

BLACK CREEK SUBWATERSHED STUDY SUMMARY

The Black Creek Subwatershed, also known as Subwatershed 10, is one of 20 subwatersheds forming the Credit River Watershed. The Black Creek Subwatershed Study has been completed to document the natural heritage characteristics of the subwatershed, to establish long term objectives for managing the watershed, to identify opportunities and threats, and to present a comprehensive management plan that will guide the CVC, the area municipalities, landowners and industry in protecting and restoring the subwatershed moving forward. As illustrated on Figure E1, the majority of the subwatershed is in Halton Hills, with the northern part of the headwaters extending into the Town of Erin. The subwatershed is predominately rural with a mix of agricultural lands and an extensive natural heritage system including parts of the Niagara Escarpment. Acton and the western limit of Georgetown are the largest municipalities in the subwatershed.

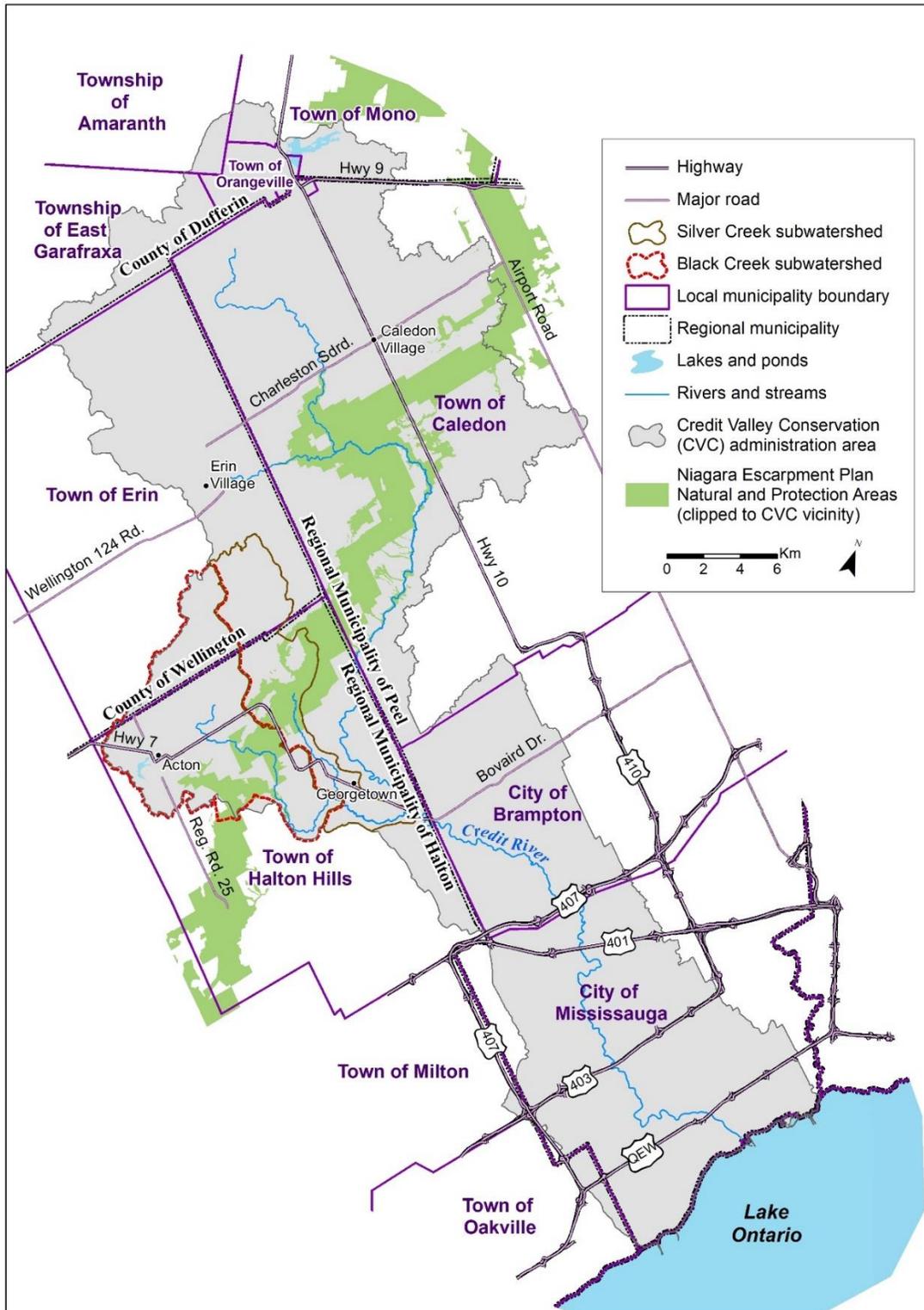
The Black Creek Subwatershed study was completed in three phases.

- *Black Creek Subwatershed Study Phase 1 Characterization Report (CVC et al., 2012)* - focused on developing a sound understanding of the features, functions and linkages of the environmental resources in the Black Creek subwatershed. From this work, goals and objectives were established.
- *Black Creek Subwatershed Impact Assessment Phase 2 Study (CVC et al., 2014)* - identified the threats, measured the impacts against the goals and objectives identified in Phase 1, and evaluated measures to mitigate land use practices. A set of six management scenarios were evaluated using groundwater and surface water hydrologic and hydraulic models to identify changes in existing conditions and variances from the subwatershed study goals and objectives. From this study, a preferred management strategy was determined for the subwatershed.
- *Black Creek Subwatershed Study: Management, Implementation, and Monitoring Plan (CVC et al., 2019)* - provides guidance, recommendations and implementation measures for a broad range of activities including upgrading or implementing new municipal infrastructure, protecting groundwater quality and quantity, improving surface water quality including Fairy Lake, guiding protection and restoration activities associated with watercourse and natural heritage features, implementation of new urban development and aggregate resource extraction.

While the Phase 3 report focuses on recommendations and implementation, understanding the previous two phases is helpful in clarifying how the management plans and recommendations were developed. Therefore, a summary has been provided herein regarding the scope and findings of both Phase 1 and Phase 2.

Phase 1 - Subwatershed Characterization

Over the last 50 years, Black Creek has significantly improved in condition; where once it received discharge from local tannery operations and minimally treated sanitary sewage, it is now habitat to one of the healthiest populations of Brook Trout in the CVC watershed. While conditions have improved, today the subwatershed is experiencing additional stressors from urban growth, aggregate operations, agricultural activities and external factors such as climate change.



Watercourses (CVC, 2018); Lakes and ponds (CVC, 2017); Black Creek subwatershed (CVC, 2009); Niagara Escarpment Plan land use designations (Ontario Ministry of Natural Resources and Forestry, 2018)

Figure E1 The location of the Black Creek subwatershed within the Credit River watershed

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The Black Creek subwatershed includes 56 percent anthropogenic land uses while 44 percent is natural. The land use can be further characterized as follows:

- Urban and Rural Development (19.4 percent),
- Aggregate Extraction (2.4 percent),
- Agriculture (34.3 percent),
- Forest and Wooded Swamp (24 percent),
- Wetland (13 percent),
- Plantations (2 percent), and
- Old Fields (4.6 percent).

In characterizing the subwatershed, Phase 1 addressed a broad range of focus areas, including: hydrogeology and water balance, surface water conveyance and fluvial geomorphology, terrestrial ecology, surface water quality, benthic invertebrates, and aquatic ecology. For each of these disciplines an in-depth understanding of the subwatershed was developed, along with an understanding of the interdependence of each of them. The characterization demonstrated that the groundwater recharge is critical to maintaining the availability of potable water and in maintaining the ecological health of the Black Creek Subwatershed. As a key example, the relationship between groundwater discharge and surface water features is an integral part of the coldwater fishery sustained in much of Black Creek.

Based on the findings, the subwatershed has been divided into seven subcatchment zones based on commonalities in features, such as surface water flow characteristics, natural landscapes, and land use activities. These seven zones were also ultimately used to establish management priorities. The seven zones are illustrated on Figure E2.

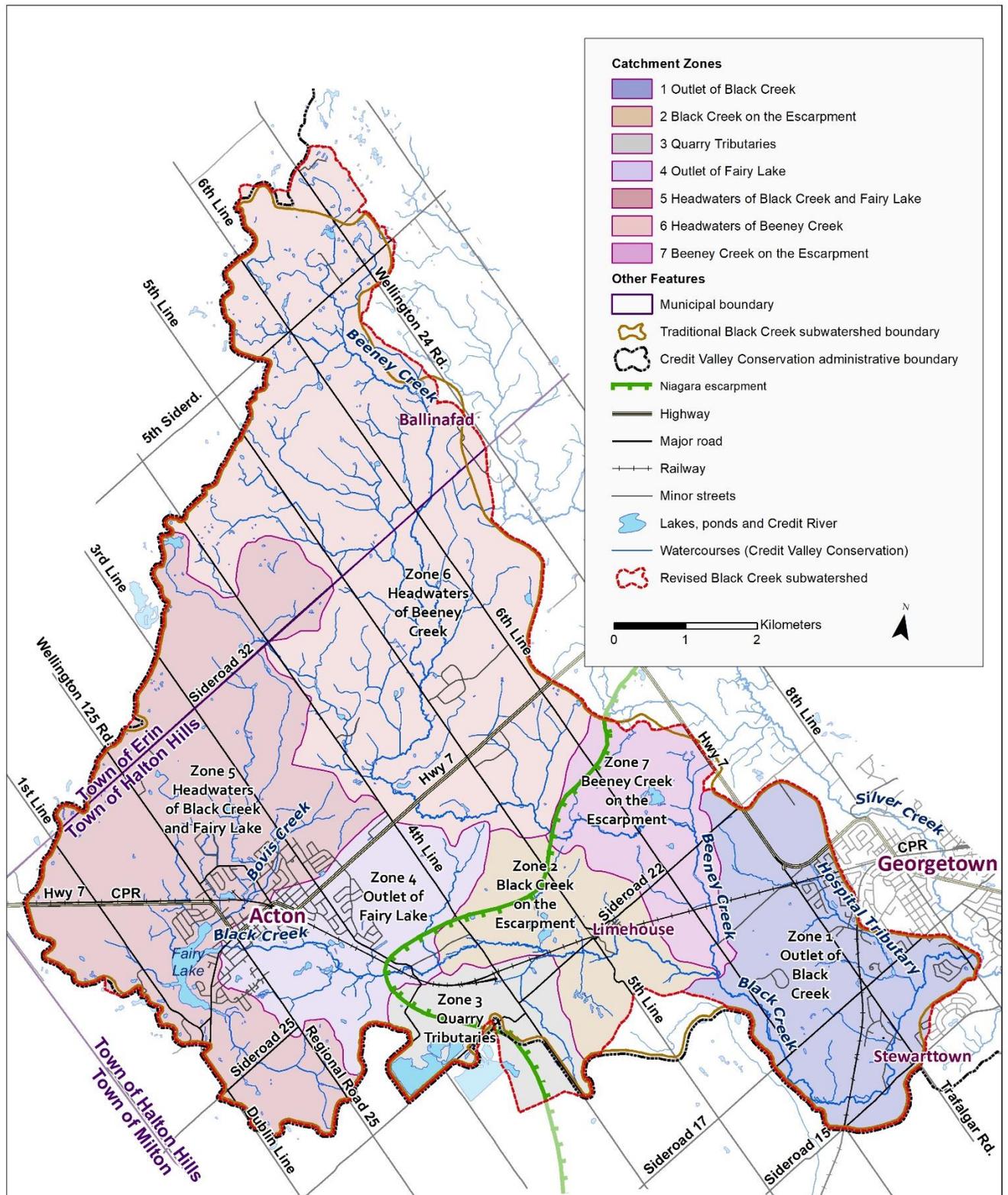
Following the Phase 1 characterization, the Goals and Vision for the Black Creek subwatershed were developed from the input provided by the public, landowners, and businesses present at the focus group meetings, as well as input from the Technical and Steering Committee.

Goals

1. Protect, enhance, and restore Black Creek;
2. Manage the Black Creek subwatershed through planning, stewardship, education, and monitoring;
3. Enhance our knowledge of the Black Creek human development and natural features, and animal and plant populations; and
4. Involve, educate, and collaborate with the Black Creek communities and stakeholders.

Vision

1. Ensuring human uses are in harmony with the environment;
2. Providing a healthy, natural heritage system linking land, water, and stream banks;
3. Maintaining healthy, diverse, and self-sustaining populations of plants and animals;
4. Fostering restoration and enhancement of natural features, functions, and linkages;
5. Valuing the Black Creek subwatershed by using its resources sustainably;
6. Ensuring public health and safety; and,
7. Ensuring a sustainable and healthy Black Creek for present and future generations.



Watercourses (CVC, 2018); Lakes and ponds (CVC, 2017); Subcatchment zones (CVC, 2008); Physiography of Southern Ontario (Ontario Geological Survey, 1972)

Figure E2 The seven subcatchment zones of the Black Creek subwatershed

To translate the goals and vision into meaningful measurable targets and recommendations, ten (10) objectives were developed. All of the objectives are considered to be of equal importance in achieving the overall goals and vision of the Black Creek subwatershed.

1. **Promote Awareness:** Increase awareness of the linkages between healthy water, healthy lifestyle, and the economic viability of rural and urban land uses.
2. **Increase Knowledge:** Increase knowledge about the wise use of surface and groundwater, having regard to both human and ecological need.
3. **Increase participation:** Increase participation in stewardship actions, in particular priority areas identified in the subwatershed study. Promote the need for environmental stewardship and better understanding of the importance of natural features and functions of the Credit River watershed.
4. **Preserve Hydrologic Cycle:** Preserve and re-establish the natural hydrologic cycle.
5. **Maintain, enhance or restore watercourse function:** Maintain, enhance or restore natural stream processes to achieve a balance of flow and sediment transport.
6. **Reduce Erosion:** Manage stream flow to reduce erosion impacts on habitats and property.
7. **Minimize Flood Risk:** Minimize risk to human life and property due to flooding.
8. **Maintain groundwater levels and baseflow:** Maintain groundwater levels and baseflows (groundwater discharge to streams) to sustain watershed functions and human uses.
9. **Maintain or enhance water quality:** Maintain or enhance water and sediment quality to achieve ecological integrity.
10. **Protect, restore or enhance ecosystem:** Protect, restore or enhance the integrity of the watershed ecosystem through an integrated network of natural areas, habitats and connecting links.

Phase 2 - Impact Assessment

Completing an impact assessment is important to gain a better understanding on how different actions and activities throughout the subwatershed affect the environment. The results of the impact assessment provide the context and guidance needed to address different environmental concerns that were identified, and to protect the healthy natural areas from future changes. Potential impacts from uncontrolled stormwater, increased groundwater takings, and urbanization all negatively impact our natural areas if not mitigated properly.

In total six alternative scenarios were developed and compared for existing and future land uses. The future land use scenarios conform to the Provincial Growth Plan for the Greater Golden Horseshoe (Places to Grow), as defined in the Official Plans (OP) of the member municipalities within the study area to the year 2031. The potential influences of each of the

alternative management scenarios on the existing and potential future conditions of the Black Creek subwatershed were assessed using a modelling approach.

The six management scenarios that were evaluated included:

- **Scenario 1: Baseline Conditions** – existing land use conditions with no additional stormwater management (SWM) measures;
- **Scenario 2: Business as Usual** - the application of the existing approach to SWM to new development based on OP 2031;
- **Scenario 3: Low Impact Development (LID) in New Development** - the application of LID SWM practices to new areas of urban development;
- **Scenario 4a: LID in New Development and Retrofitting of LID to Existing Development** - the application of LID SWM practices to new development and to previously developed areas through retrofitting;
- **Scenario 4b** – consistent with Scenario 4a plus enhanced NHS; and,
- **Scenario 4c** – consistent with Scenario 4a plus enhanced NHS and implementation of agricultural BMPs.

It was concluded that the need for and effectiveness of each management scenario varied across the seven catchment zones. In response the recommended management scenarios vary from zone to zone, although broadly speaking Scenario 4c is preferred because it achieved the level of environmental protection and restoration that is required to maintain or enhance current environmental conditions without further damage.

Table E1 summarizes the management procedures applicable to the seven catchment zones, including high priority and secondary priority catchment zones. The assignment of a high priority ranking versus a secondary ranking is based on the specific characteristics and relative benefits that will be derived from implementing the proposed measures. The priorities can broadly be summarized as follows:

- Adopt the enhanced NHS throughout the subwatershed, which includes elements defined under existing policies and practices (Greenbelt Plan, Halton Region NHS, Niagara Escarpment Commission), as well as additional lands based on stewardship (Credit River Watershed NHS);
- Implement LID as a holistic approach to SWM (i.e. through a treatment train approach) in all new developments in zones 1, 4 and 5;
- Implement LID as a holistic approach to SWM in existing developed areas through retrofitting existing land/infrastructure at a rate greater than 25 percent of the land area in zones 1, 4, and 5; and
- Implement land management and infrastructural agricultural BMPs in zones 2, 5, 6 and 7.

Table E1 Prioritization of Management Practices

Zone	Enhanced NHS	Agricultural BMPs	LID New Development	LID Retrofit in Existing Developed Areas
1	✓		✓✓	✓✓
2	✓	✓		
3	✓			
4	✓✓		✓✓	✓
5	✓✓	✓✓	✓	✓✓
6	✓	✓✓		
7	✓	✓		

Note: High priority implementation identified by two red check marks (✓✓); Secondary priority implementation is identified

Phase 3 - Management, Implementation and Monitoring

The Management, Implementation and Monitoring Plan presents the actions needed to protect and sustain the natural and human environment from known stressors, including: existing development, new development, rural activities, flooding and natural hazards, and resource extraction activities.

The Management, Implementation and Monitoring Plan was developed by a technical committee consisting of CVC staff, consultants, and municipal partners, with the assistance of the steering committee and focus groups. The Management Plan was completed to align with municipal and provincial planning documents and has been organized based on land use. The study also supports the CTC Source Protection Plan (*Source Protection Committee, 2015*). Overall, the plan aims to ensure land use and management decisions are carried out in a manner that:

- Examines the impacts of site decisions in a subwatershed and watershed context;
- Plans for long-term change and unexpected events;
- Avoids exploitive land uses that will deplete natural heritage features and impair associated functions;
- Avoids, where possible, the adverse impacts of development on ecological features and functions;
- Implements land use and management practices that are compatible with the natural features of the area; and
- Restore or enhance existing environmental conditions previously impacted by land use activities.

The Management, Implementation and Monitoring Plan has been divided into eight sections. They are grouped by land use activities, flooding and natural resources.

In total, 72 recommendations were developed. Each recommendation includes anticipated outcomes, implementation tools, timelines, and a list of the partners responsible for implementation. The recommendations are colour coded to reflect one of four implementation categories: policy, programming, land use planning and projects.

Land Use Activities

1. Existing Urban Development: Identifies opportunities to mitigate impacts from existing urban development on the subwatershed.
2. New Development: Provides direction for future studies, measures to mitigate impacts from new development, and strategies for the protection of important features and functions of the watershed.
3. Rural Land Use: Identifies opportunities to mitigate existing rural land use impacts on the subwatershed.
4. Aggregate Extraction: Identifies measures that aim to minimize impacts of aggregate extraction on the natural environment.
5. Conservation Properties: Identifies measures that provide direction to the management of conservation lands from the perspective of education, stewardship and land management.

Flooding

6. Natural Hazards: Identifies protection, management and remedial measures to manage flood and erosion risks to people and property.

Natural Resources

7. Natural Heritage: Identifies the natural heritage system, as well as aquatic and terrestrial restoration priorities to protect core areas and maintain and restore connectivity across the subwatershed.
8. Water Management: Identifies measures intended to guide both long term sustainability of groundwater, as well as the management of water takings and wastewater discharge from the perspective of the natural environment.

The recommendations address the broad range of activity in the Black Creek subwatershed. However, three key areas of focus have been identified that will help to guide the management and implementation plan by ensuring that our actions will generate the most positive impact. These include water quality, environmental resiliency and groundwater.

Water Quality: Nutrient levels (specifically Total Phosphorus (TP)) and chloride exceed Provincial Water Quality Objectives (PWQOs) in the Black Creek subwatershed due to various land use activities, including urbanization, stormwater runoff, waste water treatment plant discharge, and agricultural activities. TP will need to be managed by various mitigation techniques in urban and rural areas, before it has the chance to travel into Fairy Lake and downstream throughout the rest of the subwatershed. Chloride may be managed

through the careful application of road salt in the winter and by having contractors and maintenance staff properly trained on the negative impacts of salt on our environment.

Environmental Resiliency: In order to maintain and enhance the environmental features of Black Creek, a resilient and holistic approach is needed to protect and enhance the healthy areas and rehabilitate the areas of degradation. Terrestrial resiliency requires the healthiest areas to be protected, managed and enhanced where necessary, in order to retain the biodiversity of the area. Aquatic resiliency requires the most impaired areas to be restored back to a more natural and functional system, with restoration techniques including natural channel design, bank stabilization and riparian plantings with an increased buffer width. Addressing both the terrestrial and aquatic areas will lead to a more diverse and robust environmental system with more capacity to respond to change.

Groundwater: The protection of groundwater quantity and quality is a key requirement of the management plans for the Black Creek subwatershed. Groundwater is a critical resource from the perspective of both potable water supply and the sustaining of natural features. Groundwater quantity is deemed to be moderately stressed, based on results from the Phase 2 study and the CTC Source Protection Plan (*Source Protection Committee, 2015*). To reduce groundwater stress, measures must be taken to maintain recharge through permeability of the landscape and management of potential pollutants.