

COMPREHENSIVE LAKE COLUMBIA WATERSHED AND LAKE MANAGEMENT FIVE-YEAR PLAN

STATEMENT OF PURPOSE

A lake and watershed management plan (plan) is a dynamic document under constant review and adjustment depending on the condition of a lake, available funding, level of volunteer commitments, and the needs of lake stakeholders. The plan helps protect water bodies by encouraging partnerships and communication between lake residents, watershed residents, concerned citizens, agency staff, and diverse organizations. The plan identifies concerns of importance, sets realistic goals, objectives, action items to address identified concerns, identifies roles and responsibilities for meeting each goal, and provides a timeline for implementation for the purpose of creating, protecting, and maintaining desired conditions in a lake and its watershed. The plan also provides a framework for future lake boards and users as to what issues have been addressed and documented the level of success of those previous efforts. Lake associations must participate in a lake and watershed management plan; however, inclusion of lake management professionals yields the best results because of the variety of complex and interrelated issues at play.

MISSION

To ensure the lasting health of Lake Columbia as a body of water with appropriate sediment, nutrient, and water quality levels which supports human recreational uses and a diverse population of fish, wildlife, and native plants.

GUIDING PRINCIPLES

Lake and watershed management decisions are driven by what is best for the resource based on information that includes the ever-evolving nature of lake and watershed management.

Communication regarding lake management needs to be easy to understand, concise, and frequent.

1. Form a Lake and Watershed Management Committee

- a. Lake and watershed management actions should be performed only after hydraulic and nutrient load studies have been conducted to pinpoint the problem or problems in the lake. Watershed approaches may need to be implemented first to ameliorate nutrient or sediment loading issues from further impairing the lake, and once that these steps are completed, in-lake restoration actions based on a lake and watershed management plan may begin.
- b. Template Examples - A comprehensive long-term lake watershed management plan should be site-specific and include but not be limited to:

- Association membership communication and education
- Funding for lake management and watershed plan
- Lake information (depth, size, watershed, development, etc.)
- Watershed Management
- Shore management
- Nutrient management
- Sediment Management
- Water Quality Management
- Aquatic native species management
- Aquatic invasive species management
- Wildlife/fishery management
- Recreational management

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Suggestions to Assist Development of Lake and Watershed Management Plan

Step 1: Identify potential stakeholders. Stakeholders are not just the Lake Columbia Property Owners. The best lake management plans include all sorts of interests connected to a lake, such chambers of commerce; wildlife organizations; agricultural interests in the watershed; town/county/city organizations & agencies; and environmental groups.

Step 2: Keep the members and community informed and seek input. Written or oral surveys can be used to help identify what users consider to be problems. Seek information from various sources when gathering data to characterize the water body. Hold meetings at which you gather information and answer questions. Solicit input from all your contacts.

Step 3: Stay connected with relevant agencies. This will give you information about any necessary applications, permits, zoning issues, etc. In some states, an approved lake management plan is a prerequisite for grant funding from natural resource agencies.

Step 4: Identify the problems. Assume that everyone's perception of a problem has merit. When a problem is identified, you should also look at its impact, location, and timing, as well as known contributing factors.

Step 5: Prioritize the problems. Recognizing that all problems cannot be tackled at once, prioritize the problems.

Step 6: Look for actions and goals related to the prioritized issues. For example, a GOAL might be to reduce shoreline erosion. Some ACTIONS could include inventorying erosion sites, planting native vegetation, designing/ installing other shore protection methods, or diverting flows away from a particularly eroded area.

Step 7: Chose site-specific goals and strategies that address those goals. There may be several ways to address a problem, but success usually comes from the most site-specific actions and problem-specific actions being performed. For example, if there are several types of invasives in a lake, there may be methods that are best for one type of invasive, but do not necessarily affect the others. More than one action might be required, each targeted at a particular problem.

Step 8: Estimate the economic costs. This is a good time to be aware of grants or other funding that may be available.

Step 9: Determine a timetable for the actions and goals, as well as how control actions will be measured. This should allow efforts and activities to be coordinated, especially in the instance of seasonal actions, such as fish stocking or chemical treatment of invasive plants.

Step 10: Determine leadership & fiscal responsibility. No one person can conduct all the activities usually in a lake management plan. Dividing responsibilities, while having accountability, will increase chances of success.

Watershed and Water Quality Improvement Committee

LCPOA Board Member – Chairperson

LCPOA Board Member – Board Liaison

Nine LCPOA Shore Members – one from each shore

One LCPOA Fish Committee member

Watershed and Lake Management Consultant

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Step 11: Set methods & times for suggesting changes and modifying the plan as needed. Setting up a regular time for review (annual, bi-annual, etc.), as well as methods by which suggestions for change are made, will help ensure that results get reviewed in a timely manner.

1. Association membership communication and education Cost \$5,000 annually. (2024-2028)

- a. Membership Restoration plans presentations from consultant twice a year detailing the current and five-year plan.
- b. Other education topics for membership sponsored by LCPOA and shared information on the Website: Buy phosphorus-free lawn fertilizer, apply fertilizer at the recommended rate, late summer is the best time, do not fertilize before a storm, never apply to frozen ground, keep soil, leaves, and lawn clippings out of the street and lake, pick up pet waste promptly, control soil erosion around your house, rake it or leave it, follow the guidelines in your community for leaf pick-up, do not burn leaves near the lake, water wisely, use mulch, mow high, and use less pesticides and herbicides.
- c. Shoreline vegetation to mitigate phosphorus and nutrient run-off from lake side lot.
- d. Keep beach and lake clear of weeds.

2. RLS Plans and Costs (\$60,000) for 2024

- a. Professional RLS lake vegetation surveys annually.
- b. Monthly profile water quality sampling (April-August with quick data reporting).
- c. Storm drain sampling during heavy rainstorm and reporting for comparison with 2023 data.
- d. Pursue permitting of PrO2 Aeration system as pilot project with EGLE.
- e. Scan of delta lake bottom to evaluate Muck Biotic effectiveness for 2023.
- f. Oversee four to six Muck Biotics applications to delta and identified canals, channels, and bays with excessive organic sediment.
- g. Oversee Meta Floc usage for excessive phosphorus level. **On Hold for emergency only.**
- h. Oversee use of EPA-certified Biochar technologies (May – October) for phosphorus and nutrient reduction for the Drains, member Docks, and downstream from the Check Dam (year around in open water).
- i. Full lake scans as scheduled for comparison with 2023 data and for 2025 planning.
- j. Collaboration with EGLE on Goose Creek inlet permitting for Check Dam rebuild and J-dams (or multiple dams) or similar structures downstream from the Check Dam to slow the velocity of the easter and provide a long term, permanent solution to reduce/eliminate sediment from entering Lake Columbia from the Goose Creek inlet.
- k. Collaboration with Conservation District upstream from the Check Dam for soil erosion management and possible grants covering the cost.
- l. Personal Meetings with Watershed Committee and membership education including fundraising and the Annual Meeting.
- m. See RLS Professional Aquatic Consulting Services Contract for Lake Columbia, Jackson County, Michigan for 2024 for schedule and costs.

3. RLS Plans and Costs (\$61,800) for 2025

- a. Professional RLS lake vegetation surveys annually.
- b. Monthly profile water quality sampling (April-August with quick data reporting).
- c. Storm drain sampling during heavy rainstorm and reporting for comparison with 2024 data.
- d. If EGLE permit approved, oversee install PrO2 Aeration system-destratification for 2-3 deep basins (includes permitting maintenance, engineering of on-site, onshore units). Cost \$107,600.

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- e. Scan of delta lake bottom to evaluate Muck Biotic effectiveness of the 2024 applications to determine regiment of 2025 applications.
- f. Oversee four to six Muck Biotics applications to delta and identified canals, channels, and bays with excessive organic sediment.
- g. Oversee Meta Floc usage for excessive phosphorus level. Discontinue if Pro2 Aeration System installed in 2025.
- h. Oversee use of EPA-certified Biochar technologies for phosphorus and nutrient reduction for the Drains, member Docks and downstream from the Check Dam.
- i. Full lake scans for comparison with 2023, 2024 and 2025 data for 2026 planning.
- j. Collaboration with EGLE on Goose Creek inlet permitting for Check Dam rebuild and J-dams (or multiple dams) or similar structures downstream from the Check Dam to slow the velocity of the easter and provide a long term, permanent solution to reduce/eliminate sediment from entering Lake Columbia from the Goose Creek inlet.
- k. Continued Collaboration with Conservation District upstream from the Check Dam for soil erosion management and possible grants covering the cost.
- l. Personal Meetings with Watershed Committee and membership education including the Annual Meeting.
- m. See RLS Professional Aquatic Consulting Services Contract for Lake Columbia, Jackson County, Michigan in 2025 for schedule and costs.

4. RLS Plans and Costs (\$63,654) for 2026

- a. Professional RLS lake vegetation surveys annually.
- b. Monthly profile water quality sampling (April-August with quick data reporting).
- c. Storm drain sampling during heavy rainstorm and reporting for comparison with 2025 data.
- d. If EGLE permit approved and installed, oversee Pro2 Aeration system-destratification for 2-3 deep basins (includes permitting maintenance, engineering of on-site, onshore units).
- e. Scan of delta lake bottom to evaluate Muck Biotic effectiveness of the 2024 and 2025 applications to determine regiment of 2026 applications.
- f. Oversee four to six Muck Biotics applications to delta and identified canals, channels, and bays with excessive organic sediment.
- g. Oversee Meta Floc usage for excessive phosphorus level. Discontinue if Pro2 Aeration System installed in 2025.
- h. Oversee use of EPA-certified Biochar technologies for phosphorus and nutrient reduction for the Drains, member Docks, and downstream from the Check Dam.
- i. Full lake scans for comparison with 2023, 2024, 2025, 2026 data for 2027 planning.
- j. Collaboration with EGLE on Goose Creek inlet permitting for Check Dam rebuild and J-dams (or multiple dams) or similar structures downstream from the Check Dam to slow the velocity of the easter and provide a long term, permanent solution to reduce/eliminate sediment from entering Lake Columbia from the Goose Creek inlet.
- k. Continued Collaboration with Conservation District upstream from the Check Dam for soil erosion management and possible grants covering the cost.
- l. Personal Meetings with Watershed Committee and membership education including the Annual Meeting.
- m. See RLS Professional Aquatic Consulting Services Contract for Lake Columbia, Jackson County, Michigan in 2026 for schedule and costs.

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5. RLS Plans and Costs (\$65,564) for 2027

- a. Professional RLS lake vegetation surveys annually.
- b. Monthly profile water quality sampling (April-August with quick data reporting).
- c. Storm drain sampling during heavy rainstorm and reporting for comparison with 2026 data.
- d. If EGLE permit approved and installed, oversee ProO2 Aeration system-destratification for 2-3 deep basins (includes permitting maintenance, engineering of on-site, onshore units).
- e. Scan of delta lake bottom to evaluate Muck Biotic effectiveness for 2024, 2025, and 2026 applications to determine regiment of 2027 applications.
- f. Oversee four to six Muck Biotics applications to delta and identified canals, channels, and bays with excessive organic sediment.
- g. Oversee Meta Floc usage for excessive phosphorus level. Discontinue if ProO2 Aeration System installed in 2025.
- h. Oversee use of EPA-certified Biochar technologies for phosphorus and nutrient reduction for the Drains, member Docks, and downstream from the Check Dam.
- i. Full lake scans for comparison with 2023, 2024, 2025, 2026, and 2027 for 2028 planning.
- j. Collaboration with EGLE on Goose Creek inlet permitting for Check Dam rebuild and J-dams (or multiple dams) or similar structures downstream from the Check Dam to slow the velocity of the easter and provide a long term, permanent solution to reduce/eliminate sediment from entering Lake Columbia from the Goose Creek inlet.
- k. Continued Collaboration with Conservation District upstream from the Check Dam for soil erosion management and possible grants covering the cost.
- l. Personal Meetings with Watershed Committee and membership education including the Annual Meeting.
- m. See RLS Professional Aquatic Consulting Services Contract for Lake Columbia, Jackson County, Michigan in 2027 for schedule and costs.

6. RLS Plans and Costs (\$67,531) for 2028

- a. Professional RLS lake vegetation surveys annually.
- b. Monthly profile water quality sampling (April-August with quick data reporting).
- c. Storm drain sampling during heavy rainstorm and reporting for comparison with 2027 data.
- d. If EGLE permit approved and installed, oversee ProO2 Aeration system-destratification for 2-3 deep basins (includes permitting maintenance, engineering of on-site, onshore units).
- e. Scan of delta lake bottom to evaluate Muck Biotic effectiveness for 2024, 2025, 2026, 2027 applications to determine regiment of 2028 applications.
- f. Oversee four to six Muck Biotics applications to delta and identified canals, channels, and bays with excessive organic sediment.
- g. Oversee Meta Floc usage for excessive phosphorus level. Discontinue if ProO2 Aeration System installed in 2025.
- h. Oversee use of EPA-certified Biochar technologies for phosphorus and nutrient reduction for the Drains, member Docks, and downstream from the Check Dam.
- i. Full lake scans for comparison with 2023, 2024, 2025, 2026, and 2027 data for 2029 planning.
- j. Collaboration with EGLE on Goose Creek inlet permitting for Check Dam rebuild and J-dams (or multiple dams) or similar structures downstream from the Check Dam to slow the velocity of the easter and provide a long term, permanent solution to reduce/eliminate sediment from entering Lake Columbia from the Goose Creek inlet.

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- k. Continued Collaboration with Conservation District upstream from the Check Dam for soil erosion management and possible grants covering the cost.
 - l. Personal Meetings with Watershed Committee and membership education including the Annual Meeting.
 - m. See RLS Professional Aquatic Consulting Services Contract for Lake Columbia, Jackson County, Michigan in 2028 for schedule and costs. Final Report by November 1, 2028 for budgeting process. (\$10,000).
- 7. Goose Creek Watershed Recommendation plans cost (\$45,000) for 2024.**
- a. Currently there is an existing EGLE permitted Check Dam design at Goose Creek inlet of Lake Columbia that has been ineffective and constantly in extremely poor condition that requires annual maintenance. Our goal is to replace the Check Dam.
 - b. A bid document has been completed and sent to potential contractors about the necessary project specifications and requirements for the reduction of sediment entering Lake Columbia from Goose Creek with receipt of the bid December 15, 2023 and the winning bidder will be informed through a formal award letter that is signed by the LCPOA by January 15, 2024. A contract will then be developed between the LCPOA and the contractor.
 - c. Complete Check Dam rebuild by May 31, 2024.
 - d. Add US Biochar socks June 1, 2024 to the Check Dam to reduce phosphorus and nutrients entering the lake from the Goose Creek inlet (year around if water open). Cost is in the US Biochar project.
 - e. Submitted a request for a bid to contractors for return on February 15, 2024 to construct a J-dam in 2025 as recommended by Progressive AE to slow the velocity of the water and provide a long-term, permanent solution to reduce/eliminate sediment from entering Lake Columbia from the Goose Creek inlet.
 - f. The design should enable LCPOA to remove the sediment from the Check Dam and J-dams (or multiple dams) or similar structure(s) downstream from the Check Dam as needed on a periodic basis utilizing access from Cement City Road. Any access road improvements shall be part of the design. The document contains provisions, regulations, and other information pertinent to the site.
- 8. Goose Creek Sediment Retention plans costs (\$105,000 and \$20,00 maintenance) for 2025.**
- a. Continue US Biochar socks to the Check Dam to reduce phosphorus and nutrients entering the lake from the Goose Creek inlet (year around if water open). Cost is in the US Biochar project.
 - b. Remove heavy sediment upstream of the Check Dam as needed.
 - c. Submit a request to bid to contractors for the construction of a sedimentation trap/basin in the Goose Creek inlet downstream of Cement City Road and before the Check Dam as recommended by Progressive AE to retain sediments prior to entering Lake Columbia. If the trap, for example, were to have dimensions of sixty' long x 18' wide and a depth of 3.0 feet; it could hold approximately 120 cubic yards of sediment which would need to be removed at least one per year. On hold 2024 for EGLE permit.
 - d. Question on the size of the trap/basin as 1,200-1,400 cubic yards flow in annually.
- 9. Goose Creek Watershed Retention plans and costs (\$20,000 maintenance) for 2026**
- a. Continue US Biochar socks applied to the Check Dam to reduce phosphorus and nutrients entering the lake from the Goose Creek inlet (year around if water open). Cost is in the US Biochar project.
 - b. Remove heavy sediment upstream of the Check Dam as needed.
- 10. Goose Creek Watershed Recommendation plans and costs (\$20,000 maintenance) for 2027**
- a. Continue US Biochar socks applied to the Check Dam to reduce phosphorus and nutrients entering the lake from the Goose Creek inlet (year around if water open). Cost is in the US Biochar project.
 - b. Remove heavy sediment upstream of the Check Dam as needed.

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11. Goose Creek Watershed Recommendation plans and costs (\$20,000 maintenance) for 2028

- a. Continue US Biochar socks applied to the Check Dam to reduce phosphorus and nutrients entering the lake from the Goose Creek inlet (year around if water open). Cost is in the US Biochar project.
- b. Remove heavy sediment upstream of the Check Dam as needed.

12. Lake Columbia Watershed Shoreline Erosion upstream from the Check Dam

- a. Approximately distance of 2.4 miles of shoreline from Little Goose Lake to the Lake Columbia delta region. The majority of the entire creek banks showed substantial erosion.
- b. Areas upstream are unlikely to be sources as they would settle into Goose Lake and Little Goose Lake that would serve as functional settlement basins.
- c. RLS recommends collaboration of RLS scientists, LCPOA board members, and the local Conservation District to mitigate these areas for long-term improvements. Mitigation of this region is beyond the scope of the LCPOA and thus this level of collaboration is critical. Grant funding may likely be required with multiple partners.

13. Storm Drains Watershed Recommendations Plans and costs (\$98,400) for 2024.

- a. Obtain a permit from EGLE to use of EarthFood™ EPA Certified US Biochar for phosphorus and nutrient reduction. Such material can be placed in and around the drains, either in a retrofitted baffle box or within a filter sock. Utilized in drains, member docks, and Goose Creek inlet Check Dam.
- b. In addition to retrofitted improvements that are drain-specific, the current storm drain inventory map used by the Watershed Committee to obtain Water Quality drain sampling in 2023 will be used in the determination of incoming nutrient and pollutant sources.
- c. Drain re-routes are nearly impossible given the existing infrastructure and thus in situ methods are needed. This can also be evaluated for efficacy.

14. Storm Drain Watershed Recommendation Plans and costs (\$33,000, \$36,300, \$40,000, and \$40,00) for 2025 – 2028.

- a. Obtain a permit from EGLE to use of EarthFood™ EPA Certified US Biochar for phosphorus and nutrient reduction. Such material can be placed in and around the drains, either in a retrofitted baffle box or within a filter sock. Annual maintenance for one-third of the BioChar socks for entire US BioChar project utilized in drains, member docks, and Goose Creek inlet Check Dam.
- b. In addition to retrofitted improvements that are drain-specific, the current storm drain inventory map used by the Watershed Committee to obtain Water Quality drain sampling in 2023 will be used in the determination of incoming nutrient and pollutant sources.
- c. Drain re-routes are nearly impossible given the existing infrastructure and thus in situ methods are needed. This can also be evaluated for efficacy.

15. Member Dock Watershed Recommendations Plans for 2025-2028. Costs included in fourteen.

- a. Obtain a permit, if necessary, from EGLE to use of EarthFood™ EPA Certified US Biochar for phosphorus and nutrient reduction as part of the Storm Drain project.
- b. US BioChar socks can be placed in and around the member docks for phosphorus and nutrient reduction and help with run off from the members shoreline.

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16. Water Quality and Nutrient Management Recommendation for 2024

- a. Meta Floc Phosphorus binder until Pro2 Aeration system installed. **\$50,000 not budgeted but on hold for emergency.**
- b. Obtain permit for Pro2 Aeration system-destratification for 2-3 deep basins as a pilot project with EGLE.

17. Water Quality Management Recommendation for 2025

- a. Meta Floc Phosphorus binder until Pro2 Aeration system installed. **\$50,000 not budgeted but on hold for emergency.**
- b. Install Pro2 Aeration system-destratification for 2-3 deep basins as a pilot project with EGLE by May 2025. Cost 107,600 plus \$300/month for each of three power stations electricity, May – October for total of \$5,400. Socks are removed for November – April per EGLE requirements unless there is open water as at the Check Dam.

18. Water Quality and Nutrient Management Recommendation for 2026-2028

- a. Meta Floc Phosphorus binder until Pro2 Aeration system installed. **\$50,000 not budgeted but on hold for emergency.**
- b. Maintenance of Pro2 Aeration system-destratification for 2-3 deep basins as a pilot project with EGLE. Cost \$33,000 for annual maintenance plus \$300/month with 4% increase annually for each of three power stations electricity, May – October for total of \$5,600/2026, \$5,850/2027, and \$6,100/2028.

19. Sediment Management Plans and costs (\$50,000, \$51,500, \$53,045, \$54,636, and \$56,275) for 2024-2028.

- a. Annual evaluation and determination of whether to continue with MuckBiotics.
- b. Dredging currently EGLE requires use of other Restoration methods prior to seeking a permit for dredging any area. Dredging could be considered for the canal area separate from the delta region for ease of navigation in the future if first-line mitigation strategies are not enough in terms of riparian expectations. Any dredging is on hold by the Watershed Committee at this time until the Restoration plan proves it needs to be considered.
- c. Four to six Muck Biotics applications to delta and identified canals, channels, and bays with excessive organic sediment. RLS will continue to evaluate the efficacy of this product based on sediment organic carbon concentrations relative to baseline and sediment hardness scans compared to baseline conditions.

20. Lake Columbia Basin Vegetation & Survey Methods Recommendations cost (\$2,500 annually) for 2024-2028

- a. A whole-lake scan of all the aquatic vegetation with a WAAS-enabled Lowrance HDS 9[®] GPS with variable frequency transducer is to be conducted on Lake Columbia each summer season.
- b. The GPS Point Intercept survey is also used by RLS with an Aquatic Vegetation Assessment Site (AVAS) Survey method to assess the relative abundance of submersed, floating-leaved, and emergent aquatic vegetation within and around the littoral zones of inland lakes.

21. Lake Columbia Native Aquatic Plants

- a. The dominant native aquatic plants in Lake Columbia included Chara (24.1% of the sampling sites), and Large-leaf Pondweed (11.8% of the sampling sites).
- b. The Pondweeds grow tall in the water column and serve as excellent fish cover. In dense quantities, they can be a nuisance for swimming and boating and can be controlled selectively.

22. Lake Columbia Exotic Aquatic Plants

- a. The 2023 Survey showed Eurasian Watermilfoil, invasive Curly Leaf Pondweed, Starry Stonewort, and Purple Loosestrife.

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- b. Eurasian Watermilfoil is a major threat to the ecological balance of an aquatic ecosystem through causation of significant declines in favorable native vegetation within lakes, in that it forms dense canopies and may limit light from reaching native aquatic plant species.

23. Lake Columbia Aquatic Herbicide Treatments for budget in operational costs (\$60,000, \$61,800, \$63,654, \$65.563, and \$67,530.) for 2024-2028

- a. PLM in collaboration with RLS formulate a plan for Aquatic Herbicide Treatments annually.
- b. RLS recommends preserving most native vegetation to compete with algae and reduce algae over time. Systemic herbicides should be used for the EWM, and chelated copper is unfortunately, necessary for Starry Stonewort.
- c. RLS recommends preserving most native vegetation to compete with algae and reduce algae over time. Systemic herbicides should be used for the EWM, and chelated copper is unfortunately, necessary for Starry Stonewort
- d. Avoid full lake Sonar treatment.
- e. These treatments may be modified as the seasonal parameters change.
- f. Management may include future site-specific mechanical harvesting.

24. Wildlife/fishery management

- a. Fish Stocking.
- b. Aquatic Herbicide Treatment Control collaborating with RLS and PLM.

25. Recreational management

- a. Boat Washing
- b. Wake Boats recommendations

26. Other Considerations

- a. Enroll in Voluntary Cooperative Lakes Monitoring Program.
- b. Inlet Diversion of Excessive Water Volume through Wetland.
- c. Build/maintain 2-3 silt ponds upstream on Goose Creek as near to Cement City Road as possible.
- d. As recommended by Progressive AE build a trap/basin for collection upstream from the Check Dam of heavy sediment. The design should enable LCPOA to remove the sediment from the Check Dam as needed on a periodic basis utilizing access from Cement City Road. Any access road improvements shall be part of the design.
- e. Add Riprap to LCPOA park steel seawalls to mitigate wave surge impact and reduce bottomland sediment disturbance. Educate and encourage membership to do the same for their respective steel seawalls.

27. Part I – Professional Lake Management Consulting Components:

The following items will be included in the professional lake management consulting services for Lake Columbia in 2024:

1. Whole Lake aquatic vegetation surveys which include all growth forms (submersed, floating leaved, and emergent) during the summer of 2024. A complete inventory of all aquatic plant species will be conducted along with a complete benthic scan that will detail bathymetric depth contours, relative sediment hardness, and aquatic vegetation biovolume. This will be compared to 2023 data for changes in the communities based on new management methods. The cost for this item will be \$2,500.
2. Water quality sampling of the twenty-two storm drains during two very heavy rain events. RLS will provide pre-labelled sample bottles to Board members and/or other volunteers that may live close to a particular drain. Samples will include physical and chemical parameters similar to the ones measured in the deep basins (#2 above). RLS will utilize the established drain locations and designations for the drains as

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used in 2023. After samples are collected, then they will be placed on ice in a cooler provided by RLS and then RLS can receive the samples and take them to an EPA-certified laboratory for independent analysis. RLS will analyze the data and compare that data to baseline data to determine biochar efficacy. The cost for this item will be \$8,500 and includes data analysis.

3. RLS will conduct the baseline water quality requirements from EGLE to be used for the PrO2 permitting. RLS will work with Eden Lakes and EGLE to obtain the necessary permits and provide a year of baseline data using the methodology required by EGLE. This methodology consists of sampling five locations throughout the lake (3 deepest basins and two shallow basins) during three sampling periods (April/May, June/July, and August/September) for physical water quality parameters such as water temperature, dissolved oxygen concentration, pH, specific conductivity, total dissolved solids, and Secchi transparency and chemical water quality parameters such as total and ortho-phosphorus, total Kjeldahl nitrogen, and total inorganic nitrogen, and total suspended solids and chlorophyll-a. This data will also be compared to 2023 baseline data. The cost of this item is \$45,000.

4. RLS will combine all data into a professional scientific report using the required EGLE format which requires all data to date with formal statistical analysis. This report will be provided to EGLE and the LCPOA no later than January 31, 2025 as required but could be provided sooner if requested. This is included in the cost for #3 above as required by EGLE.

5. RLS will evaluate the efficacy of the MuckBiotics utilizing existing baseline data on sediment depths and hardness and compare this to post-application data collected late in the 2024 season. This data will also be included in the scientific report and provided to EGLE. This item will cost \$1,500.

6. RLS conducted a streambank assessment of Goose Creek in 2023 and found many areas with significant erosion. RLS will begin collaboration with the local Conservation District and other relevant groups to seek possible grants or other funding opportunities to reduce this erosion as it contributes to the degradation of water quality in Lake Columbia. The cost of this item is \$2,500 and would cover up to 20 hours of collaboration meeting and communication time. If collaborations require additional time and/or resource from RLS, an addendum to this agreement for additional funding would be needed.

Part II - Timeline for Items #1-5:

- 1.** Lake Restoration Deliverable Timeline for Completion Aquatic vegetation survey (whole lake) and lake scans for hardness, contours, and biovolume By June 20, 2024.
- 2.** Water quality sampling of lake deep basins with EGLE required protocol for baseline, PrO2 By September 30, 2024. Water quality sampling of storm drains post Biochar to determine efficacy. By September 1, 2024 (for two major events)
- 3.** Evaluation of MuckBiotics® in areas applied to determine efficacy By October 30, 2024
- 4.** Consultation with local Conservation District and other relevant parties regarding mitigation and funding sources for Streambank Stabilization of Goose Creek. Beginning Jan 30-2024 through October 2024.
- 5.** Professional technical report of all aforementioned data and further recommendations By Jan 31, 2025 as required by EGLE but sooner for LCPOA if requested,

Part III – Payments to Consultant

- 1.** The invoicing timeline for the items as described above for 2024 on Lake Columbia will be as follows: \$30,000 by May 15, 2024; \$20,000 by July 15, 2024 and \$10,000 due upon receipt of the EGLE-required report.