



**Swan Lake Water Quality Monitoring
2025 Annual Report**

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Project Number: 25214

**Swan Lake Monitoring Program
2025 Annual Report**

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List of Acronyms

DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
GIS	Geographic Information System
LED	Light Emitting Diode
MASL	Meter Above Sea Level
MDL	Method Detection Limit
OGS	Oil and Grit Separator
OMNRF	Ontario Ministry of Natural Resources and Forestry
PAC	Poly Aluminum Chloride
SAV	Submerged Aquatic Vegetation
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
TRCA	Toronto and Region Conservation Authority
VAC	(Swan Lake) Village Amenities Committee
WHO	World Health Organization

Executive Summary

Background

Swan Lake is situated in the City of Markham at the intersection of Sixteenth Avenue and Williamson Road. Swan Lake has an approximate area of 5.3 ha and a maximum water depth of 4.0 m from the edge of the Lake at 209 meters above sea level (masl). At an average elevation of about 208.2 masl (estimated or measured over the last decade), the lake maximum depth is 3.2 m and surface area is about 3.9 ha.

A gravel pit in the 1960s and 1970s, Swan Lake is currently a community feature with multiple trails and urban development surrounding it.

Several issues were discovered with Swan Lake in 2010, including high phosphorus levels and significant algal blooms during the summer months, which led to low oxygen levels and degraded fish habitats. A Phoslock treatment was administered in 2013 to reduce the phosphorus levels and algal blooms in Swan Lake.

In 2019, the City of Markham conducted a study to define a Water Quality Management Strategy for Swan Lake. The Strategy, finalized in July 2020, recommended a chemical treatment in 2021. In August 2021, 13 tonnes of Poly Aluminum Chloride (PAC) were applied to the Lake in a controlled manner over several days.

The Swan Lake Long-Term Management Plan, which was developed based on the 2019 Strategy and extensive consultation with stakeholders, was received by the Markham Sub Committee in November 2021 and approved by the Council in December 2021. It describes a phased adaptive approach, including Core, Complementary and Alternative measures, and periodic reviews to adapt the Plan to the Lake conditions.

This report summarizes management activities completed in 2025 and discusses observations at the monitored stations in the Lake throughout 2025.

Water Quality Management Activities

Core measures identified in the Long-Term Management Plan were implemented as planned from 2021 to 2025, including a second application of PAC in 2024 and planting of additional submerged aquatic vegetation following the PAC application, as it was expected that the improved water clarity following treatment would help establish the plants. A geese management program, a fish inventory and the removal of bottom-dwelling fish were completed annually.

In May 2025, 500 juvenile largemouth bass were stocked in the Lake following consultation with TRCA, MNRF, and by a private contractor. Fish stocking was identified as a Complementary measure in the 2021 Plan. This measure was brought forward to help balance the Lake's fish community.

Following the successful use of ultrasound technology to control algal blooms in a stormwater management pond in Markham, two similar units were installed at Swan Lake to further improve water clarity.

The Flow Diversion Feasibility Study was completed and the chloride treatment pilot project continued in 2025. Findings from the Flow Diversion Feasibility Study along with information on salt usage and chloride concentrations in runoff were used to update the water and chloride budget in anticipation of the Phase 1 Review.

As outlined in the 2021 Long Term Management Plan, a 5-year Review is being conducted. This Review summarizes the effectiveness of Core measures and evaluates additional Complementary measures to be considered in Phase 2.

Results- Lake Water Quality

Water quality monitoring of Swan Lake has been conducted annually since 2013 (except for 2014) to track water quality and the continued effectiveness of lake management efforts. The collected data presented in this report is part of the ongoing monitoring program that will allow for continuous assessment of the water quality in Swan Lake and will be used to implement and adapt the Long-Term Management Plan for Swan Lake.

Water quality is regularly monitored at two shoreline sites: the Dock and the Bridge, on a bi-weekly basis (from April to November). The Dock site is representative of deeper areas of the lake, while the Bridge site reflects shallow water conditions. Samples and measurements are taken at 0.5 m or 1 m increments for the depth of the lake. A level logger is used to record the water level in the Lake. A Dissolved Oxygen (DO) logger was also installed 1 m from the Lake bottom at the Dock site to record the diurnal changes in DO. In 2025, samples were also collected near the two ultrasound transducers (identified as the West and East units) to assess the effectiveness of the technology. Fewer samples were collected and analyzed in 2025 due to low water level at the Bridge site.

Trent University collected samples and launched loggers in Swan Lake in the summer of 2024 and 2025 to support a study on the environmental fates of lanthanum from La-modified bentonite in the ecosystem of Swan Lake. Data provided by Trent researchers have been incorporated in this report.

The following paragraphs provide the monitoring results for the 2025 monitoring period, as well as annual summaries of available data from 2016 to 2025. The figures include plots of measured DO and temperature, water clarity, nutrient concentration, chloride concentration, phytoplankton and geese count.

Swan Lake Water Quality Targets

Phosphorus concentration and clarity were compared to the interim targets developed for Swan Lake through the 2019 Water Quality Management Strategy. Trophic state was classified using total phosphorus concentrations to place observed conditions in the context of lake productivity. For DO and chloride, Federal and/or Provincial water quality Guidelines or Objectives are shown for perspective. It should be noted that Swan Lake is not a natural waterbody, and there is no requirement for it to comply with these guidelines and objectives. Where technically and economically feasible, the City will aim to meet these guidelines and objectives to protect and enhance the aquatic environment.

Dissolved Oxygen (DO), Temperature, and pH

The minimum DO concentration required for the protection of warm water fish is 5 mg/L for water temperatures up to 20 °C, and 4 mg/L for temperatures above 20 °C, based on the Provincial Water Quality Objectives (PWQO). DO concentrations at 1m below the surface and 1m above the lake bottom are shown below.

Day-time concentrations measured during biweekly visits were above the DO objective (above 7.0 mg/L at the surface and above 4.5 mg/L at 0.6 to 1 m from the bottom).

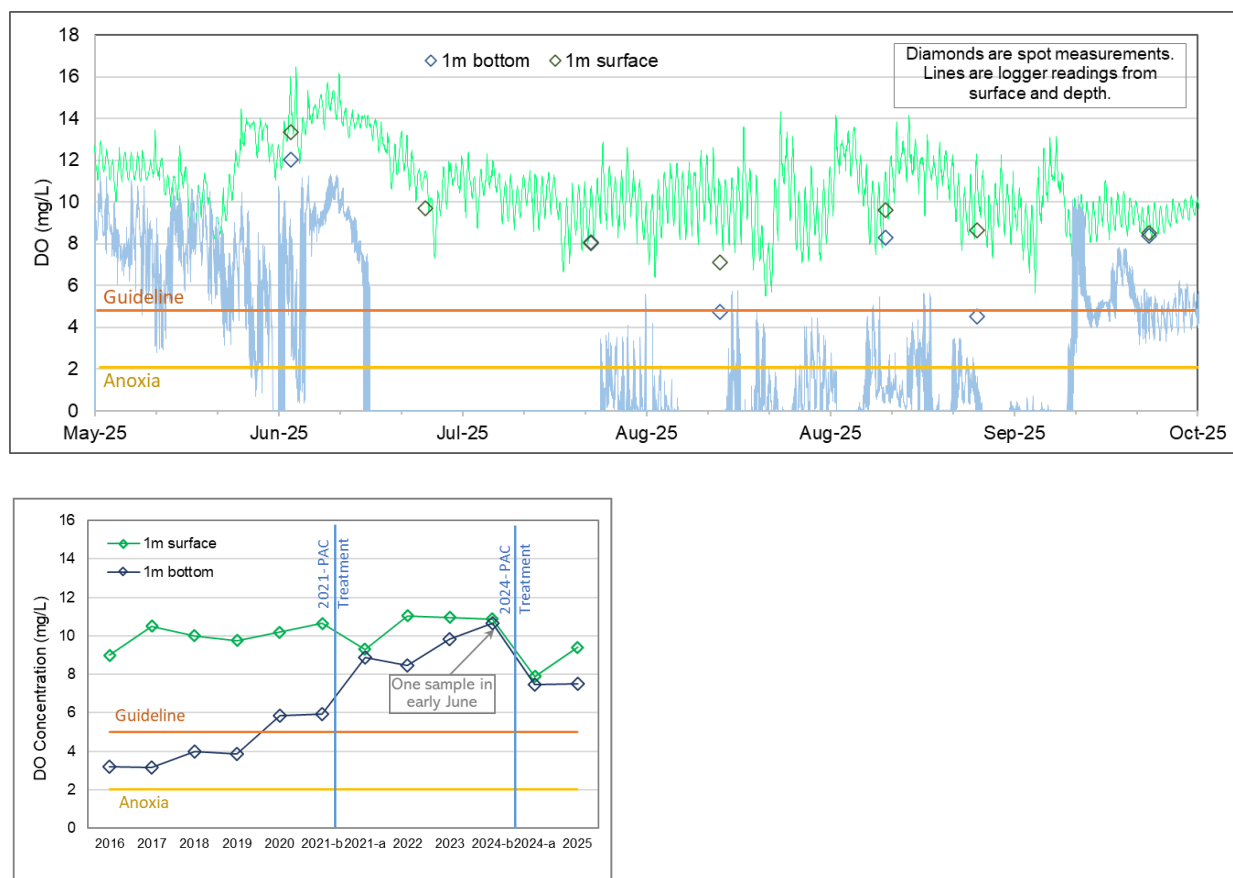
While measured daytime DO levels did not indicate anoxia during the sampling events, continuous measurements at the Dock as well as at the deepest point in the lake (i.e., monitored at a logger commissioned by Trent University) showed a decline in bottom water DO to low levels about 84% of the time during August and September, during a very dry and warm summer and fall. These declines could

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have led to periodic anoxic episodes, increasing the potential for nutrient release from the sediments. However, the PAC treatments effectively bind phosphorus in the sediments, preventing its release even under anoxic conditions. Monitoring data support this effect, as surface and bottom phosphorus concentrations do not indicate anoxia-driven phosphorus enrichment, and overall bottom water DO has improved since the PAC treatments.

Lower DO concentrations could have lethal or sub-lethal (physiological and behavioral) effects on fish; however, some fish can acclimate to lower oxygen levels and survive concentrations between 1 and 3 mg/L. During anoxic episodes, which are temporary and generally restricted to a small area of the Lake at depths below about 2.5 m, they can also avoid low oxygen conditions.

Figure ES-2: 2025 Monitoring Results and 2016-2024 Annual Results- Dissolved Oxygen



Note 1: DO concentrations are shown at 1 m from the surface (average of 0.5 and 1 m) and 1.5 m from surface (0.6-1 m from the bottom). Logger data are also shown for the duration of the monitoring for the surface and deep water DO levels.

Note 2: Historical data are shown for the average of daytime measurements during growing period (June-Sep) unless otherwise indicated. Data before 2016 are not shown for legibility.

The pH measured at the lab was about 8 throughout the year. High daytime pH is consistent with high levels of algae. Algae take up carbon dioxide, a weak acid, from the water for photosynthesis, causing the water to become more basic (higher pH).

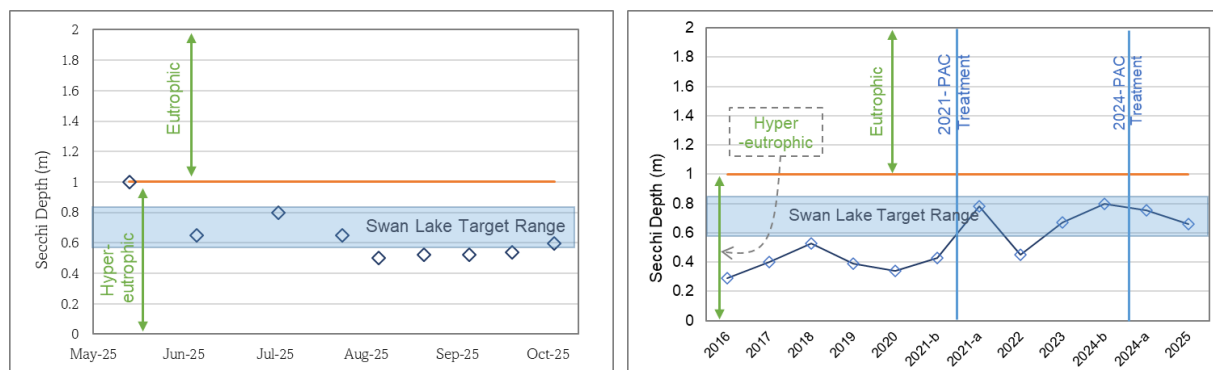
Water Transparency (Secchi Depth)

Secchi depth represents water transparency, which declines when the algae level increases. Secchi depth is often used as an indicator of trophic state, with average growing season values less than 1 m indicating

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hyper-eutrophic conditions, and values of 1-2 m indicating eutrophic conditions. The proposed interim target for Swan Lake is 0.6-0.8 m based on correlation with the phosphorus target. In 2025, the average water clarity during the growing season was within the target, with occasional declines to 0.5 m later in the fall.

Figure ES-3: 2025 Monitoring Results and 2016-2025 Annual Results- Secchi Depth

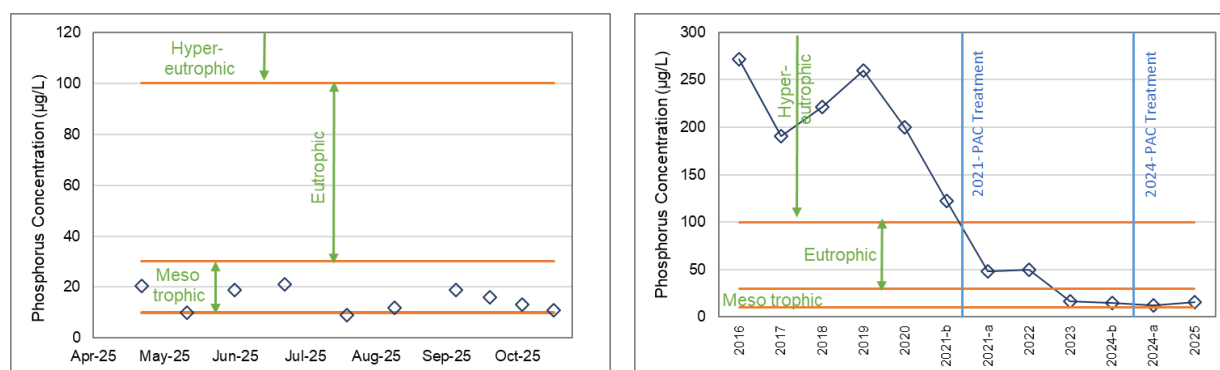


Phosphorus and Nitrogen Concentrations

Phosphorus concentration is the most important indicator of the trophic state in Swan Lake. It is an indication of how prone the Lake is to algae growth.

Phosphorus concentrations above 100 µg/L represent a hyper-eutrophic condition, which lead to high algae concentrations. In 2025, total phosphorus concentration in the top 0.5 and 1.5 m depths averaged under 16 µg/L during the growing season (under the 30 µg/L threshold for eutrophic condition, and well below the interim target of 50-100 µg/L). There was significant improvement in phosphorus concentrations after treatment by PAC.

Figure ES-1: 2025 Monitoring Results and 2016-2025 Annual Results- Total Phosphorus



Note 1: The 2025 values are averages of samples collected at 0.5 and 1.5 m from the surface. Samples were collected from the areas around the two ultrasound units (East and West) on April 24 and July 26.

Note 2: Annual concentrations are summaries of the growing period (June-Sep) unless otherwise indicated.

In 2025, total nitrogen concentrations over the growing season averaged about 0.60 mg/L generally reflecting mesotrophic conditions (below the 0.65 mg/L threshold for a eutrophic condition). In 2025, ammonia and nitrate concentrations (the forms available for uptake by biota) were generally very low (except in October), and nitrogen was mainly present in its organic form.

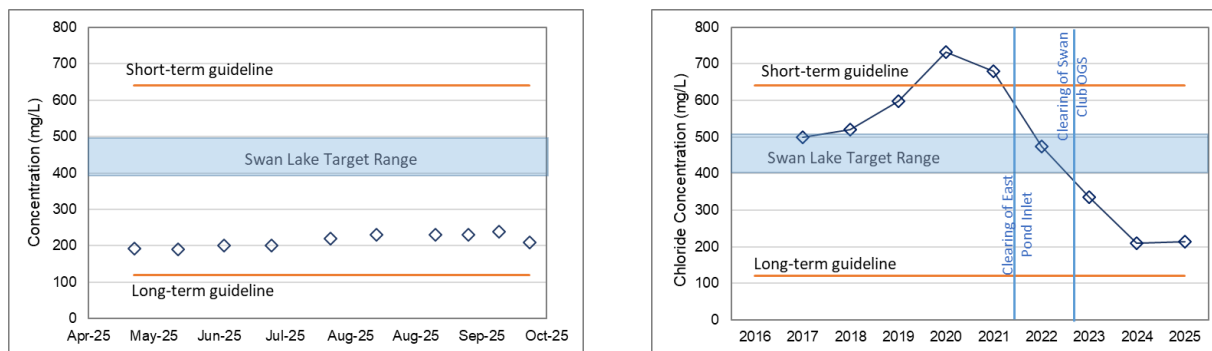
Chloride Concentration

Chloride concentration has been increasing in urban lakes as a result of de-icer application for winter maintenance of roads and walkways. Chloride does not biodegrade, readily precipitate, volatilize, or bioaccumulate. It does not adsorb readily onto mineral surfaces and therefore when introduced, concentrations remain high in surface water.

The Canadian Water Quality Guidelines for chloride developed for generic environmental data include a long-term guideline (120 mg/L) and a short-term guideline (640 mg/L). The site-specific interim target for chloride for Swan Lake is 400-500 mg/L consistent with 2013-2014 values.

In 2025, chloride levels were similar to 2024 at about 200 mg/L, which is below the target and declined considerably compared to previous years, continuing previous declines observed since 2020.

Figure ES-4: 2025 Monitoring Results and 2016-2025 Annual Results- Chloride

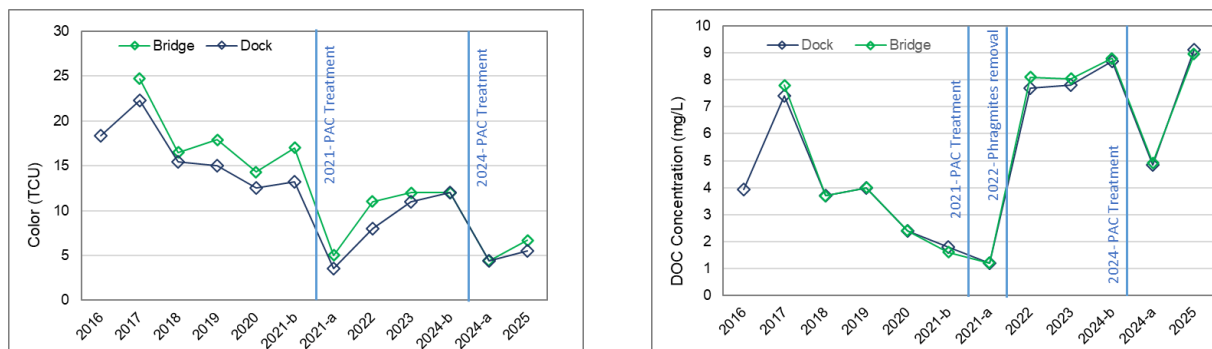


In 2025, water samples were collected from various inlets to the Lake and analyzed for chloride. These data were used to update the chloride mass balance following the completion of the Flow Diversion Feasibility Study.

Dissolved Organic Carbon and Color

Dissolved organic carbon (DOC) and colour indicate the organic content of lake water. In 2025, DOC ranged between 7 and 11 mg/L, with color ranging from 5 to 9 TCU at both stations. DOC in 2022, 2023 and 2024 (before the PAC treatment) was considerably higher than in previous years. The increase may potentially be associated with the remnants of Phragmites in the Lake, as the roots were not removed. Both colour and DOC declined sharply in 2024 following the PAC treatment, which precipitates organic matter. DOC increased to pre-treatment levels in 2025 while colour has remained low.

Figure ES-5: 2016-2025 Annual Results- DOC and Colour



Algal Growth

In 2025, very limited surface scums were observed along the shoreline around the Dock, as well as in the northern bay at the Bridge site. While the Lake was dominated by phytoplankton from late June, surface scums indicative of Cyanobacteria blooms were not widespread.

Samples were collected and sent to the laboratory for phytoplankton analysis. Test results showed higher diversity and similar cyanobacteria counts compared to 2024 at the Dock and the Bridge sites.

Six samples were analyzed for phytoplankton between April and October. The total cyanobacteria cell count ranged from 12,000 to 120,000 cells/mL, with values on three events above Health Canada's indicator value of 50,000 cells/mL for the potential production of cyanotoxins for primary contact recreation.

Several algal blooms with potentially toxic cyanobacteria were observed in years before 2011; however, testing completed before 2011 and following treatment (2013-2016) did not detect any Microcystin in the water. In 2016, a bloom was tested and resulted in a Microcystin concentration of 73 µg/L. Extended blooms were observed at several sites in 2018; however, cell density was at half of World Health Organization (WHO)'s threshold for significantly increased human health risk due to toxins. Since the 2021 PAC treatment, very limited surface scum has been observed at Swan Lake.

Geese Count

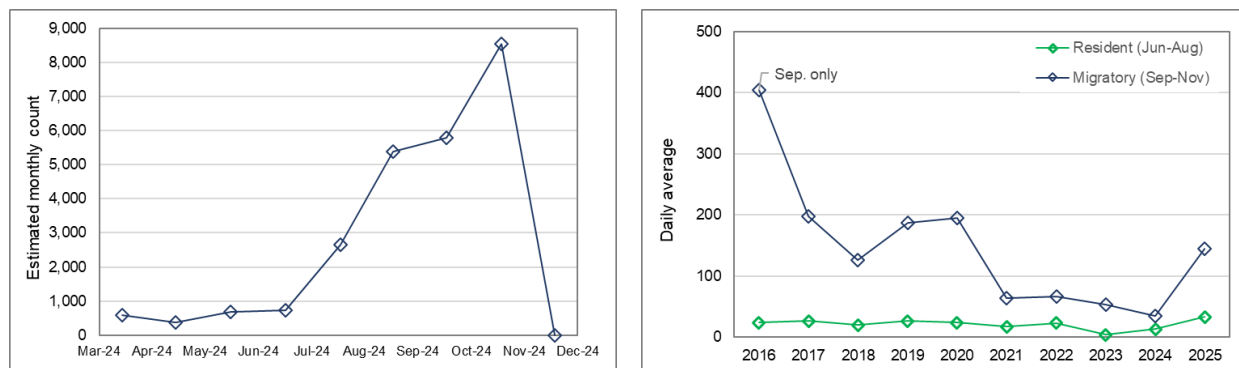
Geese are the primary external source of nutrients in the Lake. Therefore, active geese management is completed annually. The geese control program started in 2014, focusing on resident geese. The program extended to the management of migratory geese in 2016.

The 2024 and 2025 program focus of control was laser light, avian distress call and limited strategic zinc crackler pyro, as well as geese relocation. A laser emitter was installed on the south island emitting at 1 ft above water surface to prevent overnight goose populations from accumulating in Swan Lake.

The 2024 efforts were very effective in reducing the number of migratory geese visiting the Lake, further lowering the counts. Geese counts were higher in 2025, primarily due to natural population fluctuation, and partly because the laser lights that had been placed on the island were removed for product improvement.

The geese count data helped provide more certainty in the results and were used to more effectively schedule hazing efforts.

Figure ES-6: 2025 Monitoring Results and 2016-2025 Annual Results- Geese Count



Note 1: 2025 data are the sum of counts in each month, compensated for days with no count.

Note 2: Annual trends are shown as daily averages of counts over June-August and September to November, representing resident and migratory geese, respectively.

Fish Inventory

A fish inventory and removal campaign were completed in April 2025 to remove bottom-dwelling fish, which could interfere with the PAC treatment efficacy. A limited number of fish species were caught in the Lake, including Brown Bullhead, Fathead Minnow, as well as Goldfish and a hybrid of Carp/Goldfish.

Aquatic Vegetation Survey

During the PAC application in 2024, significant amounts of aquatic vegetation comprised primarily of Small Pondweed (*Potamogeton pusillus*) were observed and at times hindered the movement of the application boat. This was the first observation of any significant amounts of submerged aquatic vegetation in the lake. In 2025, a comprehensive survey was conducted to characterize the existing aquatic plant community. The survey found that SAV was abundant throughout the lake with generally moderate to high robustness (cover) at depths less than 2 m, and variable cover from high robustness to absent at depths greater than 2 m. The plants were dominated by the native species including Muskgrass (*Chara spp.*) and Canada Waterweed (*Elodea canadensis*) and lower abundances of Small Pondweed and Curly-leaved Pondweed (*Potamogeton crispus*). The newly established SAV community is consistent with improved water clarity and reduced algae levels in recent years.

Summary and Recommendations

Overall, the management activities in recent years that focused on the significant nutrient loadings identified in the water quality improvement study (i.e., chemical treatment and fish management to reduce internal loads and geese management to reduce external loads) were effective at improving water quality in the Lake as shown by reduced phosphorus and nitrogen concentrations, lower algae levels, improved dissolved oxygen levels, and the establishment of a submerged aquatic plant community. These improvements represent a positive step towards improving the aquatic habitat in the Lake and meeting the long-term water quality goals.

The 2026 monitoring program and management activities will follow the recommendation of the Long-Term Management Plan as updated by the Phase 1 Review.

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1. Introduction

Swan Lake is situated in the City of Markham at the intersection of Sixteenth Avenue and Williamson Road, as shown below in Figure 1. Swan Lake has an approximate area of 5.5 ha and a maximum water depth of 4.5 m (from the deepest point to the Lake edges at 210 meters above sea level). At an average elevation of about 208.2 masl (estimated or measured over the last decade), the lake maximum depth is 3.7 m and surface area is about 4.5 ha.

Formerly a gravel pit in the 1960s and 1970s, Swan Lake is currently a community feature with multiple trails and urban development.

Several issues were discovered with Swan Lake in 2010, including high phosphorus levels and significant algal blooms during the summer months, which led to low oxygen levels and degraded fish habitats. A Phoslock treatment was administered in 2013 to reduce the phosphorus levels and algal blooms in Swan Lake.

In 2019, the City of Markham conducted a study to define a Water Quality Management Strategy for Swan Lake (Freshwater Research 2020). The Strategy, which was finalized in July 2020, recommended chemical treatment starting in 2021. In August 2021, 13 tonnes of PAC were applied to the Lake in a controlled manner over several days.

The Swan Lake Long-Term Management Plan, which was developed based on the 2019 Strategy and extensive consultation with stakeholders, was received by Markham Sub Committee in November 2021 and approved by the Council in December 2021 (City of Markham 2021). It describes a phased adaptive approach, including Core, Complementary and Alternative measures, and periodic reviews to adapt the Plan to the Lake conditions.

Water quality monitoring of Swan Lake has been conducted annually since treatment in 2013 in order to track water quality and the effectiveness of management activities. The 2025 monitoring results presented in this report are part of the ongoing monitoring program that will allow for continuous assessment of the water quality in Swan Lake and help establish a long-term plan for the treatment of Swan Lake.

Trent University collected samples and launched loggers in Swan Lake in the summer of 2024 and 2025 to support a study on the environmental fates of lanthanum from La-modified bentonite in the ecosystem of Swan Lake. Data provided by Trent researchers have been incorporated in this report.

2. 2025 Management Activities and Studies

Core and Complementary activities planned in the Long-Term Management Plan and completed in 2025 included water quality (and biologic) monitoring, enhanced geese management, fish management, as well as ultrasound technology for algae control. An aquatic plant survey was also conducted as an additional activity in support of the program.

2.1 Geese Management

Geese reduction at Swan Lake is necessary due to the nutrient load they contribute to the Lake.

In 2025, the Wildlife Management Group Inc., an external consultant, was hired to use science-based and Environment Canada-approved techniques for managing Canada goose. Activities included nest depredation (nest monitoring, and subsequent removal between April and May), and adult goose mitigation through laser light, avian distress call and limited strategic zinc crackler pyro. It was noted that during many service visits conducted during daylight hours, no geese were observed on the water at Swan Lake. However, numbers increased during dusk and dawn fly-in periods. Service schedule was adjusted to address the rise in evening activity.

Stationary lasers were reinstalled on site; however, due to product improvements, the previous units were removed and not replaced in time for Fall applications. A summary of 2025 activities is provided in Appendix C.

The strobe lights purchased in 2020 at the request of Friends of Swan Lake Park were also installed on the Lake and the two adjacent stormwater management ponds. Strobe lights work by using a solar-powered LED light that flashes every two seconds and is intended to disrupt the geese's sleep patterns and discourage them from staying on the Lake.

2.2 Fish Management

The Long-Term Management Plan for Swan Lake (2021) has a provision for managing bottom-dwelling fish to reduce sediment disturbance.

Since 2021, the City has hired the TRCA annually to complete a fish inventory and removal operation.

A fish removal event was completed on April 25, 2025 using an electrofishing boat and a fyke net. The same electrofishing sampling transects used in previous years were repeated in 2025. All fish captured were identified and enumerated. Of the 745 Captured Brown Bullhead and Goldfish, 371 were euthenized. A summary of 2025 activities is provided in Appendix D.

In May 2025, 500 juvenile largemouth bass were added to the lake by a private contractor (Hidden Lane Fisheries from Smithville, ON), following consultation with TRCA and MNRF. Fish stocking was identified as a Complementary measure in the 2021 Long-Term Management Plan. This measure was brought forward to help balance the fish community in the Lake.

Initial discussions with the TRCA and MNRF considered the possibility of stocking with Bluegill, depending on availability from MNRF facilities. However, this option was not pursued because Bluegill feed on zooplankton, which could reduce grazing pressure on algae and potentially worsen algae conditions.

2.3 Ultrasound Treatment

Following the successful use of ultrasound technology to control of algae blooms in a stormwater management pond in Markham, two similar units were installed at Swan Lake to further improve water clarity.

Ultrasound is a low-cost and durable method commonly used to control algae growth in water-holding facilities, including drinking water reservoirs. When deployed, the ultrasound device generates vibrations that rupture gas vacuoles within algae cells (structures that control buoyancy) causing the algae to sink to deeper, lower-light areas of the pond where they become inactive. The low-power ultrasound waves used have no impact on aquatic animals, birds, or humans.

The system selected for Swan Lake consisted of two Water IQ Pulsar 3000 units powered by a land-based solar panel. This is the same equipment used in the Markham stormwater pond, allowing staff to benefit from familiarity with installation, operation, and demonstrated performance. The transducers were anchored to cinder blocks and strategically positioned in the lake to maintain direct line-of-sight coverage of all areas where algae had been observed. One limitation encountered was the 100-metre cable length between the solar panel and each unit, which constrained placement options.

2.4 Chloride Management

The Long-Term Management Plan for the Lake suggests that the main mechanism for lowering chloride levels would be source control. Emerging technologies and the feasibility of stormwater flow redirection would be considered in later phases.

At the request of area residents and as directed by the Council, the following two measures were brought forward to Phase 1.

2.4.1 Chloride Treatment Study

The City engaged York University to carry out a pilot study to develop biochar adsorption techniques to remove nutrients and chloride from Swan Lake. The specific objectives of this study are:

Objective 1. Determine adsorption potential of Biochar to remove nutrients (phosphorus and nitrogen) and chloride from Swan Lake water, and

Objective 2. Use lab-scale units to test the biochar efficiency in the removal of selected nutrients and chloride.

This study is currently underway, and results are expected by the end of 2026.

2.4.2 Flow Diversion Feasibility Study

AECOM was retained to assess the feasibility of diverting stormwater runoff from Swan Lake without increasing the flood risk within the study area or locations downstream. Several flow diversion alternatives were assessed and modelled as part of this work. The results were subsequently used by the City to estimate potential impacts on Lake's water and chloride budget (see Appendix F).

2.4.3 Aquatic Plant Survey

Historically, submerged aquatic vegetation (SAV) was rare or absent throughout Swan Lake due to poor water clarity caused by excess phytoplankton biomass. While management efforts successfully reduced nutrient concentrations and phytoplankton levels, the Lake remained dominated by phytoplankton with limited improvements in water clarity, continuing to limit SAV. During the PAC treatment in 2024,

however, significant amounts of SAV was observed, with levels sufficient to hinder the movement of the boat in some areas. In 2025, an aquatic plant survey was completed by the City and AECOM to determine the aquatic plant community composition and estimate cover and biomass throughout the lake, and to track the success of colonization with improved water clarity and lower algae levels in recent years.

3. Monitoring Program

3.1 Annual Water Quality Monitoring

3.1.1 Locations

Water quality was monitored at two shoreline sites, the Dock, and the Bridge, as shown in Figure 1. The figure also shows the location of the two ultrasound units (East and West) installed in 2025, where samples were collected.

On average, the water depth at the Dock is approximately 2.5 meters, representing deep areas of the lake. The water depth at the bridge is about 0.5 meters, and it is used to represent the conditions of the shallow bays around Swan Lake. Field testing and sampling for laboratory analysis were completed at both sites to ensure the water conditions at Swan Lake were properly represented.

During the bi-weekly monitoring, samples and measurements were taken at 0.5 m or 1 m increments for the depth of the Lake. The dock site was the deeper of the two sites, allowing for sampling and monitoring from 0.5 – 2 m, whereas the bridge site was shallow, and sampling was typically only achievable under the surface, slightly above the bottom of the Lake to avoid sediment contamination.

Trent University placed two loggers at the deepest point (station T10 as shown on the Figure), which was about 3.5 m deep, at approximately 0.5 m and 2.75 m below the water surface.

Figure 1: Swan Lake and Runoff Monitoring Stations



Note: Stations sampled by Trent U are shown as circle. The loggers were installed at station T10.

3.1.2 Duration and Frequency

In 2025, water quality was monitored monthly in April and May and bi-weekly from June to October. A total of 11 sampling events were completed.

3.1.3 Parameters and Methodology

Vertical water quality profiling, water transparency readings (Secchi depth), and photographic documentation were performed during each site visit.

Field testing was done utilizing an YSI ProODO meter to determine the temperature and DO at each sampling interval over the vertical profile of the lake. To ensure accurate readings, the meter and probe were stored in a proper carrying bag and regularly calibrated as instructed in the handheld quick-start guide.

A HOBOWare U26 oxygen logger was mounted at the Dock on March 31, 2025, and recorded the DO and temperature of the water every 15 minutes throughout the day. Before the first use, the logger was calibrated for DO at 100% saturation and 0% saturation (using a sodium sulfite solution). An anti-fouling guard was also installed on the sensor cover to protect against fouling. The sensor was placed 1m above the lakebed at the same location as the level logger.

Water transparency (as Secchi disk depth) was measured at both the dock and bridge monitoring sites. The Secchi disk was lowered into the water while rotating the handle until the black and white pattern of the Secchi disk was no longer visible. The water depth at which the Secchi disk was no longer visible was then recorded as a measure of the transparency (i.e., water clarity).

Water samples for laboratory testing were taken using a horizontal discrete-level water sampler at the target depths. Parameters analyzed at various stations and times included:

- Nutrients including Total Phosphorus (TP), ortho phosphorus, ammonia, nitrate, nitrite, Total Kjeldahl Nitrogen (TKN)
- Chloride, colour, Dissolved Organic Carbon (DOC), pH
- Phytoplankton (taxonomic identification, cell counts and cell density)

Observations of Swan Lake were noted, and photographs were taken during each monitoring/inspection site visit. Photographs provide a way to record the condition of vegetation and algae around Swan Lake. Completed inspection forms and photos can be found in Appendix A.

3.1.4 Targets and Thresholds

Generic thresholds for lake trophic classes representing gradients of biological productivity in lakes and relevant to Swan Lake, are provided in Table 1.

Table 1: Trophic State Classification

Parameter	Mesotrophic Condition (moderate productivity)	Eutrophic Condition (high productivity)	Hyper-eutrophic Condition (very high productivity)
Secchi Depth (m)	2 - 4	1 - 2	< 1
Total Phosphorus (µg/L)	10-30	31-100	100
Total Nitrogen (mg/L)	0.35-0.65	0.66-1.20	>1.20
Chlorophyll a (µg/L)	3.5-9.0	9.1 – 25	> 25

The 2019 Water Quality Management Strategy proposed a set of interim targets for Swan Lake to be used as triggers for management actions if the triggers are tripped in two consecutive years. Numerical values were defined for total phosphorus (100 µg/L) and Secchi depth (0.6-0.8 m), as updated in 2021 based on correlation with the phosphorus target.

For DO and chloride, Federal and/or Provincial water quality Guidelines¹ or Objectives² were considered for perspective. It should be noted that Swan Lake is not a natural waterbody, and there is no requirement for it to comply with these limits. Where technically and economically feasible, the City will aim to meet these objectives and guidelines to protect and enhance the aquatic environment.

The minimum DO concentration required for the protection of warm water biota is 5 mg/L for water temperatures up to 20 °C, and 4 mg/L for temperatures above 20 °C. Lower concentrations could have lethal or sub-lethal (physiological and behavioral) effects on fish. However, some fish can acclimate to lower oxygen levels and survive concentrations between 1 and 3 mg/L. Furthermore, fish can avoid areas of low oxygen concentrations.

The Canadian Water Quality Guidelines for chloride developed based on generic environmental data include a long-term guideline (120 mg/L) and a short-term guideline (640 mg/L). The long-term guideline was developed to protect the most sensitive life stage of the most sensitive aquatic life species against negative effects during indefinite exposure. The short-term guideline will protect most species against lethality during a sudden hike in chloride concentration for a short period (24-96 hrs). These guidelines may be over-protective for areas with an elevated concentration of chloride and associated adapted ecological community. For such circumstances, it has been suggested that site-specific (higher) targets be derived considering local conditions such as water chemistry, background concentrations, and aquatic community structure. The site-specific interim target for chloride in Swan Lake is 400-500 mg/L consistent with 2013-2014 values.

For total Microcystins, the Health Canada guideline for primary contact recreation was updated from 20 µg/L to 10 µg/L in 2022³. The 2022 guidelines also provide indicator values for the potential presence of cyanotoxins. The indicator guidelines for primary contact recreation include:

- Total cyanobacteria cells: 50,000 cells/mL
- Total cyanobacterial biovolume: 4.5 mm³/L
- Total chlorophyll a: 33 µg/L

3.2 Runoff Monitoring

In the Swan Lake catchment, salt application for winter maintenance is mainly completed by the City's Road department and the Swan Lake Village Corporation.

Winter maintenance of 1 km of the catchment roads and sidewalks is completed by the City of Markham. The City prescribes and tracks the quantity of salt distributed to the City roadways based on current and future forecast models and temperatures to determine the required action and material usage in compliance with the desired level of service and O.Reg. 239/02 requirements.

The remaining roads and parking areas, as well as private walkways and driveways, are serviced privately. As per the Village Amenities Committee (VAC), the Village Corporation employs "a qualified,

¹ Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (<http://ceqg-rcqe.ccme.ca/en/index.html>)

² Ontario Provincial Water Quality Objectives (PWQO) (<https://www.ontario.ca/page/water-management-policies-guidelines-provincial-water-quality-objectives#section-13>)

³ Health Canada, 2022. Guidelines for Canadian Recreational Water Quality, Cyanobacteria and their Toxins, Ottawa, Ontario.

reputable cleaning and maintenance service employing Smart About Salt principles to plow/shovel and their insurance recommends the de-icing methods of rock salt, applied as necessary to maintain their insurance and mitigate potential claim”.

Chloride in salting materials is readily dissolved in water and transported overland by runoff or infiltrated into soils, contaminating groundwater and surface water. A fraction of chloride in applied road salt is retained by soil and is not observed in surface runoff. As a result, salt loading to surface water occurs primarily in winter and spring during melt conditions but continues through the summer and fall via the discharge of impacted groundwater, dry deposition of dust to the lake surface, and non-point source runoff washing dry salt from land surfaces. Salt accumulated in the ponds could also be discharged into the Lake through the flushing of stormwater ponds.

In 2025, water samples were collected from various inlets to the Lake to quantify and determine the relative contribution of each source to chloride concentration in Swan Lake. Samples were collected from both ponds’ inlets, as well as outfalls from the ponds and OGS’s to the Lake.

Conductivity was also measured in a number of samples, as this parameter can be used as a surrogate for chloride. Samples were collected during one snowmelt event in March 2025.

3.3 External Data

Trent University collected water, sediment and biological samples and launched loggers in Swan Lake in the summer of 2025 to support a study on the environmental fates of lanthanum from La-modified bentonite in the ecosystem of Swan Lake. Data provided by Trent researchers included DO and temperature and Chl-a concentrations at the deepest point of the Lake.

3.4 Water Level Monitoring

In 2025, a Dipperlog vented data logger from Heron Instrument was installed at the Dock. The data logger recorded the pressure and temperature of the water every 15 minutes.

4. Monitoring Results

4.1 2025 Water Quality

The following sections discuss water quality results in 2025.

4.1.1 Dissolved Oxygen and Temperature

Table 2 provides the measured DO profile data over the 2025 monitoring period. At the Dock station, day-time surface and deep-water concentrations were above 7 mg/L on all sampling events. All measurements at the Bridge had a DO concentration above 5.2 mg/L with a summer average concentration of 5.7 mg/L. Based on these values, DO at both met the PWQO for warm water biota.

Table 2 also provides measured temperature profiles in 2025, indicating warm water throughout the depth in the summer months.

Profiles of temperature and dissolved oxygen at the Dock station (see Figure 2) indicate that Swan Lake was transiently stratified in June and September (when temperature decline is greater than 1 °C per m of depth). Transient stratification can cause reduced mixing and lead to anoxia at depth with the release of nutrients from the sediments.

Data collected by Trent University shows stratification during sampling events throughout the summer (Figure 3). The decline in DO occurs below the top of the thermocline where temperature decreases with depth by 1°C per m or more, reducing mixing and reoxygenation of the bottom water below that depth (~2 m below the surface).

In 2025, in addition to using the YSI ProODO meter for bi-weekly measurements of temperature and DO over the vertical profile, a continuous logger was also placed 1 m above the lake surface to measure the diurnal changes in DO. DO increases during daylight hours when photosynthesis occurs and decreases at night when respiration continues but photosynthesis does not.

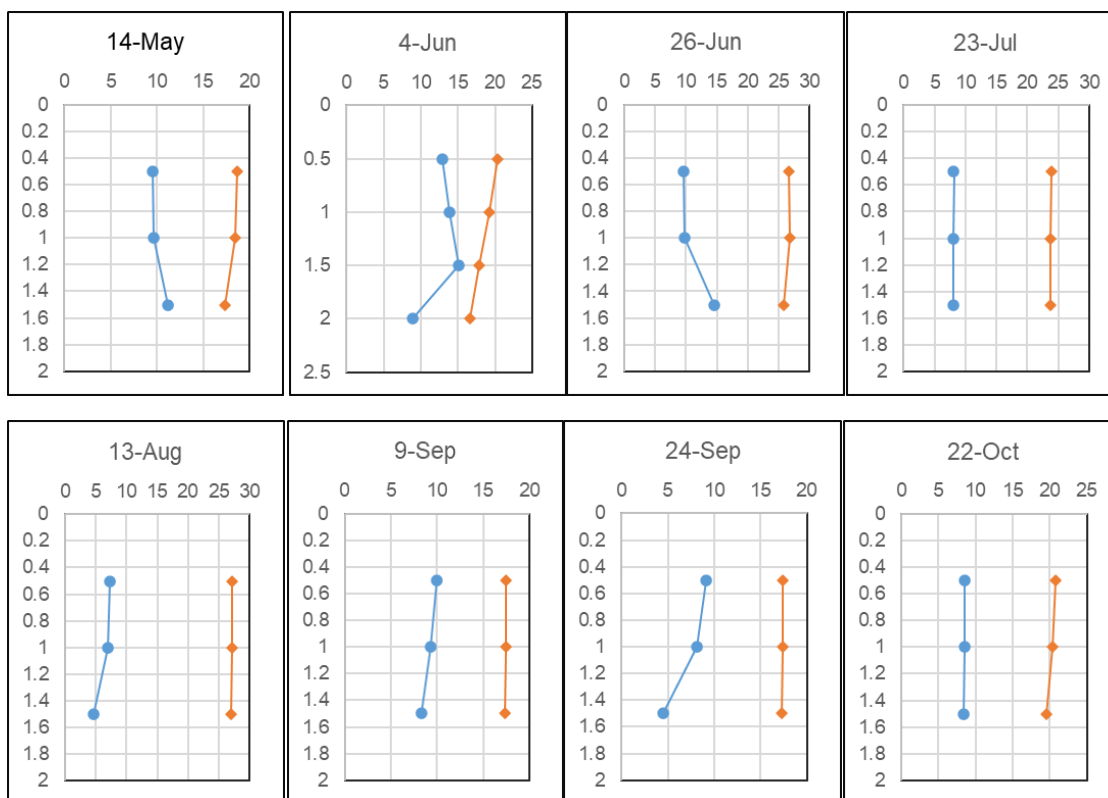
Continuous measurement of DO from April to October indicated that DO concentrations have a diurnal pattern, typical of freshwater lakes. These data are mostly consistent with the data logger used by Trent University researchers at the deepest point. While surface concentrations were always above 5 mg/L regardless of the time of day, deep water concentrations dropped to anoxic levels within ~1 m of the sediments for several days in each of the summer months, when there was minimal precipitation and warmer than usual weather.

Table 2: Measured Daytime DO and Temperature

Date	DO Concentration (mg/L)					Temperature (°C)				
	Bridge	Dock				Bridge	Dock			
	Depth (m)	Depth (m)				Depth (m)	Depth (m)			
	0.5	0.5	1	1.5	2	0.5	0.5	1	1.5	2
5/14/2025	9.9	9.6	9.6	11.2	-	18.8	18.7	18.4	17.3	-
6/4/2025	10.5	12.9	13.8	15.2	8.9	19.2	20.3	19.3	17.9	16.6
6/26/2025	5.4	9.6	9.8	14.6	-	24.4	26.7	26.8	25.8	-
7/23/2025	6.6	8.1	8.0	8.1	-	22.3	23.9	23.8	23.7	-
8/13/2025	5.2	7.2	7.0	4.7	-	24.4	27.1	27.2	26.9	-
8/25/2025	-	-	-	-	-	-	-	-	-	-
9/9/2025	-	9.9	9.3	8.3	-	-	17.4	17.4	17.3	-
9/24/2025	-	9.1	8.2	4.5	-	-	20.8	20.4	19.5	-
10/8/2025	-	-	-	-	-	-	-	-	-	-
10/22/2025	-	8.6	8.5	8.4	8.4	-	12.5	12.2	12.1	12.0

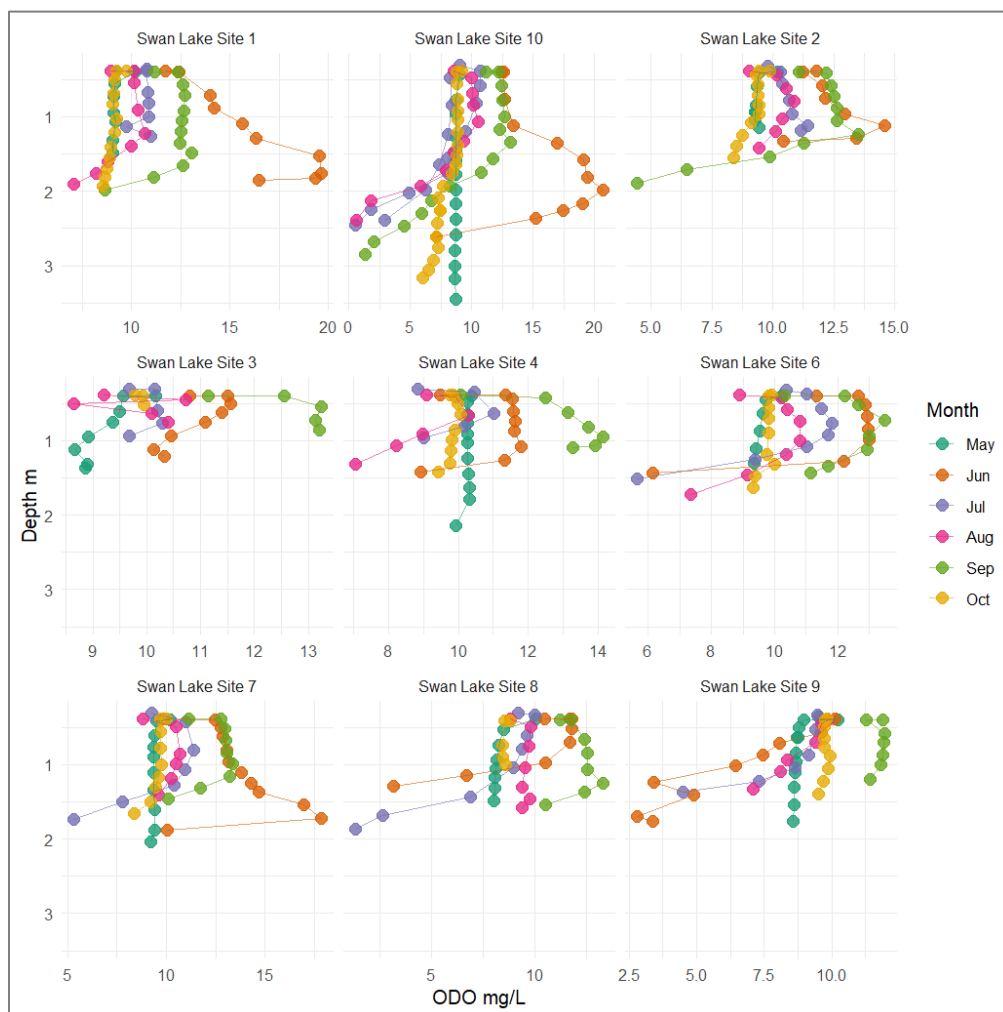
Note: fewer measurements at the Bridge site due to very low water level. No data for Aug. 25 and Oct. 8.

Figure 2: Temperature (orange) and DO (blue) Profile at the Dock Station in 2025



Note: The vertical axis shows depth (m), while the horizontal axis represents both Temperature (°C) in orange, and DO (mg/L) in blue.

Figure 3: Vertical Profiles of Dissolved Oxygen in 2025



Data courtesy of Trent University

4.1.2 Water Transparency

A robust measure of water transparency is the measurement of the Secchi disk depth, which is commonly used as an indicator of algal biomass.

Table 3 summarizes the results of the Secchi depth readings. Transparency (as Secchi depth) at the Dock station averaged 0.6 m over the growth season and was within the interim target for Swan Lake of 0.6-0.8 m and represented a hyper-eutrophic condition. Water transparency at the Bridge site was generally equal to the water depth.

Table 3: 2025 Secchi Depth Results (m)

Date	Dock	Bridge
14-May	1	0.4 *
4-Jun	0.65	0.5
26-Jun	0.8	0.5
23-Jul	0.65	0.3
13-Aug	0.50	0.15 *
25-Aug	0.52	0.15 *
9-Sep	0.52	0.15 *
24-Sep	0.54	0.15 *
8-Oct	0.60	0.15 *
22-Oct	0.65	0.15 *

* Water depth at site.

4.1.3 Nutrients Concentrations

Samples collected during each visit were tested for TP, Orthophosphate, TKN, Nitrate, Nitrite, and Ammonia. The results can be found in Figure 4 for the Dock site and Figure 5 for the Bridge site. The Certificates of Analysis from Bureau Veritas Laboratories are in Appendix B. Nutrient concentrations are shown for the depths sampled.

Total phosphorus concentration at 0.5 and 1.5 m depths averaged under 16 µg/L during the growing season and was below 30 µg/L throughout the year, representing a mesotrophic condition.

Orthophosphate and total ammonia concentrations were low throughout this period in the surface and bottom water with few exceptions indicating that internal loading due to anoxia was not significant. In the late fall, total ammonia concentrations increased, likely due to reduced uptake by algae.

Total nitrogen concentrations over the growing season averaged about 0.62 mg/L (reflecting a mesotrophic condition). Total concentrations at the Bridge site averaged 0.73 mg/L between June and mid-August. Water level was too low for sample collection afterwards. Ammonia and nitrate are the directly bioavailable forms of nitrogen, with Ammonia being the most usable form for algae. In 2025, Ammonia and Nitrate concentrations were generally close to or below the Method Detection Limit (MDL), and nitrogen was mainly present as organic compounds (i.e., TKN less Ammonia) with the exception of fall samples. Bioavailable nutrient pulses (orthophosphate and ammonia) in late summer and fall, but which occurred at low levels, are consistent with the release of these nutrients due to episodic anoxia and the decomposition of organics, including aquatic plants and algae.

Figure 4: 2025 Measured Nutrients Concentrations - Dock Site

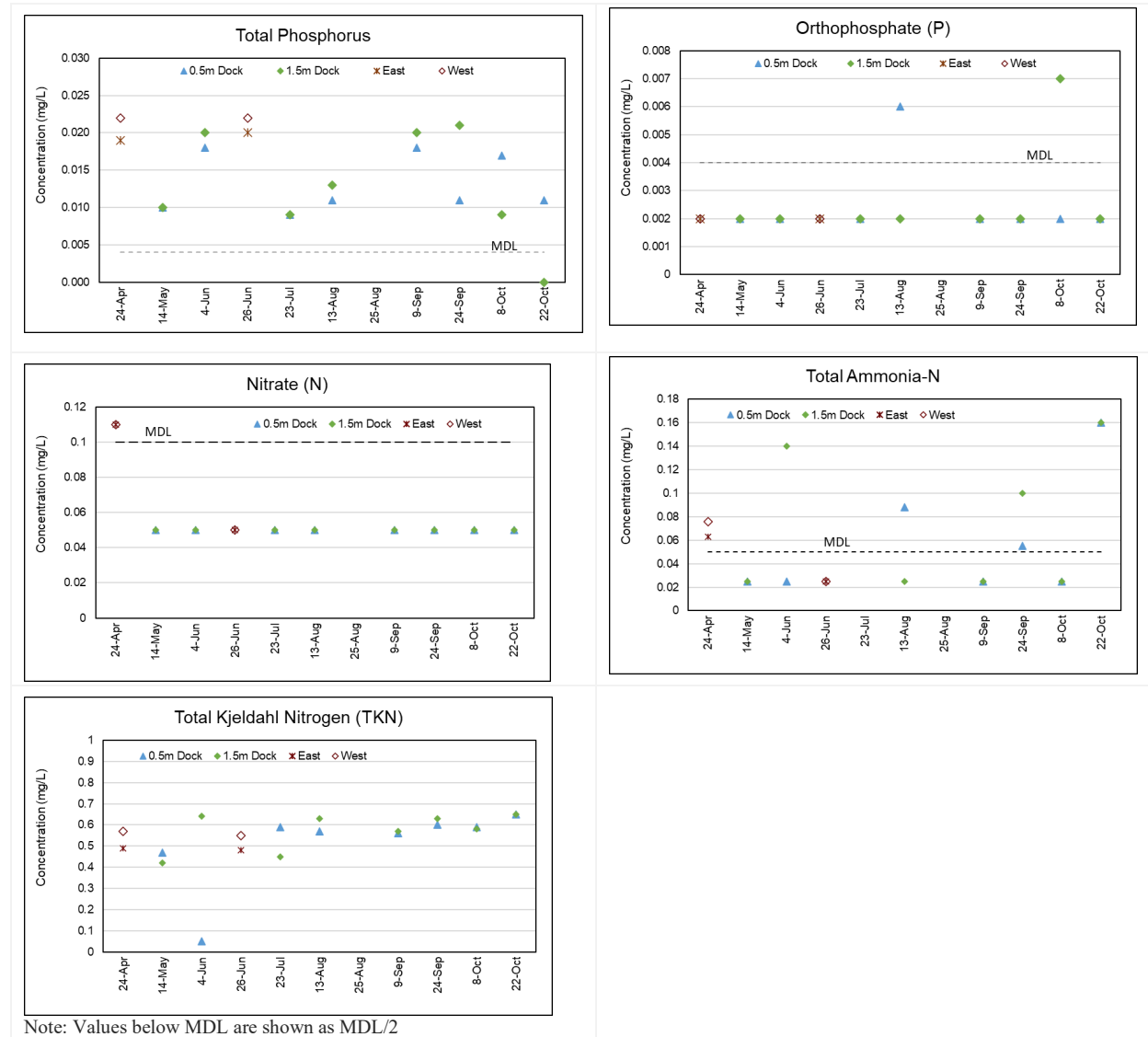
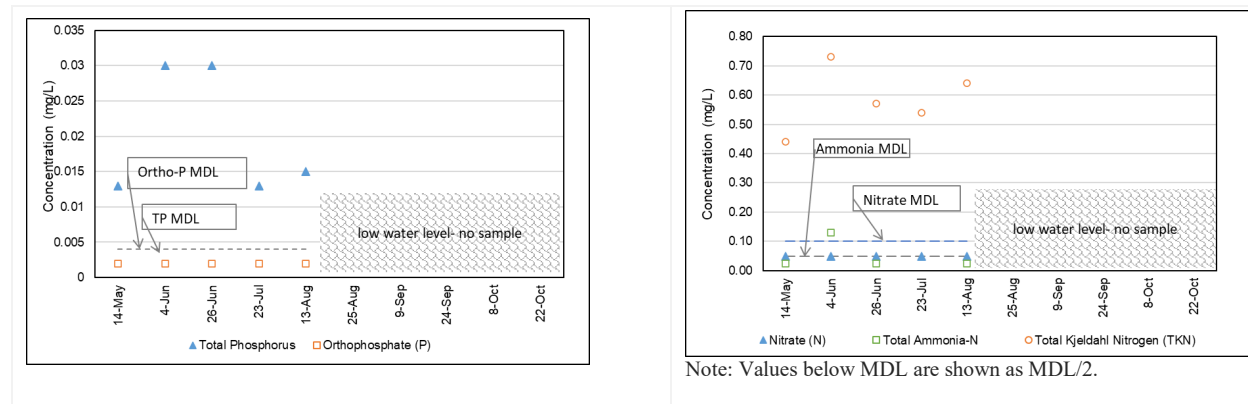


Figure 5: 2025 Measured Nutrients Concentrations - Bridge Site



4.1.4 pH

pH measured at the lab ranged from 7.9 to 8.7 throughout the year, which, except for one sample, is within the PWQO range (6.5-8.5).

4.1.5 Chloride in Lake and Runoff

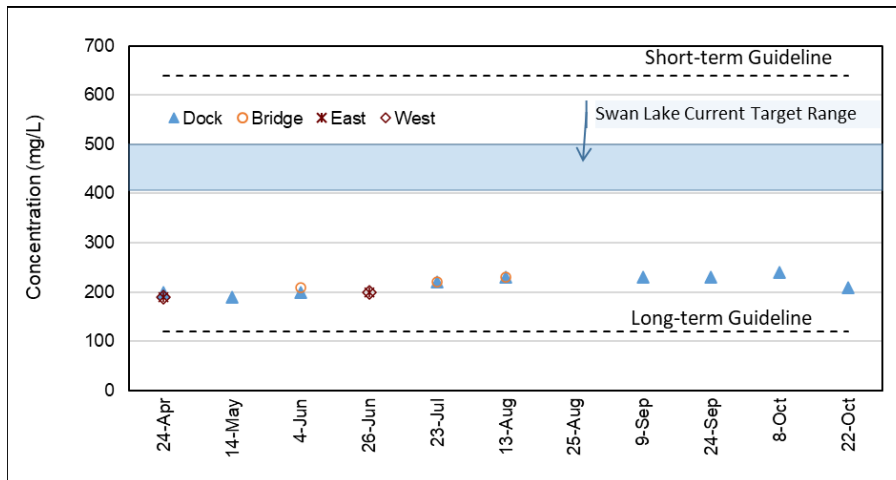
Surface samples collected during each visit were also analyzed for Chloride, as summarized in Figure 6.

Water quality testing results indicated that the samples contained between 190 and 240 mg/L of Chloride.

In 2025, chloride levels which had decreased considerably compared to 2021 and 2022 remained consistent with 2024 values at about 200 mg/L.

The Canadian Water Quality Guidelines for Chloride developed based on generic environmental data include a long-term guideline (120 mg/L) and a short-term guideline (640 mg/L). The long-term guideline has been developed to protect all organisms (present in Canadian aquatic systems) against negative effects during chronic indefinite exposure. The short-term guideline aims to protect most species against lethality during a sudden hike in chloride concentration for an acute short period (24-96 hrs). These guidelines may be over-protective for areas with an elevated concentration of chloride and associated adapted ecological community. For such circumstances, it has been suggested that site-specific (higher) targets be derived considering local conditions such as water chemistry, background concentrations, and aquatic community structure. Watercourse concentrations in Rouge River watershed urban areas and shallow groundwater concentrations in the GTA help characterize background concentrations and are consistently higher than the short-term guideline. The interim target for chloride is 400-500 mg/L consistent with 2013-2014 values. In 2025, all samples met these targets. In addition, Chloride levels were lower than the endpoint concentrations for all zooplankton species (259 – 454 mg/L) used to determine the long-term CWQG.

Figure 6: Chloride Concentrations in Swan Lake in 2025



In 2025, water samples were collected from various inlets to the Lake and analyzed for chloride.

These data were used to update the chloride mass balance following the completion of the Flow Diversion Feasibility Study (see Appendix F).

4.1.6 DOC Concentrations and Colour

Surface samples collected during each visit were also analyzed for DOC and Colour. The results are summarized in Table 4. Both DOC and colour dropped after the PAC treatment in 2024 and remained lower than pre-treatment levels throughout the season.

Table 4: Measured DOC and Color in 2025

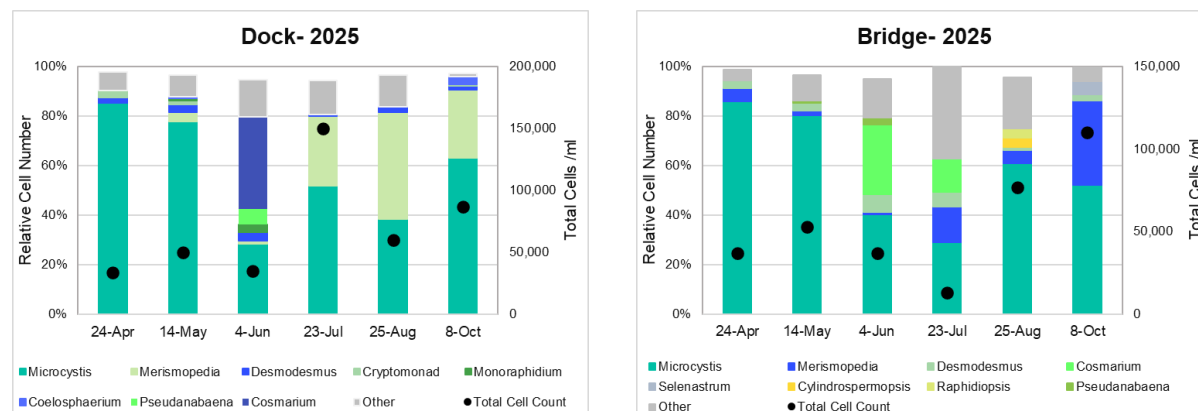
Date	Dock (East/West*)		Bridge	
	Colour	DOC	Colour	DOC
24-Apr *	5.0	5.8	-	-
14-May	6.0	7.2	9.0	7.6
4-Jun	5.0	7.2	8.0	9.3
26-Jun *	7.0	11.0	-	-
23-Jul	5.0	-	6.0	8.2
13-Aug	5.0	9.2	6.0	9.4
25-Aug	-	-	-	-
9-Sep	5.0	-	-	-
24-Sep	6.0	-	-	-
8-Oct	7.0	9.1	-	-
22-Oct	6.0	-	-	-

4.1.7 Algae Growth

In 2025, six samples were collected for phytoplankton identification as shown in Figure 7. Total cyanobacteria cell counts were similar to 2024 and about 40% lower than in 2023, with average growing season concentrations at 65,000 and 44,000 cells/mL at the Dock and Bridge sites, respectively, compared to the Health Canada indicator guideline of 50,000 cells/mL for potential presence of cyanotoxins above primary contact recreational guidelines.

Besides the actual identification and counting of cells, analysis of chlorophyll-a (chl-a), which is the green algal pigment used in photosynthesis, provides a measure of algae biomass. Concentrations of chl-a were recorded by Trent University using an Enigma probe at a depth of 1 m, indicating an average of 23 µg/L over the growing season, which is within the range for eutrophic lakes (9.1-25 µg/L) and below the Health Canada chl-a indicator value for potential presence of cyanotoxins above primary contact recreational guidelines.

Figure 7: Planktonic Cyanobacteria Population in Swan Lake in 2025



4.2 Geese Count

In 2025, the geese count was completed by the consultant and City staff.

WMG recorded the number of geese observed during each visit. Staff counted the number of geese every two weeks, coinciding with the water quality sampling site visits. All counts and other wildlife observations were recorded in a geese count App developed using ArcGIS Survey123 software.

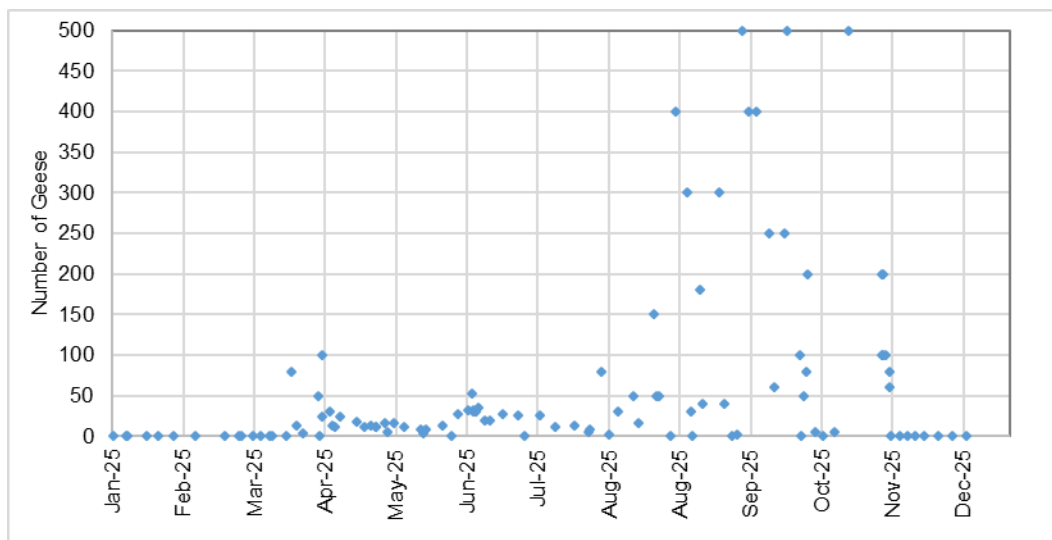
Figure 8 illustrates the number of geese counted at Swan Lake throughout the 2025 monitoring period.

In this figure, a significant increase in geese numbers is evident when they migrate south; however, the mitigation measures employed effectively reduced the number of geese present at different times of the day.

Any impact that strobe lights might have had on the geese count is not readily evident from the data.

In addition, nine nests and 33 eggs were managed at Swan Lake in April and May. The 2025 numbers show a reduction in total nests and egg counts compared to 2024. Geese nests were allowed to form a lining of goose down before removing eggs which proved successful in the prevention of re-nesting pairs.

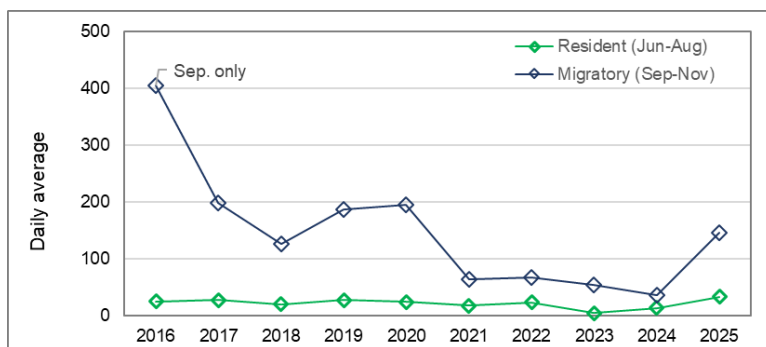
Figure 8: 2025 Geese Count Results at Swan Lake



Active geese management has been completed annually since 2014. The geese management program focused on resident geese at the beginning and extended to the management of migratory geese in 2016.

Daily Averages of counts are shown for each year in Figure 9. Data are summarized for June to August and September to November, representing resident and migratory geese, respectively. Despite a general increase in geese population in Southern Ontario, the numbers at Swan Lake have been controlled over the past years. Goose counts were higher in 2025, primarily due to natural population fluctuations, and partly because the laser lights previously installed on the island were removed for product improvement.

Figure 9: Historical Geese Counts



4.3 Fish Inventory

Fish were captured using an electrofishing boat and a fyke on April 25, 2025 at the same electrofishing sampling transects from previous years. Fish captured in 2025 included Brown Bullhead, Fathead Minnow, Goldfish and a hybrid species of Goldfish and Common Carp. Common Carp was noticeably absent from the Lake.

A summary of the results so far is shown in Table 5. Differences in years could be explained by the timing of sampling (April vs. August) and the use of nets (e.g., fewer fathead minnows in 2023 when nets were not used).

Table 5: Fish Species Collected from Swan Lake Since 2021

Date	Method	Brown Bullhead	Common Carp	Fathead Minnow	Goldfish	Common Carp x Goldfish	Emerald Shiner
April-21	3 days electrofishing + 2 days nets	210	7	>10,000	-	-	-
August-22	1 day electrofishing, 1 day nets	80	20	875	-	-	-
August-23	1 day electrofishing	84	103	14	2	-	-
April-24	1 day electrofishing, 1 day net	193	1	1521	13	59	1
April-25	1 day electrofishing, 1 day net	391	-	3586	354	1	-

The 2021 Plan recommended monitoring and removal of benthic fish for five years. Following the 2025 work, TRCA advised that fish monitoring should continue annually and that invasive species should continue to be removed. They have recommended that in 2026 consideration should be given to returning some/all the Brown Bullhead to the lake (rather than removal) since they are a native fish, and it is important to have some benthic feeders in a lake ecosystem.

Following the 2025 stocking of largemouth bass, TRCA recommended monitoring the stocked fish and their spawning activity in 2026. TRCA also advised installing signage to remind the public not to release pet fish into the Lake.

4.4 Survey of Submerged Aquatic Vegetation

The planting of SAVs was implemented in 2023 and 2024 for a total of 3000 wild celery (*Vallisneria spiralis*) stems in fenced areas along the north shore of the Lake as a pilot project. In 2023 plantings were targeted around 30 cm -1 m deep as optimal growing depths for Wild Celery. Observations in 2024 indicated better establishment at the 20 cm depth areas, with an overall low rate of establishment at about

30%, potentially due to the turbidity and fluctuating water levels. In 2024, another 1500 stems were planted in a depth of about 20-40 cm. Naturally growing aquatic plants were also abundant in 2024. The rate of establishment for planted Wild Celery was overall very low in 2025.

During the second PAC application in 2024, significant amounts of aquatic vegetation comprised primarily of Small Pondweed (*Potamogeton pusillus*) were observed and at times hindered the movement of the application boat. This was the first observation of any significant amounts of submerged aquatic vegetation in the lake. In 2025, a comprehensive survey was conducted to characterize the existing aquatic plant community. The survey found that SAV was abundant throughout the lake with generally moderate to high robustness (cover) at depths less than 2 m, and variable cover from high robustness to absent at depths greater than 2 m. The plants were dominated by the native species including Muskgrass (*Chara spp.*) and Canada Waterweed (*Elodea canadensis*) and lower abundances of Small Pondweed and Curly-leaved Pondweed (*Potamogeton crispus*). The newly established SAV community is consistent with improved water clarity and reduced algae levels in recent years.

A summary of the 2025 aquatic vegetation survey is provided in Appendix E.

4.5 Water Quality Trends

Water quality monitoring of Swan Lake has been conducted annually since treatment in 2013 (except 2015) to track water quality and the effectiveness of implemented mitigation measures. The following paragraphs and Figure 10 provide a summary of water quality trends since 2016.

Dissolved Oxygen (DO)

Historical records of DO and temperature profile show that Swan Lake thermally stratifies during the summer despite its shallow depth. The majority of surface concentrations have been above 5 mg/L since 2014. In 2025, all day-time surface and bottom concentrations measured during sampling events at the Dock station were above 7 mg/L. DO concentrations, however, have a diurnal pattern, often decreasing at night. Data collected by two continuous loggers in 2025 indicated that deep water concentrations dropped to anoxic levels for several days in each of the summer months near the sediments at water depths greater than ~2.5 m, when there was minimal precipitation and warmer than usual weather potentially resulting in transient thermal stratification and reduced mixing of the bottom water.

Water Clarity (Secchi Depth)

In Swan Lake, Secchi depth has typically been quite low throughout the summer, but it increases in November, reflecting the end of the growing period for phytoplankton. The average annual values shown in Figure 10 are all below 1 m. In 2025, water clarity averaged 0.6 m over the growth season.

Total Phosphorus (TP)

Average growing period (May - September) TP concentrations indicated hyper-eutrophic conditions in earlier monitored years except for the post-treatment years, 2013 and 2014. TP has been consistently lower since the 2021 treatment and dropped to below 30 µg/L in 2023 and has remained as such.

Nitrogen Compounds

Total nitrogen (TN) concentration over the growing period was 1.2 mg/L indicating a hyper-eutrophic condition in earlier years, except in the post-treatment year, 2014. TN dropped to concentrations reflecting mesotrophic conditions after the 2021 treatment and has remained as such.

Inorganic nitrogen compounds (NO_2 , NO_3 , and NH_3) have often been below detection limits, indicating relatively low levels of bioavailable nitrogen concentrations. In 2025, ammonia and nitrate concentrations were generally very low (except higher ammonia in the fall), and nitrogen was mainly present as organic matter.

Chloride

Chloride concentrations were increasing in Swan Lake reaching high levels in 2020 and 2021. Removing a blockage at the East Pond inlet and cleaning of the Swan Club OGS resulted in lower untreated flows (with higher chloride concentrations) to the Lake, lowering chloride concentration in Swan Lake post 2022. Chloride concentrations have been around 200 mg/L in 2024 and 2025.

DOC and Color

DOC in 2022, 2023 and 2024 (before the PAC treatment) was considerably higher than in previous years. The increase may potentially be associated with the remnants of Phragmites in the Lake, as the roots were not removed. Both colour and DOC declined sharply in 2024 following the PAC treatment, which precipitates organic matter. DOC increased to pre-treatment levels in 2025 while colour has remained low.

Algae Blooms and Cyanobacteria

Testing for algae blooms, cyanobacteria levels, and microcystin concentrations in Swan Lake has been carried out in various forms since 2011. Between 2011 and 2016, lake water was analyzed for microcystin toxicity, with only one detection recorded in 2016 at 73 $\mu\text{g/L}$ (the recreational guideline is 20 $\mu\text{g/L}$).

In 2018, extended blooms were observed at several sites in the Lake, however cell density was at half of WHO's threshold for significantly increased risk for human health. Microcystin toxicity was measured with test strips in 2019 and 2020, and all samples were below 10 $\mu\text{g/L}$.

In 2021, samples were collected before and after chemical treatment and test results showed a significant reduction in concentrations following the treatment.

In 2022, limited algae scum was observed in early June and while the Lake was dominated by phytoplankton for the remainder of the monitoring period, surface scums were not widespread. The 2022 results showed lower diversity and higher total counts compared to 2021, but surface scums were not widespread. Total counts for 2022 may be erroneous and are not shown below.

The 2023 results indicated significantly lower cell counts compared to 2021, with an additional 40% decrease in 2024. The 2025 cell counts are similar to 2024.

Figure 10: Historical Water Quality Results (Growing-Season Averages)



4.6 2025 Water Level

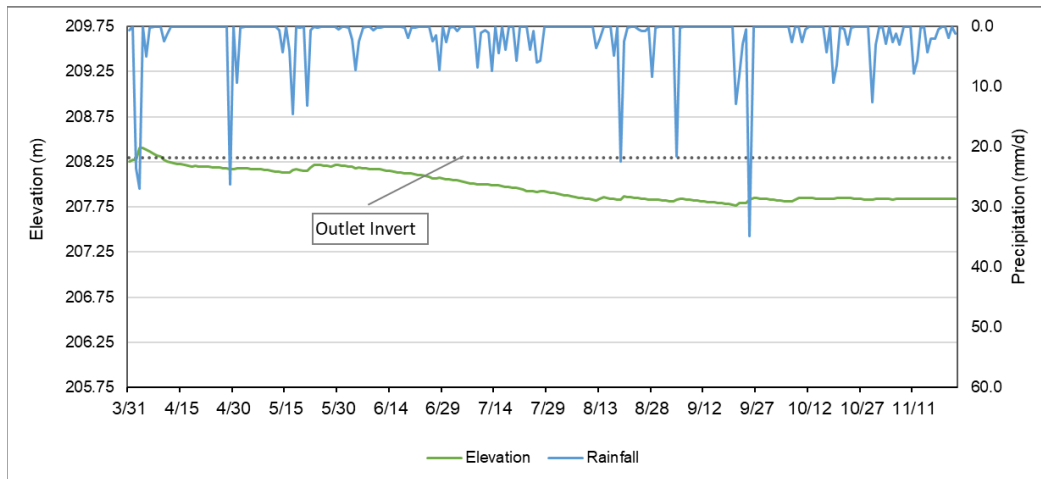
In 2025, the daily average water level changed from a maximum of 208.4 m in April to a low of 207.8 m throughout August to October. Total precipitation in 2025 was 620 mm, as recorded at the Markham Museum station.

The maximum water level recorded or estimated between 2017 and 2024 ranged from 208.25 m to 208.48, when total precipitation ranged from 670 to 1055 mm.

2025 was a very dry year during the summer and fall, which resulted in low water level and lower oxygen levels at depth.

Measured water level and daily precipitation data from the nearby rain gauge are shown in Figure 11.

Figure 11: Lake Elevation Records and Precipitation in 2025



5. Summary and Conclusions

5.1 Summary of Monitoring Results

Through the Swan Lake monitoring program, data collected in 2025 provide insight into long-term trends in water quality and will also help determine the need for and impact of management activities on Swan Lake.

Dissolved oxygen, temperature, and water transparency were measured at two stations through bi-weekly site visits. Profiles of temperature and dissolved oxygen indicated that Swan Lake was thermally stratified in June and September. The minimum dissolved oxygen concentration required for the protection of warm water fish is 5 mg/L, which was met in the surface water. Continuous measurements at depth indicated that DO dropped to anoxic levels for several days in the summer months at depths below about 2-2.5 m when there was minimal precipitation and warmer than usual weather.

pH measured at the lab was about 8, indicative of alkaline conditions due in part to high levels of photosynthesis by algae.

Transparency at the Dock station averaged at 0.6 m over the growing season and was within the interim target for Swan Lake of 0.6-0.8 m based on correlation with the phosphorus target.

Water samples were analyzed for nutrients (phosphorus and nitrogen compounds). Total phosphorus concentration in the 0.5 and 1.5m depth averaged 16 µg/L during the growing season (June-September) and throughout the year (reflecting moderately productive, or mesotrophic conditions). Concentrations also met the interim PWQO for total phosphorus of 20 µg/L for lakes to avoid nuisance concentrations of algae.

Total nitrogen concentrations over the growing season averaged about 0.62 mg/L (reflecting moderately productive, or mesotrophic conditions).

Chloride concentrations in the Lake were within the interim target range specified for the Lake (between 190 and 240 mg/L compared to 400-500 mg/L, which is the interim target), and were considerably lower than 2021 values, similar to 2024. Concentrations are similar to background concentrations reported in urban surface and groundwater systems in the GTA.

Chloride concentrations were also measured in stormwater runoff to the ponds and the Lake (from ponds, OGS's, and overland flow) during snow melt and spring freshet. The data were used to update the chloride balance to determine the relative contribution of each source to chloride concentration in Swan Lake.

In 2025, limited surface scum was found at both the Dock and Bridge sampling sites; however, the Lake was dominated by phytoplankton. Samples analyzed for cyanobacteria indicated total counts similar to 2024 and lower than 2023. Chlorophyll-a concentrations were below the hyper-eutrophic concentration.

Daily average water level at the logger location changed from a maximum of 208.4 m in April to 207.8 throughout August to October, reflecting a very dry year.

5.2 Summary of 2025 Management Activities and Studies

In 2025, geese management was completed through nest depredation and adult goose mitigation using laser light, avian distress call and limited strategic zinc crackler pyro. These mitigation measures have controlled over the past years despite a general increase in geese population in Southern Ontario. Any impact that strobe lights might have had on the geese count is not readily evident.

Fish management and the removal of bottom-dwelling fish was completed by the TRCA, and 371 Brown Bullhead and Goldfish were euthanized. Any Fathead Minnow and some of Brown Bullhead captured were released back to the Lake.

In May 2025, 500 juvenile largemouth bass added to the lake by a private contractor (Hidden Lane Fisheries from Smithville, ON), following consultation with TRCA, MNRF. Fish stocking was identified as a Complementary measures in the 2021. This measure was brought forward to help balance the fish community in the lake.

An evaluation of the SAV planting success and habitat conditions was completed in 2025, confirming the successful establishment of native SAV with abundant cover throughout the lake, consistent with a transition of the lake to more mesotrophic conditions.

Following the successful implementation of ultrasound technology to control of algae blooms in a stormwater management pond in Markham, two similar units were installed at Swan Lake to further improve water clarity.

The pilot study investigating the use of biochar adsorption techniques to remove chloride from Swan Lake water is ongoing, with results expected by the end of 2026.

The water and chloride budget for the Lake was updated using modeling results from the Flow Diversion Feasibility Study, together with information on salt usage and chloride concentrations in stormwater runoff.

5.3 Conclusions

Based on the measured nutrient concentrations in 2025, Swan Lake is classified as mesotrophic for total phosphorus (as well as nitrogen, but not for transparency; see Table 1 for definitions). Figure 12 provides a summary of phosphorus concentrations since 2010.

Overall, the management activities in 2021-2025 that focused on the significant nutrient loadings identified in the water quality management plan (i.e., chemical treatment and fish management to reduce internal loads and geese management to reduce external loads), were effective at improving water quality in the Lake as shown by reduced phosphorus concentrations, improved dissolved oxygen levels, and lower densities of cyanobacteria, together representing a shift from hyper-eutrophic to mesotrophic conditions. These improvements represent a positive step towards improving the aquatic habitat in the lake and meeting the long-term water quality goals.

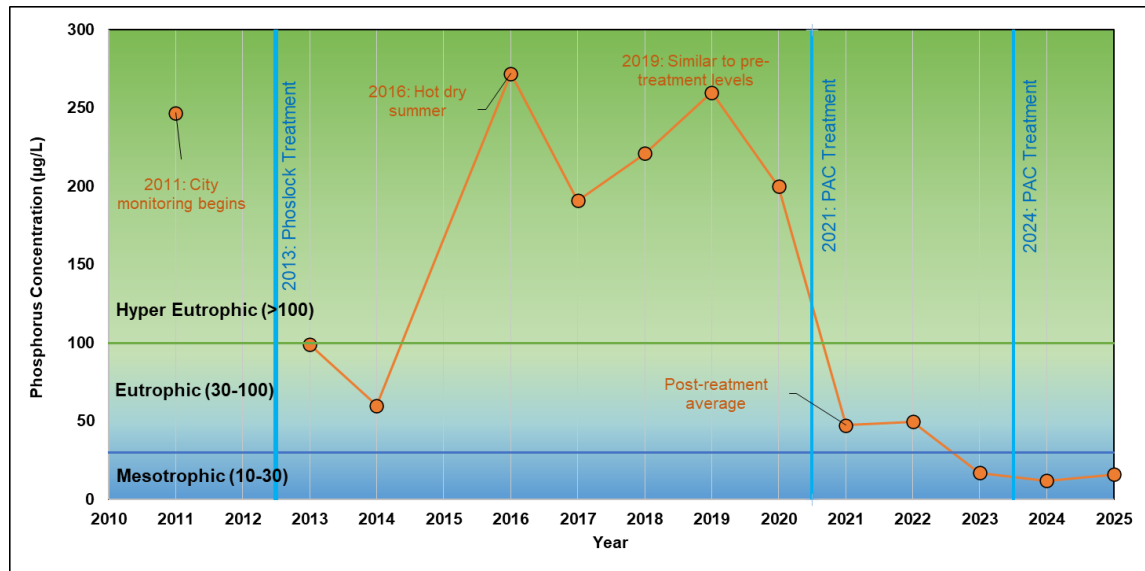
In recent years, chloride levels decreased considerably, likely due to clearing the blockage at the East Pond inlet and the Swan Club OGS, which resulted in lower untreated catchment flows to the Lake.

While internal and external source controls successfully reduced nutrient concentrations, the Lake was dominated by phytoplankton, and water clarity did not improve substantially. The planting of SAVs started in June 2023 and continued in 2024 to help improve water clarity. Natural colonization of SAV, however, occurred with a dense cover throughout most of the lake in 2025. Two ultrasound units were installed in Swan Lake to help improve water clarity further.

In accordance with the 2021 Long Term Management Plan and following the completion of Phase 1 of the plan, a 5-year Review is being conducted. This Review will summarize the effectiveness of Core measures and evaluates additional Complementary measures to consider in Phase 2.

The 2026 monitoring program and management activities will follow the recommendation of the Long-Term Management Plan, as updated through the Phase 1 Review process.

Figure 12: Trophic State Classification for Swan Lake based on Phosphorus Concentration



Appendix A : Swan Lake Water Quality Inspection Forms

Swan Lake Water Quality Monitoring

Date:	February 25, 2025	Inspectors	ZP
-------	-------------------	------------	----

Station: Dock

Time:			
Secchi Disk Reading (m)		Staff Gauge Reading (cm)	
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m			
1 m			
1.5 m			
2 m			
2.5 m			

Station: Bridge

Time:			
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			

Geese Observations

Dock	
Open Water/ West	
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	
Geese and wildlife notes	

East Pond

North Pond

Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes	No melt	

Other Photos



Swan Lake Water Quality Monitoring

Date:	March 10, 2025	Inspectors	ZP
-------	----------------	------------	----

Station: Dock

Time:			
Secchi Disk Reading (m)		Staff Gauge Reading (cm)	
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m			
1 m			
1.5 m			
2 m			
2.5 m			

Station: Bridge

Time:			
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			

Geese Observations

Dock	
Open Water/ West	
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	
Geese and wildlife notes	

East Pond

North Pond

Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS AMICA OGS	No Sample Low Flow Sample	
Swan Club OGS	Low Flow Sample	
Lake Outlet	High Flow Sample	

East Pond Inlet	Low Flow Sample	
East Pond Bypass	No Sample	
North Pond Inlet	Low Flow Sample	
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	March 31, 2025	Inspectors	ZP, DY
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Station: Dock

Time:	14:00		
Secchi Disk Reading (m)		Staff Gauge Reading (cm)	42
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m			
1 m			
1.5 m			
2 m			
2.5 m			



Station: Bridge

Time:			
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			

Geese Observations

Dock	
Open Water/ West	
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	
Geese and wildlife notes	

East Pond

North Pond

Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

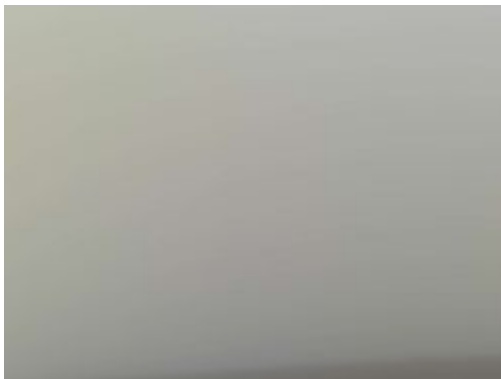
Other Photos

Swan Lake Water Quality Monitoring

Date:	April 24, 2025	Inspectors	ZP1
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Station: Dock

Time:	15:52		
Secchi Disk Reading (m)		Staff Gauge Reading (cm)	
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m			
1 m			
1.5 m			
2 m			
2.5 m			



Station: Bridge

Time:			
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			

Geese Observations

Dock	4
Open Water/ West	
Southeast Island	
Open Water/ East	4
Bridge	
Northern Island	4
Geese and wildlife notes	One swan

East Pond

North Pond

Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	May 14, 2025	Inspectors	ZP, JK
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Station: Dock

Time:	11:08		
Secchi Disk Reading (m)	1	Staff Gauge Reading (cm)	30
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	9.58	102.61	18.7
1 m	9.6	102.4	18.4
1.5 m	11.15	116.4	17.3
2 m			
2.5 m			



Station: Bridge

Time:	11:54		
Secchi Disk Reading (m)	0.4		
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth	9.89	106.4	18.8



Geese Observations

Dock	0
Open Water/ West	0
Southeast Island	0
Open Water/ East	4
Bridge	0
Northern Island	0

Geese and wildlife notes	Two adult two goslings, one cormorant, 3 swans. Aquatic veg seem to cover the botttom. Secchi disk doesnt go thtough.
--------------------------	---

East Pond

Clear inlet



North Pond

water halfway up the invert. some debris



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	June 4, 2025	Inspectors	ZP, JK
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Station: Dock

Time:	10:43		
Secchi Disk Reading (m)	0.65	Staff Gauge Reading (cm)	36
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	12.87	142.3	20.3
1 m	13.81	149.3	19.3
1.5 m	15.16	159.7	17.9
2 m	8.9	91.2	16.6
2.5 m			



Station: Bridge

Time:	11:38		
Secchi Disk Reading (m)	0.5		
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth	10.5	122	19.2



Geese Observations

Dock	
Open Water/ West	30
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	

Geese and wildlife notes	
-----------------------------	--

East Pond

North Pond



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	June 26, 2025	Inspectors	ZP, JK
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Station: Dock

Time:	10:04		
Secchi Disk Reading (m)	0.8	Staff Gauge Reading (cm)	25
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	9.62	120.2	26.7
1 m	9.77	122.1	26.8
1.5 m	14.6	178.1	25.8
2 m			
2.5 m			



Station: Bridge

Time:	10:51		
Secchi Disk Reading (m)	0.5		
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth	5.35	64	24.4



Geese Observations

Dock	0
Open Water/ West	0
Southeast Island	0
Open Water/ East	0
Bridge	
Northern Island	

Geese and wildlife notes	Geese excrement on the path
--------------------------	-----------------------------

East Pond

Clear



North Pond

Some debris in front of inlet, algae



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	July 23, 2025	Inspectors	ZP, JK
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Station: Dock

Time:	10:06		
Secchi Disk Reading (m)	0.65	Staff Gauge Reading (cm)	12
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	8.07	95.6	23.9
1 m	7.95	94.1	23.8
1.5 m	8.05	95.2	23.7
2 m			
2.5 m			



Station: Bridge

Time:	10:50		
Secchi Disk Reading (m)	0.3		
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth	6.6	75.6	22.3



Geese Observations

Dock	0
Open Water/ West	6
Southeast Island	0
Open Water/ East	0

Bridge	
Northern Island	0
Geese and wildlife notes	

East Pond

North Pond

Some branchrs in front of inlet



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	August 13, 2025	Inspectors	ZP, JK
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Station: Dock

Time:	08:20		
Secchi Disk Reading (m)	0.5	Staff Gauge Reading (cm)	5
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	7.23	90.9	27.1
1 m	6.95	87.5	27.2
1.5 m	4.73	59.2	26.9
2 m			
2.5 m			



Station: Bridge

Time:	09:06		
Secchi Disk Reading (m)	0.15		
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth	5.2	61	24.4



Geese Observations

Dock	0
Open Water/ West	16
Southeast Island	0
Open Water/ East	0

Bridge	
Northern Island	0
Geese and wildlife notes	One swan

East Pond

North Pond

Some debris in front of inlet



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	September 9, 2025	Inspectors	Daniel
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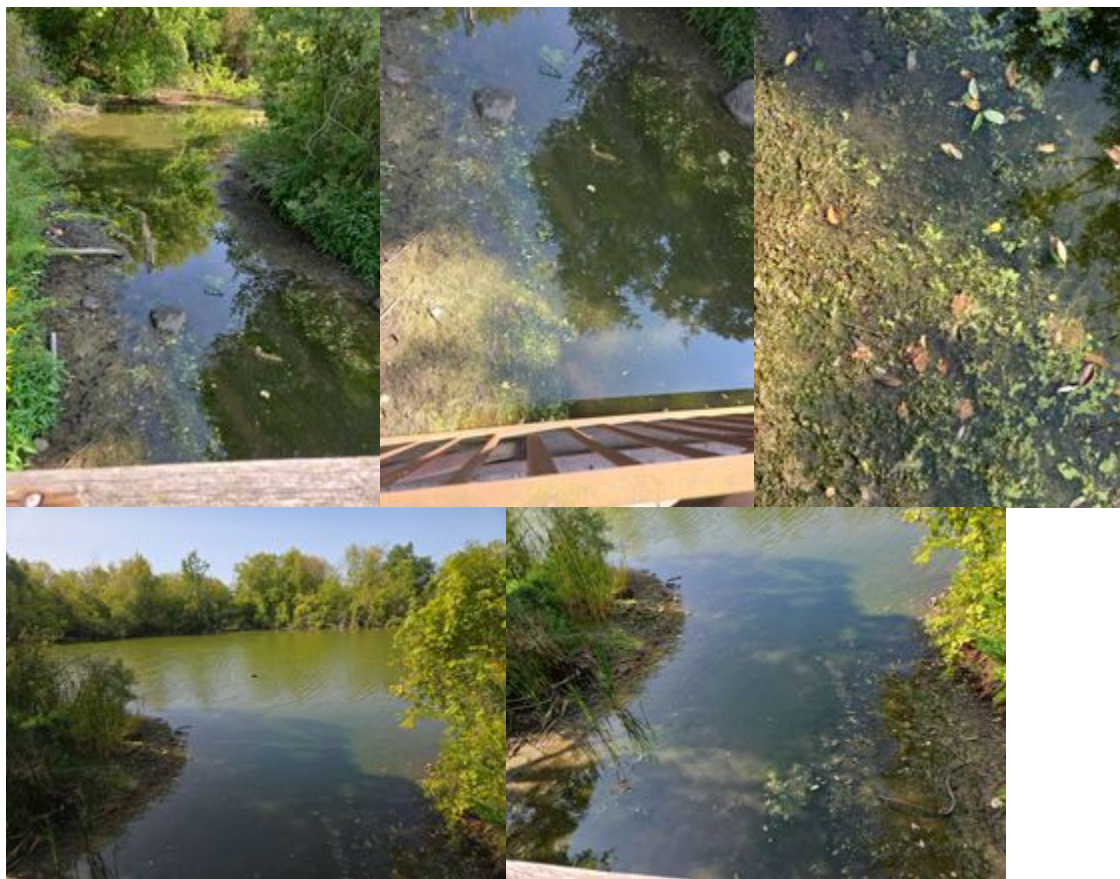
Station: Dock

Time:	10:05		
Secchi Disk Reading (m)		Staff Gauge Reading (cm)	0
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	9.92	103.6	17.4
1 m	9.3	97.4	17.4
1.5 m	8.3	86.4	17.3
2 m			
2.5 m			



Station: Bridge

Time:	10:50		
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			



Geese Observations

Dock	40
Open Water/ West	
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	

Geese and wildlife notes	
-----------------------------	--

East Pond

Inlet is clear



North Pond

Inlet is clear



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos

Swan Lake Water Quality Monitoring

Date:	September 24, 2025	Inspectors	Daniel Babaei
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Station: Dock

Time:	10:25		
Secchi Disk Reading (m)	0.54	Staff Gauge Reading (cm)	0
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	9.11	104.6	20.8
1 m	8.18	89.7	20.4
1.5 m	4.5	51.5	19.5
2 m			
2.5 m			





Station: Bridge

Time:			
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			



Geese Observations

Dock	2
Open Water/ West	
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	

Geese and wildlife notes	
-----------------------------	--

East Pond

Inlet is Clear



North Pond

Inlet is clear

Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos



Swan Lake Water Quality Monitoring

Date:	October 22, 2025	Inspectors	Daniel Babaei
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Station: Dock

Time:	10:39		
Secchi Disk Reading (m)	6.65	Staff Gauge Reading (cm)	0
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m	8.55	80.2	12.5
1 m	8.5	79.1	12.2
1.5 m	8.39	78	12.1
2 m	8.35	77.5	12
2.5 m			



Station: Bridge

Time:	11:14		
Secchi Disk Reading (m)			
Depth	Dissolved oxygen (mg/L)	Oxygen Saturation (%)	Temperature (C)
0.5 m or max depth			



Geese Observations

Dock	50
Open Water/ West	
Southeast Island	
Open Water/ East	
Bridge	
Northern Island	

Geese and wildlife notes	~20 Snow geese migration, 4 swans, 20 seagulls,
--------------------------	---

East Pond

Clear



North Pond

Clear



Runoff Sampling (Snowmelt and Spring Freshet)/ Station Photos

Swan Lake Blvd OGS		
AMICA OGS		
Swan Club OGS		
Lake Outlet		
East Pond Inlet		
East Pond Bypass		
North Pond Inlet		
North Pond Bypass		
Runoff Notes		

Other Photos

Appendix B : Certificates of Analysis



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1033122

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/09/19
Report #: R8616047
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5A5266

Received: 2025/08/26, 15:14

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Phytoplankton	2	N/A	N/A		

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1033122

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/09/19
Report #: R8616047
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5A5266

Received: 2025/08/26, 15:14

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

=====

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BUREAU
VERITAS

Bureau Veritas Job #: C5A5266

Report Date: 2025/09/19

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AUML38	AUML39	
Sampling Date		2025/08/25 10:30	2025/08/25 11:00	
COC Number		1033122	1033122	
	UNITS	S105	S205	QC Batch
Miscellaneous Parameters				
Subcontract Parameter	N/A	ATTACHED	ATTACHED	A008974
QC Batch = Quality Control Batch				



BUREAU
VERITAS

Bureau Veritas Job #: C5A5266
Report Date: 2025/09/19

City of Markham
Site Location: SWAN LAKE
Your P.O. #: PB22006
Sampler Initials: ZP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.0°C
-----------	-------

Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C5A5266

Report Date: 2025/09/19

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

James Aspin, Senior Project Manager

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 147554

Work ID:

C5A5266

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 2

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Authorized by: Sarah Ostler, Laboratory Supervisor

Workorder Summary

Analysis Results Comments

14755401 (AUML38-01) - Specimen A

Dolichospermum (formerly Anabaena)

14755401 (AUML38-01) - Specimen B

Desmodesmus

14755401 (AUML38-01) - Specimen C

Cryptomonas

14755401 (AUML38-01) - Specimen D

Monoraphidium

14755401 (AUML38-01) - Specimen E

Phacus

14755401 (AUML38-01) - Specimen F

Raphidiopsis/Cylindrospermopsis. Filaments approx. 3um in width. Due to the narrowness of the filament cell enumeration could not be performed. An estimated total of 6600 filaments per ml were calculated to be present in the sample. This total has not been included in the final total for cell per ml.

14755401 (AUML38-01) - Specimen G

Planktolyngbya. Filaments approx. 2um in width. Due to the narrowness of the filament cell enumeration could not be performed. An estimated total of 1860 filaments per ml were calculated to be present in the sample. This total has not been included in the final total for cell per ml.

14755401 (AUML38-01) - Total Cells

A 10 x dilution was required to enumerate. The values reported have been adjusted accordingly and are estimated values.

14755402 (AUML39-01) - Specimen A

Dolichospermum (formerly Anabaena)

14755402 (AUML39-01) - Specimen B

Desmodesmus

14755402 (AUML39-01) - Specimen C

Cryptomonas

Report Date: 9/11/2025 5:43:40 PM

Report ID: 147554-6577726

Page 1 of 5

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664

LABORATORY ANALYSIS REPORT



Work Order #: 147554

Work ID:

C5A5266

Workorder Summary

Analysis Results Comments

14755402 (AUML39-01) - Specimen D

Monoraphidium

14755402 (AUML39-01) - Specimen F

Raphidiopsis/Cylindrospermopsis. Filaments approx. 3um in width. Due to the narrowness of the filament cell enumeration could not be performed. An estimated total of 2660 filaments per ml were calculated to be present in the samples. This total has not been included in the final total for cell per ml.

14755402 (AUML39-01) - Specimen G

Planktolyngbya. Filaments approx. 2um in width. Due to the narrowness of the filament cell enumeration could not be performed. An estimated total of 1260 filaments per ml were calculated to be present in the samples. This total has not been included in the final total for cell per ml.

14755402 (AUML39-01) - Specimen H

Dictyosphaerium

14755402 (AUML39-01) - Total Cells

A 10 x dilution was required to enumerate. The values reported have been adjusted accordingly and are estimated values.



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 147554

Work ID:

C5A5266

Analytical Results

Lab ID: 14755401	Sample ID: AUML38-01	Criteria: N/A	Date Received: 8/27/2025
Matrix: Water	Location: S105		Date Collected: 8/25/2025
Type: Raw Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	140	cells/mL		20	1		08/27/2025	09/10/2025	
Chroococcus	240	cells/mL		20	1		08/27/2025	09/10/2025	
Cosmarium	40	cells/mL		20	1		08/27/2025	09/10/2025	
Fragilaria	100	cells/mL		20	1		08/27/2025	09/10/2025	
Lagerheimia	20	cells/mL		20	1		08/27/2025	09/10/2025	
Merismopedia	26000	cells/mL		20	1		08/27/2025	09/10/2025	
Microcystis	23000	cells/mL		20	1		08/27/2025	09/10/2025	
Nitzschia	240	cells/mL		20	1		08/27/2025	09/10/2025	
Scenedesmus	1300	cells/mL		20	1		08/27/2025	09/10/2025	
Small Unidentifiable Algae	6500	cells/mL		20	1		08/27/2025	09/10/2025	
Specimen A	1200	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen B	1200	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen C	20	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen D	240	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen E	20	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen F	See comment	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen G	See comment	cells/mL		20	1		08/27/2025	09/10/2025	*
Staurastrum	60	cells/mL		20	1		08/27/2025	09/10/2025	
Tetraedron	200	cells/mL		20	1		08/27/2025	09/10/2025	
Total Cells	60000	cells/mL		20	1		08/27/2025	09/10/2025	*

Report Date: 9/11/2025 5:43:40 PM

Report ID: 147554-6577726

Page 3 of 5

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 147554

Work ID:

C5A5266

Analytical Results

Lab ID: 14755402	Sample ID: AUML39-01	Criteria: N/A	Date Received: 8/27/2025
Matrix: Water	Location: S205		Date Collected: 8/25/2025
Type: Raw Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	440	cells/mL		20	1		08/27/2025	09/10/2025	
Chroococcus	80	cells/mL		20	1		08/27/2025	09/10/2025	
Cosmarium	120	cells/mL		20	1		08/27/2025	09/10/2025	
Euglena	20	cells/mL		20	1		08/27/2025	09/10/2025	
Fragilaria	80	cells/mL		20	1		08/27/2025	09/10/2025	
Meridion	40	cells/mL		20	1		08/27/2025	09/10/2025	
Merismopedia	37000	cells/mL		20	1		08/27/2025	09/10/2025	
Microcystis	57000	cells/mL		20	1		08/27/2025	09/10/2025	
Navicula	20	cells/mL		20	1		08/27/2025	09/10/2025	
Nitzschia	200	cells/mL		20	1		08/27/2025	09/10/2025	
Oocystis	40	cells/mL		20	1		08/27/2025	09/10/2025	
Pediastrum	640	cells/mL		20	1		08/27/2025	09/10/2025	
Peridinium	120	cells/mL		20	1		08/27/2025	09/10/2025	
Pinnularia	40	cells/mL		20	1		08/27/2025	09/10/2025	
Scenedesmus	1200	cells/mL		20	1		08/27/2025	09/10/2025	
Selenastrum	5900	cells/mL		20	1		08/27/2025	09/10/2025	
Small Unidentifiable Algae	3900	cells/mL		20	1		08/27/2025	09/10/2025	
Specimen A	500	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen B	2800	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen C	180	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen D	360	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen F	See comment	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen G	See comment	cells/mL		20	1		08/27/2025	09/10/2025	*
Specimen H	180	cells/mL		20	1		08/27/2025	09/10/2025	*
Staurastrum	60	cells/mL		20	1		08/27/2025	09/10/2025	
Tetraedron	80	cells/mL		20	1		08/27/2025	09/10/2025	
Total Cells	110000	cells/mL		20	1		08/27/2025	09/10/2025	*

Report Date: 9/11/2025 5:43:40 PM

Report ID: 147554-6577726

Page 4 of 5

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1033901

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/09/19
Report #: R8615898
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5B2189

Received: 2025/09/10, 15:29

Sample Matrix: Water
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	1	N/A	2025/09/15	CAM SOP-00463	SM 24 4500-Cl E m
Colour	1	N/A	2025/09/16	CAM SOP-00412	SM 24 2120C m
Conductivity	1	N/A	2025/09/16	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2025/09/13	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	2	N/A	2025/09/15	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2025/09/11	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	1	2025/09/15	2025/09/16	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	2	N/A	2025/09/11	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	2	2025/09/15	2025/09/16	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	2	2025/09/15	2025/09/16	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1033901

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/09/19
Report #: R8615898
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5B2189

Received: 2025/09/10, 15:29

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager
Email: Nazeema.Rahaman@bureauveritas.com
Phone# (905)817-5806

=====

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



**BUREAU
VERITAS**

Bureau Veritas Job #: C5B2189

Report Date: 2025/09/19

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AUZA57			AUZA57			AUZA58		
Sampling Date		2025/09/09 10:30			2025/09/09 10:30			2025/09/09 11:00		
COC Number		1033901			1033901			1033901		
	UNITS	S105	RDL	QC Batch	S105 Lab-Dup	RDL	QC Batch	S115	RDL	QC Batch
Inorganics										
Total Ammonia-N	mg/L	ND	0.050	A009639				ND	0.050	A009639
Colour	TCU	5	2	A011368						
Conductivity	umho/cm	1000	2.0	A009923						
Total Kjeldahl Nitrogen (TKN)	mg/L	0.56	0.10	A010813				0.57	0.10	A010813
Dissolved Organic Carbon	mg/L	8.9	0.40	A009690						
Orthophosphate (P)	mg/L	ND	0.004	A008068	ND	0.004	A008068	ND	0.004	A008068
pH	pH	7.93		A009924						
Total Phosphorus	mg/L	0.018	0.004	A010844				0.020	0.004	A010844
Dissolved Chloride (Cl-)	mg/L	230	2.0	A009654						
Nitrite (N)	mg/L	ND	0.010	A008381				ND	0.010	A008381
Nitrate (N)	mg/L	ND	0.10	A008381				ND	0.10	A008381
Nitrate + Nitrite (N)	mg/L	ND	0.10	A008381				ND	0.10	A008381
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.										



BUREAU
VERITAS

Bureau Veritas Job #: C5B2189

Report Date: 2025/09/19

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C
-----------	-------

Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C5B2189

Report Date: 2025/09/19

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A008068	Orthophosphate (P)	2025/09/11	66 (1)	80 - 120	96	80 - 120	ND, RDL=0.004	mg/L	NC	20		
A008381	Nitrate (N)	2025/09/11	96	80 - 120	95	80 - 120	ND, RDL=0.10	mg/L	0.19	20		
A008381	Nitrite (N)	2025/09/11	109	80 - 120	108	80 - 120	ND, RDL=0.010	mg/L	NC	20		
A009639	Total Ammonia-N	2025/09/15	NC	75 - 125	96	80 - 120	ND, RDL=0.050	mg/L	0.14	20		
A009654	Dissolved Chloride (Cl-)	2025/09/15	NC	80 - 120	96	80 - 120	ND, RDL=1.0	mg/L	0.21	20		
A009690	Dissolved Organic Carbon	2025/09/13	93	80 - 120	96	80 - 120	ND, RDL=0.40	mg/L	0	20		
A009923	Conductivity	2025/09/16			102	85 - 115	ND, RDL=2.0	umho/cm	0	10		
A009924	pH	2025/09/16			102	98 - 103			1.0	N/A		
A010813	Total Kjeldahl Nitrogen (TKN)	2025/09/16	101	80 - 120	102	80 - 120	ND, RDL=0.10	mg/L	11	20	103	80 - 120
A010844	Total Phosphorus	2025/09/16	91	80 - 120	97	80 - 120	ND, RDL=0.004	mg/L	18	20	96	80 - 120
A011368	Colour	2025/09/16			97	80 - 120	ND, RDL=2	TCU	NC	25		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C5B2189

Report Date: 2025/09/19

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1034658

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/10/02
Report #: R8624350
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5C0233

Received: 2025/09/25, 15:20

Sample Matrix: Water
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	1	N/A	2025/09/30	CAM SOP-00463	SM 24 4500-Cl E m
Colour	1	N/A	2025/10/01	CAM SOP-00412	SM 24 2120C m
Conductivity	1	N/A	2025/10/01	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2025/09/29	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	2	N/A	2025/10/02	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2025/09/29	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	1	2025/09/29	2025/10/01	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	2	N/A	2025/09/30	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	2	2025/10/01	2025/10/01	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	2	2025/10/01	2025/10/02	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1034658

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/10/02
Report #: R8624350
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5C0233

Received: 2025/09/25, 15:20

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (3) "The CCME method and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

=====

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RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AVOJ93			AVOJ94		
Sampling Date		2025/09/24 10:30			2025/09/24 10:40		
COC Number		1034658			1034658		
	UNITS	S105	RDL	QC Batch	S115	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L	0.055	0.050	A022504	0.10	0.050	A022504
Colour	TCU	6	2	A022873			
Conductivity	umho/cm	1000	2.0	A021497			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.60	0.10	A022999	0.63	0.10	A022999
Dissolved Organic Carbon	mg/L	8.8	0.40	A021558			
Orthophosphate (P)	mg/L	ND	0.004	A022099	ND	0.004	A022099
pH	pH	8.13		A021492			
Total Phosphorus	mg/L	0.011	0.004	A022995	0.021	0.004	A022995
Dissolved Chloride (Cl-)	mg/L	230	2.0	A021458			
Nitrite (N)	mg/L	ND	0.010	A021208	ND	0.010	A021208
Nitrate (N)	mg/L	ND	0.10	A021208	ND	0.10	A021208
Nitrate + Nitrite (N)	mg/L	ND	0.10	A021208	ND	0.10	A021208
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.							



BUREAU
VERITAS

Bureau Veritas Job #: C5C0233

Report Date: 2025/10/02

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.3°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C5C0233

Report Date: 2025/10/02

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A021208	Nitrate (N)	2025/09/29	99	80 - 120	93	80 - 120	ND, RDL=0.10	mg/L	1.9	20		
A021208	Nitrite (N)	2025/09/29	90	80 - 120	101	80 - 120	ND, RDL=0.010	mg/L	NC	20		
A021458	Dissolved Chloride (Cl-)	2025/09/30	89	80 - 120	96	80 - 120	ND, RDL=1.0	mg/L	NC	20		
A021492	pH	2025/10/01			102	98 - 103			0.30	N/A		
A021497	Conductivity	2025/10/01			102	85 - 115	ND, RDL=1.0	umho/cm	0.48	10		
A021558	Dissolved Organic Carbon	2025/09/29	92	80 - 120	95	80 - 120	ND, RDL=0.40	mg/L	0.51	20		
A022099	Orthophosphate (P)	2025/09/30	102	80 - 120	100	80 - 120	ND, RDL=0.004	mg/L	NC	20		
A022504	Total Ammonia-N	2025/10/02	102	75 - 125	104	80 - 120	ND, RDL=0.050	mg/L	11	20		
A022873	Colour	2025/10/01			100	80 - 120	ND, RDL=2	TCU	NC	25		
A022995	Total Phosphorus	2025/10/02	96	80 - 120	102	80 - 120	ND, RDL=0.004	mg/L	6.3	20	92	80 - 120
A022999	Total Kjeldahl Nitrogen (TKN)	2025/10/02	101	80 - 120	104	80 - 120	ND, RDL=0.10	mg/L	3.0	20	113	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times \text{RDL}$).



BUREAU
VERITAS

Bureau Veritas Job #: C5C0233

Report Date: 2025/10/02

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1035349

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/10/24
Report #: R8637992
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5C7322

Received: 2025/10/09, 15:25

Sample Matrix: Water
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	1	N/A	2025/10/14	CAM SOP-00463	SM 24 4500-Cl E m
Colour	1	N/A	2025/10/14	CAM SOP-00412	SM 24 2120C m
Conductivity	1	N/A	2025/10/16	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2025/10/12	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	2	N/A	2025/10/10	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2025/10/10	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	1	2025/10/15	2025/10/16	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	2	N/A	2025/10/15	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	2	2025/10/14	2025/10/16	CAM SOP-00938	SM 4500-N B m
Total Phosphorus Low Level Colourimetric	2	2025/10/15	2025/10/16	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1035349

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/10/24
Report #: R8637992
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5C7322

Received: 2025/10/09, 15:25

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (3) "The CCME method and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager
Email: Nazeema.Rahaman@bureauveritas.com
Phone# (905)817-5806

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



BUREAU
VERITAS

Bureau Veritas Job #: C5C7322

Report Date: 2025/10/24

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AWAZ47			AWAZ47			AWAZ48		
Sampling Date		2025/10/08 10:30			2025/10/08 10:30			2025/10/08 10:30		
COC Number		1035349			1035349			1035349		
	UNITS	S105	RDL	QC Batch	S105 Lab-Dup	RDL	QC Batch	S115	RDL	QC Batch

Inorganics										
Total Ammonia-N	mg/L	ND	0.050	A029721				ND	0.050	A029721
Colour	TCU	7	2	A031389						
Conductivity	umho/cm	1000	2.0	A032368						
Total Kjeldahl Nitrogen (TKN)	mg/L	0.59	0.10	A031890	0.59	0.10	A031890	0.58	0.10	A031890
Dissolved Organic Carbon	mg/L	9.1	0.40	A030469						
Orthophosphate (P)	mg/L	ND	0.004	A030136				0.007	0.004	A030136
pH	pH	8.06		A032365						
Total Phosphorus	mg/L	0.017	0.004	A033226				0.009	0.004	A033226
Dissolved Chloride (Cl ⁻)	mg/L	240	2.0	A030461						
Nitrite (N)	mg/L	ND	0.010	A029894				ND	0.010	A029894
Nitrate (N)	mg/L	ND	0.10	A029894				ND	0.10	A029894
Nitrate + Nitrite (N)	mg/L	ND	0.10	A029894				ND	0.10	A029894

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Bureau Veritas ID		AWAZ48		
Sampling Date		2025/10/08 10:30		
COC Number		1035349		
	UNITS	S115 Lab-Dup	RDL	QC Batch

Inorganics				
Orthophosphate (P)	mg/L	ND	0.004	A030136

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.



BUREAU
VERITAS

Bureau Veritas Job #: C5C7322

Report Date: 2025/10/24

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.3°C
-----------	-------

Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C5C7322

Report Date: 2025/10/24

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A029721	Total Ammonia-N	2025/10/10	97	75 - 125	99	80 - 120	ND, RDL=0.050	mg/L	NC	20		
A029894	Nitrate (N)	2025/10/10	NC	80 - 120	100	80 - 120	ND, RDL=0.10	mg/L	0.56	20		
A029894	Nitrite (N)	2025/10/10	103	80 - 120	105	80 - 120	ND, RDL=0.010	mg/L	NC	20		
A030136	Orthophosphate (P)	2025/10/15	94	80 - 120	97	80 - 120	ND, RDL=0.004	mg/L	NC	20		
A030461	Dissolved Chloride (Cl-)	2025/10/14	92	80 - 120	91	80 - 120	ND, RDL=1.0	mg/L	NC	20		
A030469	Dissolved Organic Carbon	2025/10/12	91	80 - 120	96	80 - 120	ND, RDL=0.40	mg/L	6.0	20		
A031389	Colour	2025/10/14			98	80 - 120	ND, RDL=2	TCU	NC	25		
A031890	Total Kjeldahl Nitrogen (TKN)	2025/10/16	105	80 - 120	102	80 - 120	ND, RDL=0.10	mg/L	0	20	104	80 - 120
A032365	pH	2025/10/16			102	98 - 103			1.4	N/A		
A032368	Conductivity	2025/10/16			102	85 - 115	ND, RDL=2.0	umho/cm	0.17	10		
A033226	Total Phosphorus	2025/10/16	107	80 - 120	105	80 - 120	ND, RDL=0.004	mg/L	3.7	20	101	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



BUREAU
VERITAS

Bureau Veritas Job #: C5C7322

Report Date: 2025/10/24

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Louise Harding, Scientific Specialist

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 150205

Work ID:

C5C7322

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 1

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Authorized by: Jennifer Koene-Fenton, Laboratory Superintendent

Workorder Summary

Analysis Results Comments

15020501 (1) - *Cryptomonad*

The specimens could not be characterized due to the small size of the algal specimens. The specimens observed may have been a mixture of Cryptomonads and/or green flagellated algae.

15020501 (1) - *Specimen A*

Phacus

15020501 (1) - *Specimen B*

Trachelomonas

15020501 (1) - *Specimen C*

Elakatothrix

15020501 (1) - *Specimen D*

Cryptomonas

15020501 (1) - *Specimen E*

Desmodesmus

15020501 (1) - *Specimen F*

Monoraphidium

15020501 (1) - *Specimen G*

Achnanthydium

15020501 (1) - *Specimen H*

Unidentified filamentous cyanobacterial genus. Filaments comprised of small cylindrical cells (approx. 2µm x 3µm) with a thin sheath. Due to the small size of the cells within the filament enumeration could not be performed. A total of 640 filaments per ml were calculated to be present in the samples. This total has not been included in the final total for cell per ml.

15020501 (1) - *Total Cells*

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

Analytical Results

Report Date: 10/23/2025 12:03:12 PM

Report ID: 150205-6674641

Page 1 of 4

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 150205

Work ID:

C5C7322

Analytical Results

Lab ID:	15020501	Sample ID:	1	Criteria:	N/A	Date Received:	10/10/2025
Matrix:	Water	Location:	S105			Date Collected:	10/8/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Amphora	20	cells/mL		2	1		10/10/2025	10/21/2025	
Ankistrodesmus	140	cells/mL		20	1		10/10/2025	10/21/2025	
Chlamydomonas	20	cells/mL		20	1		10/10/2025	10/21/2025	
Chroococcus	4	cells/mL		2	1		10/10/2025	10/21/2025	
Coelosphaerium	2600	cells/mL		20	1		10/10/2025	10/21/2025	
Cosmarium	80	cells/mL		20	1		10/10/2025	10/21/2025	
Cryptomonad	580	cells/mL		20	1		10/10/2025	10/21/2025	*
Dinobryon	100	cells/mL		20	1		10/10/2025	10/21/2025	
Euglena	40	cells/mL		20	1		10/10/2025	10/21/2025	
Mallomonas	20	cells/mL		20	1		10/10/2025	10/21/2025	
Meridion	4	cells/mL		2	1		10/10/2025	10/21/2025	
Merismopedia	24000	cells/mL		20	1		10/10/2025	10/21/2025	
Microcystis	55000	cells/mL		20	1		10/10/2025	10/21/2025	
Nitzschia	80	cells/mL		20	1		10/10/2025	10/21/2025	
Oocystis	140	cells/mL		20	1		10/10/2025	10/21/2025	
Peridinium	4	cells/mL		2	1		10/10/2025	10/21/2025	
Quadrigula	200	cells/mL		20	1		10/10/2025	10/21/2025	
Scenedesmus	440	cells/mL		20	1		10/10/2025	10/21/2025	
Small Unidentifiable Algae	780	cells/mL		20	1		10/10/2025	10/21/2025	
Specimen A	4	cells/mL		2	1		10/10/2025	10/21/2025	*
Specimen B	8	cells/mL		2	1		10/10/2025	10/21/2025	*
Specimen C	16	cells/mL		2	1		10/10/2025	10/21/2025	*
Specimen D	48	cells/mL		2	1		10/10/2025	10/21/2025	*
Specimen E	1300	cells/mL		20	1		10/10/2025	10/21/2025	*
Specimen F	200	cells/mL		20	1		10/10/2025	10/21/2025	*
Specimen G	40	cells/mL		20	1		10/10/2025	10/21/2025	*
Specimen H	460	cells/mL		2	1		10/10/2025	10/21/2025	*
Staurastrum	10	cells/mL		2	1		10/10/2025	10/21/2025	
Tetraedron	280	cells/mL		20	1		10/10/2025	10/21/2025	

Report Date: 10/23/2025 12:03:12 PM

Report ID: 150205-6674641

Page 2 of 4

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664

LABORATORY ANALYSIS REPORT



Work Order #: 150205

Work ID:

C5C7322

Analytical Results

Lab ID: 15020501	Sample ID: 1	Criteria: N/A	Date Received: 10/10/2025
Matrix: Water	Location: S105		Date Collected: 10/8/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Total Cells	87000	cells/mL		20	1		10/10/2025	10/21/2025	*

Report Date: 10/23/2025 12:03:12 PM

Report ID: 150205-6674641

Page 3 of 4

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



LABORATORY ANALYSIS REPORT

Work Order #: 150205

Work ID:

C5C7322

[illegible]

Report Date: 10/23/2025 12:03:12 PM

Report ID: 150205-6674641

Page 4 of 4

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1036026

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/10/31
Report #: R8642797
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5D4750

Received: 2025/10/23, 14:50

Sample Matrix: Water
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	1	N/A	2025/10/28	CAM SOP-00463	SM 24 4500-Cl E m
Colour	1	N/A	2025/10/28	CAM SOP-00412	SM 24 2120C m
Conductivity	1	N/A	2025/10/30	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2025/10/28	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	2	N/A	2025/10/29	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2025/10/28	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	1	2025/10/28	2025/10/30	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	2	N/A	2025/10/28	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	2	2025/10/29	2025/10/30	CAM SOP-00938	SM 4500-N B m
Total Phosphorus Low Level Colourimetric	2	2025/10/29	2025/10/30	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1036026

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/10/31
Report #: R8642797
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5D4750

Received: 2025/10/23, 14:50

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager
Email: Nazeema.Rahaman@bureauveritas.com
Phone# (905)817-5806

=====

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



BUREAU
VERITAS

Bureau Veritas Job #: C5D4750

Report Date: 2025/10/31

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AWOY95			AWOY96		
Sampling Date		2025/10/22 10:00			2025/10/22 10:30		
COC Number		1036026			1036026		
	UNITS	S105	RDL	QC Batch	S115	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L	0.16	0.050	A041940	0.16	0.050	A041940
Colour	TCU	6	2	A041487			
Conductivity	umho/cm	1000	2.0	A041944			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.65	0.10	A042157	0.65	0.10	A042157
Dissolved Organic Carbon	mg/L	9.0	0.40	A041177			
Orthophosphate (P)	mg/L	ND	0.004	A041388	ND	0.004	A041388
pH	pH	7.94		A041947			
Total Phosphorus	mg/L	0.011	0.004	A042621	0.015	0.004	A042621
Dissolved Chloride (Cl-)	mg/L	210	2.0	A041297			
Nitrite (N)	mg/L	ND	0.010	A040992	ND	0.010	A040992
Nitrate (N)	mg/L	ND	0.10	A040992	ND	0.10	A040992
Nitrate + Nitrite (N)	mg/L	ND	0.10	A040992	ND	0.10	A040992
RDL = Reportable Detection Limit QC Batch = Quality Control Batch ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.							



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.3°C
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Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C5D4750

Report Date: 2025/10/31

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A040992	Nitrate (N)	2025/10/28	97	80 - 120	99	80 - 120	ND, RDL=0.10	mg/L	NC	20		
A040992	Nitrite (N)	2025/10/28	102	80 - 120	104	80 - 120	ND, RDL=0.010	mg/L	NC	20		
A041177	Dissolved Organic Carbon	2025/10/28	90	80 - 120	96	80 - 120	ND, RDL=0.40	mg/L	0.68	20		
A041297	Dissolved Chloride (Cl-)	2025/10/28	NC	80 - 120	94	80 - 120	ND, RDL=1.0	mg/L	1.5	20		
A041388	Orthophosphate (P)	2025/10/28	94	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20		
A041487	Colour	2025/10/28			100	80 - 120	ND,RDL=2	TCU	3.1	25		
A041940	Total Ammonia-N	2025/10/29	98	75 - 125	97	80 - 120	ND, RDL=0.050	mg/L	NC	20		
A041944	Conductivity	2025/10/30			101	85 - 115	ND, RDL=2.0	umho/cm	0.28	10		
A041947	pH	2025/10/30			102	98 - 103			0.56	N/A		
A042157	Total Kjeldahl Nitrogen (TKN)	2025/10/30	NC	80 - 120	94	80 - 120	ND, RDL=0.10	mg/L	1.8	20	93	80 - 120
A042621	Total Phosphorus	2025/10/30	106	80 - 120	106	80 - 120	ND, RDL=0.004	mg/L	NC	20	105	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



BUREAU
VERITAS

Bureau Veritas Job #: C5D4750

Report Date: 2025/10/31

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1024532

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/03/14
Report #: R8503105
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C525833

Received: 2025/03/11, 15:35

Sample Matrix: Water
Samples Received: 5

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	5	N/A	2025/03/14	CAM SOP-00463	SM 24 4500-Cl E m
Conductivity	3	N/A	2025/03/12	CAM SOP-00414	SM 24 2510 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1024532

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/03/14
Report #: R8503105
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C525833

Received: 2025/03/11, 15:35

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

=====

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BUREAU
VERITAS

Bureau Veritas Job #: C525833

Report Date: 2025/03/14

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AOUE57			AOUE58		AOUE59			AOUE60		
Sampling Date		2025/03/10 11:00			2025/03/10 11:10		2025/03/10 11:15			2025/03/10 11:20		
COC Number		1024532			1024532		1024532			1024532		
	UNITS	AMICA-OGS	RDL	QC Batch	OUTLET	RDL	EP-IN	RDL	QC Batch	SLC-OGS	RDL	QC Batch
Inorganics												
Conductivity	umho/cm				1000	2.0	10000	2.0	9889704			
Dissolved Chloride (Cl-)	mg/L	200	2.0	9890339	200	2.0	3300	20	9890339	3300	20	9890339
RDL = Reportable Detection Limit												
QC Batch = Quality Control Batch												

Bureau Veritas ID		AOUE61		
Sampling Date		2025/03/10 11:25		
COC Number		1024532		
	UNITS	NP-IN	RDL	QC Batch
Inorganics				
Conductivity	umho/cm	930	2.0	9889704
Dissolved Chloride (Cl-)	mg/L	160	1.0	9890339
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU
VERITAS

Bureau Veritas Job #: C525833

Report Date: 2025/03/14

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.0°C
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Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C525833

Report Date: 2025/03/14

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9889704	Conductivity	2025/03/12			99	85 - 115	ND, RDL=2.0	umho/cm	0.44	10
9890339	Dissolved Chloride (Cl-)	2025/03/14	NC	80 - 120	94	80 - 120	ND, RDL=1.0	mg/L	0.11	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)



BUREAU
VERITAS

Bureau Veritas Job #: C525833

Report Date: 2025/03/14

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

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Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1026800

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/06/03
Report #: R8549866
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C546528

Received: 2025/04/25, 15:45

Sample Matrix: Water
Samples Received: 3

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	1	N/A	2025/04/28	CAM SOP-00463	SM 24 4500-Cl E m
Chloride by Automated Colourimetry	2	N/A	2025/04/30	CAM SOP-00463	SM 24 4500-Cl E m
Colour	1	N/A	2025/04/29	CAM SOP-00412	SM 24 2120C m
Colour	1	N/A	2025/05/01	CAM SOP-00412	SM 24 2120C m
Conductivity	1	N/A	2025/04/28	CAM SOP-00414	SM 24 2510 m
Conductivity	2	N/A	2025/04/30	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2025/04/29	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	2	N/A	2025/05/01	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2025/04/30	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	2	2025/04/29	2025/04/30	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	2	N/A	2025/04/30	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	2	2025/04/30	2025/04/30	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	2	2025/04/30	2025/05/01	CAM SOP-00407	SM 24 4500-P I

Remarks:

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1026800

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/06/03
Report #: R8549866
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C546528

Received: 2025/04/25, 15:45

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

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BUREAU
VERITAS

Bureau Veritas Job #: C546528

Report Date: 2025/06/03

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AQGQ41			AQGQ41			AQGQ42		
Sampling Date		2025/04/24 13:00			2025/04/24 13:00			2025/04/24 13:10		
COC Number		1026800			1026800			1026800		
	UNITS	East	RDL	QC Batch	East Lab-Dup	RDL	QC Batch	West	RDL	QC Batch
Inorganics										
Total Ammonia-N	mg/L	0.063	0.050	9919426				0.076	0.050	9919426
Colour	TCU	4	2	9917945				6	2	9917946
Conductivity	umho/cm	920	2.0	9918797				920	2.0	9918797
Total Kjeldahl Nitrogen (TKN)	mg/L	0.49	0.10	9919381				0.57	0.10	9919381
Dissolved Organic Carbon	mg/L	5.9	0.40	9917872				5.7	0.40	9917872
Orthophosphate (P)	mg/L	ND	0.004	9918762	ND	0.004	9918762	ND	0.004	9918762
pH	pH	8.13		9918796				8.11		9918796
Total Phosphorus	mg/L	0.019	0.004	9919289				0.022	0.004	9919289
Dissolved Chloride (Cl-)	mg/L	190	1.0	9918526				190	1.0	9918526
Nitrite (N)	mg/L	ND	0.010	9917779				ND	0.010	9917779
Nitrate (N)	mg/L	0.11	0.10	9917779				0.11	0.10	9917779
Nitrate + Nitrite (N)	mg/L	0.11	0.10	9917779				0.11	0.10	9917779
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.										

Bureau Veritas ID		AQGQ43		
Sampling Date		2025/03/31 14:10		
COC Number		1026800		
	UNITS	Dock	RDL	QC Batch
Inorganics				
Conductivity	umho/cm	930	2.0	9917590
Dissolved Chloride (Cl-)	mg/L	200	1.0	9916838
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C
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Sample AQGQ41 [East] : Nitrite+Nitrate: Analysis was performed past sample holding time. This may increase the variability associated with these results.

Sample AQGQ42 [West] : Nitrite+Nitrate: Analysis was performed past sample holding time. This may increase the variability associated with these results.

Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C546528

Report Date: 2025/06/03

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9916838	Dissolved Chloride (Cl-)	2025/04/28	89	80 - 120	94	80 - 120	ND, RDL=1.0	mg/L	0.63	20		
9917590	Conductivity	2025/04/28			101	85 - 115	ND, RDL=2.0	umho/cm	0	10		
9917779	Nitrate (N)	2025/04/30	96	80 - 120	94	80 - 120	ND, RDL=0.10	mg/L	NC	20		
9917779	Nitrite (N)	2025/04/30	107	80 - 120	104	80 - 120	ND, RDL=0.010	mg/L	NC	20		
9917872	Dissolved Organic Carbon	2025/04/29	92	80 - 120	97	80 - 120	ND, RDL=0.40	mg/L	1.1	20		
9917945	Colour	2025/04/29			97	80 - 120	ND, RDL=2	TCU	12	25		
9917946	Colour	2025/05/01			100	80 - 120	ND, RDL=2	TCU	NC	25		
9918526	Dissolved Chloride (Cl-)	2025/04/30	NC	80 - 120	94	80 - 120	ND, RDL=1.0	mg/L	1.2	20		
9918762	Orthophosphate (P)	2025/04/30	99	80 - 120	98	80 - 120	ND, RDL=0.004	mg/L	NC	20		
9918796	pH	2025/04/30			102	98 - 103			0.41	N/A		
9918797	Conductivity	2025/04/30			101	85 - 115	ND, RDL=2.0	umho/cm	0.57	10		
9919289	Total Phosphorus	2025/05/01	97	80 - 120	95	80 - 120	ND, RDL=0.004	mg/L	3.8	20	92	80 - 120
9919381	Total Kjeldahl Nitrogen (TKN)	2025/04/30	104	80 - 120	99	80 - 120	ND, RDL=0.10	mg/L	NC	20	97	80 - 120
9919426	Total Ammonia-N	2025/05/01	102	75 - 125	102	80 - 120	ND, RDL=0.050	mg/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



BUREAU
VERITAS

Bureau Veritas Job #: C546528
Report Date: 2025/06/03

City of Markham
Site Location: SWAN LAKE
Your P.O. #: PB22006

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Louise Harding, Scientific Specialist

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 140847

Work ID:

C546528

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 2

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Authorized by: Jennifer Koene-Fenton, Laboratory Superintendent

Workorder Summary

Analysis Results Comments

14084701 (1) - *Cryptomonad*

The specimens could not be characterized due to the small size of the algal specimens. The specimens observed may have been a mixture of Cryptomonads and/or green flagellated algae.

Estimate

14084701 (1) - *Microcystis*

Estimate

14084701 (1) - *Small Unidentifiable Algae*

Estimate

14084701 (1) - *Specimen A*

Desmodesmus

Estimate

14084701 (1) - *Specimen B*

Cryptomonas

Estimate

14084701 (1) - *Specimen C*

Gonium

14084701 (1) - *Specimen D*

Monoraphidium

14084701 (1) - *Specimen E*

Trachelomonas

14084701 (1) - *Specimen F*

Phacotus

14084701 (1) - *Total Cells*

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

Report Date: 5/8/2025 9:53:23 AM

Report ID: 140847-6270161

Page 1 of 6

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664

LABORATORY ANALYSIS REPORT



Work Order #: 140847

Work ID:

C546528

Workorder Summary

Analysis Results Comments

14084702 (2) - *Cryptomonad*

The specimens could not be characterized due to the small size of the algal specimens. The specimens observed may have been a mixture of Cryptomonads and/or green flagellated algae.

14084702 (2) - *Microcystis*

Estimate

14084702 (2) - *Specimen A*

Desmodesmus

14084702 (2) - *Specimen B*

Cryptomonas

14084702 (2) - *Specimen C*

Gonium

14084702 (2) - *Specimen D*

Monoraphidium

14084702 (2) - *Specimen E*

Trachelomonas

14084702 (2) - *Specimen F*

Phacotous

14084702 (2) - *Total Cells*

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

Report Date: 5/8/2025 9:53:23 AM

Report ID: 140847-6270161

Page 2 of 6

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 140847

Work ID:

C546528

Analytical Results

Lab ID:	14084701	Sample ID:	1	Criteria:	N/A	Date Received:	4/29/2025
Matrix:	Water	Location:	EAST			Date Collected:	4/24/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	280	cells/mL		20	1		04/29/2025	05/06/2025	
Closteriopsis	2	cells/mL		2	1		04/29/2025	05/06/2025	
Cosmarium	2	cells/mL		2	1		04/29/2025	05/06/2025	
Cryptomonad	960	cells/mL		20	1		04/29/2025	05/06/2025	*
Diatoma	28	cells/mL		2	1		04/29/2025	05/06/2025	
Dinobryon	72	cells/mL		2	1		04/29/2025	05/06/2025	
Mallomonas	80	cells/mL		20	1		04/29/2025	05/06/2025	
Microcystis	29000	cells/mL		20	1		04/29/2025	05/06/2025	*
Navicula	2	cells/mL		2	1		04/29/2025	05/06/2025	
Nitzschia	220	cells/mL		20	1		04/29/2025	05/06/2025	
Pediastrum	16	cells/mL		2	1		04/29/2025	05/06/2025	
Peridinium	48	cells/mL		2	1		04/29/2025	05/06/2025	
Scenedesmus	160	cells/mL		20	1		04/29/2025	05/06/2025	
Selenastrum	120	cells/mL		20	1		04/29/2025	05/06/2025	
Small Unidentifiable Algae	1400	cells/mL		20	1		04/29/2025	05/06/2025	*
Specimen A	760	cells/mL		20	1		04/29/2025	05/06/2025	*
Specimen B	1100	cells/mL		20	1		04/29/2025	05/06/2025	*
Specimen C	100	cells/mL		2	1		04/29/2025	05/06/2025	*
Specimen D	74	cells/mL		2	1		04/29/2025	05/06/2025	*
Specimen E	24	cells/mL		2	1		04/29/2025	05/06/2025	*
Specimen F	6	cells/mL		2	1		04/29/2025	05/06/2025	*
Staurastrum	2	cells/mL		2	1		04/29/2025	05/06/2025	
Total Cells	34000	cells/mL		20	1		04/29/2025	05/06/2025	*
Treubaria	2	cells/mL		2	1		04/29/2025	05/06/2025	

Report Date: 5/8/2025 9:53:23 AM

Report ID: 140847-6270161

Page 3 of 6

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Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 140847

Work ID:

C546528

Analytical Results

Lab ID:	14084702	Sample ID:	2	Criteria:	N/A	Date Received:	4/29/2025
Matrix:	Water	Location:	WEST			Date Collected:	4/24/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	320	cells/mL		20	1		04/29/2025	05/06/2025	
Ceratium	2	cells/mL		2	1		04/29/2025	05/06/2025	
Closterium	4	cells/mL		2	1		04/29/2025	05/06/2025	
Coelastrum	16	cells/mL		2	1		04/29/2025	05/06/2025	
Cryptomonad	460	cells/mL		20	1		04/29/2025	05/06/2025	*
Diatoma	6	cells/mL		2	1		04/29/2025	05/06/2025	
Dinobryon	260	cells/mL		20	1		04/29/2025	05/06/2025	
Mallomonas	60	cells/mL		20	1		04/29/2025	05/06/2025	
Merismopedia	2000	cells/mL		20	1		04/29/2025	05/06/2025	
Microcystis	31000	cells/mL		20	1		04/29/2025	05/06/2025	*
Mougeotia	120	cells/mL		20	1		04/29/2025	05/06/2025	
Nitzschia	180	cells/mL		20	1		04/29/2025	05/06/2025	
Pediastrum	46	cells/mL		2	1		04/29/2025	05/06/2025	
Peridinium	140	cells/mL		20	1		04/29/2025	05/06/2025	
Scenedesmus	80	cells/mL		20	1		04/29/2025	05/06/2025	
Small Unidentifiable Algae	620	cells/mL		20	1		04/29/2025	05/06/2025	
Specimen A	1100	cells/mL		20	1		04/29/2025	05/06/2025	*
Specimen B	640	cells/mL		20	1		04/29/2025	05/06/2025	*
Specimen C	72	cells/mL		2	1		04/29/2025	05/06/2025	*
Specimen D	64	cells/mL		2	1		04/29/2025	05/06/2025	*
Specimen E	30	cells/mL		2	1		04/29/2025	05/06/2025	*
Specimen F	2	cells/mL		2	1		04/29/2025	05/06/2025	*
Staurastrum	2	cells/mL		2	1		04/29/2025	05/06/2025	
Total Cells	37000	cells/mL		2	1		04/29/2025	05/06/2025	*
Treubaria	4	cells/mL		2	1		04/29/2025	05/06/2025	

Report Date: 5/8/2025 9:53:23 AM

Report ID: 140847-6270161

Page 4 of 6

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C546528

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LABORATORY ANALYSIS REPORT

Work Order #: 140847

Work ID:

C546528

Page 1 of 1



York-Durham
Regional Environmental Laboratory

901 McKay Road, Pickering ON L1W 3A3 Toll Free: 1-877-551-8877 Local: 905-686-0041
Fax: 905-686-0664 Email: rel@durham.ca Web: www.durham.ca

C546528

Non-regulated Water, Wastewater, Biosolid, Soil

[illegible]

Report Date: 5/8/2025 9:53:23 AM

Report ID: 140847-6270161

Page 6 of 6

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1027811

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/06/03
Report #: R8549867
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C556009

Received: 2025/05/15, 15:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride by Automated Colourimetry	2	N/A	2025/05/21	CAM SOP-00463	SM 24 4500-Cl E m
Colour	2	N/A	2025/05/22	CAM SOP-00412	SM 24 2120C m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2025/05/18	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	3	N/A	2025/05/22	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	3	N/A	2025/05/17	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	2	2025/05/17	2025/05/20	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	3	N/A	2025/05/21	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	3	2025/05/20	2025/05/21	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	3	2025/05/20	2025/05/21	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1027811

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/06/03
Report #: R8549867
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C556009

Received: 2025/05/15, 15:30

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

=====

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



BUREAU
VERITAS

Bureau Veritas Job #: C556009

Report Date: 2025/06/03

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AQYB60	AQYB61			AQYB61		AQYB62		
Sampling Date		2025/05/14 11:20	2025/05/14 12:00			2025/05/14 12:00		2025/05/14 11:30		
COC Number		1027811	1027811			1027811		1027811		
	UNITS	S105	S205	RDL	QC Batch	S205 Lab-Dup	QC Batch	S115	RDL	QC Batch

Inorganics										
Total Ammonia-N	mg/L	ND	ND	0.050	9932556			ND	0.050	9932556
Colour	TCU	6	9	2	9931129					
Total Kjeldahl Nitrogen (TKN)	mg/L	0.47	0.44	0.10	9932013			0.42	0.10	9932013
Dissolved Organic Carbon	mg/L	7.2	7.6	0.40	9931023					
Orthophosphate (P)	mg/L	ND	ND	0.004	9931126			ND	0.004	9931126
pH	pH	8.03	7.88		9931114	7.88	9931114			
Total Phosphorus	mg/L	0.010	0.013	0.004	9931956			0.010	0.004	9931956
Dissolved Chloride (Cl-)	mg/L	190	190	1.0	9931016					
Nitrite (N)	mg/L	ND	ND	0.010	9930984			ND	0.010	9930984
Nitrate (N)	mg/L	ND	ND	0.10	9930984			ND	0.10	9930984
Nitrate + Nitrite (N)	mg/L	ND	ND	0.10	9930984			ND	0.10	9930984

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Bureau Veritas ID		AQYB62		
Sampling Date		2025/05/14 11:30		
COC Number		1027811		
	UNITS	S115 Lab-Dup	RDL	QC Batch

Inorganics				
Total Kjeldahl Nitrogen (TKN)	mg/L	0.43	0.10	9932013
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				
Lab-Dup = Laboratory Initiated Duplicate				



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.3°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C556009

Report Date: 2025/06/03

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9930984	Nitrate (N)	2025/05/17	94	80 - 120	97	80 - 120	ND, RDL=0.10	mg/L	1.7	20		
9930984	Nitrite (N)	2025/05/17	99	80 - 120	98	80 - 120	ND, RDL=0.010	mg/L				
9931016	Dissolved Chloride (Cl-)	2025/05/21	NC	80 - 120	99	80 - 120	ND, RDL=1.0	mg/L	1.4	20		
9931023	Dissolved Organic Carbon	2025/05/17	91	80 - 120	94	80 - 120	ND, RDL=0.40	mg/L	0.40	20		
9931114	pH	2025/05/20			102	98 - 103			0.030	N/A		
9931126	Orthophosphate (P)	2025/05/21	94	80 - 120	94	80 - 120	ND, RDL=0.004	mg/L	NC	20		
9931129	Colour	2025/05/22			99	80 - 120	ND,RDL=2	TCU	1.9	25		
9931956	Total Phosphorus	2025/05/21	101	80 - 120	95	80 - 120	ND, RDL=0.004	mg/L	NC	20	100	80 - 120
9932013	Total Kjeldahl Nitrogen (TKN)	2025/05/21	101	80 - 120	97	80 - 120	ND, RDL=0.10	mg/L	2.4	20	101	80 - 120
9932556	Total Ammonia-N	2025/05/22	NC	75 - 125	99	80 - 120	ND, RDL=0.050	mg/L	0.43	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



BUREAU
VERITAS

Bureau Veritas Job #: C556009

Report Date: 2025/06/03

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 2

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Workorder Summary

Analysis Results Comments

14191901 (1) - Ankistrodesmus

Estimate

14191901 (1) - Coelosphaerium

Estimate

14191901 (1) - Cryptomonad

The specimens could not be characterized due to the small size of the algal specimens. The specimens observed may have been a mixture of Cryptomonads and/or green flagellated algae.

Estimate

14191901 (1) - Merismopedia

Estimate

14191901 (1) - Microcystis

Estimate

14191901 (1) - Scenedesmus

Estimate

14191901 (1) - Small Unidentifiable Algae

Estimate

14191901 (1) - Specimen A

Cryptomonas

Estimate

14191901 (1) - Specimen B

Trachelomonas

14191901 (1) - Specimen C

Gonium

14191901 (1) - Specimen D

Monoraphidium

Estimate

Report Date: 5/26/2025 2:37:10 PM

Report ID: 141919-6311790

Page 1 of 7

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Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Workorder Summary

Analysis Results Comments

14191901 (1) - Specimen E

Desmodesmus

Estimate

14191901 (1) - Specimen F

Pseudanabaena

14191901 (1) - Specimen H

Keratococcus

14191901 (1) - Specimen K

Stauridium

14191902 (2) - Anabaena

Dolichospermum (formerly Anabaena)

14191902 (2) - Ankistrodesmus

Estimate

14191902 (2) - Coelosphaerium

Estimate

14191902 (2) - Cryptomonad

Estimate

14191902 (2) - Merismopedia

Estimate

14191902 (2) - Microcystis

Estimate

14191902 (2) - Peridinium

Estimate

14191902 (2) - Scenedesmus

Estimate

14191902 (2) - Small Unidentifiable Algae

Estimate

14191902 (2) - Specimen A

Cryptomonas

Estimate

14191902 (2) - Specimen B

Trachelomonas

Report Date: 5/26/2025 2:37:10 PM

Report ID: 141919-6311790

Page 2 of 7

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Workorder Summary

Analysis Results Comments

14191902 (2) - Specimen C

Gonium

14191902 (2) - Specimen D

Monoraphidium

14191902 (2) - Specimen E

Desmodesmus

Estimate

14191902 (2) - Specimen F

Pseudanabaena

Estimate

14191902 (2) - Specimen G

Phacus

14191902 (2) - Specimen I

Golenkinia

14191902 (2) - Specimen J

Limnotherix

14191902 (2) - Uncharacterized Algae

Colonial green algae, cells ellipsoid to ovoid in shape with a single pyrenoid. Cells in colony arranged mostly in pairs at the ends of spirally twisted strands of parental cell wall material; possibly from the genus Lobocystis.

Analytical Results

Lab ID:	14191901	Sample ID:	1	Criteria:	N/A	Date Received:	5/16/2025
Matrix:	Water	Location:	S105			Date Collected:	5/14/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	1600	cells/mL		2	1		05/16/2025	05/21/2025	*
Chroococcus	140	cells/mL		2	1		05/16/2025	05/21/2025	
Coelastrum	96	cells/mL		2	1		05/16/2025	05/21/2025	
Coelosphaerium	320	cells/mL		2	1		05/16/2025	05/21/2025	*
Cosmarium	40	cells/mL		2	1		05/16/2025	05/21/2025	
Cryptomonad	770	cells/mL		2	1		05/16/2025	05/21/2025	*
Diatoma	6	cells/mL		2	1		05/16/2025	05/21/2025	

Report Date: 5/26/2025 2:37:10 PM

Report ID: 141919-6311790

Page 3 of 7

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LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Analytical Results

Lab ID: 14191901	Sample ID: 1	Criteria: N/A	Date Received: 5/16/2025
Matrix: Water	Location: S105		Date Collected: 5/14/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Dinobryon	46	cells/mL		2	1		05/16/2025	05/21/2025	
Fragilaria	16	cells/mL		2	1		05/16/2025	05/21/2025	
Mallomonas	6	cells/mL		2	1		05/16/2025	05/21/2025	
Merismopedia	1800	cells/mL		2	1		05/16/2025	05/21/2025	*
Microcystis	39000	cells/mL		2	1		05/16/2025	05/21/2025	*
Mougeotia	18	cells/mL		2	1		05/16/2025	05/21/2025	
Navicula	2	cells/mL		2	1		05/16/2025	05/21/2025	
Nitzschia	26	cells/mL		2	1		05/16/2025	05/21/2025	
Pediastrum	30	cells/mL		2	1		05/16/2025	05/21/2025	
Peridinium	52	cells/mL		2	1		05/16/2025	05/21/2025	
Scenedesmus	400	cells/mL		2	1		05/16/2025	05/21/2025	*
Selenastrum	110	cells/mL		2	1		05/16/2025	05/21/2025	
Small Unidentifiable Algae	1800	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen A	510	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen B	30	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen C	200	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen D	450	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen E	1600	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen F	130	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen H	6	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen K	8	cells/mL		2	1		05/16/2025	05/21/2025	*
Staurastrum	4	cells/mL		2	1		05/16/2025	05/21/2025	
Tetraedron	110	cells/mL		2	1		05/16/2025	05/21/2025	
Total Cells	50000	cells/mL		2	1		05/16/2025	05/21/2025	
Treubaria	4	cells/mL		2	1		05/16/2025	05/21/2025	

Report Date: 5/26/2025 2:37:10 PM

Report ID: 141919-6311790

Page 4 of 7

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Analytical Results

Lab ID:	14191902	Sample ID:	2	Criteria:	N/A	Date Received:	5/16/2025
Matrix:	Water	Location:	S205			Date Collected:	5/14/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Anabaena	32	cells/mL		2	1		05/16/2025	05/21/2025	*
Ankistrodesmus	1400	cells/mL		2	1		05/16/2025	05/21/2025	*
Chroococcus	76	cells/mL		2	1		05/16/2025	05/21/2025	
Coelosphaerium	840	cells/mL		2	1		05/16/2025	05/21/2025	*
Cosmarium	20	cells/mL		2	1		05/16/2025	05/21/2025	
Cryptomonad	1000	cells/mL		2	1		05/16/2025	05/21/2025	*
Diatoma	2	cells/mL		2	1		05/16/2025	05/21/2025	
Dinobryon	22	cells/mL		2	1		05/16/2025	05/21/2025	
Fragilaria	24	cells/mL		2	1		05/16/2025	05/21/2025	
Merismopedia	1100	cells/mL		2	1		05/16/2025	05/21/2025	*
Microcystis	42000	cells/mL		2	1		05/16/2025	05/21/2025	*
Nitzschia	22	cells/mL		2	1		05/16/2025	05/21/2025	
Oocystis	12	cells/mL		2	1		05/16/2025	05/21/2025	
Pediastrum	14	cells/mL		2	1		05/16/2025	05/21/2025	
Peridinium	490	cells/mL		2	1		05/16/2025	05/21/2025	*
Scenedesmus	610	cells/mL		2	1		05/16/2025	05/21/2025	*
Selenastrum	32	cells/mL		2	1		05/16/2025	05/21/2025	
Small Unidentifiable Algae	1900	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen A	950	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen B	10	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen C	120	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen D	230	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen E	1600	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen F	540	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen G	2	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen I	2	cells/mL		2	1		05/16/2025	05/21/2025	*
Specimen J	60	cells/mL		2	1		05/16/2025	05/21/2025	*
Staurastrum	2	cells/mL		2	1		05/16/2025	05/21/2025	
Tetraedron	140	cells/mL		2	1		05/16/2025	05/21/2025	

Report Date: 5/26/2025 2:37:10 PM

Report ID: 141919-6311790

Page 5 of 7

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Analytical Results

Lab ID: 14191902	Sample ID: 2	Criteria: N/A	Date Received: 5/16/2025
Matrix: Water	Location: S205		Date Collected: 5/14/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Total Cells	53000	cells/mL		2	1		05/16/2025	05/21/2025	
Treubaria	2	cells/mL		2	1		05/16/2025	05/21/2025	
Uncharacterized Algae	44	cells/mL		2	1		05/16/2025	05/21/2025	*

Report Date: 5/26/2025 2:37:10 PM

Report ID: 141919-6311790

Page 6 of 7

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

PRELIMINARY REPORT

Work Order #: 141919

Work ID:

C556009

Page 1 of 1



York-Durham
Regional Environmental Laboratory

901 McKay Road, Pickering ON L1W 3A3 Toll Free: 1-877-551-8877 Local: 905-686-0041
Fax: 905-686-0664 Email: rel@durham.ca Web: www.durham.ca

C556009

Non-regulated Water, Wastewater, Biosolid, Soil Chain of Custody Form

Client Information				Invoice To (leave blank if same as Client)				Report to (email address)																			
Company Name: Bureau Veritas Canada				Company:				1) nazeema.rahaman@bureauveritas.com																			
Facility Name:				Quote #:				2)																			
Facility Address: 6740 Campobello Rd.				PO #:				3)																			
Facility Contact: Nazeema Rahaman								4)																			
Email: nazeema.rahaman@bureauveritas.com				Tel:				5)																			
Project Information (if applicable)				Standard Turnaround Time (TAT) is 10 business days ☐ *RUSH				*Rush TAT requires lab approval in advance. Surcharge will apply.																			
Description:																											
Sample(s) Information				Collection				Container				Chlorine		Apply Criteria													
Lab ID (lab use only)		Field ID		Location/Description/Comment(s)		Matrix		Type		mm-dd-yy		HH:MM		Test Group(s)		Type		Sent		Rec'd		Free		Total		Apply Criteria (Y/N) (*1)	
01				S105		W		Surface		05/14/2025		00:11 00:20		Algaecells		preserved		1		1							
02				S205		W		Surface		05/14/2025		00:12 00:00		Algaecells		preserved		1		1							



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1028859

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/07/29
Report #: R8584914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C565795

Received: 2025/06/05, 15:15

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride by Automated Colourimetry	1	N/A	2025/06/10	CAM SOP-00463	SM 24 4500-Cl E m
Chloride by Automated Colourimetry	1	N/A	2025/06/11	CAM SOP-00463	SM 24 4500-Cl E m
Colour	2	N/A	2025/06/10	CAM SOP-00412	SM 24 2120C m
Conductivity	2	N/A	2025/06/10	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2025/06/06	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	3	N/A	2025/06/11	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	3	N/A	2025/06/09	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	2	2025/06/10	2025/06/10	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	3	N/A	2025/06/07	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	3	2025/06/10	2025/06/11	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	3	2025/06/10	2025/06/11	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1028859

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/07/29
Report #: R8584914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C565795

Received: 2025/06/05, 15:15

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(3) "The CCME method and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



**BUREAU
VERITAS**

Bureau Veritas Job #: C565795

Report Date: 2025/07/29

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		ARPY74			ARPY74			ARPY75		
Sampling Date		2025/06/04 11:10			2025/06/04 11:10			2025/06/04 12:00		
COC Number		1028859			1028859			1028859		
	UNITS	S105	RDL	QC Batch	S105 Lab-Dup	RDL	QC Batch	S205	RDL	QC Batch

Inorganics										
Total Ammonia-N	mg/L	ND	0.050	9946677	0.054	0.050	9946677	0.13	0.050	9946677
Colour	TCU	5	2	9945960				8	2	9945960
Conductivity	umho/cm	840	2.0	9946516				840	2.0	9946516
Total Kjeldahl Nitrogen (TKN)	mg/L	ND (1)	0.50	9946191				0.73	0.50	9946191
Dissolved Organic Carbon	mg/L	7.2	0.40	9944381				9.3	0.40	9944385
Orthophosphate (P)	mg/L	ND	0.004	9944544				ND	0.004	9944544
pH	pH	8.72		9946518				8.46		9946518
Total Phosphorus	mg/L	0.018	0.004	9946519				0.030	0.004	9946519
Dissolved Chloride (Cl-)	mg/L	200	1.0	9945492				210	2.0	9945492
Nitrite (N)	mg/L	ND	0.010	9944939				ND	0.010	9944650
Nitrate (N)	mg/L	ND	0.10	9944939				ND	0.10	9944650
Nitrate + Nitrite (N)	mg/L	ND	0.10	9944939				ND	0.10	9944650

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

(1) TKN : Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Bureau Veritas ID		ARPY75			ARPY76			ARPY76		
Sampling Date		2025/06/04 12:00			2025/06/04 11:20			2025/06/04 11:20		
COC Number		1028859			1028859			1028859		
	UNITS	S205 Lab-Dup	RDL	QC Batch	S115	RDL	QC Batch	S115 Lab-Dup	RDL	QC Batch

Inorganics										
Total Ammonia-N	mg/L				0.14	0.050	9946677			
Conductivity	umho/cm	840	2.0	9946516						
Total Kjeldahl Nitrogen (TKN)	mg/L				0.64	0.50	9946191			
Orthophosphate (P)	mg/L				ND	0.004	9944544			
pH	pH	8.47		9946518						
Total Phosphorus	mg/L				0.020	0.004	9946519	0.017	0.004	9946519
Nitrite (N)	mg/L				ND	0.010	9944650			
Nitrate (N)	mg/L				ND	0.10	9944650			
Nitrate + Nitrite (N)	mg/L				ND	0.10	9944650			

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.



BUREAU
VERITAS

Bureau Veritas Job #: C565795

Report Date: 2025/07/29

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.0°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C565795

Report Date: 2025/07/29

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9944381	Dissolved Organic Carbon	2025/06/06	94	80 - 120	97	80 - 120	ND, RDL=0.40	mg/L	0.90	20		
9944385	Dissolved Organic Carbon	2025/06/06	93	80 - 120	96	80 - 120	ND, RDL=0.40	mg/L	5.0	20		
9944544	Orthophosphate (P)	2025/06/07	97	80 - 120	95	80 - 120	ND, RDL=0.004	mg/L	NC	20		
9944650	Nitrate (N)	2025/06/09	94	80 - 120	94	80 - 120	ND, RDL=0.10	mg/L	0.85	20		
9944650	Nitrite (N)	2025/06/09	79 (1)	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L	NC	20		
9944939	Nitrate (N)	2025/06/09	95	80 - 120	94	80 - 120	ND, RDL=0.10	mg/L	1.2	20		
9944939	Nitrite (N)	2025/06/09	98	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L	1.6	20		
9945492	Dissolved Chloride (Cl-)	2025/06/10	NC	80 - 120	100	80 - 120	ND, RDL=1.0	mg/L	0.30	20		
9945960	Colour	2025/06/10			98	80 - 120	ND, RDL=2	TCU	NC	25		
9946191	Total Kjeldahl Nitrogen (TKN)	2025/06/10	NC	80 - 120	97	80 - 120	ND, RDL=0.10	mg/L	1.4	20	98	80 - 120
9946516	Conductivity	2025/06/10			100	85 - 115	ND, RDL=2.0	umho/cm	0.24	10		
9946518	pH	2025/06/10			102	98 - 103			0.21	N/A		
9946519	Total Phosphorus	2025/06/11	93	80 - 120	103	80 - 120	ND, RDL=0.004	mg/L	17	20	103	80 - 120
9946677	Total Ammonia-N	2025/06/11	100	75 - 125	104	80 - 120	ND, RDL=0.050	mg/L	8.2	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C565795

Report Date: 2025/07/29

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 142966

Work ID:

C565795

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 2

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Authorized by: Sarah Ostler, Laboratory Supervisor

Workorder Summary

Analysis Results Comments

14296601 (1) - *Cryptomonad*

The specimens could not be characterized due to the small size of the algal specimens. The specimens observed may have been a mixture of Cryptomonads and/or green flagellated algae.

14296601 (1) - *Specimen A*

Desmodesmus

14296601 (1) - *Specimen B*

Trachelomonas

14296601 (1) - *Specimen D*

Cryptomonas

14296601 (1) - *Specimen E*

Elakatothrix

14296601 (1) - *Specimen F*

Monoraphidium

14296601 (1) - *Specimen G*

Pseudanabaena

14296601 (1) - *Specimen J*

Woronichinia

14296601 (1) - *Total Cells*

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

14296602 (2) - *Cryptomonad*

The specimens could not be characterized due to the small size of the algal specimens. The specimens observed may have been a mixture of Cryptomonads and/or green flagellated algae.

14296602 (2) - *Specimen A*

Desmodesmus

14296602 (2) - *Specimen B*

Trachelomonas

Report Date: 6/12/2025 2:21:40 PM

Report ID: 142966-6349942

Page 1 of 6

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York-Durham Regional Environmental Laboratory

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LABORATORY ANALYSIS REPORT

Work Order #: 142966

Work ID:

C565795

Workorder Summary

Analysis Results Comments

14296602 (2) - Specimen C

Phacus

14296602 (2) - Specimen D

Cryptomonas

14296602 (2) - Specimen E

Elakatothrix

14296602 (2) - Specimen F

Monoraphidium

14296602 (2) - Specimen G

Pseudanabaena

14296602 (2) - Specimen I

Pandorina

14296602 (2) - Specimen K

Gonium

14296602 (2) - Total Cells

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

14296602 (2) - Uncharacterized Algae

Colonial green algae, cells ellipsoid to ovoid in shape with a single pyrenoid. Cells in colony arranged mostly in pairs at the ends of spirally twisted strands or parental cell wall material; possibly form the genus Lobocystis.

Analytical Results

Lab ID:	14296601	Sample ID:	1	Criteria:	N/A	Date Received:	6/6/2025
Matrix:	Water	Location:	S105			Date Collected:	6/4/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	650	cells/mL		2	1		06/06/2025	06/10/2025	
Ceratium	2	cells/mL		2	1		06/06/2025	06/10/2025	
Chlamydomonas	16	cells/mL		2	1		06/06/2025	06/10/2025	
Chroococcus	240	cells/mL		40	1		06/06/2025	06/10/2025	
Closteriopsis	8	cells/mL		2	1		06/06/2025	06/10/2025	
Coelastrum	32	cells/mL		2	1		06/06/2025	06/10/2025	
Coelosphaerium	150	cells/mL		2	1		06/06/2025	06/10/2025	

Report Date: 6/12/2025 2:21:40 PM

Report ID: 142966-6349942

Page 2 of 6

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 142966

Work ID:

C565795

Analytical Results

Lab ID: 14296601	Sample ID: 1	Criteria: N/A	Date Received: 6/6/2025
Matrix: Water	Location: S105		Date Collected: 6/4/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Cosmarium	13000	cells/mL		40	1		06/06/2025	06/10/2025	
Cryptomonad	280	cells/mL		40	1		06/06/2025	06/10/2025	*
Cyclotella	2	cells/mL		2	1		06/06/2025	06/10/2025	
Diatoma	22	cells/mL		2	1		06/06/2025	06/10/2025	
Euglena	4	cells/mL		2	1		06/06/2025	06/10/2025	
Merismopedia	410	cells/mL		2	1		06/06/2025	06/10/2025	
Microcystis	10000	cells/mL		40	1		06/06/2025	06/10/2025	
Mougeotia	4	cells/mL		2	1		06/06/2025	06/10/2025	
Nitzschia	14	cells/mL		2	1		06/06/2025	06/10/2025	
Pediastrum	6	cells/mL		2	1		06/06/2025	06/10/2025	
Peridinium	310	cells/mL		2	1		06/06/2025	06/10/2025	
Scenedesmus	480	cells/mL		40	1		06/06/2025	06/10/2025	
Selenastrum	8	cells/mL		2	1		06/06/2025	06/10/2025	
Small Unidentifiable Algae	2400	cells/mL		40	1		06/06/2025	06/10/2025	
Specimen A	1200	cells/mL		40	1		06/06/2025	06/10/2025	*
Specimen B	20	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen D	22	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen E	24	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen F	1100	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen G	2200	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen J	110	cells/mL		2	1		06/06/2025	06/10/2025	*
Staurastrum	26	cells/mL		2	1		06/06/2025	06/10/2025	
Total Cells	35000	cells/mL		40	1		06/06/2025	06/10/2025	*
Treubaria	1400	cells/mL		40	1		06/06/2025	06/10/2025	

Lab ID: 14296602	Sample ID: 2	Criteria: N/A	Date Received: 6/6/2025
Matrix: Water	Location: S205		Date Collected: 6/4/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
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PHYTOPLANKTON (Cells/mL) (RELM-14)

Report Date: 6/12/2025 2:21:40 PM

Report ID: 142966-6349942

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 142966

Work ID:

C565795

Analytical Results

Lab ID: 14296602	Sample ID: 2	Criteria: N/A	Date Received: 6/6/2025
Matrix: Water	Location: S205		Date Collected: 6/4/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Ankistrodesmus	390	cells/mL		2	1		06/06/2025	06/10/2025	
Chlamydomonas	20	cells/mL		2	1		06/06/2025	06/10/2025	
Chroococcus	160	cells/mL		40	1		06/06/2025	06/10/2025	
Closteriopsis	12	cells/mL		2	1		06/06/2025	06/10/2025	
Coelastrum	48	cells/mL		2	1		06/06/2025	06/10/2025	
Coelosphaerium	250	cells/mL		2	1		06/06/2025	06/10/2025	
Cosmarium	9800	cells/mL		40	1		06/06/2025	06/10/2025	
Cryptomonad	160	cells/mL		40	1		06/06/2025	06/10/2025	*
Diatoma	4	cells/mL		2	1		06/06/2025	06/10/2025	
Euglena	6	cells/mL		2	1		06/06/2025	06/10/2025	
Fragilaria	4	cells/mL		2	1		06/06/2025	06/10/2025	
Gyrosigma	2	cells/mL		2	1		06/06/2025	06/10/2025	
Merismopedia	370	cells/mL		2	1		06/06/2025	06/10/2025	
Microcystis	14000	cells/mL		40	1		06/06/2025	06/10/2025	
Mougeotia	12	cells/mL		2	1		06/06/2025	06/10/2025	
Navicula	2	cells/mL		2	1		06/06/2025	06/10/2025	
Nitzschia	6	cells/mL		2	1		06/06/2025	06/10/2025	
Pediastrum	64	cells/mL		2	1		06/06/2025	06/10/2025	
Peridinium	430	cells/mL		2	1		06/06/2025	06/10/2025	
Scenedesmus	160	cells/mL		40	1		06/06/2025	06/10/2025	
Small Unidentifiable Algae	2700	cells/mL		40	1		06/06/2025	06/10/2025	
Specimen A	2500	cells/mL		10	1		06/06/2025	06/10/2025	*
Specimen B	170	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen C	2	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen D	140	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen E	28	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen F	1100	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen G	980	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen I	16	cells/mL		2	1		06/06/2025	06/10/2025	*
Specimen K	650	cells/mL		2	1		06/06/2025	06/10/2025	*

Report Date: 6/12/2025 2:21:40 PM

Report ID: 142966-6349942

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664

LABORATORY ANALYSIS REPORT



Work Order #: 142966

Work ID:

C565795

Analytical Results

Lab ID:	14296602	Sample ID:	2	Criteria:	N/A	Date Received:	6/6/2025
Matrix:	Water	Location:	S205			Date Collected:	6/4/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Spirogyra	8	cells/mL		2	1		06/06/2025	06/10/2025	
Staurastrum	10	cells/mL		2	1		06/06/2025	06/10/2025	
Total Cells	37000	cells/mL		40	1		06/06/2025	06/10/2025	*
Treubaria	2000	cells/mL		2	1		06/06/2025	06/10/2025	
Uncharacterized Algae	14	cells/mL		2	1		06/06/2025	06/10/2025	*

Report Date: 6/12/2025 2:21:40 PM

Report ID: 142966-6349942

Page 5 of 6

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Pickering, ON L1W 3A3
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LABORATORY ANALYSIS REPORT



Work Order #: 142966

Work ID:

C565795

Page 1 of 1



York-Durham
Regional Environmental Laboratory

901 McKay Road, Pickering ON L1W 3A3 Toll Free: 1-877-551-8877 Local: 905-686-0041
Fax: 905-686-0664 Email: rel@durham.ca Web: www.durham.ca

C565795

WORK ID

Non-regulated Water,
Wastewater, Biosolid, Soil
Chain of Custody Form

DW

Client Information				Invoice To (leave blank if same as Client)				Report to (email address)				
Company Name: Bureau Veritas				Company:				1) Nazeema.rahaman@bureauveritas.com				
Facility Name:								2)				
Facility Address: 6740 Campobello Rd				Quote #:				3)				
Facility Contact: Nazeema Rahaman				PO #:				4)				
Email: Nazeema.rahaman@bureauveritas.com Tel: 905-817-5700								5)				
Project Information (if applicable)				Standard Turnaround Time (TAT) is 10 business days ☐ *RUSH *Rush TAT requires lab approval in advance. Surcharge will apply.								
Description: C565795												
Sample(s) Information												
Lab ID (lab use only)	Field ID	Location/Description/Comment(s)	Matrix	Type	mm-dd-yy	HH:MM	Test Group(s)	Type	Sent	Rec'd	Chlorine Free Total	Apply Criteria (Y/N) (*1)
01		S105	WA -SW	SL	6-04-25	11:10	Phytoplankton (cells/ml)			1		
02		S205	WA -SW	SL	6-04-25	12:00	Phytoplankton (cells/ml)			1		
* See email regarding sample type and matrix. Please see email regarding sample name DW 06/06/25. See phone log for confirmation of report recipient JC 06/06/25												
Sampled By: * Zahra Parhizgari				Tel:				(1) Select One Applicable Criteria Provide Municipality / City / Description				
Relinquished By (Print/Sign): Nazeema Rahaman				Date/Time: 2025/06/05				☐ Sanitary Sewer Use By-law ☐ Storm Sewer Use By-law ☐ New Water Main ☐ Other				
LABORATORY USE ONLY												
Delivery Method: Courier ☐ Drop Off ☐ YDREL Pickup ☐				Sorted by: Labelled by: Checked by: Proved by:				Date/Time: JUN 6 2025 11:55				
WO #: 142966				Barcode: 142966								
REL-COC-NONREG-NOV-2019-REV-1												

Report Date: 6/12/2025 2:21:40 PM

Report ID: 142966-6349942

Page 6 of 6

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Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1031529

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/08/14
Report #: R8593932
Version: 1 - Partial

CERTIFICATE OF ANALYSIS – PARTIAL RESULTS

BUREAU VERITAS JOB #: C590431

Received: 2025/07/25, 15:40

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride by Automated Colourimetry	2	N/A	2025/07/29	CAM SOP-00463	SM 24 4500-Cl E m
Colour	2	N/A	2025/07/29	CAM SOP-00412	SM 24 2120C m
Conductivity	2	N/A	2025/07/30	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2025/07/26	CAM SOP-00446	SM 24 5310 B m
Nitrate & Nitrite as Nitrogen in Water (2)	3	N/A	2025/07/28	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	2	2025/07/29	2025/07/30	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	3	N/A	2025/07/29	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	3	2025/07/30	2025/07/30	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	3	2025/07/30	2025/07/31	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.



Bureau Veritas - Partial/Partial Results

Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1031529

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/08/14
Report #: R8593932
Version: 1 - Partial

CERTIFICATE OF ANALYSIS – PARTIAL RESULTS

BUREAU VERITAS JOB #: C590431

Received: 2025/07/25, 15:40

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Nazeema Rahaman, Project Manager
Email: Nazeema.Rahaman@bureauveritas.com
Phone# (905)817-5806

=====

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BUREAU
VERITAS

Bureau Veritas Job #: C590431

Report Date: 2025/08/14

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		ATKF48	ATKF49			ATKF50		
Sampling Date		2025/07/23 10:30	2025/07/23 10:40			2025/07/23 11:00		
COC Number		1031529	1031529			1031529		
	UNITS	S105	S205	RDL	QC Batch	S115	RDL	QC Batch
Inorganics								
Colour	TCU	5	6	2	9978724			
Conductivity	umho/cm	900	910	2.0	9979413			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.59	0.54	0.10	9979683	0.45	0.10	9979683
Dissolved Organic Carbon	mg/L	8.2	7.8	0.40	9977637			
Orthophosphate (P)	mg/L	ND	ND	0.004	9978351	ND	0.004	9978351
pH	pH	8.32	8.08		9979414			
Total Phosphorus	mg/L	0.009	0.013	0.004	9979812	0.009	0.004	9979812
Dissolved Chloride (Cl-)	mg/L	220	220	2.0	9978134			
Nitrite (N)	mg/L	ND	ND	0.010	9977922	ND	0.010	9977922
Nitrate (N)	mg/L	ND	ND	0.10	9977922	ND	0.10	9977922
Nitrate + Nitrite (N)	mg/L	ND	ND	0.10	9977922	ND	0.10	9977922
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.								



BUREAU
VERITAS

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GENERAL COMMENTS

Results relate only to the items tested.

Bureau Veritas - Partial/Rush Results



BUREAU
VERITAS

Bureau Veritas Job #: C590431
Report Date: 2025/08/14

City of Markham
Site Location: SWAN LAKE
Your P.O. #: PB22006
Sampler Initials: ZP

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9977637	AJT	Matrix Spike [ATKF48-02]	Dissolved Organic Carbon	2025/07/26		94	%	80 - 120
9977637	AJT	Spiked Blank	Dissolved Organic Carbon	2025/07/26		97	%	80 - 120
9977637	AJT	Method Blank	Dissolved Organic Carbon	2025/07/26	ND, RDL=0.40		mg/L	
9977637	AJT	RPD [ATKF48-02]	Dissolved Organic Carbon	2025/07/26	0.79		%	20
9977922	C_N	Matrix Spike	Nitrite (N)	2025/07/28		103	%	80 - 120
			Nitrate (N)	2025/07/28		103	%	80 - 120
9977922	C_N	Spiked Blank	Nitrite (N)	2025/07/28		103	%	80 - 120
			Nitrate (N)	2025/07/28		105	%	80 - 120
9977922	C_N	Method Blank	Nitrite (N)	2025/07/28	ND, RDL=0.010		mg/L	
			Nitrate (N)	2025/07/28	ND, RDL=0.10		mg/L	
9977922	C_N	RPD	Nitrite (N)	2025/07/28	NC		%	20
			Nitrate (N)	2025/07/28	NC		%	20
9978134	ADB	Matrix Spike	Dissolved Chloride (Cl-)	2025/07/29		NC	%	80 - 120
9978134	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2025/07/29		100	%	80 - 120
9978134	ADB	Method Blank	Dissolved Chloride (Cl-)	2025/07/29	ND, RDL=1.0		mg/L	
9978134	ADB	RPD	Dissolved Chloride (Cl-)	2025/07/29	1.9		%	20
9978351	ADB	Matrix Spike [ATKF49-01]	Orthophosphate (P)	2025/07/29		80	%	80 - 120
9978351	ADB	Spiked Blank	Orthophosphate (P)	2025/07/29		91	%	80 - 120
9978351	ADB	Method Blank	Orthophosphate (P)	2025/07/29	ND, RDL=0.004		mg/L	
9978351	ADB	RPD [ATKF49-01]	Orthophosphate (P)	2025/07/29	NC		%	20
9978724	VRO	Spiked Blank	Colour	2025/07/29		98	%	80 - 120
9978724	VRO	Method Blank	Colour	2025/07/29	ND,RDL=2		TCU	
9978724	VRO	RPD	Colour	2025/07/29	NC		%	25
9979413	NGI	Spiked Blank	Conductivity	2025/07/30		103	%	85 - 115
9979413	NGI	Method Blank	Conductivity	2025/07/30	ND, RDL=2.0		umho/cm	
9979413	NGI	RPD [ATKF49-01]	Conductivity	2025/07/30	0.66		%	10
9979414	NGI	Spiked Blank	pH	2025/07/30		102	%	98 - 103
9979414	NGI	RPD [ATKF49-01]	pH	2025/07/30	2.2		%	N/A
9979683	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2025/07/30		103	%	80 - 120
9979683	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2025/07/30		103	%	80 - 120
9979683	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2025/07/30		103	%	80 - 120
9979683	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2025/07/30	ND, RDL=0.10		mg/L	
9979683	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2025/07/30	NC		%	20
9979812	VKH	Matrix Spike	Total Phosphorus	2025/07/31		102	%	80 - 120
9979812	VKH	QC Standard	Total Phosphorus	2025/07/31		102	%	80 - 120
9979812	VKH	Spiked Blank	Total Phosphorus	2025/07/31		106	%	80 - 120
9979812	VKH	Method Blank	Total Phosphorus	2025/07/31	ND, RDL=0.004		mg/L	



BUREAU
VERITAS

Bureau Veritas Job #: C590431

Report Date: 2025/08/14

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC		QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
Batch	Init							
9979812	VKH	RPD	Total Phosphorus	2025/07/31	0.45		%	20
N/A = Not Applicable								
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.								
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.								
QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.								
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.								
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.								
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)								
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).								



BUREAU
VERITAS

Bureau Veritas Job #: C590431

Report Date: 2025/08/14

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Louise Harding, Scientific Specialist

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Bureau Veritas - Partial/Rush Results



York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 2

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Authorized by: Jennifer Koene-Fenton, Laboratory Superintendent

Workorder Summary

Analysis Results Comments

14582501 (1) - Specimen A

Phacus

14582501 (1) - Specimen B

Desmodesmus

14582501 (1) - Specimen C

Monoraphidium

14582501 (1) - Specimen D

Gloeocapsa

14582501 (1) - Specimen E

Elakatothrix

14582501 (1) - Specimen F

Cryptomonas

14582501 (1) - Specimen G

Achnanthyidium

14582501 (1) - Specimen H

Raphidiopsis/Cylindrospermopsis

14582501 (1) - Specimen I

Trachelomonas

14582501 (1) - Specimen J

Pseudanabaena

14582501 (1) - Total Cells

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

14582502 (2) - Specimen B

Desmodesmus

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 1 of 6

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LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Workorder Summary

Analysis Results Comments

14582502 (2) - Specimen C

Monoraphidium

14582502 (2) - Specimen D

Gloeocapsa

14582502 (2) - Specimen F

Cryptomonas

14582502 (2) - Specimen H

Raphidiopsis/Cylindrospermopsis

14582502 (2) - Specimen I

Trachelomonas

14582502 (2) - Specimen J

Pseudanabaena

14582502 (2) - Total Cells

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

Analytical Results

Lab ID: 14582501	Sample ID: 1	Criteria: N/A	Date Received: 7/28/2025
Matrix: Water	Location: S105		Date Collected: 7/23/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	180	cells/mL		20	1		07/29/2025	08/11/2025	
Chlamydomonas	20	cells/mL		20	1		07/29/2025	08/11/2025	
Chroococcus	560	cells/mL		20	1		07/29/2025	08/11/2025	
Closteriopsis	6	cells/mL		2	1		07/29/2025	08/11/2025	
Closterium	4	cells/mL		2	1		07/29/2025	08/11/2025	
Cosmarium	280	cells/mL		20	1		07/29/2025	08/11/2025	
Euglena	2	cells/mL		2	1		07/29/2025	08/11/2025	
Gomphosphaeria	580	cells/mL		20	1		07/29/2025	08/11/2025	
Merismopedia	42000	cells/mL		20	1		07/29/2025	08/11/2025	
Microcystis	78000	cells/mL		20	1		07/29/2025	08/11/2025	
Nitzschia	60	cells/mL		20	1		07/29/2025	08/11/2025	

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 2 of 6

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York-Durham Regional Environmental Laboratory

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Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Analytical Results

Lab ID:	14582501	Sample ID:	1	Criteria:	N/A	Date Received:	7/28/2025
Matrix:	Water	Location:	S105			Date Collected:	7/23/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Pediastrum	4	cells/mL		2	1		07/29/2025	08/11/2025	
Peridinium	140	cells/mL		20	1		07/29/2025	08/11/2025	
Scenedesmus	320	cells/mL		20	1		07/29/2025	08/11/2025	
Selenastrum	20	cells/mL		20	1		07/29/2025	08/11/2025	
Small Unidentifiable Algae	20000	cells/mL		20	1		07/29/2025	08/11/2025	
Specimen A	2	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen B	800	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen C	180	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen D	820	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen E	40	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen F	20	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen G	4	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen H	4800	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen I	12	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen J	160	cells/mL		20	1		07/29/2025	08/11/2025	*
Staurastrum	20	cells/mL		20	1		07/29/2025	08/11/2025	
Tetraedron	440	cells/mL		20	1		07/29/2025	08/11/2025	
Total Cells	150000	cells/mL		20	1		07/29/2025	08/11/2025	*
Treubaria	2	cells/mL		2	1		07/29/2025	08/11/2025	

Lab ID:	14582502	Sample ID:	2	Criteria:	N/A	Date Received:	7/28/2025
Matrix:	Water	Location:	S205			Date Collected:	7/23/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	120	cells/mL		20	1		07/29/2025	08/11/2025	
Chlamydomonas	40	cells/mL		20	1		07/29/2025	08/11/2025	
Chroococcus	480	cells/mL		20	1		07/29/2025	08/11/2025	
Closteriopsis	2	cells/mL		2	1		07/29/2025	08/11/2025	
Coelastrum	16	cells/mL		2	1		07/29/2025	08/11/2025	

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Analytical Results

Lab ID: 14582502	Sample ID: 2	Criteria: N/A	Date Received: 7/28/2025
Matrix: Water	Location: S205		Date Collected: 7/23/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Cosmarium	40	cells/mL		20	1		07/29/2025	08/11/2025	
Diatoma	2	cells/mL		2	1		07/29/2025	08/11/2025	
Eudorina	40	cells/mL		2	1		07/29/2025	08/11/2025	
Euglena	4	cells/mL		2	1		07/29/2025	08/11/2025	
Gomphosphaeria	780	cells/mL		20	1		07/29/2025	08/11/2025	
Merismopedia	4000	cells/mL		20	1		07/29/2025	08/11/2025	
Microcystis	47000	cells/mL		20	1		07/29/2025	08/11/2025	
Navicula	4	cells/mL		2	1		07/29/2025	08/11/2025	
Nitzschia	40	cells/mL		20	1		07/29/2025	08/11/2025	
Pediastrum	32	cells/mL		2	1		07/29/2025	08/11/2025	
Peridinium	12	cells/mL		2	1		07/29/2025	08/11/2025	
Pinnularia	2	cells/mL		2	1		07/29/2025	08/11/2025	
Scenedesmus	440	cells/mL		20	1		07/29/2025	08/11/2025	
Selenastrum	80	cells/mL		20	1		07/29/2025	08/11/2025	
Small Unidentifiable Algae	15000	cells/mL		20	1		07/29/2025	08/11/2025	
Specimen B	1000	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen C	100	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen D	2100	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen F	80	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen H	5700	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen I	4	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen J	120	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen K	8	cells/mL		2	1		07/29/2025	08/11/2025	
Staurastrum	60	cells/mL		20	1		07/29/2025	08/11/2025	
Stephanodiscus	2	cells/mL		2	1		07/29/2025	08/11/2025	
Tetraedron	560	cells/mL		20	1		07/29/2025	08/11/2025	
Total Cells	77000	cells/mL		20	1		07/29/2025	08/11/2025	*

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 4 of 6

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C590431




**York-Durham
Regional Environmental Laboratory**

901 McKay Road, Pickering ON L1W 3A3 Toll Free: 1-877-551-8877 Local: 905-686-0041
Fax: 905-686-0664 Email: rel@durham.ca Web: www.durham.ca

WORK ID: C590431

**Non-regulated Water,
Wastewater, Biosolid, Soil**

Chain of Custody Form

Client Information

Company Name: Bureau Veritas Canada

Facility Name:

Facility Address: 6740 Campobello Rd.

Facility Contact: Grace Zhao

Email: azeema.rahaman@bureauveritas.com

Tel:

Invoice To (leave blank if same as Client)

Company:

Quote #:

PO #:

Report to (email address)

1) azeema.rahaman@bureauveritas.com

2)

3)

4)

5)

Project Information (if applicable)

Description:

Standard Turnaround Time (TAT) is 10 business days

☐ *RUSH

*Rush TAT requires lab approval in advance. Surcharge will apply.

Sample(s) Information

Lab ID		Location/Description/Comment(s)	Matrix	Type	Collection		Test Group(s)	Container			Chlorine		Apply Criteria (Y/N) (*)
(lab use only)	Field ID				mm-dd-yy	HH:MM		Type	Sent	Rec'd	Free	Total	
01		S105	W	Surface	7-23-25	1030	Algaecells	preserved					
02		S205	W	Surface	7-23-25	1040	Algaecells	preserved					

Sampled By: Zahra Parhizgari

Relinquished By (Print/Sign): Grace Zhao

Tel:

Date/Time: 2025/07/28

(1) Select One Applicable Criteria

Provide Municipality / City / Description

☐ Sanitary Sewer Use By-law
☐ Storm Sewer Use By-law
☐ New Water Main
☐ Other

LABORATORY USE ONLY

Delivery Method: Courier ☒ Drop Off ☐ YDREL Pickup ☐

Sorted by: Labelled by: CN

Checked by: Proofed by:

WO #: 145825



145825

d Date/Time: d By: Received on July 28/2025 at 12:35pm

nts: DW

REL-COC-NONREG-NOV-2019-REV-1

Page 5 of 6

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1031529

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/09/03
Report #: R8605172
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C590431

Received: 2025/07/25, 15:40

Sample Matrix: Water
Samples Received: 3

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	2	N/A	2025/07/29	CAM SOP-00463	SM 24 4500-Cl E m
Colour	2	N/A	2025/07/29	CAM SOP-00412	SM 24 2120C m
Conductivity	2	N/A	2025/07/30	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2025/07/26	CAM SOP-00446	SM 24 5310 B m
Nitrate & Nitrite as Nitrogen in Water (2)	3	N/A	2025/07/28	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	2	2025/07/29	2025/07/30	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	3	N/A	2025/07/29	CAM SOP-00461	SM 24 4500 P-E
Phytoplankton	2	N/A	N/A		
Total Kjeldahl Nitrogen in Water	3	2025/07/30	2025/07/30	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	3	2025/07/30	2025/07/31	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1031529

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/09/03
Report #: R8605172
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C590431

Received: 2025/07/25, 15:40

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

- (1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager
Email: Nazeema.Rahaman@bureauveritas.com
Phone# (905)817-5806

=====

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		ATKF48			ATKF48			ATKF49		
Sampling Date		2025/07/23 10:30			2025/07/23 10:30			2025/07/23 10:40		
COC Number		1031529			1031529			1031529		
	UNITS	S105	RDL	QC Batch	S105 Lab-Dup	RDL	QC Batch	S205	RDL	QC Batch

Miscellaneous Parameters										
Subcontract Parameter	N/A	ATTACHED	N/A	9989596				ATTACHED	N/A	9989596

Inorganics										
Colour	TCU	5	2	9978724				6	2	9978724
Conductivity	umho/cm	900	2.0	9979413				910	2.0	9979413
Total Kjeldahl Nitrogen (TKN)	mg/L	0.59	0.10	9979683				0.54	0.10	9979683
Dissolved Organic Carbon	mg/L	8.2	0.40	9977637	8.2	0.40	9977637	7.8	0.40	9977637
Orthophosphate (P)	mg/L	ND	0.004	9978351				ND	0.004	9978351
pH	pH	8.32		9979414				8.08		9979414
Total Phosphorus	mg/L	0.009	0.004	9979812				0.013	0.004	9979812
Dissolved Chloride (Cl-)	mg/L	220	2.0	9978134				220	2.0	9978134
Nitrite (N)	mg/L	ND	0.010	9977922				ND	0.010	9977922
Nitrate (N)	mg/L	ND	0.10	9977922				ND	0.10	9977922
Nitrate + Nitrite (N)	mg/L	ND	0.10	9977922				ND	0.10	9977922

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.



**BUREAU
VERITAS**

Bureau Veritas Job #: C590431

Report Date: 2025/09/03

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		ATKF49			ATKF50		
Sampling Date		2025/07/23 10:40			2025/07/23 11:00		
COC Number		1031529			1031529		
	UNITS	S205 Lab-Dup	RDL	QC Batch	S115	RDL	QC Batch
Inorganics							
Conductivity	umho/cm	900	2.0	9979413			
Total Kjeldahl Nitrogen (TKN)	mg/L				0.45	0.10	9979683
Orthophosphate (P)	mg/L	ND	0.004	9978351	ND	0.004	9978351
pH	pH	8.26		9979414			
Total Phosphorus	mg/L				0.009	0.004	9979812
Nitrite (N)	mg/L				ND	0.010	9977922
Nitrate (N)	mg/L				ND	0.10	9977922
Nitrate + Nitrite (N)	mg/L				ND	0.10	9977922
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.							



BUREAU
VERITAS

Bureau Veritas Job #: C590431

Report Date: 2025/09/03

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.3°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C590431

Report Date: 2025/09/03

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9977637	Dissolved Organic Carbon	2025/07/26	94	80 - 120	97	80 - 120	ND, RDL=0.40	mg/L	0.79	20		
9977922	Nitrate (N)	2025/07/28	103	80 - 120	105	80 - 120	ND, RDL=0.10	mg/L	NC	20		
9977922	Nitrite (N)	2025/07/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L	NC	20		
9978134	Dissolved Chloride (Cl-)	2025/07/29	NC	80 - 120	100	80 - 120	ND, RDL=1.0	mg/L	1.9	20		
9978351	Orthophosphate (P)	2025/07/29	80	80 - 120	91	80 - 120	ND, RDL=0.004	mg/L	NC	20		
9978724	Colour	2025/07/29			98	80 - 120	ND,RDL=2	TCU	NC	25		
9979413	Conductivity	2025/07/30			103	85 - 115	ND, RDL=2.0	umho/cm	0.66	10		
9979414	pH	2025/07/30			102	98 - 103			2.2	N/A		
9979683	Total Kjeldahl Nitrogen (TKN)	2025/07/30	103	80 - 120	103	80 - 120	ND, RDL=0.10	mg/L	NC	20	103	80 - 120
9979812	Total Phosphorus	2025/07/31	102	80 - 120	106	80 - 120	ND, RDL=0.004	mg/L	0.45	20	102	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



BUREAU
VERITAS

Bureau Veritas Job #: C590431

Report Date: 2025/09/03

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

James Aspin, Senior Project Manager

Louise Harding, Scientific Specialist

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Description:

Client: Bureau Veritas Laboratories
Profile: Non-regulated Water Sampling
Sampled By: Zahra Parhizgari
Sample Count: 2

Report To: Nazeema Rahaman
Bureau Veritas Canada
6740 Campobello Rd

Authorized by: Jennifer Koene-Fenton, Laboratory Superintendent

Workorder Summary

Analysis Results Comments

14582501 (1) - Specimen A

Phacus

14582501 (1) - Specimen B

Desmodesmus

14582501 (1) - Specimen C

Monoraphidium

14582501 (1) - Specimen D

Gloeocapsa

14582501 (1) - Specimen E

Elakatothrix

14582501 (1) - Specimen F

Cryptomonas

14582501 (1) - Specimen G

Achnanthyidium

14582501 (1) - Specimen H

Raphidiopsis/Cylindrospermopsis

14582501 (1) - Specimen I

Trachelomonas

14582501 (1) - Specimen J

Pseudanabaena

14582501 (1) - Total Cells

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

14582502 (2) - Specimen B

Desmodesmus

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 1 of 6

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Workorder Summary

Analysis Results Comments

14582502 (2) - Specimen C

Monoraphidium

14582502 (2) - Specimen D

Gloeocapsa

14582502 (2) - Specimen F

Cryptomonas

14582502 (2) - Specimen H

Raphidiopsis/Cylindrospermopsis

14582502 (2) - Specimen I

Trachelomonas

14582502 (2) - Specimen J

Pseudanabaena

14582502 (2) - Total Cells

A 10 x dilution was required to enumerate several genera. The values reported have been adjusted accordingly and are an estimated value.

Analytical Results

Lab ID:	14582501	Sample ID:	1	Criteria:	N/A	Date Received:	7/28/2025
Matrix:	Water	Location:	S105			Date Collected:	7/23/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	180	cells/mL		20	1		07/29/2025	08/11/2025	
Chlamydomonas	20	cells/mL		20	1		07/29/2025	08/11/2025	
Chroococcus	560	cells/mL		20	1		07/29/2025	08/11/2025	
Closteriopsis	6	cells/mL		2	1		07/29/2025	08/11/2025	
Closterium	4	cells/mL		2	1		07/29/2025	08/11/2025	
Cosmarium	280	cells/mL		20	1		07/29/2025	08/11/2025	
Euglena	2	cells/mL		2	1		07/29/2025	08/11/2025	
Gomphosphaeria	580	cells/mL		20	1		07/29/2025	08/11/2025	
Merismopedia	42000	cells/mL		20	1		07/29/2025	08/11/2025	
Microcystis	78000	cells/mL		20	1		07/29/2025	08/11/2025	
Nitzschia	60	cells/mL		20	1		07/29/2025	08/11/2025	

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 2 of 6

The results pertain to the items tested and apply to the sample as received. This report shall not be reproduced, except in full, without the written consent of York-Durham Regional Environmental Laboratory. All supporting analytical information including measurement uncertainty is available upon request. The statement of conformity is based on simple acceptance, whether the result is within or outside the acceptance limits. The uncertainty is not taken into account in the statement of conformity. The end user is responsible for determining conformity.

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Analytical Results

Lab ID:	14582501	Sample ID:	1	Criteria:	N/A	Date Received:	7/28/2025
Matrix:	Water	Location:	S105			Date Collected:	7/23/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Pediastrum	4	cells/mL		2	1		07/29/2025	08/11/2025	
Peridinium	140	cells/mL		20	1		07/29/2025	08/11/2025	
Scenedesmus	320	cells/mL		20	1		07/29/2025	08/11/2025	
Selenastrum	20	cells/mL		20	1		07/29/2025	08/11/2025	
Small Unidentifiable Algae	20000	cells/mL		20	1		07/29/2025	08/11/2025	
Specimen A	2	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen B	800	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen C	180	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen D	820	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen E	40	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen F	20	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen G	4	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen H	4800	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen I	12	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen J	160	cells/mL		20	1		07/29/2025	08/11/2025	*
Staurastrum	20	cells/mL		20	1		07/29/2025	08/11/2025	
Tetraedron	440	cells/mL		20	1		07/29/2025	08/11/2025	
Total Cells	150000	cells/mL		20	1		07/29/2025	08/11/2025	*
Treubaria	2	cells/mL		2	1		07/29/2025	08/11/2025	

Lab ID:	14582502	Sample ID:	2	Criteria:	N/A	Date Received:	7/28/2025
Matrix:	Water	Location:	S205			Date Collected:	7/23/2025
Type:	Surface Water	Description:					

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
PHYTOPLANKTON (Cells/mL) (RELM-14)									
Ankistrodesmus	120	cells/mL		20	1		07/29/2025	08/11/2025	
Chlamydomonas	40	cells/mL		20	1		07/29/2025	08/11/2025	
Chroococcus	480	cells/mL		20	1		07/29/2025	08/11/2025	
Closteriopsis	2	cells/mL		2	1		07/29/2025	08/11/2025	
Coelastrum	16	cells/mL		2	1		07/29/2025	08/11/2025	

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 3 of 6

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York-Durham Regional Environmental Laboratory

901 McKay Road
Pickering, ON L1W 3A3
Phone (905)686-0041 Fax (905)686-0664



LABORATORY ANALYSIS REPORT

Work Order #: 145825

Work ID:

C590431

Analytical Results

Lab ID: 14582502	Sample ID: 2	Criteria: N/A	Date Received: 7/28/2025
Matrix: Water	Location: S205		Date Collected: 7/23/2025
Type: Surface Water	Description:		

Parameter	Results	Units	MDL	RDL	DF	Limit	Prepared	Analyzed	C
Cosmarium	40	cells/mL		20	1		07/29/2025	08/11/2025	
Diatoma	2	cells/mL		2	1		07/29/2025	08/11/2025	
Eudorina	40	cells/mL		2	1		07/29/2025	08/11/2025	
Euglena	4	cells/mL		2	1		07/29/2025	08/11/2025	
Gomphosphaeria	780	cells/mL		20	1		07/29/2025	08/11/2025	
Merismopedia	4000	cells/mL		20	1		07/29/2025	08/11/2025	
Microcystis	47000	cells/mL		20	1		07/29/2025	08/11/2025	
Navicula	4	cells/mL		2	1		07/29/2025	08/11/2025	
Nitzschia	40	cells/mL		20	1		07/29/2025	08/11/2025	
Pediastrum	32	cells/mL		2	1		07/29/2025	08/11/2025	
Peridinium	12	cells/mL		2	1		07/29/2025	08/11/2025	
Pinnularia	2	cells/mL		2	1		07/29/2025	08/11/2025	
Scenedesmus	440	cells/mL		20	1		07/29/2025	08/11/2025	
Selenastrum	80	cells/mL		20	1		07/29/2025	08/11/2025	
Small Unidentifiable Algae	15000	cells/mL		20	1		07/29/2025	08/11/2025	
Specimen B	1000	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen C	100	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen D	2100	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen F	80	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen H	5700	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen I	4	cells/mL		2	1		07/29/2025	08/11/2025	*
Specimen J	120	cells/mL		20	1		07/29/2025	08/11/2025	*
Specimen K	8	cells/mL		2	1		07/29/2025	08/11/2025	
Staurastrum	60	cells/mL		20	1		07/29/2025	08/11/2025	
Stephanodiscus	2	cells/mL		2	1		07/29/2025	08/11/2025	
Tetraedron	560	cells/mL		20	1		07/29/2025	08/11/2025	
Total Cells	77000	cells/mL		20	1		07/29/2025	08/11/2025	*

Report Date: 8/12/2025 3:36:12 PM

Report ID: 145825-6503933

Page 4 of 6

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C590431

[illegible]

Page 5 of 6

Legend: MDL = Method Detection Limit; RDL = Reporting Detection Limit; MU = Measurement Uncertainty; < or ND = Less Than or Non-detect; ^ = Result outside limit; Limit = MAC; DF = Dilution Factor; OG = Operational Guideline; AO = Aesthetic Objective; HC = Health Canada; C = Comment; * = Comment Present

C590431
2025/07/25 15:40



NONT-2025-07-5591

IMMEDIATE

eCOC Number
T-1031529-H

Please use this form for custody tracking when submitting the work instructions via eCOC (electronic Chain of Custody). Please ensure your form has a barcode or a Bureau Veritas eCOC confirmation number in the top right hand side. This number links your electronic submission to your samples. This form should be placed in the cooler with your samples.

Relinquished By				Received By			
Zahra Parhizgari	Z parhizgari	Date	2025/07/25	Sugan	Sugan	Date	2025/07/25
		Time (24 HR)	13:00			Time (24 HR)	15:40
		Date				Date	
		Time (24 HR)				Time (24 HR)	
		Date				Date	
		Time (24 HR)				Time (24 HR)	

Unless otherwise agreed to, submissions and use of services are governed by Bureau Veritas' standard terms and conditions which can be found at www.bvna.com.

Triage Information			
Sampled By (Print)	# of Coolers/Pkgs	Rush ☐	Immediate Test ☐
Zahra Parhizgari	1	Micro ☐	Food Residue ☐
			Food Chemistry ☐

*** Laboratory Use Only ***								
Received At	Lab Comments:	Custody Seal		Cooling Media		Temperature °C		
Labeled By		Present (Y/N)	Intact (Y/N)	Present (Y/N)	1	2	3	
Verified By		H	H	Y	7	8	4	
Drinking Water Metals Preservation Check Done (Circle) YES NO								



Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1032493

Attention: Zahra Parhizgari

City of Markham
Environmental Services Depart
8100 Warden Ave
Markham, ON
Canada L6G1B4

Report Date: 2025/08/21
Report #: R8598482
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C599750

Received: 2025/08/14, 15:35

Sample Matrix: Water
Samples Received: 3

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Chloride by Automated Colourimetry	2	N/A	2025/08/20	CAM SOP-00463	SM 24 4500-Cl E m
Colour	2	N/A	2025/08/18	CAM SOP-00412	SM 24 2120C m
Conductivity	1	N/A	2025/08/19	CAM SOP-00414	SM 24 2510 m
Conductivity	1	N/A	2025/08/20	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2025/08/18	CAM SOP-00446	SM 24 5310 B m
Total Ammonia-N	3	N/A	2025/08/21	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	3	N/A	2025/08/18	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (3)	2	2025/08/19	2025/08/19	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate (low level)	3	N/A	2025/08/20	CAM SOP-00461	SM 24 4500 P-E
Total Kjeldahl Nitrogen in Water	3	2025/08/20	2025/08/20	CAM SOP-00938	SM 4500-N B m
Total Phosphorus (Colourimetric)	3	2025/08/20	2025/08/20	CAM SOP-00407	SM 24 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Your P.O. #: PB22006
Site Location: SWAN LAKE
Your C.O.C. #: 1032493

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Received: 2025/08/14, 15:35

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(3) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Nazeema Rahaman, Project Manager

Email: Nazeema.Rahaman@bureauveritas.com

Phone# (905)817-5806

=====

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BUREAU
VERITAS

Bureau Veritas Job #: C599750
Report Date: 2025/08/21

City of Markham
Site Location: SWAN LAKE
Your P.O. #: PB22006
Sampler Initials: ZP

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		AUBS75		AUBS76			AUBS77		
Sampling Date		2025/08/13 08:30		2025/08/13 09:30			2025/08/13 08:45		
COC Number		1032493		1032493			1032493		
	UNITS	S105	QC Batch	S205	RDL	QC Batch	S115	RDL	QC Batch
Inorganics									
Total Ammonia-N	mg/L	0.088	9992849	ND	0.050	9992849	ND	0.050	9992847
Colour	TCU	5	9991662	6	2	9991662			
Conductivity	umho/cm	960	9993182	970	2.0	9991930			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.57	9993439	0.64	0.10	9993439	0.63	0.10	9993439
Dissolved Organic Carbon	mg/L	9.2	9991743	9.4	0.40	9991743			
Orthophosphate (P)	mg/L	0.006	9992193	ND	0.004	9992193	ND (1)	0.004	9992193
pH	pH	8.34	9992179	7.92		9992179			
Total Phosphorus	mg/L	0.011	9993373	0.015	0.004	9993373	0.013	0.004	9993373
Dissolved Chloride (Cl-)	mg/L	230	9991088	230	2.0	9991088			
Nitrite (N)	mg/L	ND	9991517	ND	0.010	9991517	ND	0.010	9991517
Nitrate (N)	mg/L	ND	9991517	ND	0.10	9991517	ND	0.10	9991517
Nitrate + Nitrite (N)	mg/L	ND	9991517	ND	0.10	9991517	ND	0.10	9991517
RDL = Reportable Detection Limit QC Batch = Quality Control Batch ND = Not Detected at a concentration equal or greater than the indicated Detection Limit. (1) Matrix Spike exceeds acceptance limits, probable matrix interference									

Bureau Veritas ID		AUBS77		
Sampling Date		2025/08/13 08:45		
COC Number		1032493		
	UNITS	S115 Lab-Dup	RDL	QC Batch
Inorganics				
Orthophosphate (P)	mg/L	ND	0.004	9992193
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.				



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.0°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C599750

Report Date: 2025/08/21

QUALITY ASSURANCE REPORT

City of Markham

Site Location: SWAN LAKE

Your P.O. #: PB22006

Sampler Initials: ZP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9991088	Dissolved Chloride (Cl-)	2025/08/20	96	80 - 120	97	80 - 120	ND, RDL=1.0	mg/L	4.8	20		
9991517	Nitrate (N)	2025/08/18	97	80 - 120	99	80 - 120	ND, RDL=0.10	mg/L	NC	20		
9991517	Nitrite (N)	2025/08/18	107	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L	NC	20		
9991662	Colour	2025/08/18			98	80 - 120	ND,RDL=2	TCU	NC	25		
9991743	Dissolved Organic Carbon	2025/08/18	92	80 - 120	95	80 - 120	ND, RDL=0.40	mg/L	0.22	20		
9991930	Conductivity	2025/08/19			100	85 - 115	ND, RDL=2.0	umho/cm	0.69	10		
9992179	pH	2025/08/19			102	98 - 103			0.21	N/A		
9992193	Orthophosphate (P)	2025/08/20	76 (1)	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20		
9992847	Total Ammonia-N	2025/08/21	104	75 - 125	106	80 - 120	ND, RDL=0.050	mg/L	NC	20		
9992849	Total Ammonia-N	2025/08/21	104	75 - 125	107	80 - 120	ND, RDL=0.050	mg/L	NC	20		
9993182	Conductivity	2025/08/20			103	85 - 115	ND, RDL=2.0	umho/cm	NC	10		
9993373	Total Phosphorus	2025/08/20	100	80 - 120	99	80 - 120	ND, RDL=0.004	mg/L	11	20	108	80 - 120
9993439	Total Kjeldahl Nitrogen (TKN)	2025/08/20	NC	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	0.19	20	100	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C599750
Report Date: 2025/08/21

City of Markham
Site Location: SWAN LAKE
Your P.O. #: PB22006
Sampler Initials: ZP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

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Appendix C : 2025 Canada Goose Management Program



Canada Goose

Management Program 2025

City of Markham Summary Report



January, 2026

The Wildlife Management Group Inc

Completed by: *Michael von Kaitz*

Wildlife Hazard Specialist/ Certified Goose Management Professional



Canada Goose Management 2025

Introduction

The City of Markham has maintained an ongoing Canada Goose Management Program for many years, focusing on areas of concern within the city's boundaries, and the 2025 program continues an approach initiated in 2024. The 2025 program continues to focus on two locations within these boundaries, being Swan Lake Pond and Toogood Pond.

The program allowed for an integrated approach to addressing strategic objectives and incorporated many science-based and Environment Canada-approved techniques.

In addition to on-site mitigation, off-site land-use assessments were conducted in 2024 -2025 during the seasonal biological stages of geese, which aided in determining resident goose populations in and around the program control zones.

The program objectives are simple

- *Immediately reduce the number of geese seasonally at designated site locations using approved techniques*
- *Monitor trends and obtain data for reporting to the City*
- *Maintain a healthy balance between geese and people*

By following Environment Canada 'Best Practices' guidelines, implementing humane science- based control techniques for evaluating goose pressure on adjacent city-owned land areas, all the objectives of the program have been accomplished.

Nesting Report for 2025

Swan Lake & Toogood Pond



Swan Lake and Toogood Pond Nesting Data 2025

Nest #	Lat	Long	Egg count #1 19/04/2025	Egg count #2 13/05/2024
1	43.53'.49N	79.15.2.87W	11	0
2	43.53'.51.48N	79.15'10.59W	7	0
3	43.53'.51.40N	79.15'10.81W	4	0
4	43.53'.51.68N	79.15'11.03W	5	0
5	43.53'51.86N	79.15'10.82W	6	0
6	43.53'49.04N	79.15'12.38W	predated	0
Toogood Pond	43.52'20.17N	79.18'59.62W	0	5
Totals			33	5



May 13, 2025

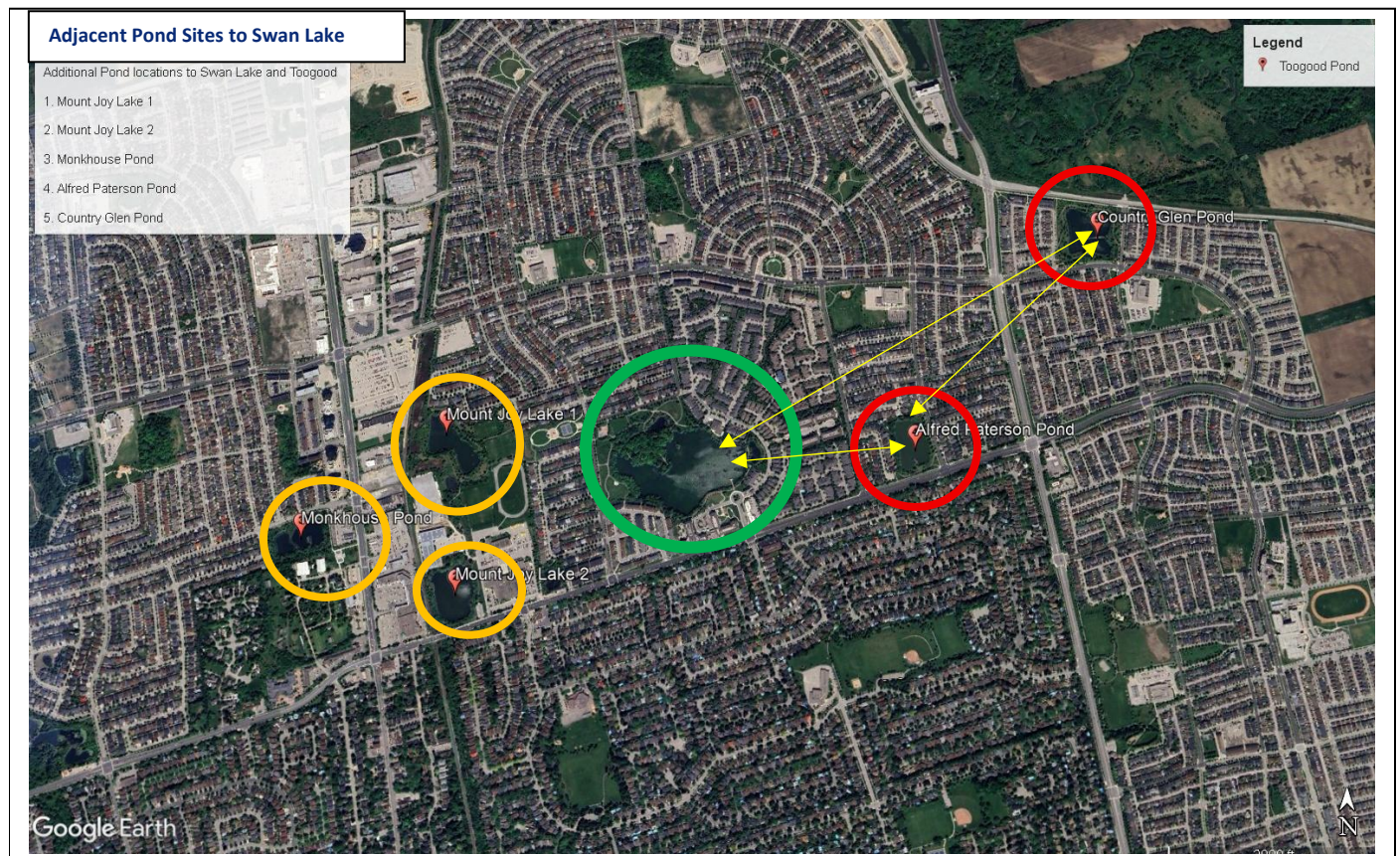
No second or third nesting occurred on Swan Lake due to predation and continued mitigation on goose populations.

1 Nest was treated in **Toogood Pond** on May 13, 2025 containing 5 eggs.



Adult Goose Mitigation

During the control year, the primary focus of control was laser light, avian distress calls, and limited strategic zinc-crackling pyro. It was recorded that during many service occasions during daylight hours, zero geese were found on the water at Swan Lake, but that number escalated during dusk and dawn fly-in times. Service times were adjusted to accommodate the increase in evening occurrences.



During fall-time patrols, geese were observed leaving Swan Lake and taking refuge in nearby ponds, where they would remain overnight or for only a few hours. This localized bird pressure strongly influenced the timing of geese returning to Swan Lake. Ponds to the west of Swan Lake were not monitored; however, knowing that geese fly westerly would indicate easy refuge in these localized pond sites, especially where short manicured turf exists.



Laser Light:

This method of control/harassment humanely and effectively moves 2 or 200 geese from the targeted areas. It does not interfere with other birds or wildlife in the same area, as it targets geese.

Application times are focused on dusk to dawn, with daytime follow-up to ensure the effectiveness of control.

Often, follow-up services are conducted within 1-2 hours of the initial application to ensure that 'return times' for geese align with the program's objectives.



This was again a preferred method of control in 2025, and the geese could be effectively moved from Swan Lake and Toogood Pond during twilight hours.

Stationary lasers were again placed on site, but due to product improvements, the previous lights were removed and not replaced in time for fall applications. Improved design and remote solar charging have improved and will be a focus tool in Swan Lake during 2026. The monitoring and recording of results from this application will continue from early spring through late fall.

Mobile Distress Call

Used in conjunction with laser light, the application of a mobile (in-vehicle) distress signal effectively draws the attention of geese with a digitized alarm call. Once applied to cars with LED lights, this is now recognized by geese as on-site predation.

Used primarily in daytime applications, the geese quickly associate the vehicle with distress and limit the return of resident geese to the area.

Zinc Crackler Pyro

During daytime service applications, laser light and other distress-call techniques may be somewhat limited in their effectiveness against persistent geese on site. At Swan Lake Pond, the use of mild pyro 'cracklers' is applied to alarm the geese and very effectively move them from the site. This method of control is applied with great care and diligence to avoid disturbing the pond's natural environment and to ensure safety



during assessment and application. The integration of all tools and techniques has led to a highly effective program again in 2025.

Key Performance Indicators of the program are obviously the number of resident and transient birds in targeted control zones, the number of non-targeted species still present on site as part of its natural environment, and, foremost, water quality, which is monitored for bacteria counts.

The following tables present trends in goose numbers on Swan Lake Pond and Toogood Pond for 2025, with 2024 and 2023 comparables where applicable.

The tables show the total average number of geese per week, starting March 16 (week 1) and ending December 31 (December 15, 2023).

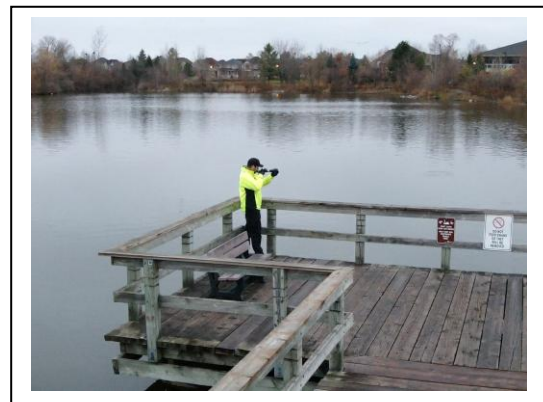
Although the 2025 program was initiated in the first week of January, frozen water prevented the attraction of geese to sites until March.

The tabulated numbers show;

- trends in resident and transient geese during four seasons
- long-term effects of mitigation used during each service, and cumulative services

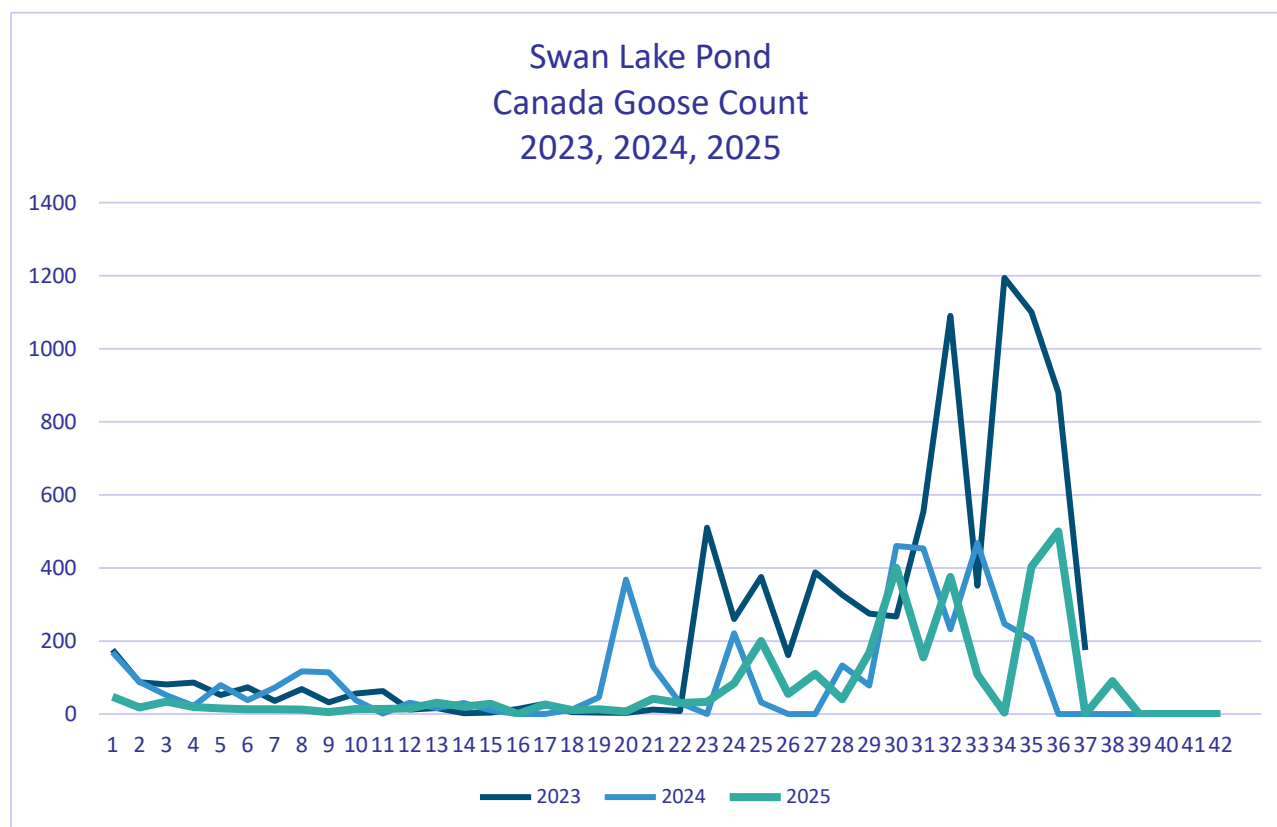
Long-term effects will be most evident in 2025 and beyond, as goose pressure decreases due to the continued presence of service in both daytime and nighttime applications. This was a key factor in deterring geese during the fall months of October and November, as a stationary laser was used on a small island.

Enhancements to the program will continue to reduce goose pressure on sites and maintain the program's objectives.





Swan Lake Pond Trend Analysis



Average weekly numbers are shown as the total number of geese counted for the week divided by the number of services completed.

Notable significant dates

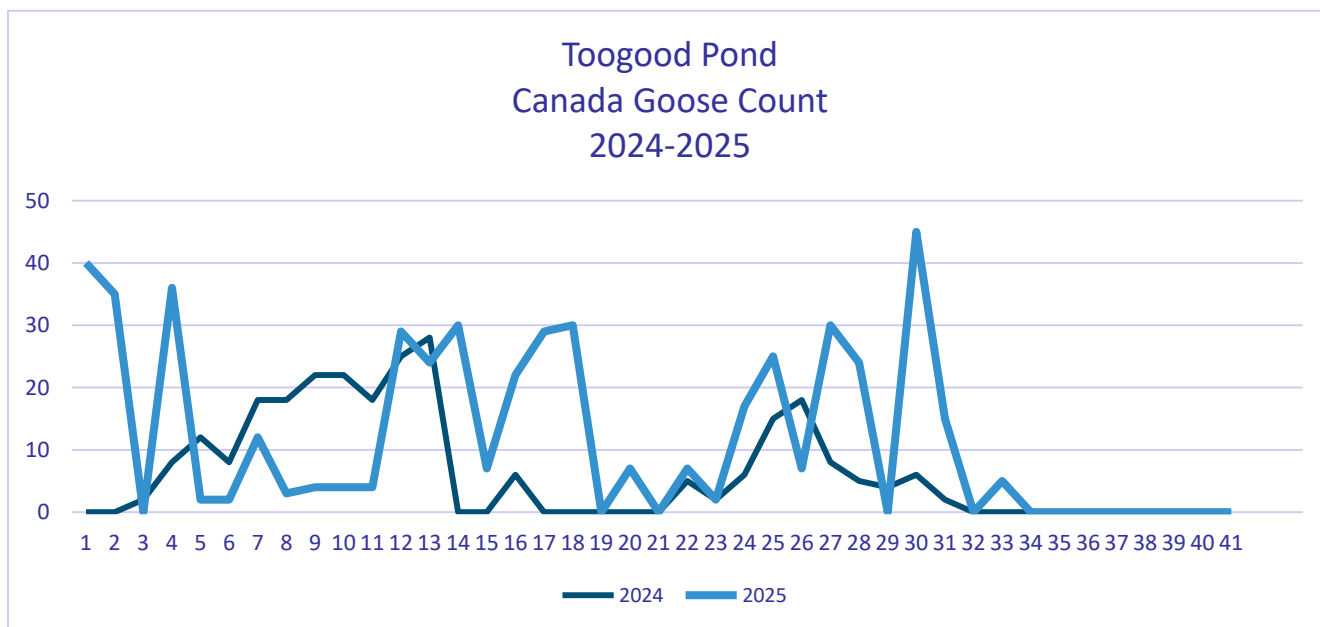
- Data range: week 1 is March 16, week 41 is December 28-Jan 2.
- Below-average counts until week 25.
- Data Recording initiated first week of January with weekly site inspections with zero counts until March 19 (Week 1) when the first notable numbers were recorded, they were still significantly lower than in previous years. Zero number of geese from Jan 1- March 19, and again from November 28- January 1 largely due to ice formation on water.

Highest count at one time in week

- Week 3 – 100 geese April 1
- Week 24 – 400 geese August 29
- Week 28 – 500 geese September 26
- Week 34 – 800 geese November 3



Toogood Pond Trend Analysis



Average weekly numbers are shown as the total number of geese counted for the week divided by the number of services completed

Notable significant dates

- Data range: week 1 is March 16, week 41 is December 28-Jan 2.
- 2 large groups of 40 and 35 geese recorded in weeks 1 and 2, then another large group of 95 geese on a one-day event in week 4 (April 9), then averaged below 2024 numbers until week 12
- Data Recording initiated first week of January with weekly site inspections with zero counts until March 16 (Week 1)
- Zero number of geese from Jan 1- March 16 and again last week of November through December.
- slight increase in numbers in December in adjacent ponds but not represented on this data

5 geese average per service in 2025

Highest count at one time in week

- Week 4 – 95 geese April 9
- Week 25 – 50 geese September 3
- Week 28 – 60 geese September 26

TREND ANALYSIS

Two essential factors in the two pond areas contribute to fluctuations in goose populations on these sites.

- Weather within the flyway
- Seasonal Off-Site Land Use Influence

Weather plays a vital role in determining whether geese are present in areas where water is their primary attractant. This is a well-known variable in goose management programs, as evidenced by the City of Markham's goose management program. It is most evident in spring and early winter, when ponds freeze over, yet turf remains available. When adjacent pond sites are open and targeted ponds are frozen over, geese remain highly visible in the immediate area.

This was evident in December, when Toogood Pond was frozen over, and the majority of Swan Lake Pond also had significant ice. The adjacent Country Glen Pond had large open water areas, and geese were still being sighted flying over Swan Lake and occasionally landing on turf areas beside the pond.

As in 2024, during the post-molt period, 2025 showed noticeable numbers of geese flying into Swan Lake Pond, more often in the evening and just before twilight. Very often, zero or very few geese are sighted during daytime inspections, with increased twilight activity a few hours later.

Seasonal off-site land uses are another vital factor in goose pressure in these urban ponds.

From agriculture and specific crop cycles nearby to land development that removes these seasonal food sources, the geese adapt and change their patterns, relying on the safe environments of large nearby water sources. Springtime soybean planting will increase goose activity between May and June (molt), while corn harvesting in the fall will draw substantially more geese to the borderlands of urban environments to the north and east of Markham sites.

Understanding crop rotation and property developments within 10-20 km of city borders will enable anticipation of trends in seasonal goose activity.



Adjacent Pond Monitoring

We have monitored goose activity after they moved from Swan Lake Pond and Toogood Pond. Their trajectory leads them directly to other nearby ponds and/or open turf or agricultural fields within their immediate flyway. While these adjacent sites can serve as alternative destinations for the geese, we have found that in 2025 the geese use them only as a refuge to return to the larger, more habitable Swan Lake Pond and Toogood.

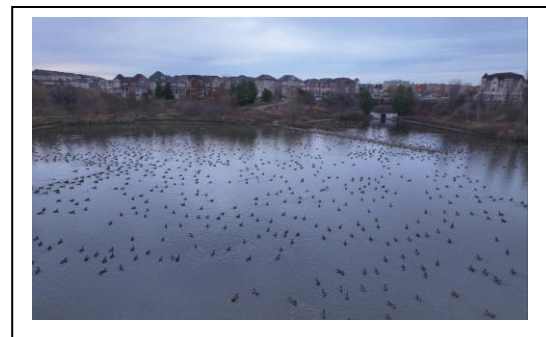
Alfred Paterson Pond

This particular pond is very near Swan Lake Pond. At times, there are so many geese in this pond that they overflow onto private residential properties. This is an ideal refuge for geese when they are being moved from Swan Lake Pond, and it also shows that the effects of mitigation at Swan Lake Pond are successful in deterring geese from wanting to fly back to it.



Country Glen Pond

This pond is a little farther from Swan Lake than Alfred Paterson Pond, but as the crow flies, it lies perfectly between agricultural lands and a buffet of short, manicured turf. It is an ideal refuge for geese being harassed out of Swan Lake, and it harbors them through the winter, as only a portion of its water ever freezes.



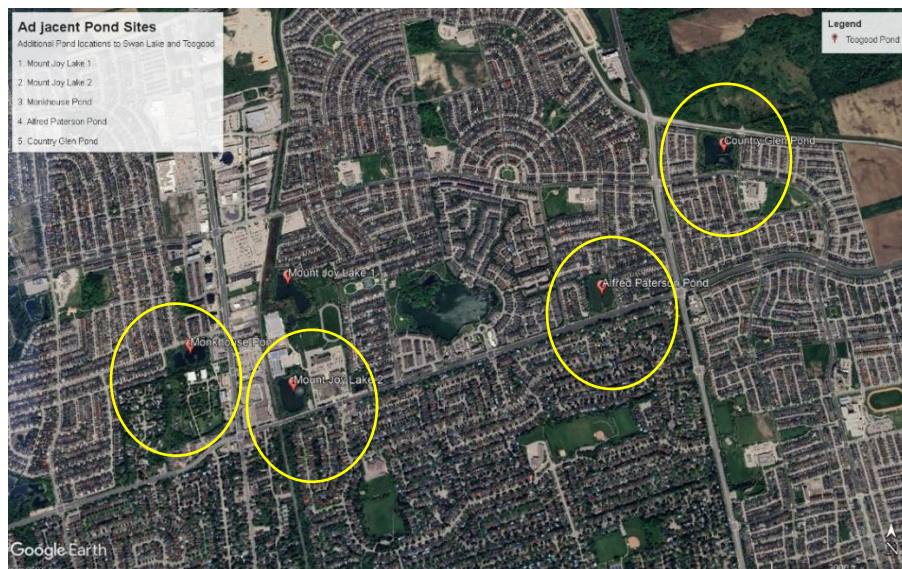


Mount Joy Lake 1 and 2

Both of these large bodies of water are ideal for goose nesting and provide refuge from Swan Lake and Toogood Ponds. When geese travel westerly from Swan Lake and north from Toogood, these ponds contribute to local goose pressure, which supports the local goose population and affects targeted pond sites.

Monkhouse Pond

Some geese have been observed in this pond, which serves as a retreat for geese. However, not much time has been spent monitoring consistent activity in this pond to date. This site also serves as another nesting and refuge site for geese, which would help geese access Swan Lake and Toogood Ponds due to its proximity to them, especially during post-molt and fall migration times.



Integrated Service Techniques

Integrated controls improve as technology becomes available to support effective goose management initiatives.

Continued use of improved deterrent systems will aid in moving geese from targeted sites both day and night, but sometimes more aggressive forms of control may be required if environmental conditions keep the geese close. As any program can say... *we can't keep the geese from coming... but we can keep them from wanting to stay.*



Moving forward in 2026, improved patrol techniques will include;

- Improved stationary laser light applications in humane and safe applications at both Swan Lake and Toogood Ponds
- **Increased** twilight service schedules to match daytime patrol schedules
- **Increased** monitoring of habitat modification applications and consulting on new application techniques.

Recommendations

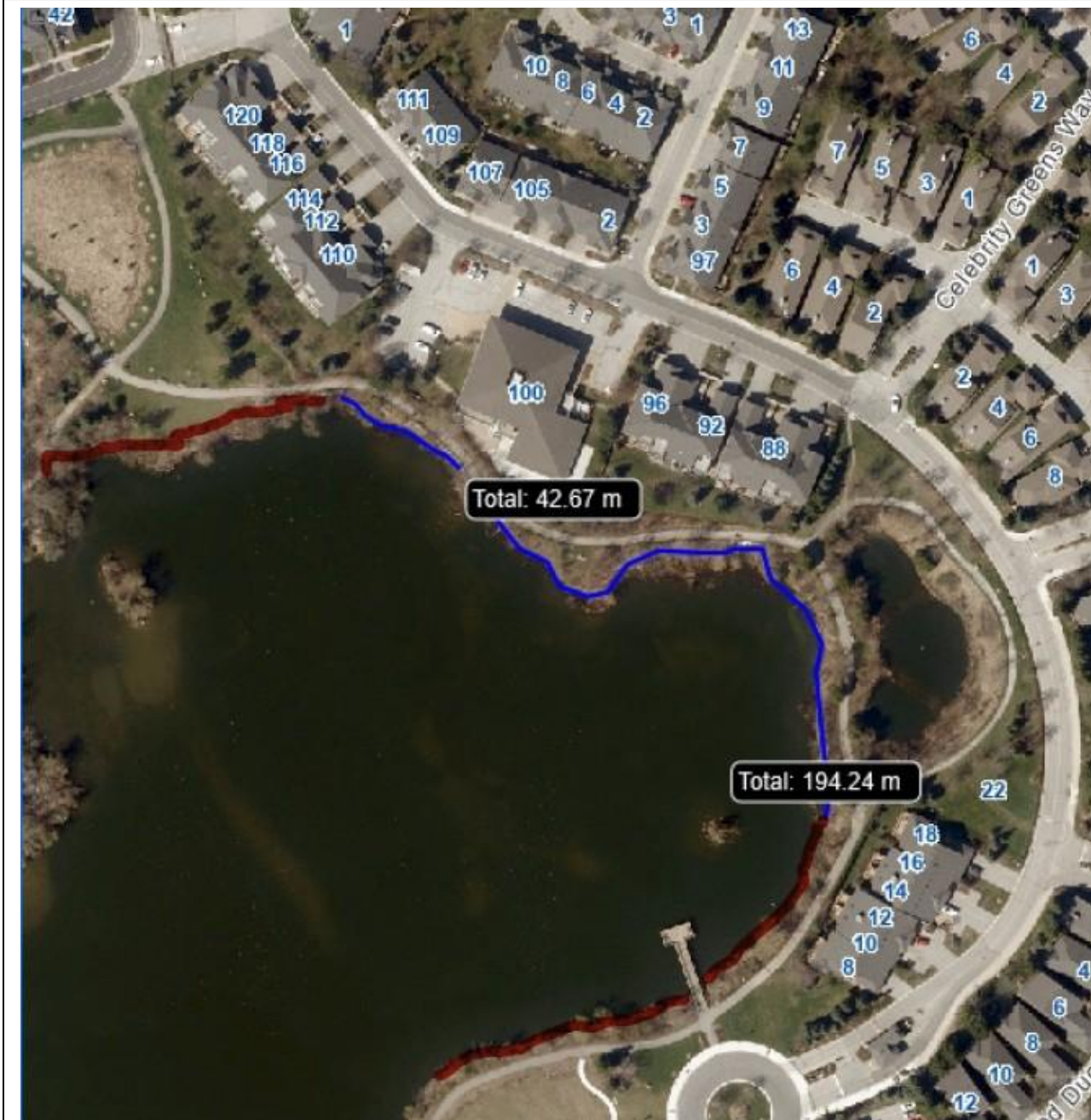
As with any process involving natural wildlife behavior, many aspects of advancing the program need to be considered to maintain its objectives.

- Science-based approach, understanding the species, environment, and integrated controls used in the management of each species
- Monitoring and data recording of each service and observation, identifying adverse effects, population trends, effects of mitigation, and assessment of this data for continuous improvement direction
- Environmental conditions that affect the typical natural or expected process of species being managed, specifically in this program, include how weather, land development, and avian influenza or other similar factors may influence trends and control parameters.

Although environmental factors and changes in on-site service times affected goose pressure on targeted sites, the use of technology- and science-based approaches has proven highly effective in mitigating goose pressure away from Swan Lake Pond and Toogood Pond.

It is recommended that;

- Placement of proven tools, such as safe and humane laser light control in strategic areas, should be continued
- habitat modification with seasonal silt fencing to prevent access to turf and walkways at Toogood Pond
- continued dense vegetation planting along the shoreline to prevent access of geese, similar to a silt fence
- continued public education on feeding geese
- continued monitoring and control of geese on other city properties to effectively manage larger areas of control, which benefits all areas, and other pond sites around targeted sites
- Continue with both daytime and twilight services to effectively manage goose populations away from control zones



 Continued fencing /shrub planting at Swan Lake to close of all accessible goose pathways to land areas, leaving an access spot for service boats

Appendix D : 2025 Fish Inventory

Memo

To: Zahra Parhizgari; City of Markham
From: Brian Graham
Cc: Angela Wallace, Danny Moro; Toronto and Region Conservation Authority
Date: November 19, 2025
Re: Swan Lake Fish Inventory and Removal

Introduction

Toronto and Region Conservation Authority (TRCA) was contracted by the City of Markham to complete a fish inventory and removal at Swan Lake. This memo outlines the completion of these deliverables as well as recommendations for future monitoring and management related to the Swan Lake fishery.

Background

Swan Lake in Markham, Ontario, is hyper-eutrophic meaning it is extremely rich in nutrients. On June 23, 2020, City of Markham Council approved the *Swan Lake Water Quality Improvement Program*. The program includes: the continuation of an annual water quality monitoring program, continuation of goose control, a chemical treatment program, and a fish management program. In 2021, the City asked TRCA to facilitate the fish inventory and relocation portion of the program through a fee-for-service contract. In 2021, three fish species were captured across five different sampling events. The three species were: Brown Bullhead (*Ameiurus nebulosus*), Common Carp (*Cyprinus carpio*) and Fathead Minnow (*Pimephales promelas*; see August 5, 2021 memo to City of Markham for more details). To reduce disturbance to the chemical treatment, 7 Common Carp were euthanized and 210 Brown Bullhead (a native bottom-dwelling fish) were relocated to Milne Pond in 2021. From 2022 to 2025, a less intensive sampling program was conducted and 1143 fish were euthanized to remove them from the lake.

Permitting

For 2025, TRCA completed the work under License to Collect Fish for Scientific Purposes AMOS-2024-FWCA-00197. Similar to past years, Ontario Ministry of Natural Resources and Forestry (OMNRF) requested that both Common Carp and Brown Bullhead be euthanized rather than relocated. The follow up information for the License to Collect Fish for Scientific Purposes will be submitted to OMNRF in late 2025 or early 2026 as part of TRCA's larger fish monitoring program reporting.

Fish Sampling Methods & Results

Fish were captured using an electrofishing boat on April 25, 2025. A fyke net was also used to capture fish. The same electrofishing sampling transects from previous years were repeated in 2025. All fish captured were identified and enumerated.

Three fish species were captured in 2025 (Table 1):

- Brown Bullhead – native, bottom dwelling
- Fathead Minnow – native minnow
- Goldfish – non-native

No new species were identified in Swan Lake. Common Carp were noticeably absent from the 2025 sample.

Table 1. Results from fish sampling conducted in Swan Lake by TRCA in spring 2025

Date	Average Water Temp (°C)	Sampling Method	Fish Species	# Fish
April 25, 2025	12.32	Boat electrofishing / Fyke Net	Brown Bullhead	391
			Fathead Minnow	3586
			Goldfish	354
			Common Carp x Goldfish	1

All fish species are considered tolerant to environmental perturbation. A total of 371 Brown Bullhead, Goldfish and hybrids were euthanized in 2025.

Table 2. Summary of 2021 to 2024 fish sampling data for Swan Lake

Date	Sample Effort	Fish Species	# Fish
April 2021		Brown Bullhead	210

	3 days boat electrofishing + 2 days of nets	Common Carp	7
		Fathead Minnow	>10,000
August 2022	1 day boat electrofishing + 1 day of nets	Brown Bullhead	80
		Common Carp	20
		Fathead Minnow	875
August 2023	1 day boat electrofishing	Brown Bullhead	84
		Common Carp	103
		Fathead Minnow	14
		Goldfish	2
April 2024	1 day boat electrofishing + 1 day of nets	Brown Bullhead	193
		Common Carp	1
		Fathead Minnow	1521
		Goldfish	13
		Common Carp x Goldfish	59
		Emerald Shiner	1
April 2025	1 day boat electrofishing + 1 day of nets	Brown Bullhead	391
		Fathead Minnow	3586
		Goldfish	354
		Goldfish x Common Carp hybrid	1

Sampling in 2021, 2022, 2024 and 2025 had more sampling effort compared to 2023 (i.e. no nets) which likely explains why there were less Fathead Minnow caught in that year. Goldfish first appeared in the 2023 sampling and their numbers have increased in the following years. They have also begun to hybridize with the Common Carp population. The timing of the sampling (April versus August) may have also influenced the catch due to differences in water temperature and fish activity.

Summary and Recommendations

Fish sampling was completed in Swan Lake by TRCA from 2021 to 2025. Only six fish species were caught: Common Carp, Brown Bullhead, Fathead Minnow, Emerald Shiner, Goldfish, and Goldfish x Common Carp hybrids. A total of 582 Brown Bullhead, 131 Common Carp, 369 Goldfish and 60 hybrids have been removed from Swan Lake between 2021 and 2025. Although Brown Bullhead, Common Carp, Goldfish and the hybrids have been removed from the lake, they likely have not been eliminated completely from the system. This leaves the Fathead Minnow as the main native fish species remaining. All of the captured fish species are considered tolerant of poor habitat (e.g. non-ideal water quality) conditions. A small number of

fish species in a lake does not constitute a well-balanced community. Healthy fish communities in Toronto Region lakes usually comprised of multiple fish species from a variety of trophic levels.

This is the third year of sampling that Goldfish were captured. Their population appears to be increasing. Pet Goldfish may have been released by into the pond. If signage does not already exist, we recommend installing a sign to remind people not to release pet fish into the pond.

If chemical treatment is again scheduled for next year, fish sampling before the next chemical treatment should be considered. If you would like TRCA to conduct the fish sampling/removal again, please contact us as early as possible in 2026 so that we may begin project planning.

The *Swan Lake Long-term Management Plan* (City of Markham, 2021) recommended benthic fish removal for 5 years (2021-2025). This work has now been completed. TRCA recommends that fish monitoring continues annually and that invasive species are removed. As in 2025, consideration should be given to returning some/all of the Brown Bullhead to the lake (rather than removal) since they are a native fish, and it is important to have some benthic feeders in a lake ecosystem. Almost 600 Brown Bullhead have been removed from the lake therefore reducing benthic disturbance by this fish species. Common Carp (along with other invasive fish such as Koi and Goldfish) should continue to be euthanized and removed from the system.

The *Swan Lake Long-term Management Plan* also recommended that a fish management plan be developed in Phase 2 (post 2025). This included stocking fish in cooperation with OMNR. As per communication with Town of Markham staff, 500 Largemouth Bass were stocked after TRCA sampling in May of 2025. Monitoring of these stocked fish and their spawning activity is recommended in 2026.

Appendix E : Survey of Aquatic Plants

Memorandum

To: Zahra Parhizgari, Environmental Engineer (City of Markham)
Rober Muir, Manager, Stormwater (City of Markham)

From: Tammy Karst-Riddoch, Principal (BlueCycle Canada, Inc.)

Date: April 23, 2026

Re: Swan Lake Submerged Aquatic Plant Survey

1. Introduction

Historically, submerged aquatic vegetation (SAV) was rare or absent in Swan Lake primarily due to poor water clarity associated with elevated phytoplankton biomass. Although internal and external nutrient controls implemented under the Swan Lake Long-Term Management Plan (Markham 2021) significantly reduced phytoplankton, in 2023, the lake remained phytoplankton dominated with only modest improvements in water clarity. The persistence of phytoplankton dominance may, in part, reflect the absence of SAV, which under low-light conditions is competitively displaced by phytoplankton, reinforcing a turbid-state for the lake.

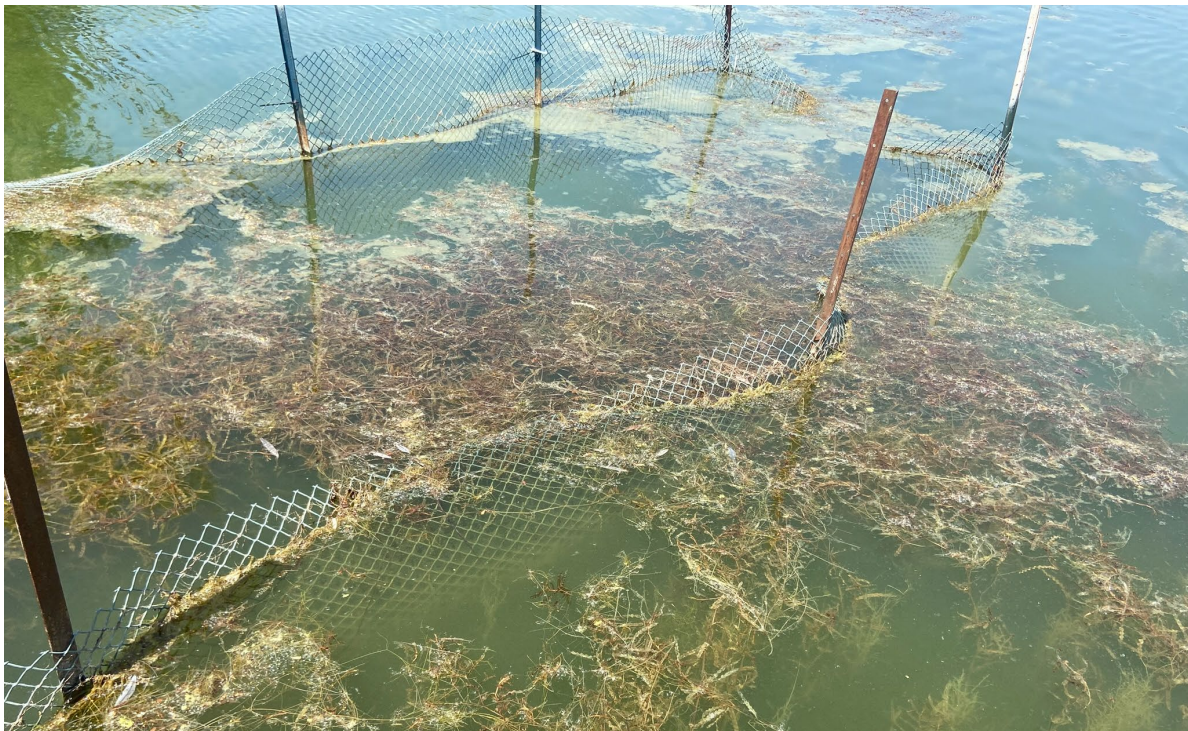
A pilot SAV planting program was initiated by the City of Markham in June 2023 and continued in 2024 to promote SAV establishment and improve water clarity through enhanced nutrient uptake, sediment stabilization, and competition with phytoplankton. A total of 3000 Wild Celery (*Vallisneria americana*) stems were planted in fenced enclosures along the north shore of the lake. While establishment of Wild Celery was generally low at about 30% within the enclosures, abundant natural colonization by other species of SAV was observed throughout the lake in June 2024 (Figures 1 and 2). During the lake treatment with polyaluminum chloride (PAC) for internal phosphorus control, densities of SAV, in particular Small Pondweed (*Potamogeton pusillus*), were sufficient to impede boat movement in some areas during the lake. This was the first documented occurrence of significant SAV in Swan Lake.

In 2025, the City completed an aquatic plant survey to characterize the newly established SAV community within defined lake management zones and depth strata of Swan Lake. This memorandum presents the results of the survey and their implications for ongoing lake management decisions.

Figure 1. Submerged aquatic plants visible in Swan Lake, June 18, 2024



Figure 2. Submerged aquatic plants within an enclosure for the pilot Wild Celery planting project, June 18, 2024



2. Methods Summary

The survey followed the methodology outlined in the Swan Lake Aquatic Plant Survey Plan (AECOM 2025) and integrates:

- A semi-quantitative Point-Intercept Survey to define species distribution and percent cover; and
- A quantitative Stratified Random Rake-Toss Biomass Survey to estimate wet biomass.

The field surveys were conducted between July 10-12, 2026, to coincide with peak macrophyte biomass conditions.

Point-Intercept Surveys were conducted at 45 pre-established grid locations distributed throughout the lake and representing a range of lake depths and management zones. At each location:

- Water depth and Secchi depth were recorded.
- Percent aquatic plant cover was visually estimated within an approximately 1-m² area using categorical cover classes (Absent, Trace, Low, Moderate, High) where possible.
- Two rake tosses were completed to identify species present and relative cover using the categorical cover classes.
- Species were identified in the field or preserved for confirmation.
- Observations of surface algae were recorded where present.

At 25 of the survey sites:

- Dissolved oxygen concentration was measured at 0.5 m below the water surface
- Plants retrieved from rake tosses were collected and sorted by species.
- Surface water was removed using a standardized spinning method.
- Wet weight was measured to ± 0.1 g for each sample by species per rake toss.

The survey data were used to delineate plant bed types, characterize aerial coverage, biomass and species composition across the lake within lake management zones and lake depth areas.

Aquatic plant survey data are included in **Appendix A**.

3. Results

Aquatic vegetation was widely distributed throughout Swan Lake at the time of the 2025 survey, with submerged aquatic vegetation (SAV) observed at most sampled locations. Secchi depth ranged from approximately 0.3 to 0.95 m, indicating moderate to good water clarity relative to historical conditions. Surface water temperatures were elevated, ranging from approximately 25 to 28°C, consistent with peak summer conditions. Surface dissolved oxygen concentrations were generally high (approximately 8 to 16 mg/L) and frequently exceeded 100% saturation (up to approximately 200% at some sites), indicating localized

supersaturation associated with high rates of photosynthetic activity. These conditions are consistent with abundant macrophyte and/or algal biomass and reflect strong daytime oxygen production within the lake. Elevated dissolved oxygen and supersaturation under daytime conditions are indicative of high biological productivity and do not represent water quality impairment.

The SAV community was dominated by native species, including Muskgrass (*Chara spp.*), Canada Waterweed (*Elodea canadensis*), Small Pondweed (*Potamogeton pusillus*), and Coontail (*Ceratophyllum demersum*). Muskgrass was the most prevalent species, occurring at approximately 90–95% of sites and typically at high cover. Canada Waterweed was also widely distributed (55–65% of sites) and frequently co-occurred with Muskgrass at moderate to high cover. Coontail and Small Pondweed occurred less frequently (40–50% and 30–40% of sites, respectively). Coontail was generally present at low abundance, whereas Small Pondweed exhibited a patchy distribution with occasional areas of high cover (Table 1).

Table 1. Species Occurrence and Cover

Species	Occurrence (%)	Typical Cover	Notes
Muskgrass (<i>Chara spp.</i>)	~90–95%	High	Dominant, widespread
Canada Waterweed (<i>Elodea canadensis</i>)	~55–65%	Moderate–High	Frequently co-occurs with Muskgrass
Coontail (<i>Ceratophyllum demersum</i>)	~40–50%	Trace–Low	Widespread but low abundance
Small Pondweed (<i>Potamogeton pusillus</i>)	~30–40%	Patchy (locally high)	Localized dominance

Notes: Based on point-intercept survey data; occurrence represents percentage of sites where species were observed.

Aquatic plant cover was predominantly high, with approximately 84% of sites classified as high cover. Areas of low or trace cover were limited and primarily associated with deeper locations. Complete absence of vegetation was observed at only a small number of sites, generally at depths exceeding approximately 2.5 m. The spatial distribution of plant cover (Figure 3) illustrates the widespread establishment of SAV.

SAV was consistently present in shallow (<1 m) and intermediate (1–2 m) depth ranges, where both cover and biomass were highest. Vegetation extended into deeper areas of the lake, with occurrences recorded at depths of approximately 2.4–2.7 m; however, both cover and biomass declined with increasing depth, consistent with light limitation (Table 2).

SAV was observed across all management zones, with no clear spatial limitation. Both high cover and elevated biomass were observed in multiple zones, indicating lake-wide establishment. The distribution of sampled sites by depth and management zone (Table 3) demonstrates representative coverage. Overall, vegetation patterns are more strongly related to depth than to management zone.

Figure 3. Spatial distribution of submerged aquatic vegetation (SAV) cover in Swan Lake based on point-intercept survey results, with bathymetric contours (m asl).

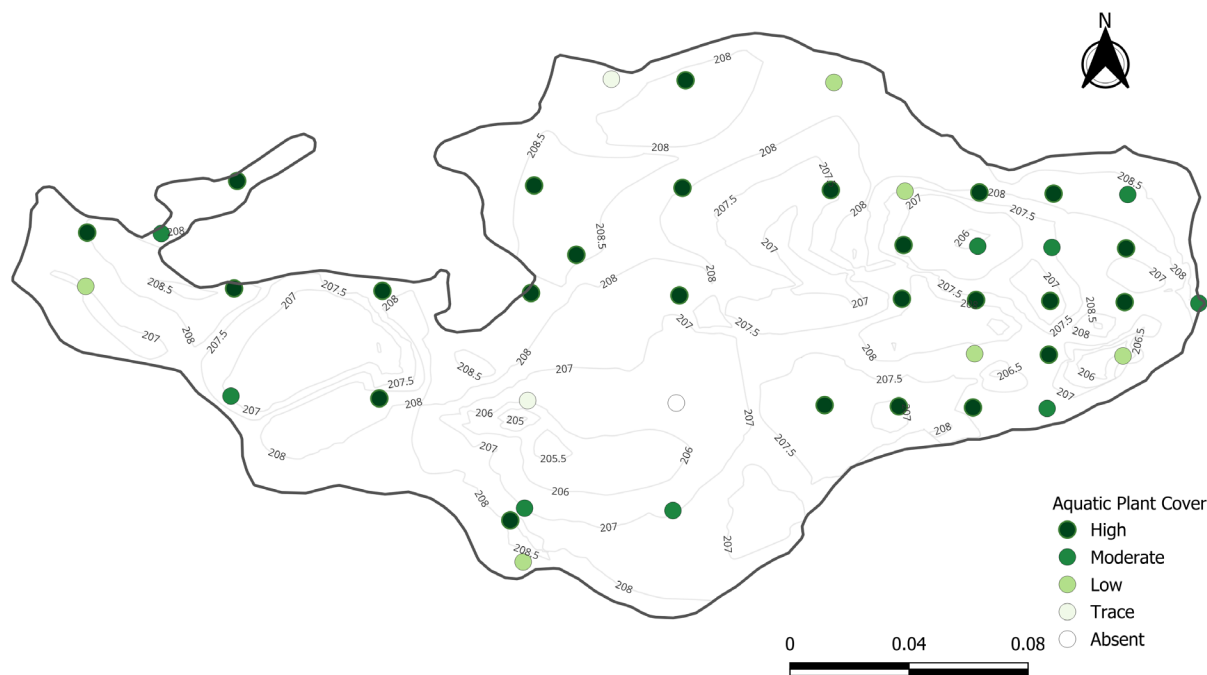


Table 2. SAV Distribution by Depth

Depth Range	Cover	Biomass	Interpretation
<1 m	High	High	Optimal growth
1–2 m	Moderate–High	Moderate	Active zone
>2 m	Variable	Low	Light-limited

Table 3. Sample Distribution by Zone and Depth

Zone	<1 m	1–2 m	>2 m	Total
1	5	5	5	15
2	4		4	8
3	7	1	6	14
4	2			2
5	3		3	6
Total	21	6	18	45

Quantitative biomass measurements indicate that SAV is both widespread and ecologically significant. Biomass ranged from trace amounts (<0.5 g) to greater than 650 g per sample, with most values between approximately 20 and 200 g. Muskgrass was the dominant contributor to total biomass, frequently exceeding 100 g and reaching a maximum of approximately 650 g. Canada Waterweed contributed moderate biomass, while Small Pondweed was locally abundant and Coontail contributed minimally. Biomass was highest in shallow to intermediate depths, particularly where Muskgrass dominated. These densities indicate well-developed plant beds capable of influencing sediment stability, nutrient cycling, and overall water quality (Table 4).

Table 4. Biomass Summary by Species

Species	Min (g)	Max (g)	Range (g)	Relative Contribution
Muskgrass	<1	~650	50–300	Dominant
Canada Waterweed	<1	~125	10–100	Moderate
Small Pondweed	<1	~25	5–30	Localized
Coontail	<1	~20	<10	Low

4. Discussion

The 2025 survey confirms that Swan Lake now supports a well-established and ecologically significant SAV community. Vegetation occurs across all management zones and extends through shallow and intermediate depths, with colonization to approximately 2.5 m. This distribution, together with moderate to high cover and substantial biomass, indicates that SAV is no longer strongly light-limited across much of the lake and reflects a marked improvement in condition.

The community is dominated by native species, particularly Muskgrass and Canada Waterweed, characteristic of stable, clear-water systems. Muskgrass plays an important role in sediment stabilization and limiting nutrient resuspension. The presence of multiple native species indicates that conditions now support sustained macrophyte growth and community development.

SAV establishment is consistent with improved water quality resulting from nutrient management. Reductions in phosphorus and associated declines in phytoplankton biomass have increased light availability, enabling macrophyte colonization. Once established, SAV reinforces these improvements through sediment stabilization, nutrient uptake, and competition with phytoplankton. The consistent distribution across all management zones indicates a lake-wide response.

Although limited establishment of Wild Celery was previously attributed to insufficient water clarity, the 2025 results indicate that light is no longer a primary constraint. The absence of Wild Celery, despite successful colonization by other species, suggests that species-specific factors, competitive interactions, and localized conditions within enclosures were more likely responsible.

Depth remains the primary control on SAV distribution, with highest cover and biomass in shallow and intermediate areas and reduced presence beyond approximately 2–2.5 m, consistent with light limitation. No clear relationship with management zones was observed.

Elevated dissolved oxygen and frequent supersaturation reflect high rates of daytime photosynthesis. Aquatic systems with abundant SAV also exhibit diel variability, including nighttime reductions in dissolved oxygen due to respiration and increased oxygen demand during periods of senescence. These dynamics are typical of shallow, warm-water lakes with well-developed SAV communities and reflect natural ecosystem function rather than impairment. In contrast to historical conditions, such fluctuations are not expected to result in widespread or persistent low-oxygen conditions.

Collectively, these findings indicate that Swan Lake has transitioned to a stable, macrophyte-influenced condition with improved water quality and ecological function.

5. Management Implications

The 2025 survey indicates that SAV is well established and self-sustaining within Swan Lake. Additional planting is not required, as the existing community provides key ecological functions, including sediment stabilization, nutrient uptake, and habitat support.

Future management should focus on maintaining conditions that support SAV persistence, including continued control of nutrient inputs and protection of existing vegetation from disturbance. Periodic monitoring (every 3–5 years) is recommended to assess long-term stability and detect changes in community structure.

While the community is dominated by submerged species, limited diversification (e.g., floating-leaved species) could be considered to enhance habitat complexity; however, such measures are not necessary to achieve current objectives.

Dense SAV has implications for in-lake treatments. To ensure effective deposition of products such as PAC, applications should occur during periods of minimal biomass (early spring prior to establishment or late summer–fall following senescence). Treatment during peak growth may result in interception by vegetation and reduced effectiveness.

6. Conclusions

The 2025 aquatic plant survey confirms that Swan Lake now supports a widespread and well-established submerged aquatic vegetation (SAV) community dominated by native species. Vegetation is distributed across all management zones and extends through shallow and intermediate depths, with colonization occurring to approximately 2.5 m. These findings indicate that light availability and overall water quality conditions are sufficient to support sustained macrophyte growth across much of the lake.

The observed SAV community reflects a fundamental shift from a phytoplankton-dominated system to a macrophyte-influenced condition, consistent with improvements in water quality following nutrient management. The absence of Wild Celery (*Vallisneria americana*) and the widespread natural colonization by other native species indicate that recovery is being driven by improved environmental conditions rather than active planting.

Given the extent and density of SAV, the current vegetation community is expected to provide key ecological functions, including sediment stabilization, nutrient uptake, and support for aquatic habitat. As such, additional planting is not warranted, and future management should focus on maintaining conditions that support SAV persistence through continued nutrient control and periodic monitoring.

Tammy Karst-Riddoch, PhD
Principal
BlueCycle Canada, Inc.

Appendix

Table A1 – Site Properties

Site ID	Depth (m)	Secchi Depth (m)	DO (mg/L)	DO Sat (%)	Temperature (C)	Cover	Latitude	Longitude	Zone	Actual Depth Category
ENC_001	0.6	0.5	9.62	120.3	27	H	43.89722	-79.2531	2	<1 m
ENC_002	0.4	0.4				H	43.89722	-79.2531	2	<1 m
ENC_003	0.95	0.8				H	43.89611	-79.2533	1	<1 m
SL_002	2	0.65	10.1	127.8	27.7	L	43.89709	-79.2551	2	1–2 m
SL_003	1.2	0.65				H	43.89732	-79.2551	2	1–2 m
SL_006	0.5	0.5	10	122	22.5	M	43.89731	-79.2548	4	<1 m
SL_007	2	0.7				M	43.89663	-79.2545	2	1–2 m
SL_009	0.7	0.7	10.8	128	27.9	H	43.89708	-79.2545	2	<1 m
SL_010	0.5	0.5	16	199	27.8	H	43.89753	-79.2545	4	<1 m
SL_016	1.75	0.6	10	126	27.2	H	43.89662	-79.2539	2	1–2 m
SL_018	0.8	0.5				H	43.89707	-79.2539	2	<1 m
SL_023	0.35	0.35				L	43.89594	-79.2533	3	<1 m
SL_024	1.1	0.9				M	43.89616	-79.2533	3	1–2 m
SL_026	2.4	0.95				T	43.89661	-79.2533	1	>2 m
SL_028	0.3	0.3				H	43.89706	-79.2532	1	<1 m
SL_030	0.48	0.48				H	43.89751	-79.2532	5	<1 m
SL_041	2	0.8				T	43.89796	-79.2529	5	1–2 m
SL_043	0.55	0.55				M	43.89615	-79.2527	3	<1 m
SL_045	2.7	0.9				A	43.8966	-79.2526	1	>2 m
SL_047	0.5	0.5	9.11	112.5	26.2	H	43.89705	-79.2526	1	<1 m
SL_049	0.66	0.66				H	43.8975	-79.2526	5	<1 m
SL_051	1.2	0.8				H	43.89795	-79.2526	5	1–2 m
SL_063	1.1	0.95				H	43.89659	-79.252	1	1–2 m
SL_067	1.5	0.7	8.45	104	25.5	H	43.89749	-79.252	5	1–2 m
SL_069	0.5	0.5	7.9	96.9	25.7	L	43.89794	-79.252	5	<1 m
SL_070	1.8	0.67				H	43.89659	-79.2517	3	1–2 m
SL_072	0.8	0.8				H	43.89704	-79.2517	1	<1 m
SL_073	2.4	0.6				H	43.89726	-79.2517	1	>2 m
SL_074	1.1	0.7				L	43.89749	-79.2517	1	1–2 m
SL_076	1.2	0.77				H	43.89658	-79.2514	3	1–2 m
SL_077	1.2	0.65	8.85	110.9	27	L	43.89681	-79.2514	1	1–2 m
SL_078	1.2	0.7				H	43.89703	-79.2514	1	1–2 m
SL_079	2.2	0.7	9.48	118.5	27	M	43.89726	-79.2514	1	>2 m
SL_080	0.65	0.65	9.4	119	27.4	H	43.89748	-79.2514	3	<1 m

Site ID	Depth (m)	Secchi Depth (m)	DO (mg/L)	DO Sat (%)	Temperature (C)	Cover	Latitude	Longitude	Zone	Actual Depth Category
SL_081	0.65	0.65	8.3	101.8	25.6	M	43.89658	-79.2511	3	<1 m
SL_082	1.5	0.75				H	43.8968	-79.2511	3	1–2 m
SL_083	2.3	0.8				H	43.89703	-79.2511	1	>2 m
SL_084	1.4	0.7				M	43.89725	-79.2511	1	1–2 m
SL_085	1	0.7				H	43.89748	-79.2511	3	1–2 m
SL_086	0.61	0.61	8.11	100.2	25.8	L	43.8968	-79.2508	3	<1 m
SL_087	0.95	0.9				H	43.89702	-79.2508	3	<1 m
SL_088	1.4	0.7				H	43.89725	-79.2508	3	1–2 m
SL_089	N/A	0.6				M	43.89747	-79.2507	3	>2 m
SL_090	0.9	0.72	8.21	102	26.1	M	43.89702	-79.2504	3	<1 m

Table A2 – Point-Intercept Data

Site ID	Sample #	Species	Proportion Code
ENC_001	1	MG	H
ENC_001	1	CW	H
ENC_001	1	CP	T
ENC_002	1	MG	L
ENC_002	1	CW	M
ENC_002	2	MG	H
ENC_002	2	CP	T
ENC_002	2	CW	T
ENC_003	1	CW	H
ENC_003	1	MG	L
ENC_003	1	CP	T
ENC_003	1	PP	T
ENC_003	2	MG	H
ENC_003	2	CP	T
SL_002	1	PP	H
SL_002	2	PP	H
SL_003	1	MG	H
SL_003	2	MG	M
SL_003	2	CW	M
SL_006	1	CW	M
SL_006	1	MG	M
SL_006	2	MG	M
SL_006	2	PP	M
SL_006	2	CW	T
SL_007	1	CW	M

Site ID	Sample #	Species	Proportion Code
SL_007	1	PP	M
SL_007	2	PP	H
SL_009	1	MG	H
SL_009	2	MG	H
SL_010	1	CP	T
SL_010	1	MG	M
SL_010	1	CW	M
SL_010	2	MG	H
SL_010	2	CP	T
SL_016	1	CW	H
SL_016	1	MG	H
SL_016	2	MG	H
SL_018	1	MG	H
SL_018	1	CP	T
SL_018	2	MG	H
SL_018	2	CP	T
SL_023	1	MG	H
SL_023	2	MG	H
SL_023	2	CW	T
SL_024	1	MG	H
SL_024	2	MG	H
SL_024	2	CP	T
SL_026	1	PP	H
SL_026	2	PP	H
SL_028	1	MG	H
SL_028	2	MG	H
SL_030	1	CW	H
SL_030	1	MG	T
SL_030	2	MG	H
SL_030	2	PP	T
SL_041	1	-	A
SL_041	2	CW	H
SL_043	1	MG	H
SL_043	2	MG	H
SL_045	1	-	A
SL_045	2	-	A
SL_047	1	MG	H
SL_047	1	CP	T
SL_047	2	MG	H
SL_049	1	MG	H
SL_049	1	CP	T

Site ID	Sample #	Species	Proportion Code
SL_049	2	MG	H
SL_049	2	CP	T
SL_051	1	MG	H
SL_051	2	MG	H
SL_051	2	CW	L
SL_063	1	MG	H
SL_063	2	MG	H
SL_067	1	CP	M
SL_067	1	PP	M
SL_067	1	CW	T
SL_067	2	MG	H
SL_069	1	CW	H
SL_069	2	MG	H
SL_069	2	CP	T
SL_070	1	PP	H
SL_070	1	CP	T
SL_070	1	CW	T
SL_070	2	PP	H
SL_070	2	CP	T
SL_071	1	MG	H
SL_071	2	-	A
SL_072	1	MG	H
SL_072	2	MG	H
SL_073	1	MG	H
SL_073	1	CP	L
SL_073	1	PP	T
SL_073	2	-	A
SL_074	1	MG	H
SL_074	2	CW	H
SL_076	1	MG	H
SL_076	2	MG	H
SL_076	2	CP	T
SL_077	1	MG	H
SL_077	2	MG	H
SL_078	1	MG	H
SL_078	2	MG	H
SL_078	2	CP	L
SL_079	1	-	A
SL_079	2	-	A
SL_080	1	MG	H
SL_080	2	PP	H

Site ID	Sample #	Species	Proportion Code
SL_081	1	MG	H
SL_081	1	CW	T
SL_081	2	CW	H
SL_082	1	MG	H
SL_082	2	MG	H
SL_083	1	-	A
SL_083	2	MG	L
SL_083	2	CW	H
SL_084	1	CP	M
SL_084	1	PP	M
SL_084	2	CW	H
SL_084	2	CP	L
SL_085	1	MG	H
SL_085	2	MG	H
SL_085	2	CP	T
SL_086	1	CW	H
SL_086	1	CP	T
SL_086	2	MG	H
SL_087	1	MG	H
SL_087	1	CW	T
SL_087	1	CP	T
SL_087	2	MG	H
SL_087	2	CW	L
SL_087	2	CP	T
SL_088	1	PP	T
SL_088	2	MG	H
SL_088	2	CW	L
SL_088	2	CP	T
SL_089	1	MG	H
SL_089	1	CP	T
SL_089	2	MG	H
SL_089	2	CW	L
SL_089	2	CP	T
SL_090	1	MG	H
SL_090	2	MG	H

Table A3 – Biomass Data

Site ID	Sample #	Species	Weight (grams)
ENC_001	1	MG	10.5
ENC_001	1	CW	9
ENC_001	1	CP	<0.5
ENC_001	2	MG	192.5
ENC_001	2	CW	12
ENC_001	2	CP	2.5
SL_002	1	PP	16.5
SL_002	2	PP	23.5
SL_003	1	MG	176
SL_003	2	PP	21.5
SL_003	2	CW	58
SL_009	1	MG	341
SL_009	2	MG	128
SL_009	2	CP	<1
SL_016	1	CW	124
SL_016	1	MG	224
SL_016	1	CP	<1
SL_016	2	CW	9.5
SL_016	2	CP	3
SL_016	2	MG	653
SL_047	1	MG	100
SL_047	1	PP	<0.5
SL_047	1	CP	<0.5
SL_047	2	MG	48.5
SL_067	1	CP	20
SL_067	1	PP	26
SL_067	1	CW	2
SL_067	2	MG	78
SL_067	2	CP	<1
SL_069	1	MG	28
SL_069	2	MG	46.5
SL_077	1	MG	23
SL_077	1	CW	10.5
SL_077	2	MG	32.5
SL_080	1	PP	2.5
SL_080	1	MG	17
SL_080	1	CW	<0.5
SL_080	2	MG	64
SL_080	2	CW	<0.5

SL_081	1	MG	194.5
SL_081	1	CW	<0.5
SL_081	2	CW	123.5
SL_081	2	MG	31
SL_086	1	CW	22
SL_086	1	CP	1
SL_086	2	MG	130
SL_090	1	MG	167
SL_090	1	CW	16
SL_090	2	MG	23.5

Appendix F : Water and Chloride Budget



MEMORANDUM

To: File
Prepared by: Zahra Parhizgari, Environmental Engineer
Rober Muir, Manager, Stormwater
Date: April 15, 2026

Re: **Swan Lake Water Quality Management-
Water and Chloride Budget**

Introduction

This memorandum was prepared to describe the water balance model developed for Swan Lake based on the results of InfoWorks model completed in 2025. This memo analyzes the impact of various flow diversion scenarios on the water and chloride budget in Swan Lake based on existing information on chloride concentration in the Lake and sources of chloride.

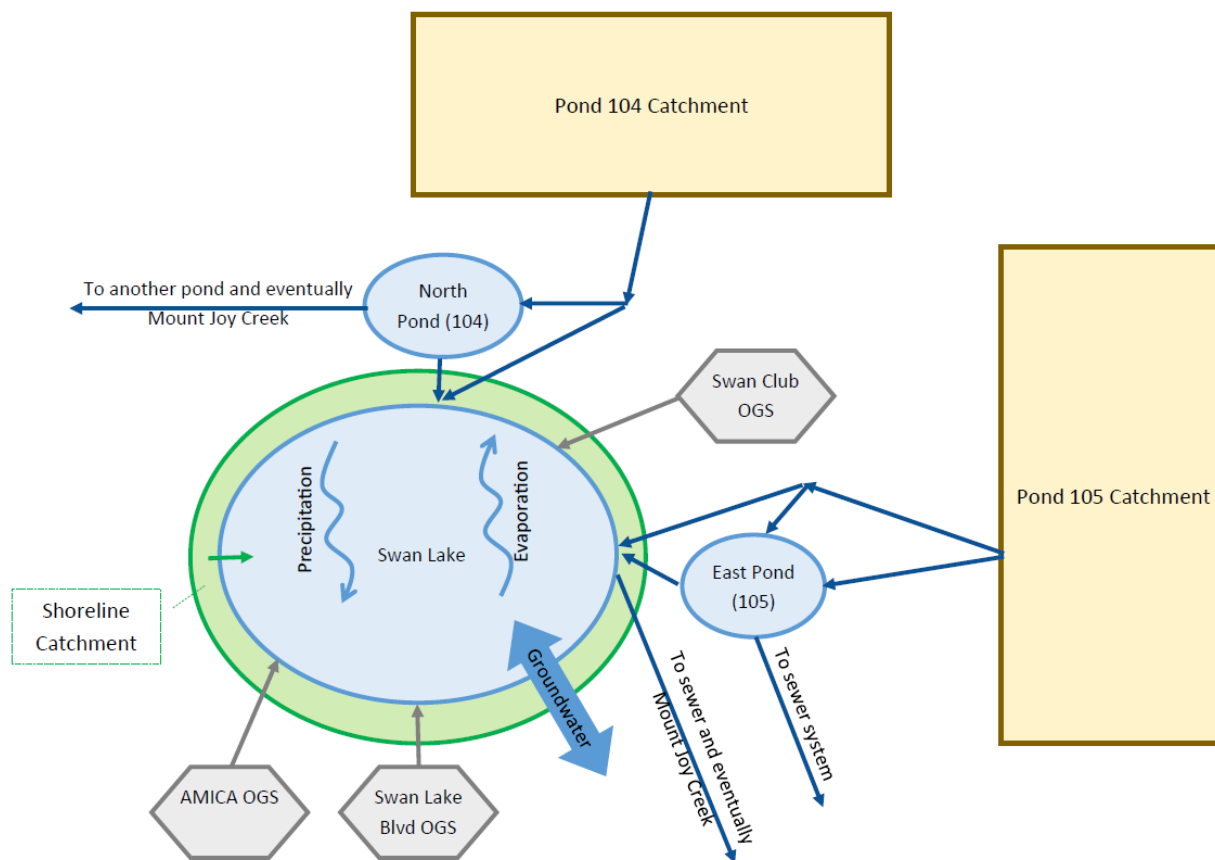
Water Flow Analysis

A conceptual model of flows in and out of Swan Lake is shown in Figure 1. Various components of this model and the methods used to quantify them are described below.

Drainage and Stormwater System

The Swan Lake catchment area is 42.9 ha (excluding the lake itself). In the Swan Lake catchment, runoff is collected by local storm sewers and conveyed to the North and East Ponds. Low intensity rainfall events drain directly into these ponds, while high intensity events are diverted to Swan Lake when flow levels are high enough to spill over weirs located at the inlet of each pond. The outflow from both Swan Lake and the East Pond (#105) is then collected by downstream storm sewers, ultimately discharging to the creek. The outflow from the North Pond (#104) is received by sewers which eventually discharge to City Pond #102 (not shown).

The major industrial, commercial, and institutional (ICI) zone in the study area is along the south shoreline of Swan Lake. Runoff in this area is pre-treated by three OGS units before draining to Swan Lake.

Figure 1: Swan Lake Conceptual Site Model

Modelling

In 2019, a PCSWMM model was developed by staff to model both minor and major systems continuously for all years since 2009. This model was further refined in subsequent years until 2022.

In 2023, the City retained AECOM Canada to develop a dual drainage hydraulic model using InfoWorks ICM to assess the feasibility of diverting stormwater runoff from the Lake without increasing the flood risk within the study area or downstream location. Details of methods used, and assumptions applied can be found in the Swan Lake Flow Diversion Assessment report (AECOM, May 2025).

As part of the modeling exercise, a continuous simulation was conducted for precipitation data from 2009 to 2024 for existing conditions, and for a representative year, which was determined to be 2013, for flow diversion scenarios.

Precipitation and Evaporation

Meteorological parameters are the most frequently measured and affect several components of the water balance analysis.

Precipitation data in 5-min intervals are available from the Markham Museum meteorological station, complemented with data from the Mount Joy Community Center station. Daily minimum, average, and maximum temperature are available from the Buttonville Airport station up to 2018 and from Toronto North York station after 2018.

Evapotranspiration (ET) rates are traditionally not measured and were calculated using climate data from the nearest stations, HY058. Based on data availability and the required resolution, ET was estimated using the Priestley-Taylor model (Priestley & Taylor, 1972).

Outflow

Once the Swan Lake water level exceeds an elevation of 208.3 m, excess storage is released through the foundation drain collection (FDC) system. A 165 mm orifice plate located at the outlet side of the Lake headwall adjacent to the East Pond controls the outflow from Swan Lake to the FDC system. The Lake release rate is limited to 100 L/s to accommodate the downstream drainage constraint at the 16th Ave. storm sewer (2-year peak flow of 1.166 m³/s).

Since there is limited measurement of outflow (except for November 2022 to October 2023), collected water level data were used to estimate outflow by assuming that discharge starts when the water level reaches an elevation of 208.3 m, i.e., the invert of the overflow weir. Water level data are available since 2017 for the ice-free periods.

Groundwater Exchange (and other uncertainties)

Available reports, including the 1995 Environmental Master Plan, various geotechnical reports prepared in support of development applications in the area, as well as reports on the methane gas ventilation system, were reviewed to develop an estimate of groundwater exchange between the Lake and the surrounding area. Based on these reports, groundwater flow in and out of the Lake was estimated to range between 10 and 300 m³/day; however, there is not enough spatial and temporal resolution to use these values in the water balance analysis.

Water Balance Results

A summary of the annual water balance results is provided in Table 1. Direct precipitation and evaporation from the Lake are based on data from meteorological stations. Inflow from various catchments is based on InfoWorks model simulation results. Outflow was estimated based on measured water level and limited measured outflows. The balance of all estimated components is shown as 'Balance', which could be attributed to uncertainties in the model assumptions, including outflows, as well as groundwater contribution.

Table 1: Average Water Balance Flows (m³/mon) for Existing Conditions for the Period of 2009-2024

Month	Direct Precipitation	Evaporation	North Pond	East Pond	Shoreline Runoff	SLB OGS	AMICA OGS	SC OGS	Outflow	Balance
Jan	1883	-354	383	1521	164	124	294	63	-130	-3976
Feb	1880	-715	61	806	175	135	331	66	-504	-2255
Mar	2418	-2411	300	1424	230	178	416	88	-1703	-952
Apr	3836	-4121	412	2084	390	298	695	152	-4682	928
May	2855	-6689	292	1501	309	244	551	119	-4289	5148
Jun	3938	-7640	579	1909	340	282	633	132	-6188	6026
Jul	3346	-8049	908	2602	340	305	599	131	-4722	4570
Aug	3312	-6371	901	2666	293	267	561	110	-4166	2440
Sep	2729	-3811	478	1826	257	213	465	99	-3662	1390
Oct	3294	-1644	296	1855	294	217	547	114	-2784	-2164
Nov	2069	-651	109	1178	201	143	373	77	-616	-2878
Dec	2446	-289	75	1183	256	184	467	99	-221	-4242

Note: Compared to the previous water balance analysis, that was based on a less detailed PCSWMM model, the current analysis shows lower flows from the North Pond and the uncontrolled shoreline runoff. These refinements affect the calculation of the un-accounted or the 'Balance' component.

The calculation of Lake's surface area and volume was also updated in March 2026, resulting in a smaller surface area (and hence direct precipitation and evaporation amount). The update resulted in smaller volume, impacting outflow and 'balance' quantities.

Flow Diversion Scenarios

The following flow diversion scenarios were evaluated for impacts on water quantity and quality in Swan Lake:

1. Redirecting minor system flow from the AMICA OGS and Swan Lake Blvd. OGS units to the 16th Ave. sewers.
2. Redirecting the "first flush" portion (the most pollutant-laden runoff) of the minor system flow from the AMICA OGS and Swan Lake Blvd. OGS units to the 16th Ave. sewer.
3. Redirecting minor system flow from AMICA OGS and Swan Lake Blvd. OGS units to the Lake outlet.
4. Redirecting minor system flow from Swan Club OGS to the North Pond.
5. Adjusting the flow splitter weir for the East Pond and North Pond to reduce flow bypass to the Lake (5a). A modified version of this scenario was also modeled with upsizing of the inflow pipes (5b).
6. Expanding the storage capacity in the East Pond and North Pond to reduce flow bypass to the Lake (6a). Variations of this scenario included expanding the storage capacity for only the North Pond (6b), and only the East Pond (6c).
7. Several combinations were assessed, including Scenario 4 combined with Scenario 5a (7a), Scenario 4 combined with Scenario 5b (7b), and Scenario 4 combined with Scenario 6b (7c).
8. Creating underground storage capacity to attenuate the flows from AMICA OGS and Swan Lake Blvd. OGS before they enter the local sewer system.

Table 2 provides total annual flows into the Lake from each catchment under different flow diversion scenarios.

Table 2: Average Water Balance Flows (m³/year) for the Representative Year for Flow Diversion Scenarios

Scenario	Pond 104	Pond 105- north outlet	Pond 105- south outlet	SLB OGSs	AMICA OGSs	SC OGSs	Total Flow Reduction
Baseline	2586	4351	1355	2501	5770	1232	-
S1	2586	4351	1355	0	0	1232	46%
S2	2586	4351	1355	0	0	1232	46%
S3	2586	4351	1355	0	0	1232	46%
S4	2815	4351	1355	2501	5770	0	6%
S5a	1131	1407	704	2501	5770	1232	28%
S5b	896	1112	758	2501	5770	1232	31%
S6a	0	0	0	2501	5770	1232	47%
S6b	0	4351	1355	2501	5770	1232	15%
S6c	2586	0	0	2501	5770	1232	32%
S7a	1331	4351	1355	2501	5770	0	14%
S7b	1075	4351	1355	2501	5770	0	15%
S7c	0	4351	1355	2501	5770	0	21%
S8	2586	4351	1355	0	0	1232	46%

Chloride Analysis

Background

Chloride concentration has been increasing in urban lakes due to de-icer application for winter maintenance of roads and walkways. Chloride does not biodegrade, readily precipitate, volatilize, or bioaccumulate. It does not adsorb readily onto mineral surfaces, and therefore when introduced, concentrations remain high in surface water.

Chloride guidelines developed for generic environmental data include a long-term guideline (120 mg/L) and a short-term guideline (640 mg/L). The long-term guideline has been developed to protect all organisms (i.e., present in Canadian aquatic systems) against negative effects during continuous, indefinite exposure. The short-term guideline aims to protect most species against lethality during a sudden increase in chloride concentration for a short period (24-96 hrs). These guidelines may be over-protective for areas with an elevated concentration of chloride and associated adapted ecological communities. For such circumstances, it has been suggested that site-specific (higher) targets be derived considering local conditions such as water chemistry, background concentrations, and aquatic community structure.

Chloride Concentration

Water quality is regularly monitored at two shoreline sites, the Dock (S1) and the Bridge (S2). The water depth at the dock is approximately 2.5-3 meters, representing deeper sections of Swan Lake, and this station has historically been used to represent the ‘whole lake’. The water depth at the

bridge is about 0.5 meters deep, and it is used to represent the conditions of the shallow bays around Swan Lake.

In the earlier years of monitoring, sampling was completed at the deepest point in the Lake (Main or Central station, S3). Samples were not analyzed for chloride regularly, but conductivity was measured frequently. Conductivity has been found to be linearly related to chloride concentration in roadway runoff; however, there is higher variability in pond outlets due to the presence of other ions (MNDOT, 2017). About 60 Swan Lake samples with both chloride and conductivity measurements were reviewed, and a strong correlation was found between the two constituents, where conductivity ($\mu\text{S}/\text{cm}$) is about three times chloride concentration (mg/L).

Monthly averages for the three Lake stations (Dock, Bridge, Central, or S1/S2/S3) averaged over all depths (when available) are provided in Table 3.

Water quality testing results indicated that samples taken between 2017 and 2021 contained high chloride levels and decreased considerably since 2022 after the East pond inlet blockage was removed.

Monthly values have been highest in April-July and lower in Aug-Nov. Few data points are available for Jan-Mar as the Lake is frozen during this period. A possible explanation could be that chloride concentrations in the runoff are highest during snowmelt (March-April). Lake concentrations remain high through the spring and part of the summer until the Lake water is diluted with precipitation and unsalted runoff.

Table 3: Monthly Average Concentration of Chloride (mg/L) in the Lake

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Annual Average
2011								568	529	388		492
2012			294									294
2013		199			424		436	404	348	311	220	341
2014	318			462	432	481	472	401	300	320	239	383
2017				732	638	502	429	417	409	438	398	477
2018				457	585	558	590	615	393	392	345	511
2019				581	544		585	656	575	608	570	596
2020				711	717	717	762	749	742	753	717	737
2021	749		700	784	762	733	624	968	613	515	480	679
2022			255	438	447	485	500	490	463	470	438	425
2023	810		280	353	373	343	332	305	250	285	353	356
2024	695			253	255	230	203	193	190	210	253	257

Note: Estimated based on conductivity for 2011-2014, when few measurements of chloride are available.

Since 2022, water samples have been collected from various inlets to the Lake and analyzed for chloride. These data, along with scattered data from previous years, are shown in Table 4. Based on this limited dataset, chloride concentration in the winter melt/spring runoff from the pond catchments is about 1200 mg/L (average of pond inlet measurements). This concentration would not usually end up in the Lake, except through the East Pond bypass during the period that the northern inlet was blocked. At other times, the bypass would carry ‘cleaner’ water (after the first flush), with concentrations around 250 mg/L .

Samples were also collected from the Swan Lake Blvd. (SLB), AMICA OGS and Swan Club OGS (SC OGS- since 2024 after outlet cleanout) at the outfall to the Lake. The outfalls were not flowing during some sampling events, in which case, samples were collected from the pool of water present. Average runoff concentrations from samples collected from SLB OGS, AMICA OGS SC OGS was about 1000 mg/L (excluding two samples assumed outliers).

Samples were also collected from the shoreline runoff, which resulted in very low chloride concentrations (about 25 mg/L).

Table 4: Chloride Concentrations in Inflow and Outflow from Ponds and OGSs

Date	East Pond			North Pond			OGSs		
	Pond Inlet	Pond	Inflows to Lake (bypass)	Pond Inflow	Pond	Inflow to Lake (bypass)	AMICA-OGS	SLB-OGS	SC-OGS
3/26/2021	957	343	-	98.5	199	-	-	-	-
4/11/2021	-	-	131	79	-	-	-	-	-
1/13/2022	-	-	-	-	-	-	-	3160	-
2/15/2022	2340	-	-	2120	-	-	360	836	-
3/6/2022	380	410	-	410	180	-	610	1200	-
3/16/2022	3700	-	-	3100	-	-	470	4800	-
3/24/2022	1200	-	150	1100	-	-	240	1900	-
4/6/2022	2800	-	350	-	-	-	1100	-	-
5/5/2022	-	-	370	-	-	-	-	-	-
1/18/2023	2000	-	240	1200	-	-	120	-	-
2/8/2023	3900	-	-	650	-	-	450	-	-
2/9/2023	360	-	-	340	-	-	300	420	-
3/24/2023	1300	-	180	765	-	120	-	-	-
1/15/2024	1900	-	270	210	-	-	2100	3300	4200
1/26/2024	560	-	150	-	-	280	-	320	680
2/29/2024	2467	-	333	-	-	-	-	-	-

Note: Some samples were from very low flow conditions and were excluded from averages.

Sources of Chloride

Salt usage data were obtained from the City's Road department and the Swan Lake Village Corporation.

Winter maintenance of 1 km of the catchment roads and sidewalks is completed by the City of Markham. The City prescribes and tracks the quantity of salt distributed to the City roadways based on current and future forecast models and temperatures to determine the required action and material usages in compliance with the desired service level of service and O.Reg. 239/02 requirements.

The City has used an average of 2,650 kg of salt per year over the past five years. Swan Lake Blvd (130 m of primary roads) received 920 kg of salt per year, while local roads north of Swan Lake (880 m) received 1730 kg of salt per year. About 40 salting events are completed for primary roads and 10 for local roads each year.

The remaining roads and parking areas, as well as private walkways and driveways are serviced privately.

As per the Village Amenities Committee (VAC) (M. Petit personal communication, February 2, 2022), the Village Corporation employs “a qualified, reputable cleaning and maintenance service employing Smart About Salt principles to plow/shovel and their insurance recommend the de-icing methods of rock salt, applied as necessary to maintain their insurance and mitigate potential claim”. The amount of rock salt applied is about 88-110 tons per winter season, of which 30% is applied to the 14 km of single-lane kilometers of roadways plus parking areas, and 70% is applied to unit walkways and driveways and mail locations.

Information on salt usage in the AMICA property (0.75 ha) serviced by an OGS is not available. The amount of salt used in residential driveways north of Swan Park Road is not known. Table 5 provides the assumption used for salt usage in each catchment area.

Table 5: Salt Usage Assumptions

Area	Maintained by	Road Length (m)	Walkway/ Driveway/ Parking** (ha)	Road Salt (kg/yr)	Walkway/ Parking Salt (kg/yr)	Salt used (ton/event)	Cl Content ★ (kg/event)	Retention in soil
East Pond- north catchment	VAC	7800*	7.7	16600*	38500 *	1.4	496	0.4
East Pond- south catchment	VAC	1900*	1.9	4200 *	9600 *	0.3	124	0.4
North Pond	VAC	4300*	4.3	9200*	21400 *	0.8	230	0.5
SLC OGS	VAC	0	0.1	0	500 *	0.01	8	0
North Pond	City (local roads)	900	0	1700	10000 ***	1.2	115	0.35
SL Blvd	City (primary road)	100	0	900	0	0.02	14	0
AMICA OGS	AMICA	0	0.4	0	2000 +	0.1	31	0

Notes:

* 14 km (and associated salt usage) divided based on catchment area fractions (69% East pond, and 31% North Pond- in the East pond catchment, 80% drains to north inlet and 20% to south inlet)

** Assumed 50% of the surface area

*** Assumed the same application rate as in the Village by local resident

+ Assumed the same application rate as SLC OGS

★ 60% of rock salt is chloride

To refine the number of salting events for calculation purposes, snowfall information for each day was used, with a summary shown in Table 6.

Table 6: Annual Snowfall and Estimated Number of Salting Events

Year	Total Snowfall (cm)	Number of Snow Days (snowfall>0)	Estimated Number of Salting Events
2009	155	31	38
2010	81	33	35
2011	155	42	50
2012	105	30	35
2013	180	44	53
2014	176	37	44
2015	90	29	34
2016	163	43	51
2017	109	26	32
2018	144	39	48
2019	172	29	39
2020	151	31	37
2021	74	19	24
2022	119	26	30
2023	112	16	21
2024	63	14	17

Chloride Transport

Chloride in salting materials is readily dissolved in water and transported overland by runoff or infiltrated into soils, contaminating groundwater and surface water. A fraction of chloride in applied road salt is retained by soil and is not observed in surface runoff.

As a result, salt loading to surface water occurs primarily in winter and spring during melt conditions but continues through the summer and fall via the discharge of impacted groundwater, dry deposition of dust to the lake surface, non-point source runoff washing dry salt from land surfaces. Salt accumulated in the ponds could also be discharged into the Lake through the flushing of stormwater ponds.

Source Contributions to Chloride Levels in the Lake

In order to identify the most efficient strategy for reducing chloride loading to the Lake, a high-level estimate was made of the contribution of different sources. Two independent methods were used for this estimate, and adjustments were made to achieve similar results between the two methods.

The first method uses available runoff concentrations and modelled flows to estimate chloride input to the Lake. Model assumptions include:

- Runoff volumes were divided into catchments with different salting arrangements based on catchment areas.

- Runoff produced from December to April contains chloride concentrations of 250 mg/L for pond flows, 800 mg/L for SLB and SC OGS flows and 600 mg/L for AMICA OGS (after adjusting for consistency between the two methods). Chloride concentration in other months, and from the shoreline catchment was assumed at 25 mg/L.
- The northern inlet to the East Pond was blocked between 2018 and 2021, during which, chloride concentration in the lake inflow was set at 1200 mg/L.

The second method uses salt usage data and event numbers, as well as assumptions related to salt retention in soil. Model assumptions include:

- Salting operation occurred from December to March based on the number of snow events in each month (snowfall information from Toronto Buttonville station and Toronto North York station).
- Salt usage data were used to estimate the amount of salt applied in each catchment per event and the corresponding amount of chloride in runoff from the area.
- The fraction of runoff from each area discharged to the Lake (after passing through stormwater controls, if applicable) was estimated from the InfoWorks model. Average fractions were about 7% for the North Pond catchment and 11% for the East Pond (80% when the inlet was blocked) over all years. Monthly values were used in the calculations.
- Lower salt usage (up to 50%) was considered for years before 2016 to achieve similar results to the first method.

Estimated contributions are provided in Table 7 for the two methods. Average of the two methods for the last three years of calculations are shown in this table as well, indicating about three tons of chloride input into the Lake annually, half of which is from the three OGSs (no chloride treatment or water retention), about one ton from the East pond and about half ton from the North pond.

Given the many assumptions made for these estimates, the results should be used with caution. Nonetheless, both methods show a significant increase in chloride loading from the untreated runoff from the East Pond catchment. The blocked inlet causing this load was cleared in 2021, and therefore, this load will not be present in the future.

Table 7: Chloride Contribution (ton/yr) Estimated using Runoff Concentrations / Salt Usage Data

Year	Pond 104- Village	Pond 104- City	Pond105- south	Pond105- north	SC OGS	SL Blvd	AMICA OGS
Runoff Con. (mg/L)	250	250	250	1200	1000	1000	600
Salt Usage (ton/event)	0.77	1.17	0.34	1.38	0.01	0.02	0.05
2009	0.21/0.26	0.1/0.13	0.26/0.21	0.41/0.85	0.33/0.15	0.65/0.52	0.97/0.58
2010	0.19/0	0.09/0	0.18/0	0.32/0	0.26/0.13	0.5/0.47	0.81/0.52
2011	0.01/0	0/0	0.01/0	0.01/0	0.21/0.19	0.35/0.68	0.65/0.75
2012	0.11/0	0.05/0	0.08/0	0.22/0	0.21/0.14	0.42/0.48	0.66/0.54
2013	0.12/0.18	0.05/0.09	0.1/0.15	0.27/0.61	0.33/0.2	0.65/0.69	0.97/0.77
2014	0.07/0	0.03/0	0.06/0	0.14/0.01	0.21/0.15	0.4/0.52	0.62/0.58
2015	0.19/0.1	0.09/0.05	0.19/0.07	0.32/0.27	0.19/0.13	0.36/0.44	0.57/0.49
2016	0.01/0.02	0.01/0.01	0.05/0.09	0.09/0.36	0.33/0.34	0.63/0.63	1/1.32
2017	0.07/0.11	0.03/0.05	0.09/0.12	0.21/0.48	0.38/0.24	0.77/0.43	1.17/0.95
2018	0.12/0.08	0.06/0.04	0.09/3.46	16.04/13.83	0.32/0.27	0.61/0.48	1.1/1.07
2019	0.16/0.44	0.08/0.22	0.23/3.56	18.74/14.23	0.34/0.27	0.64/0.48	1.32/1.07
2020	0.67/0.74	0.31/0.37	0.65/3.28	25.17/13.14	0.47/0.25	0.95/0.44	1.66/0.98
2021	0.58/0.08	0.27/0.04	0.34/2.06	18.48/8.22	0.32/0.16	0.72/0.29	1.06/0.64
2022	0.08/0.15	0.04/0.08	0.09/0.12	0.16/0.49	0.29/0.22	0.56/0.39	1.11/0.86
2023	0.22/0.22	0.11/0.11	0.19/0.14	0.39/0.57	0.28/0.16	0.56/0.28	1.02/0.61
2024	0.51/0.35	0.24/0.18	0.5/0.35	1.06/1.41	0.41/0.13	0.82/0.23	1.53/0.52
Average of 2022-2024	0.26	0.12	0.23	0.68	0.25	0.47	0.94

Chloride Reduction due to Flow Diversion Scenarios

The runoff concentration methodology was applied to various flow diversion scenarios.

Table 8 provides total chloride contribution into the Lake from each catchment under different flow diversion scenarios for the representative year, 2013.

Unit costs for chloride reduction for each scenario were calculated based on the diversion scenario cost estimate provided in AECOM (2025) as shown in Table 9. A summary of other potential impacts is also provided for each scenario.

Table 8: Total Chloride Contribution (ton/year) for the Representative Year for Flow Diversion Scenarios

Scenario	Pond 104	Pond 105-north outlet	Pond 105-south outlet	SLB OGSs	AMICA OGSs	SC OGSs	Total Chloride Contribution
Baseline	0.17	0.27	0.10	0.46	0.87	0.24	2.12
S1	0.17	0.27	0.10	0.00	0.00	0.24	0.78
S2	0.17	0.27	0.10	0.00	0.00	0.24	0.78
S3	0.17	0.27	0.10	0.00	0.00	0.24	0.78
S4	0.18	0.27	0.10	0.46	0.87	0.00	1.88
S5a	0.07	0.08	0.05	0.46	0.87	0.24	1.78
S5b	0.06	0.07	0.05	0.46	0.87	0.24	1.76
S6a	0.00	0.00	0.00	0.46	0.87	0.24	1.58
S6b	0.00	0.27	0.10	0.46	0.87	0.24	1.95
S6c	0.17	0.00	0.00	0.46	0.87	0.24	1.75
S7a	0.08	0.27	0.10	0.46	0.87	0.00	1.78
S7b	0.07	0.27	0.10	0.46	0.87	0.00	1.78
S7c	0.00	0.27	0.10	0.46	0.87	0.00	1.70
S8	0.17	0.27	0.10	0.00	0.00	0.24	0.78

Table 9: Unit Price for Chloride Reduction for Flow Diversion Scenarios

Scenario	Cost (M\$)	Chloride Reduction (ton/yr)	Cl reduction cost (\$M/ton/yr)	Other Potential Impacts
S1	7.06	1.34	\$5.29	Requires downstream pipe upgrade
S2	1.11	1.34	\$0.83	Risk of backflow
S3	1.76	1.34	\$1.32	-
S4	0.28	0.23	\$1.18	Low effectiveness due to constraint at North Pond
S5a	0.03	0.34	\$0.09	Increases risk of basement flooding, potential for bypass, ownership
S5b	0.12	0.36	\$0.35	Increases flow bypass, ownership
S6	2.96	0.54	\$5.50	Disturbance and loss of park and maintenance area, ownership
S6b	1.66	0.17	\$9.71	Significant soil removal, disturbance and loss of park area, ownership
S6c	1.30	0.37	\$3.54	Constraint by roadway and trails, limited space for pond cleaning, ownership
S7a	0.29	0.33	\$0.86	Ownership
S7b	0.32	0.34	\$0.92	Ownership
S7c	1.90	0.41	\$4.58	Significant soil removal, disturbance and loss of park area
S8	6.10	1.34	\$4.56	Requires underground storage construction

Chloride Management and Mitigation Strategy

The 2021 Swan Lake Long-Term Management Plan is currently under review to evaluate the outcome of management activities implemented to date and determine the need for any new measures. If the review indicates a need to further reduce chloride concentrations (which are already within the interim targets), further studies could be completed on the scenarios with the highest reduction and least adverse effects, such as redirecting OGS flows.

Research into the effectiveness of biochar for chloride removal is also underway by York University through partial funding by the City of Markham.

Other measures that could be considered if chloride concentration is found to affect the Lake's health may include managing the de-icing material application rate and type (e.g., sand and salt mix or other material instead of rock salt, salting equipment calibration) to achieve an optimum value that addresses safety concerns as well as chloride load.

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