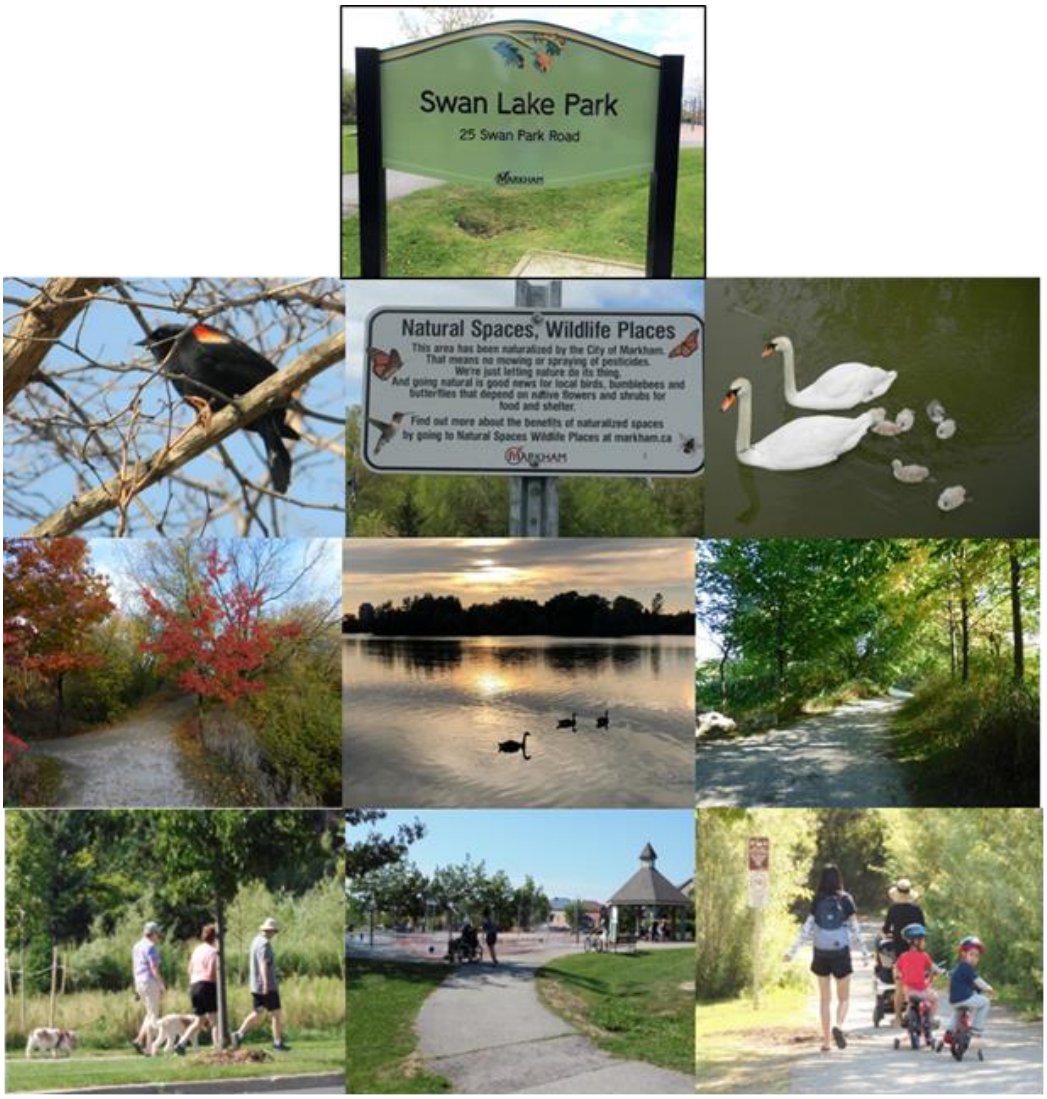
Friends of Swan Lake Park

PRESERVING THE BIODIVERSITY OF SWAN LAKE PARK



June 2025

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Executive Summary

Swan Lake Park is one of the most biodiverse areas in Markham, but it is under stress from the increasing urbanization of the area. The challenge is to preserve the biodiversity while accommodating the increase in visitors to the park.

Markham is in the process of approving the Mt. Joy redevelopment plan along Markham Road, which will include several large condo complexes housing over 25,000 new residents. The increased population is expected to add to the number of visitors to Swan Lake Park.

Milne Dam Conservation Park and Toogood Pond Park, the only other parks in Markham containing large bodies of water, are classified by Markham as Natural Heritage Lands. As such, greater financial resources are available for their care than for Swan Lake Park which is classified as a "Community Park" within "Other Greenway Lands".

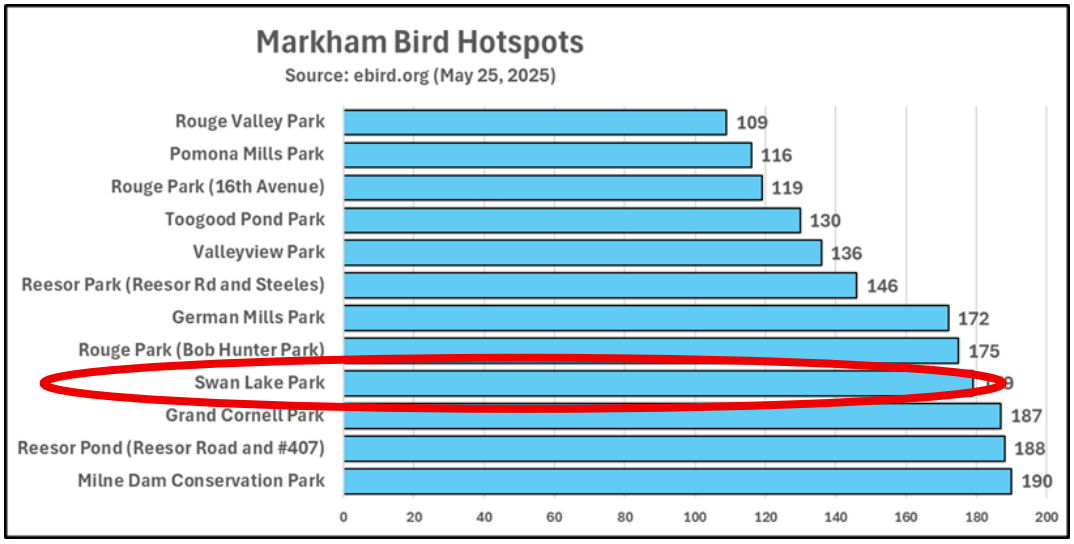
Natural Heritage status is given to areas that contain natural features and serve as corridors for natural migration. Most of Swan Lake Park is categorized as "Natural Spaces, Wildlife Places", meaning no mowing or spraying and "letting nature do its thing".

Swan Lake Park is approximately 14 hectares in size. At 5.4 hectares, Swan Lake is the second largest of the three major water bodies in Markham.

	Size of Park (hectares)	**Size of Water Body**	**Bird Species** (May 2025)
Milne Dam Conservation Park	123 ha	21 ha	190
Swan Lake Park	14 ha	5.4 ha	179
Toogood Pond Park	33 ha	3.0 ha	130

Though one of the smaller parks in Markham, Swan Lake Park has the fourth largest number of bird species reported in 12 areas within Markham based on reported sightings on ebird.org on May 25, 2025.

Ebird.org is a website where bird watchers can record their sightings. It is supported by Cornell University in New York State and by Birds Canada.



In June 2025, 313 area residents responded to a Friends of Swan Lake Park's ("FOSLP") questionnaire about their views on the status of Swan Lake Park. They were asked about their concerns, if any, on the impact of increased urbanization on the biodiversity of Swan Lake Park. The community response to FOSLP's questionnaire:

- 93% indicated they are concerned about the loss of birds and biodiversity
- 95% believe Markham should be doing more to preserve the bird and wildlife habitat

Our Recommended Actions to Support Biodiversity Throughout Markham

1) Develop an integrated Natural Asset strategy that reflects the interconnected terrestrial, water and human elements
2) Develop an expanded Citizen Engagement model for use throughout the city by:
   a. leveraging the activities of the Swan Lake Citizen Science Lab
   b. endorsing Swan Lake Park as a pilot project for an invasive species management program comparable to the Toronto Nature Stewards' program
3) Adopt action plans to preserve bird populations outlined in the State of the Birds report
4) Undertake to have Markham recognized as the next "Bird Friendly" city

Our Recommended Actions for Swan Lake and Swan Lake Park

1) Designate Swan Lake and Swan Lake Park as Natural Heritage Assets
2) Extend the naturalized areas in Swan Lake Park
3) Develop a nesting support program for the wildlife within the park
4) Engage environmental consultants to develop recommendations for a program to stabilize and enhance the habitat for all wildlife species.
5) Accelerate the aquatic habitat program during the next phase of the water quality program
6) Support human interaction in the park by approving shoreline enhancements such as recreational nodes and other features such as Forest Therapy trails.

1) Markham's Environmental Policy Framework

Markham staff have described Swan Lake as a "regulatory orphan". It is not considered part of the Rouge River system nor a stormwater pond, so it has been managed as a unique feature without any formal environmental policy framework.

Swan Lake Park is also a unique facility within Markham's park system. In 2024, FOSLP requested that Markham follow up on a 2022 TRCA recommendation for enhancements to the shoreline to support improved accessibility to the water but this request was denied by city staff due to "city-wide equity with other parks".

However, no other community park contains a 5.4-hectare lake. FOSLP believes the facilities needed within Swan Lake Park can only be compared to those within Milne or Toogood Pond parks. FOSLP is appealing the staff response to Markham Council.

A) Markham's Greenway System and Natural Heritage Network

Markham's Official Plan designates many ecologically sensitive areas as part of its Greenway System. Areas within the Greenway System are areas "that will preserve significant ecological value" and that "provide opportunities to improve biodiversity and connectivity of natural features and ecological function". Areas within the Greenway system are protected from future development.

The Greenway system is comprised of six categories of environmentally protected areas: 1) Greenbelt Plan lands; 2) Oak Ridges Moraine Conservation Plan area lands; 3) Rouge Watershed Protection area; 4) Natural Heritage Network Lands; 5) Natural Heritage Network Enhancement Lands; and 6) Other Greenway Lands including certain naturalized stormwater management facilities.

Swan Lake Park is recognized as an ecologically important area under the Greenway system. Though Swan Lake is not a stormwater pond, Swan Lake Park is designated as a "Community Park" within the "Other Greenway Lands including certain naturalized stormwater management facilities", a category used primarily for areas containing large stormwater ponds and areas which do not receive the same environmental review and focus as do Natural Heritage Network Lands.

Swan Lake is not fed by any surface level streams. Outflows from Swan Lake go into the local stormwater system and then Mt. Joy Creek, which feeds the Rouge River.

Stand-alone major water bodies like Swan Lake can be considered significant natural sources for recharging the aquifer and on that basis be included within the Natural Heritage Systems lands. An April 2022 flow analysis by Markham staff confirms Swan Lake's role as a source for naturally recharging the aquifer. Over the 13-year period 2009 – 2021, it is estimated that 35% of all water flowing into Swan Lake enters the aquifer. In some years, the contribution to the aquifer has exceeded 50%.

At FOSLP's request, on May 11, 2022, the Markham Subcommittee asked staff to "report back on the feasibility, and implications, of designating Swan Lake a natural heritage asset, as part of the Official Plan update". The staff report is expected in 2026.

An upgrade to Natural Heritage Network Lands status would provide Swan Lake and Swan Lake Park an environmental status comparable to Milne Dam Conservation Park and Toogood Pond Park and should provide a more effective and meaningful policy framework for ongoing environmental stewardship of the lake and park.

When asked in the June 2025 questionnaire, 88% of the respondents said they would like to see Swan Lake and Swan Lake Park designated as Natural Heritage Lands.

B) Markham's Natural Asset Management Plan (May 2024)

In May 2024, Markham Council approved three documents that will be integral to the environmental policy framework for managing natural assets throughout the city under the 2025 Markham Official Plan:

1) Natural Assets Inventory and Evaluation Study[14] which reported on the terrestrial natural assets throughout the city. The inventory report sets out eight "Community Levels of Services" including the ecological condition and biodiversity of the natural assets.
2) Natural Area Management Guidebook[15] which assessed vegetation communities and supplemented its findings with TRCA data. Phase 1 of the report[6] was released in May 2021 and was one of the sources used by FOSLP to categorize plant species in this report.
3) Invasive Plant Species Management Plan[16] which identifies 41 invasive plant species of concern and outlines a management framework. Swan Lake Park contains 19 of the invasive species of concern.

C) Need for an Integrated Natural Asset Strategy for Land and Water

The biodiversity of Swan Lake Park is built upon the interrelationship between the terrestrial and aquatic habitat. A robust environmental policy framework should reflect the interconnectivity between terrestrial, aquatic and human elements.

The environmental policies adopted in May 2024 provide an important structure for managing the land-based assets but do not provide a policy framework for the water elements within Markham. Many of the water systems within Markham fall under the jurisdiction of the TRCA but there is still the need for Markham to develop a complementary policy framework.

In 2020, the City of Brampton initiated two programs that provide an integrated environmental focus for their parks and lakes. Many of Brampton's 14 lakes fall under the TRCA's jurisdiction, but Brampton still recognized their role in managing these critical assets, particularly the human interaction element. Brampton's approach is referred to as "holistic" – assessing the whole. Their Eco Park and Lake Enhancement Strategies are designed to bring together all elements to achieve integrated community and environmental objectives for their parks and 14 lakes.

Brampton's Eco Park Vision (2020)

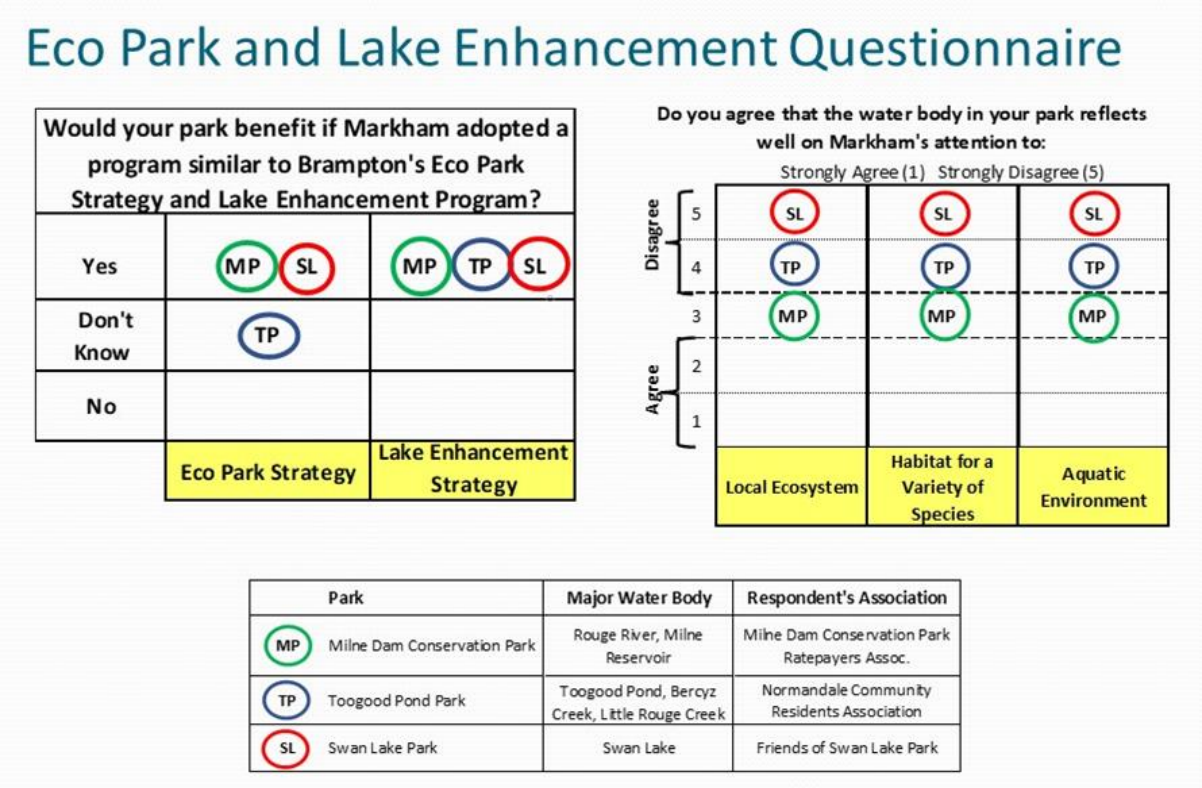
By 2040 all Natural Heritage Systems, parks, and applicable urban spaces within Brampton will be transitioned into a connected network of Eco Spaces forming one grand Brampton Eco Park. Brampton Eco Park is a place that reflects Brampton's identity, provides unique social services, builds community cohesion, protects, and supports City infrastructure while conserving, enhancing, and celebrating Brampton's natural landscapes.

Brampton's Lake Enhancement Strategy (2021)

The Lake Enhancement Strategy aims to transform Brampton lakes into signature citywide destinations within Brampton's recreational open spaces by presenting conceptual park and lake improvements and recreational programming expansion. This strategy also aims to incorporate Brampton's lakes into the Brampton Eco Park by creating animated Eco Spaces that integrate the utilization of outdoor spaces for recreational activities with natural heritage conservation.

In February 2022, FOSLP sent out a questionnaire[10] to ratepayer groups within Markham, soliciting their views on the parks within their areas designated as having natural settings and adjacent to a major water body. The questionnaire was based on the founding principles cited by the Brampton's Eco Park Strategy and Lake Enhancement Program.

Responses from the Milne Dam Conservation Park Ratepayers Assoc. ("MP") and the Normandale Community Residents Association ("TP") with a focus on Toogood Pond Park were that both Milne Dam Conservation Park and Toogood Pond Park would benefit if Markham adopted a policy comparable to Brampton's Lake Enhancement strategy.



In May 2024, FOSLP encouraged Markham Council to adopt the new terrestrial policy framework outlined by staff but also asked that they consider Brampton's approach for an integrated environmental model that would cover all rivers, streams as well as Markham's three major water bodies: Milne Reservoir, Toogood Pond, and Swan Lake.

D) Expanding Markham's Citizen Engagement Programs

Markham has an "Adopt-a-Park" program that supports organizations that will engage in park clean-up and support local plantings. Markham Lions Club has "adopted" Swan Lake Park and FOSLP and the Markham Lions Club have worked with Markham staff to support pollinator plantings and the installation of bird houses in the park.

The new Markham Invasive Species Management policy recommends engaging residents to help identify invasive species of concern. There are, however, additional options available that can build upon these baseline services by extending the scope of the existing citizen engagement programs. Two examples are:

a) Swan Lake Citizen Science Lab

FOSLP has partnered with leading researchers from York University to introduce four advanced technologies, drone monitoring, AI, simulation and virtual reality, as tools for a citizen volunteer program for monitoring environmentally sensitive areas.

Using Swan Lake Park as a pilot program, the objective of the Swan Lake Citizen Science Lab (the "Lab") will be to deliver three core outcomes:

1) Protocols and approaches for monitoring plant life, particularly the 19 priority invasive species highlighted in the Markham Invasive Species Management Plan that were found in Swan Lake Park. We expect this process will be helpful in assessing invasive species in the other environmentally sensitive areas throughout Markham. The Lab incorporates four of the strategies outlined in Section 2.3 of Markham's Invasive Species Management Plan:
    a. Encouragement and use of community data
    b. Collaboration with local experts
    c. Use of remote sensing imagery
    d. Fostering partnerships with educational institutions and others
2) Protocols for a water quality monitoring program and an assessment on whether these techniques have the potential to be a meaningful tool for monitoring algae and other water quality elements in Swan Lake and elsewhere.
3) Development of training programs and procedures, as well as documentary films for use by other environmental groups in volunteer/citizen engagement programs throughout York Region, nationally and potentially internationally.

b) Toronto Nature Stewards

Toronto Nature Stewards (TNS) has developed a dynamic model of a citizen-led stewardship program that could be applied to managing the natural areas throughout Markham.

Launched in 2021, TNS has an agreement with the City of Toronto Urban Forestry Division to run a stewardship program in over 40 natural areas throughout Toronto without direct city supervision. Sites are managed by Lead Stewards who have been trained, follow agreed-upon protocols for ecological restoration, and report their stewardship activities.

TNS Stewards support the ecological restoration of ravines and natural areas by picking up litter, removing invasive plants, planting native species, and monitoring the environmental impact of stewardship activities. They meet in small, local groups to care for approved sites in Toronto's ravines and natural areas. Each stewardship site has been approved by the City of Toronto and each stewardship group is committed to stewarding their local site for several years.

Stewardship on Toronto Nature Stewards (TNS) sites is a shared responsibility of TNS and the City of Toronto.

Toronto Nature Stewards is responsible for:

- Recruiting and training Lead Stewards
- Submitting new stewardship sites to the City of Toronto for approval
- Creating and maintaining the TNS website
- Coordinating and aggregating monitoring and reporting
- Providing a point of contact between TNS Stewards and the City of Toronto
- Providing stewardship guidance to private property owners
- Overseeing Stewards who develop management plans, remove invasive plants, and plant native species.

The City of Toronto is responsible for:

- Providing criteria for determining sites and activities
- Circulating information to relevant internal City of Toronto divisions for site approval
- Reviewing Invasive Plant Information Sheets, providing input on best management practices, and approving species for removal and planting

In June 2025, Friends of Swan Lake Park requested Council support to initiate a Swan Lake Park Nature Stewards pilot project with the goal of being given the authority to remove certain invasive species from Swan Lake Park.

2) Preserving the Biodiversity in Swan Lake Park

A) FOSLP's Inventory of Wildlife and Plants

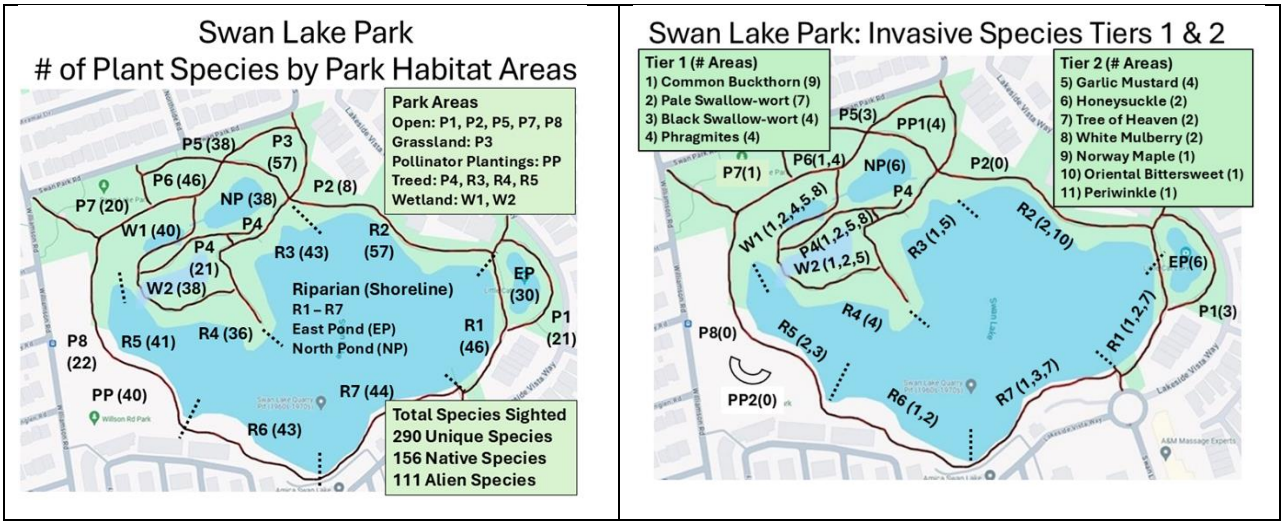
In 2024, FOSLP initiated a Park Habitat project that involved over twenty volunteers identifying and detailing the location of trees and plants in the park using PlantNet. The project also compiled information on bird species from ebird.org and local bird watchers.

Bird watchers have recorded 184 different bird species in Swan Lake Park, of which the Toronto and Region Conservation Authority (the "TRCA") has rated 111 species (60%) as L2 – L4, which means they are at risk within TRCA's territory. Fifteen species sighted are listed on the Federal government's SARA Schedule 1 with eight species rated as Threatened and one of Special Concern. More details are provided in Appendix C.

ALL BIRDS SIGHTED	TRCA Ratings of Birds Recorded in Swan Lake Park								
Nature Counts Canada and eBird.org Groupings	Species at Greatest Risk					Not Rated	Total	% of Total	% At Risk
	L2	L3	L4	L5	LV & L+				
Forest Birds	4	29	15	18	6	17	**89**	48%	54%
Wetland Birds	4	12	9	3	2	2	**32**	17%	78%
Aerial Insectivores	1	2	8	2	1	1	**15**	8%	73%
Birds of Prey	3	3	4	2			**12**	7%	83%
Grassland Birds	1	3	2				**6**	3%	100%
Not Categorized	0	1	2	1	1	2	**7**	4%	43%
Marine, Shorebirds, Arctic Birds	1	5	2			15	**23**	13%	35%
Total	**14**	**55**	**42**	**26**	**10**	**37**	**184**	100%	60%
% of Total Species At Risk	8%	30%	23%	14%	5%	20%	100%		
Source: ebird.org, Nature Counts Canada, TRCA									

Appendix D provides a summary of mammals, turtles, and insects found in Swan Lake Park.

The terrestrial inventory identified 290 different plant species including 19 that rated as Invasive Species under Markham's Invasive Species Management Plan. Specific details on species and locations are provided in Appendix E.



B) Actions to Improve the Terrestrial Habitat

The State of Birds Report[18] outlines actions that can have a positive influence on supporting bird populations including:

- Support efforts to conserve, enhance, or restore habitats like wetlands, grasslands, and forests.
- Make your property more bird and insect-friendly by planting native trees, shrubs, and flowering plants.
- Help identify and report invasive plant species.
- Reduce the use of pesticides and support less harmful pest management strategies.
- Support clean water initiatives that reduce agricultural and industrial runoff, improve wastewater management, or reduce plastic waste.
- Treat windows to reduce bird strikes, and advocate for window treatments and lights-out practices for large buildings.
- Keep birds and cats safe by keeping cats from roaming free outdoors and support efforts to control feral cat populations.
- Leash dogs on beaches where there may be shorebirds, and in other sensitive areas.
- Volunteer for bird conservation. Take part in a Citizen Science program through Birds Canada or Environment and Climate Change Canada.
- Participate in initiatives like tree plantings, invasive species control, habitat creation, and restoration projects.

Nature Canada has launched a program to declare cities “bird friendly”. As of May 2025, 32 cities across Canada have qualified including 18 in Ontario. Toronto and two York Region cities, Vaughan and Richmond Hill, have also qualified.

Nature Canada describes a Bird Friendly City as a community where:

- Key threats to birds are effectively mitigated
- Nature is restored so native bird populations can thrive
- Residents are actively engaged in admiring and monitoring local bird populations

- Organizations are creating events to protect birds
- Progressive municipal policies are created to protect urban bird populations; and
- A Bird Team has been created to oversee and lead these initiatives.

The goal of the program is to ensure our urban environments are safe havens for birds rather than a source of threats. From predation by domestic cats, to window and car collisions, cities and towns present many preventable hazards to birds.

Markham was recognized as one of the first "Butterfly Friendly Cities" in Canada and FOSLP, encourages Markham to join the program to become the next Bird Friendly City.

Preserving the Habitat in Swan Lake Park

There are several specific programs that can be initiated to support and sustain the biodiversity of Swan Lake Park. FOSLP recommends that Markham undertake the following initiatives to sustain the biodiversity of the park:

a) Extend Naturalized Areas

The western portion of Swan Lake Park along Williamson Road is an open manicured space with sparse planting of trees. 86% of the respondents indicated they would support conversion of these open spaces into "Natural Spaces, Wildlife Places" if it would help support biodiversity of the park.

b) Providing Nesting Support

In 2024, FOSLP supported Markham Lions Club and City of Markham staff in installing nine birdhouses throughout the park. Tree Swallows occupied five of the birdhouses in 2024.

FOSLP recommends consideration be given to finding other ways to support additional nesting sites in the park for other species, including installation of an osprey nest.

Over the past few years, wild Trumpeter Swans have visited Swan Lake. It is hoped that a pair will settle and nest within Swan Lake Park.

It is important that shoreline restoration activities planned for the next few years recognize the need to support nesting areas for the Trumpeters Swans and other shore nesting species.

C) Aquatic Habitat of Swan Lake

Aquatic Health

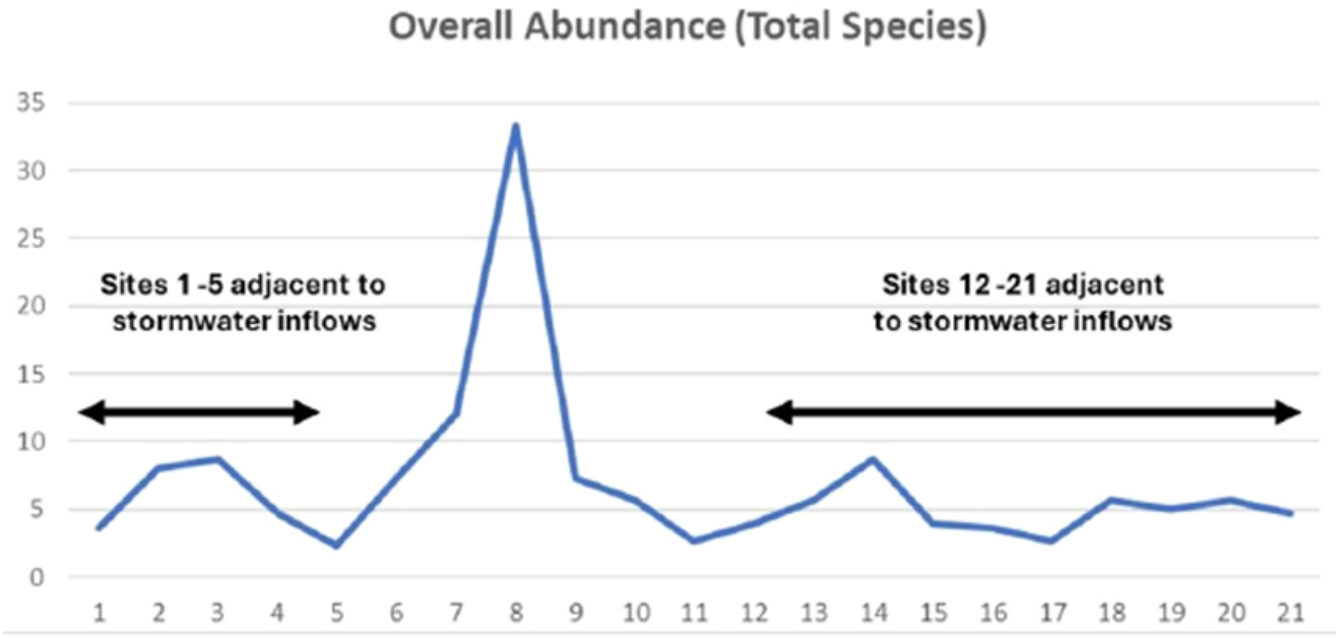
Swan Lake has a high chloride content from road salt. It is expected that the high chloride levels impair the health of lower-level aquatic species such as zooplankton as well as the aquatic plants in the lake.

Benthic macroinvertebrates are small organisms that live on the bottom of streams, rivers, and lakes. They are useful as water quality indicators because they have relatively long lifespans and are sensitive to changes in the aquatic environment. Benthic macroinvertebrates can include insects, worms, mollusks, and crustaceans.

FOSLP asked Markham to undertake an inventory of the lower-level forms of aquatic life to provide a benchmark for monitoring planned improvement in the aquatic health of the lake. The request was denied by staff, noting that the information would not alter their current management plan and was not considered necessary.

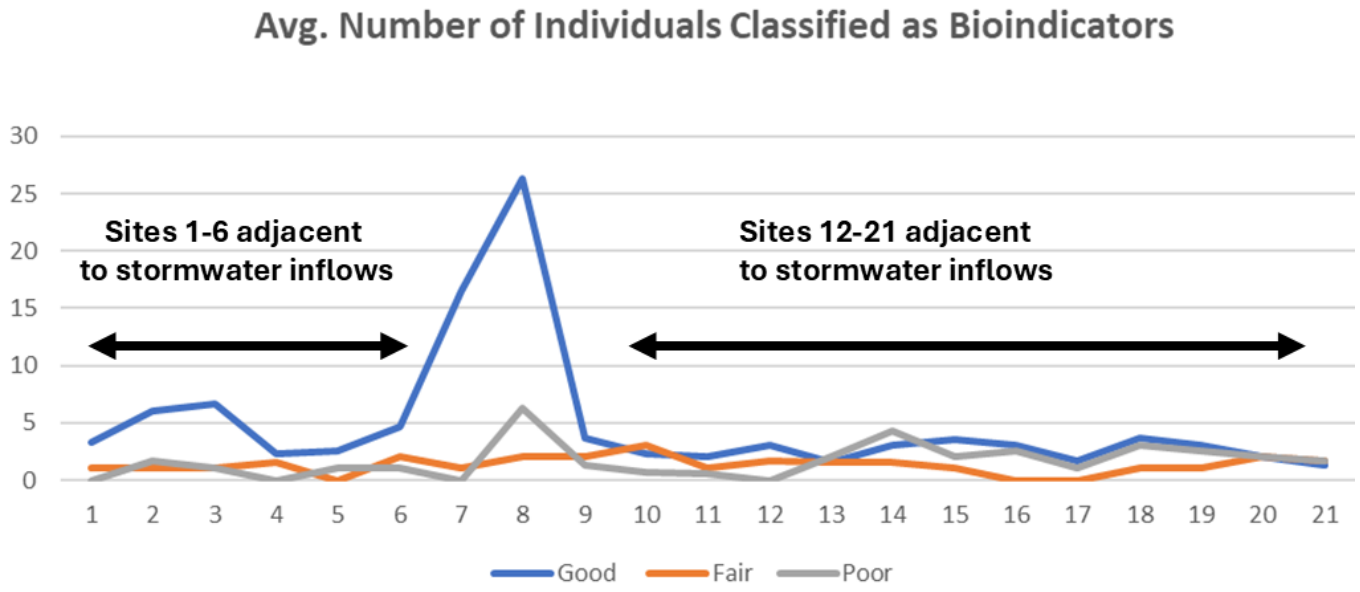
In 2023, FOSLP engaged Chris Reeves to conduct a Benthic Invertebrate survey which is provided in Appendix F. The presence of Ephemeroptera (Mayfly), Plecoptera (Stonefly) and Trichoptera (Caddisfly), or EPT, are indicators of good water quality and overall ecosystem health and can be considered a good benchmark for monitoring future progress.

The results indicated that the number of species identified was notably lower near the stormwater inflow sites. The report concludes that Swan Lake, given the taxa found and percentage of EPT, is currently of fair or intermediate water quality.



Swan Lake is host to 16 taxonomic classes, these were categorized as good, fair or poor as bioindicators.

- Ephemeroptera (Mayflies), Trichoptera (Caddisflies), and Anisoptera (Dragonflies) were identified and categorized as bioindicators of good water quality.
- Gerridae (Water Strider), Zygoptera (Damselflies) Amiphipoda (scuds), Isopoda (Isopods) were categorized as fair water quality bioindicators.
- Diptera [this includes 2 species of Midge, as well as Aedes sp. (Mosquito), Corixidae (Water Boatmen), Gastropods (Snails), and Nematoda sp. (Nematode worm) were categorized as poor or low water quality.
- Species that could not be used as water quality bioindicators included Ranatra (Water scorpion), and Coleoptera (2 different species of Water Beetle).
- Although Ranatra and Coleoptera were removed as water quality indicators their presence has been associated with elevated levels of salinity, also water boatmen and water striders are also associated with saline rich environments.



The TRCA has been actively involved in the rehabilitation of the water quality in Swan Lake since 2021. They have undertaken projects such as removal of phragmites, planting of wild celery as a pilot project to restore aquatic life, a fish inventory program and a proposal to redesign the shoreline which included recommendations related to preserving the habitat for resident turtles and other species.

The TRCA was engaged to undertake a fish inventory and removal of bottom feeding fish such as carp and goldfish from Swan Lake. The following table summarizes the fish species identified through 2024. Brown Bullhead, Common Carp and Goldfish are euthanized while Fathead minnows are returned to the lake.

Date	Fish Species	Number of Fish
April 2021 (3 days electrofishing + 2 days nets)	Brown Bullhead	210
	Common Carp	7
	Fathead Minnow	>10,000
August 2022 (1 day electrofishing, 1 day nets)	Brown Bullhead	80
	Common Carp	20
	Fathead Minnow	875
August 2023 (1 day electrofishing)	Brown Bullhead	84
	Common Carp	103
	Fathead Minnow	14
	Goldfish	2
April 2024 (1 day electrofishing, 1 day net)	Brown Bullhead	193
	Common Carp	1
	Fathead Minnow	1521
	Goldfish	13
	Common Carp x Goldfish	59
	Emerald Shiner	1

The long-term plan has provisions for restocking the lake with a variety of fish species when the water quality is amendable. In spring of 2025, 500 small largemouth bass were added.

Aquatic Plants

Drone Imagery of Wild Celery May 2025

In 2023, Markham introduced submerged aquatic vegetation (macrophytes) to improve algae levels. The TRCA was engaged to initiate a pilot program of planting Wild Celery ("Vallisneria americana") in four restricted areas. The report notes that Wild Celery has proven to be effective in absorbing nutrients for algae control and for stabilizing sediments to reduce turbidity.

The TRCA reports attribute the lack of success of the 2023 plantings to turbidity which prevented light from penetrating to the greater depths and to the fluctuating lake levels. The report makes no reference to whether high chloride levels in the lake were a possible factor.

The TRCA preliminary comments on the program note that:

a) In 2023, the 1500 stems were planted at 0.3 – 1.0 m deep, the mid-point for optimal growing depths for Wild Celery. Approximately 90% beyond the 30 cm. mark were absent in 2024 with a few persisting in deeper nodes. Only about 30% of the plantings were found at 30 cm depth.
b) Another 1500 stems were planted in 2024 between 20 – 40 cm.
c) Recommendation is to observe the success of the 2024 plantings through 2025 and if successful follow up with more plantings in 2026 in adjacent areas and other shallow areas.

The following tables list the aquatic plantings that were proposed in the 1993 Environmental Management Study[1]. An asterisk* denotes species existing at that time.

Open Waters: 0.5 m to 1.5 m deep	
pond lily	*Nuphar variegatum*
water lily	*Nymphaea odorata*
pondweed	*Potamogeton richardsonii*
pondweed	*Potamogeton pectinatus*

Lake margins and waters to 0.75 m deep	
bur-reed	*Sparganium eurycarum*
sweet flag	*Acorus calamus*
soft-stem bulrush	*Scirpus validus*

Shores and waters to 0.5 m deep	
narrow-leaved cattail	*Typha angustifolia**
wide-leaved cattail	*Typha latifolia*
giant reed	*Phragmites australis**
river bulrush	*Scirpus fluviatilis*

Shores and waters to 0.25 m deep	
blue flag	*Iris veriscolor*
pickerelweed	*Pontedaria cordata*
arrowhead	*Sagittaria latifolia*
water plantain	*Alisma plantago-aquatica*

Lake riparian zone	
bulrush	*Scirpus atrovirens*
bulrush	*Scirpus cyperinus*
rush	*Juncus effusus*
spike rush	*Eleocharis palustris*
reed canary grass	*Phalaris arundinacea**
sedges	*Carex lacustris**
Joe-Pye-weed	*Eupatorium maculatum*
rice cutgrass	*Leersia oryzoides*
marsh milkweed	*Asclepias incarnata*
ninebark	*Physocarpus opulifolius*
red-osier dogwood	*Cornus stolonifera**
nannyberry	*Viburnum lentago*
highbush cranberry	*Viburnum trilobum*
willow	*Salix eriocephala**

Actions Recommended:

1) While increased plantings may be beneficial in reducing algae and reducing turbidity, an assessment is required as to how impactful this is as a lake management option to reduce algae. How much of the lake would need to be planted and how long would it take compared to future chemical treatments or other lake management options?
2) Undertake an extensive Benthic Monitoring survey for use as a benchmark for monitoring improvements.
3) Review shoreline and other areas for improvements in habitat for fish, turtles and other aquatic life.
4) Implement an aquatic and shoreline planting strategy
5) Stock lake with lower-level aquatic species to help control algae
6) Implement options to minimize chloride inflows

D) Developing a Habitat Preservation Plan

FOSLP has completed all of the species and habitat work it can do as a citizen-led group.

To preserve the biodiversity in Swan Lake Park, the guidance of an environmental specialist is required to interpret the data collected, to provide an assessment of the current habitat and to outline recommendations for actions that can be initiated to preserve or improve the habitat and biodiversity of Swan Lake Park.

Building upon the current bird species information and the terrestrial information gathered by FOSLP, a Biodiversity Assessment Report by professional environmentalists will outline recommendations on ways to secure the existing biodiversity in the Swan Lake Park.

The outcome will be a report that includes an assessment of the current habitat and recommended steps to be undertaken to preserve and enhance the habitat for the bird species identified by the TRCA as being at risk as well as other species at risk such as mammals, turtles, Monarch Butterflies and insects.

Anticipated Outcomes:

1) A professional assessment of the current status of the habitat for the bird species at risk will identify which species should be the focus of rehabilitation efforts.
2) Recommendations on what actions FOSLP and others can do to stabilize or improve upon the current habitat.
3) Recommendations on what actions FOSLP or others can do to mitigate the impact of the increased urbanization on all bird species (e.g.: minimize bird kills associated with the new towers).
4) This project will have a direct impact on the Swan Lake Citizen Science Lab
    a. It will provide an example of the approaches and processes that can be used by other citizen science environmental groups in building the essential information for professional assessments.
    b. Specific action plans will be shared with other regional environmental groups participating in the project and regionally, nationally and internationally.
5) This project will have a direct impact on the Swan Lake Water Quality Plan by providing guidance to Markham on several critical elements required to preserve the biodiversity of Swan Lake by:

a) Identifying which bird species are dependent upon a healthy aquatic environment.

6) Outlining specific recommendations on actions that can be undertaken to improve the aquatic and shoreline environment particularly for wetland species.

E) Actions to Facilitate Human Interaction

One of the core challenges is to balance the environmental goals of preserving the biodiversity of the park given the increasing urbanization of the area.

72% of the respondents to the June 2025 Questionnaire indicated they were concerned about the impact of the increased urbanization of the area on the park and 71% were concerned about the increase in visitor traffic on the wildlife.

The questionnaire asked the area residents for their views on which features they would support to accommodate the expected increase in use of the park by the expanding neighbourhood and whether they were supportive of having the park designated as a "Destination Park" and promoted to tourists visiting Markham.

Possible Features of Swan Lake Park as a "Destination Park"

The residents supported the following potential enhancements to the park:

- 81% said they would support the installation of waterfalls
- 78% would support the creation of "Forestry Therapy" areas within the park.
- 54% would support the recreational nodes around the lake to enhance shoreline access

The residents were less supportive of the following:

a) Only 43% indicated they would support the installation of a boardwalk across the lake that would extend the pathways and open outlets for fishing.

b) 45% were in favour of installing a small parking lot in the south-western area of the park.

54% were in favour of having the park declared a "Destination Park."

References

1) Swan Lake Community Environmental Management Study, December 1993, Cosburn Patterson Wardman Limited
2) Rouge River State of the Watershed Report, Terrestrial System, Toronto and Region Conservation Authority, 2008
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5) Swan Lake Park, Parks Operation and Parks Refresh Draft Plan, November 2, 2020
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8) Swan Lake Water Quality Management Plan, City of Markham, Nov. 16, 2021
9) Markham Forest Study 2022: Technical Report, Toronto and Region Conservation Authority
10) Eco Park Questionnaire, Friends of Swan Lake Park, March 2022
11) Designating Swan Lake Park as a Significant Component of Markham's Natural Heritage Network Lands, Friends of Swan Lake Park, June 2022
12) Invasive Species in Ontario, Ontario Natural Resources and Forestry, December 2023
13) Shoreline Enhancement Questionnaire, Friends of Swan Lake Park, March 2024
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15) City of Markham Natural Assets Inventory and Evaluation Study: Consolidated Report, May 2024
16) Natural Area Management Guidebook, Natural Heritage Management Plan, Markham, May 2024
17) Invasive Plant Species Management Plan, Natural Heritage Management Study, Markham, May 2024
18) State of Canada's Birds, Birds Canada and Environment and Climate Change Canada, Nov. 2024
19) Noxious Weed List, Ontario Ministry of Agriculture, Food and Agribusiness, April 2025
20) Natural Heritage Status and Destination Park Questionnaire, Friends of Swan Lake Park, May 2025
21) eBird Canada website eBird - Discover a new world of birding... https://ebird.org/home
22) NatureCounts, an interactive data portal sponsored by Birds Canada
23) Water Efficient Plants: Selection Guide, York Region Environmental Services
24) Planting for Pollinators, Environmental Alliance, York Region

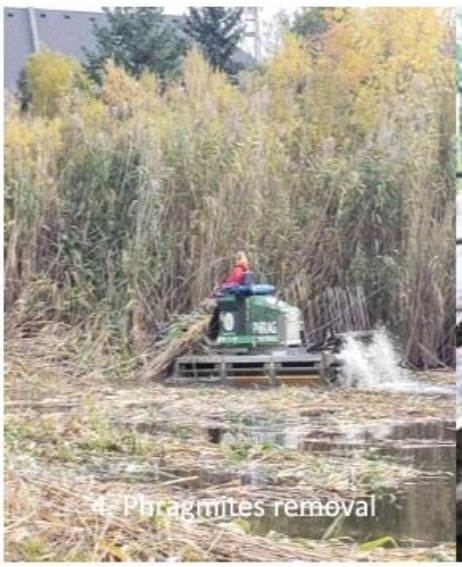
Detailed listing of bird and plant species in Swan Lake Park available on request from friends@friendsofswanlakepark

APPENDIX A: Markham's Park Improvement Program

Since 2021, Markham's Park Staff have undertaken a series of improvements to the features in the Swan Lake Park**,** including a program for removal of phragmites and other invasive plant species.

The following slides were presented by Markham staff at a public meeting on March 25, 2024.

PRESERVING THE BIODIVERSITY OF SWAN LAKE PARK


4. Phragmites removal


5. Shoreline improvements

6. Educational outreach


Bank erosion project


Post and rail replacement


Benches upgraded with center arm rest

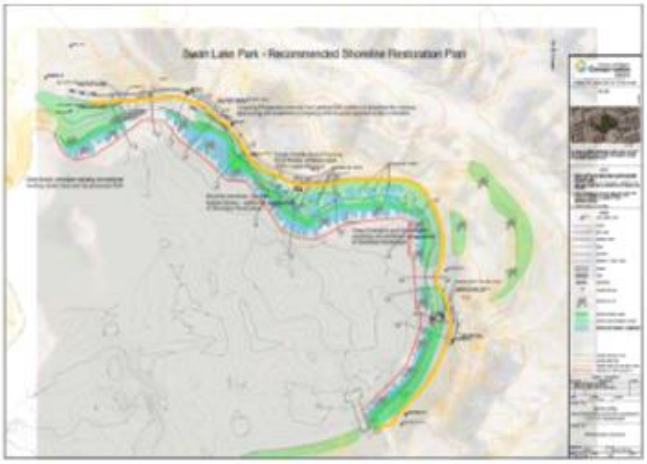

rfacing Pathway resurfa


Mulch tree rings in


Bridge Replacement

The following slide, released June 2025, outlines the plan for goose restraint fencing that is expected to be installed along the eastern shoreline in 2025.

- The City is advancing the approved shoreline restoration plan which includes permanent barrier fence for waterfowl in the area where Phragmites was removed as shown by the thick yellow line of the restoration plan and image of typical fencing which will be closer to the waters edge when constructed.



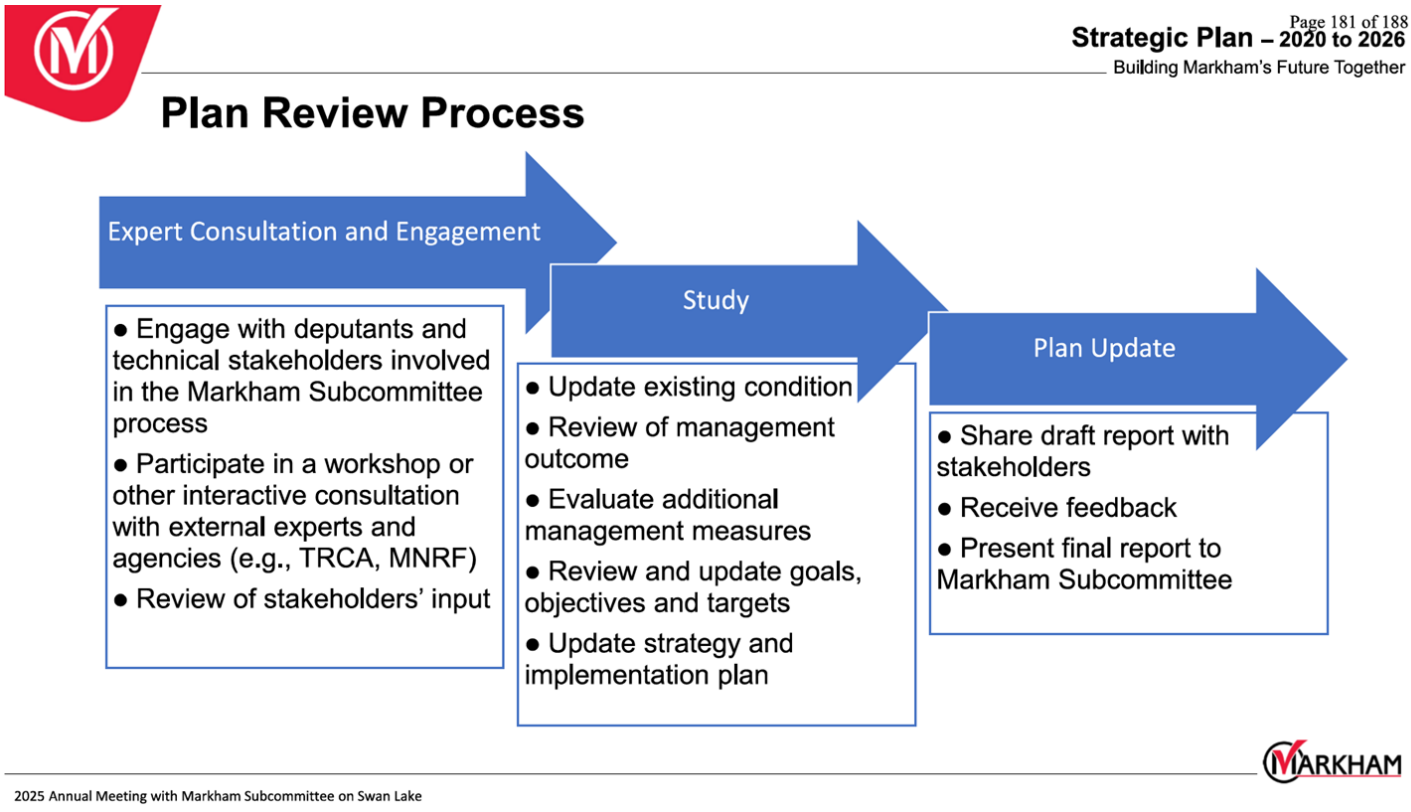
MARKHAM

025 Annual Meeting with Markham Subcommittee on Swan Lake

APPENDIX B: Markham's 2021 Water Quality Program

In December 2021, Markham Council approved the Swan Lake Long-term Water Quality Plan[8] which describes a phased adaptive approach, including provisions for periodic chemical treatments initially every three years. Highlights of the plan are summarized below including several actions related to Natural Features such as aquatic, and shoreline planting and potential fish stocking . A review of Phase 1 of the Plan (the initial 5-years) is scheduled for 2026.

At the request of FOSLP, Markham Council asked staff to consider incorporating a "workshop" of independent consultants in 2026 to review the proposed amendments to the long-term plan before being submitted to Council for approval.



a) Phase 1 Goal and Interim Targets

The long-term plan includes the following goal statement.

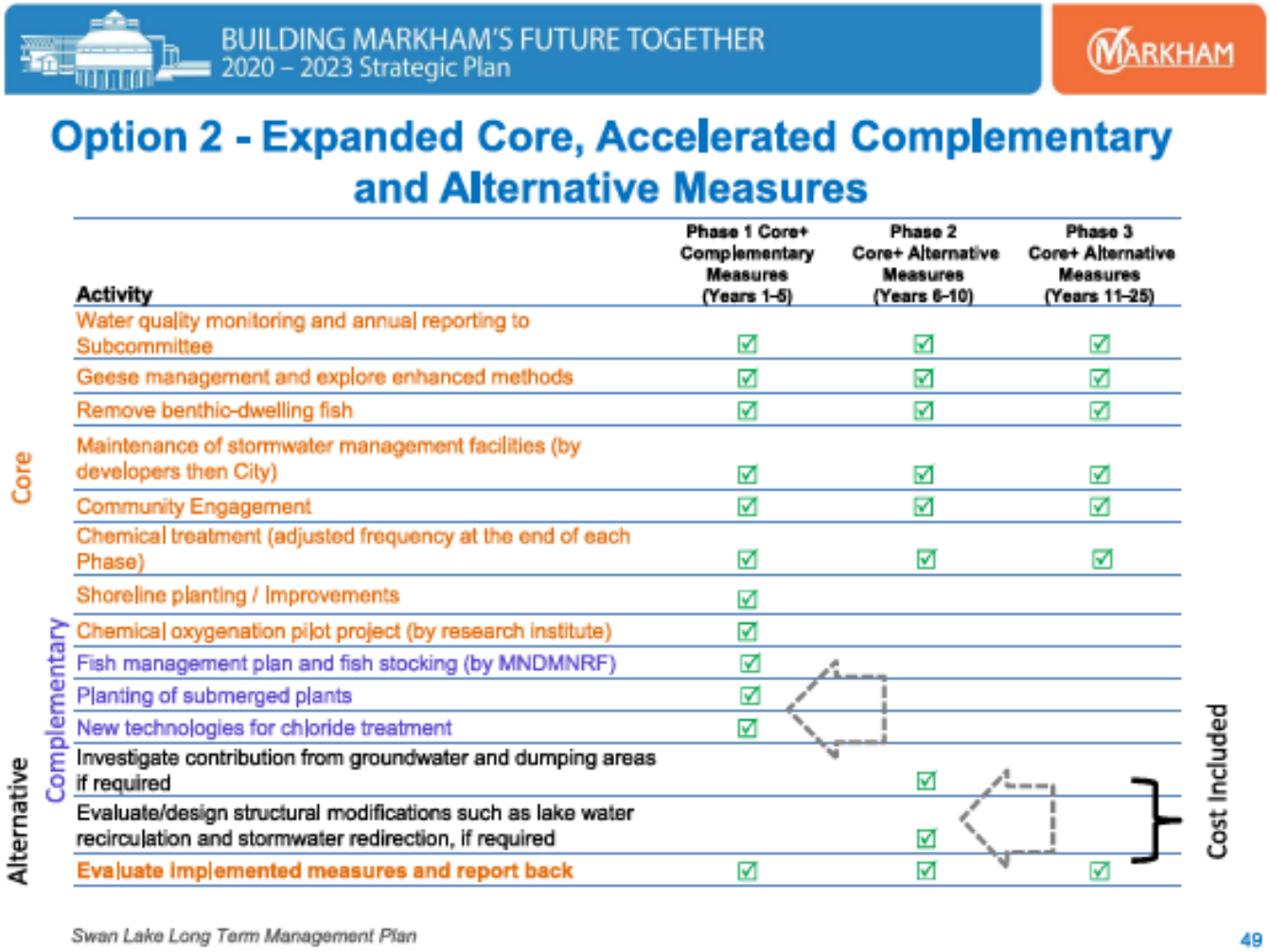
> ***GOAL:*** *To improve the overall health of Swan Lake, which will provide opportunities for no-contact activities for the enjoyment of the community.*

The table below sets out the "Interim" water quality targets for the initial five year period (2021 – 2025).

Parameter	Current Values	Interim Target	Objective and Rationale
Total Phosphorus (µg/L)	>200	50 - 100	Current value: the average of growing season TP values in the period since 2016 has been 200. Interim target: will provide a low eutrophic condition in the first year after treatment increasing to eutrophic in year 3.
Secchi Transparency (m)	< 0.5	0.6 – 0.8	Based on correlation with the phosphorus target. Secchi is also a substitute for Chlorophyll a.
Frequency of algae blooms	Annual	Every 3 years	Trigger for treatment every three years
Internal phosphorus load (kg/yr.)	53	0 - 25	Both internal and external loads should be controlled to achieve the lake concentration target (see above)
External phosphorus load (kg/yr.)	30	15	

b) Phase 1 Scheduled Activities

Based on subsequent discussions and undertakings, Markham's current activities closely mirror the "Option 2" activities outlined in the original plan.



c) Actions Undertaken by Markham Staff Since December 2021

Actions undertaken by Markham staff include:

i) Measure IL1: A Poly Aluminum Chloride (PAC) treatment was applied in July 2021 and a second treatment during the summer of 2024.

ii) Measure OL1: In 2023, Markham installed an oxygen monitor at the dock to track oxygen levels over a 24-hour cycle.

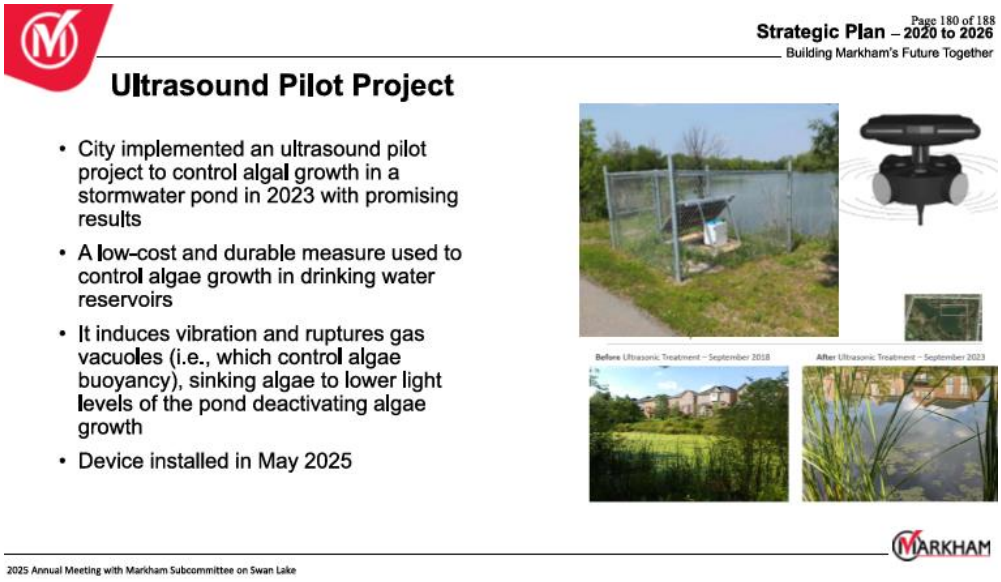
iii) Measure NF2: In 2023, the Toronto Region Conservation Authority ("TRCA") initiated a pilot aquatic plant project with the planting of wild celery in five areas. Only about 30% of the plantings were successful in the shallow area (less than 0.3 m) and only 10% in the deeper locations.

iv) Measure EL3: The TRCA recommended redesigning the shoreline around the lake to restrict Canada geese and to improve recreational access to the lake. Removal of phragmites was undertaken in 2022 and 2023 by the TRCA. Installation of shoreline fencing is expected in 2025 but Markham staff are not recommending improved recreational nodes due to cost. FOSLP has appealed to Council for additional shoreline enhancements.

v) Measure IL2: The TRCA was engaged to undertake a fish inventory and removal of bottom feeding fish such as carp and goldfish from Swan Lake. Brown Bullhead, Common Carp and Goldfish are euthanized while Fathead minnows are returned to the lake. The TRCA recommended that the Brown Bullhead should be returned to the lake, rather than removed, since they are a native fish, and it is important to have some benthic feeders in a lake ecosystem. The long-term plan has provisions for restocking with a variety of fish species when the water quality improves. In the spring of 2025, 500 small largemouth bass were added to the lake.

Ultrasonic Device Spring 2025

In 2024, Markham initiated a pilot project for controlling algae in a stormwater pond using an ultrasound device that uses sound waves to control algae growth. The city notes that the ultrasound devices are low-powered and do not affect animals, birds or humans.



d) Additional Actions Proposed by FOSLP

Friends of Swan Lake Park proposed four actions following the adoption of the long-term plan.

i) Measure CL2: In 2022, FOSLP recommended research by a York University research team into the use of BioChar (a type of charcoal filter) into the removal of nutrients and chloride from the lake system. This application may be feasible in stormwater inflow areas or in concert with flows directed through the North Channel. Markham staff, based on the recommendations of their consultant AECOM, requested budget funding to support continuing research into this possible application.

ii) Measure CL3: FOSLP submitted two reports detailing the source of the stormwater flows into the lake with recommendations on rerouting the flows. Subsequently, Markham staff undertook an analysis of the inflows confirming that the stormwater sources were contributing on average 3.2 metric tonnes of chloride each year. These reports triggered two actions: a) removal of the blockage in one of the stormwater pipes that was triggering excess flows into the lake, and 2) Council approval of $150,000 for a "Flow Diversion Study" into the feasibility of rerouting stormwater flows as proposed by FOSLP. The report was released in June 2025 outlining various options that would reduce inflows by over 90%. Due to cost involved, staff have recommended that consideration of adopting these measures be deferred until Phase 3 (2030 or later).

iii) Measure OL1: In May 2022, FOLSP recommended research by Fleming College into the use of calcium peroxide as a source for improving oxygen levels. Based on AECOM's analysis, Markham has declined to proceed with this "early stage" research.

iv) Measure OL1: In May 2023, FOSLP requested approval for a University of Toronto research team to install an oxygenation device for three months on Swan Lake during the summer of 2023 at no cost to the city. It was expected that the research would help gauge the sensitivity of the sediments to mechanical aeration. Staff denied the request on the basis that previous recommendations by Freshwater Research had indicated that mechanical oxygenation would be detrimental to the rehabilitation efforts.

Table 9: Evaluation of Optional Measures

Issue	Measure No.	Description	Technical Feasibility and Effectiveness	Unit Cost
Internal Load	IL1	Chemical Treatment for Phosphorus Control	Feasible; lowers nutrient input from the most significant and bioavailable source and hence the most immediate and effective solution.	$150,000 per full application (three-year intervals)
	IL2	Bottom-Dwelling Fish Management	Feasible; lowers internal load release.	$18,000 initial $5000 annually
	IL3	Nitrogen Control (by pumping & treatment or artificial wetlands)	Water pumping and treatment will result in increased water temperature, and significant disturbance of the area. Artificial wetlands provide geese habitat and promote settling of solids beneath the mats. Nitrogen will be controlled by lowering productivity through other management measures, and does not need targeted treatment.	Significant
External Load	EL1	Geese Management (including Toogood Pond)	Feasible; lowers nutrient input from the most significant external source.	Existing measures: $27,000 annually New measures: $40,000 annually
	EL2	Stormwater Management Ponds Maintenance (2 wet ponds)	Feasible; lowers nutrient input; currently maintained by the developers and, once ponds are assumed, by the City.	$1500 annually $500,000 cleanout ($33,000 annualized)
	EL3	Shoreline Planting/ Improvements	Feasible; lowers nutrient input by blocking geese access to the Lake, intercepts nutrient runoff	$35,000 design $125,000 implementation
	EL4	Groundwater and historic dumping areas	Groundwater requires extensive investigation. A study of the dumping areas will involve the developers and private owners; low priority	Significant
Oxygen Level	OL1	Mechanical or chemical oxygenation	Mechanical circulation will have negative impacts because of sediment disturbance and nutrient release. Calcium peroxide may be used in a pilot project.	Pilot project TBD through a research institute
Chloride Level	CL1	Winter Maintenance on Private Land	Stakeholder engagement for snow and salt management will help reduce chloride concentration.	Privately funded
	CL2	Physical or Biological Treatment	Existing methods are not very effective; New technologies may be considered when proven effective.	TBD
	CL3	Redirecting Stormwater	Involves private landowners and York Region and detailed study to assess impacts/feasibility, and chloride levels may not impact desired aquatic biota; low priority.	Significant
Natural Features	NF1	Shoreline Planting/ Improvements	Feasible; will provide fish habitat	See EL3
	NF2	Planting of Submerged Water Plants	Feasible; will help solidify sediment and provide fish habitat	TBD
	NF3	Fish Management Plan and Fish Stocking	Feasible; once water quality improves.	TBD for the Plan MNDMNRF for Fish Culture program

APPENDIX C: Birds of Swan Lake Park

In November 2024, Birds Canada and Environment and Climate Change Canada released a study, the State of Birds in Canada[18]. The following summaries on the state of the various bird populations are extracted from the State of the Birds Report.

FOSLP integrated the species information from the State of Birds in Canada report and the species at risk assessment by the Toronto and Region Conservation Authority ("TRCA") with a listing of 184 bird species sighted in Swan Lake Park as reported on eBird.org in November 2024 and by local bird watchers.

The TRCA ratings for specific species were taken primarily from the Phase 1 Report, Markham Natural Heritage Inventory and Assessment Study[15] submitted by North-South Environmental to Markham Council in April 2021. The TRCA ratings of L2, L3 and L4 are applied to species of concern within the TRCA's jurisdiction. The TRCA ratings are relevant to those species that nest within the TRCA jurisdiction. Detailed information on the species nesting in Swan Lake Park was not available so further analysis is required to more closely identify specific nesting species of concern in Swan Lake Park.

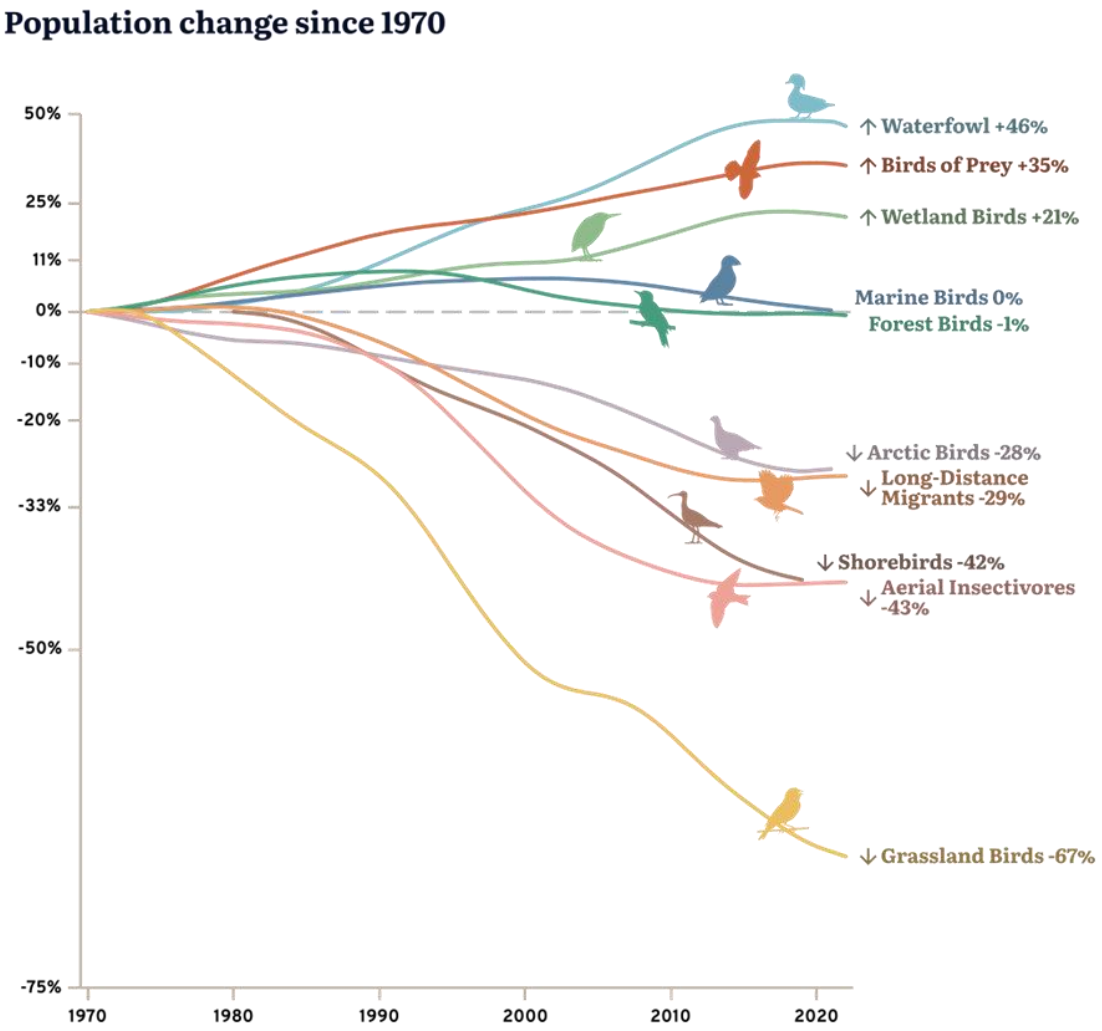
Due to the increasing urbanization of the area of particular concern for Swan Lake Park are species designated L3, species that can withstand minor disturbance and L4, those that can withstand some disturbance. The long-term objective is to find approaches that can stabilize these species.

TRCA Rating of Birds	
Species at Greatest Risks	**Secure or Non-Native Species**
L2: Of concern regionally, probably rare in TRCA jusrisdiction	**L5**: Species that are considered secure throughout the region
L3: Of concern regionally, able to withstand minor disturbance	**L+:** Introduced species, not native to the region
L4: Of concern in urban matrix, able to withstand some disturbance	**LV:** Sporadic breeder, species not recorded in region for past 10 yrs

The State of the Birds Report identified long-distance migrants as a separate group. These birds migrate primarily to tropical regions, and they have declined by 29% since 1970. Habitat loss threatens them in all parts of their annual cycle, and their long journeys expose them to other risks. International cooperation is key to their conservation.

Over 70% of the species sighted in Swan Lake Park are categorized as either Forest Birds, Wetland Birds or Aerial Insectivores. The national change in these species since 1970 is summarized below.

National Change Since 1970 in Types of Birds Sighted in Swan Lake Park					
Grouping	**# Swan Lake Species**	**Increasing**	**Little Change**	**Decreasing**	**No Data**
Forest Birds	120	33%	30%	34%	3%
Wetland Birds	63	38%	30%	25%	6%
Aerial Insectivores	30	17%	10%	67%	7%



The following table summarizes the TRCA ratings for the different species reported in Swan Lake Park using the groupings outlined in the State of Birds Report.

ALL BIRDS SIGHTED	TRCA Ratings of Birds Recorded in Swan Lake Park								
Nature Counts Canada and eBird.org Groupings	Species at Greatest Risk					Not			
	L2	L3	L4	L5	LV & L+	Rated	Total	% of Total	% At Risk
Forest Birds	4	29	15	18	6	17	**89**	48%	54%
Wetland Birds	4	12	9	3	2	2	**32**	17%	78%
Aerial Insectivores	1	2	8	2	1	1	**15**	8%	73%
Birds of Prey	3	3	4	2			**12**	7%	83%
Grassland Birds	1	3	2				**6**	3%	100%
Not Categorized	0	1	2	1	1	2	**7**	4%	43%
Marine, Shorebirds, Arctic Birds	1	5	2			15	**23**	13%	35%
Total	**14**	**55**	**42**	**26**	**10**	**37**	**184**	100%	60%
% of Total Species At Risk	8%	30%	23%	14%	5%	20%	100%		
Source: ebird.org, Nature Counts Canada, TRCA									

The table highlights that 60% of all of the recorded species in Swan Lake Park are considered to be at risk in the TRCA's jurisdiction with over 70% of the wetland birds and aerial insectivores rated to be at risk.

Swan Lake has been described by ecologists from the University of Toronto as a "constructed wetland", so the 32 Wetland Birds reported in Swan Lake Park are of particular concern.

In Swan Lake Park, 55 species or 30% of all species are categorized as L3 - those able to withstand only minor disturbance.

i) Forest Birds[18]

Forest birds live in Canada's coniferous, deciduous, and mixed forests. The birds in this group are as varied as the forests themselves. This large group contains mostly songbirds like vireos, warblers, thrushes, flycatchers, finches, and sparrows. A few birds of prey and several gamebirds like grouse are also forest dwellers.

Nationally, forest bird populations appear stable overall, but only because roughly the same number of species are increasing as are decreasing. Understanding which species are declining and why is key to taking conservation action for this group.

Like many long-distance migrants, forest birds that migrate from Canada's forests to those in the tropics have declined as a group by 17% since 1970. These birds' long journeys expose them to many risks, and the loss of forests in Central and South America is a significant threat.

In contrast, birds that spend their entire year in Canada's forests have shown a modest increase of 19% since 1970. This suggests that many of Canada's forests are doing okay, though some regions and forest types are facing more threats than others.

FOREST BIRDS	TRCA Ratings of Birds Recorded in Swan Lake Park								
Nature Counts Canada and eBird.org Groupings	Species at Greatest Risk					Not Rated	Total	% of Total	% At Risk
	L2	L3	L4	L5	LV & L+				
Total Long Distance Migrants	**3**	**14**	**6**	**4**	**0**	**8**	**35**	**39%**	**66%**
Wood Warblers	3	9	1	1	0	5	**19**	21%	68%
Thrushes	0	2	0	0	0	2	**4**	4%	50%
Vireos	0	1	1	1	0	1	**4**	4%	50%
All Other Long-distant	0	2	4	2	0	0	**8**	9%	75%
Total of Other Forest Birds	**1**	**15**	**9**	**14**	**6**	**9**	**54**	**61%**	**46%**
New World Sparrows	0	2	1	2	0	5	**10**	11%	30%
Wood-Warblers	0	2	1	0	0	4	**7**	8%	43%
Woodpeckers	0	3	3	1	0	0	**7**	8%	86%
All Other Forest Birds	1	8	4	11	6	0	**30**	34%	43%
Total All Forest Birds	**4**	**29**	**15**	**18**	**6**	**17**	**89**	**100%**	**54%**

Long distant migrants represent 39% of the Forest Birds found in Swan Lake Park but represent the highest level of at risk (66%). Other Forest Birds not categorized as long-distant migrants represent 61% of the species. While only 46% are flagged as a risk, it still represents the same number of species (25) as long distant migrants (23).

Threats

The loss or alteration of forests threatens the birds that rely on them. Logging, mining, urbanization, and development impact forests both in Canada and where these birds spend their nonbreeding seasons. Climate change is affecting forests too, altering the timing of seasonal events and worsening wildfires.

Predation by outdoor cats is a major threat to many birds in this group, especially when migration brings them into urban and rural areas. Window collisions also take a heavy toll on migrating forest birds.

ii) Wetland Birds (Increase 21%)[18]

Wetland birds are a diverse group of species that live in vegetated, freshwater habitats. This group includes some ducks and geese, as well as other swimming and diving birds like loons and grebes. There are also species that wade at the water's edge or skulk through vegetation, like herons and rails, and a few water-loving songbirds too. This report focuses on wetlands that lie south of the boreal forest, which face the greatest pressure from human activity.

Overall, wetland bird populations have increased slightly since 1970. There has been much investment in wetland conservation and stewardship since the mid-1900s, and these efforts likely underpin this rise. Despite the positive group trend, some species have declined. Continued action is needed to preserve wetland habitat for these and other members of this group.

Canada's wetland bird populations show a slight increase of 21% since 1970. This upward trend is hopeful, but it is strongly influenced by several ducks and geese whose populations have grown substantially. Some other birds in this group have not benefited as much from past conservation work and have more worrying trends that must be addressed.

Wetland Waterfowl (Increase 74%)

Waterfowl that rely on freshwater wetlands have increased by 74% since 1970, likely as a result of both waterfowl conservation efforts and the availability of waste grain on their migratory routes. Some of these birds have begun to decline recently, but their trends still raise the average for wetland birds as a whole.

Other Wetland Birds (Increase 1%)

Besides waterfowl, populations of other birds that rely on wetlands have not changed much at all. This diverse group includes gulls, herons, grebes, songbirds, and others.

Population Changes by species

Wetland bird population trends are highly variable among species. Many populations are increasing, likely as a result of wetland conservation efforts in the last half-century. Many others are declining though, as wetland loss and degradation is still a threat in many areas. Ongoing work to preserve wetlands is vital for this group.

As a "constructed wetland", Swan Lake plays an important role in supporting both migratory wetland species and those that chose to reside in the park.

Wetland Birds	TRCA Ratings of Birds Recorded in Swan Lake Park								
Nature Counts Canada and eBird.org Groupings	Species at Greatest Risk					Not Rated	Total	% of Total	% At Risk
	L2	L3	L4	L5	LV & L+				
Total Wetland Birds	4	12	9	3	2	2	**32**	**36%**	**78%**
Ducks	2	4	2	1	1	2	**12**	13%	67%
Herons, Ibis and Allies	0	4	1	0	0	0	**5**	6%	100%
Waterfowl	0	1	1	1	1	0	**4**	4%	50%
All other species	2	3	5	1	0	0	**11**	12%	91%

Threats

The biggest threat to wetland birds is the destruction or degradation of the wetlands they rely on. About 70% of wetlands in southern Canada were lost to development and agriculture by 1990. These sensitive habitats are also particularly vulnerable to the effects of climate change and pollution.

Healthy and abundant wetlands are critical for this group. Wetlands also help us fight climate change by storing more carbon than any other ecosystem and acting as sponges that buffer nearby communities from floods and droughts.

iii) Aerial Insectivores[18]

Aerial insectivores are linked by their unique feeding strategy of catching insects in flight. Many are among Canada's fastest and nimblest fliers and put on spectacular displays in their aerial pursuits. This group includes the swallows, swifts, nightjars, and flycatchers.

Canada's aerial insectivore populations have declined since 1970, and we are only just beginning to understand why. Their population freefall has leveled off in recent years, but while this is a hopeful sign, population levels are far below where they should be. Conservation action is needed to reverse the losses in these vulnerable birds.

Aerial Insectivores (Decline 43%)

Aerial insectivore populations in Canada have declined by 43% since 1970. That decline appears to have gradually leveled off in recent decades, but populations are now much lower than they were 50 years ago.

Flycatchers (Decline 23%)

Flycatchers catch flying insects by flitting out from a perch. They have declined by 23%. Trends within this group are varied: some species are increasing but others, like the Olive-sided Flycatcher, are in steep decline.

Swifts, swallows, and nightjars (Decline 60%)

These three families capture insects, falling most steeply in the 1990s. The decline seems to have leveled off, and some populations are beginning to increase.

Aerial Insectivores benefit from the wetland features of Swan Lake. Swan Lake Park hosts 15 different species of which 11 (73%) are listed as at risk.

AERIAL INSECTIVORES	TRCA Ratings of Birds Recorded in Swan Lake Park								
Nature Counts Canada and eBird.org Groupings	Species at Greatest Risk L2	L3	L4	L5	LV & L+	Not Rated	Total	% of Total	% At Risk
Total Long Distance Migrants	0	2	6	1	1	1	**11**	**12%**	**73%**
Tyrant Flycatchers	0	0	4	0	1	1	**6**	7%	67%
Martins and Swallows	0	1	1	1	0	0	**3**	3%	67%
All Other Long-distant	0	1	1	0	0	0	**2**	2%	100%
Total Other Aerial Insectivores	1	0	2	1	0	0	**4**	**4%**	**75%**
Total All Aerial Insectivores	1	2	8	2	1	1	**15**	**17%**	**73%**

Threats

The threats affecting aerial insectivores are complex and not entirely understood. Declines in insect populations are likely a driving factor. These may be caused by pesticide use, farming practices, wetland drainage, introduced plant species, and the effects of climate change. Many of these birds also rely on wetland or grassland habitats, which are disappearing or being degraded. Threats to these species occur throughout their life cycles, during breeding, roosting, migration and on the nonbreeding grounds.

iv) Ontario and Federal Bird Species at Risk

Fifteen bird species reported in Swan Lake Park are listed on the Ontario ("SARO") and the Federal government's official listing of species at risk in Canada ("SARA") and on the listing of species of concern by the Committee on the Status of Endangered Species in Canada ("COSEWIC"). Six of the species are Forest Birds of which 5 are rated L2 or L3 within the TRCA jurisdiction. Another six species are Aerial Insectivores of which 3 are rated as L2 or L3 by the TRCA.

SARA//COSEWIC/SARO Ratings of Birds Recorded in Swan Lake Park						
Common Name	**Scientific Name**	**LD Migrant**	**SARA**	**COSEWIC**	**SARO**	**TRCA**
FOREST BIRDS						
Prothonotary Warbler	Protonotaria citrea		END	END	END	L2
Barn Swallow	Hirundo rustica	Yes	THR	THR	SC	L4
Red-headed Woodpecker	Melanerpes erythrocephalus		END	END	END	L3
Wood Thrush	Hylocichla mustelina	Yes	THR	THR	SC	L3
Canada Warbler	Cardellina canadensis	Yes	THR	THR	SC	L2
Golden-winged Warbler	Vermivora chrysoptera	Yes	THR	THR	SC	L2
AERIAL INSECTIVORES						
Olive-sided Flycatcher	Contopus cooperi	Yes	SC	SC	SC	LV
Chimney Swift	Chaetura pe/agica	Yes	THR	THR	THR	L4
Eastern Wood-Pewee	Contopus virens	Yes	SC	SC	SC	L4
Bank Swallow	Riparia riparia	Yes	THR	THR	THR	L3
Common Nighthawk	Chordeiles minor	Yes	THR	SC	SC	L3
Eastern Whip-poor-will	Antrostomus vociferus		THR	SC	THR	L2
GRASSLAND BIRDS						
Eastern Meadowlark	Sturnella magna		THR	THR	THR	L3
Bobolink	Dolichonyx oryzivorus	Yes	THR	THR	THR	L2
WETLAND BIRDS						
Least Bittern	Ixobrychus exilis		THR	SC	THR	L2

SARA: Federal Species at Risk
COSEWIC: Committee on Status of Endangered Species in Canada
SARO: Ontario Species at Risk

SC Species of Concern
THR Threatened
END Endangered

APPENDIX D: Other Wildlife of Swan Lake Park

The following summary of terrestrial wildlife in Swan Lake Park was compiled from the photographic records of Don and Cindy Fowler, Kathleen Elizabeth Noel and Sheniz Janmohamed, members of Friends of Swan Lake Park

a) Mammals, Reptiles, Turtles, and Amphibians

It is worth noting that both native species of turtles, the Common Snapping Turtle (*Chelydra serpentina*) and Midland Painted Turtle (*Chrysemys picta*) that live and nest at the park are classified as Special Concern under the federal government's SARA Schedule 1. The Woodland Vole (*Microtus pinetorum*), which has also been recorded at the park is also classified as Special Concern under the federal government's SARA Schedule 1.

Mammals

1. North American Beaver
2. Eastern Coyote
3. Eastern Cottontail Rabbit
4. American Mink
5. Common Racoon
6. American Red Squirrel
7. Eastern Meadow Vole
8. Eastern Deer Mouse
9. Eastern Chipmunk
10. Grey Squirrel
11. Muskrat
12. Red Fox
13. Striped Skunk
14. Woodland Vole

Turtles

Native Species

1. Midland Painted Turtle
2. Common Snapping Turtle

Invasive Species

1. Red-eared Slider

Other Reptiles

1. DeKay's Brownsnake
2. Eastern Gartersnake

Amphibians

1. American Bullfrog
2. Green Frog
3. Northern Leopard Frog
4. American Toad

b) Arachnids:

1. Mackenzie's Thin-legged Wolf Spider (*Pardosa mackenziana*)
2. Dark Fishing Spider (*Dolomedes tenebrosus*)
3. European Harvestman (*Phalangium opilio*)
4. Shamrock Orb Weaver (*Arneus trifolium*)
5. Arrow-shaped Micrathena (*Micrathena sagittata*)
6. Flower Crab Spider (*Misumena vatia)*

c) Insects

Appendix F includes a copy of the Benthic Invertebrate Monitoring Report undertaken by Chris Reeves for FOSLP which identified additional species. It is worth noting that the Monarch Butterfly (*Danaus plexippus*) is listed as Endangered and the American Bumblebee (Bombus *pensylvanicus*) is listed as Special Concern under the federal government's SARA Schedule 1.

	Common Name	Scientific Name
INSECTS		
1	Bald Faced Hornet	*Dolichovespula maculata*
2	Black Blowfly	*Phormia regina*
3	Black Saddlebags Dragonfly	*Tramea lacerata*
4	Black-tipped Darner Dragonfly	*Aeshna tuberculifera*
5	Common Eastern Bumble Bee	*Bombus impatiens*
6	Cabbage White Butterfly	*Pieris rapae*
7	Canada Darner Dragonfly	*Aeshna canadensis*
8	Carolina Grasshopper	*Dissosteira carolina*
9	Eastern Carpenter Bee	*Xylocopa virginica*
10	Common Whitetail Dragonfly	*Plathemis lydia*
11	Eastern Amber Dragonfly	*Perithemis tenera*
12	Black Swallowtail Butterfly	*Papilio polyxenes*
13	Familiar Bluet Damselfly	*Enallagma civile*
14	German Yellowjacket	*Vespula germanica*
15	Great Black Wasp	*Sphex pensylvanicus*
16	Common Green Bottle Fly	*Lucilia sericata*
17	European Honeybee	*Apis mellifera*
18	Japanese Beetle	*Popillia japonica*
19	Large White Butterfly	*Pieris brassicae*
20	Monarch Butterfly	*Danaus plexippus*
21	Mustard White Butterfly	*Pieris oleracea*
22	Narrow-headed Marsh Fly	*Helophilus fasciatus*
23	Orange Sulfur Butterfly	*Colias eurytheme*
24	Painted Lady Butterfly	*Vanessa cardui*
25	Peck's Skipper Butterfly	*Polites peckius*
26	Question Mark Butterfly	*Polygonia interrogationis*
27	Red Admiral Butterfly	*Vanessa atalanta*
28	Red-legged Grasshopper	*Melanoplus femurrubrum*
29	Slender Spreadwing Damselfly	*Lestes rectangularis*
30	Viceroy Butterfly	*Limenitis archippus*
31	Western Conifer Seed bug	*Leptoglossus occidentalis*
32	Widow Skimmer Dragonfly	*Libellula luctuosa*
33	Yellow-legged Mud-dauber	*Sceliphron caementarium*
34	Eastern Tiger Swallowtail Butterfly	*Papilio glaucus*
35	Giant Swallowtail Butterfly	*Papilio cresophontes*

36	Pipevine Swallowtail Butterfly	*Battus philenor*
37	Mourning Cloak Butterfly	*Nymphalis antiopa*
38	American Painted Lady Butterfly	*Vanessa virginiensis*
39	Bicolored Striped Sweat Bee	*Agapostemon virescens*
40	Common Aerial Yellowjacket	*Dolichovespula arenaria*
41	Yellow-legged Meadowhawk Dragonfly	*Sympetrum vicinum*
42	Clouded Sulfur Butterfly	*Colias philodice*
43	Eastern Comma Butterfly	*Polygonia comma*
44	American Bumblebee	*Bombus pensylvanicus*
45	Silvery Blue Butterfly	*Glaucopsyche lygdamus*
46	White Admiral Butterfly	*Limenitis arthemis arthemis*
47	Red-spotted Purple Butterfly	*Limenitis arthemis astyanax*
48	Ebony Jewelwing Damselfly	*Calopteryx maculata*
49	Variable Eastern Taedia	*Taedia scrupea*
50	Clouded Plant Bug	*Neurocolpus nubilus*
51	Cocklebur Weevil	*Rhodobaenus quinquepunctatus*
52	Drury's Long-horned Bee	*Melissodes druriellus*
53	Bumble Flower Beetle	*Euphoria inda*
54	Grape Flea Beetle	*Altica chalybea*
55	Tiger Bee Fly	*Xenox tigrinis*
56	Golden Dung Fly	*Scathophaga stercoraria*
57	Organ Pipe Mud Dauber Wasp	*Trypoxylon politum*
58	European Paper Wasp	*Polistes dominula*
59	Willow Pinecone Gall Midge	*Rabdophaga strobiloides*
60	Thistle Stem Gall Fly	*Urophora cardui*
61	Blue Dasher Dragonfly	*Pachydiplax longipennis*
62	Two-spotted Bumble Bee	*Bombus bimaculatus*
63	Northern Dog-day Cicada	*Neotibicen canicularis*
64	Common Green Darner Dragonfly	*Anax junius*
65	Twenty-spotted Lady Beetle	*Psyllobora vigintimaculata*
66	Common Red Soldier Beetle	*Rhagonycha fulva*
67	Two-striped Grasshopper	*Melanoplus bivittatus*
68	Lily Leaf Beetle	*Lilioceris lilii*
69	European Fire Ant	*Myrmica rubra*
70	Isabella Tiger Moth	*Pyrrharcita isabella*
71	Eastern Black Carpenter Ant	*Camponotus pensylvanicus*
72	Ferruginous Tiger Crane Fly	*Nephrotoma ferrungina*
73	Common Green Lacewing	*Chrysoperia carnea*
74	Harlequin Bug	*Murgantia histrionica*
75	European Earwig	*Forficula auricularia*
76	European Mantis	*Mantis religiosa*
77	Road Duster	*Dissosteira carolina*
78	Fall Field Cricket	*Gryllus pensylvanicus*

79	Sedge Sprite Damselfly	*Nehalennia irene*
80	Skimming Bluet Damselfly	*Enallagma geminatum*
81	Eastern Amberwing Dragonfly	*Perithemis tenera*
82	Locust Borer Beetle	*Megacyllene robinae*
82	Woods Firefly	*Photuris pennsylvanicus*
83	Common Wood-nymph Butterfly	*Cercyonis pegala*
84	Six-spotted Tiger Beetle	*Cicindela sexguttata*
85	Red Goldenrod Aphid	*Uroleucon nigrotuberculatum*
86	Seven Spot Ladybird	*Coccinella septempunctata*
87	Mock-orange Scissor Bee	*Chelostoma philadelphi*
88	Bramble Mason Wasp	*Ancisterocerus adiabatus*

d) Fish of Swan Lake

The TRCA was engaged to undertake a fish inventory and removal of bottom feeding fish such as carp and goldfish from Swan Lake. The following table summarizes the fish species identified through 2024. Brown Bullhead, Common Carp and Goldfish are euthanized while Fathead minnows are returned to the lake.

Date	Fish Species	Number of Fish
April 2021 (3 days electrofishing + 2 days nets)	Brown Bullhead	210
	Common Carp	7
	Fathead Minnow	>10,000
August 2022 (1 day electrofishing, 1 day nets)	Brown Bullhead	80
	Common Carp	20
	Fathead Minnow	875
August 2023 (1 day electrofishing)	Brown Bullhead	84
	Common Carp	103
	Fathead Minnow	14
	Goldfish	2
April 2024 (1 day electrofishing, 1 day net)	Brown Bullhead	193
	Common Carp	1
	Fathead Minnow	1521
	Goldfish	13
	Common Carp x Goldfish	59
	Emerald Shiner	1

The TRCA recommended that the Brown Bullhead should be returned to the lake, rather than removed, since they are a native fish, and it is important to have some benthic feeders in a lake ecosystem.

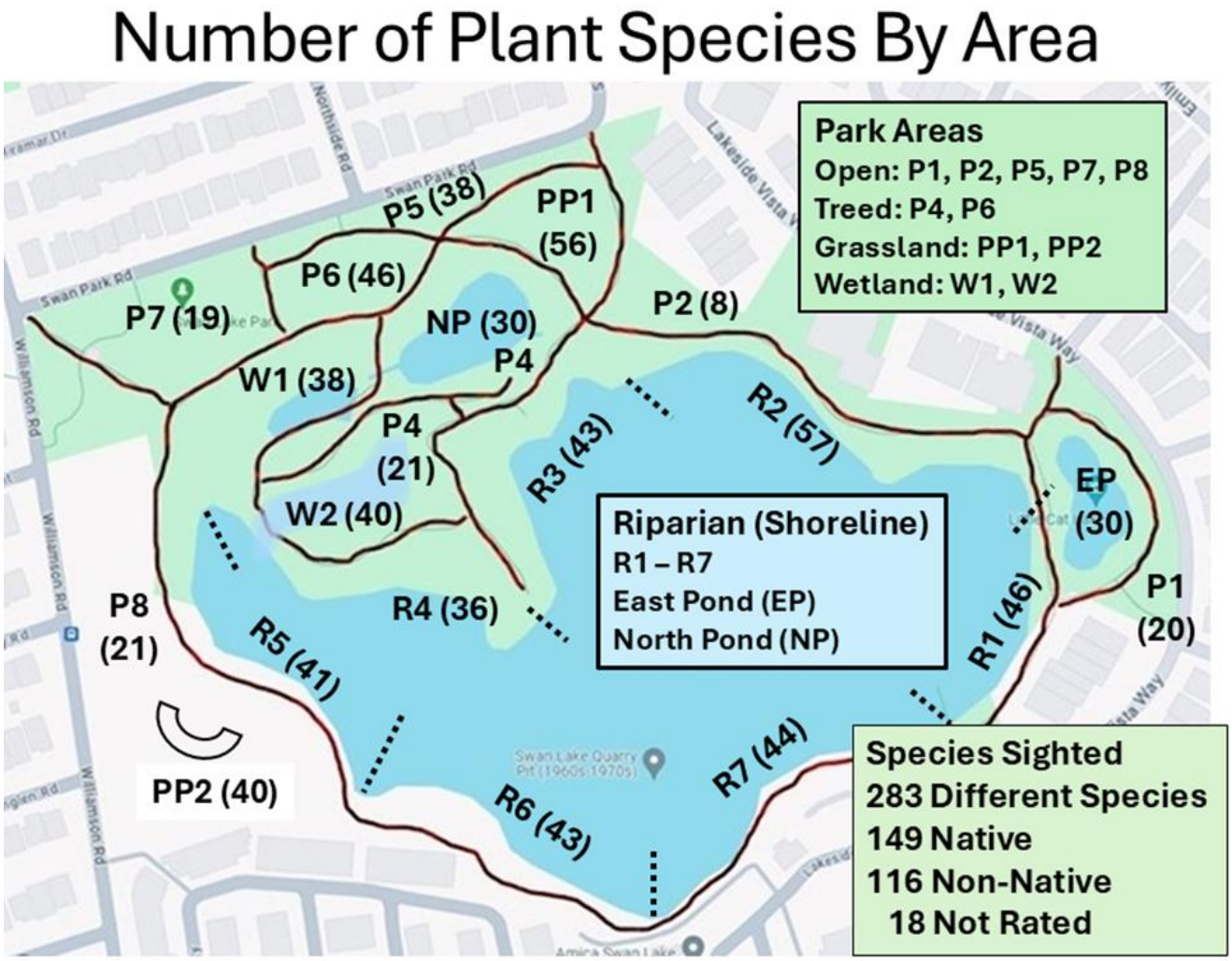
The long-term plan has provisions for restocking with a variety of fish species when the water quality improves. In the spring of 2025, 500 small largemouth bass were added to the lake and Bluegill may be added when they are available.

APPENDIX E: Terrestrial Diversity of Swan Lake Park

In August 2024, a group of 20 volunteers undertook a field inventory of the plants in Swan Lake Park, using cell phones linked to the PlantNet app which identifies plants based on leaves, bark or flowers. The volunteers recorded plants distributed across 20 different segments of the park. The different segments were categorized as Treed, Wetland, Shoreline, Grassland or Open Parkland.

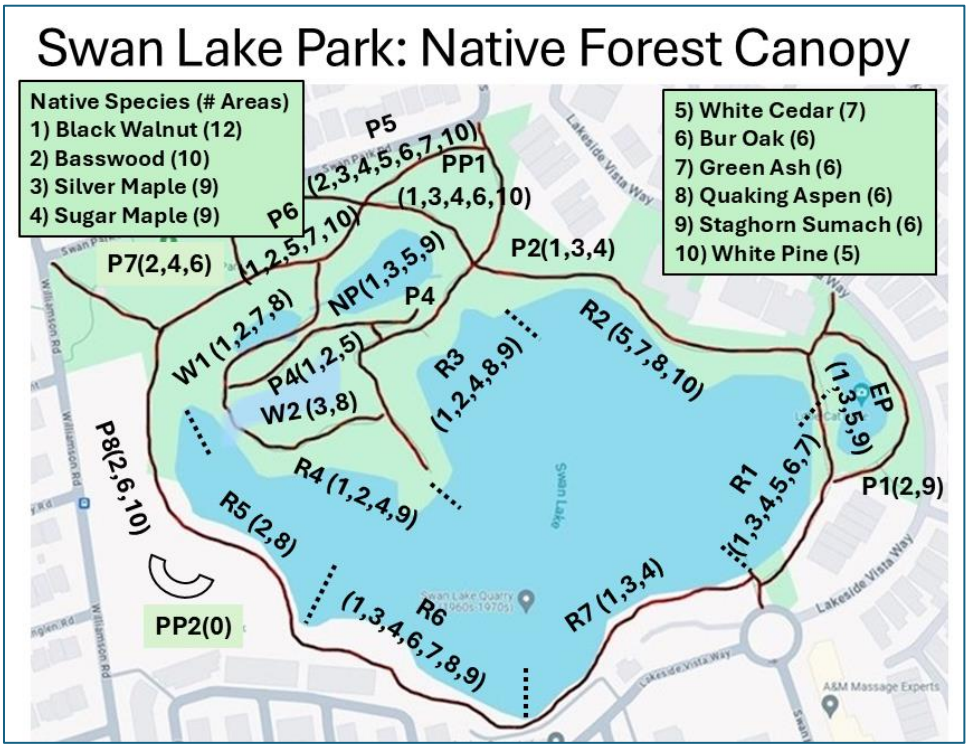
In April 2021, North-South Environmental submitted to Markham Council the Markham Natural Heritage Inventory and Assessment Study[6] which included the ranking of the various species found in Markham by organizations such as the Ontario government and the Toronto and Region Conservation Authority (the "TRCA"). The Swan Lake Park results incorporated the categorization structures set by the TRCA, Markham and York Region in the Heritage Inventory and Assessment Report and various other resources listed in the references section.

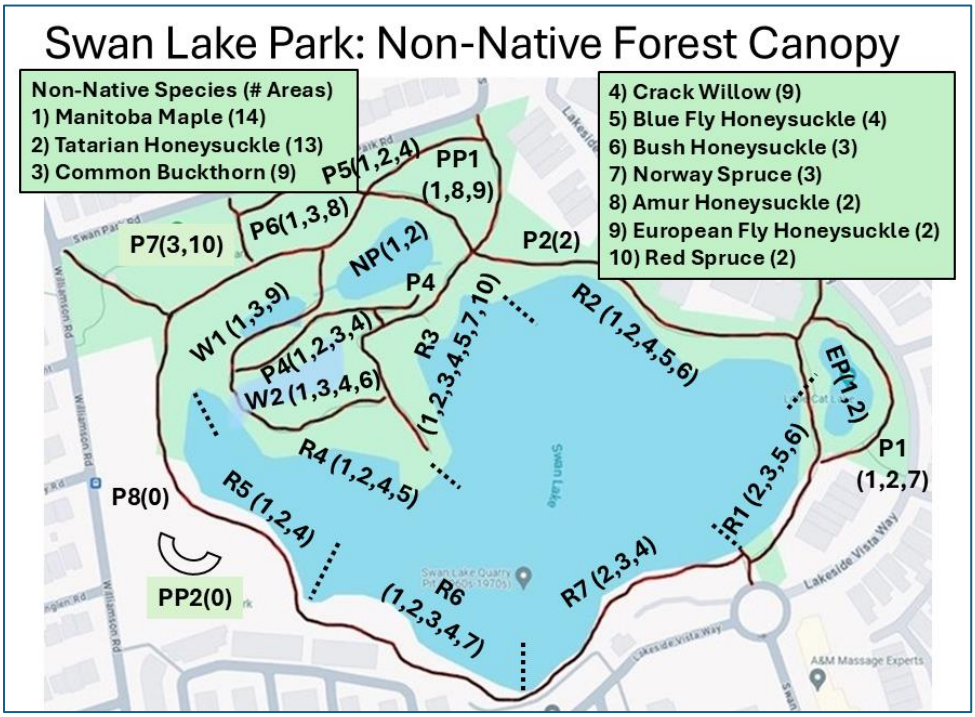
The volunteers identified 283 different species of which 149 are considered native to the area and 18 that were not rated. They also identified a significant number of non-native species (116) in the park.



A) Primary Tree Canopy

In March 2023, the Toronto and Region Conservation Authority released a study[9] on the composition of forests throughout Markham. FOSLP documented 25 of the Native Species listed in the TRCA survey and 19 Non-Native species in Swan Lake Park. The following charts identify the location of the top 10 native and non-native species that dominate the canopy in Swan Lake Park and indicate how many areas they were found.





B) Species Most Beneficial to Birds and Wildlife

The Selection Guide for Water Efficient Plants[23] on the York Region website includes a summary of plants considered beneficial to birds or other wildlife**.** The following tables indicate how many areas they have been found within Swan Lake Park.

Species Beneficial for Birds & Wildlife

Native Species	# Areas
Sugar Maple	9
Riverbank Grape	8
Staghorn Sumach	6
Red Maple	4
Nannyberry	4
Wild Black Raspberry	3
Wild Strawberry	2
Smooth Wild Rose	1
Ironwood	3
Wrinkled Rose	1

Species Beneficial for Birds

Native Species	# Areas
New England Aster	8
Virginia Creeper	7
White Cedar	7
Ninebark	5
White Pine	5
White Spruce	3
Indian Grass	1
Non-native Species	
Honeysuckle Specie	2
Scouler's Willow	2
Pear	1

C) Species Most Beneficial for Pollinators

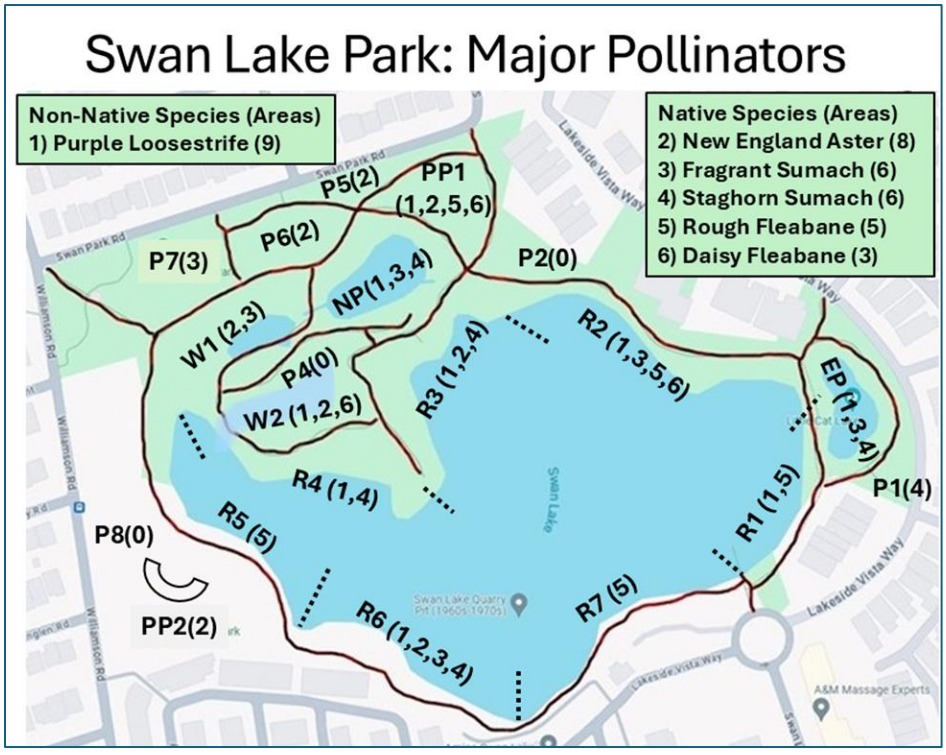
The York Region Selection Guide for Water Efficient Plants[24] also indicates which plants are considered beneficial to pollinators. The following table summarizes the major pollinator supportive plants in Swan Lake Park and whether they appeal to butterflies, bees or both. Two plants were identified as appealing to hummingbirds.

Pollinator Supportive Plants In Swan Lake Park (August 2023)

	Name	# Areas
Butterflies Only		
Native		
N	New England Aster	8
N	Fragrant Sumach	6
N	Staghorn Sumach	6
N	Black Oak	2
N	Early Goldenrod	2
N	Eastern Snowberry	2
N	Black Cherry	1
N	Black-eyed Susan	1
N	Butterfly Milkweed	1
N	Indian Grass	1
N	Stiff Goldenrod	1
N	Wrinkled Rose	1
Non Native		
NN	Clasping Mullein	1
NN	Dense-flowered Mullein	1
NN	Pear	1

	Name	# Areas
Bees Only		
NN	Purple Loosestrife	9
NN	Honeysuckle Species	2
NN	Scouler's Willow	2
NN	Black Locust	1
Bees and Butterflies		
N	Rough Fleabane	5
N	Daisy Fleabane	3
N	Foxglove Beard-tongue	2
N	Hoary Vervain	2
N	Wild Bergamot	2
N	Tall Fleabane	1
Hummingbirds		
N	Wild Bergamot	2
NN	Wayfaring Tree	1

The shoreline and wetland areas supported most of the pollinator plants as indicated in the following map.



D) Supporting Monarch Butterflies

The Monarch Butterfly is rated as a Species at Risk under the Federal Species at Risk Act and organizations such as the David Suzuki Foundation have encouraged efforts to support the Monarch. Several years ago some area residents, in association with the David Suzuki Foundation, planted a variety of pollinator plants in a canoe near the dock area in Swan Lake Park.

Markham, added pollinator plants to the grassland area in the northeastern section of the park in 2021 (PP1) and, supported by the Markham Lions and Friends of Swan Lake Park, created a pollinator garden 2022 in the new parkland area along Williamson Road (PP2).

Monarchs are threatened by a number of factors such as pesticides and the deforestation of their winter resting places in Mexico. Locally, there is a significant threat in the rise of the dog-strangling vine, an aggressive invasive plant in the same family as milkweed, the primary plant that sustains monarchs. Monarchs lay their eggs on both milkweed and dog-strangling vine; however, since the larva can eat only from milkweed plants, the eggs laid on the dog-strangling vine do not survive.

In a blog dated September 27, 2024, Erica Browne Grivas outlined the “Top 10 Types of Milkweed to Support Monarch Butterflies”. Fortunately the four species in Swan Lake Park are on that list.

Swan Lake Park is also home to both species of dog-strangiling vine. Some efforts have been made to curtail dog-strangling vine along the pathways but it remains one of the most pervasive plants in the park. The Markham Invasive Management Plan categorizes Dog-strangling vine as a Tier 1 species, one of its top priorities.

The following extract from the Ontario Invasive Species Awareness website provides greater detail on the species:

The name "Dog-strangling Vine" refers to two invasive plants native to Eurasia– black swallowwort and pale swallowwort. These look-alike members of the milkweed family were introduced to the northeastern United States in the mid-1800s for use in gardens. In recent years these perennial vines have spread rapidly throughout central and southern Ontario. Because they are so similar, both species have the same common name.

Dog-strangling Vine prefers open sunny areas but can grow well in light shade. It grows aggressively up to two metres high by wrapping itself around trees and other plants or trailing along the ground. Dense patches of the vine can "strangle" plants and small trees.

The plant can produce up to 28,000 seeds per square metre. The seeds are easily spread by the wind, and new plants can grow from root fragments, making it difficult to destroy. The vine has invaded ravines, hillsides, fence lines, stream banks, roadsides and utility corridors.

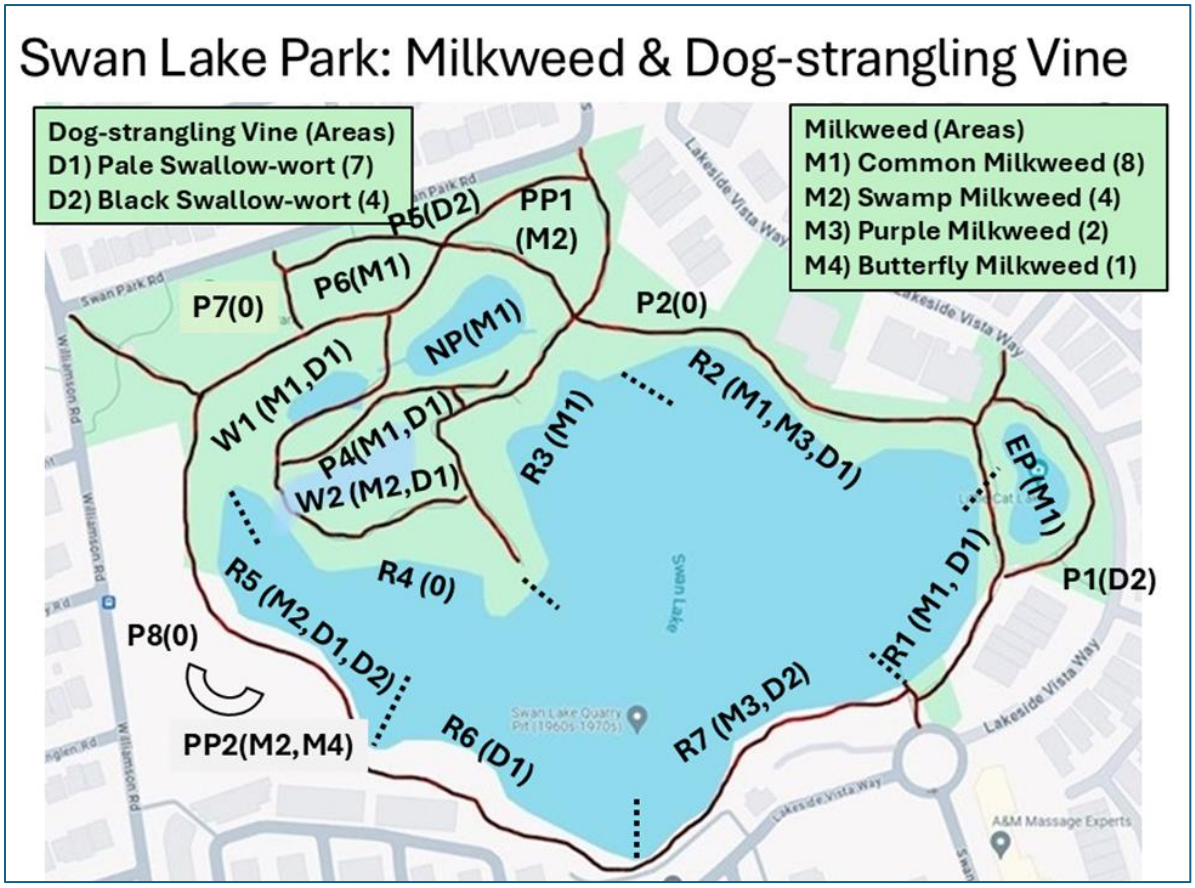
Impacts of Dog-Strangling Vine

- *Dog-strangling Vine forms dense stands that overwhelm and crowd out native plants and young trees, preventing forest regeneration.*
- *Colonies form mats of interwoven vines that are difficult to walk through and interfere with forest management and recreational activities.*
- *Leaves and roots may be toxic to livestock. Deer and other browsing animals also avoid dog-strangling vine, which can increase grazing pressure on more palatable native plants.*
- *The vine threatens the monarch butterfly, a species at risk in Ontario. The butterflies lay their eggs on the plant, but the larvae are unable to complete their life cycle and do not survive.*

Milkweed & Dog-strangling Vine in Swan Lake Park

Common Name	Scientific Name	Class	# Areas
Milkweed Species			
Common Milkweed	Asclepias syriaca	Apocynaceae	8
Swamp Milkweed	Asclepias incarnata	Apocynaceae	4
Purple Milkweed	Asclepias purpurascens	Apocynaceae	2
Butterfly Milkweed	Asclepias tuberosa interior	Apocynaceae	1
Dog-strangling Vine			
Pale Swallow-Wort	Vincetoxicum rossicum	Apocynaceae	7
Black Swallow-Wort	Vincetoxicum nigrum	Apocynaceae	4

The following section provides more information on the management of Dog-Strangling Vine.



E) Invasive Species

The Government of Canada defines invasive species as plants, animals, and micro-organisms that are found outside of their natural range, and whose presence poses a threat to environmental health, the economy, or society.

The following section is extracted from the Invasive Plant Species Management Plan, Natural Heritage Management Study, Markham, May 2024[17]

> *The City of Markham (the City) retained CBCL Limited (CBCL) in July of 2022 to undertake a natural heritage management study to support stewardship and enhancement of City owned natural areas in the Greenway System. The City of Markham's 2014 Official Plan designates approximately 7,000 ha. of lands as the City's Greenway System and establishes policies to maintain and enhance this interconnected network of natural areas. More than half of the Greenway System is owned and managed by public agencies: approximately 1,000 ha. are owned by the city and another 3,200 ha. by Parks Canada (i.e., Rouge National Urban Park*).
>
> *During field work carried out by CBCL in 2022, invasive plant species were the most frequently observed type of management concern in City-owned natural areas. Invasive species are a major threat to ecosystems and introductions of invasive species to Ontario are predicted to become more frequent in an increasingly globalized world (Nienhuis and Wilson 2018). Invasive species*

have a variety of impacts on ecosystems and are one of the leading threats to biodiversity worldwide (McNeely et al. 2001). Invasive plant species may compete with native species for water, light, nutrients, and physical space (Duenas et al. 2018; Reaser et al. 2020). In the worst cases, invasive species can cause extirpation of native species and completely dominate habitats where they occur.

This report provides an invasive Plant Species Management Plan (IPSMP) with information on key invasive plants in Markham, past and ongoing management efforts, and direction on the prioritization and implementation of invasive species management projects in City-owned natural areas. The scope of the IPSMP is limited to plants and does not include other invasive pests such as insects.

Invasive plant species are common in Markham's natural areas. A least 41 invasive species are considered to pose a risk to natural areas in Markham.

Invasive species pose the second greatest threat to biodiversity after habitat loss (Erlich, 1998; Wilson, 1992). Invasive plant species can displace native species in a community, negatively impacting ecosystem function and services, and are a growing threat to human health and the economy. Many invasive plants have the ability to spread rapidly and aggressively, leading to a decline in ecological health and recreational enjoyment. The following are some of the significant impacts on natural ecosystems in urbanized environments:

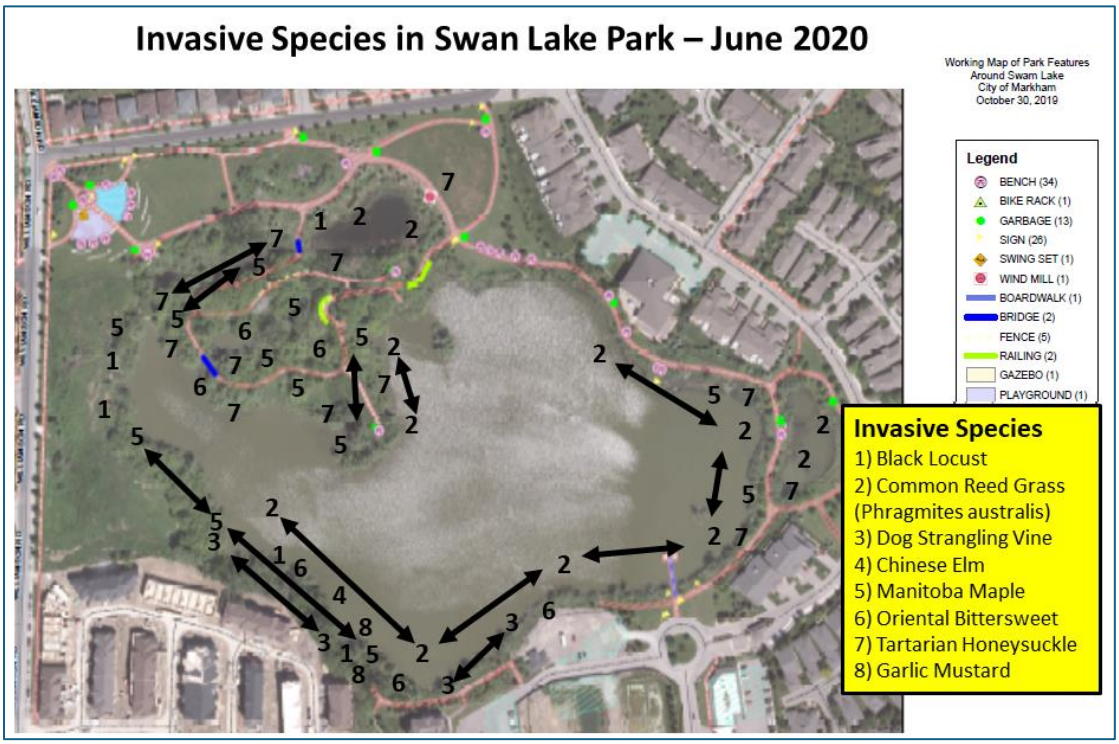
***Biodiversity loss, habitat degradation, and disruption of ecological and hydrological processes** – Invasive plants can outcompete native plants for resources such as water, light and nutrients, leading to a decline in native plant populations. As native plants decline, the habitat structure and composition of ecosystems are altered. The degradation of ecosystems can impact native animals by reducing nesting sites and foraging opportunities or disrupt natural ecological and hydrological processes such as dispersal, pollination, water quality and nutrient cycling.*

***Human health, safety, and recreational enjoyment** – Some invasive plant species pose risks to human health causing severe skin irritations or injuries, impacting the enjoyment of outdoor activities. Certain invasive plant species can limit visibility in rights-of-way increasing the risk of vehicle accidents or they can intensify fire risk by increasing fuel loads or altering fire regimes. Other invasive plants can reduce the aesthetic value or accessibility of recreational land and waterbodies.*

***Economic impacts** – Invasive plant species can have significant economic consequences including the costs of control and management, such as surveys, eradication programs, and public awareness campaigns. In addition, costs can be incurred due to damaged infrastructures, reduction in property values, and negative effects on agriculture and landscaping industries.*

In June 2020, volunteers with the Friends of Swan Lake Park undertook a field survey to identify invasive plant species in Swan Lake Park. Markham staff have used this summary to address certain areas,

specifically Dog-strangling Vine along the southern pathways and in 2023 TRCA was engaged to remove Phragmites along the eastern shoreline and the North Pond.



In May 2024, Markham Council approved the Invasive Species Management Guide which identified 41 invasive species of concern in Markham. From a management perspective, the 6 species that were currently being addressed by Markham's park staff were rated as Tier 1 while the 14 species that the report recommnend as the next highest priority were rated Tier 2. It was recommended that the other 21 species rated as Tier 3 should be addressed when resouces permit.

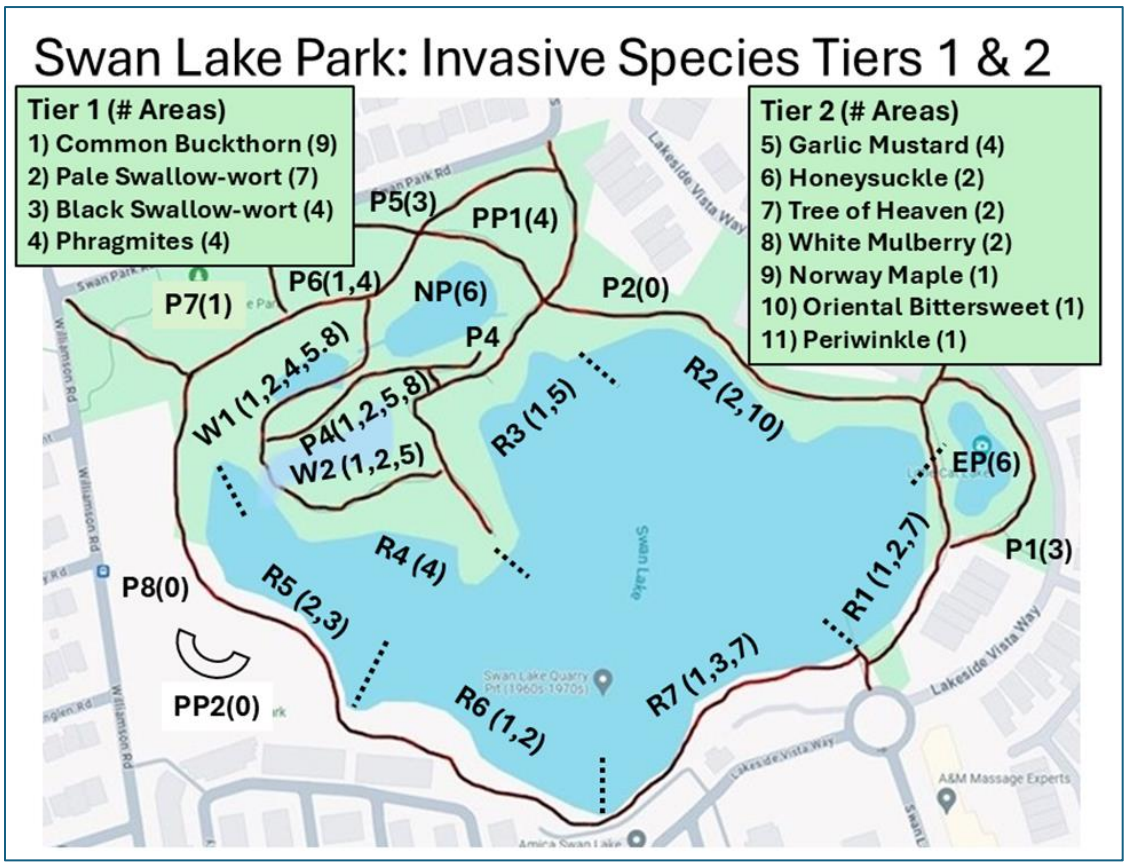
In March 2025, the Friends of Swan Lake Park and leading researchers from York University launched the Swan Lake Citizen Science Lab. The Citizen Science Lab is a pilot program that will involve environmental monitoring of both water quality and invasive plant species using four advanced technologies, Drone Monitoring, Artificial Intelligence, Virtual Reality and Simulation.

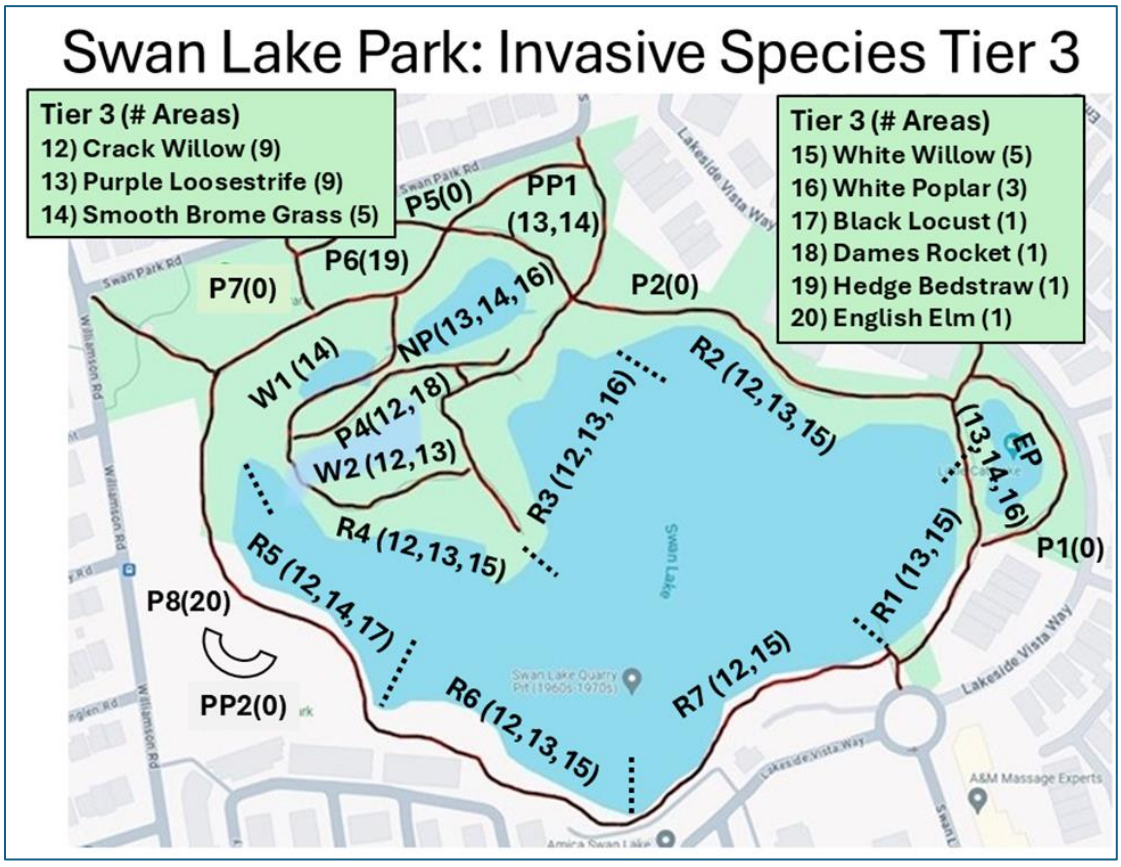
The advanced drone measurements will provide key metrics for a comprehensive assessment of the water quality in Swan Lake throughout the year.

Drone imagery will try to map the 19 invasive plant species found in Swan Lake Park that Markham identified to be of concern in its 2024 Invasive Species Management Plan.

The Citizen Science Lab incorporates four of the strategies outlined in Section 2.3 of Markham's Invasive Species Management Plan:

i. Encouragement and use of community data
ii. Collaboration with local experts
iii. Use of remote sensing imagery
iv. Fostering partnerships with educational institutions and others


Swan Lake Park: Invasive Species Tiers 1 & 2
Tier 1 (# Areas)
1) Common Buckthorn (9)
2) Pale Swallow-wort (7)
3) Black Swallow-wort (4)
4) Phragmites (4)
Tier 2 (# Areas)
5) Garlic Mustard (4)
6) Honeysuckle (2)
7) Tree of Heaven (2)
8) White Mulberry (2)
9) Norway Maple (1)
10) Oriental Bittersweet (1)
11) Periwinkle (1)
P5(3)
PP1(4)
P6(1,4)
NP(6)
P2(0)
P7(1)
P4
W1 (1,2,4,5,8)
P4(1,2,5,8)
W2 (1,2,5)
R3 (1,5)
R2 (2,10)
EP(6)
P1(3)
R4 (4)
P8(0)
R5 (2,3)
R1 (1,2,7)
PP2(0)
R6 (1,2)
R7 (1,3,7)
Swan Lake
Lakeside Vista Way
Williamston Rd
Swan Park Rd
A&M Massage Experts


Swan Lake Park: Invasive Species Tier 3
Tier 3 (# Areas)
12) Crack Willow (9)
13) Purple Loosestrife (9)
14) Smooth Brome Grass (5)
Tier 3 (# Areas)
15) White Willow (5)
16) White Poplar (3)
17) Black Locust (1)
18) Dames Rocket (1)
19) Hedge Bedstraw (1)
20) English Elm (1)
P5(0)
PP1 (13,14)
P6(19)
P7(0)
P2(0)
NP(13,14,16)
W1 (14)
P4(12,18)
W2 (12,13)
R3 (12,13,16)
R2 (12,13,15)
EP (13,14,16)
P1(0)
R4 (12,13,15)
R5 (12,14,17)
P8(20)
R1 (13,15)
PP2(0)
R6 (12,13,15)
R7 (12,15)
Swan Lake
Lakeside Vista Way
Williamston Rd
Swan Park Rd
A&M Massage Experts

F) Management of TIER 1 Invasive Plant Species

The Invasive Species Management Plan[17] included the following summary on the issues and treatment for the three Tier 1 Invasive species found in Swan Lake Park.

Common Buckthorn (Found in 9 areas in Swan Lake Park)

Most prevalent in woodlands and early successional communities in the Markham Greenway System, Common Buckthorn is a deciduous shrub or small tree that can form dense thickets that rapidly outcompete native vegetation. Common Buckthorn reproduces through both seed and vegetative propagation and can disperse widely as the berries are consumed and dispersed by birds.

By forming dense thickets that shade out and suppress native plant species, Common Buckthorn reduces biodiversity and alters native plant communities by suppressing understory plant growth, changing soil nutrient composition, and interrupting successional processes. Buckthorn thickets provide poor habitat for native wildlife and negatively affect the availability of food and nesting sites for birds. Buckthorn can also have negative impacts on recreational values where it is established.

A typical treatment option for Common Buckthorn is through mechanical control measures. Mechanical management is achieved by pulling or cutting the shrubs (with efforts focused on removing female plants). It is recommended to pull plants in the fall when they are readily identifiable and when disturbance to the dormant native vegetation is minimized, but care must be taken to contain branches containing berries.

Resprouting can be a problem after mechanical treatments and control measures are often combined with controlled burns and chemical control. Chemical control may be an effective option for treating larger infestations, especially those that threaten forestry or agriculture. Repeated burning may be effective where feasible. Flooding and re-establishment of water levels is another method that may help to control buckthorn. Federal, provincial, or conservation authority permits or approvals may be required to use this control method.

Regular follow-up monitoring is suggested to identify and address any new growth or seedlings. New sprouts and seedlings should be promptly removed to prevent further spread and re-infestation. Mowing can be used to reduce vigour of smaller stems and kill seedlings. A typical timeline for treatment of buckthorn is two to six years or more; however, a recent study found that treatment of buckthorn may be needed for only one to two years (Schuster, et. al, 2023). Re-planting with native vegetation following treatment is recommended once buckthorn is eradicated or under control.

Dog-strangling Vine - 2 species (Found in 11 areas in Swan Lake Park)

A common invasive plant of early successional communities in the City, Dog-strangling Vine is a perennial, herbaceous vine that forms extensive stands with the ability to exclude all other species from a site. It is especially problematic for wildlife (particularly grassland birds) due to its habitat-altering capability which reduces *capacity to provide food resources for native insects, including the Monarch butterfly (Danaus plexippus). Dog-strangling Vine can also severely inhibit recreational*

activities where it is established, due to the difficulty of travel though the dense tangled mats that it forms.

Infestations of Dog-Strangling Vine can be managed by digging out the plants, ensuring that all root fragments are removed to prevent re-sprouting. This method is most effective when applied before seed production. Other mechanical methods of control include clipping and tarping when eradication may not be possible. Seed pod removal can be used in the case of a late season discovery to reduce seed dispersal when other control methods are not an option.

Chemical control of Dog-Strangling Vine by licensed exterminators using herbicides is typically applied during the plant's active growth phase. Reapplication of herbicides is needed for several years to target seedling growth.

In Ontario, there has been notable progress in the biological control of this weed by introducing Hypena opulenta, a leaf-feeding caterpillar (Anderson, 2012). This type of control is best suited to large sites with a high density of plant cover; however, the most effective approach often involves integrated strategies that combine control methods.

Prioritization of efforts should be made where the population of plants is small or newly detected and eradication is possible. Site restoration is needed during and after control activities to reduce the risk of re-invasion.

Phragmites/ European Reed (Found in 4 areas in Swan Lake Park)

A common invasive plant, Phragmites/European Reed is a tall, perennial grass species that is widespread in Ontario. It has a fibrous root system and can spread through underground rhizomes outcompeting native plants and forming dense monocultures. Phragmites typically grow in dense stands that can reach heights of more than 5 metres, blocking shoreline views and access. Major highways and secondary roads are commonly a vector of spread of this species. A native species of Phragmites is also found in Ontario and does not have the same negative impacts on habitat and biodiversity. Native Phragmites should be distinguished from invasive Phragmites before considering management actions. Native Phragmites grow in sparser stands mixed with other plants, in contrast to the near monoculture stands of invasive Phragmites. Morphologically, native Phragmites can be distinguished from invasive Phragmites by the ligule width, stem colour, leaf retention and smaller, sparser seedheads.

Monotypic stands of Phragmites can significantly alter wetland habitats and have several negative ecological impacts such as reduced biodiversity (including significant impacts hydrology and nutrient cycling. In addition, Phragmites can create human health or safety hazards such as increased fire hazard due to dead stems and reduced visibility along roadways (Nichols, 2020).

Managing Phragmites infestations requires a combination of control methods, and the choice of treatment depends on the extent of the invasion and the specific site conditions. Treatment options typically include mechanical and chemical control methods. Cutting stems can help reduce their density and prevent seed production.

This method is best employed repeatedly during the growing season and performed for several years to weaken the plant. However, TRCA does not recommend cutting as a treatment option for Phragmites as it can invigorate growth and increased density. Herbicides can be used to target stands during their active growth phase. Herbicides are typically applied by licensed professionals and should follow environmental regulations to minimize non-target impacts. Other control techniques include mulching and prescribed burning and, where possible on wet sites, flooding can be an effective management tool.

Re-vegetation with native plant species, including grasses and forbs, is being used to resist the invasion of Phragmites in Ontario (Nichols, 2020). Research has identified competitive native plants, and initiatives are successfully converting landscapes, such as highway *verges, into tall prairie grasslands, effectively inhibiting the plant's spread. Re-vegetation not only prevents its return but also protects soil and complements restoration efforts.*

G) Other Invasive Species

Natural areas such as Swan Lake Park provide shelter and food for wildlife, remove pollutants from air and water, produce oxygen through photosynthesis and provide valuable recreational and educational opportunities. Invasive species can threaten these important services.

Invasive species generally are non-native plant, animal or pest species that outcompete native species for resources and dominate space.

The following invasive species have been reported in Swan Lake Park by local residents. The invasive fish species are listed as invasive under either the Ontario Invading Species Awareness Program (”OISAP”) or by the Toronto and Region Conservation Authority (“TRCA”). Information on invasive insects is from the Ministry of Agriculture.

Invasive Fish		
• **Goldfish** (Carassius auratus)	OISAP	Goldfish are quite tolerant of poor water quality, including water with low levels of dissolved oxygen and may threaten some native species in degraded ecosystems. Goldfish eat snails, small insects and young fish, making this species a competitor with, and predator of, native fish. They stir up mud and other matter when they feed, which increases the cloudiness of the water and affects the growth of aquatic plants.
Invasive Insects		
• **Japanese Beetles** (Popillia japonica)		Adult beetles skeletonize foliage. While adults do not damage turf, they do feed on foliage and fruit of about 300 species of plants. Larval feeding on the fibrous roots of grasses makes this stage a destructive pest for turf. Injured turf initially wilts and yellows during August and September. Eventually, dead patches of turf can be observed.

• **Yellow-headed Spruce Sawfly** (Pikonema alaskensis (Rohwer))		Larvae emerge in early spring and begin feeding on the succulent needles. Larvae initially feed on the new needles, leaving only short brown stubs. Once the new growth is devoured, the larvae move back on the branch and feed on the older needles. By July, infested trees appear ragged and yellowish-brown especially near the tops. Heavily infested trees may be completely stripped of foliage. Three to four consecutive years of moderate to heavy attacks can kill the tree.

H) Noxious Weeds

In Ontario, a noxious weed is a plant that has been listed in the Schedule of Noxious Weeds found in Regulation 1096 made under the *Weed Control Act*. This list is commonly referred to as the "noxious weed list."[19]

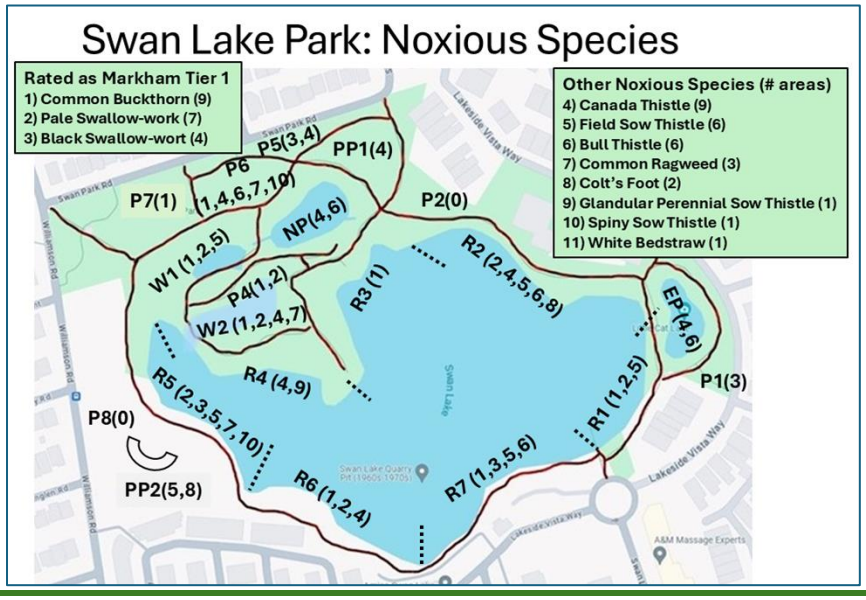
In general, a species designated as a noxious weed under the *Weed Control Act* is one that:

- is difficult to manage on agricultural land once established and will reduce the yield and quality of the crop being grown
- negatively affects the health and well-being of livestock
- poses a risk to the health and well-being of agricultural workers

The intent of the *Weed Control Act* is to reduce:

- the infestation of noxious weeds that negatively impact agriculture and horticulture lands
- plant diseases by eliminating plant disease hosts such as common barberry and European buckthorn
- health hazards to livestock and agricultural workers caused by poisonous plants

Of the 25 weeds designated as noxious under the Weed Control Act, 11 species were found in Swan Lake Park.



APPENDIX F: Swan Lake Benthic Invertebrate Monitoring

1

Swan Lake Benthic Invertebrate Monitoring

Chris Reeves

January 12, 2024

Commissioned by

Friends of Swan Lake Park

Objective

Currently as there has been no benthic invertebrate sampling done in Swan Lake it is proposed that a total of 21 sites throughout the lake will be sampled with the purpose of providing a baseline for current water quality and lake health but also to provide an understanding of any improvements to water quality following future restoration efforts over the coming years.

Indicator species of water quality and lake health provide a basis for understanding the impacts development has had on the waterbody but also provide baseline for the improvement of lake health.

If overall water quality is improving in Swan Lake this will be reflected in changes of abundance, diversity, and the presence of certain indicator species. Low water quality will provide a different taxon than higher water quality, and thus monitoring of invertebrates is an effective way of establishing a baseline for ecosystem health. Presence of Ephemeroptera (Mayfly), Plecoptera (Stonefly) and Trichoptera (Caddisfly), or EPT, are indicators of good water quality and overall ecosystem health and can be considered a great benchmark for future years.

It is proposed that a range of habitat types will be assessed throughout the lake, however sampling will be conducted in-shore at depths of less than 3 feet, along 20 foot transects with use of dip net, and wash tray for identification purposes (Rosenberg, Davies, Cobb, and Wiens; 1997).

Results

A total of 21 sites were sampled, over the course of 3 weeks. Sampling was conducted on days with no rainfall and very little cloud cover, days of sampling were July 22nd, July 30th, and August 5th.

Swan Lake is host to 16 taxonomic classes, these were categorized as good, fair or poor as bioindicators. Ephemeroptera (Mayflies), Trichoptera (Caddisflies), and Anisoptera (Dragonflies) were identified and categorized as bioindicators of good water quality. Gerridae (Water Strider), Zygoptera (Damselflies) Amiphipoda (scuds), Isopoda (Isopods) were categorized as fair water quality bioindicators. Diptera [this includes 2 species of Midge, as well as Aedes sp. (Mosquito)], Corixidae (Water Boatmen), Gastropods (Snails), and Nematoda sp. (Nematode worm) were categorized as poor or low water quality.

Species that could not be used as water quality bioindicators included Ranatra (Water scorpion), and Coleoptera (2 different species of Water Beetle). Although Ranatra and Coleoptera were removed as water quality indicators their presence has been associated with elevated levels of salinity, also water boatmen and water striders are also associated with saline rich environments. Also, there was a painted turtle observed at one site and a Common carp captured in the dipnet during the survey.

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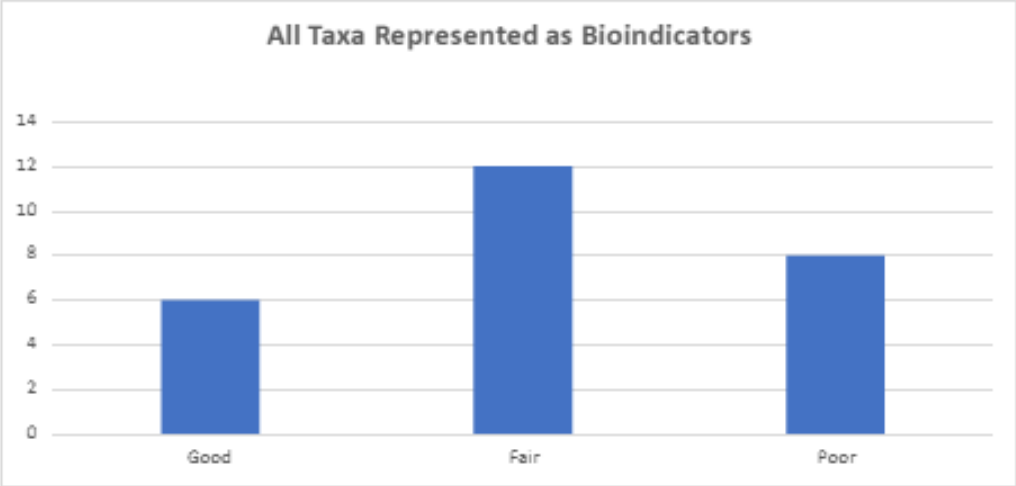
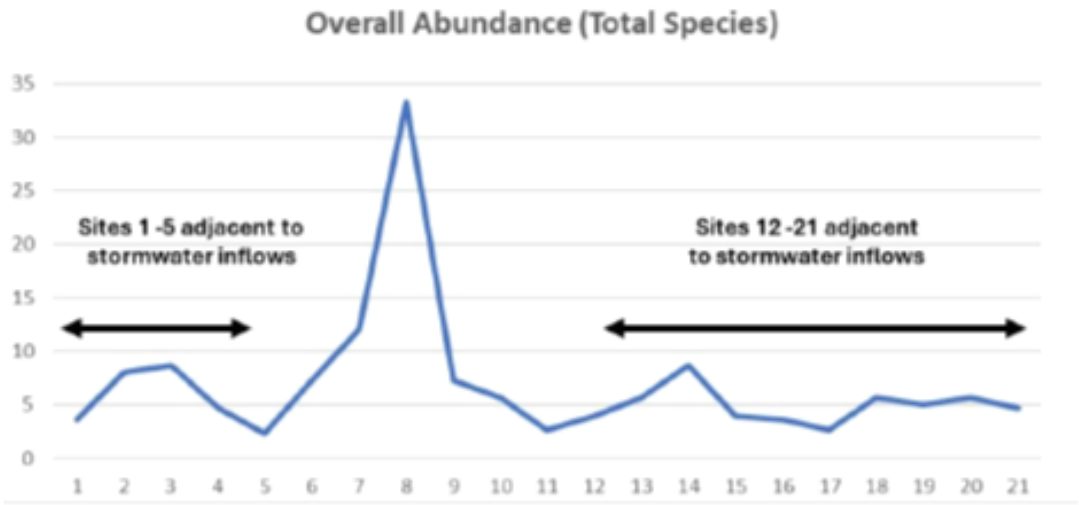
EPT as a percentage of all species sampled was found to be 12.5 % in respect to all taxonomic groups. Between 7% to 13% is typical of fair water quality (North Carolina Department of Environment, Health and Natural Resources; 1997).

Although EPT was found to be 48.96% of all individuals sampled in the survey. Mayflies are present at a few sites in high numbers, also some caddisflies were present, these species were found in less developed and more naturalized areas. Overall abundance in these areas was also high in comparison to other sites observed in the study. The total number of individuals according to EPT suggests good water quality, however given the diversity and types of species found overall the lake is found to be of fair or intermediate water quality.



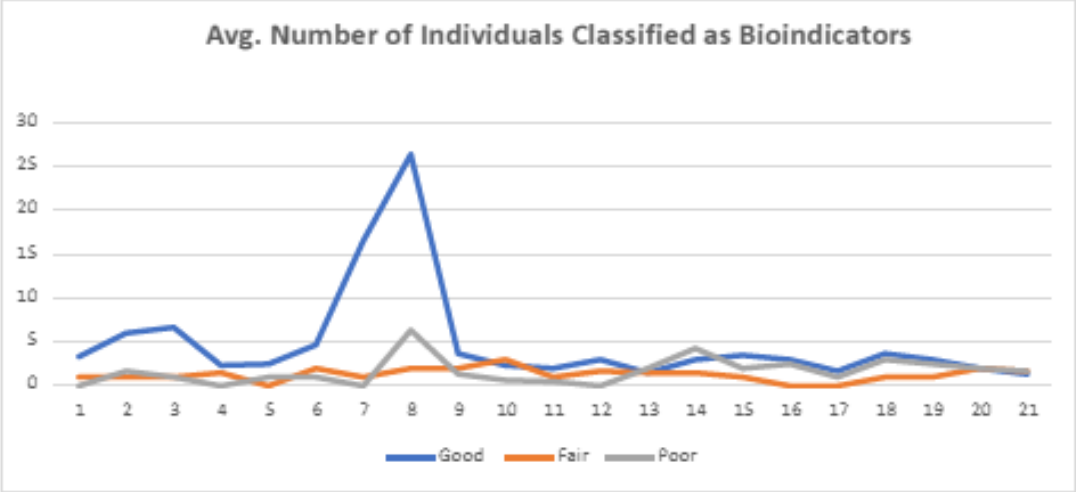
Given taxa categorized and given EPT percentage to total taxa, it is concluded that Swan Lake based off existing invertebrate populations sampled is of intermediate or fair water quality. Although the overall abundance seems rather low, the majority of sites had very few individuals. Considering the areas of little or no invertebrates may suggest point sources of pollution, this however would need to be correlated with additional water quality measures.



The purpose of this survey was to establish a baseline for water quality, if changes in the assemblage of bioindicators is observed in future years this will create a better understanding of improvements made in water quality. Also, the presence of water scorpions may be an indicator of higher-than-normal salinity. Elevated numbers of Hemiptera species would also be indicative of higher than usual salinity (Anufriyeva, Shadrin; 2016), also it is worth noting that water striders due to there presence on the surface are underrepresented in the surveyed benthic population, although Water Striders are still found in the survey it is most likely they are captured incidentally during the process of sampling (Spence, Anderson; 2003). The abundance of these species may be associated with road salt(s) run-off, however hydraulic conductivity data would be useful to gain a better understanding of this.

A lack of Oligochaete found in the survey seemed peculiar, it is difficult to say why this is the case as surficial sediment varied between sites sampled. Although it has been proposed that a Gerking sampler may be more effective at capturing sedentary species, this may be the reason for the lack of Oligochaete sp. as well as Leeches (Sychra, Zdeněk; 2010), also grab sampling may provide a better method for capturing these species (Rosenberg, Davies, Cobb, and Wiens; 1997).

In conclusion Swan Lake, given the taxa found and percentage of EPT, is currently of fair or intermediate water quality.



This report establishes a baseline for water quality. Changes in invertebrate populations in future years will establish a better understanding of either potential improvements or further degradation that may be occurring within the lake.

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Testing Locations in Swan Lake, Markham

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Summary of Site Visit Data – Summer 2023

species classified as total individual		Good	Fair	Poor
site visit 1	total n	155	16	46
site visit 2	total n	59	62	23
site visit 3	total n	757	25	60
total		971	103	129

Species Composition (classification as bioindicators)	Good	Fair	Poor
	2	4	4
	3	5	2
	1	3	2
total	6	12	8

Avg. Number of Categorized Species per Site Visit			
Site Number	Good	Fair	Poor
1	3.333333	1	0
2	6	1	1.666667
3	6.666667	1	1
4	2.333333	1.5	0
5	2.5	0	1
6	4.666667	2	1
7	16.5	1	0
8	26.33333	2	6.333333
9	3.666667	2	1.333333
10	2.333333	3	0.666667
11	2	1	0.5
12	3	1.666667	0
13	1.5	1.5	2
14	3	1.5	4.25
15	3.5	1	2
16	3	0	2.5
17	1.666667	0	1
18	3.666667	1	3
19	3	1	2.5
20	2	2	2
21	1.333333	1.666667	1.666667

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Data: Site Visit 1 - July 22, 2023

			Good	Poor	Poor		Fair		Fair	Fair	Poor		Fair	Good	Poor	Fair		
Site	Depth	Coordinates	Mayflys	Water Boatmen	Midge Spotted	[redacted]	Damselfly	[redacted]	Water Beetle	Water Strider	Gastropod	Isopod	Amphipodae	Caddisfly	Mosquito (Aedes sp.)	Isopod	Water Strider (2)	Nematoda
1	1	43.89694/-79.25047	4		0													
2	2	43.89762/-79.25072	3	1	3	1	1	2										
3	1	43.89764/-79.25107	12		1		1	1	1	1								
4	2.5	43.89805/-79.25103	4		0				1	2	1							
5	1	43.89809/-79.25209	4		1			1				1						
6	1	43.89775/-79.25326	12		1	1	2						1					
7	2.5	43.89745/-7925511	30		0		1				1							
8	2	43.89748/-79.2552	50	3	0									1				
9	2.5	43.89747/-79.25527	3	2	0					1								
10	2	43.89627/-79.25435	1		0				1									
11	1.5	43.89625/-79.25427	1		0		1								1			
12	1	43.89575/-792526	1		0						1							
13	1	43.89691/-79.25231	2		2			2								1		
14	2	43.89606/-79.25212	5		10	3		7									1	
15	2	43.89627/-79.25202	3		3	3												
16	2	43.89635/-79.25189	3		1	1												
17	2.5	43.89642/-79.25167	1		0													
18	2	43.8965/-7925125	7		3	1	1	2										1
19	1.5	43.89652/-79.25108	4		4			4										
20	1	43.89655/-79.25095	2	1	1		1	1										
21	1	43.89663/-79.2508	2	1	3			3					2					
total			154	8	33	10	8	23	3	4	4	1	3	1	1	1	1	1

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Data: Site Visit 2 - July 30, 2023

Site	Depth	Coordinates	Mayflies	Water Boatmen	Midge Sp total	[redacted]	Damselfly	[redacted]	Water Beetle	Water Strider	Gastropod	water beetle	Amphipopdae	Caddisfly	Mosquito (Aedes sp.)	Isopod	Water Strider (2)	Nematoda	Dragonfly	waterscorpian
1	1	48.898984/-79.25647	1							1									1	
2	2	48.897852/-79.25072	2																	
3	1	48.897864/-79.25107	2	1									1							
4	2.5	48.898805/-79.25193	1																	
5	1	48.898809/-79.25109																		
6	1	48.897975/-79.25105	1							3			2							
7	2.5	48.897945/-79.25511	3				1													
8	2	48.898948/-79.2512	15							2										
9	2.5	48.897437/-79.25127	4	2						3										
10	2	48.898227/-79.25485	1	1												1				1
11	1.5	48.898425/-79.25437	1	1																
12	1	48.898375/-79.25526	1							2			2							
13	1	48.898191/-79.25131		1	1		2					2								
14	2	48.898806/-79.25172	1	1	1								1			2				
15	2	48.898427/-79.25102	4		1											1				
16	2	48.898435/-79.25199	1		4															
17	2.5	48.898442/-79.25167	1		2									1						
18	2	48.89865/-79.25125	2		3															
19	1.5	48.898452/-79.25108	1										1							
20	1	48.898435/-79.25085	1		4								4							
21	1	48.898663/-79.25208	1										2							
total			57	7	16	0	3	0	0	11	0	2	13	1	0	4	0	0	1	1

Swan Lake Benthic Invertebrate Monitoring Report Summer 2023

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Data: Site Visit 3 – August 5, 2023

Site	Depth	Coordinates	Mayflys	Water Boatmen	Midge Sp total		Damselfly		Water Beetle	Water Strider	Gastropod	water beetle	Amphipodae	Caddisfly	Mosquito (Aedes sp.)	Isopod	water strider	Nematoda	Dragonfly	water scorpian
1	1	43.699604/-79.25047	3																	
2	2	43.699762/-79.25072	19	1			1													
3	1	43.699784/-79.25107	6				1													
4	1.5	43.699805/-79.25193	2							1								1		
5	1	43.699859/-79.25209	1																	
6	1	43.699775/-79.25326	1		1															
7	1.5	43.699745/-792553					1													
8	2	43.699788/-79.2552	15		16															17
9	1.5	43.699747/-79.25557	4							2								1		
10	2	43.699627/-79.25435	4		3					5										
11	1.5	43.699629/-79.25427											2							
12	1	43.699575/-792526								1										
13	1	43.699581/-79.25211	1		4															
14	2	43.699606/-79.25213			5															
15	2	43.699627/-79.25282																		
16	2	43.699655/-79.25189																		
17	1.5	43.699642/-79.25167	1																	
18	2	43.69965/-79.25125	2																	
19	1.5	43.699652/-79.25108	1		1															
20	1	43.699655/-79.25085								1								2		
21	1	43.699663/-79.2508	1		1					1										