPDES storm water permit to regulate sediment laden storm water flowing into waters of the State from discharges associated with construction activities. In Georgia, the General Permit was issued and became effective on September 24, 2013. This permit will expire on July 21, 2018, at which time the GA EPD is expected to reissue the permit. Any person proposing a construction activity, one acre or greater of land disturbance, shall submit a site registration application Notice of Intent (NOI) form a minimum of 14 days prior to commencing the operation. We assume submittal of the NOI would be required for all scenarios.

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3 Sediment Sampling

Depending on the option selected, sediment removed could be used either for construction of an embankment or as fill in the associated wetland. Either option would require additional assessment of the sediment to verify its ability to be compacted and repurposed. Depending on the total amount of sediment authorized for removal, it will be necessary to take anywhere from six-to-ten sediment samples throughout Lake Garrett to identify and calculate the maximum sediment depth for removal.

3.1 Testing

All sediment samples would be tested and analyzed for the following:

- Standard proctor compaction test – American Society for Testing and Materials (ASTM) Method D698. This test is used to determine optimal moisture content for dry soils. Specifically this test determines the relationship between water content and the dry unit weight of soils to establish maximum density achievable for the materials in the field.
- Sieve analysis – ASTM Method C136. This analysis is used to determine the gradation (the distribution of aggregate particles, by size, within a given sample) capability and its end use. The sieve analysis is also a very good quality/quality acceptance tool.
- Atterberg limits – ASTM Method D4943 / D4318. This test determines the water content at which the soil changes from a more liquid state to a solid or dry state. Another aspect is the compatibility or shrinkage of the soils.
- Organic content – ASTM Method D2974. This test determines the ratio, expressed as percentage, of the mass of organic matter to the mass of the dry soil solids. The organic content is an indicator of the water holding capacity, nutrient contributions, biological activity, and water/air infiltration rates.

All samples, as needed, would be submitted to a qualified laboratory under chain-of-custody protocols.

3.1.1 Methodology

All samples must be collected in accordance with the U.S. EPA Science and Ecosystem Support Division (SESD) Sediment Sampling operating procedure SESDPROC-200-R3 dated August 2014. All sampling would be performed prior to any dredging activities utilizing all the appropriate sediment sampling equipment via a boat throughout Lake Garrett.

3.1.2 Cost

The cost to perform this sediment sampling plan varies on the amount of sediment required to be dredged. However, the baseline cost for the testing referenced above is estimated to be $6,000.

3.2 USACE Sediment Sampling

In the case that a USACE Individual Permit is required, the USACE could request additional sediment sampling. Per the USACE rules, if dredged materials are to be repurposed or placed for inland disposal, then prior to dredging the sediment is required to go through the Inland Testing procedure.

3.2.1 Methodology

The Inland Testing procedure is a series of physical, chemical, and/or biological tests to determine the acceptability of the material to be disposed. The Inland Testing procedure consists of three separate Tiers, with each Tier being more advanced in the testing requirements. The exact testing procedures required would be determined by the USACE during the permitting process, but would follow the Inland Testing Manual.

Per the Inland Testing Manual Section 230.60(c), "testing may not be necessary where discharge site is adjacent to the excavation site and subject to the same sources of contaminants, and materials at the two sites are substantially similar." As all potential disposal areas are adjacent to Lake Garrett, no Inland Testing would be required. *Therefore, no substantial Inland Testing is required with respect to the USACE Individual Permit application process.*

However, in order to verify that the disposal site is "substantially similar," some physical, chemical, and/or biological confirmation sediment testing may still be required by the USACE.

3.2.2 Cost

If additional physical, chemical, and/or biological sediment testing is required by the USACE to confirm the "substantially similar" aspect, then the cost for this testing is estimated to be on the order of $5,000.

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4 Option Analysis

Cardno and its teaming partner, Great Lakes Environmental and Infrastructure (GLE&I), have evaluated various options and costs to remove sediments from Lake Garret in Mountain Park, Georgia. Removal methodologies include the following five options:

1. No action.
2. Install a weir or sediment trap to minimize future sedimentation of Lake Garrett.
3. Dewater/dredge the lake, dig and haul the sediment off-site for proper disposal.
4. Dewater/dredge the lake, dig and haul the sediment to east end of Lake Garret at the mouth of an existing wetland area. Place and construct an embankment with stabilized channel for flow of water from the eastern discharge (wetland) area. Install a weir or sediment trap in the channel to minimize future sediment issues.
5. Dewater/dredge the lake, dig and haul the sediment and place on Lake Garret's north-slope. Approximately three acres of the north-slope would be cleared and graded. Excavated sediment would be placed on the north-slope and graded up the bank to construct a new embankment. The newly constructed embankment would be compacted, stabilized with Turf Reinforcement Material (TRM) and seeded and/or utilized as a trail bed. Installation of drainage featured along the top portion of the embankment.
6. Dewater/dredge the lake, then hydraulically dredge material from the lake into geotubes placed along the existing wetland area on the east end of Lake Garrett. Geotubes would need to remain in place until liquids are drained. The tubes could then be opened and removed. The materials could then be graded and seeded. Install a weir or sediment trap in the channel to minimize future sediment issues.

A more detailed summary of each option, including methodology, access, permitting, additional considerations, and cost, are listed below.

It should be noted that the cost evaluation is based on our preliminary findings and is an overall estimate to help the City review its options. This document should not be considered an official proposal for any of the options provided. Significant assumptions were included in providing the cost estimates and are further discussed below.

The costs for sediment removal and management is broken down into two options: removal of 40,000 cubic yards or the removal of 80,000 cubic yards of sediment. The removal of 40,000 cubic yards will result in approximately 2 feet of sediment removed from all of Lake Garrett. The removal of 80,000 cubic yards will result in approximately 4 feet of sediment removal from all of Lake Garrett. The removal of greater amounts of sediment represents an economy of scale with respect to dredging, construction, and engineering/design.

4.1 Option 1 – No Action

4.1.1 Methodology and Access

The no action option would leave Lake Garrett as it is with no removal of sediment.

4.1.2 Permitting

No permitting requirements are necessary with this option.

4.1.3 Additional Considerations

No additional considerations are necessary for this option. However, in order to extend the life of Lake Garrett, it is recommended that additional sedimentation controls be considered, including limited development along and upstream of the lake and implementing additional soil erosion controls.

4.1.4 Cost

Limited cost is required for this option beyond any on-going maintenance of existing structures and oversight of existing sedimentation control measures. Roughly $5,000 per year in maintenance cost should be budgeted for this option

4.2 Option 2 – Install a Weir or Sediment Trap

4.2.1 Methodology and Access

Rocky Creek entering Lake Garrett would need to be diverted, either back into Lake Garrett or into Lake Cherful. Rows of turbidity barriers would be placed as needed throughout Lake Garrett and, if necessary, Lake Cherful, to eliminate heavy sediments from entering during area construction activities. After Rocky Creek is diverted, a berm would be created at the western limit of the existing wetland area to the east of Lake Garrett and along Rocky Creek. This berm would be approximately 360 feet long, 60 feet wide, and 10 feet tall, with a 2-to-1 slope. A weir would be constructed within the berm approximately 30 feet across in order to trap sediments in Rocky Creek prior to entering Lake Garrett. Total quantity of materials placed in the berm would be approximately 5,000 cubic yards.

Access points on the east end at the wetland area of Lake Garrett would be required. Access roads and hauling routes would be established for equipment deliveries and day-to-day maintenance.

4.2.2 Permitting

- US Army Core of Engineers Individual Permit would be required as the material is to be placed in a known wetland area. This can be done in conjunction with Options 3-5 and would not add significant cost or time. If the weir were to be constructed alone, then:
    - This permit would take over one year to process
    - A cost of approximately $60,000 for investigation and permitting is anticipated
- GA EPD Section 401 Water Quality Certification in conjunction with the USACE Individual Permit would be required
    - A cost of approximately $5,000 for investigation and permit application is anticipated
- GA EPD land disturbance permit for Stream Buffer Variance would be required
    - A cost of approximately $1,000 for investigation and permit application is anticipated
- GA EPD NPDES Storm Water permit would be required
    - A cost of approximately $2,000 for investigation and permit application is anticipated

4.2.3 Additional Considerations

Because of the direct disturbance of the adjacent wetland, this option would require a USACE Individual Permit, which typically takes a year or more to process. Also, there is always the chance that the Individual Permit could be denied by the USACE.

Under the Clean Water Act, this project will likely require some form of wetland mitigation with the purchase of mitigation credits to compensate for the destruction of the on-site wetland. The costs depends on the amount of wetland impacted or displaced. The minimum amount of materials to be moved with this option is approximately 0.5 acres. The price range for credits vary. Mitigation credits are estimated at $8,000 per credit and approximately 7.6 credits are needed per acre. Therefore, the cost estimate for 0.5-acre is approximately $30,400.

The development of the weir or sediment trap can be performed in conjunction with all Options below. However, due to the requirement of the Individual Permit, it is included in Options 4 and 6.

4.2.4 Cost

The cost of the weir depends on the type of berm and structure developed. For the purpose of this cost estimate, two options are included: a simple reinforced earthen weir or an accessible weir similar to the spillway between Lake Garrett and Lake Cherful along Russel Road.

Application	Type/Notes	Costs
Permitting	USACE Individual Permit	$68,000
Mitigation Credits	0.5 acres	$30,400
Sediment Sampling	None	$11,000
Construction	Earthen reinforced weir	$100,000
	Spillway similar to Russell Road	$400,000
Engineering/Design and Inspection	Earthen reinforced weir	$20,000
	Spillway similar to Russell Road	$80,000
Total Cost	**Earthen reinforced weir**	**$229,400**
	Spillway similar to Russell Road	**$589,400**

4.3 Option 3 – Dewater/dredge Lake and Haul Sediment Off-Site

4.3.1 Methodology and Access

A sump would be constructed on the west end of the lake that would be utilized to transfer water from Lake Garrett into Lake Cherful over the existing spillway. Rows of turbidity barriers would be placed as needed throughout Lake Garrett and, if necessary, Lake Cherful, to eliminate heavy sediments from entering during all construction activities.

Once dewatering is complete, excavators on mats and/or marsh buggy will be used to excavate channels from Rocky Creek entering the lake on the east end of the lake to prevent additional water from entering Lake Garrett. The incoming creek water will be pumped over the spillway into Lake Cherful.

Access points on the west and southwest end of Lake Garrett would be required. Access roads and hauling routes would be established for equipment deliveries and day-to-day maintenance.

Materials may need to be removed from the bank in the launching areas in order to access the lake with excavation equipment and dredging equipment. A 6" – 8" hydraulic dredge would be utilized. Sediment would be dug out with excavation equipment and hauled to an area by the spillway to be loaded into dump trucks for removal. Dump trucks would remove the sediment to a landfill where it is anticipated to be used as landfill cover.

Upon completion of the removal of the sediment, the lake bottom will be rough graded, and dewatering systems removed, and site access and laydown areas restored.

4.3.2 Permitting

- US Army Core of Engineers Nationwide permit would be required
  - This permit would require an additional 45-60 days
  - An additional cost of approximately $5,000 for investigation and permit application
- GA EPD land disturbance permit for Stream Buffer Variance would be required
  - An additional cost of approximately $1,000 for investigation and permit application
- GA EPD NPDES Storm Water permit would be required
  - An additional cost of approximately $2,000 for investigation and permit application

4.3.3 Additional Considerations

This option is likely the quickest with respect to the permitting as the USACE Nationwide permit takes 45-60 days, as this option would not require an Individual Permit. This option is also the least expensive active option with respect to permitting as very little disturbance is anticipated. In addition, no sediment sampling or mitigation credits would be needed for this option.

However, based on the anticipated weight, hauling capacity, and frequency of the dump trucks, Cardno's Team anticipates that the trucks would increase traffic congestion, noise pollution, and cause significant damage to the municipal roads surrounding Lake Garrett. If this option was chosen, it is estimated that a minimum of $100,000 be set aside with this option for road repairs and repaving.

4.3.4 Cost

Application	Type/Notes	Costs
Permitting	USACE Nationwide Permit	$8,000
Mitigation Credits	None	$0
Sediment Sampling	None	$0
Construction	40,000 cubic yards	$2,330,000
	80,000 cubic yards	$3,860,000
Engineering/Design and Inspection	40,000 cubic yards	$466,000
	80,000 cubic yards	$722,000
Road Damage	Anticipated from truck usage	$100,000
Total Cost	**40,000 cubic yards**	**$2,904,000**
	80,000 cubic yards	**$4,690,000**

4.4 Option 4 – Dewater/dredge Lake and Haul Sediment to Wetlands East of Lake Garret

4.4.1 Methodology and Access

A sump would be constructed on the west end of the lake and would pump water from Lake Garrett into Lake Cherful over the existing spillway. Rows of turbidity barriers would be placed as needed

throughout Lake Garrett and, if necessary, Lake Cherful, to eliminate heavy sediments from entering during all construction activities.

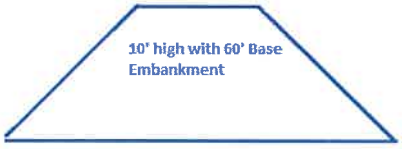
Once dewatering is complete, excavators on mats and/or marsh buggy will be used to excavate channels from Rocky Creek entering the lake on the east end of the lake to prevent additional water from entering Lake Garrett. The incoming creek water will be pumped over the spillway into Lake Cherful.

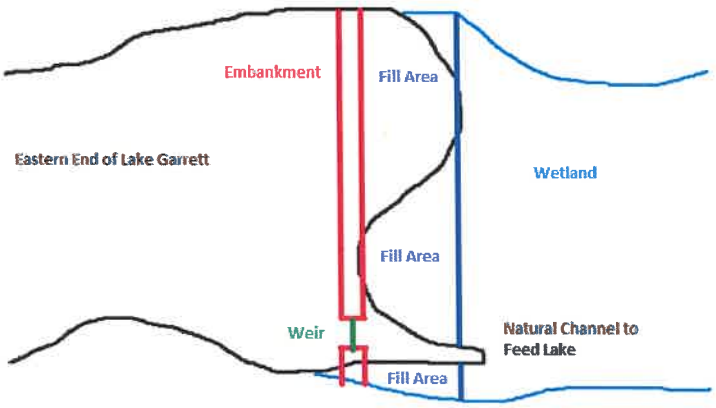
Access points on the east end at the wetland area, west and southwest end of Lake Garrett would be required. Access roads and hauling routes would be established for equipment deliveries and day-to-day maintenance.

Materials may need to be removed from the bank in the launching areas in order to access the lake with excavation equipment and the dredge. A 6" – 8" hydraulic dredge would be utilized. Sediment would be dug out with excavation equipment and hauled into the wetland area to the east of Lake Garrett. It is anticipated that an approximately 10 foot high with approximately 60-foot base embankment would be created in the wetland area. Depending on the amount of sediment to be excavated, the eastern portion of the lake would be reduced from approximately 15-to-20 feet by the construction of this embankment. This would result in approximately five acres of wetland being impacted. Once the embankment has been developed, it would be required to be compacted and developed with drainage features.

This option includes the development of a weir as previously described in Option 2.

A rough concept drawing for this option is provided below.





Once the sediments are removed and placed in the embankment, the lake bottom will be rough graded, dewatering systems removed, and site access and laydown areas restored.

4.4.2 Permitting

- US Army Core of Engineers Individual Permit would be required as the material is to be placed in a known wetland area.
    - This permit would take over one year to process
    - A cost of approximately $60,000 for investigation and permit application is anticipated

- GA EPD Section 401 Water Quality Certification in conjunction with the USACE Individual Permit would be required
    - A cost of approximately $5,000 for investigation and permit application is anticipated
- GA EPD land disturbance permit for Stream Buffer Variance would be required
    - A cost of approximately $1,000 for investigation and permit application is anticipated
- GA EPD NPDES Storm Water permit would be required
    - A cost of approximately $2,000 for investigation and permit application is anticipated

4.4.3 Additional Considerations

Because of the direct disturbance of the adjacent wetland, this option would require a USACE Individual Permit, which typically takes a year or more to process. Also, there is a chance that the Individual Permit could be denied by the USACE.

Under the Clean Water Act, this project will likely require some form of wetland mitigation with the purchase of a mitigation credits to compensate for the destruction of the on-site wetland. The costs would vary depending on the amount of wetland area disturbed, which is directly associated with the amount of sediment removed and placed in the wetland. For example, the minimum removal of around 40,000 cubic yards would require a minimum of two acres, while the removal of 80,000 cubic yards would require a minimum of five acres. Also, the development of the weir would require an additional 0.5 acres. The price range for mitigation credits vary, however, anticipated mitigation costs could range from $60,800 for one acre to approximately $304,000 for five acres.

4.4.4 Cost

Application	Type/Notes	Costs
Permitting	USACE Individual Permit	$68,000
Mitigation Credits	2.5 acres	$150,000
	5.5 acres	$340,000
Sediment Sampling	N/A	$11,000
Construction	40,000 cubic yards	$1,800,000
	80,000 cubic yards	$2,600,000
Engineering/Design and Inspection	40,000 cubic yards	$360,000
	80,000 cubic yards	$520,000
Total Cost	**40,000 cubic yards**	**$2,389,000**
	80,000 cubic yards	**$3,539,000**

4.5 Option 5 – Dewater/dredge Lake and Haul Sediment to the North Bank of Lake Garrett

4.5.1 Methodology and Access

A sump would be constructed on the west end of the lake and would pump water from Lake Garrett into Lake Cherful over the existing spillway. Rows of turbidity barriers would be placed as needed

throughout Lake Garrett and, if necessary, Lake Cherful, to eliminate heavy sediments from entering during area construction activities.

During the dewatering activities, a logging road will be constructed on the north-slope, approximately 50-to-75 feet up the bank. The embankment below the logging road would be cleared of all vegetation and the embankment graded and/or excavated as necessary to receive sediment materials.

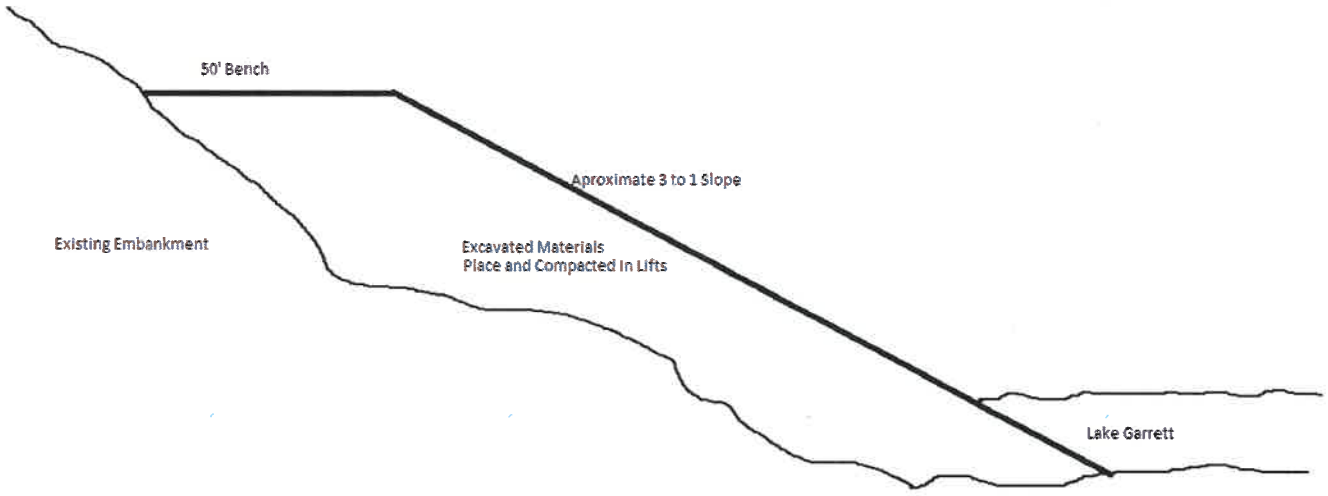
In addition, access points on the northeast end near the wetland area, west and southwest end of Lake Garrett would be required. Access roads and hauling routes would be established for equipment deliveries and day to day maintenance.

Once dewatering is complete, excavators on mats and/or marsh buggy will be used to excavate channels from Rocky Creek entering the lake on the east end of the lake to prevent additional water from entering Lake Garrett. The incoming creek water will be pumped over the spillway into Lake Cherful.

Materials may need to be removed from the bank in the launching areas in order to access the lake with excavation equipment and the dredge. A 6" – 8" hydraulic dredge would be utilized. Sediment would be dug out with excavation equipment and hauled off to the toe of the north-slope to be placed by another crew constructing the embankment.

The size, length, and slope of the embankment will vary depending on the amount of excavated sediment, but it is anticipated to include an approximately 50-foot bench with an approximate 3-to-1 slope. Embankment materials will be placed, graded, compacted, and stabilized with Turf Reinforcement Material (TRM) and seeded. Drainage features would need to be installed along the top portion of the embankment as well as in up to four valleys throughout the embankment. The bench could be utilized as a greenspace, or walking/biking path.

A rough concept drawing for this option is provided below.



Once the sediments are removed and placed along the embankment, the lake bottom will be rough graded, dewatering systems removed, and site access and laydown areas restored.

4.5.2 Permitting

- US Army Core of Engineers Individual Permit would be required as the material is to be placed in a known wetland area, and given that the footprint of the lake would be reduced slightly by filing the bank. Considerations include:

  - This permit would take over one year to process
  - A cost of approximately $50,000 for investigation and permit application is anticipated
- GA EPD Section 401 Water Quality Certification in conjunction with the USACE Individual Permit would be required
  - A cost of approximately $5,000 for investigation and permit application development is anticipated
- GA EPD land disturbance permit for Stream Buffer Variance would be required
  - A cost of approximately $1,000 for investigation and permit application development is anticipated
- GA EPD NPDES Storm Water permit would be required
  - A cost of approximately $2,000 for investigation and permit application development is anticipated.

4.5.3 Additional Considerations

Because of the significant disturbance to the lake and the existing waterways, this option would require a USACE Individual Permit, which typically takes a year or more to process. Also, there is always the chance that the Individual Permit could be denied by the USACE. However, as there is minimal disturbance to the adjacent wetland, it is unlikely that this permit would be denied, nor would there be any additional wetland mitigation requirements. As less investigation is needed, the overall permitting cost is slightly lower than previously discussed alternatives.

It is assumed that a minimum of four valleys/drainage structures will need to be cut through the north-slope embankment for drainage purposes. The estimated cost to install these structures is $150,000, and is included in all cost estimates.

There may be a limited amount of grant or loan funding available for this alternative for the development of a greenway/trail and/or greenspace along the bench.

4.5.4 Cost

Application	Type/Notes	Costs
Permitting	USACE Individual Permit	$58,000
Mitigation Credits	None	$0
Sediment Sampling	N/A	$11,000
Construction	40,000 cubic yards	$1,800,000
	80,000 cubic yards	$2,600,000
Engineering/Design and Inspection	40,000 cubic yards	$360,000
	80,000 cubic yards	$520,000
Total Cost	**40,000 cubic yards**	**$2,229,000**
	80,000 cubic yards	**$3,189,000**

4.6 Option 6 – Dewater/dredge Lake and Place in Geotubes along Wetlands East of Lake Garret

4.6.1 Methodology and Access

A sump would be constructed on the west end of the lake and would pump water from Lake Garrett into Lake Cherful over the existing weir. Rows of turbidity barriers would be placed as needed throughout Lake Garrett and, if necessary, Lake Cherful, to eliminate heavy sediments from entering during all construction activities.

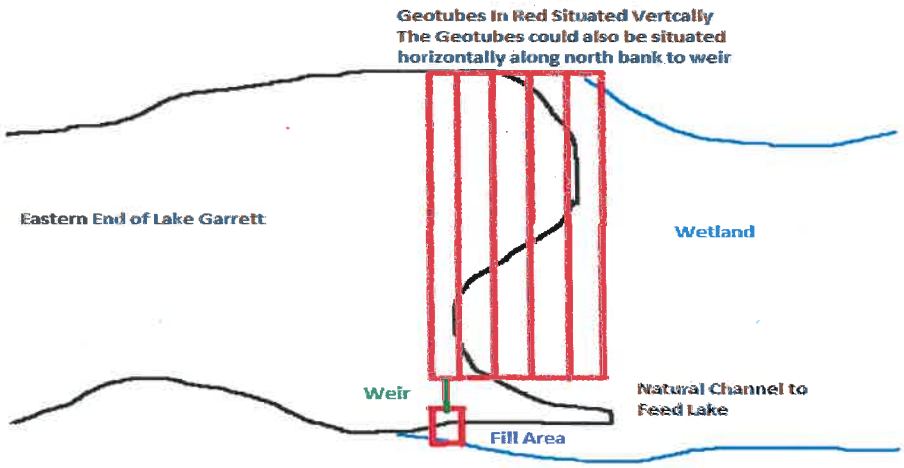
Once dewatering is complete, excavators on mats and/or marsh buggy will be used to excavate channels from Rocky Creek entering the lake on the east end of the lake to prevent additional water from entering Lake Garrett. The incoming creek water will be pumped over the spillway into Lake Cherful.

Access points on the east end at the wetland area, west and southwest end of Lake Garrett would be required. Access roads and hauling routes would be established for equipment deliveries and day-to-day maintenance.

Materials may need to be removed from the bank in the launching areas in order to access the lake with excavation equipment and the dredging equipment. A 6" – 8" hydraulic dredge would be utilized. Piping would run across the lake to the east end and tied into geotubes placed throughout the wetland area east of Lake Garrett. The geotubes would be situated horizontally along the north bank to the weir. The amount of geotubes required depends on the amount of sediment removal. Water that drains from the geotubes will naturally flow back into Lake Garrett. As a result, the water elevation fluctuations will be minimal.

This option includes the development of a weir as previously described in Option 2. The weir would be utilized to keep the geotubes in place within the wetlands.

A rough concept drawing for this option is provided below.



After dredging is complete, it is assumed 1-to-2 months will be needed for the geotubes to drain sufficient amounts of moisture in order to place equipment on the tubes that will remove the majority of the tubes' casing such that the material in the tubes may be graded and compacted. The tube materials would be taken off-site and disposed of, the graded materials would then be seeded.

Once the sediments are removed and placed in the geotubes, the lake bottom will be rough graded, dewatering systems removed, and site access and laydown areas restored.

4.6.2 Permitting

- US Army Core of Engineers Individual Permit would be required as the material is to be placed in a known wetland area.
    - This permit would take over one year to process
    - An cost of approximately $60,000 for investigation and permit application development is anticipated
- GA EPD Section 401 Water Quality Certification in conjunction with the USACE Individual Permit would be required
    - A cost of approximately $5,000 for investigation and permit application development is anticipated
- GA EPD land disturbance permit for Stream Buffer Variance would be required
    - A cost of approximately $1,000 for investigation and permit application development is anticipated
- GA EPD NPDES Storm Water permit would be required
    - A cost of approximately $2,000 for investigation and permit application development is anticipated.

4.6.3 Additional Considerations

This option is the least expensive because there is no additional compaction, drainage features, or stabilization of the sediment as placement into the geotubes will allow for natural stabilization.

Because of the direct disturbance of the adjacent wetland, this option would require a USACE Individual Permit, which typically takes a year or more to process. Also, there is a chance that the Individual Permit could get denied by the USACE.

Under the Clean Water Act, this project will likely require some form of wetland mitigation with the purchase of mitigation credits to compensate for the destruction of the on-site wetland. The costs depends on the amount of wetland impacted or displaced. For example, the minimum removal of around 40,000 cubic yards would require a minimum of two acre, while the removal of 80,000 cubic yards would require a minimum of five acres. Also, the development of the weir would require an additional 0.5 acres. The price range for credits vary, but is approximately $60,800 for one acre to approximately $304,000 for five acres.

4.6.4 Cost

Application	Type/Notes	Costs
Permitting	USACE Individual Permit	$68,000
Mitigation Credits	2.5 acres	$150,000
	5.5 acres	$340,000
Sediment Sampling	N/A	$11,000

Application	Type/Notes	Costs
Construction	40,000 cubic yards	$490,000
	80,000 cubic yards	$880,000
Engineering/Design and Inspection	40,000 cubic yards	$98,000
	80,000 cubic yards	$176,000
Total Cost	**40,000 cubic yards**	**$817,000**
	80,000 cubic yards	**$1,475,000**

4.7 Assumptions

Cardno's Team made the following assumptions with respect to the above outlined options:

1. Dredged/excavated materials exhibit typical geotechnical properties and are suitable for drying, bulk excavation, hauling, placement, and compaction.
2. Dredged/excavated materials consist of sand and silty clays. Heavy impacted clays and silt, debris, and other materials will not be encountered.
3. Lake Garrett can be dewatered with the flow into Lake Cherful without any treatment through standard dewatering practices.
4. It is assumed that there is an approximate 6-inch tolerance above or below the proposed grade in Lake Garrett.

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5 Peripheral Factors

Peripheral factors considered during this project include an approximation of the useful life of Lake Garrett, a spillway and dams review, a preliminary assessment of Lake Cherful, and an overview of potential funding options.

5.1 Useful Life of Lake Garrett

The useful life of Lake Garrett is dependent on a variety of factors, including rate of sedimentation, volume of water in the lake, and desired use of the lake. As it is assumed that the continued desired use of the lakes is for recreational purposes, including boating, fishing, and swimming, and given that no data regarding the measured sedimentation rate or volume of the lake was provided, we have developed a reasonable approximation of the useful life of Lake Garrett based on the following assumptions:

- Total lake volume will remain constant over time.
- Mass rates of sediment deposition will remain constant over time.
- The current lake depth and sediment level are described in the United Consulting computer aided Design (CAD) files provided by the Client and visual observations made during a December 6, 2017 site visit.

More specifically, Cardno's calculations are based on the following parameters

- Average lake depth - 10 ft
- Average lake length - 2,500 ft
- Average lake width - 250 ft
- Present sediment volume – 2,678,571 cubic feet (ft^3)
- Total lake volume – 6,250,000 ft^3

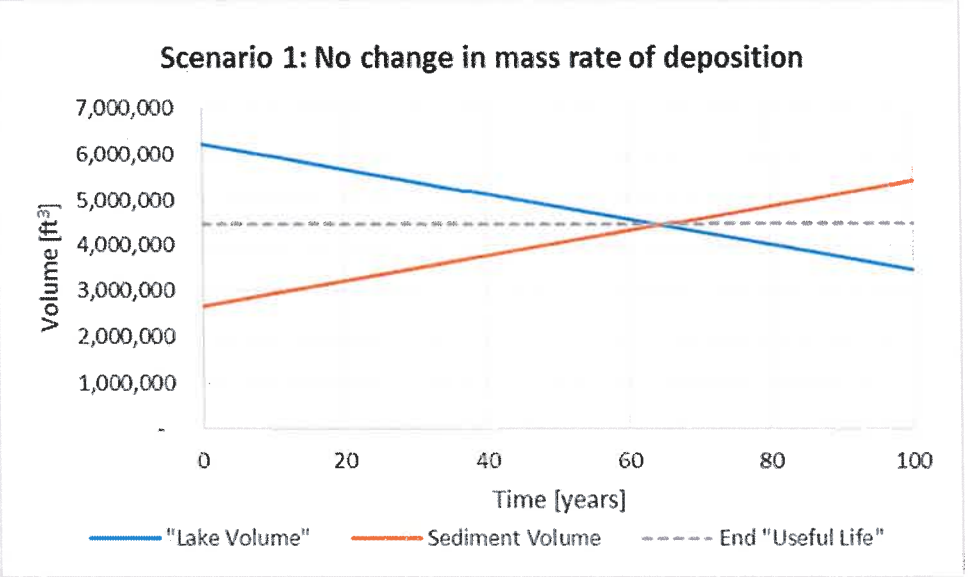
This gives an estimated sediment volume of around 40% of the total volume. Given this volume, and the total life of the lake currently (97 years), assuming there was no sedimentation during the creation of the lake, then the rate of sedimentation is approximately 27,614 ft^3/year.

The assumption is that useful life is when the sediment volume occupies more than 70% of the total volume, or 4,500,000 ft^3. This would leave approximately 2-3 feet of total water, with 7-8 feet of sediment throughout the lake.

Based on these assumptions and calculations, Cardno reviewed the usefulness of the life based on four scenarios:

5.1.1 Scenario 1: No Action

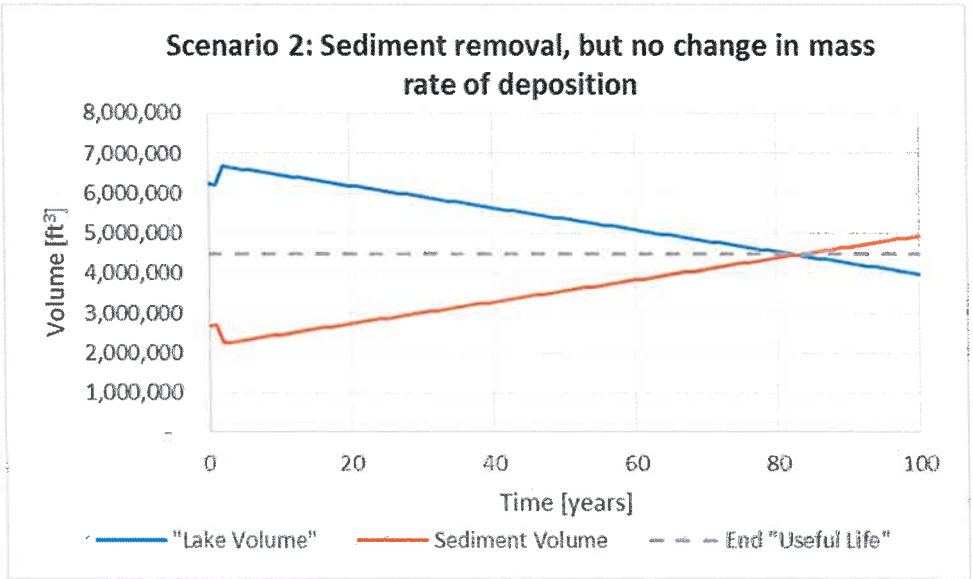
If no action were taken with respect to the rate of sedimentation or the current level of sedimentation, the following graph shows the useful life of Lake Garrett:



A total useful life of approximately 65 years is anticipated with this option.

5.1.2 Scenario 2: Sediment Removal

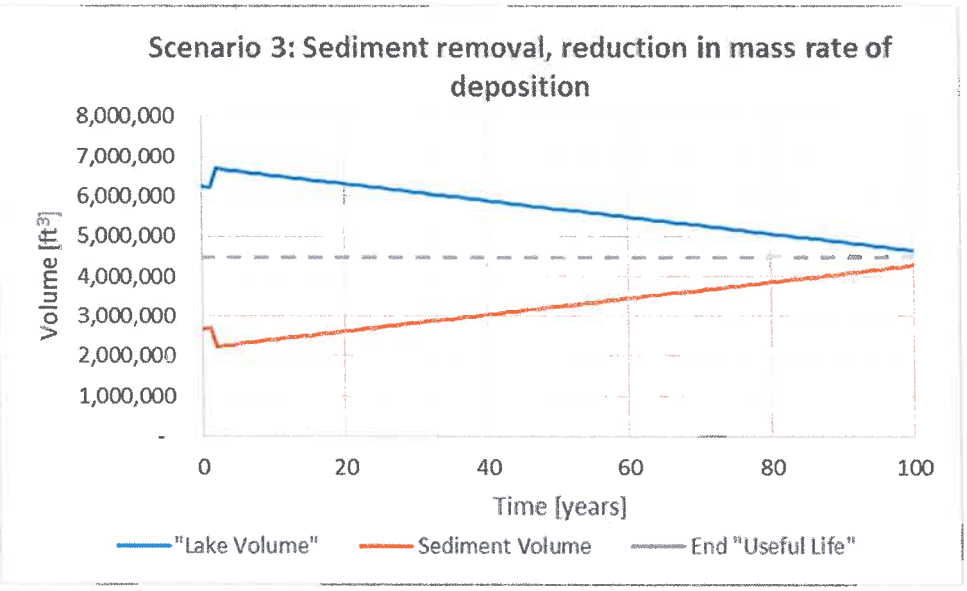
Cardno assumed that if a minimal amount of sediment removal is completed (approximately 550,000 ft^3, or approximately 20,000 cubic yards). Based on these action the following graph was generated and approximates the useful life of Lake Garrett at approximately 82 years given this scenario.



In summary, for each 1,000 cubic yards removed from Lake Garrett slightly less than one year of useful life is added.

5.1.3 Scenario 3: Sediment Removal and Reduce Sedimentation Rate

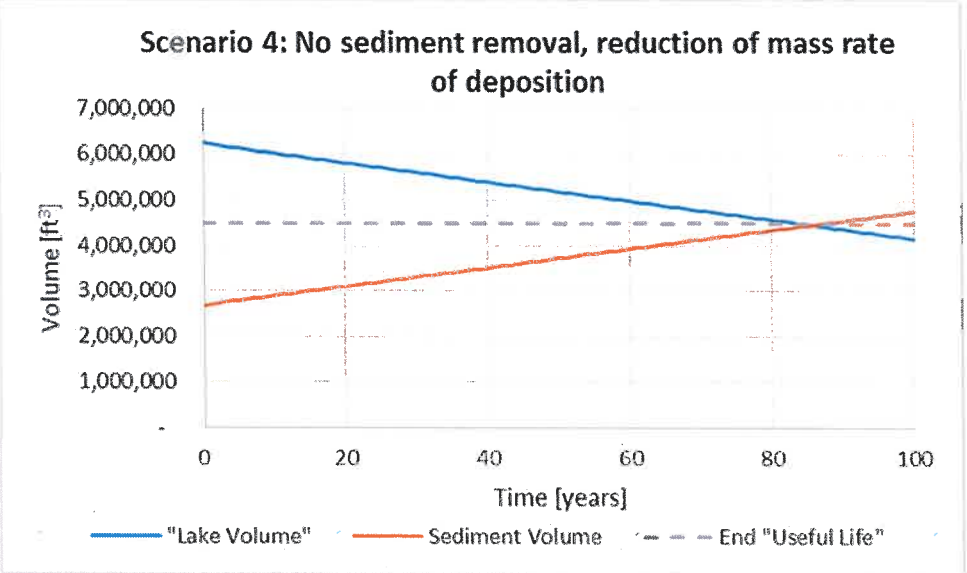
The sediment level is removed by approximately 550,000 ft^3, or approximately 20,000 cy, and the rate of sedimentation is reduced by half by installing a weir or sediment trap, then the following graph summarizes the useful life of Lake Garrett:



Given these factors, a total useful life of over 100 years is anticipated based on this scenario.

5.1.4 Scenario 4: No Sediment Removal and Reduce Sedimentation Rate

If no sediment removal is conducted and the rate of sedimentation is reduced by half by installing a weir or sediment trap, then the following graph summarizes the useful life of Lake Garrett at roughly 82 years.



5.1.5 Summary

The following table summarizes the findings:

Scenario	Type/Notes	Useful Life
1	No Action	65 Years
2	Sediment Removal	82 Years
3	Sediment Removal and Reduction in Rate of Sedimentation	> 100 Years
4	Reduction in Rate of Sedimentation only	82 Years

Implementation of Scenario 3 (removing sediment and reducing the rate of sedimentation) yields a useful life of over 100 years for Lake Garrett.

However, it should be noted that these calculations consider a number of baseline assumptions, including that the rate of sedimentation is constant over a period of time. From Cardno's understanding, majority of the sedimentation resulted from the recent development of the land surrounding and upstream of Lake Garrett. Additional measures to reduce the rate of sedimentation would be to enforce stricter soil erosion controls, limit the amount of development surrounding Lake Garrett, or to provide additional buffers or barriers between development and Lake Garrett.

To ensure a useful life of greater than one hundred years, the removal of greater amounts of sediment as considered in the options presented in Sections 4.2 through 4.6 will yield an even greater useful life of Lake Garrett. Further, it is Cardno's opinion though that any sediment removal in conjunction with the reduction in the rate of sedimentation will further extend the usefulness of the lakes.

5.2 Spillway and Dams Review

Cardno was provided an April 2014 US Department of Agriculture Natural Resources Conservation Service (NRCS) Watershed Structure Inspection Report for the watershed dam on the northwest end of Lake Cherful. A copy of this report is included as Attachment A. In the report, the dam was reportedly developed in April 15, 1959, it was noted that a roadway existed on top of the dam, and that numerous houses were developed around the pool area. The only reported action taken in the 12 months prior to the inspection report was a mowing event. Corrective action measures recommended in the report included the monitoring of two small holes, removal of trash and debris, erosion in the outlet channel, and monitoring of possible seepage.

Cardno retained the services of Walden, Ashworth, and Associates, Inc. (Walden), a GA EPD Safe Dams Program Civil Engineering firm to provide a visual review of the spillway and watershed dam on the northwest portion of Lake Cherful and of the spillway and watershed dam between Lake Garrett and Lake Cherful along Russell Road. Cardno's Douglas Strait, P.E., and Walden's Martin Walden, P.E., visually inspected both dams and spillways on January 25, 2018 to ensure that the structures were generally capable of supporting the proposed Lake Garrett sediment removal options.

It should be noted that Walden was retained to provide a preliminary opinion. An official condition report was not conducted on either the spillway or the watershed dam.

5.2.1 Lake Cherful Watershed Dam and Spillway Review

Overall the Lake Cherful watershed dam and spillway appeared to be in good condition with no significant damage or immediate issues of concern. However, seepage was noted in portions of the downstream slope through the embankment, and severe erosion was noted in the outlet channel of the secondary spillway.

Walden recommended the following:

- A comprehensive inspection of the Lake Cherful dam by a GA EPD Safe Dams Geotechnical Engineer be conducted to determine the stability and permeability of the embankment.
- All undesirable vegetation be removed near the water line.
- After the removal of all undesirable vegetation, the soil should be compacted to a smooth, stable slope with rip-rap protection installed with a filter fabric.
- Upstream and downstream slopes of the dam should be no steeper than three (3) horizontal to one (1) vertical (3:1) ratio.
- All bare areas of the embankment should be covered with a good stand of grass.
- All means of draining the lake should be provided.
- A regularly scheduled program of inspection and maintenance should be established.

5.2.2 Lake Garrett Dam and Spillway Review

Overall the dam and spillway between Lake Cherful and Lake Garratt was in good condition with no significant damage or immediate issues of concern. However, significant spalling and deterioration of the concrete structure was observed throughout the length of the spillway.

Walden recommended the following:

- A comprehensive inspection be conducted by a qualified structure engineer to determine the stability and structure integrity of the dam.

5.2.3 Summary

Walden found no indication that the spillway or the watershed dam would not be able to maintain the water volume requirements associated with the sediment removal options as they are described in this report. This assumes that all construction and dredging activities will be conducted at a minimum distance of 50 feet from any existing structure. Copies of Walden's preliminary assessment are included as Attachment B.

5.3 Lake Cherful

As noted previously, Lake Cherful is located adjacent and to the west of Lake Garrett and was also created in the 1920s with the impoundment of Rocky Creek. Russell Road and a spillway separate Lake Cherful from Lake Garrett. A dam is located on the northwest end of Lake Cherful which discharges into Rocky Creek. A small unnamed tributary discharges into Lake Cherful on the west end.

Lake Cherful reportedly has also filled in with silt in its upper reaches, but not to the same extent as Lake Garrett. This sediment is reducing the open water portions and resulting in reduction of the overall depth of the lake. In addition, reported recent nearby residential development has caused

additional sedimentation issues, specifically upstream of the small unnamed tributary. No prior assessment of the amount of silt and sediment in Lake Cherful has been conducted.

A field review as conducted by Cardno's Team on January 24, 2018 to obtain an initial visual characterization to assess the overall health of Lake Cherful, specifically with respect to the amount of sediment and lake depth. Overall, Lake Cherful appeared to range from two to eight feet in depth, with an average of approximately one to two feet of underlying sediment.

Cardno was provided review of excerpts from a Kendall & Associates, Inc. (Kendall) Lake Cherful Sediment Sampling Report dated December 29, 2017. In the report, five sediment samples (S1-S5) were collected on the southwest portion of Lake Cherful and analyzed to assess the deferent levels and types of sediment within the lake. Approximately 48 inches or four feet of sediment were noted in each sample, of which approximately 0.25 to 1.75 inches consisted of reddish sediment which appeared to be recently added.

While not as impacted as Lake Garrett, there is still potential for significant sediment issues associated with Lake Cherful. Prior to initiating any restoration efforts with respect to Lake Cherful, a full survey of the lake would be required, with detailed analysis of the total depth, sediment levels, and sediment deposition rates.

5.4 Funding

In order to help the City of Mountain Park with the financial decision with respect to the sediment options outlined in this report, Cardno reviewed potential local, state, and federal grants and potential low interest loan programs.

5.4.1 Grants

Georgia DNR Section 319 (h) Nonpoint Source Implementation Grant

Available funding - up to $400,000 with a 40% match

Website – https://epd.georgia.gov/section-319h-georgias-nonpoint-source-implementation-grant

Timeline – Due October 2018

Goals – Provides education and outreach about nonpoint source pollution in the adopted Basin Management Action Plan (BMAP) areas. Nonpoint sources include storm water runoff from urban surface area and agricultural operations, failing septic tanks, and erosion. Proposals must specify the nonpoint sources of pollution and identify the activities best suited to address these sources, specifically with watershed restoration and urban storm water management. Nonpoint pollution source into Lake Garrett would need to be clearly defined as the incoming sedimentation. A plan to address the sedimentation issue would be required in addition to training and community outreach.

Georgia DNR Recreation Trails Program

Available funding – up to $200,000 with a 20% match

Website – **http://gastateparks.org/rtp/**

Timeline – Pre-application due *January 2, 2018,* full application May 26, 2018

Goals – Restoration of recreation trails, specifically associated with "aquatic or water activities." This year's application has passed, but it is possible to plan for next year. This is only applicable for Option 4, specifically with the development of a trail on the bank. Additional Options include the development of a canoe launch or creation of a trail on the bench.

SFY2019 Regional Water Plan Seed Grant

Available funding - Up to $75,000 with a 40% match

Website - https://epd.georgia.gov/regional-water-plan-seed-grant-funds

Timeline - Expected announcement September 2018

Goals - Support and incentivize local governments and other appropriate water users as they undertake their implementation responsibilities as provided in the applicable Regional Water Plans. Project proposals must specifically address implementation of management practice(s) or other recommendation(s) from one or more Regional Water Plans, and applications must include a letter of endorsement from the Council Chair of the relevant regional Water Planning Council(s). A pre-application meeting is required. To Cardno's knowledge, Lake Garrett is not considered a member of the Regional Water Planning Council, and as a result is likely not eligible for this funding.

Five Star and Urban Waters Restoration Grant Program

Available funding – Approximately $30,000

Website - http://www.nfwf.org/fivestar/Pages/2017rfp.aspx

Timeline - TBD

Goals - The Five Star and Urban Waters Restoration grant program seeks to develop community capacity to sustain local natural resources for future generations by providing modest financial assistance to diverse local partnerships focused on improving water quality, watersheds and the species and habitats they support. Projects include a variety of ecological improvements including: wetland, riparian, forest and coastal habitat restoration; wildlife conservation; community tree canopy enhancement; and/or water quality monitoring and storm water management; along with targeted community outreach, education and stewardship. The applicability of this funding source would need to be established based on the option selected.

5.4.2 Loan Programs

Cardno reviewed several loan programs, including Georgia Cities Foundation Revolving Loan Fund and the EPA WIFA loan, but none appear to be applicable with respect to this project or the options presented.

5.4.3 Alternative Funding Options

Cardno suggest the following alternative approaches to funding:

- Commercial development for lease that attracts more visitors;
    - Restaurants, stores, recreational venues that yield sales and use taxes
- Commercial entity for naming rights/sponsorship of park and trail area;
- Levy a new tax or add as a referendum item in next election;
- Approach Fulton County to develop a park with more open space;
- Start a fundraising campaign with crowd-funding or memorial aspects; and
- Include art or sculpture along trail/lake to open additional funding options from arts organizations.

5.4.4 Summary

The majority of the funding have a focus on are designed for environmental restoration, water and/or wastewater management, or greenspace and/or trail development. As a result, it appears that an option which includes the development of greenspace and/or trails, like Option 4, might have the greatest chance of being partially funded.

As the project evolves, however, it is feasible that other funding mechanisms may be established. Cardno will continue to monitor www.grants.gov and other funding outlets for options that might apply to the Lake Garrett project.

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6 Summary/Conclusions

The following table summarizes the costs associated with the sediment removal/management options presented and discussed in this report.

Option	Summary	USACE Permit Type	Removal Amount	Costs
1	No Action	None	None	$5,000 per year for maintenance
2	Install weir on incoming Rocky Creek	Individual	None	$229,000 - $589,000
3	Dredge and haul sediment off-site	Nationwide	40,000 cubic yards	$2,904,000
			80,000 cubic yards	$4,690,000
4	Dredge and haul sediment to adjacent wetland, install weir	Individual	40,000 cubic yards	$2,389,000
			80,000 cubic yards	$3,539,000
5	Dredge and haul sediment on north-slope	Individual	40,000 cubic yards	$2,229,000
			80,000 cubic yards	$3,189,000
6	Dewater/dredge and place in Geotubes along adjacent wetland, install weir	Individual	40,000 cubic yards	$817,000
			80,000 cubic yards	$1,475,000

The City of Mountain Park initially requested that options be developed and presented in keeping with three cost tiers, 1) up to $500,000, 2) up to $1,500,000, and 3) above $1,500,000. In order to provide the City of Mountain Park with all potential options, a more thorough assessment was conducted beyond the initially requested ranges. Specifically, costs range between a minimum of $5,000 per year for on-going maintenance under Option 1 to a maximum of upwards of $4,690,000 for the removal of 80,000 cubic yards of sediment under Option 3.

When the useful life evaluation presented in Section 5.1 is considered, it is evident that some action should be taken to both minimize the flow of sediment into Lake Garrett, and remove some amount of sediment. In reviewing the options presented herein, Option 6, dredge and transfer sediment into geotubes placed in the adjacent wetland and install a weir provides maximum benefit at the lowest cost.

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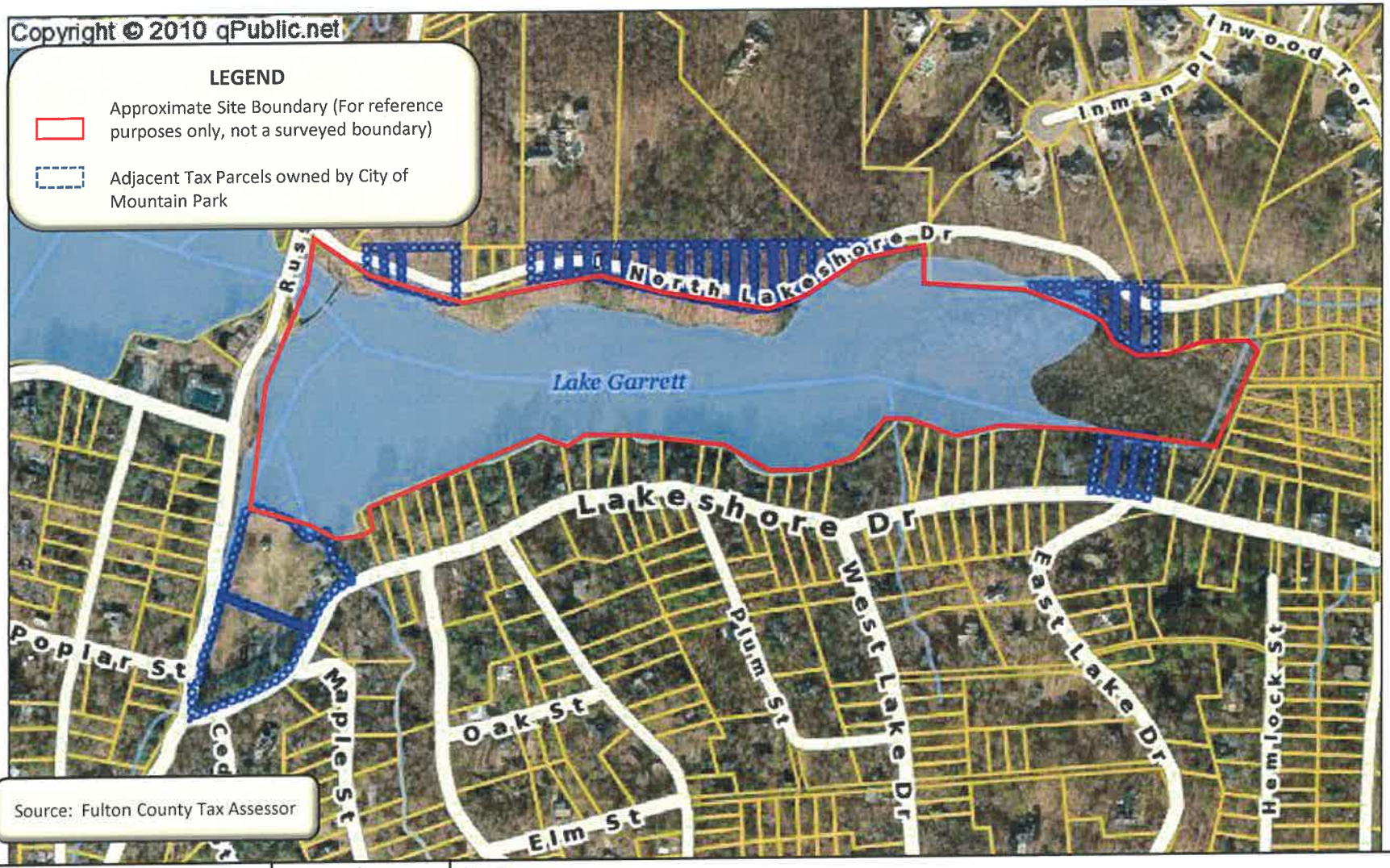
Figures

Cardno

Sediment Removal Options
Lake Garrett
Mountain Park, Fulton County, Georgia
City of Mountain Park
Cardno Project: 0002408000

Figure 1
Site Location Map
Source: USGS 2014

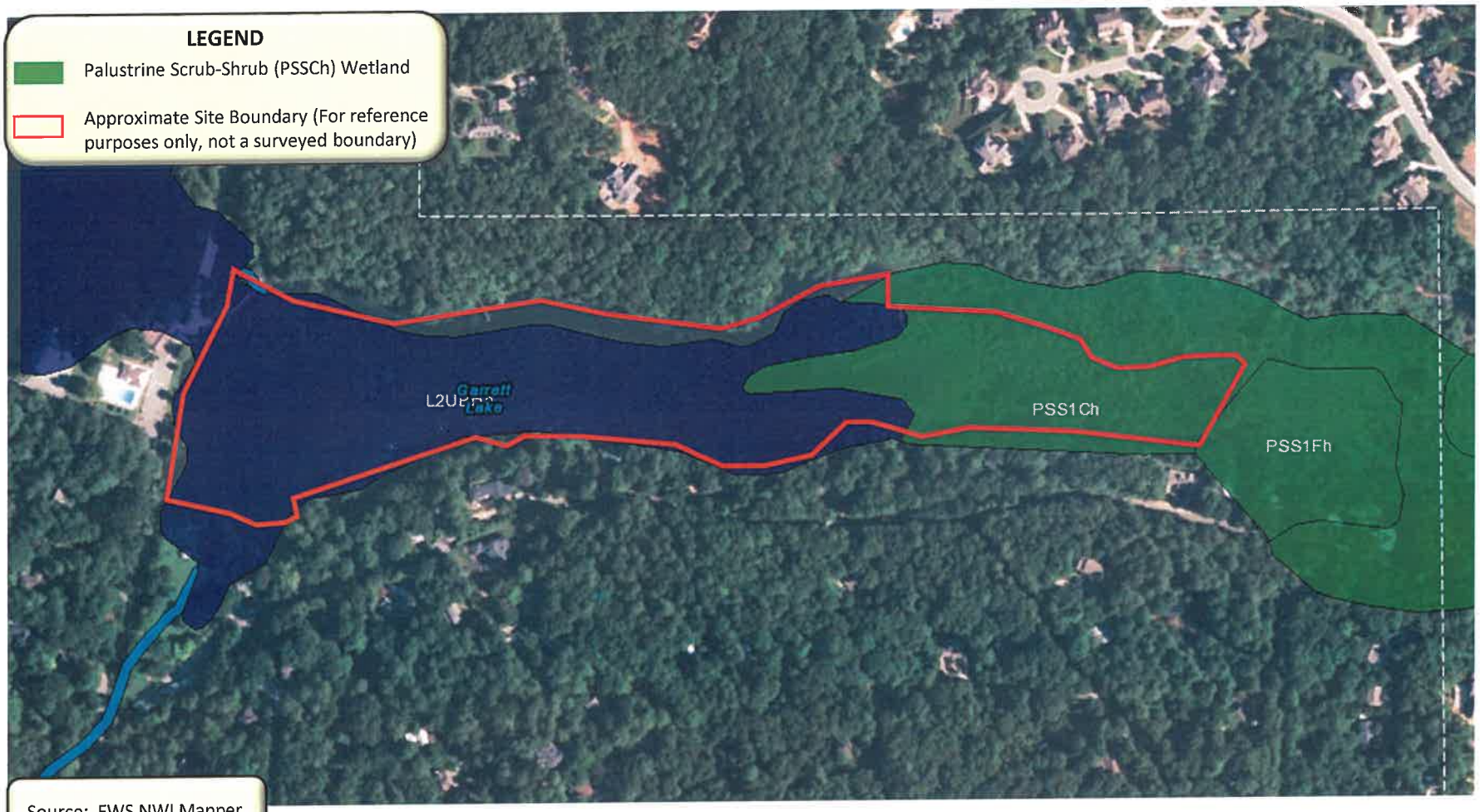


Cardno

"This is not a map of survey."

Sediment Removal Options
Lake Garrett
Mountain Park, Fulton County, Georgia
City of Mountain Park
Cardno Project: 0002408000

Figure 2
Tax Map with City of Mountain Park Parcels Depicted



Cardno

"This is not a map of survey."

Sediment Removal Options
Lake Garrett
Mountain Park, Fulton County, Georgia
City of Mountain Park
Cardno Project: 0002408000

Figure 3
Wetland Map

Appendix A

April 2014 NRCS Dam Inspection Report

U.S. Department of Agriculture
Natural Resources Conservation Service

GA-ADS-042
2-83 (Rev. 06/05)

WATERSHED STRUCTURE INSPECTION REPORT

Little River	38	Fulton County SWCD
Project	Structure Number	Local Maintenance Organization(s)

Date of Operation and Maintenance Agreement: 4/15/59 Date of Inspection: 4-16-14

Type of Inspection: ____ Annual ✓ Formal (5-Year) ____ Other (Explain) ____

NRCS Classification (A, B, or C): C Safe Dams Program Classification (I or II): II

If "High Hazard" is there an Emergency Action Plan (EAP) Prepared for this Structure (yes or no): No

Sponsors Present During Inspection: ____

NRCS Representatives Present: Valerie Pickard, George Skovran, Steve Blackston

"YES" responses need explanation added to "Remarks" section (ie: What? Where? Extent?). "NO" responses indicate problems not observed during inspection. Non-applicable items should be lined out.

ITEM	YES	NO	REMARKS
1. General Conditions			
a. Alterations to dam?	✓		Access roadway on top of dam
b. Development in downstream floodplain?		✓	
c. Development around reservoir?	✓		Numerous houses around pool area
2. Embankment			
a. Is vegetative cover inadequate?		✓	
b. Are trees growing on the embankment?		✓	
c. Is brush/weed control needed?	✓		Small brush
d. Are trees/brush growing at waterline?	✓		Small brush
e. Is drift debris present?		✓	
f. Are cracks, settlement, or bulges present?		✓	
g. Are animal burrows present?		✓	
h. Are animal trails present?		✓	
i. Any vehicular trails present?		✓	
j. Any seepage observed?	✓		Possible - middle of dam
3. Front Slope Protection			
a. Any wave damage observed?	✓		Minor wave damage
b. Is riprap inadequate?			N/A
c. Are rodent holes present?		✓	

Use the following standard abbreviations:

L/S - left side looking downstream U/S - upstream P/S - primary spillway
R/S - right side looking downstream D/S - downstream A/S - auxiliary spillway

ITEM	YES	NO	REMARKS
4. Inlet Structure and Gate Valves			
a. Does concrete exhibit deterioration?		✓	N/A, metal riser and trash rack
b. Is concrete reinforcement exposed?		✓	N/A, metal riser and trash rack
c. Was leakage observed inside inlet?			Not checked
d. Any corrosion of metal appurtenances?		✓	
e. Is trash rack obstructed?	✓		Debris covering top of trash rack
f. Is trash rack corroded?		✓	
g. Is gate stem broken or bent?		✓	
h. Are components missing?		✓	
i. Was gate determined not operational?			Date gate last operated: Not operated
j. Has inlet been modified to alter water surface?		✓	
5. Principal Spillway Conduit			
a. Is concrete conduit deteriorated?			N/A, metal pipe
b. Is metal conduit corroded?		✓	N/A
c. Was leakage observed at pipe joints?			Not checked
6. Auxiliary Spillway			
a. Is vegetative cover inadequate?			Concrete spillway, some erosion D/S of strc.
b. Any animal trails observed?		✓	
c. Any vehicular trails observed?		✓	
d. Is flow area obstructed?		✓	
e. Is control section disturbed?		✓	
7. Principal Spillway Release Channel			
a. Does scour hole appear unstable?		✓	
b. Is there undesirable vegetation around scour hole?	✓		Brush and trees around basin
c. Any boils observed?		✓	
d. Is riprap inadequate?		✓	
e. Any seepage observed?		✓	
f. Is conduit outlet submerged?		✓	
g. Is conduit outlet not properly supported?		✓	
h. Is outlet channel obstructed?		✓	
i. Is outlet channel degrading?		✓	
j. Is foundation drain submerged?		✓	
k. Is foundation drain rodent barrier missing?		✓	
l. Is foundation drain not functional?		✓	Flowing
8. Perimeter Fence			
a. Is fence inadequate?		✓	
b. Are gates open?		✓	
9. Easements/landrights			
a. Are terms of landrights out of compliance?		✓	
b. Are landrights boundaries being encroached upon?		✓	

Use the following standard abbreviations:

L/S - left side looking downstream
R/S - right side looking downstream
U/S - upstream
D/S - downstream
P/S - primary spillway
A/S - auxiliary spillway

U.S. Department of Agriculture
Natural Resources Conservation Service

GA-ADS-042
2-83 (Rev. 06/05)

ACTIONS TAKEN: (Identify all work performed preceding 12 months by sponsors and/or NRCS, including approximate cost and date completed).

Mowed

ACTIONS NEEDED: (Identify items by priority: low - next 12 months; high - as soon as possible).

There are 2 small holes approximately 50 ft rt of P/S pipe. Holes need to be monitored yearly (L)
Erosion in the outlet channel on RT side approximately 100 ft D/S of concrete chute. Appears to be from storm flows. Not endangering sstructure or concrete chute. Needs to be monitored (L)
Remove debris from trash rack (H)
Remove woody debris around plunge pool (L)
Mow dam and treat brush as needed (L)
Monitor posible seepage at D/S toe (L)
Monitor F/S wave damage (L)

We have inspected this work and all items that are pertinent have been checked and found to be as noted above.

MAINTENANCE ORGANIZATION(S) REPRESENTATIVE(S)

Name	Title	Signature & Date
ALAN O. KINSey	Chairman	5-21-14

NATURAL RESOURCES CONSERVATION SERVICE REPRESENTATIVE

Name	Title	Signature & Date
G. Skovran	Area Engineer	

I have reviewed the above inspection report and concur with the findings shown above.

Remarks:

Name	Title	Signature & Date
G. SKOVRAN	ACT. Assistant State Conservationist (F.O.)	

LITTLE RIVER 38

RISER

AUXILIARY SPILLWAY

PLUNGE POOL

TOP OF EMBANKMENT

Appendix B

Walden Preliminary Investigations of Dams and Spillways

Cardno

WALDEN, ASHWORTH & ASSOCIATES, INC.
CONSULTING ENGINEERS
P.O. BOX 6462 $ MARIETTA, GEORGIA 30065 $ 770/956-7879

January 30, 2018

Mr. Keith J. Ziobron, P.E.
Branch Manager
CARDNO
2000 First Drive
Suite 220
Marietta, GA 30062

RE: LAKE CHERFUL DAM CURSORY VISUAL INSPECTION
CITY OF MOUNTAIN PARK
WA&A J.O. 3801200

Dear Mr. Ziobron:

This letter report presents the results of our brief cursory visual inspection of the Lake Cherful Dam located in the City of Mountain Park in Fulton County, Georgia. Our cursory inspection of the dam was conducted on January 25, 2018 and was made without the benefit of surveying equipment and no measurements were taken. The purpose and scope of the cursory inspection was to identify obvious issues observed in a very quick look at the dam and did not include a thorough and comprehensive visual inspection.

GENERAL DESCRIPTION

The Lake Cherful Dam is an earthen embankment located on Rocky Creek, a tributary of the Little River in Fulton County, Georgia in the City of Mountain Park. The dam is approximately 450 feet long and has a top width of 12-15 feet. It is approximately 25 feet high and impounds a lake having a surface of approximately 2.5 acres at normal pool. The normal pool elevation of the lake is controlled by a CMP riser located near the center of the dam.

OBSERVATIONS

The visual inspection was conducted on January 25, 2018. No field measurements were made. We have only listed the obvious issues we observed in the very quick look at the dam. The failure to mention any component of the dam in this report should not be viewed as a declaration regarding the condition of that component and does not imply a good or acceptable condition. It simply means that there were no obvious issues that we observed on the day of our visit to the dam. A more comprehensive inspection may reveal issues that were not observed in our cursory inspection.

UPSTREAM SLOPE
Because the lake was at normal pool at the time of our inspection, our ability to inspect the upstream slope was limited. The portion of the slope that is visible above the water level is covered with grass and weeds. No shoreline wave protection such as rip-rap was observed. No slides or sloughs were observed. The abutment contacts are covered with trees. The slope is estimated to be a 3 horizontal to 1 vertical (3:1).

TOP OF DAM
The horizontal and vertical alignment of the earth embankment appears to be generally good. The dam is approximately 450 feet long along the top and has an overall top width of approximately 12 to 15 feet. The top of the dam includes a paved roadway that is currently closed to traffic. Two surface cracks were observed in the pavement. The abutment contacts were good.

DOWNSTREAM SLOPE
The downstream slope of the dam is covered with grass and weeds. The slope appears to be approximately 3 horizontal on 1 vertical (3:1).

SEEPAGE ON DOWNSTREAM SLOPE
Some portions of the downstream slope were wet from seepage through the embankment.

INSTRUMENTATION
No evidence of any instrumentation, such as piezometers or observation wells, was observed.

DOWNSTREAM AREA
The downstream area is overgrown with trees, shrubs, weeds and heavy undergrowth of small saplings and bushes. The area is generally accessible by foot only.

PRIMARY SPILLWAY
The primary spillway consists of a CMP riser and low level outlet pipe. The condition of the spillway is unknown.

SECONDARY SPILLWAY
The secondary spillway consists of an estimated 30 ft. wide concrete chute spillway. Severe erosion has occurred in the outlet channel at the end of the concrete.

OUTLET WORKS
A gate control was observed upstream of the CMP primary spillway riser.a

RECOMMENDATIONS

Based on our visual inspection, the dam needs remedial work. It should be noted that it is not possible to evaluate the adequacy of the discharge capacity of the outlet works based on a visual inspection.

We recommend that the following steps be taken:

1. The primary spillway system should be evaluated to determine its condition and if it is adequately sized to safely handle the design storm.

2. The structure should be further evaluated by a qualified Geotechnical Engineer to determine the stability and permeability of the embankment.

3. All undesirable growth such as trees, bushes, vines and other undergrowth should be removed from near the water line. Roots of trees and bushes should be thoroughly removed. Any depressions that remain should be backfilled with well compacted material and grassed. This action should be done only with the lake in a "drawn down" or drained condition.

4. Once the vegetation has been removed any erosion rills should be filled and compacted to a smooth, stable slope.

5. The rip-rap wave protection should be installed with filter fabric.

6. Both the upstream and downstream slopes of the dam should have slopes no steeper than three (3) horizontal and one (1) vertical (3:1).

7. All bare areas on the embankment should be covered with a good stand of grass.

8. A means of draining the lake should be provided.

9. A regularly scheduled program of inspection and maintenance should be established. Visual inspection of the dam and its appurtenant facilities should be made a minimum of once a year by a qualified dam engineer and quarterly by on-site personnel. Particular attention should be given to looking for seepage from the downstream face and at the downstream embankment/abutment contacts.

   The appearance of wetness or water flow on the embankment or in the downstream area, or movement within the embankment should receive prompt engineering attention.

   The maintenance program should include a regular schedule for mowing of grass and removal of all undesirable growth from the embankment, the spillway channel and the area extending approximately 50 feet downstream of the toe of the dam. Eroded areas should be promptly repaired so that they do not become channels for the concentration of flow which could result in more severe erosion.

We appreciate the opportunity to provide you with this report of our cursory visual inspection of this dam. Please do not hesitate to contact me if you have any questions.

Very truly yours,

WALDEN, ASHWORTH & ASSOCIATES, INC.

Martin L. Walden, P.E.
President

MLW/cla

WALDEN, ASHWORTH & ASSOCIATES, INC.
CONSULTING ENGINEERS
P.O. BOX 6462 $ MARIETTA, GEORGIA 30065 $ 770/956-7879

January 30, 2018

Mr. Keith J. Ziobron, P.E.
Branch Manager
CARDNO
2000 First Drive
Suite 220
Marietta, GA 30062

RE: GARRETT LAKE DAM CURSORY VISUAL INSPECTION
CITY OF MOUNTAIN PARK
WA&A J.O. 3801100

Dear Mr. Ziobron:

This letter report presents the results of our brief cursory visual inspection of the Garrett Lake Dam located in the City of Mountain Park in Fulton County, Georgia. Our cursory inspection of the dam was conducted on January 25, 2018 and was made without the benefit of surveying equipment and no measurements were taken. The purpose and scope of the cursory inspection was to identify obvious issues observed in a very quick look at the dam and did not include a thorough and comprehensive visual inspection.

GENERAL DESCRIPTION

The Garrett Lake Dam is approximately 170 feet long. The height is unknown. The dam impounds a lake having a surface of approximately 20 acres at normal pool. The normal pool elevation of the lake is controlled by stop logs on the top of the overflow concrete wall which constitutes the entire dam.

OBSERVATIONS

The visual inspection was conducted on January 25, 2018. No field measurements were made.

The horizontal and vertical alignment of the structure appears to be uniform. At the time of the inspection the water level in the lake appeared to be at normal pool and was overflowing the wall at several bays. The water level of the lake is controlled by the principal spillway which consists of stop logs on the top of the overflow concrete wall. Significant spalling and deterioration of the concrete structure was observed throughout the length.

A detailed inspection of the upstream and downstream faces of the overflow wall structure was not possible because of the water level on both sides and the continuous overflow on the day of our inspection.

RECOMMENDATIONS

Based on our visual inspection, the dam needs remedial work. It should be noted that it is not possible to evaluate the adequacy of the discharge capacity of the outlet works based on a visual inspection.

We recommend that the following steps be taken:

1. The concrete overflow structure should be inspected when the lake level on both sides has been lowered.

2. The structure should be evaluated by a qualified structural engineer to determine the stability and structural integrity of the dam/weir.

PLANNED DREDGING OF GARRETT LAKE

It is our understanding that several options for the dredging of Lake Garrett are being considered. To prevent any impacts to the dam / spillway structure, all dredging operations, including the disposal of any dredged material, should be no closer than 50 feet from the spillway structure.

We appreciate the opportunity to provide you with this report of our cursory visual inspection of this dam. Please do not hesitate to contact me if you have any questions.

Very truly yours,

WALDEN, ASHWORTH & ASSOCIATES, INC.

Martin L. Walden, P.E.
President

MLW/cla