The Cataraqui Region Conservation Authority (CRCA) has provided environmental leadership and service to local communities since 1964. It is one of 36 watershed-based agencies within Ontario dedicated to the conservation and protection of the natural environment through a variety of management tools including land ownership, education, monitoring, reporting and regulation.

To learn more about the lakes in our region, the CRCA and partners collect samples, take measurements and compare this information against established standards to identify any significant changes or areas of concern. This Lake Fact Sheet focuses on key parameters to assess the health and resilience of Charleston Lake with respect to nutrient loading, invasive species colonization and acidification.

**Legend**
- Cataraqui Region Conservation Authority
- Gananoque River Watershed
- Charleston Lake
Charleston Lake is located within the Gananoque River watershed with a significant portion being owned by Ontario Parks as part of Charleston Lake Provincial Park. Nearby lakes include Bass Lake, Green Lake, Lyndhurst Lake, Red Horse Lake, Singleton Lake, Higley Lake and Killenbeck Lake.

**County:** United Counties of Leeds Grenville  
**Municipality:** Township of Leeds and the Thousand Islands and the Township of Athens

**Watershed:** Gananoque River  
**Average Depth (m):** 17.4  
**Coordinates:** 44.534 Lat., -76.016 Long.  
**Volume (m$^3 \times 10^6$):** 43.6

<table>
<thead>
<tr>
<th>Surface Area (ha)</th>
<th>Max. Depth (m)</th>
<th>Shore Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2517</td>
<td>91.1</td>
<td>161</td>
</tr>
</tbody>
</table>
The map below shows water depths and the topography of the lake bottom (bathymetry). It also presents the multiple basins, islands, and direction of water flow. Water flows into Charleston Lake from seven inlets and exits at one outlet. Inflows enter Charleston Lake through Beales Creek, Leeders Creek, Fosters Creek, Killenbeck Lake, Green Lake and other smaller tributaries. Water flows out into Wiltse Creek at the Outlet (southwest corner).
Charleston Lake is a natural, deep, coldwater lake, located on the Canadian Shield and enhanced by the construction of a dam. It is the largest inland lake in the Cataraqui Region. As with most lakes within the Cataraqui Region, Charleston Lake ‘mixes’ in the spring and fall due to the lake water warming and cooling. During this mixing process, nutrients are cycled throughout the lake, giving the water a cloudy appearance as well as a brown or green hue from algae that feed off the cycling nutrients. Later in the spring, summer, and winter, water temperatures vary by depth (thermal stratification) so multiple fish species are found at different depth and temperature ranges. Refer to the Cataraqui Region Lake Assessment Report for more detail.

Water levels are controlled by Energy Ottawa at the Outlet Dam and are kept within a one-meter range dependent on rain, snowmelt, drought, and weather conditions. In the spring, docks may be underwater due to heavy snowmelt and spring flooding. Levels are lowest in the fall to compensate for the snow and spring melt expected. More information on Charleston Lake can be found in the Charleston Lake Plan (2006)\(^1\).

**LAKE FEATURES**

**IMPORTANT NATURAL FEATURES:**
Charleston Lake Provincial Park, Provincially Significant Wetland, Area of Natural and Scientific Interest

**SURROUNDING LAND USE:**
Woodlands, Wetlands, Residential (year-round and seasonal)

**PRIMARY WATER LEVEL CONTROL:**
Energy Ottawa via the Outlet Dam

**WATER ACCESS:**
Foot of Water Street in Charleston Village (CRCA), near Outlet off County Road 3 (CRCA), or through the Provincial Park (fee required)
Information about Charleston Lake has been used to identify whether it is vulnerable to a few common stressors to lake water quality and biodiversity. Stressors include excess nutrient build up (eutrophication), the introduction of invasive species, and pH levels that are too low (acidification). Refer to the scoring card below that grades these risks for Charleston Lake.

**EUTROPHICATION:** The process of increasing nutrient levels in a waterbody. It results in excess algal growth, lower oxygen levels, and reduced biodiversity. For more information refer to the *Cataraqui Region Lake Assessment Report*.

- **Low:** Low nutrient levels (oligotrophic), minimal algae present
- **Medium:** Moderate nutrient levels (mesotrophic), algae present
- **High:** High nutrient levels (eutrophic), algae bloom presence likely

**INVASIVE SPECIES:** Species that are not native to an environment, but are introduced, establish, and reproduce in a new system. For more information about invaders in the region, refer to *Appendix 5* of the Cataraqui Region Lake Assessment Report.

- **Absent:** No aquatic invaders reported
- **Present:** Aquatic invaders established
**ACIDIFICATION:** The process of lake water becoming more acidic, resulting in reduced biodiversity and increased water clarity.

- **Low:** pH 6.5 to >7.5, not impacted, neutral or alkaline conditions
- **Medium:** pH 6 to 6.5, sensitive but acceptable range
- **High:** pH <6 hyper-sensitive, threatened or critically impaired

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**CHARLESTON LAKE VULNERABILITY SCORES**

<table>
<thead>
<tr>
<th>Eutrophication</th>
<th>Invasive Species</th>
<th>Acidification</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>PRESENT</td>
<td>LOW</td>
</tr>
</tbody>
</table>

- Based on an average total phosphorus concentration of 0.009 mg/L, nutrient levels are low with no risk of nuisance algae bloom growth
- The Charleston Lake Association has reported zebra mussels throughout the lake
- Charleston Lake maintains a neutral pH with little risk to acidification

The water quality of a lake is affected by many factors including temperature, pH, oxygen, nutrients (trophic status), and transparency (Secchi disk depth). Classifying lakes by these factors can provide a better understanding of lake health. For more information, refer to the **Cataraqui Region Lake Assessment Report**. As Charleston Lake has many bays with varying geology and surrounding land uses, samples are taken at multiple locations and are reported as separate results.
Vulnerability

Water quality

Charleston Lake hosts populations of lake trout because of coldwater habitats in deeper areas and dissolved oxygen concentrations of an average 10 mg/L to support young fish growth. The Secchi disk depth and average total phosphorus readings indicate lower nutrient conditions throughout the majority of the lake with the exception of Webster Bay. The lower nutrient levels indicate sufficient nutrient cycling and less cause for concern of algae bloom growth.

The Ministry of Natural Resources and Forestry (1989)\(^5\) has predicted that low pH (acidic) conditions are unlikely based on a high buffering capacity due to high carbonate and calcium concentrations within the lake. This means the wide range of species found in Charleston Lake will be protected from the effects of acidification. Similar results were found by Nienhuis et al. (2014). The study reported an alkalinity concentration of >90 mg/L and pH of 7.92 suggesting a high buffering capacity to change and low risk to acidification\(^6\).

Average calcium is crucial for the formation of shells and skeletons. Charleston Lake has average calcium concentrations that are high in Deep Water and extremely low in Big Water. The remainder of the lake hosts concentrations sufficient to support aquatic diversity. Zebra mussels have been reported by the Charleston Lake Association. Big Water is the only basin with conditions not suitable for invasive mussel establishment.

<table>
<thead>
<tr>
<th>Sampling Location</th>
<th>Big Water</th>
<th>Deep Water</th>
<th>Donaldson Bay</th>
<th>Eastern Water</th>
<th>Goose Island (north end)</th>
<th>Southern Water</th>
<th>Webster Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Secchi Disk Depth (m)(^1)</td>
<td>6</td>
<td>7.6</td>
<td>7.9</td>
<td>8</td>
<td>7.4</td>
<td>6.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Average Total Phosphorus (mg/L)(^3)</td>
<td>0.007</td>
<td>0.009</td>
<td>0.009</td>
<td>0.009</td>
<td>0.009</td>
<td>0.009</td>
<td>0.011</td>
</tr>
<tr>
<td>Average Calcium (mg/L)(^3)</td>
<td>4.73</td>
<td>26.4</td>
<td>11.9</td>
<td>12.2</td>
<td>12.7</td>
<td>12.5</td>
<td>12.7</td>
</tr>
</tbody>
</table>
Charleston Lake is a highly sensitive trout lake hosting a high diversity of fish species. As this lake is deep, there are many cold sections providing critical habitat for trout and salmon species. When coldwater species are present, this is an indication of water quality since these species require clean and cold conditions. Fish species previously caught in Charleston Lake are listed below.

<table>
<thead>
<tr>
<th>COMMON FISH FAMILIES</th>
<th>SPECIES PRESENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>North American Catfish</td>
<td>Brown Bullhead</td>
</tr>
<tr>
<td></td>
<td>Yellow Bullhead</td>
</tr>
<tr>
<td>Pikes</td>
<td>Northern Pike</td>
</tr>
<tr>
<td></td>
<td>Central Mudminnow</td>
</tr>
<tr>
<td>Trout &amp; Salmon</td>
<td>Lake Trout</td>
</tr>
<tr>
<td></td>
<td>Cisco</td>
</tr>
<tr>
<td></td>
<td>Lake Whitefish</td>
</tr>
<tr>
<td>Sculpins</td>
<td>Mottled Sculpin</td>
</tr>
<tr>
<td>Suckers</td>
<td>White Sucker</td>
</tr>
<tr>
<td></td>
<td>Shorthead Redhorse</td>
</tr>
<tr>
<td>Cods</td>
<td>Burbot</td>
</tr>
<tr>
<td>Herring</td>
<td>Alewife</td>
</tr>
<tr>
<td>Sunfishes &amp; Basses</td>
<td>Largemouth Bass</td>
</tr>
<tr>
<td></td>
<td>Smallmouth Bass</td>
</tr>
<tr>
<td></td>
<td>Pumpkinseed</td>
</tr>
<tr>
<td></td>
<td>Bluegill</td>
</tr>
<tr>
<td></td>
<td>Rock Bass</td>
</tr>
<tr>
<td></td>
<td>Black Crappie</td>
</tr>
<tr>
<td>Carps &amp; Minnows</td>
<td>Variety</td>
</tr>
<tr>
<td>Perches &amp; Darters</td>
<td>Yellow Perch</td>
</tr>
<tr>
<td></td>
<td>Logperch</td>
</tr>
<tr>
<td></td>
<td>Johnny Darter</td>
</tr>
</tbody>
</table>
There are also a variety of minnows supplementing the food chain along the shallow shoreline areas that have not been recorded. Charleston Lake is a very popular fishing destination among campers, visitors, and local residents. It is important to maintain sustainable fishing practices to ensure the populations remain healthy within the lake.

There are some species at risk in the region that will benefit from good lake care practices. At the time of reporting, the following species at risk have been observed within the last ten years:

- Northern Map Turtle
- Blanding’s Turtle
- Snapping Turtle
- Bridle Shiner
- Eastern Musk Turtle
- Grass Pickerel

Additional species may also be present, but have yet to be reported. It is important to conserve shoreline vegetation and woody debris, and reduce pollution to maintain healthy aquatic communities.

For more information, follow the links below:

- Fish ON-Line
- Reptile and Amphibian Atlas
- Zone 18 Fishing Regulations
- Guide to Eating Ontario Fish
- Species at Risk by Region
**Maintain a natural shoreline:**
Create a buffer zone by planting native species to control erosion, increase habitat for wildlife, maintain cooler water temperatures (shade), protect from flooding and improve water quality.

Contact Watersheds Canada to learn more about their Natural Edge shoreline naturalization program.

**Build low impact-docks:**
Increase habitat and reduce sediment disruption. Examples of low impact docks include cantilever, floating or post styles.

**Reduce runoff from pollutants:**
Use phosphate-free, biodegradable soaps and detergents at a distance from the lake and limit or eliminate fertilizers to decrease nutrient input. Limit the amount of hard surfaces to control runoff of pollutants entering the lake.

**Handle and dispose of chemicals properly:** Fuel motor craft responsibly to avoid spills and bring extra chemicals and storage containers to a hazardous waste depots.

**Manage animal waste and grazing areas:** Avoid overgrazing as it can expose soil and increase erosion. Remove animal waste to avoid excess nutrients.

**Maintain your septic system:**
Septic systems can last 15-25 years if properly maintained; pump out your septic tank every 3-5 years. Keep septic systems far from the shore to reduce risk of water pollution and limit damage.

**Prevent the spread of invasive species:** Clean, drain, dry and disinfect any watercraft prior to entering the lake. Do not release live fishing bait or aquarium fish.
Become a citizen scientist:
Citizen science is a great way to learn and engage with nature. Volunteers provide valuable research that allow scientists to track environmental changes to a greater extent than if they were to do it alone. Learn how to get involved by visiting the sites below.

Invading Species Watch Program  www.invadingspecies.com
Lake Partner Program  www.desc.ca
Loon Watch  www.birdscanada.org
Nature Watch (frog, plant, ice, worm)  www.naturewatch.ca
Ontario Reptile & Amphibian Atlas  www.ontarionature.org
Water Rangers  www.waterrangers.ca

To report large blooms of algae:
KFL&A Public Health  1-800-267-7875
Leeds, Grenville & Lanark Health Unit  613-345-5685
Blue-Green Algae Bloom Sighting (MOECC)  1-800-268-6060

To report invasive species:
EDD Mapping System App  www.eddmaps.org/ontario
Invasive Species Hotline (OFAH)  1-800-563-7711 or info@invadingspecies.com

For more information:
Cataraqui Region Conservation Authority  1-877-956-2722 or 613-546-4228
Water Level Questions (Energy Ottawa)  613-225-0418 or info@energyottawa.com

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1 Charleston Lake Association. 2006. Charleston Lake Plan, Keeping Charleston Lake Beautiful in Every Way
2 Data provided by the Broad Scale Monitoring Program (2008)
3 Average total phosphorus data provided by the Lake Partner Program
4 Data provided by Queen’s University (2013)
5 Ministry of Natural Resources and Forestry (1989) Acid Sensitivity of Lakes in Ontario
7 Ministry of Natural Resources and Forestry (Fish ON-Line and personal communication 2016)
8 Ontario Nature Reptile and Amphibian Atlas and Fisheries and Oceans Canada (2016)