City of Charlottetown Brook Trout Conservation and Protection Plan

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Prepared for Ellen's Creek Watershed Group Inc 2014

by

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CHARLOTTETOWN

Prince Edward Island CANADA

Ellen's Creek Watershed Group

Title page photograph: Brook Trout by Norman Dewar © 2014

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1. Purpose of Management Plan

Within the City of Charlottetown (Prince Edward Island), four freshwater streams travel through green space, industry and densely populated neighbourhoods to empty into the Charlottetown Harbour. They make up part of the Hillsborough River complex – a heritage river with great cultural and natural significance for Islanders. While some of the upper reaches have been buried over the course of the City's development, there remain 9.5 km of freshwater stream habitat in Ellen's, Wright's, Hermitage, and Hazard Creeks. A freshwater community exists here and in some reaches appears relatively healthy. Brook trout (*Salvelinus fontinalis*) are a top predator whose population status may be considered as an indicator of each stream's functional integrity.

This management plan is intended to direct watershed work within the City limits as it pertains to brook trout habitat protection and restoration. While the focus is stream habitat, this plan recognizes the profound impact of land use on aquatic function. Therefore, the goals, objectives and strategies describe actions that should occur at the watershed / landscape-level as well as at the ecosystem-level.

2. Current State of Watersheds

The three watersheds included in this management plan for brook trout habitat are Ellen's, Hermitage and Wright's Creeks. The Ellen's Creek watershed also encompasses Hazard Creek described in some historical accounts as Three Mile Brook. While they are all urban in their general make-up, they have some unique features and challenges. The following subsections describe their current conditions.

2.1 Ellen's Creek (including Three Mile Brook / Hazard Creek)

Ellen's Creek runs in two branches through the western sections of Charlottetown, beginning in the community of Winsloe and emptying into the North River just beyond Beach Grove Rd. The main (western) branch travels down from Royalty Junction above Highway 2 through a mix of agricultural land and residential development; the distance from headwater springs to the head-of-tide is 3.8 km. The other, called Hazard Creek, travels underground from near the airport to the bypass at Superior Sanitation Services Ltd and from there above-ground for 1.5 km past the Malpeque Rd. Pumping Station

and through MacNeill's Pond. The two branches meet near the corner of Capital Drive and North River Road. The total watershed area is 1,190 ha, all within City limits.

An electrofishing survey conducted roughly midway up the western branch suggests there is a resident population of brook trout in these upper reaches (Figure 2.1). Juvenile brook trout were present at a density of 85 per 100 m^2. Rainbow trout (*Oncorhynchus mykiss*), an introduced and potentially invasive species, was not present. The riparian margin here is a mix of mostly coniferous trees and grasses that provide excellent overhead and stream-bank cover. Frequent undercut banks, large woody debris and eight spring inputs also contribute to good quality brook trout habitat. The largest spring just south of Sherwood Rd was contributing 300,000 $L \cdot day^{-1}$ in July 2014; that value represented 20 % of the total flow in the western branch, from the spring outlet to the Charlottetown Bypass Highway (Figure 2.2).

Figure 2.1 Electrofishing Ellen's Creek in the summer of 2014, a joint initiative of the Ellen's Creek Watershed Group Inc and the PEI Department of Agriculture and Forestry, Fish & Wildlife Division (Photos courtesy of Norman Dewar)

Figure 2.2 A large spring contributing 20% of baseflow to this section of Ellen's Creek during the summer months (Photo courtesy of Norman Dewar)

While no formal fish surveys have been conducted in the smaller eastern branch called Hazard Creek, brook trout were seen here in 2010. Subsequent anecdotal observations suggest there are much lower densities of trout in this system than in the main Ellen's Creek. The gravel – rock substrate provides potentially good brook trout spawning habitat and there are two cold water springs present.

A survey of stream macroinvertebrate populations in 2011 described low-diversity assemblages and many species that are tolerant of organic pollution[1]. A high proportion of burrowers in the western branch were indicative of a heavy sediment burden. Nonetheless, some sensitive species were also present in both branches, including stoneflies, caddisflies and mayflies, which are important food for brook trout.

[1] Gardner, B. and Tummon- Flynn, P. (2011). *Macroinvertebrate sampling and water chemistry in Ellen's Creek*. Prepared for Ellen's Creek Watershed Group and Watershed Ecology 462, University of Prince Edward Island.

The most recent land use census was derived from 2010 aerial surveys of the province. It indicated that Ellen's Creek watershed in 2010 was 52 % developed land, 39.8 % agriculture and 6.8 % forest (Figure 2.3). Since that time, residential development has continued and it is likely that most has occurred at the expense of previously agricultural land.

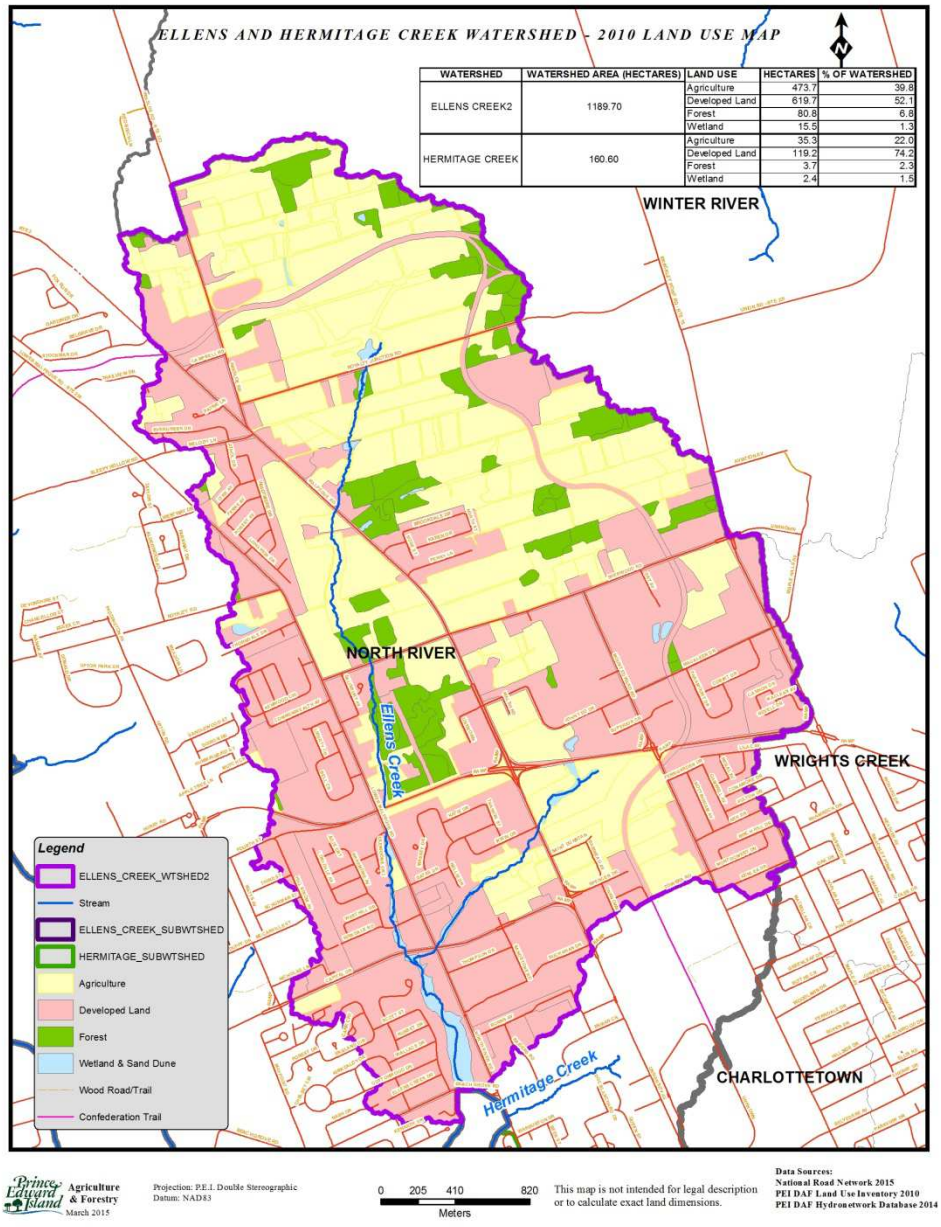

Figure 2.3 Land use in the Ellen's Creek watershed according to 2010 aerial survey data (courtesy of PEI Department of Agriculture & Forestry – Forest, Fish and Wildlife Division)

A riparian assessment in 2013 identified nine areas of concern, the majority (6) associated with public and private road crossings[2]. Unstable banks and undersized culverts contribute to erosion and sediment deposition at these points with further sedimentation occurring downstream during high flow events. The best quality riparian margin was found in the northern headwaters sections, whereas riparian vegetation along the estuary bordering the salt marsh between Capital Dr. and Beach Grove Rd. suffered most from urban encroachment, including residential mowing and paved surfaces.

2.2 Wright's Creek

Wright's Creek runs along the eastern side of Charlottetown from the airport downstream through Andrew's Pond to empty into the Hillsborough River above the Queen Elizabeth Hospital and École François Buote. It branches in a number of places but there is effectively just one main channel contributing most of the water during all but peak flow periods. The creek flows for 1 km before entering Andrew's Pond, which is 0.6 km long and covers roughly 12 acres. Two other short tributaries also enter the pond from the west. Andrew's Pond is an old mill pond (Figure 2.4) with an earthen berm dam and 6m vertical drop-inlet culvert with log draw-down structure. The dam is now maintained through a partnership between the Andrew family (who still owns the pond) and Ducks Unlimited. The pond exit is at the head-of-tide and there is a further 1 km of stream with adjoining salt marsh before the water reaches the Hillsborough River. The total watershed size is 1,039 ha.

There have been no formal surveys for aquatic life in Wright's Creek. However, anecdotal evidence exists of a long-established brook trout population. Andrew's Pond was one of the most popular angling spots in Charlottetown in the first half of the 1900's and was routinely stocked. Today, brook trout are frequently visible in the eight restored springs and six constructed sediment traps above the pond. The pond itself was recently drawn down and restored by excavating out the accumulating sediment burden; the pond is now likely of sufficient depth and cool temperature to sustain brook trout throughout the year. Below the dam in the area of tidal influence, rainbow smelts migrate up to a restored spring to spawn every spring. In the past, sea-run brook trout have also come up to the base of the dam but their relative abundance is not documented.

[2] MacEachern, J. (2013). *Urban Watershed Riparian Area Health Assessment – Charlottetown. Ellen's Creek, Wright's Creek*. Prepared for the City of Charlottetown.

Figure 2.4 Andrew's Mills on Wright's Creek, circa 1900 with Andrew's Pond in the foreground. The homestead in the center still exists today but the mill structure is gone. (Photo courtesy of John Andrew)

A riparian assessment in 2013 identified fourteen areas of concern, but also small intact areas of high quality, mature forest (eastern hemlock, yellow birch, and red maple)[3]. Some of the problem riparian areas were flagged because there had been recent disturbance (bare ground) related to restoration work that needed heavy equipment in the buffer zone. These would be temporary bare ground events, with grass seeding occurring quickly after the clean-out of sediment from in-stream traps. Other identified concerns related to inadequacies in the width and density of riparian vegetative cover. Several sections of waterway adjacent to agricultural fields and development have very thin treed margins which do not provide much protection, cover or shading for the stream and pond habitats.

Wright's Creek does benefit from having two protected upland forest stands within its watershed boundaries – East Royalty Acadian Forest Park and the Royalty Red Oaks stand. These help to increase the proportion of forested land within the watershed, but 2010 land use census data indicate it is still only at 8.3%. Proportions of developed and

[3] MacEachern, J. (2013). *Urban Watershed Riparian Area Health Assessment – Charlottetown. Ellen's Creek, Wright's Creek*. Prepared for the City of Charlottetown.

agricultural land are similar to Ellen's Creek, at 52.3% and 38.1%, respectively (Figure 2.5).

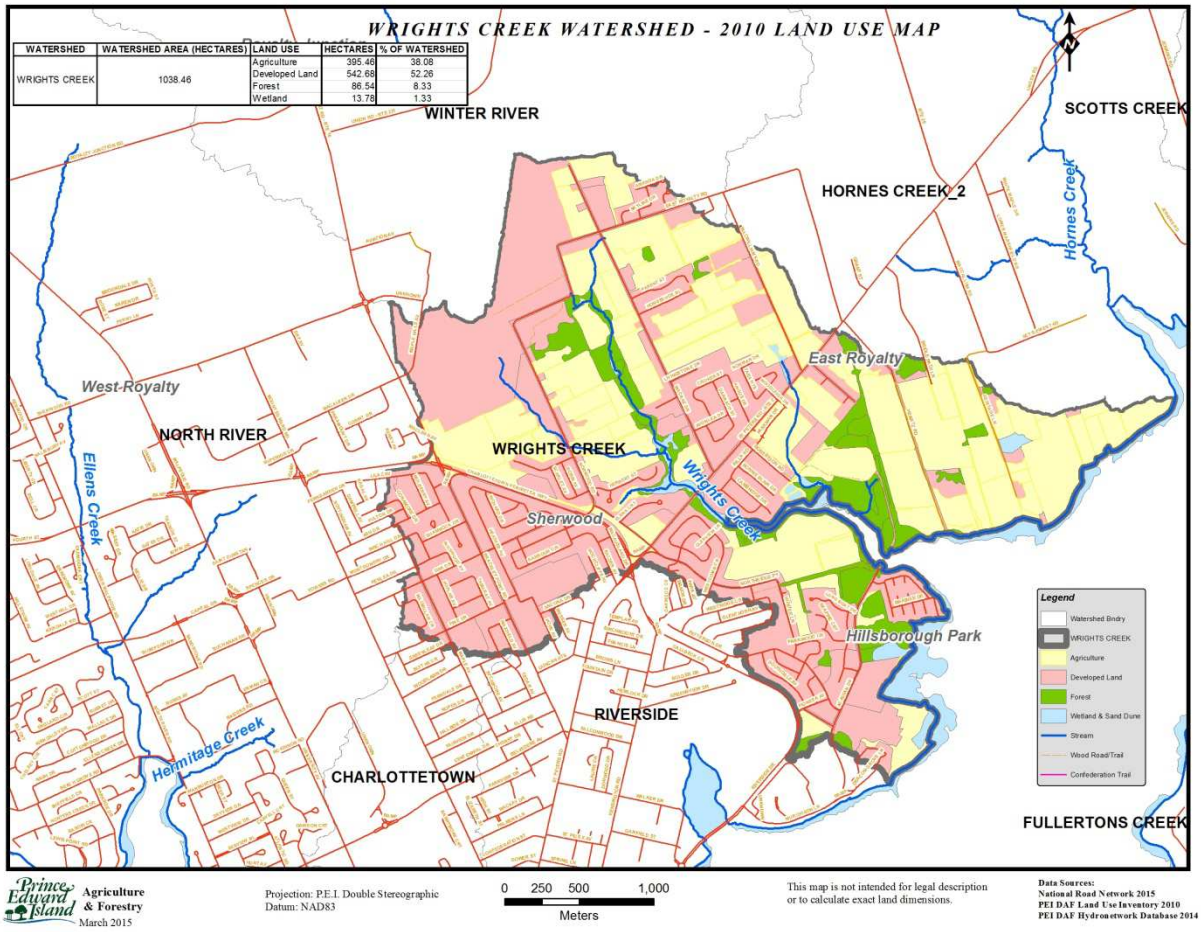

Figure 2.5 Land use in the Wright's Creek watershed according to 2010 aerial survey data (courtesy of PEI Department of Agriculture & Forestry – Forest, Fish and Wildlife Division)

2.3 Hermitage Creek

Hermitage Creek is a small watershed adjacent to the mouth of Ellen's Creek. It is just 161 ha in size with 0.7 km of freshwater stream habitat. The headwaters are located in a relatively natural area of trees and wetland on the grounds of the University of PEI. However, 74.2% of the watershed is developed, with 22% in agriculture and only 2.3% in forest.

The headwaters of the creek are blocked for fish passage by a culvert near Charlottetown Rural High School. A small pond immediately upstream of this culvert has been stocked with brook trout in the past but the current state of populations in the pond or downstream of the culvert are unknown.

3. Main Challenges for Brook Trout

3.1 Sedimentation

Many Island streams have a major challenge with red water. Our sandstone-based fine soils are easily erodible; they are susceptible when bare and exposed to surface water and wind[4]. Bare soil from farm fields, land under development and clay roads is carried to the low points in the landscape where it accumulates, often in stream bottoms and estuaries. In the context of brook trout habitat, these fine soil particles settle over the gravel and cobble of spawning beds, smothering eggs and fry[5]. They also limit the macroinvertebrates, that young and adult trout rely on for food, to a few tolerant species in a simplified aquatic community[6]. Where the soil content is high in clay, the fine silts can stay suspended in the water column for great distances and times, impacting fish respiration and shellfish feeding. More broadly, heavy sediment loads in stream bottoms shallow and widen streams, making them more susceptible to flooding. Road crossing infrastructure may also be compromised if areas immediately upstream of under-sized culverts become deposition zones for sediment. When culverts fail they then take large pulses of sediment and debris downstream, further degrading freshwater habitat.

The Ellen's Creek, Hermitage Creek, Hazard Creek and Wright's Creek watersheds all have issues with "red" water and excessive sedimentation. While there is some agriculture in the headwaters of Ellen's and Wright's Creeks, much of this farmland is not routinely tilled (e.g., it is in pasture and/or perennial crops). The drivers for this problem in an urban landscape are typically inadequate storm-water management and lack of best management practices in the residential and commercial construction industries (Figure 3.1).

[4] Harris, M., Dupuis, T., Guignion, D. and MacFarlane, R. (2012). *Technical manual for watershed management on Prince Edward Island*. Prepared for the PEI Watershed Alliance.
[5] Soulsby, C., Youngson, A.F., Moir, H.J. and Malcolm, I.A. (2001). Fine sediment influence on salmonid spawning habitat in a lowland agricultural stream: a preliminary assessment. *The Science of the Total Environment* 265: 295-307
[6] Rabeni, C.F., Doisy, K.E. and Zweig, L.D. (2005). Stream invertebrate community functional responses to deposited sediment. *Aquatic Sciences* 67: 395-402.

Figure 3.1 Inadequate storm water runoff control at the construction site of the new Sobey's Mall off Malpeque Rd in 2011 during an intense rain event allowed sediment to flow directly into Hazard Creek

Storm-water in several instances is channelled to these four urban creeks in Charlottetown, dramatically increasing peak flows during intense rain and snow-melt events (Figure 3.2). In addition, when the Charlottetown Airport was expanded, land that would normally have drained into the Winter River watershed had surface runoff diverted into Wright's Creek, further increasing the storm-water load to that freshwater system. While the primary objective of a storm-water system may be to divert water away from roads, homes and businesses, it can create more problems downstream if peak flows are not moderated. Erosion and sediment deposition is one ecological impact, but culvert loading is another that is of concern in these Charlottetown systems. Most if not all of the existing culverts are unable to accommodate the more frequent and intense precipitation events we are now experiencing with climate change. Figure 3.3 is one example from Ellen's Creek (2008) of the pressure put on existing infrastructure when a storm-water system is not designed to handle our changing weather patterns.

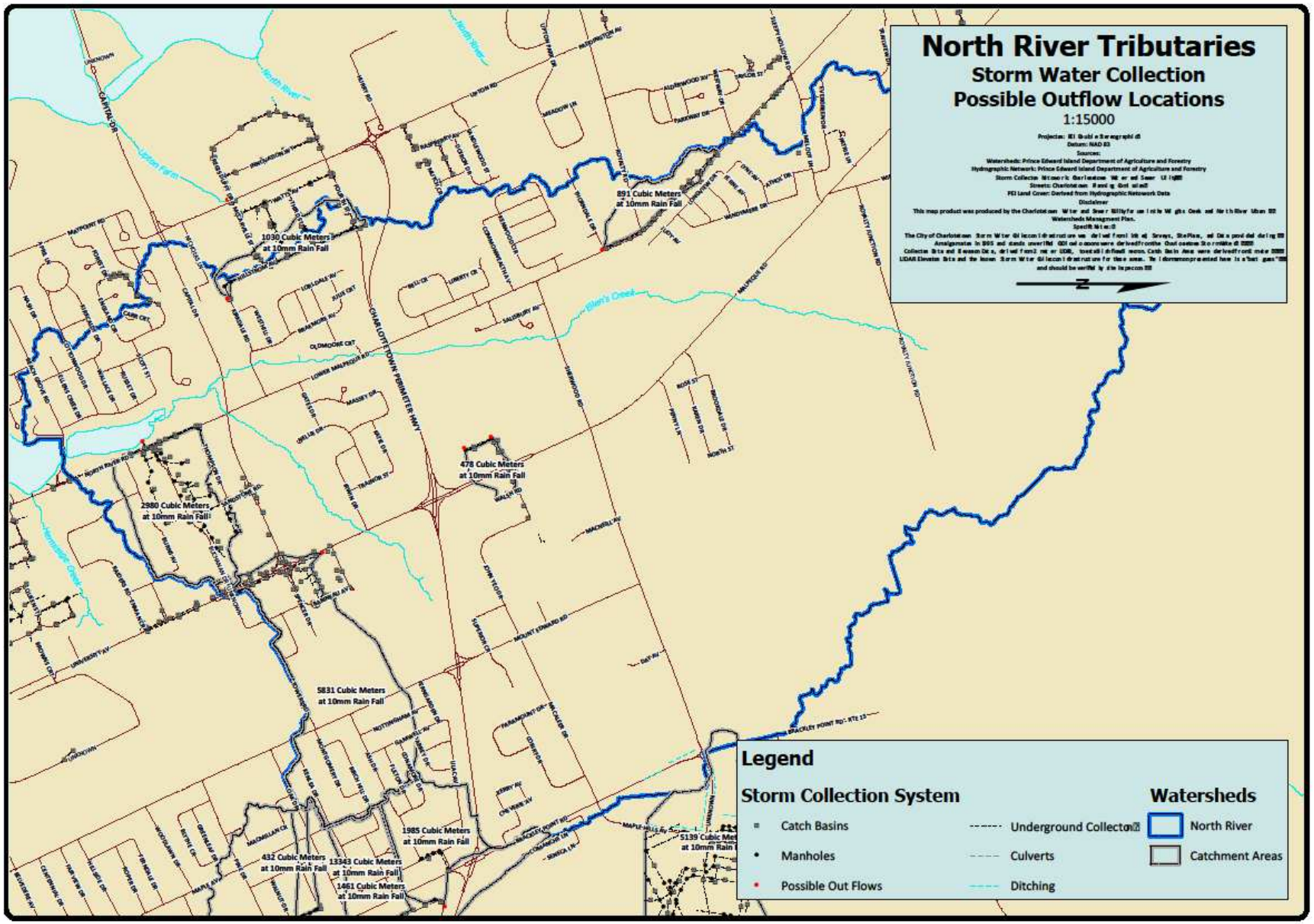

Figure 3.2a Map of known locations for storm-water discharges to Ellen's Creek (courtesy City of Charlottetown). Water volumes are estimates based on collection area and a 10 mm rainfall event

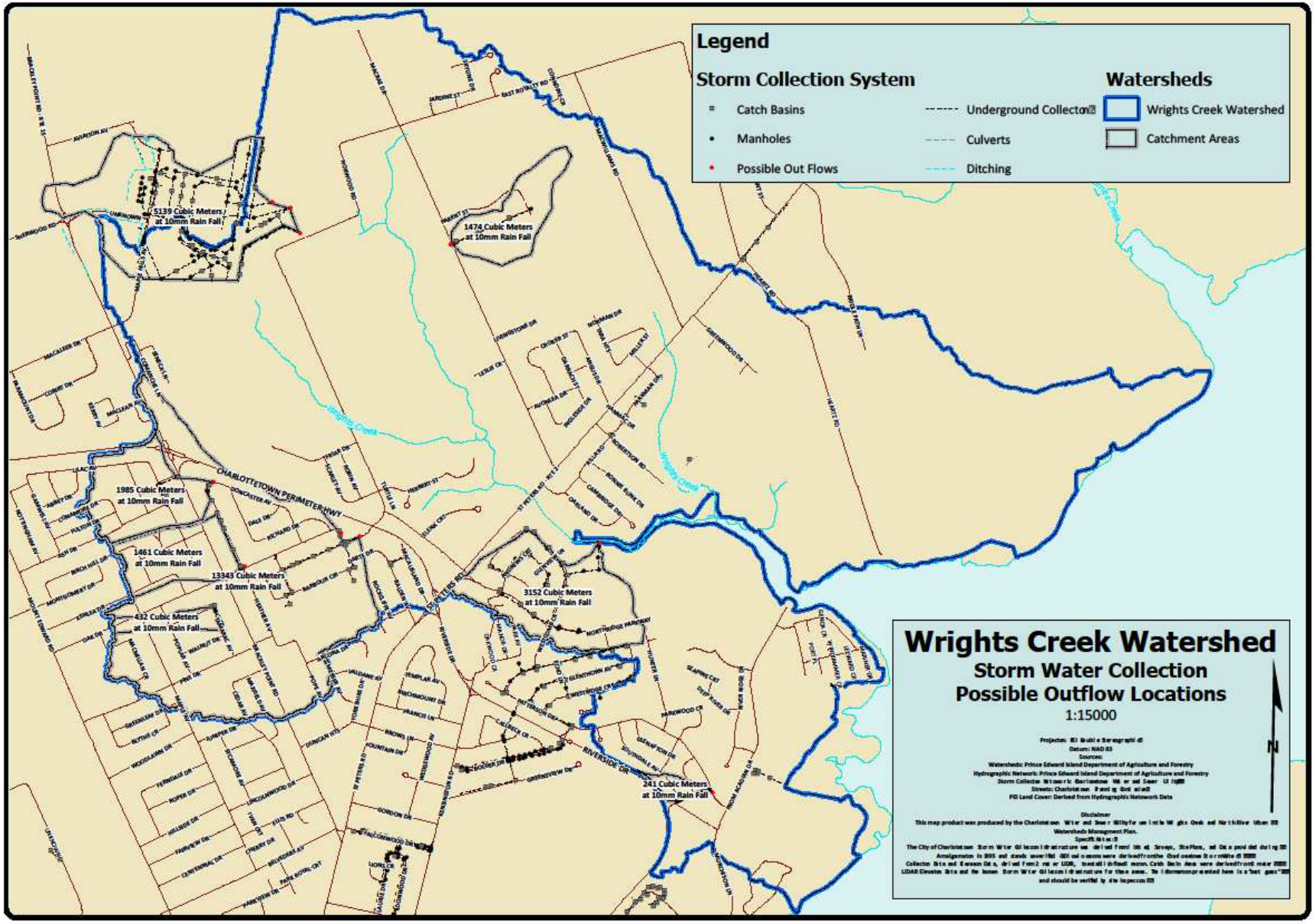

Figure 3.2b Map of known locations for storm-water discharges to Wright's Creek (courtesy City of Charlottetown) Water volumes are estimates based on collection area and a 10 mm rainfall event

Figure 3.3 Flooding of Lower Malpeque Rd in the Ellen's Creek watershed during an extreme rain event in September 2008

3.2 Fragmentation / Access

Freshwater streams on PEI tend to be short and many-branched, in keeping with the low topography and narrow profile of the island. In populated areas, this pattern produces many road crossings. Where road culverts have been in place for several decades, there are often obstacles to fish passage, because crossings were designed simply to channel water without consideration of stream connectivity for aquatic animals. Culverts may present access barriers to upstream habitat for fish by being:

- perched (where there is a drop of 15 cm or more at the downstream end),
- too shallow (where there is insufficient water depth)

- too long and narrow (where the velocity of the water exceeds what a fish can swim up against and/or the length doesn't provide opportunity for rests)[7].

Brook trout prefer spring water for spawning; if access to springs is blocked by culverts, dams or other artificial or natural structures, the available habitat for this species can be severely restricted.

Within the three City watersheds there are seventeen culverts at public and private road crossings. Ellen's Creek has the majority, with 7 public and 3 private culverts (and an additional private crossing recently blown out and not replaced). Wright's Creek has 5 public culverts, but also a private dam at the head-of-tide which currently blocks all fish passage to the 12-acre Andrew's Pond and 1 km of upstream habitat (Figure 3.4). While the potential for a fish ladder at the dam has been investigated, it would be difficult and costly to instate, and would only allow partial access (for some sea-run brook trout but not for rainbow smelts or other weak swimmers). Hermitage Creek has 2 public culverts, but the upper-most one acts more like a dam in that it is a vertical, drop-inlet culvert that impounds water to maintain a small pond. There is no fish passage possible with drop-inlet culverts.

Figure 3.4 Dam at Andrew's Pond, Wright's Creek watershed (photo courtesy of John Andrew)

A partial assessment of Ellen's Creek road crossings was completed in April 2015 and the results are tabulated in Appendix I. Based on structural condition and knowledge of

[7] Harris, M., Dupuis, T., Guignion, D. and MacFarlane, R. (2012). *Technical manual for watershed management on Prince Edward Island*. Prepared for the PEI Watershed Alliance

past storm events, all but the Bypass culvert are under-sized for the present and projected future climatic storm flow loadings, and are nearing the end of their structural design. With the exception of the large concrete box culvert under the Bypass, all the culverts are aging and beginning to show signs of failure. A sudden road failure has a significant impact to the travelling public, public safety, the environment, and the economy. An example of a recent sudden catastrophic crossing failure within the City was the Sherwood Road which blew out on December 10, 2014. Debris from the crossing failure in-stream below the repaired roadway is presenting problems for fish passage and is backing up water into the culvert. The responsibility for maintenance of public road crossings is now split between the City of Charlottetown and the Province (Figure 3.5). As these structures begin to fail and are replaced, federal legislation (enforced by Fisheries and Oceans Canada) will require that fish passage be considered in the new design.

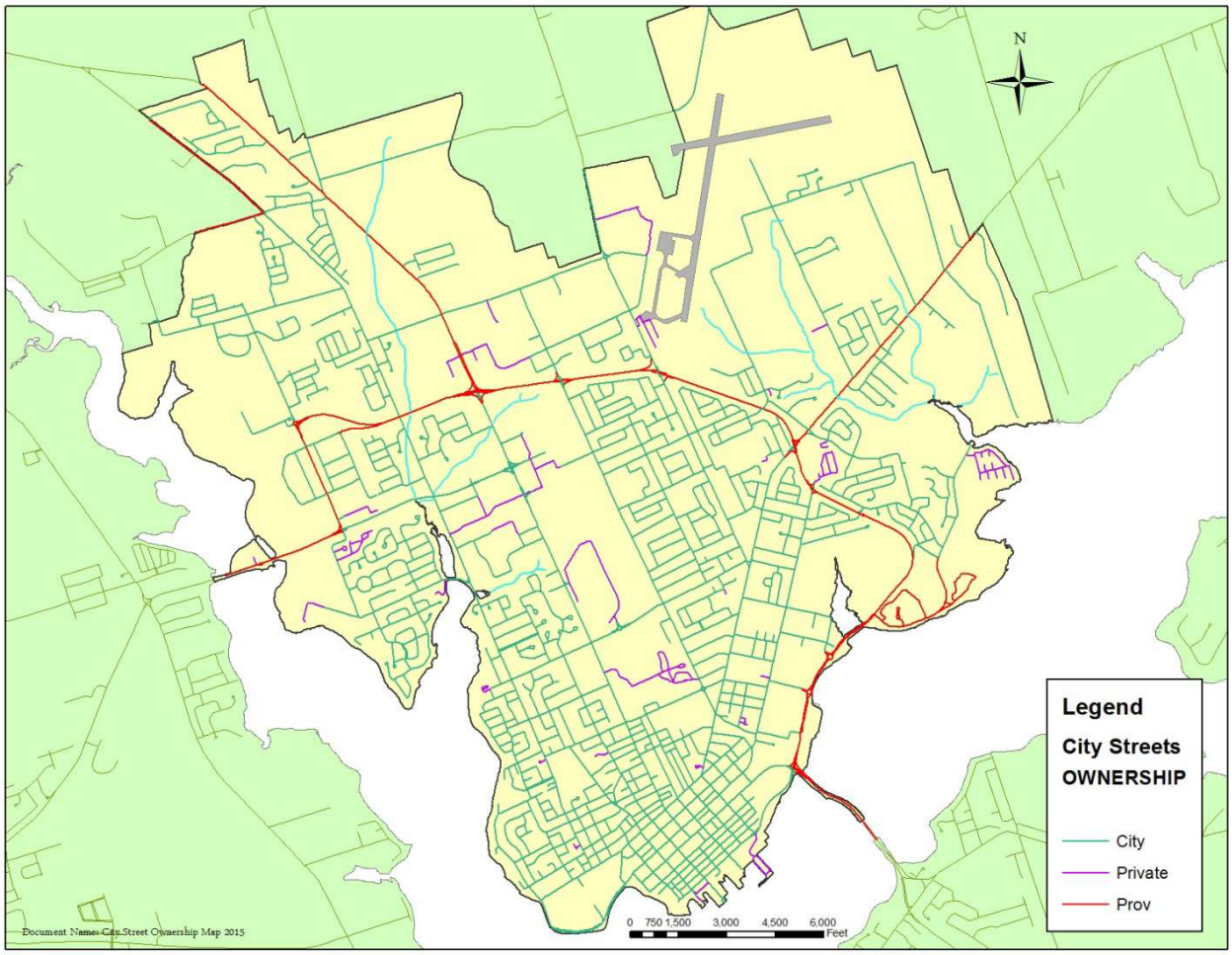

Figure 3.5 Map of Charlottetown showing jurisdictional division of responsibility for maintenance of public roads, culverts and bridges

For the sea-run population of brook trout, there may be additional barriers to passage in estuaries and the Charlottetown Harbour. Water quality monitoring within the harbour suggests that there is an area with low dissolved oxygen that could present a physiological barrier to fish passage[8]. The full ramifications of this low-oxygen zone for marine life are still poorly understood.

3.3 Water Quantity

Urban watersheds have unique challenges with water quantity because the movement of surface water and sometimes groundwater is so strictly managed. Precipitation that would normally percolate into the ground is blocked by hard, impermeable surfaces and redirected into storm-water infrastructure. Consequently, it cannot recharge the groundwater that sustains springs and freshwater streams. In instances where the storm-water system discharges into streams, it creates artificially high peak flows and associated erosion because the discharge is not moderated by groundwater residence time. These restrictions can have a significant impact on baseflow in urban streams which in turn impacts availability of habitat suitable for brook trout.

Charlottetown relies on groundwater for all of its residential, commercial and industrial needs; however, the bulk of that groundwater is sourced from a rural watershed, the Winter River. One groundwater pumping station within the Ellen's Creek watershed, the Malpeque Road station, provides about 1% of the total annual water demand of City of Charlottetown. A new well field is being developed in North River adjacent to Ellen's Creek which it is a sub-watershed of. There is potential for this high-capacity well to drawdown the Ellen's Creek water table and reduce the discharge from springs in its headwaters.

Development of land in the headwaters of all three City watersheds would also likely reduce the discharge from springs on these streams. Much of the land in these upper reaches is currently in agriculture and that allows for some level of groundwater recharge. A land use change to residential or otherwise developed land would increase the proportion of impermeable surface and limit infiltration of rainwater and snowmelt. There is no protection from such development in these headwater areas at present.

[8] D. Guignion. personal communication

There is also an expectation that climate change will reduce baseflow of Island streams more frequently during the summer. Data analysis of stream flows from a permanent hydrometric station on the nearby West River indicates that summer baseflows have been at 30-year minimums for four years in a row[9]. This implies that groundwater recharge in the region has been low since 2009. There are no flow monitoring stations on the Ellen's, Wright's or Hermitage Creeks but the reductions in baseflow are likely similar or worse, given the additional loss of groundwater recharge associated with urban environments. The lack of long-term data on these systems also makes it difficult to evaluate the potential flows and water depths possible with full recharge and fully functional headwater springs.

3.4 Water Quality

Urban environments by their nature have issues with groundwater and surface water contamination. Oil, grease, surfactants, metals and other pollutants are carried along in rainwater through storm-water infrastructure or overland to streams. The type and density of industry creates the contaminant signature unique to each urban watershed and understanding what industries might be contributing to runoff is the first step in identifying what to look for in each stream.

The upper portion of Hazard Creek now runs underground but traverses an area of heavy industry in and around the Sherwood Rd. Immediately before surfacing at the Charlottetown bypass, the creek headwaters pass through the Superior Sanitation Services Ltd refuse sorting facility, where a variety of materials are open-air stored. This is also where fly ash from the energy from waste plant is stored. Fly ash from coal-burning (also used at the plant) contains oxides of silicon, aluminum, iron, and calcium, with lesser amounts of magnesium, sulfur, sodium, potassium and other metals. Considering that the waste-to-energy facility also burns household garbage, the fly ash could also contain chlorinated hydrocarbons (from plastics) including polychlorinated dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDFs) and polybrominated diphenyl ethers (PBDEs). PCDDs and PCDFs are carcinogenic and can accumulate in fish tissues. Many of the salts can impair respiration and osmoregulation in freshwater fishes. One water sample collected from Hazard Creek in November 2011 contained elevated concentrations of chloride, magnesium, sodium, potassium and calcium, suggesting there may be leaching of ash constituents from the sanitation facility grounds. Other signature components for fly ash described above were not analysed for and their presence in surface water of the Ellen's Creek watershed remains unknown.

[9] Environment Canada online hydrometric data; http://wateroffice.ec.gc.ca/google_map/google_map_e.html?searchBy=p&province=PE&doSearch=Go

Other industry in the vicinity includes metal recycling depots, concrete manufacturing and general construction depots.

The Wright's Creek watershed drains surface and groundwater from the Charlottetown Airport and a retired landfill site. In addition to road-associated contaminants like oil, grease, asbestos and fuel, the airport could be a source for de-icing or anti-icing chemicals during the winter months. The most common de-icing and anti-icing agents contain propylene glycol or ethylene glycol along with a number of additives and water[10]. Three main classes of additives are the corrosion inhibitors/ flame retardants benzotriazole (BT) and methyl-substituted benzotriazole (MeBT), the surfactant alkylphenol ethoxylates (APEOs) and the pH modifier triethanolamine. Some of the additives used on runways are urea- or acetate-based. Many others are unknown because the formulations are considered proprietary. Impacts identified and associated with de-icing formulations entering freshwater streams include low dissolved oxygen, nutrient enrichment and fish kills. While Transport Canada regulates the treatment and/or collection of these contaminants at airports, it is not known what facilities are in place to manage de-icing agents or other runway contaminants at the Charlottetown Airport. Surface water samples collected from the headwaters of Wright's Creek in 1990 showed elevated nitrate – Nitrogen concentrations (6 – 8 mg/L) which could be associated with the airport or adjacent agriculture. No other water sampling data could be found for the creek.

Lower in the Wright's Creek watershed an old landfill site exists to the east and adjacent to an un-named tributary that enters the main creek in a tidal reach. During the riparian assessment of 2013, there was considerable garbage observed in the stream-bed of this small tributary, suggesting that there is discharge to the river originating in the old landfill. The chemical makeup of leachate from a landfill varies somewhat with the era in which it was active but likely includes those common in household cleaners, paints, plastics and flame retardants (like polychlorinated biphenyls or PCBs).

Many of these potential contaminants are expensive to assess in water and there is no indication that their environmental presence in these City watersheds has ever been investigated. Nonetheless, they all could have significant negative impacts on brook trout populations and the broader aquatic communities in Ellen's and Wright's Creeks.

[10] U.S. Environmental Protection Agency (EPA). (2012). Environmental impact and benefit assessment for the final effluent limitation guidelines and standards for the airport deicing category. U.S. EPA Office of Water, Engineering and Analysis Division, Washington, DC. EPA-821-R-12-003

To determine the true magnitude of their influence, water monitoring needs to be conducted and should be timed to capture peak flows when chemical pulses are most likely to occur.

3.5 Urban Encroachment

Riparian zones serve many important functions in any watershed. Riparian vegetation:

- provides protective cover for fishes,
- cools water temperatures by shading the stream,
- slows surface runoff thereby protecting the stream from erosion and flood damage,
- collects some of the sediment and nutrient loads before they enter the stream,
- provides an important terrestrial energy input to freshwater food webs,
- provides habitat for wildlife[11].

In urban environments, these riparian margins may be a thin buffer between the stream and heavily developed land. On the Island, the legislated buffer zone (where no development is permitted) is 15 meters to either side of sediment bank of a wetland or watercourse. There is good evidence that this width is inadequate to protect many of the ecological services identified above[12]. Nonetheless, in urban environments it can be difficult to maintain even that meagre width free from human interference. People often want a manicured landscape, mowing lawn right to the stream bank or clearing up any natural debris that might be valuable wildlife habitat. Conversely, they may dump yard waste in the margin where it mobilizes during high flow events and contributes to blocked culverts.

Encroachment of the urban environment into riparian zones on Ellen's and Wright's Creeks is prevalent in estuarine and mid-system reaches. Some of this is purposeful and can be managed appropriately, like the establishment of walking trails around and above Andrew's Pond. In the instance of trails, the impact can be managed by limiting their width, ensuring that the trail surface is not bare and establishing healthy understory and canopy vegetation to either side of trails. The other common form of encroachment involves lawn or paved surfaces which cover a larger surface area and are more likely

[11] Richardson, J.S., Taylor, E., Schluter, D., Pearson, M. and Hatfield,T. (2010). Do riparian zones qualify as critical habitat for endangered freshwater fishes? *Canadian Journal of Fisheries and Aquatic Sciences* 67: 1197–1204.

[12] Simpson, J. (2008). *Restoring the Acadian Forest. A Guide to Forest Stewardship for Woodlot Owners in the Maritimes*. Four East Publications, Tanatallon, NS.; Harris P, *Beneficial management practices for riparian zones in Atlantic Canada.* Prepared for Agriculture & Agri-Food Canada and Island Nature Trust.

to impact stream habitat quality. In the case of pavement, once in place it is difficult to remove and restore natural riparian elements.

The headwater areas of Ellen's Creek, Wright's Creek and Hermitage Creek have relatively healthy, well vegetated riparian margins in place, albeit narrow in places. Where streams start in fields, there are instances where the buffer to the field is too thin and the vegetation in the buffer is not providing high quality protection to the stream. However, these grassy areas are provide valuable brook trout habitat. They tend to be narrow sections of stream, and the grass provides canopy, and thus not overly prone to warming especially if headwaters not impounded. The banks are often undercut, providing cover. There is also no long-term protection beyond the 15 m for the existing riparian zone in these headwater reaches. Given the value of these agricultural areas for City expansion, they are at risk of further urban encroachment in the near future.

4. Brook Trout Habitat Management Goals, 2015 – 2020

Considering the main challenges for brook trout outlined in section three, the following subsections describe priority management goals for restoration and protection of brook trout habitat on Ellen's, Hermitage and Wright's Creeks.

GOAL 1: Alleviate ongoing sedimentation impacts

Objective 1.1: *Work with the City and province to repair or replace under-sized culverts on Ellen's Creek*

By eliminating ponding behind structures during high-water events, the sediment load settling to the stream bottom will be reduced over time.

Objective 1.2: *Work with the City and Charlottetown Airport Authority to address excess storm-water loading to Wright's Creek*

The volume of storm-water coming from the airport should be slowed before discharge to the natural stream system. Areas to detain water without creating a bird risk to air traffic include the existing excavation pits or fields to the east of the main airport runway on private land.

Objective 1.3: *Work with the City to improve storm-water retention on land at mapped outlet locations through more effective landscaping and wetland vegetation*

Objective 1.4: *Establish a City-wide program to minimize bare soil*
The management of construction sites should be more intensive until the industry gets used to best management practices for soil conservation.

Objective 1.5: *Promote increased uptake of green storm-water management*
Green management of storm-water could include a downspout disconnect program similar to Toronto, green roofs, rain barrels and rain gardens, more vegetated swales, pervious pavement on secondary roads and sidewalks and use of rainwater cisterns for gray water use in households and businesses.

Useful supplementary information:
- automated monitoring of turbidity at long-term data stations in Ellen's and Wright's Creeks to evaluate effectiveness of control measures
- monitor peak flows

GOAL 2: Minimize habitat fragmentation

Objective 2.1: *Work with the City and province to correct any velocity or other barriers to fish passage at culverts*
Correction of passage barriers may be achieved through structure replacement or mitigation alternatives like addition of baffles and rock riffles. A prioritization plan could evolve from the culvert assessment presented in Appendix I.

Objective 2.2: *Explore possibilities for moving fish around Andrew's dam (including manual transfer of smelts) and/or stock Andrew's Pond with brook trout*
At this time, the construction of a fish ladder at Andrew's dam is considered too expensive and unjustified given the amount of brook trout habitat upstream from the dam (~2 km). There is not enough available land to create a by-pass channel. Stocking in Wright's Creek should be conducted in tandem with electrofishing monitoring to ensure that stocked fish are surviving.

Objective 2.3: *Investigate potential to remove the vertical drop-inlet culvert on Hermitage Creek by Charlottetown Rural High School*
The removal of this vertical culvert would involve some re-engineering of a road and would also require discussions with the local community as it could mean the loss of a small pond upstream. A by-pass channel might allow for fish passage and maintain the pond. Currently the pond is used by the Charlottetown Rural Conservation Programs

and as a non-potable water source. Nonetheless, it could provide better flushing for the downstream estuarine area and improve as well as increase habitat availability for brook trout.

Objective 2.4: *Work with Fisheries and Oceans Canada to better understand the causes, magnitude and ramifications of anoxic pockets in the Charlottetown Harbour*

Objective 2.5: *Work with the City to protect Ellen's, Wright's and Hermitage Creeks from any further additions of road crossings or artificial stream channeling and structures*

There is a danger in managing urban streams as if they are extensions of storm-water systems rather than natural environments that support healthy and diverse freshwater ecosystems. There is a need for clear policy distinguishing these creeks as ecosystems worth preserving, as free as possible from artificial constructs like channel straightening or rock lining.

Useful supplementary information:

- engineering assessment of the drop-inlet vertical culvert on Hermitage Creek;
- mapping inventory of road crossings and their condition (updated semi-annually)

GOAL 3: Protect water quantity in Ellen's, Wright's and Hermitage Creeks

Objective 3.1: *Work with the City and province to develop long-term protection for remaining green space in headwater areas of all three creeks*

As the City grows, there will be increasing pressure to develop the farm-land that remains in the headwaters of Ellen's, Wright's and Hermitage Creeks. That land conversion will incrementally reduce the replenishment of groundwater. Ultimately there will be a reduction in groundwater discharge to the three City streams, lowering stream levels and limiting habitat. There is a need for a long-term vision for green space preservation similar to that seen in larger Canadian cities like Toronto, Calgary and Edmonton where streams, ravines and riparian margins are permanently protected from development.

Objective 3.2: *Explore development of storm-water detention areas with the City that would capture runoff, filter it through natural and artificial wetlands or other vegetation and provide a slow feed of storm-water to creeks and groundwater*

This is tied to objectives 1.3 and 1.5 but emphasises the need for groundwater recharge. Storm-water detention should allow for more than just temporary storage of excess water. The use of clay-lined ponds will not allow water to percolate through to the water table. Green space is more effective in this regard. A variety of mechanisms will be necessary to serve different water balance functions.

Useful supplementary information:

- establishment of a long-term monitoring program for base water flows at springs & main stems of creeks

GOAL 4: Identify sources of contamination and develop remediation processes

Objective 4.1: *Work with the City and province to develop a monitoring program for water quality and presence of contaminants in all main tributaries*

As discussed in section 3, the existing industrial and commercial development within these watersheds puts them at risk for aquatic contamination. Particular attention should initially be placed on establishing the level of impact of runoff from the Charlottetown Airport and Superior Sanitation Services Ltd facilities. Contaminants of concern would include de-icing ingredients, heavy metals, salt signatures of coal fly ash, and polychlorinated and polybrominated organics. Comprehensive testing for a suite of compounds could be followed by targeted intensive sampling to establish the temporal and spatial extent of contamination.

Objective 4.2: *Work with corporations and other stakeholders to establish remediation mechanisms once contamination is characterized*

Following from objective 4.1, diversion and treatment procedures for contaminants of concern should be established once the magnitude of the problem has been characterized in the three creeks.

GOAL 5: Restore and enhance brook trout habitat in streams and springs

Objective 5.1: *Encourage landowners to provide high quality in-stream brook trout habitat and riparian cover habitat through best management practices*

Public awareness is limited about the need in nature for messy, complex and diverse habitat along and in streams. People of differing backgrounds and experiences hold widely varying perceptions of what is meant by “natural”. When remnant natural

landscapes persist within urban settings, they offer a valuable opportunity to educate and engage the general public in high quality habitat protection and restoration. People ultimately retain messages more when they are given the chance to experience them. Volunteer work mornings can be lifelong teaching moments and should be incorporated into a broader education campaign that targets landowners of stream-front properties.

Objective 5.2: *Protect and foster the expansion of the 15 m buffer through public education*

In an urban setting where surface runoff from impermeable materials is an issue, the strict adherence to a 15 m vegetated buffer along streams will frequently be inadequate to allow for a resilient environment. Wherever landowners are receptive, promotion of a protected or voluntary 30 – 60 m natural buffer would be of great value to the watershed as a whole, particularly in the vicinity of groundwater springs.

Objective 5.3: *Restore in-stream and riparian habitat with key elements favoured by brook trout*

Brook trout habitat can be gradually restored while sediment, contaminant, water volume and habitat access issues are resolved. Key restoration strategies would include

- targeted planting of native shrubs and grasses,
- gravel bed restoration,
- pool creation,
- protection of under-cut stream banks,
- bank stabilization,
- retention and installation of large woody debris,
- gravel restoration of springs and spring leads,
- protection of vegetative cover (often water cress) or introduction of woody cover (split logs) in springs, and
- removal of urban waste.

Useful supplementary information:

- establishment of a long-term electrofishing program
- photographic record-keeping of spring and stream habitat over time

5. Timeframes for Implementation, Monitoring and Review

This management plan is intended to be a living document. As the urban landscape changes, so too must the plans to manage urban streams for brook trout habitat. The management goals described in section four are meant for implementation in a five- to ten-year time window. The suggestions for supplementary monitoring information at the end of each goal subsection will be invaluable in evaluating the progress toward goals and the corresponding state of brook trout populations. The Ellen's Creek and Wright's Creek watershed groups will work with the City of Charlottetown and the Province of Prince Edward Island to establish priorities and timelines for work toward these stated goals. Beyond the ten year timeframe, this plan should be revisited and revised to reflect the changing watershed and City landscape.

APPENDIX I. Culvert Survey of Ellen's Creek (16th April, 2015)

Note: Survey is ongoing. Due to snow cover and high flow stream conditions, not all culverts were safe for viewing or even visible. All will be revisited in early summer 2015.

Location	Type	Size	Condition	Foreslope	Road Surface	Baffles Present	Fish Passage	Comments
Public Road Crossings	All except the Charlottetown Bypass box culvert are the responsibility of the City of Charlottetown							
Royalty Junction Rd	Round PVC culvert	3' diameter 51' long	good	Rocks, gravel (rough, looks temporary)	Millings, poor condition	No	No, seasonal water flow only	2' overflow culvert beside, blocked with rock
Sherwood Rd	Half round corrugated steel culvert	5' diameter	Poor; under-sized, at capacity, blew out in Dec/14	Gabion baskets, rock	Paved	No	Uncertain, debris in-stream below from blowout may block access	2 overflow culverts above; repairs unfinished; large storm-water pipe enters directly above culvert
Charlottetown Bypass (Provincial)	Box concrete culvert	10' diameter	Good but grates are catching debris	Rocks	Paved	No but boulders placed inside	Uncertain, partial	Spacing between boulders inside long culvert impacts passage of fish
Lower Malpeque Rd	Half round corrugated steel culvert	Unknown, not visible	Poor; under-sized, at capacity	Soil & grass	Paved	No	Uncertain, partial	Road is low, stream coming over road at times, shoulders giving way
Kirkdale Rd	Half round corrugated steel culvert	8' diameter	Fair; debris blockage midway	Soil & grass	Paved	No	Uncertain, partial	Wooden floor in poor condition

Location	Type	Size	Condition	Foreslope	Road Surface	Baffles Present	Fish Passage	Comments
Capitol Dr	Box creosoted wood culvert	8' diameter (square)	Poor; undermined at top east edge, timbers collapsing inward, sagging in middle	Soil & grass	Paved	No	Uncertain, partial	Deteriorating – stream at top entering at a 90 degree angle, causing erosion of banks, timbers swung cross-wise at entrance, no floor left inside
Capitol Dr x North River Rd (Hazard Creek)	Mix – wooden box, concrete arch or round culvert	5' diameter concrete (upstream), 4.5' square box (downstream end)	Unknown; concern about junction of round with box culvert under road	Soil & grass downstream edge is slumping	Paved	Unknown	Uncertain, partial	Two types of culvert must meet under the intersection somewhere
Private Road Crossings	* Last 3 private crossings not accessible at time of survey							
339 Malpeque Rd	Round corrugated steel culvert	3' diameter	Poor; breached & in pieces	Soil, clay	Clay	No	No	Old Mol homestead, breached in Dec/14 by DTIR
*** 426 Malpeque Rd**								Mol's farm lane crossing
*** Parcel 1045293**								Old farm crossing
*** 178 Lower Malpeque Rd**								

April 2015 Culvert Photo Gallery

Capitol Drive box culvert:

Downstream end (right), upstream end (below) with lowest timbers swung crosswise and sides collapsing inward

Kirkdale Rd steel half round culvert:

Downstream end with debris jam midway through (right)

Charlottetown Bypass concrete box culvert:

Wood & grass debris collecting on grates at downstream end, increasing the water level within the culvert (right)

Sherwood Rd steel half round culvert:

Downstream end showing 2 small overflow culverts (left)

Downstream end showing debris from blow-out altering stream course and backing up water into at-capacity main culvert (right)

Royalty Junction Rd PVC round culvert:

Upstream end with storm-water and stream inputs (right), upstream end overflow culvert with rock blocking entrance (below)

Breached culvert at old Mol homestead:

Corrugated culvert pieces and concrete slabs in-stream (right), other pieces scattered on banks downstream with rock & sediment