



# Swan Lake

## Annual Meeting with Markham Subcommittee

### Environmental Services

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June 26, 2024

# Agenda

- Background
- Completed Work
- Ongoing Work
- Public Information Meeting
- 2024 Plan and Recommendations





# Background



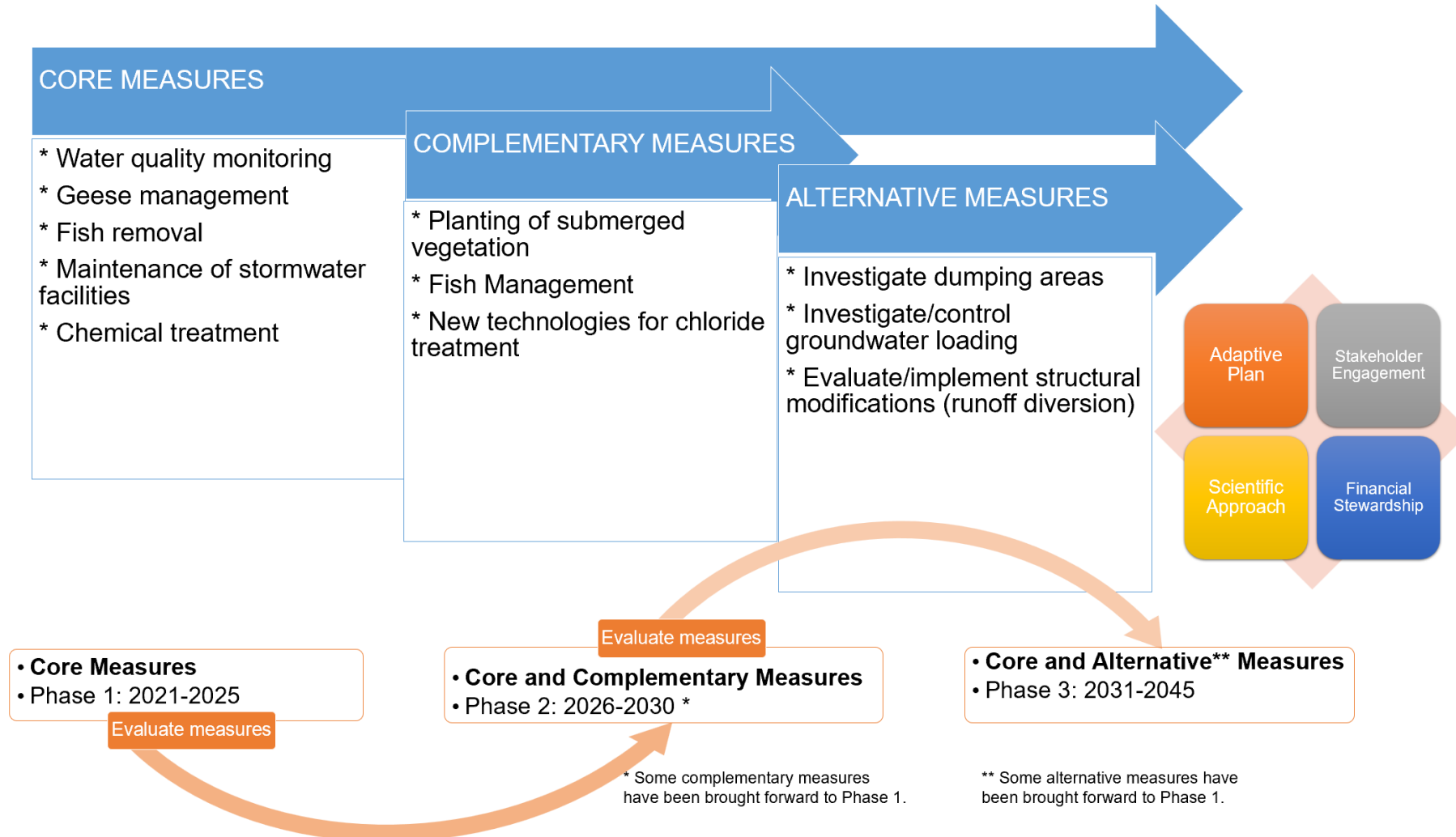
# Location and History

- Gravel pit in the 1960s and 1970s; construction waste dump in the early 1980s
- Lake formed when pumping for the gravel pit ceased operations
- Drainage area is fully developed, serviced by two stormwater management ponds and three oil and grit separators
- Closed system, prone to build-up of nutrients and algae growth
- Winter maintenance increases chloride concentration
- Water quality issues from 2010 and possibly earlier
- Active management of water quality since 2013 (Phoslock treatment, followed by geese management and monitoring)





# Long Term Management Plan (2021)





## 2023 Council Resolutions

That the General Committee consider the following motion passed at the May 11, 2023, Markham Sub-Committee meeting:

1. That the report entitled “Swan Lake- 2022 Water Quality Status and Updates” be received; and,
2. That Staff continue to implement the Long-term Management Plan for Swan Lake approved by Council in December 2021, including advancement of submerged aquatic vegetation, research into chloride treatment, and flow diversion evaluation (previously in Phases 2 and 3 of the Plan); and,
3. That Staff report back annually on water quality results and evaluation of adapted Core and Complementary measures for consideration in Phase 2 of the Plan through the Markham Sub-Committee with the participation of the Friends of Swan Lake Park; and,
4. That the next review of the Plan will be in 2026 (after completion of Phase 1 and other measures as listed under item 2) and that a workshop of independent industry experts be considered after completion of Phase 1, and;
5. That the deputation from Fred Peters be received, and further;
6. That Staff be authorized and directed to do all things necessary to give effect to this resolution.

**It was also recommended Staff hold a public meeting to communicate the Swan Lake water quality improvement program to City residents.**



# Completed Work



## 2023 Measures

| Activity  | Phase 1 Core Measures<br>(Years 1-5)                  |
|---|---|
| Water quality monitoring and annual reporting to Subcommittee | <input checked="" type="checkbox"/>                   |
| Enhanced Geese management                                     | <input checked="" type="checkbox"/>                   |
| Removal of benthic-dwelling fish                              | <input checked="" type="checkbox"/>                   |
| Maintenance of stormwater management facilities               | <input checked="" type="checkbox"/>                   |
| Community Engagement  | <input checked="" type="checkbox"/>                   |
| Shoreline planting / Improvements                             | <input checked="" type="checkbox"/>                   |
| Planting of submerged plants *                                | <input checked="" type="checkbox"/>                   |
| New technologies for chloride treatment *                     | <input checked="" type="checkbox"/> Planning underway |
| Fish management plan and fish stocking                        | Pending improved water quality                        |
| Flow Diversion Feasibility Study **                           | Underway  |

\* Originally planned for Phase 2

\*\* Originally planned for Phase 3



# Water Quality Monitoring

- Important for understanding issues and planning mitigation measures and adapting the plan based on the results
- Includes chemistry and biology
- Water level logger and staff gauge
- Measurements and samples by City staff
- Analysis by accredited laboratories
- Regular site inspections and observations
- External experts hired for review and updates

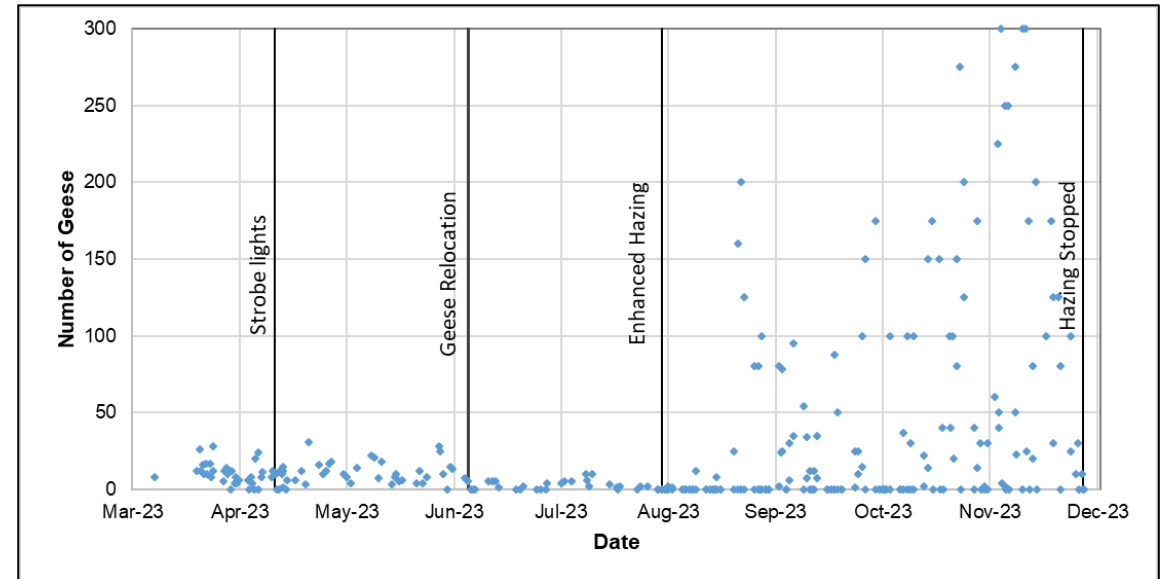
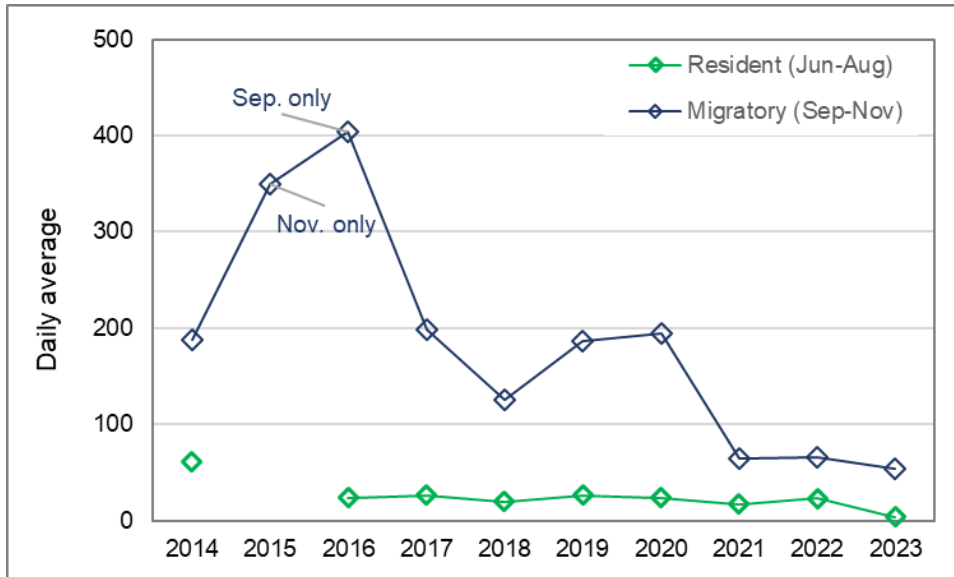


# Geese Management

- Geese relocation and hazing and egg/nest management
- Increased hazing frequency and geese relocation reduced the number of geese present at different times of the day
- No evidence of strobe lights being effective



Swan Lake Geese Count Survey QR Code



\* Some assumptions have been made in calculating the daily average for each year to fill in data gaps.

## Fish Management

- Removal of bottom-dwelling fish (to avoid disturbance of sediment)
- Fish inventory (Common Carp, Brown Bullhead, and Fathead Minnow)
- Fish management plan and fish stocking pending improved water quality and planting of submerged aquatic vegetation



## Storm System Maintenance

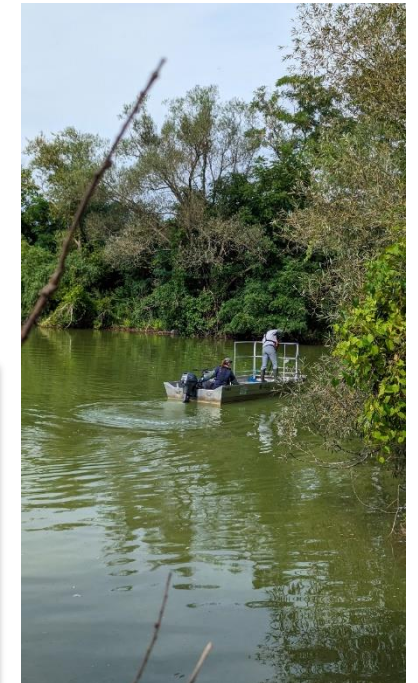
- Blocked outlet from Swan Club OGS was cleared
- Pond assumption discussions underway





# Submerged Aquatic Vegetation Planting

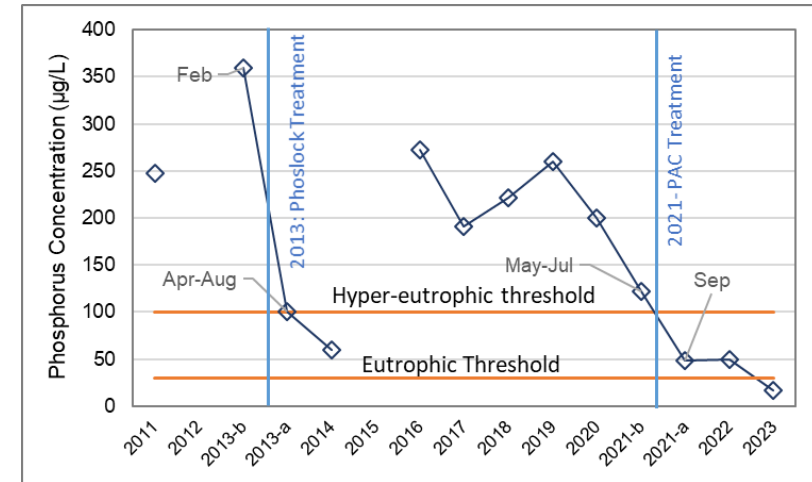
- Planned for Phase 2 of the Long-Term Plan to help solidify the sediment and provide fish habitat.
- Moved to Phase 1 after a review of 2022 water quality results by our limnologist consultant
- Submerged aquatic vegetation (macrophytes) can compete with and help mitigate algae (phytoplankton) growth
- Macrophytes will increase water clarity, which in turn, enhances their own growing conditions.
- TRCA planted wild celery in five fenced locations on the north site



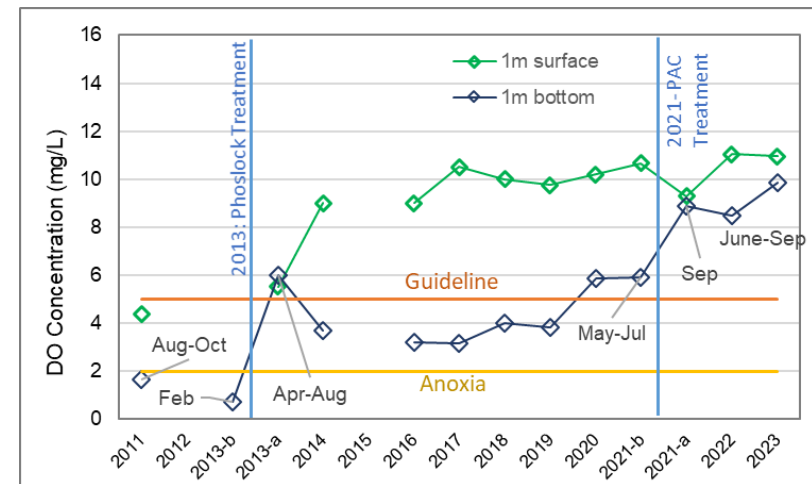


# Water Quality- Nutrients and Oxygen

- Total Phosphorus:
  - Average under 30 µg/L during growing season
  - Decreased significantly after each treatment
- Total Nitrogen:
  - Average about 0.6 mg/L during growing season (limit 1.2)
  - Dominant forms not bioavailable
- Dissolved Oxygen:
  - Surface concentration > 8.5mg/L all year
  - Bottom concentration mostly > 8mg/L (except one reading)
  - Increased compared to previous years
  - Continuous measurement at depth started; data need verification



Phosphorus



Dissolved Oxygen



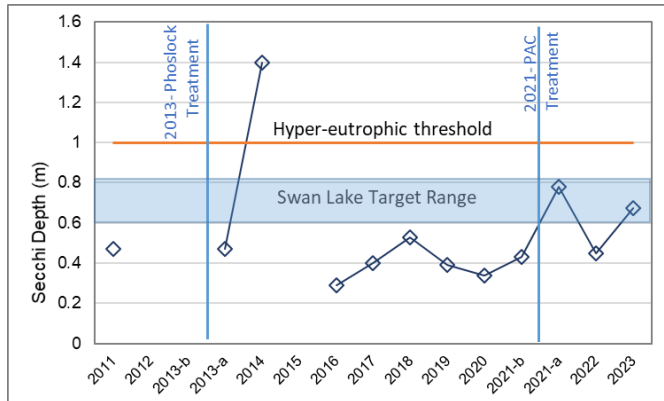


# Water Quality- Algae and Clarity

- Algal growth:
  - Cyanobacteria cell numbers significantly lower than 2022
  - Chlorophyll-a within the eutrophic state
  - Surface bloom not occurring since treatment
- Clarity:
  - Above >0.6 until July; Low clarity after July
  - Growing-season average within target



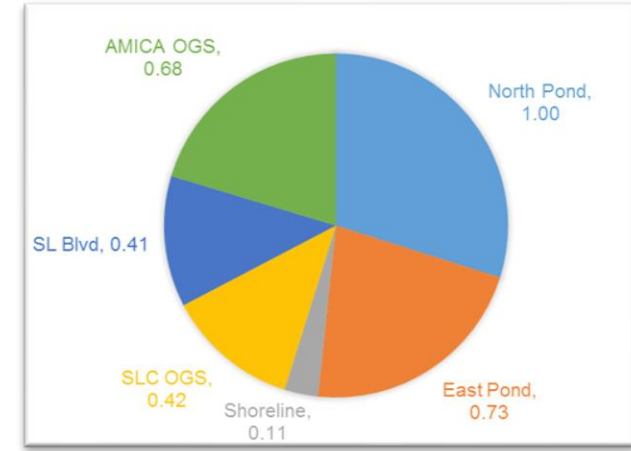
Algal bloom before treatment  
(photo from July 2020)



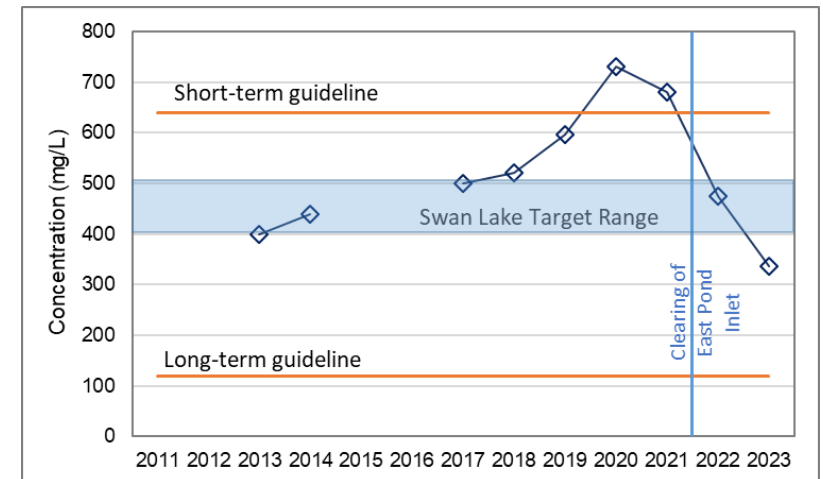
No surface bloom since treatment (photo from July 2023)

# Winter Maintenance and Chloride Concentration

- Salt Usage:
  - Swan Lake Village Corporation
  - City roads
  - Residents north of the Lake
  - AMICA Corporation to the south
- Chloride Estimates: runoff sample collections and water balance
- Contribution higher during ~2018-2021 when the inlet to East pond was blocked but decrease significantly since 2021.
- Current chloride concentrations below Swan Lake targets



Initial estimate of chloride contribution to the Lake (tonne/yr) from each source based on modeled flows and salt usage data  
Values will be refined through the Flow Diversion Study.

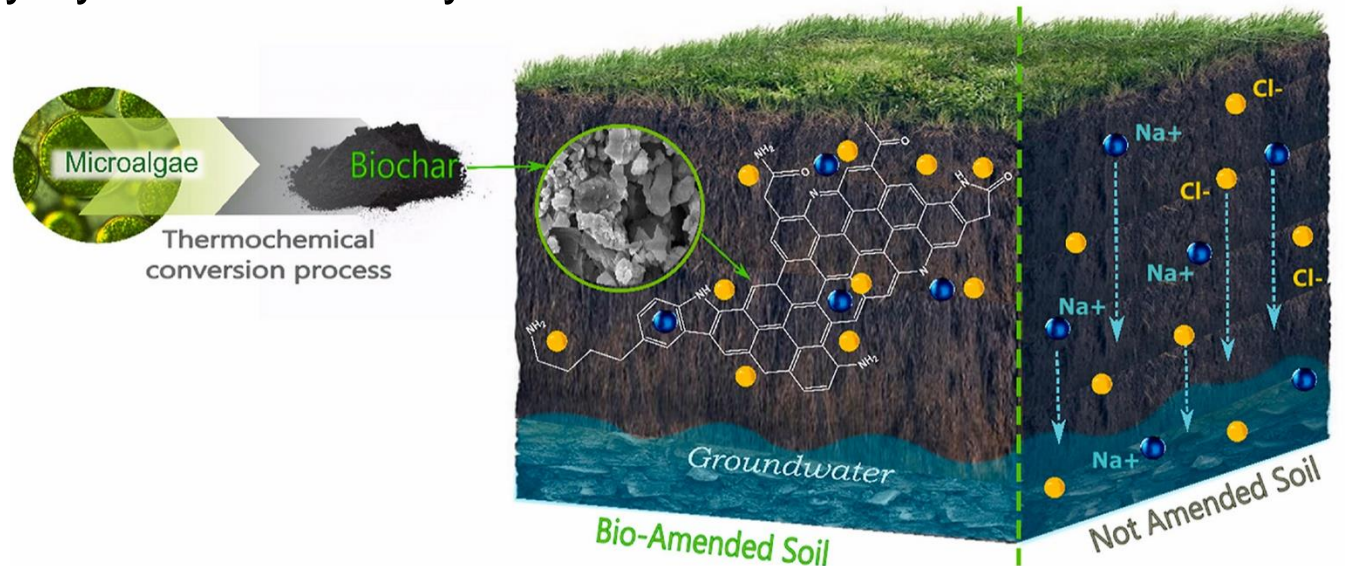




# Ongoing Work

## Assessment of New Technologies for Chloride Treatment

- Initially planned for 2027 at a cost of 50K
- Advanced to 2024
- Lab-scale units to test the biochar efficiency
- Refined scope of work with researchers
- Application for NSERC grant underway by York University



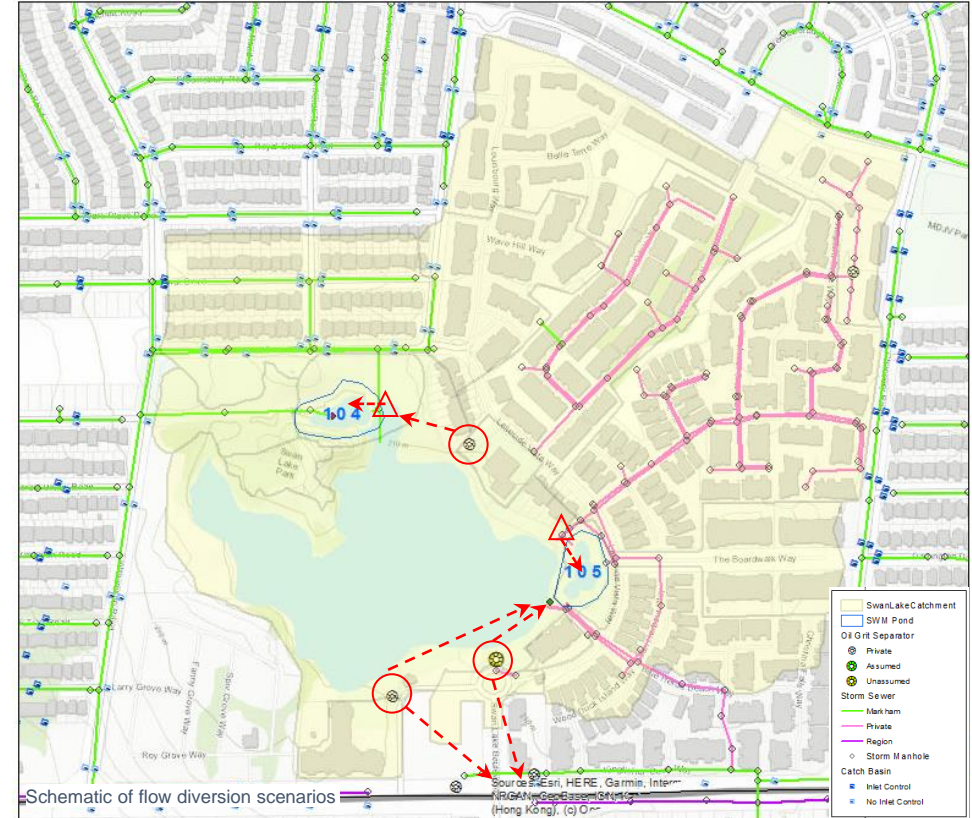
## Flow Diversion Feasibility Study

- Alternative measure in Phase 3: evaluate/design structural modifications such as lake water recirculation and stormwater redirection
- FOSLP proposed to reduce Swan Lake's role in the 'local stormwater management regime' by rerouting the flows ... in order to control chloride concentrations.
- Flow Diversion Feasibility Study initiated:
  - Technical analysis to assess the feasibility of rerouting flows to determine if the infrastructure within Swan Lake can support the proposed changes.
  - Data collection/digitization of private sewer infrastructure completed.
  - Consultant was hired in 2023; model development underway.
  - Study to be completed by end of 2024.
- Further studies may be required to engage all stakeholders (including private landowners and York Region) and identify a preferred alternative.



# Flow Diversion Feasibility Study - Scenarios

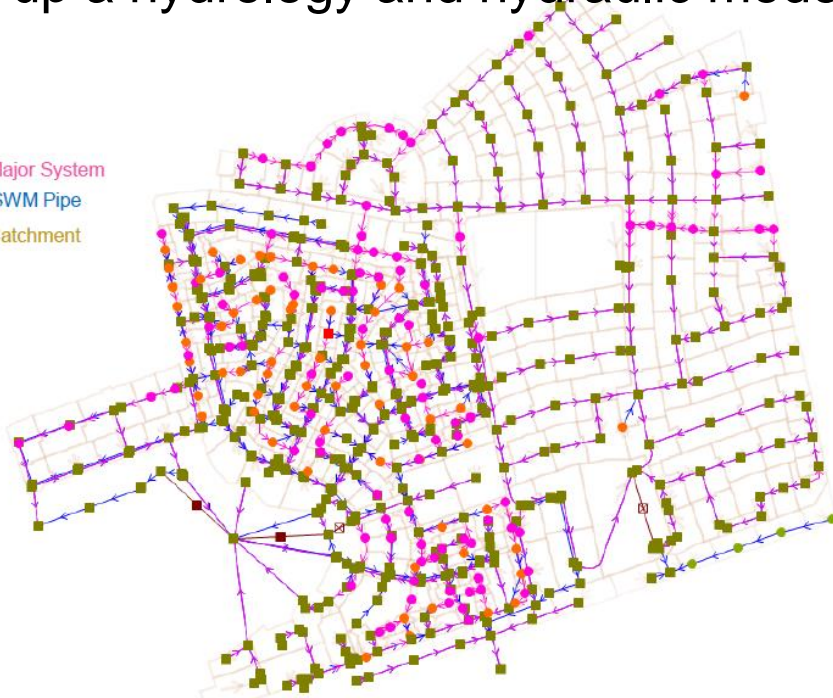
| Source                             | Scenario   |
|------------------------------------|--|
| AMICA OGS and Swan Lake Blvd OGS   | Redirect flows to 16 <sup>th</sup> Ave sewer                                       |
|                                    | Redirect flows to Lake Outlet  |
|                                    | Redirect the first-flush (most pollutant-laden runoff) in a small diversion sewer  |
| Swab Lake Club OGS                 | Redirect flow to North Pond Splitter   |
| East Pond and North Pond           | Adjust the flow splitter weir to reduce flow bypass to the Lake                    |
|                                    | Expanding the storage capacity to reduce flow bypass to the Lake *                 |
| Foundation Drain Collectors        | Redirecting flows toward Swan Lake to supply potentially cleaner, cool groundwater |
| Combination of the above scenarios |  |



\* To consider if the redirecting scenarios increases flood risk and if less costly than any sewer capacity upgrades

# Flow Diversion Feasibility Study - Modelling

- Background review
- Field investigations (identify downspout connections to sewer, confirmation of sewer elevations, chloride sampling)
- Flow and rainfall monitoring
- Setting up a hydrology and hydraulic model





# Public Information Meeting





## Meeting Objective

- Provide details of the water quality improvement program
- Share achievements of the program since it started
- Inform the public about upcoming activities in 2024
- Discuss ways to get involved in improving water quality and habitat health
- Answer any questions the public may have
- Operations staff provided updates on the Shoreline Restoration project and its continuing role supporting water quality improvement as a priority

## Meeting Outcome

- Meeting on March 25, 2024, at Markham Museum Transportation Hall
- Over 120 residents attended the meeting
- A Power Point presentation was delivered on program details and its positive results
- Active participation and expressed appreciation from the community







# 2024 Plan and Recommendations

## 2024 / 2025 Planned Activities

### CORE MEASURES:

- Water quality monitoring and annual reporting to Subcommittee
- Geese and fish management
- Community engagement
- Chemical treatment in 2024
- Shoreline restoration (Operations)\*
- Continue pond assumption process
- 5-year review in 2025

Research by Trent University on Rare Earth Elements

\* In 2024, staff will submit 2025 capital budget request to construct permanent goose exclusion fencing and plantings to further support water quality improvements.

### COMPLEMENTARY AND ALTERNATIVE MEASURES:

- Planting of Submerged Aquatic Vegetation
- Flow Diversion Feasibility Study
- Assessment of New Technologies for Chloride Treatment





## Recommendations

1. THAT the report entitled “Swan Lake- 2023 Water Quality Status and Updates” be received;
2. AND THAT Staff continue to implement the Long-term Management Plan for Swan Lake approved by Council in December 2021, including advancement of submerged aquatic vegetation, research into chloride treatment, and flow diversion evaluation (previously in Phases 2 and 3 of the Plan);
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5. AND THAT Staff be authorized and directed to do all things necessary to give effect to this resolution.



**Questions?**





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