

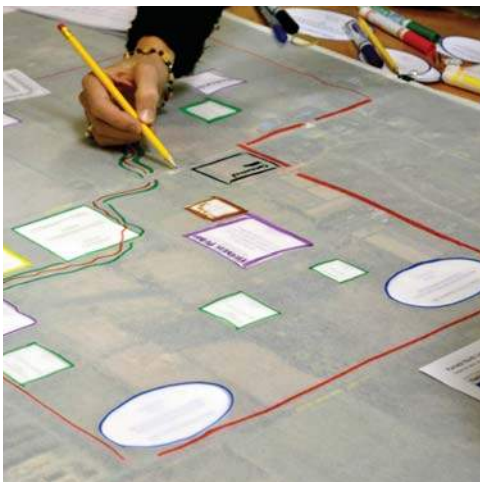


KANATA NORTH

COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN

REPORT



FINAL DRAFT
JUNE 28, 2016





KANATA NORTH COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN

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KANATA NORTH
ENVIRONMENTAL MANAGEMENT PLAN – FINAL DRAFT
City of Ottawa

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112117-EMP: Recommended Environmental Management Plan

VOLUME 2 – LIST OF APPENDICES

Included under a separate cover.

Appendix A: Scope of Work & Detailed Work Program

Appendix B: Correspondence

Appendix C: Woodlot Evaluations

Appendix D: Hydrologic Calculations & Modeling Files (Event-Based)

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Appendix I: Engineering Drawings

VOLUME 3 – EXISTING CONDITIONS REPORTS

Included at the back of Volume 2 (separate cover) – Provided as a CD.

- Appendix J: Kanata North Urban Expansion Area Community Design Plan Environmental Management Plan Existing Conditions Report: Storm Drainage, Hydrology & Floodplain Mapping (Novatech – February 2016)
- Appendix K: Existing Conditions Natural Environment Features Kanata North Urban Expansion Area (Muncaster Environmental Planning Inc. – January 2016)
- Appendix L: Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan (Patterson Group – October 7, 2013)
- Appendix M: Future Development Lands 936 March Road Slope Stability Excerpt (Patterson Group June 13, 2013)
- Appendix N: Hydrogeological Existing Conditions Report Kanata North Urban Expansion Area (Patterson Group – May 18, 2016)
- Appendix O: Kanata North Urban Expansion Area Fluvial Geomorphic Assessment (Parish Aquatic Services – March 2016)
- Appendix P: Kanata North Urban Expansion Area Headwater Drainage Features Geomorphic Assessment (Parish Aquatic Services – March 2016)
- Appendix Q: Kanata North Headwaters Report (Bowfin Environmental Consulting & Muncaster Environmental Planning Inc. – September 2015)
- Appendix R: Sensitive Groundwater Assessment: Discharge and Recharge Area Evaluation Woodlot S20 (Patterson Group – October 24, 2014)
- Appendix S: South March Highlands Blanding's Turtle Conservation Needs Assessment (Dillon Consulting Limited – January 31, 2013)
- Appendix T: Kanata North Community Design Plan Blanding's Turtle Compensation Plan (DST Consulting Engineers – June 2015)
- Appendix U: Kanata North Community Design Plan Blanding's Turtle Compensation Plan – Offsite Compensation Concept (Memo) (DST Consulting Engineers – November 12, 2015)
- Appendix V: Kanata North Urban Expansion Area Water Budget Analysis (Novatech – May, 2016)

EXECUTIVE SUMMARY

This Environmental Management Plan (EMP) has been prepared as a component of the Community Design Plan (CDP) for Kanata North. The Kanata North Urban Expansion Area (KNUEA) includes approximately 181 hectares (447.6 acres) between the established urban communities of Morgan's Grant, Briarbrook, and Brookside to the south and the abandoned CN railway corridor to the east.

The major landowners in the KNUEA, known collectively as the "Kanata North Land Owners Group" (KNLOG), initiated a Community Design Plan process to fulfill the requirements of the Official Plan. Collectively, the sponsoring land owners represent approximately 87% of the land within the KNUEA. The CDP, while funded by the KNLOG, will be balanced and shaped in accordance with the goals, objectives and policy directives of the City of Ottawa Official Plan.

Objectives

The objective of the CDP is to create a set of guiding documents which will help shape the future of Kanata North as a liveable community, with a land use plan, Master Servicing Study, Transportation Master Plan and an Environmental Management Plan. A critical element of completing a successful planning exercise is the integration of the CDP preparation process with the Municipal Class Environmental Assessment (Class EA) processes for required infrastructure to service the KNUEA. Meeting the requirements of the Environmental Assessment Act is a requirement of Section 3.11 of the Official Plan.

The primary objectives of the Environmental Management Plan are to:

- Create an inventory and evaluation of existing natural features;
- Consider the impacts of the proposed development on natural features,
- Develop stormwater management options and identify a recommended alternative; and
- Develop a recommended strategy to mitigate adverse effects and protect, enhance or restore the natural system.

Existing Conditions Environmental Inventory

Existing conditions reports have been prepared with the objective of identifying and mapping significant natural features within the limits of the KNUEA study area in accordance with provincial and municipal policies. These reports provide the framework for the environmental inventory for the KNUEA, which includes:

- aquatic features and fish habitat;
- headwater drainage channels;
- terrestrial features and habitat;
- species at risk;
- woodlot evaluations;
- geotechnical investigations;
- hydrogeology;
- storm drainage and hydrology;
- fluvial geomorphology;

Stormwater Management Criteria

Stormwater management criteria have been established on the basis of aquatic habitat protection and the sensitivity of the downstream erosion regime, with input from various regulatory agencies including:

- MVCA, Section 28 of the Conservation Authorities Act – Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses;
- DFO, Section 35 of the Federal Fisheries Act – Fish Habitat;
- MOECC, Ontario Water Resources Act
- MNRF, Endangered Species Act 2007

The NCC have also provided some input into the development of the overall stormwater management strategy related to the increase in storm runoff to Shirley's Brook following development of the KNUEA.

Evaluation of SWM Alternatives

The development of a preferred stormwater management strategy for the KNUEA followed a two-stage process. The first stage was the development of preliminary alternatives and a coarse screening process. The second stage was the selection of a preferred alternative, and refinement of that alternative to generate more detailed solutions. Alternatives considered in the evaluation included:

- Do Nothing / Limit Growth
- No Stormwater Management
- Lot-level & Conveyance Controls
- Low Impact Development / Green Stormwater Infrastructure
- End-of-Pipe SWM Facilities
- Combination of SWM Facilities / Lot Level Controls

SWM options were evaluated using the general criteria outlined in the Municipal Class Environmental Assessment Manual (MEA, 2015) for Municipal Water and Wastewater Projects to determine which alternative best meets the overall SWM objectives for each area. From this evaluation, it was concluded that a combination of lot-level controls and end-of-pipe stormwater management facilities represents the best alternative to achieve the land use objectives while minimizing negative impact to both the social and natural environment.

The conceptual layout of the recommended stormwater management facilities included in the EMP are intended to demonstrate the approximate size and configuration of the Pond Block for the purposes of the Community Design Plan. The size and layout of the facilities are subject to change at the detailed design stage to ensure the Pond Blocks are appropriately sized to the satisfaction of the City.

Water Budget

A site specific water budget analysis was completed for the KNUEA, consisting of a review of the natural environmental systems and the development of a water budget model to evaluate the impacts of development on the hydrologic cycle and provide recommendations for minimizing adverse impacts.

The findings of the water budget indicate that there will be an increase in runoff and a corresponding decrease in infiltration following development, but the changes to the hydrologic cycle are not anticipated to have a significant impact on groundwater resources.

Environmental Management Guidelines and Recommendations

The recommended environmental management strategy has been developed based on the findings of the existing conditions studies and is intended to represent a holistic approach for addressing and mitigating the environmental impacts associated with development of the KNUEA. The size and location of recommended SWM facilities, stream corridors and other areas recommended for retention have been integrated into the land use plan along with the recommended solutions for servicing and transportation.

Key elements of the recommended environmental management plan for the Kanata North Community are as follows:

Tree Preservation

- That the stand of healthy, mature white cedars in the northwest corner of Woodlot S20 should be retained as part of the proposed parkland within the KNUEA.
- The areas of Woodlot S23 outside of the proposed SWM facility should be retained and transferred to the City of Ottawa as part of the City's Natural Heritage System.
- The portions of the southwest wooded area located along the western border of the KNUEA should be retained as a part of the Natural Heritage System (NHS) and conveyed to the City for conservation.
- Where feasible, the preservation of individual healthy trees and clusters of woody vegetation should be considered on case-by-case basis along edge conditions, in neighborhood parks and school sites.
- Where feasible, retain and/ or enhance the existing perimeter hedgerows with active management and new native plantings to provide more tree cover between the old and new neighbourhoods.

Species at Risk

Blanding's Turtles

- New habitat enhancement and compensation features will be created within the proposed stream corridors to compensate for the potential impacts on Blanding's Turtle habitat resulting from development of the KNUEA.
- Turtle exclusion fencing should be installed on both sides of the 40 m creek corridor, except where adjacent to park blocks. The type of fencing used may vary based on location, and will be assessed at the detailed design stage.

Butternut Trees

- Compensation for butternut trees to be removed will be addressed on a case-by-case basis as part of each individual Site Plan or Plan of Subdivision.

Barn Swallows

- Compensation habitat in the form of artificial Barn Swallow nesting structures will be built northwest of the KNUEA.

Headwater Drainage Features

- Mitigation will be required to compensate for the loss of headwater channels within the KNUEA. Compensation measures will be developed at the detailed design stage, in consultation with the Conservation Authority, to comply with the appropriate permit process and regulations.

Stream Corridors

- 40m wide stream corridors for Tributaries 2 and 3 will be retained through the KNUEA. The stream corridors will serve a variety of ecological functions and will be a key component of the overall storm drainage strategy for the KNUEA.
- Areas where the existing channel will be realigned (Tributary 2) should be designed using natural channel design techniques to ensure long-term stability and enhance the ecological function of the corridor.

Planting

- Realigned channel sections should be seeded with a native wetland/riparian seed mix to encourage re-establishment of native vegetation and improve habitat quality.
- Where possible, the realigned channel sections should be designed to take advantage of existing shade trees and surrounding woody vegetation in hedgerows.
- Shade tree planting should be selective, as the goal is not to create a fully shaded riparian corridor. Landscaping and grading features will be identified at the detailed design stage to ensure that critical habitat areas are well separated from the adjacent recreational trails.

New Habitat Features & Enhancements

- Deep pools will function as potential hibernacula sites for Blanding's Turtles, while also providing general foraging habitat and refuge areas for other aquatic wildlife.
- Artificial nesting areas will create nesting habitat for Blanding's Turtles.
- Shallow pans/shallow pools excavated around the channel will expand the wetted area and provide areas where aquatic and semi-aquatic vegetation can grow to create habitat for amphibians, turtles and other aquatic wildlife.
- Small deeper pockets (approximately 30 to 45 cm below the main channel grade) constructed along the length of the channel will create deeper refuge pools within the channel for turtles, fish and other aquatic wildlife.

Culvert Crossings

- The proposed culvert crossings of Tributaries 2 and 3 should be sized to ensure the 100-year floodplain is confined within the limits of the proposed stream corridors.
- At the detailed design stage, all culvert crossings will need to be designed using a multi-disciplinary approach in accordance with all applicable standards and regulations, including but not limited to: hydraulics, fish / wildlife passage, and geomorphology.

Shirley's Brook Realignment

- The reach of Shirley's Brook within the March Valley Road right-of-way should be redesigned and relocated onto the adjacent federal lands managed by NCC to avoid any adverse impacts development of the KNUEA may have on erosion and washout of the roadway embankment along March Valley Road.

Low Impact Development

- Based on the findings of the geotechnical and hydrogeological investigations and feedback from the City, there are areas within the KNUEA where LID designs should be considered:
 - The alluvial sand deposits east of March Road represent the most suitable areas for LID within the KNUEA. The alluvial soils are relatively shallow and underlain by clay and/or bedrock, and do not provide any significant contribution to groundwater recharge. However, these soils can provide storage and attenuation of runoff, and contribute to baseflow in Shirley's Brook.
 - The soils west of March Road generally consist of tight clays with relatively shallow depths to bedrock. While this does not preclude the use of LIDs in this area, infiltration based stormwater best management practices should be considered a low priority west of March Road.

Stormwater Management

- Three (3) new end-of-pipe SWM facilities are proposed to service the KNUEA. The recommended SWM facility designs will incorporate:
 - Baseflow enhancement
 - Water quality control (80% long-term TSS removal)
 - Erosion Control (based on geomorphic assessment)
 - Peak flow control
- On-site water quality and quantity controls are proposed for approximately 8 hectares in the southwest quadrant of the KNUEA:
 - Quantity control storage can be provided using a combination of surface and underground storage.
 - Quality control could be provided using treatment units (Stormceptor, Vortech, etc.) or through the use of low-impact development design.
- Recommended best management practices for residential areas include:
 - Perforated pipes for rearyard catchbasin leads.
 - Direct roof leaders to rearyard areas.
 - Direct storm runoff from rearyard areas to stream corridors and/or headwater drainage channels.

Hydrogeology

Existing Wells

- Unused and unmaintained wells within the limits of the proposed development are to be properly decommissioned to ensure they do not create a direct connection between the ground surface and the aquifers.
- A baseline monitoring program is recommended for selected existing water wells in the vicinity of the subject site. The baseline monitoring program should be completed at all wells within 500 m of the subject site, and may be expanded on an as-required basis.

Existing Private Sewage Systems

- It is recommended that existing private sewage systems within the subject site be properly decommissioned by a qualified contractor prior to the redevelopment of the subject site.

Existing Tile Drains

- It is recommended that tile drains be removed and/or capped on an as-encountered basis.

Sources of Contamination

- Prior to and during site development, it is recommended that construction best practices with respect to fuels and chemical handling, spill prevention, and erosion and sediment control be followed, to minimize the potential for the introduction of contaminants to the soil, surface water, or groundwater at the subject site.

Blasting

- Best management practices for blasting are to be followed at all times. The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Groundwater Control in Excavations

- For any water taking of greater than 50,000 L/day, a Permit To Take Water (PTTW) or registration of the water taking activity on the Environmental Activity and Sector Registry (EASR) is required from the MOECC.
- Construction best practices should be employed when dewatering excavations at the subject site, including erosion and sedimentation control measures and discharge quality control.

Compensation by Quadrant

Each quadrant within the KNUEA lands will have a combination of environmental compensation and mitigation as outlined in the above sections relating to species at risk, headwater drainage features, and stream corridors.

Northwest Quadrant

- Realigned 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Channel 'F' (Nadia Lane) should be intercepted at the KNUEA property boundary and piped to Tributary 2.
- A portion of the southwest wooded area should be maintained as a part of the stream corridor for Shirley's Brook Tributary 3.
- A 0.30 ha portion of the southwest wooded area will be maintained as a part of the Natural Heritage system, and conveyed to the City for conservation.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/pools, and deep channel pockets.
- Headwater features compensation within protected and/ or enhanced creek corridor

Southwest Quadrant

- 40m corridor + 6m pathway for Shirley's Brook Tributary 3.
- Channel 'G' (Marchbrook Circle) should be intercepted at the KNUEA property boundary and piped to Tributary 3.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/pools, and deep channel pockets.
- Headwater features compensation within the protected and/ or enhanced creek corridor

Northeast Quadrant

- Realigned 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Healthy and mature white cedars in the northwest corner of Woodlot S20 should be retained as a part of the proposed parkland.
- Blanding's turtle compensation with shallow pans/pools, and deep channel pockets.
- Rear-yard flows from properties along eastern boundary should be directed to culverts crossing the abandoned CN rail corridor to maintain flows in channels 'C' and 'D'
- Re-grade ditch west of the former rail corridor to eliminate perched culverts and direct rearyard drainage to headwater channels east of the rail corridor
- Replace headwater functions in protected stream corridors or other areas.

Southeast Quadrant

- 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/pools, and deep channel pockets.
- Rear-yard flows from properties along eastern boundary should be directed to culverts crossing the abandoned CN rail corridor to maintain flows in existing headwater channels.
- Re-grade ditch west of the former rail corridor to eliminate perched culverts and direct rearyard drainage to headwater channels east of the rail corridor.
- Replace headwater functions in protected stream corridors or other areas.

EA Project Listing

EA Projects

The EMP component of the Kanata North CDP satisfies the requirements of Phases 1 through 4 of the Municipal Class EA Process. Infrastructure projects that will be undertaken in concert with development of the KNUFA and their schedule classification are as follows:

- Stormwater Management Pond #1 and associated storm sewers and access pathways (Schedule B)
- Stormwater Management Pond #2 and associated storm sewers and access pathways (Schedule B)
- Stormwater Management Pond #3 and associated storm sewers and access pathways (Schedule B)
- Realignment of Shirley's Brook Tributary 2 (Schedule B)
- Enhancement of Tributaries 2 & 3 with provisions for Blanding's Turtle habitat, and recreational pathways (Schedule B)
- Realignment of a portion of Shirley's Brook Main Branch at March Valley Road (Schedule B)
- Re-direction and piping through development area of Headwater Channel 'F' from KNUFA property boundary to Tributary 2 (Schedule B)
- Re-direction and piping through development area of Headwater Channel 'G' from KNUFA property boundary to Tributary 3 (Schedule B)

Other Approval Requirements

Additional approvals will be required for implementation of the proposed development plan including, but not limited to, the following:

Ministry of Environment and Climate Change (MOECC)

- All sanitary sewers, stormwater drainage and stormwater facilities are regulated under the Ontario Water Resources Act and will require an Environmental Certificate of Approval from the Ministry of the Environment and Climate Change.

Department of Fisheries and Oceans (DFO)

- Proposed works that may constitute a harmful alteration, disruption or destruction (HADD) of fish habitat and will require authorization from DFO under the Fisheries Act may include but are not limited to:
 - The realignment of Tributary 2 of Shirley's Brook;
 - The removal of the existing weir structures along Tributary 3 of Shirley's Brook;
 - The installation of culvert crossings on Tributaries 2 and 3, and at March Road;
 - The realignment of Shirley's Brook Main Branch at March Valley Road.

Conservation Authority (CA)

- Alterations to watercourses are regulated under Section 28 of the Conservation Authorities Act and will require approval from the Mississippi Valley Conservation Authority (MVCA).

Ministry of Tourism, Culture and Sport (MTCS)

- Archaeological Clearance for Stage 1 Archaeological Assessment and Stage 2 must be provided by the MTCS.

Ministry of Natural Resources and Forestry (MNRF)

- The Endangered Species Act (S.O. 2007, c.6) is administered by the MNRF and requires registration of activities that may represent a disruption to Species at Risk. An Overall Benefit Permit may also be required.

National Capital Commission (NCC)

- It is anticipated that the realignment of Shirley's Brook Main Branch at March Valley Road will require approval under the NCC's Federal Land Use, Design, and Transaction Approval Process (FLUDTA).

Implementation and Phasing

The following processes and mechanisms will guide the implementation of the Kanata North Community Design Plan:

- Amendment to the City of Ottawa Official Plan;
- Guidance on the interpretation of the CDP;
- Process to amend the CDP and Environmental Assessments;
- Preparation of a financial implementation plan, involving cost sharing agreements;
- Schedule for staging of key infrastructure to service the lands;
- Development monitoring.

As development proceeds within the Kanata North Urban Expansion Area, the implementation mechanisms will guide the timely advancement of municipal infrastructure and community amenities and facilities. Implementation strategies will include the use of front-ending agreements with the City that will allow the developer(s) to advance the construction of certain facilities in accordance with agreed-upon principles.

Section 1.0 Introduction

This Environmental Management Plan (EMP) has been prepared as a component of the Community Design Plan (CDP) for Kanata North. The CDP will establish a community-wide land-use framework for the Kanata North Urban Expansion Area (KNUEA) that reflects the principles, objectives and policies for community development as directed by the Official Plan. The purpose of a CDP is to provide a level of direction between Official Plan policy and development approval to enable development to occur incrementally over time in an optimum and coordinated manner. Community design plans are used as a guide to the preparation and review of future applications for development.

The primary objectives of the Environmental Management Plan are to:

- Create an inventory and evaluation of existing natural features;
- Consider the impacts of the proposed development on natural features; and,
- Develop a recommended strategy to mitigate adverse effects and protect, enhance or restore the natural system.

1.1 Kanata North Urban Expansion Area

The Kanata North Urban Expansion Area (KNUEA) is approximately 181 hectares in area (447.6 acres) located north of the established urban communities of Morgan's Grant, Briarbrook, and Brookside and adjacent to a number of rural estate subdivisions including Hillview Estates Subdivision to the north, and the Marchbrook Circle and Panandrick subdivisions to the west. The abandoned CN railway corridor forms the KNUEA boundary to the east. For the purposes of this report, March Road is considered to run north/south

As shown on **Figure 1.1**, the KNUEA extends north from the urban portion of Kanata along both sides of March Road. The area is predominantly rural but also includes existing development such as St. Isidore Roman Catholic Church and St. Isidore Catholic School (Ottawa Catholic School Board) as well as several other existing rural residential and commercial uses along the west side of March Road.

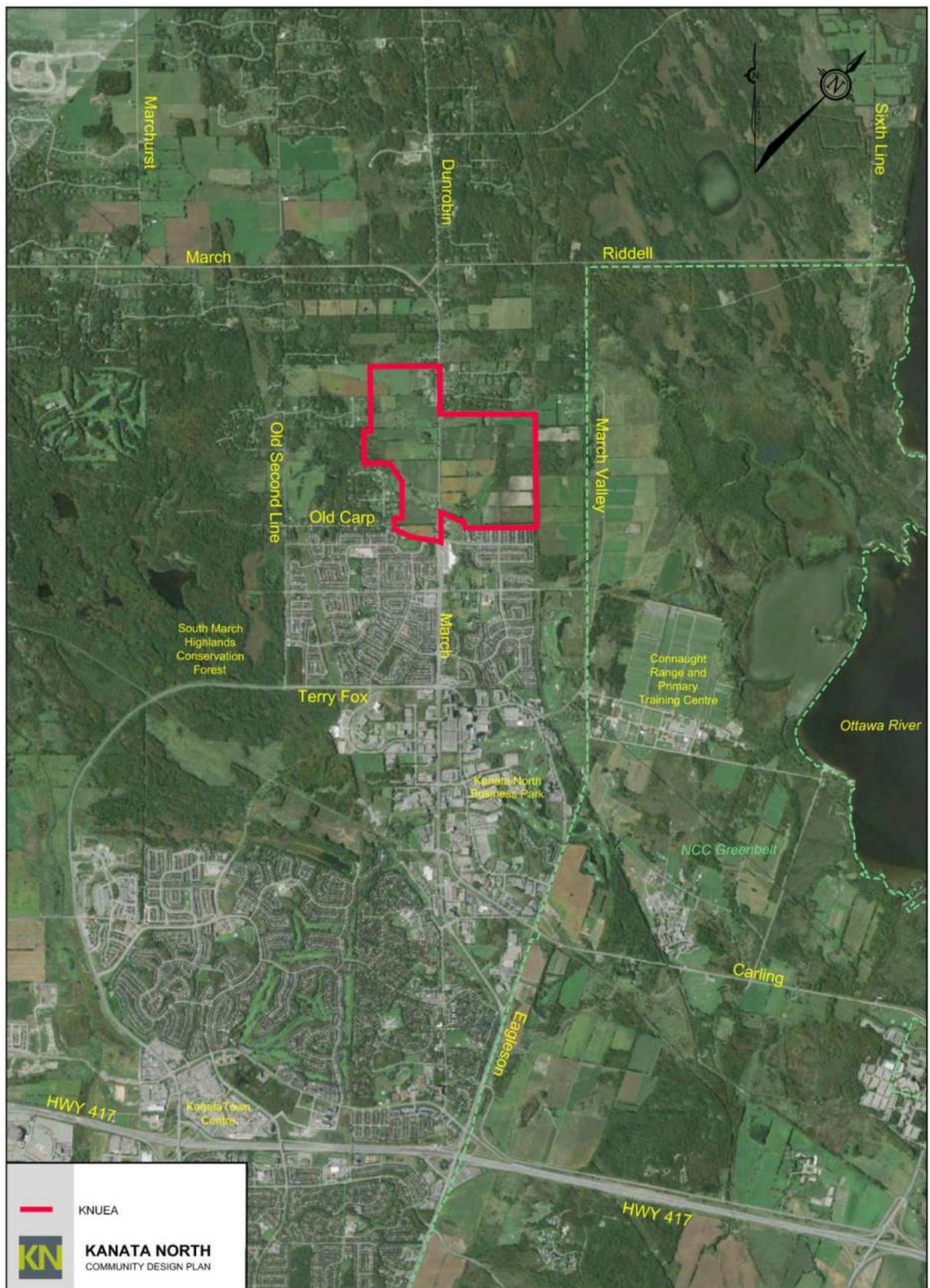


Figure 1.1: Kanata North Urban Expansion Area (KNUEA) Context and Location

1.2 Background

When the City's Official Plan was reviewed in 2009, City Council and the Ontario Municipal Board approved a number of urban expansion areas to support projected population growth to 2031. The Kanata North Urban Expansion Area (KNUEA) was one of several areas amended from a "General Rural" designation to "Urban Expansion Study Area" through Official Plan Amendment 76 (OPA 76).

OPA 76 also added Section 3.11 of the Official Plan which sets out a process for further amending the "Urban Expansion Study Area" to "General Urban Area" and other land use designations appropriate for urban development. The preparation of a CDP, including satisfying Environmental Assessment and Official Plan Amendment requirements, is a necessary component of this process and must be completed before the City will consider development applications for the area.

The major landowners in the KNUEA, known collectively as the "Kanata North Land Owners Group" (KNLOG), initiated a Community Design Plan process to fulfill the requirements of the Official Plan. Collectively, the sponsoring land owners represent approximately 87% of the land within the KNUEA. The CDP, while funded by the KNLOG, has been balanced and shaped in accordance with the goals, objectives and policy directives of the City of Ottawa Official Plan. The Sponsoring Landowners include:

- Metcalfe Realty Company Ltd.;
- Brigil (3223701 Canada Inc.);
- Valecraft (8409706 Canada Inc.)/JG Rivard Ltd.; and
- Junic/Multivesco (7089121 Canada Inc.).

Early in the process formal invitations were sent to other landowners to participate; however, none other than the group listed above chose to join the KNLOG. Non-participating landowners have been involved in the CDP process through consultation and opportunities to comment as the plan evolved. **Figure 1.2** provides a map showing the ownership of lands within the KNUEA. Adjacent properties owned by members of the KNLOG are also shown. For clarity, the KNUEA is sometimes referred to as being divided into quadrants, east and west of March Road and north and south roughly based on property ownership. The quadrants are labeled on **Figure 1.2**.

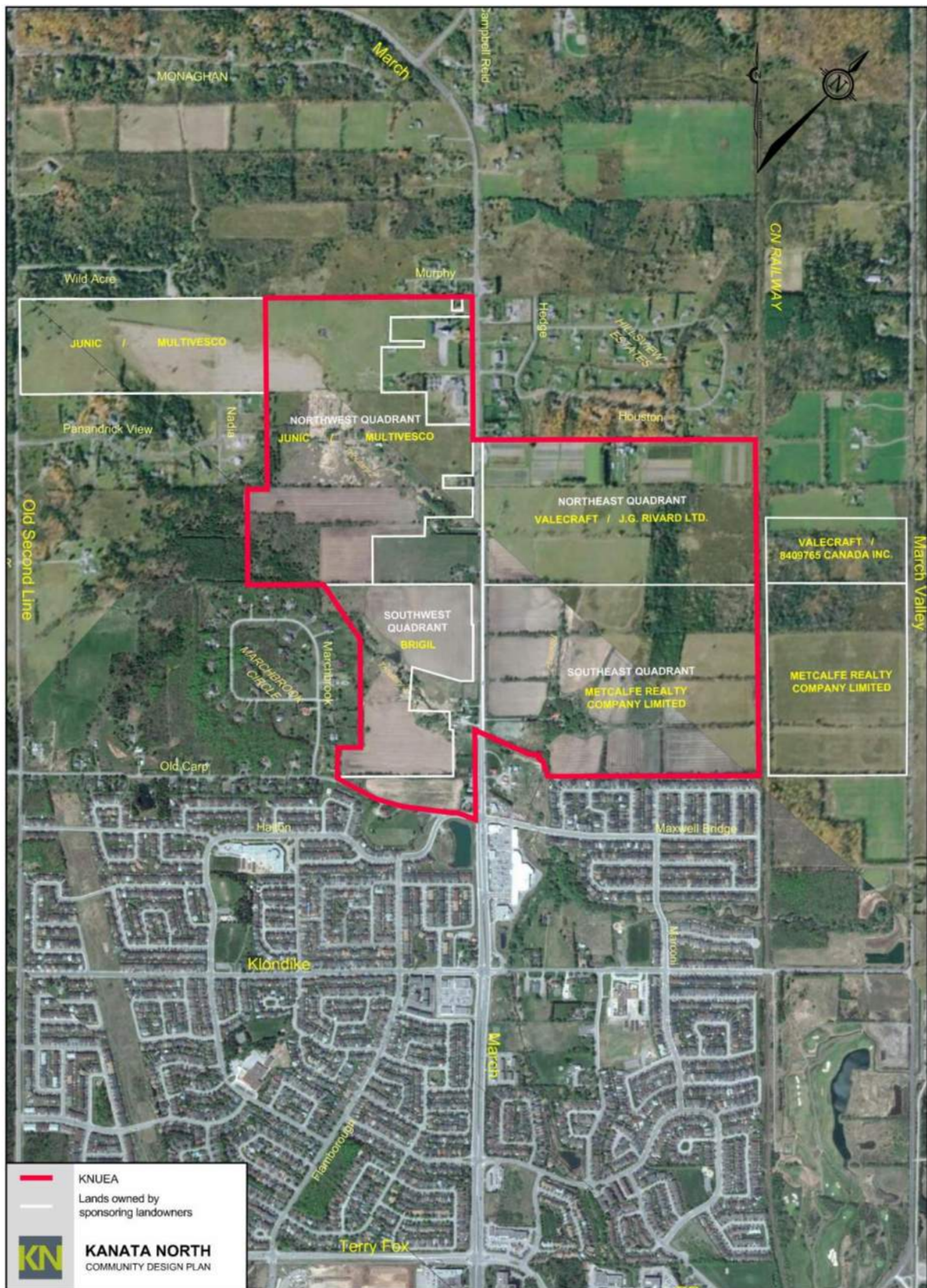


Figure 1.2: KNUEA Boundaries and Properties of Sponsoring Landowners

1.3 Integrated Planning Process

A critical element of completing a successful planning exercise is the integration of the CDP and Official Plan Amendment (OPA) process with the Municipal Class Environmental Assessment (Class EA) processes for associated infrastructure projects. The objective of the integrated process is to create a set of guiding documents that will shape the development of Kanata North as a healthy, vibrant, liveable community. The guiding documents are as follows:

- a Community Design Plan (CDP) to determine the location of land uses and provide direction for future development in the KNUFA;
- an Environmental Management Plan (EMP) to address the management of the Natural Heritage System;
- a Transportation Master Plan (TMP) to provide an integrated and sustainable transportation network; and
- a Master Servicing Study (MSS) to inform the design and implementation of sanitary, water, and stormwater management infrastructure.

The Planning Act process to implement the CDP will be an Official Plan Amendment approved by City Council, implementing the recommendations set out in the EMP, TMP, MSS and CDP.

The Master Plans set out a network of roads and municipal infrastructure including water, sanitary and stormwater management system(s). These facilities will ultimately be turned over to the City of Ottawa as municipal infrastructure through the subdivision approvals process. The Province of Ontario's Environmental Assessment Act requires an Environmental Assessment for any major public sector undertaking which includes public roads, transit, water, sanitary and stormwater installations. Meeting requirements of the Environmental Assessment Act is a requirement of Section 3.11 of the Official Plan.

Combining the CDP process with the Class EA creates an opportunity to co-ordinate the approval requirements of the Environmental Assessment Act and the Planning Act and provides an integrated approach to the planning and development of all aspects of the community. For example, an integrated planning process means that background studies and existing conditions reports can be shared between the two processes, stakeholders and advisory committees are able to consider all aspects of planning and servicing, and the public review and approval processes can be consolidated and simplified. The Master Plan and CDP process was integrated in accordance with Approach #4 as outlined in the Class EA.

A figure showing the integration of the Class EA process and the Community Design Plan/Official Plan Amendment process is provided as **Figure 1.3**.

KANATA NORTH URBAN EXPANSION STUDY AREA CDP

Class EA and Planning Act Processes

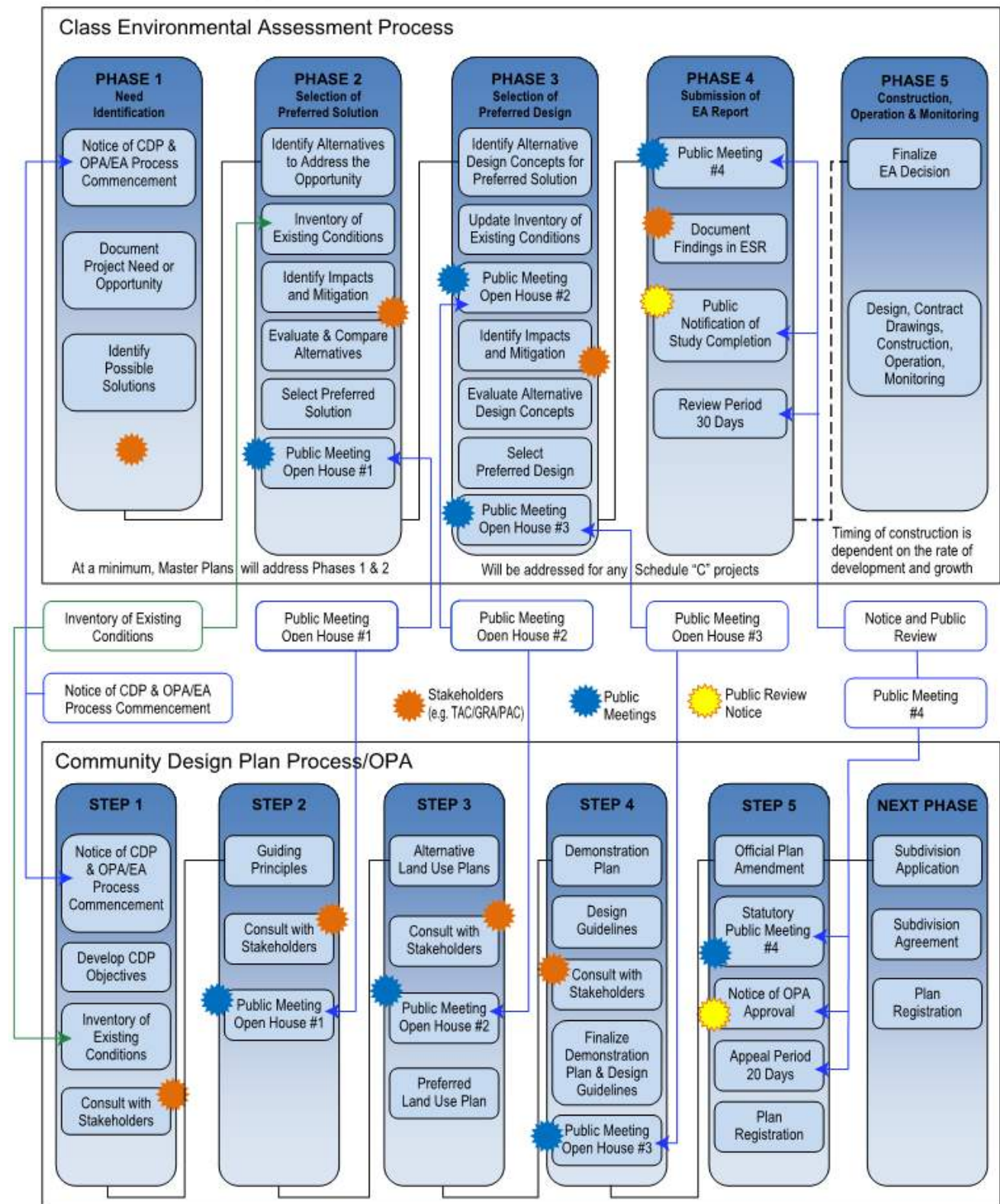


Figure 1.3 - Integrated Class EA and CDP Planning Framework

1.4 Consultation Process

1.4.1 Public Meetings and Workshop

Both the CDP and Environment Assessment processes include an important component of public consultation that gives the public and community stakeholders meaningful opportunities to be involved in shaping the community.

A Consultation Plan was developed as part of the initial Terms of Reference for the Kanata North CDP and three public open houses and a workshop session were held in Kanata between the summer of 2013 and spring of 2016. The first two open houses and workshop led to the development of the preferred options for land use, transportation, infrastructure and environmental management. The third open house presented the preferred land use plan and supporting master plans to the community. A fourth and final public meeting was held in June 2016 to present the CDP, Official Plan Amendment and Master Plans to Planning Committee.

Additional information about the public consultation process is available in the Kanata North Community Design Plan and in the Kanata North Public Consultation Report prepared by Morrison Hershfield.

1.4.2 Project Team

The preparation of the CDP included the participation of a number of committees or teams created to enable a collaborative study process encompassing a range of stakeholders.

1.4.3 Core Project Team (CPT)

The Core Project Team (CPT) was established to lead the CDP process. The CPT was comprised of the Kanata North Land Owners Group, the Consultant Team, and City of Ottawa staff from the Department of Planning and Growth Management. The primary function of the CPT was to review reports, resolve issues and achieve consensus at each step of the CDP work program.

Novatech was retained by the KNLOG as Project Managers to lead the Consulting Team. Novatech was also responsible for Land Use Planning, Urban Design, the Master Servicing Study, Transportation Master Plan, and the Environmental Management Plan. The City of Ottawa provided an internal project manager for coordination and guidance. The CPT had representation from the following organizations:

City of Ottawa

- City of Ottawa staff from the Planning and Growth Management Department;

Kanata North Landowners Group

- Metcalfe Realty Company Ltd.;
- Brigil (3223701 Canada Inc.);
- Valecraft (8409706 Canada Inc.)/JG Rivard Ltd.; and
- Junic/Multivesco (7089121 Canada Inc.).

Consulting Team

- Land Use Planning and Urban Design – Novatech;
- Integrated Environmental Assessment – Morrison Hershfield;
- Master Servicing Study – Novatech;
- Transportation Master Plan – Novatech;
- Environmental Management Plan – Novatech;
- Geotechnical – Paterson Group Inc.;
- Hydrogeology – Paterson Group Inc.;
- Natural Heritage and Species at Risk (Environment) - Muncaster Environmental Planning Inc., DST, Bowfin Environmental, McKinley Environmental Solutions;
- Fluvial Geomorphology – Matrix Solutions and Parish Geomorphics;
- Archaeology – Paterson Group Inc.; and
- Potable Water Assessment – Stantec.

1.4.4 Technical Advisory Committee (TAC)

The Technical Advisory Committee (TAC) was created to provide guidance and review critical deliverables on an as-needed basis. Specifically, TAC Meetings were held to discuss the evolving land use plan and information related to the preparation of the Transportation Master Plan, Master Servicing Study and Environmental Management Plan. In addition, as needed, the members of the TAC were available to provide input throughout the CDP process. Representatives of the following organizations were invited to participate:

- CPT Members (as needed);
- City of Ottawa Planning and Growth Management Department;
- City of Ottawa Traffic Services;
- City of Ottawa Parks and Recreation Branch;
- City of Ottawa Infrastructure Approvals;
- City of Ottawa Transit Services;
- Ottawa Public Health;
- Ottawa Public Library;
- Ottawa Carleton District School Board (OCDSB);
- Conseil des écoles publiques de l'Est de l'Ontario (CEPEO);
- Ottawa Catholic School Board (OCSB);
- Conseil des écoles catholiques du Centre-Est (CECCE); and
- Hydro Ottawa.

Government Review Agencies (GRA) are specific agencies with an interest in land use and development. The GRA were provided with copies of all notices prepared for the project and requested to provide input and comments. Representatives were invited to sit as regular members of the TAC and depending on the agency were involved to provide technical input at various stages from the initial steps to reviewing the details of alternative designs. The level of participation was at the discretion of the agency/representative and some agencies were involved throughout the process while others were consulted primarily to acknowledge they will have a role in future subdivision applications. Individual meetings were held with GRA as required and TAC meeting agendas were distributed in advance to assist in determining if attendance/participation was required. Government Review Agencies consulted included:

- Ontario Ministry of the Environment and Climate Change (Environment);
- Ontario Ministry of Natural Resources and Forestry (Environment);
- Ontario Ministry of Tourism, Culture and Sport (Archaeology);
- Ontario Ministry of Aboriginal Affairs (Heritage);
- Mississippi Valley Conservation Authority (Environment/Floodplain);
- National Capital Commission (Adjacent landowner); and
- Department of Fisheries and Oceans Canada (Fish habitat);

1.4.5 Public Advisory Committee (PAC)

The varied interests of the surrounding community (i.e., community associations, local residents, and special interest groups) were represented through a Public Advisory Committee (PAC). The PAC met with members of the project team on a regular basis to:

- Identify any community issues early in the CDP process;
- Review technical analyses;
- Provide direct input to the establishment of the guiding principles of the CDP;
- Review land use alternatives; and
- Provide meaningful feedback on all study activities and work-in-progress.

The composition of the PAC was determined through consultation with the Ward Councillors and City of Ottawa staff and included:

- City Councillors from Wards 4 (Kanata North) and 5 (West Carleton-March)
- Residents and representatives of the March Rural Community Association and the Briarbrook, Brookside and Morgan's Grant Community Association
- A representative from the Kanata Chamber of Commerce

Section 2.0 Policy Framework for the EMP

The purpose of the Environmental Management Plan (EMP) is to document the existing natural conditions for the Kanata North Community and develop recommendations for mitigating any environmental impacts associated with the proposed development. The legislative requirement for the preparation of an EMP and the specific criteria for protecting particular natural features and areas are set out in a series of provincial and municipal plans and documents.

2.1 Provincial Policy Statement

The 2014 Provincial Policy Statement (PPS) provides policy direction on land use planning and development matters of provincial interest. Authority of the PPS comes from Section 2 of the Planning Act. All decisions affecting planning matters within the Province of Ontario are required to “be consistent with” policies of the PPS.

Section 2 of the PPS sets out policies relating to the *Wise Use and Management of Resources*. Section 2.1, Natural Heritage, includes policies directing where and when development and site alteration are permitted within or adjacent to Natural Heritage Features such as significant wetlands, significant woodlands, fish habitat and habitat of endangered or threatened species. The 2014 update to the PPS added additional detail to the definition and criteria for identifying significant woodlands.

Section 2.2 of the PPS provides policy on the protection of water resources and directs planning authorities to use watershed boundaries as the ecological meaningful scale for integrated and long-term planning. Among a list of policies designed to protect, improve or restore the quality and quantity of water, the PPS specifically requires planning authorities to identify water resource systems; maintain linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features; and ensure stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

Section 3 of the PPS addresses “Protecting Public Health and Safety” and includes policies to protect the public from natural or human-made hazards. Section 3.1 directs development to areas outside of hazardous lands impacted by flooding hazards, erosion hazards and/or dynamic beach hazards. Section 3.2 addresses development on or adjacent to human-made hazards such as mining and mineral aggregate operations or petroleum resources operations.

The EMP provides a summary of all the studies and field work conducted through the CDP process to ensure that the development of Kanata North respects these priorities and is consistent with the policies of the PPS.

2.2 Official Plan Policy

The City of Ottawa Official Plan provides a vision of the future growth of the city and a policy framework to guide its physical development to the year 2031.

The KNUA is designated in the City of Ottawa Official Plan (2003) as ‘Urban Expansion Study Area,’ which is a designation given to areas outside of the urban boundary that have been selected to contribute to the provision of sufficient urban land to support the residential demands of the projected population to 2031.

Before any development applications (i.e. official plan amendment, subdivision, site plan, and zoning) can be considered within an area designated as Urban Expansion Area, the Sponsoring Landowners in the CDP Area must fulfill the requirements of the Official Plan set out in Section 3.11.

The requirements of Section 3.11 include the preparation of a community design plan and mandate a comprehensive consultation process with the community to identify issues and potential solutions. In addition to policies relating to land use, cost sharing and community consultation, Policy 4 of Section 3.11 specifically includes the following direction with regard to the preparation an EMP:

- 4) *Proponents of development will complete, to the satisfaction of the City, studies and a plan of sufficient detail to:*
 - a) *Identify the location, timing and cost of roads and transit facilities, water and wastewater services, public utilities, stormwater management facilities, etc. required on-site and off-site to service the area; and*
 - b) *Identify the natural heritage system on the site independent of the potential developable area. Typically an environmental management plan as described in Section 2.4.3 will be prepared where a subwatershed study does not exist or does not provide sufficient guidance to identify the environmental features on the site and their functions, which together constitute the natural heritage system. The components of this system are generally described in Section 2.4.2, with the exception that significant woodlands are to be further evaluated consistent with the Urban Natural Areas Environmental Evaluation Study. No development is permitted within this system, which is to be conveyed to the City for public use before development of the area is approved;*

Policy 5)b of Section 3.11 sets out the conveyance requirement *for proponents of development to prepare a Financial Implementation Plan and commit to providing the natural heritage system as non-developable lands to be transferred to the City for \$1.*

As referenced above, Section 2.4.3 of the Official Plan outlines policies defining the requirements for an Environmental Management Plan:

- Where implementation of a subwatershed plan requires further detail or coordination of environmental planning and stormwater management among several sites, the City will coordinate the preparation of an Environmental Management Plan, in consultation with the Conservation Authorities.
- An Environmental Management Plan will address such matters as:
 - Delineation of creek corridor widths and setbacks from surface water features;
 - Specific mitigation measures to protect significant features, such as creeks, identified for preservation at the subwatershed level; and,
 - Conceptual and functional design of stormwater management facilities and creek corridor restoration and enhancement.
- Recommendations from environmental management plans will be implemented largely through development approval conditions and stormwater site management plans.

This EMP fulfills the policies of Sections 2.4.3 and 3.11 of the Official Plan for the KNUEA.

2.3 Local Planning Studies

There are three studies related to Shirley's Brook and the Kanata North Urban Expansion Area that have been completed by others. The findings of these studies have been reviewed as part of the data collection for the EMP and have been used as reference material for the development of the existing conditions inventory for the KNUEA.

Shirley's Brook & Watts Creek Subwatershed Study (Dillon, 1999)

This report provides an overview of the Shirley's Brook Subwatershed including inventories of existing terrestrial and aquatic habitat, streamflow monitoring, hydrologic modeling, stream corridor characterization (meander belt widths, etc.). This report makes recommendations concerning the level of protection to be afforded to existing terrestrial features and identifies opportunities to create linkages between some extensive headwaters features and the lands along the Ottawa River.

Greater Shirley's Brook Constance Creek Environmental Management Study Final Report (Aquafor Beech, 2006)

This report provides a review of data and information from previous studies, and provides additional information, with an emphasis on smaller terrestrial features, and how they provide linkages between the larger core natural features within the study area. This report also provides an assessment of riparian lands within Shirley's Brook and its tributaries and identifies opportunities for restoration and enhancement of terrestrial and aquatic communities.

Shirley's Brook & Watts Creek Phase 2 Stormwater Management Study (AECOM, 2013)

This report provides a detailed hydrologic and hydraulic analysis and fluvial geomorphologic assessment of Shirley's Brook and Watt's Creek / Kizell Drain to assess flooding and erosion sensitivities within the watercourse systems that may be affected by future storm runoff from development lands located within the headwater areas adjacent to the Beaver Pond and Kizell Wetland (primarily KNL Developments).

Section 3.0 Existing Conditions Assessment

The existing conditions reports provide the basis for identifying and mapping significant natural features within the limits of the KNUEA study area in accordance with provincial and municipal policies.

Study area extents for each of the various studies listed below vary, and are outlined in the respective reports. Generally, the study area follows the northern, southern, and western boundaries of the KNUEA and extends just east of Shirley's Brook Main Branch at the boundary of the DND lands.

The environmental inventory represents the integrated summary and assessment of the natural features identified in the existing conditions reports (available under separate cover in Volume 3):

- Kanata North Urban Expansion Area Community Design Plan Environmental Management Plan Existing Conditions Report: Storm Drainage, Hydrology & Floodplain Mapping (Novatech – February 2016)
- Existing Conditions Natural Environment Features Kanata North Urban Expansion Area (Muncaster Environmental Planning Inc. – January 2016)
- Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan (Patterson Group – October 7, 2013)
- Hydrogeological Existing Conditions Report Kanata North Urban Expansion Area (Patterson Group – May 18, 2016)
- Kanata North Urban Expansion Area Fluvial Geomorphic Assessment (Parish Aquatic Services – March 2016)
- Kanata North Urban Expansion Area Headwater Drainage Features Geomorphic Assessment (Parish Aquatic Services – March 2016)
- Kanata North Headwaters Report (Bowfin Environmental Consulting & Muncaster Environmental Planning Inc. – September 2015)
- Sensitive Groundwater Assessment: Discharge and Recharge Area Evaluation Woodlot S20 (Patterson Group – October 24, 2014)
- South March Highlands Blanding's Turtle Conservation Needs Assessment (Dillon Consulting Limited – January 31, 2013)
- Kanata North Community Design Plan Blanding's Turtle Compensation Plan (DST Consulting Engineers – June 2015)
- Kanata North Community Design Plan Blanding's Turtle Compensation Plan – Offsite Compensation Concept (Memo) (DST Consulting Engineers – November 12, 2015)

3.1 Naming Conventions

3.1.1 Aquatic Features

The KNUEA contains a variety of aquatic features (ponds, watercourses, headwater channels) which have been evaluated as part of the various existing conditions studies. Many of these drainage features have no formal names, and have been referred to under a variety of names in the existing conditions reports prepared by the various subconsultants. **Figure 3.1** identifies all of the aquatic features within the KNUEA using the following naming convention:

- “Tributary” is used to refer to the larger drainage channels that ultimately outlet to a named watercourse such as Shirley’s Brook (eg. “Tributary 1, Tributary 2, etc.”);
- The small headwater channels within the KNUEA are referred to using an alphabetical system (‘A’, ‘B’, ‘C’, etc.);
- “Shirley’s Brook Northwest Branch” refers to the collective watercourses located within a 730 ha area upstream up the confluence of Tributaries 2 and 3. Included under this name are Tributary 2, Tributary 3, and the small headwater channels within the KNUEA, west of March Road.

3.1.2 Quadrants

The KNUEA has been divided into four “quadrants” which are used to describe the location of existing natural features. **Figure 3.1** identifies the areas represented by each quadrant (northeast, northwest, southeast, southwest).

3.2 Aquatic Features and Fish Habitat

The following section provides an overview of the fish habitat assessment completed by Muncaster Environmental Planning Inc. Please refer to the following report for additional details:

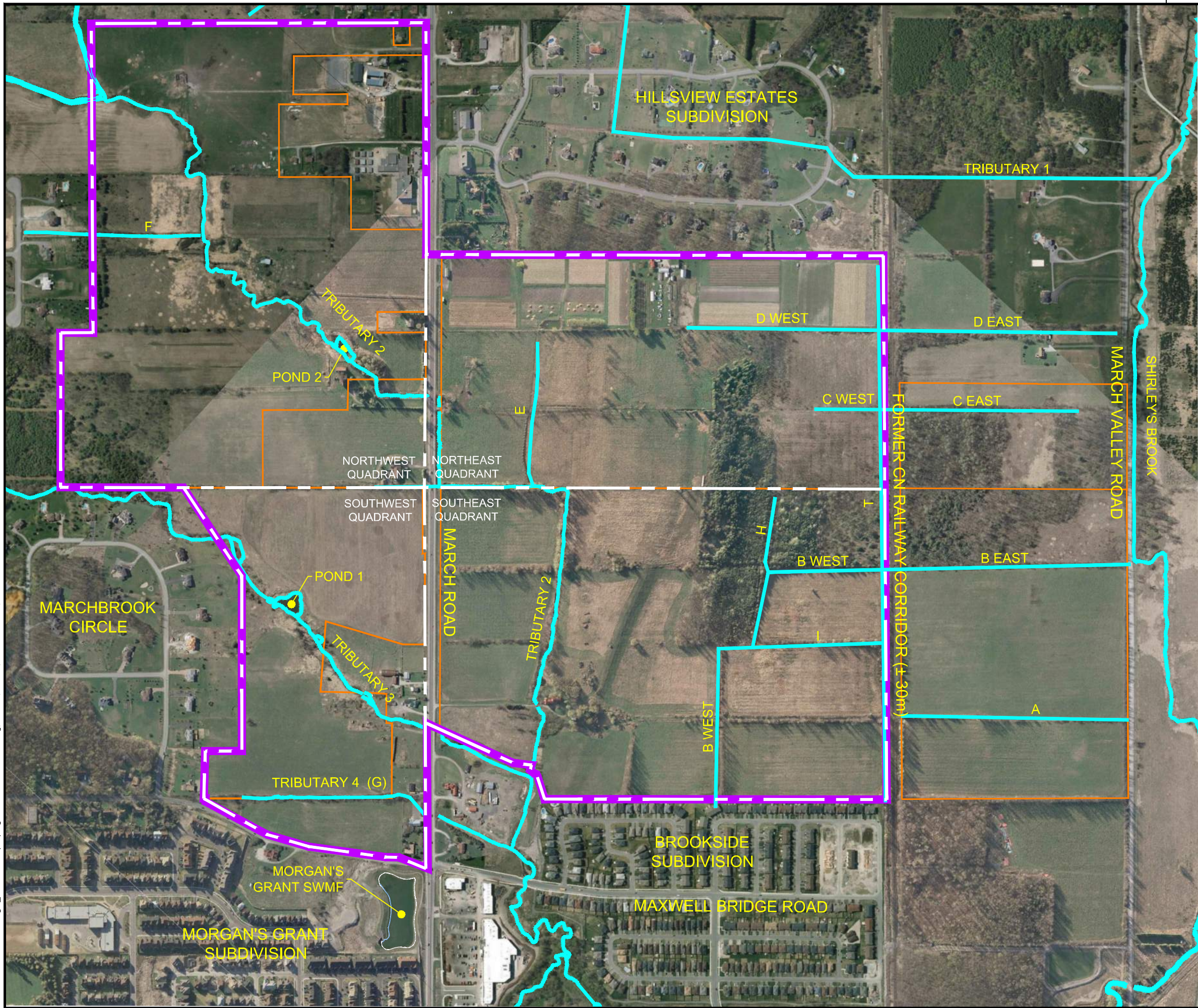
- *Existing Conditions, Natural Environment Features – Kanata North Urban Expansion Area* (Muncaster, January 2016) (located in **Volume 3, Appendix K**)

The extent of fish habitat and information on fish communities was assessed during multiple field visits in the summer of 2009 and the spring and summer of 2013. A total of eighteen sampling sites were investigated, sixteen (16) of which are within the watercourses and two (2) are in the existing inline ponds on Tributaries 2 and 3 – refer to **Figure 3.2**.

Fish sampling was primarily conducted with an electrofisher where possible. If water depth was insufficient, dip nets were used to sample the fish community. Overnight baited minnow traps were also used in the ponding areas along both Tributary 2 and Tributary 3. In addition to inventorying the fish communities, the fish habitat was assessed using several parameters, including:

- Channel width;
- Wetted width;
- Water depth;
- Channel morphology;
- Exposed substrate;
- Potential blockages in fish movement;
- In-stream structure;
- Stream cover; and
- Other components of the riparian corridor.

M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.1 Watercourses.dwg, FIG-3.1, Mar 24, 2016 - 11:51am, kbanks



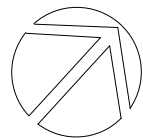
LEGEND

- KNUEA
- STUDY AREA QUADRANT BOUNDARY
- PROPERTY LINES
- DRAINAGE CHANNEL
- DRAINAGE CHANNEL ID

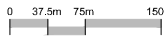


KANATA NORTH COMMUNITY DESIGN PLAN

FIGURE NO. 3.1 NAMING CONVENTIONS FOR DRAINAGE CHANNELS

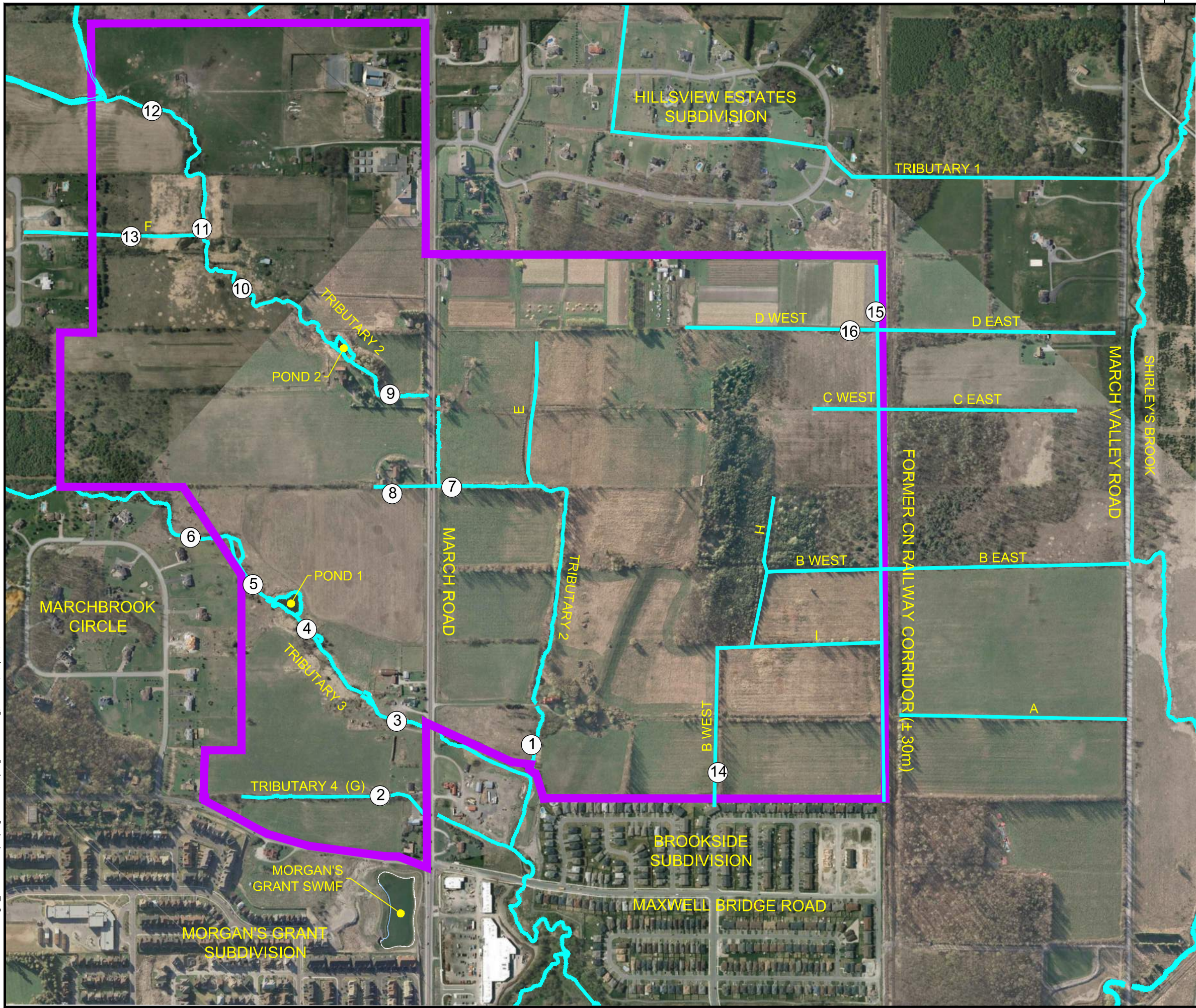


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M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.2 Sampling Stations.dwg, FIG-3.2, May 16, 2016 - 10:39am, kbanks



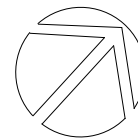
LEGEND

- KNUEA
- DRAINAGE CHANNEL & FLOW DIRECTION
- FISH SAMPLING STATION
- DRAINAGE CHANNEL ID



KANATA NORTH COMMUNITY DESIGN PLAN

FIGURE NO. 3.2 AQUATIC HABITAT SAMPLING STATIONS



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0 37.5m 75m 150m

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Habitat summaries, including unique or specialized habitats for specific life stages such as spawning, rearing, and foraging, were derived from the habitat information. Examples of specialized habitats include pools, riffles, and in-stream structures.

3.2.1 Shirley's Brook Main Branch

The main branch of Shirley's Brook flows through the Brookside Subdivision just south of the KNUEA to March Valley Road. The watercourse then turns northwest, flowing parallel to March Valley Road before ultimately outletting to the Ottawa River at Shirley's Bay. Shirley's Brook has a total watershed area of approximately 3,043 hectares.

The tributaries comprising the Northwest Branch of Shirley's Brook flow through the KNUEA to a confluence with the Main Branch near the northwest corner of the Brookside Subdivision.

3.2.2 Shirley's Brook Tributary 1

Tributary 1 is located just north of the KNUEA study area. This watercourse flows east, crossing March Road and through the rear yards of lots on Houston Crescent before entering the Main Branch of Shirley's Brook at March Valley Road.

A small portion in the northwest quadrant of the KNUEA is within the Tributary 1 catchment area. Runoff from this area is conveyed to Tributary 1 via the existing roadside ditch on the west side of March Road.

3.2.3 Shirley's Brook Northwest Branch - Tributary 2

Tributary 2 runs through the northwest quadrant of the KNUEA, crosses under March Road, then turns south before coming to a confluence with Tributaries 3 and 4 just outside the southern limit of the KNUEA. In-stream cover on Tributary 2 is limited. Where present, it consists of aquatic vegetation such as reed canary grass, purple loosestrife, and spotted jewelweed. Large woody debris is also present. The banks are fully vegetated with herbaceous species consisting of reed canary grass, purple loosestrife, and enchantment's nightshade, and woody species consisting of common buckthorn, wild black currant, wild red raspberry, Manitoba maple, crack willow and white ash. Canopy cover is intermittent with good tree cover in the deciduous hedgerows east of March Road.

West of March Road

A small artificial agricultural inline pond just upstream of March Road provides relatively deep pool habitat, with depths of greater than 0.85 m approximately 2.0 m from the shoreline. The substrate consists of unconsolidated muck. A crushed stone weir at the downstream end of the pond represents a partial barrier to fish migration. The only vegetation present was reed canary grass.

Further upstream and west of the pond, Tributary 2 flows through pasture lands (often occupied by cattle) and often meanders through dense patches of reed canary grass, which often makes access to the Tributary difficult. Sections of the tributary have been trampled by cattle, and are undefined. Patches of spotted joe-pye-weed and purple loosestrife were also found along the channel. The average measured channel and wetted widths were 7.8 m and 1.1 m respectively, with an average depth of 0.09 m. The habitat consisted of glide morphological units, and the substrate was composed primarily of bedrock. The banks showed no signs of erosion, and were fully vegetated with herbaceous species including the dominant reed canary grass, along with Canada goldenrod, purple loosestrife, and wild carrot. Woody vegetation is generally lacking in the riparian corridor, with some hawthorn shrubs further upstream.

East of March Road

Tributary 2 comes to a confluence with Tributary 3 approximately 200m east of March Road. A shallow pool in this area (max depth of 0.20 to 0.34 m) provides aquatic habitat for a diversity of cool and warmwater forage and coarse fish. In 2009, a beaver dam was found upstream of the sampling station located within the Southeast quadrant (Muncaster, 2016). In this area, a large number of fish were captured representing several species.

Channel dimensions east of March Road were measured on May 8th, 2009 (Muncaster, 2016). The average wetted width of the channel is between 2.2 and 3.2 m. The average bankfull depth is approximately 0.40 m. Recorded flow depths ranged between 0.05 to 0.35 m, with an average depth of 0.15 m. The substrate in the vicinity of March Road is dominated by silt, transitioning to bedrock and sand further downstream with some pebbles, gravel, and hard packed clay. The substrate in the pool was composed of fines and bedrock.

Fish Habitat

Based on the most recent fish sampling and fish habitat assessments, Tributary 2 has been found to support direct fish habitat within the majority of the urban expansion area. However, the watercourse is intermittent and much of the fish community likely migrates downstream to the main branch of Shirley's Brook during low flow periods. **Section 3.2.6** provides more detail on the species of fish observed.

Findings from Previous Studies

The *Shirley's Brook and Watts Creek Subwatershed Study* (Dillon, 1999) did not consider Tributary 2 to provide direct fish habitat on the west side of March Road. Rather, the watercourse was considered to support the overall productivity of the Shirley's Brook system, particularly during the spring period. Tributary 2 was considered a low priority for restoration and enhancement.

3.2.4 Shirley's Brook Northwest Branch - Tributary 3

Tributary 3 runs through the southwest quadrant of the KNUFA, from the northeast corner of the Marchbrook Circle subdivision, crossing under March Road before reaching a confluence with Tributary 2 just south of the study area. Tributary 3 contains several concrete weir structures, creating inline ponds behind each weir. Exposed bedrock is common in the channel, particularly downstream of the inline ponds along the watercourse. The remainder of the channel generally consists of a channel over bedrock, with limited wetted widths in glade habitats.

Channel dimensions were measured on August 20th, 2013 (Muncaster, 2016). The average channel and wetted widths were measured at 3.2 m and 0.40 m, respectively. The average bankfull depth was approximately 0.21 m and the average water depth ranged from 0.01 to 0.03 m.

The channel banks are generally fully vegetated with herbaceous species and also with scattered woody species. Herbaceous vegetation consists of reed canary grass, grass-leaved goldenrod, wild carrot, spotted jewel-weed, and purple loosestrife. The woody species includes apple, Manitoba maple, common buckthorn, tartarian honeysuckle, crack willow, white ash, and large-toothed aspen.

Inline Pond

The banks of the inline pond located between fish sampling stations 4 and 5 (refer to Figure 3.1) are fully vegetated primarily with herbaceous species such as reed canary grass, spotted jewelweed, and purple loosestrife. There is intermittent woody vegetation in the area consisting of pussy willow, Manitoba maple, white cedar, white spruce, and white ash, but with no appreciable canopy cover over the pond. Within the pond, aquatic vegetation consists of broad-leaved cattail, common arrowhead, chara species, giant bur-reed, and sago pondweed.

Fish Habitat

Based on the most recent fish sampling and fish habitat assessments, Tributary 3 has been found to support direct fish habitat within the majority of the urban expansion area. **Section 3.2.6** provides more detail on the species of fish observed.

Findings from Previous Studies

The *Shirley's Brook and Watts Creek Subwatershed Study* (Dillon, 1999) considered the reach of Tributary 3 within the KNUEA to be a high priority area for restoration and enhancement, including the removal of barriers to enhance fish movement.

The *Greater Shirley's Brook / Constance Creek Environmental Management Study* (Aquafor Beech, 2006) concluded that Tributary 3 supported a moderately tolerant to tolerant warmwater fish community upstream of the confluence with Tributary 2.

3.2.5 Shirley's Brook Northwest Branch - Tributary 4 (Ditch G)

Shirley's Brook Northwest Branch Tributary 4 runs through the southwest quadrant of the KNUEA parallel to Old Carp Road. West of March Road, this channel serves as the outlet for a portion of the Marchbrook Circle subdivision, as well as the existing rural lands in the southwest quadrant of the KNUEA. East of March Road, Tributary 4 serves as the outlet from the Morgan's Grant SWM Facility.

3.2.6 Fish Habitat Summary

A total of ten (10) species were captured during both the spring and summer sampling periods, as noted in **Table 3.1**. All of the fish species listed are commonly found in cool and warm water fish habitats in eastern Ontario.

Based on the fish sampling and fish habitat assessments, Tributary 2 and Tributary 3 of Shirley's Brook support direct fish habitat for the majority of the urban expansion area.

Table 3.1: Summary of Fish Captured per Season (2013)

Species Name	Scientific Name	Number Caught (Size range, mm)		Location
		Spring	Summer	
White sucker	<i>Catostomus commersonii</i>	3 (180-212)	2 (46-53)	Tributary 3
Central mudminnow	<i>Umbra limi</i>	5 (64-109)	1 (56)	Tributary 2/3
Northern redbelly dace	<i>Phoxinus eos</i>	4 (41-54)	2 (10-62)	Tributary 3
Finescale dace	<i>Phoxinus neogaeus</i>	1 (57)	1 (61)	Tributary 2
Longnose dace	<i>Rhinichthys cataractae</i>	-	21 (27-86)	Tributary 3
Blacknose dace	<i>Rhinichthys obtusus</i>	1 (80)	-	Tributary 3
Fathead minnow	<i>Pimephales notatus</i>	-	1 (15)	Tributary 2
Creek chub	<i>Semotilus atromaculatus</i>	7 (46-119)	72 (30-157)	Tributary 2/3
Brook stickleback	<i>Culaea inconstans</i>	38 (35-56)	28 (15-48)	Tributary 2/3
Pumpkinseed	<i>Lepomis gibbosus</i>	1 (62)	-	Tributary 3
Total		51	128	-
Number of Species:		8	8	-

3.3 Headwater Drainage Channels

Headwater drainage channels can provide a variety of ecological and hydrologic functions in a watershed. Headwater systems can potentially provide important sources of food, sediment, water, nutrients and organic matter for downstream reaches.

The headwater drainage features in the vicinity of the KNUFA have been assessed in accordance with the *Headwater Drainage Features Guidelines* (CVC, January 2014). Supporting information is provided in the following reports (also located in **Volume 3, Appendices P & Q**):

- *Kanata North Headwaters Report* (Bowfin / Muncaster, September 2015).
- *Kanata North Urban Expansion Area Headwater Drainage Features Geomorphic Assessment* (Parish Aquatic Services, March 2016)

3.3.1 Headwater Drainage Features Assessment

The headwater drainage feature classification follows a four-step process:

- 1) Hydrology Classification
- 2) Riparian Classification
- 3) Fish and Fish Habitat Classification
- 4) Terrestrial Habitat Classification

Using the CVC guidelines and the data collected as part of the existing conditions evaluations, management recommendations have been developed for each headwater channel as summarized in **Table 3.2**. Detailed descriptions of each of the listed headwater channels can be found in the headwaters assessment (Parish, 2016) located in **Volume 3, Appendix P**.

Table 3.2: Headwater Drainage Feature Evaluation, Classification & Management Summary

Drainage Feature	Classification				Management Recommendation
	Hydrology	Riparian	Fish and Fish Habitat	Terrestrial Habitat	
A	Limited	Limited	Not Sampled	Not Sampled	No Management Required
B	Contributing	Important	Valued to Contributing	Limited	Conservation
C	Limited	Important	None (not connected)	Not Sampled	No Management Required
D East	Contributing	Valued	Unknown	Not Sampled	Conservation
D West	Contributing	Limited	Contributing	Not Sampled	Mitigation
E	Limited	Limited	Not Sampled	Not Sampled	No Management Required
F – Upstream of Confluence	Contributing	Valued	Contributing	Not Sampled	Mitigation
F – at Confluence	Contributing	Important	Valued	Not Sampled	Protection
G	Contributing	Limited	No fish habitat during summer. May provide habitat in spring but poor downstream connection	Not Sampled	Mitigation
H	Limited	Important	Contributing	Important	Conservation
I	Limited	Limited	Contributing	Limited	No Management Required
T	Limited	Limited	Contributing	Limited	No Management Required

3.4 Terrestrial Features & Habitat

The following section provides an overview of the terrestrial features and habitat assessment completed by Muncaster Environmental Planning Inc. More detailed information, including lists of species observed, is provided in the report *Natural Environment Features Kanata North Community Design Plan* (Muncaster, revised January, 2016) which can be found in **Volume 3, Appendix K**. Individual Woodlot Evaluations can be found in **Volume 2, Appendix C**.

Wildlife and vegetation surveys were completed by Muncaster Environmental Planning between December 2012 and August 2015. In addition, butternut health assessments were completed on June 13th and July 2nd, 2013. References to terrestrial features are identified on **Figure 3.3**.

The study area is comprised mainly of existing and former agricultural lands, including corn and soybean crops, hay fields, and pasture lands. Several wooded areas and hedgerows can be found throughout the site, with the majority being on the east side of March Road and beyond the abandoned CN rail line (outside the KNUEA). These areas are populated by a variety of trees, and provide habitat to several species of wildlife.

3.4.1 Agricultural Fields and Cultural Meadows/ Thickets

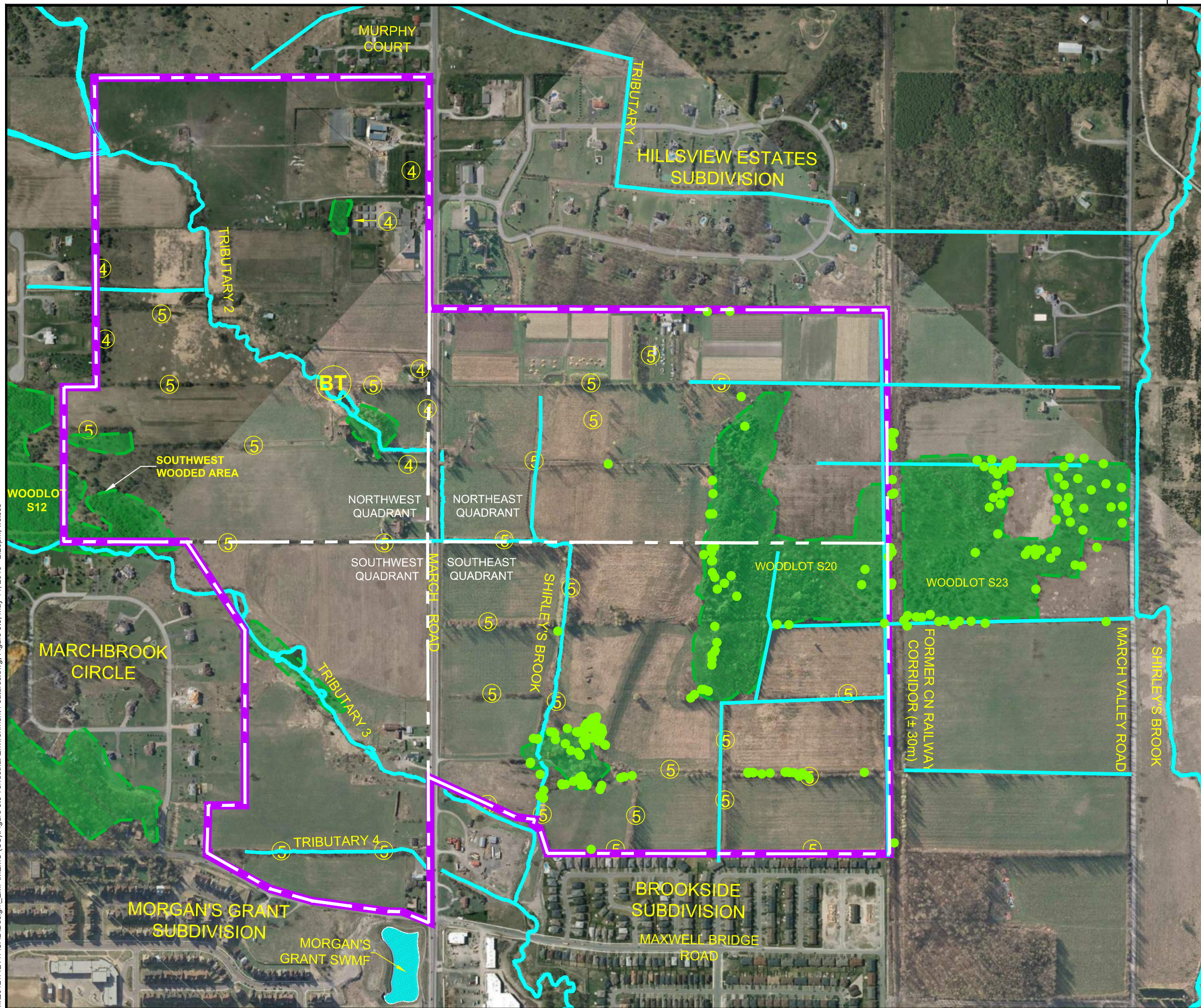
The lands comprising the KNUEA are dominated by agricultural fields, which were primarily planted with soybeans and corn in the past. There is also a pasture area located in the Northwest quadrant. Commonly found within the pasture area and along the boundaries of the agricultural fields were several different species of grass, and other plants commonly found in agricultural areas. Cultural thickets are also found scattered within the agricultural parts of the KNUEA.

3.4.2 Hedgerows

Within the KNUEA there are many deciduous hedgerows bordering the existing agricultural fields (denoted with #5 on **Figure 3.2**). Hedgerows on both the west and east sides of March Road are mainly populated by white ash, with some having Manitoba maple as the most dominant species. Some of the ash were found to be in poor condition with stripped bark and trunk decay. Other species present within the hedgerows include white elm, bur oak, white cedar, sugar maple, basswood, crack willow, white pine, red maple, white birch, apple, black cherry, and trembling aspen. Butternut trees were also present in some of the hedgerows – refer to **Section 3.5.2**. Extensive vine growth on many of the poplars and willows was encountered and common buckthorn and hawthorn shrubs were common among the hedgerow trees. Several mature trees were noted within the deciduous hedgerows including several bur oaks, a white ash, and a sugar maple.

There are a few coniferous hedgerows or windbreaks within the KNUEA, mainly located within the vicinity of Nadia Lane at the western boundary, near St. Isidore School, and around Tributary 2 of Shirley's Brook near March Road. Each hedgerow is typically made up of a single species of tree including white pine, red pine, white spruce, and white cedars. Coniferous hedgerows are denoted with #4 on **Figure 3.3**.

M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.3 Terrestrial Environment Features.dwg, Figure 3.3, May 11, 2016 - 2:26pm, wsboss



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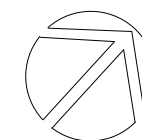
- KNUEA
- DRAINAGE CHANNEL
- ④ CONIFEROUS HEDGEROW
- ⑤ DECIDUOUS HEDGEROW
- BUTTERNUT LOCATIONS (EXAMPLES)
- BT BLANDING'S TURTLE SIGHTING LOCATION
- WOODED AREA



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FIGURE NO. 3.3 EXISTING CONDITIONS - TERRESTRIAL ENVIRONMENT FEATURES

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3.4.3 Woodlot S20

Located within the KNUFA on the east side of March Road, straddling the boundary of the northeast and southeast quadrants is a wooded area covering approximately 8.1 ha. This area was designated as a "Natural Area Not Protected from Development" by Dillon (1999) and named 'Woodlot S20'. This area is populated primarily with young white cedar trees, white elm, and trembling aspen common along portions of the periphery. Green ash, white ash, bur oak, white birch, butternut, Manitoba maple, and sugar maple are also present. Wildlife observed within Woodlot S20 included black-capped chickadee, American robin, blue jay, American crow, American goldfinch, common yellowthroat, yellow warbler, cedar waxwing, great-crested flycatcher, song sparrow, white-tailed deer, and green frogs. There are several mature, healthy white cedar trees located at the top of the ridge in Woodlot S20.

3.4.4 Woodlot S23

Woodlot S23 is a wooded area covering approximately 11 ha, located east of the abandoned CN Rail line that borders the KNUFA and west of March Valley Road. The woodland is somewhat fragmented, with successional fallow fields and meadows located in the clearings along its north and south perimeters.

The forests within Woodlot S23 are generally dominated by deciduous trees, with some scattered coniferous trees. Green ash was found to be dominant in both the northeast and north-central deciduous forests, with ash and poplar trees being dominant in the north-west forest. Many large pine (up to 90cm dbh) and bur oak (up to 100cm dbh) were found within Woodlot S23. Most of the trees in the woodlot are in good condition, with the exception of some of the butternuts having poor leaf-out and canker, and a few of the ash having trunk decay.

Butternut trees are very common within Woodlot S23, as shown on **Figure 3.3**. The butternuts within the woodlot range in size from 2cm dbh to 55cm dbh. Some of the trees are relatively healthy, while others have been significantly impacted by the butternut canker.

3.4.5 Southwest Wooded Area

The wooded area located along the central-west edge of the northwest quadrant (Southwest Wooded Area) is a small mixed forest, dominated by white pines up to 36cm in diameter at breast height (dbh). Smaller green ash, white elm, and white cedar are also present in this area. Rock was found to be common near the ground surface in this area. West of this mixed forest is a small area densely populated by white cedar. White pine, green ash, white birch, and white elm were also found.

3.4.6 Other Treed Areas

Scattered throughout the KNUFA are a few cultural woodlands, where the tree cover is found to be greater than thicket habitats. These areas were found to consist of large white pines with a dbh of up to 46cm, smaller green ash, bur oak, Manitoba maple, red pine, trembling aspen, basswood, grey birch, and white elm. Some of these areas appeared to be used for firewood by the previous landowners.

Surrounding the farm houses located along March Road were several mature coniferous and deciduous trees including white cedar, ash, crack willow, sugar maple, and Manitoba maple.

3.4.7 Linkages

There is limited potential linkage function within the KNU EA between Shirley's Bay and the Ottawa River to the east and the South March Highlands to the west. This is due to the presence of extensive agricultural lands, DND activities, March Road, March Valley Road, and the existing residential developments. There is limited woody vegetation along Tributary 2 to the west of March Road and the linkage value of the watercourse corridors is limited due to their poor length-width ratio. The scattered woodlots within the KNU EA are poorly connected to one-another as a result of the existing land use. Past studies including the results of 2013 Official Plan Review (Official Plan Amendment 150) have identified linkages between Shirley's Bay and the Ottawa River to the east and the South March Highlands to the west to the north of the KNU EA in the vicinity of Riddell Drive, the east-west section of March Road and Constance Creek. No regional-scale linkages were identified through the KNU EA during the 2013 Official Plan Review.

3.4.8 Wildlife

Wildlife and vegetation surveys were completed by Muncaster Environmental Planning on the following dates:

- December 4th & 13th, 2012
- May 3, 2013
- June 19th & 21st, 2013
- June 5, 2014
- May 14, 2015
- June 9th, 10th & 18th, 2015

During other site visits, incidental wildlife observations were gathered and recorded. Summaries of wildlife encountered can be found in the Existing Conditions Natural Environment Features Report (Muncaster, January 2016) located in **Volume 3, Appendix K**.

As part of the wildlife and vegetation surveys, the potential for significant wildlife habitat was assessed following the protocols outlined in the OMNR *Reference Manual for Natural Heritage Policies of the Provincial Policy Statement* (2010) and the MNRF *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E* (2015). Overall, field observations indicate that there were no triggers for significant wildlife habitat designation:

- Several different species of wildlife were observed, including red squirrel, white-tailed deer, gray tree frog, spring peeper, garter snake, snapping turtle, among others.
- While several species were observed, no specialized habitats were identified.
 - With the possible exception of the larger pond along Tributary 3 (see "Pond 1" on **Figure 3.1**) which would be considered significant wildlife habitat if there are snapping turtles that overwinter in the pond.

Two breeding bird surveys were completed by Muncaster Environmental Planning on June 13th and July 2nd, 2013. During the surveys, a total of 49 species (including three threatened species) were observed within the study area. A list of the observed species and locations is included in **Volume 3, Appendix K**.

3.5 Species at Risk

Correspondence with the Ministry of Natural Resources and Forestry identified several potential species at risk in the general area including butternut trees, Blanding's Turtle, bobolink, barn swallows, whip-poor-will, and eastern meadowlark. Surveys were completed throughout the KNUFA in an effort to locate possible existing habitat for the species at risk. During the surveys, the following Species at Risk were identified within the study area:

- Blanding's Turtle
- Butternut Trees
- Barn Swallow

Bobolink and eastern meadowlark were observed flying and calling within the KNUFA, however no nesting birds were observed. Whip-poor-will was not observed within the KNUFA.

3.5.1 Blanding's Turtle

A population of Blanding's Turtle inhabits the South March Highlands Conservation Forest, which is located west of the KNUFA. This turtle population is part of a larger population in the surrounding areas of northwest Ottawa. It is understood that the turtles could use Shirley's Brook and its tributaries for passage between the South March Highlands and Shirley's Bay.

A single Blanding's Turtle was observed during the environmental surveys (Muncaster 2014) in the small inline pond on Tributary 2 west of March Road – refer to **Figure 3.3**. Due to the early nature of this sighting, it is presumed that this pond has the potential to function as a hibernacula habitat and is therefore considered as Category 1 habitat.

Previous Studies

A study of the Blanding's Turtle population (*South March Highlands Blanding's Turtle Conservation Needs Assessment* – which can be found in **Volume 3, Appendix S**) was completed by Dillon Consulting Limited in January, 2013. Dillon's assessment consists of the following:

- Review of turtle biology;
- Threat assessment;
- Population viability analytical model;
- Characterization of suitable habitats;
- Potential and observed movement corridors; and,
- Specific objectives and recommendations to manage conservation.

The assessment determined that the Blanding's Turtle population in this area is considered to be at a high risk of decline, and faces eventual extirpation if specific actions to limit turtle mortality are not incorporated into proposed development in the area. Vehicle collisions and habitat loss due to urbanization were found to be the most significant factors affecting the turtle population in this area.

Other studies on Blanding's Turtle within the area of the KNUFA are as follows, and can be found in **Volume 3, Appendices T and U**:

- Kanata North Community Design Plan Blanding's Turtle Compensation Plan (DST Consulting Engineers – June 2015)
- Kanata North Community Design Plan Blanding's Turtle Compensation Plan – Offsite Compensation Concept (Memo) (DST Consulting Engineers – November 12, 2015)

Blanding's Turtle Habitat within the KNUEA

The *General Habitat Description of the Blanding's Turtle* (OMNRF 2013) was used to categorize the extent of Blanding's turtle habitat within the KNUEA:

- The small inline pond on Tributary 2 west of March Road is presumed to have the potential to function as a hibernacula habitat and is therefore considered as Category 1 habitat.
- Because the entirety of the KNUEA is within 2km of the noted observations, all suitable waterbodies and wetland areas are considered to be Category 2 habitat. This includes Shirley's Brook Northwest Branch Tributaries 2 and 3, and Tributary 4 east of March Road.
- In general, the areas within 250 m from the edge of the Category 2 habitat are considered to be Category 3 habitat.

3.5.2 *Butternut Trees*

One hundred and sixty-seven (167) butternut trees have been assessed by a qualified butternut health assessor in accordance with the MNRF guidelines on and within 25 m of the KNUEA, mainly within Woodlots S20 and S23 east of March Road - refer to **Figure 3.3**. No butternuts were observed to the west of March Road. The butternuts within the KNUEA vary in size, with a diameter at breast height (dbh) ranging between 2 and 55 cm.

Butternuts are assessed in one of three categories:

- Category 1: unhealthy
- Category 2: healthy;
- Category 3: healthy, at least 20cm dbh, and within 40m of a Category 1 tree.

Of the 167 butternuts assessed, 137 were assessed as healthy, with six (6) trees meeting the Category 3 criteria. Category 3 trees have the potential to be archived, as they may have features that are resistant to the canker fungus

3.5.3 *Barn Swallows*

Barn Swallows nest in old farm buildings including old barns, sheds, abandoned silos, etc. Barn Swallow nests were found in several derelict farming structures within the western part of the KNUEA, indicating that Barn Swallows are nesting in these areas. A total of nine (9) barn swallow nests were found in three (3) separate buildings including an old barn, a barn shed, and a cattle shed.

3.6 Woodlot Evaluation

An evaluation of the woodlots in the vicinity of the KNUEA was completed to determine which areas would be considered significant woodlands. Please refer to the following report for additional details:

- *Existing Conditions, Natural Environment Features – Kanata North Urban Expansion Area* (Muncaster, January 2016).

The above report can be found in **Volume 3, Appendix K**. Individual Woodlot Evaluations can be found in **Volume 2, Appendix C**.

3.6.1 Woodlot S20

Woodlot S20 was initially assessed using the criteria in Policy 1c of Section 2.4.2 of the City of Ottawa Official Plan, which defines significant woodlands in the rural area as woodlands that combine all three features listed below in a contiguous, forested area:

- i. Mature stands of trees 80 years of age or older; and
- ii. Interior forest habitat located more than 100 m inside the edge of a forest patch; and
- iii. Woodland adjacent to a surface water feature such as a river, stream, drain, pond or wetland, or any groundwater feature including springs, seepage areas, or areas of groundwater upwelling;

Woodlot S20 did not satisfy the interior forest habitat criteria as there is no portion of the woodlot that is greater than 100 metres from a forest edge. Due to the areas of cultural woodland east of Woodlot S20 and the forest canopy break at the former railway, Woodlot S23 and Woodlot S20 are not considered to be contiguous. As all three criteria must be met, Woodlot S20 was not considered a Significant Woodland using the Official Plan criteria.

Following the 2014 Provincial Policy Statement, Woodlot S20 was also assessed for significance using the criteria in OMNR (2010). This assessment concluded that Woodlot S20 contains several mature trees but overall does not have the attributes to be considered a Significant Woodland and is not considered a natural heritage system feature. The features and functions of Woodlot S20 were found to be limited by a lack of interior habitat with no observations of forest interior or area sensitive wildlife:

- no observations of vernal pools;
- no observations of Species at Risk other than butternut;
- limited amount and diversity of regenerating stems;
- high level of disturbance from non-native species, wind throw and historical logging; and,
- a linear shape that reduces the ecological features and functions due to edge effects

3.6.2 Woodlot S23

The forests to the east of the former railway line, Woodlot S23, would likely be considered a Significant Woodland due to the older tree structure present, some interior forest habitat and presence of a drainage feature. The functions of the northeast forest component of Woodlot S23 are reduced due to the dominance of ash and poplar in many areas, disturbed and very thick understory, ground flora dominated by non-native and/or invasive flora, the lack of forest interior potential in the forest width up to 150 metres, road noise and open canopy in many areas.

3.6.3 Southwest Wooded Area

The Southwest Wooded Area is located in the southwest quadrant of the KNU EA adjacent to the Marchbrook Circle Subdivision. This area is included on Schedule L3 of the City of Ottawa Natural Heritage System Overlay.

This area has been historically disturbed by agriculture and had no contiguous tree cover on 1976 aerial photography. The southwest wooded area does extend in a continuous, although tenuous, manner west and southwest to the core Woodland S12 area. As a watercourse is present and the contiguous forest to the southwest of the site does have small areas of forest that are greater than 100 metres from a forest edge, the entire contiguous forest is considered a Significant Woodland.

A portion of the wooded area (approximately 0.3 ha), located along the western border of the KNU EA is to be retained as a part of the Natural Heritage System (NHS). This area consists of a white cedar coniferous forest, where the trees are generally young, but in good health. This portion of the southwest wooded area is contiguous with and forms a part of the larger wooded area to the west and southwest, including Woodlot S12. As this area is considered a part of the NHS, it is important that it be retained as a part of the proposed development and conveyed to the City for conservation. The other portions of the southwest wooded area within the KNU EA lack the same degree of connectivity to the larger wooded area to the west and southwest, have fewer regenerating stems and opportunities for wildlife habitat, and a lower condition of ecological integrity.

3.7 Geotechnical

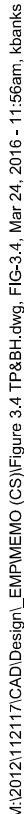
A geotechnical investigation of the soils within the KNU EA was completed to assess soils conditions and provide preliminary guidelines with respect to slope stability, grade raise restrictions and foundation design requirements. The following report (which can be found in **Volume 3, Appendix L**) consolidates the geotechnical studies completed for the individual properties within the KNU EA:

- *Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan* (Patterson – October 7, 2013)

3.7.1 Methodology

The geotechnical investigation included a field program consisting of test pits excavated by a hydraulic shovel or backhoe. The test holes were distributed in a manner to provide general coverall of the subject sites comprising the KNU EA. Refer to **Figure 3.4** for the location of all test pits and boreholes within the KNU EA.

- Soils samples from the test pits were recovered from the side walls for further examination and classification.
- Subsurface conditions observed in the boreholes were recorded in detail in the field and logged on the test pit data sheets.
- Groundwater infiltration levels were observed at the time of excavation at each test pit location.



3.7.2 Surficial Geology

The surficial geology of the KNUEA is shown on **Figure 3.5**. The surficial soils in the subject area generally consist of silty clay and glacial till, which is generally consistent with marine deposits associated with the Champlain Sea. Silty sand with trace clay was found in several test pits, but is only present in isolated pockets throughout the site. Based on the borehole and test pit program carried out by Paterson Group, the overburden thickness across the site generally ranges from 0m thick to greater than 10m thick. Bedrock is present just beneath the topsoil and glaciofluvial soil veneer in the southwest quadrant of the KNUEA and trends downward moving towards the northern portion of the site. There are weathered outcroppings of bedrock in both the southeast and southwest quadrants, and both Tributary 2 and Tributary 3 contain long expanses of exposed, competent bedrock.

3.7.3 Bedrock Geology

The bedrock which underlies the KNUEA consists of generally flat-lying bedrock of sedimentary origin. Bedrock is present at variable depths across the subject lands, and the depth to bedrock varies significantly from the south to the north, as well as from the east to the west. The site primarily consists of interbedded sandstone and limestone of the March Formation. Approximately one third of the study area (in the northeast and northwest quadrants) is underlain by limestone of the Oxford Formation.

The March Formation is the older of the two formations, and transitions to the Oxford Formation by way of a vertical fault. Sections of the bedrock mapping for the KNUEA and surrounding area are provided in the Consolidated Preliminary Geotechnical Investigation Report.

A review of the Ontario Geologic Survey (OGS) bedrock mapping reveals that the March and Oxford Formations present beneath the KNUEA are not considered to contain potential or inferred karst features. The term karst is used to describe a geologic formation which is shaped by the dissolution of a layer, or layers, of soluble bedrock. Typically this is found in carbonate rock such as limestone or dolostone. Although the bedrock that underlays the site is comprised of carbonate bedrock, they represent older bedrock in the study area and have a denser crystalline structure versus the younger Ottawa Formation bedrock.

3.7.4 Slope Stability

A significant soil ridge (approximately 9.0 m high with a slope of 8H:1V) runs in a north-south direction through the east portion of the KNUEA.. Test pits and boreholes conducted in the area of the existing slope were analyzed to determine the subsurface soil conditions.

Paterson Group conducted modeling of two cross-sections along the slope, and found that both sections are stable with slope stability factors of safety greater than 1.5. Refer to **Volume 3, Appendix M** for slope stability tables & data.

3.8 Hydrogeology

A hydrogeologic investigation was completed to characterize the existing conditions within the KNUEA with respect to bedrock and surficial geology, aquifers, aquitards, horizontal and vertical flow patterns, existing groundwater use, and aquifer vulnerability. The hydrogeologic characterization is based on a combination of existing information and site specific information provided by the fieldwork and other analyses. Please refer to the following report (located in **Volume 3, Appendix N**) for additional information:

- *Hydrogeological Existing Conditions Report - Kanata North Urban Expansion Area* (Paterson, May 18, 2016)

3.8.1 Groundwater Recharge and Discharge

In general, groundwater will follow the path of least resistance from areas of higher hydraulic head to areas of lower hydraulic head. While upward and downward hydraulic gradients may be indicative of areas of discharge and recharge respectively, other factors must be considered.

Previous Studies

The *Shirley's Brook and Watt's Creek Subwatershed Study* (Dillon 1999) and the *Kanata North Environmental/Stormwater Management Plan* (CH2MHill 2001) reports were reviewed by Paterson staff as part of the existing conditions geotechnical investigation. While the majority of overburden soils within the KNUEA were reportedly silty clay or glacial till deposits, the Dillon report identified alluvial soils in the eastern portions of the study area. Alluvial soils are comprised of loose, unconsolidated material which has previously been eroded and re-shaped by water, and can potentially transmit overburden groundwater significant lateral distances via gravity flow and provide groundwater recharge and discharge to Shirley's Brook.

Dillon (1999) estimated the alluvial soils to be up to 2 m thick, where present, and indicated that these soils could provide an opportunity for infiltration-based stormwater management measures. The Dillon report also identified exposed bedrock ridges near the western boundary of the study area as representing a potential bedrock groundwater recharge area.

The *Greater Shirley's Brook Constance Creek Environmental Management Study* (Aquafor Beech, October 2006) also indicates the presence of a large alluvial sand deposit between March Road and March Valley Road extending for a distance of approximately 7 km through the low area below the ridge. Refer to **Volume 2, Appendix G, Figure 1** for the location of the alluvial soils deposit, identified as "High Recharge" in the legend.

Within the limits of the KNUEA, the alluvial sand deposits are generally underlain by stiff silty clay, which significantly limits the groundwater recharge potential in this area. The alluvial soils correspond to the sand / sandy loam areas shown on **Figure 3.5**.

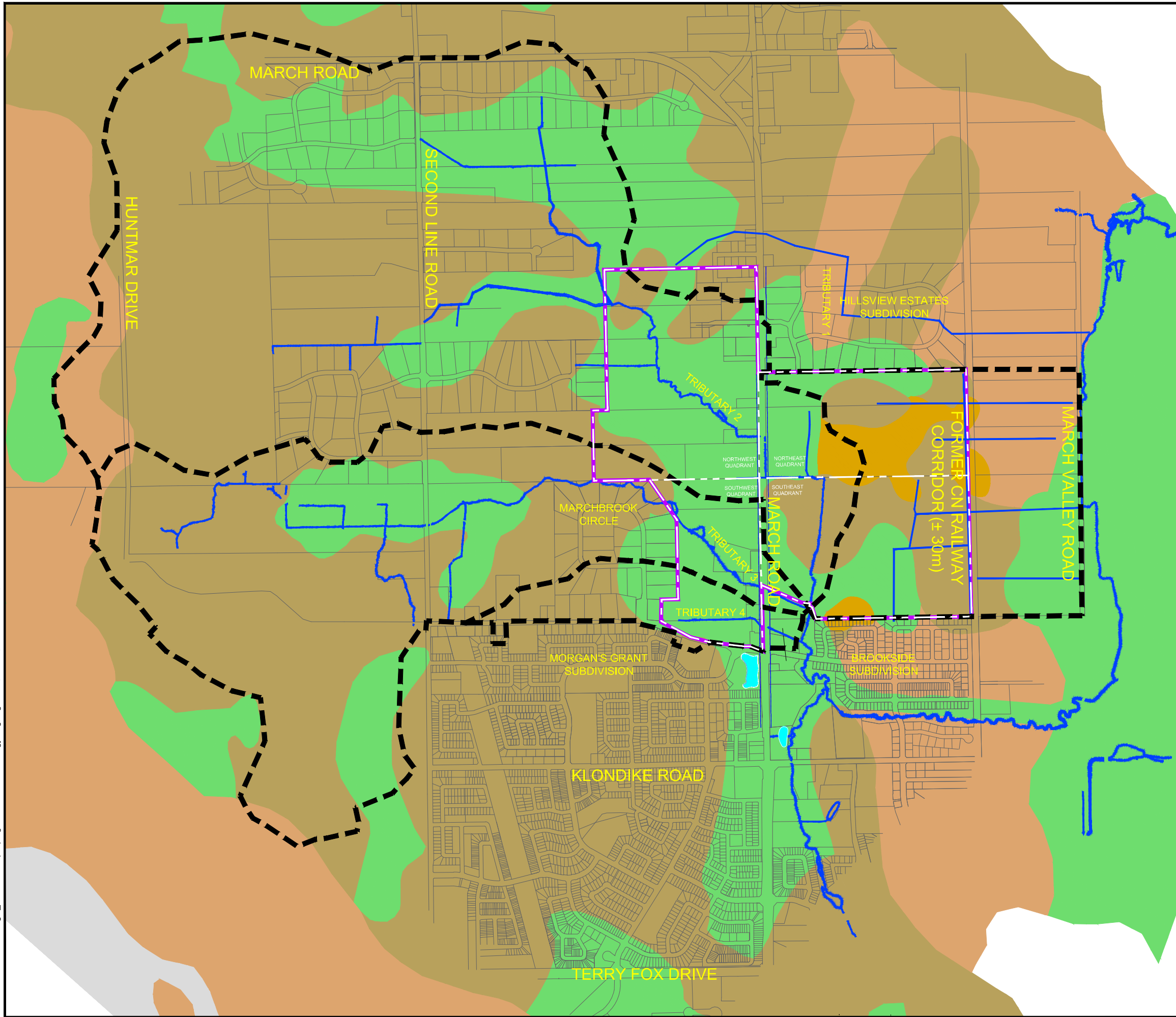
Results of Field Testing

Based on hydraulic conductivity testing undertaken in the bedrock unit, and hydraulic conductivity estimates based on grain size analysis of overburden soils, the bedrock unit is considered to have a higher hydraulic conductivity than the silty clay and glacial till overburden soils, which are generally considered to act as a confining layer. As such, groundwater will generally flow laterally through the fractured bedrock aquifer units or through localized shallow silty sand deposits, as opposed to vertically upwards or downwards through the overburden soils of lower hydraulic conductivity. The borehole and piezometer locations used in the groundwater recharge/discharge assessment are shown on **Figure 3.4**.

- In areas where downward hydraulic gradients were observed (BH1/BH1A, BH4/ BH4A), the presence of overburden soils of lower hydraulic conductivity overlying the bedrock aquifer units are considered to limit the potential for significant groundwater recharge in these areas.
- In areas where upward hydraulic gradients were observed (BH2/BH2A, BH3/BH3A, BH5/BH4A), the presence of overburden soils of lower hydraulic conductivity overlying the bedrock aquifer units are considered to limit the potential for significant groundwater discharge in these areas.

Furthermore, the presence of groundwater levels in the vicinity of BH1/BH1A and BH5/BH5A at elevations above ground surface supports the conclusion that overburden soils are acting as a confining layer above the bedrock aquifer units in these specific locations.

M:\2012\112117\CAD\Design\1_EMP\MEMO (CS)\Figure 3.5 Surficial Geology.dwg, Figure 3.5, Mar 24, 2016 - 11:57am, kbanks



LEGEND

- KNUEA
- DRAINAGE CHANNEL
- PRE-DEVELOPMENT DRAINAGE BOUNDARIES

SURFICIAL SOIL TYPE (HSG)

- MEDIUM/COARSE SAND (HSG 'AB')
- SANDY LOAM OR LOAMY SAND (HSG 'B')
- FINE SANDY LOAM OR LOAMY FINE SAND (HSG 'C')
- SILT LOAM, SILTY CLAY, SILTY CLAY LOAM, CLAY LOAMS OR CLAY (HSG 'D')

SOURCE OF INFORMATION

- KNUEA
(BASED ON GEOTECHNICAL REPORTS - REFER TO FIGURE 3.4)
- EXTERNAL AREAS
(BASED ON SOILS OF THE REGIONAL MUNICIPALITY OF OTTAWA-CARELTON (ONTARIO). 1987. SOIL SURVEY REPORT NO. 58 (SHEET 3))



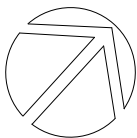
KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.5
SURFICIAL SOILS
HYDROLOGIC SOIL GROUP
(HSG)

DATE
MAY 2016

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NOVATECH
Engineers, Planners & Landscape Architects

Woodlot S20

Water at ground surface has historically been observed within Woodlot S20, in the vicinity of the alluvial silty sand deposits. No natural drainage outlets are present within Woodlot S20. Drainage channels are negatively graded in areas and the culverts crossing the former rail corridor are perched, allowing water to pond.

To determine whether this area represents a significant location for groundwater recharge or discharge, A shallow piezometer installation and groundwater monitoring program was completed in 2014. Soil samples were obtained by hand augering in various locations, and shallow piezometers were installed to measure vertical hydraulic gradients in overburden soils. Site soils consisted of topsoil and sandy silt overlying a silty clay layer of lower permeability. Please refer to the following report (located in **Volume 3, Appendix R**) for further information:

- Sensitive Groundwater Assessment: Discharge and Recharge Area Evaluation Woodlot S20 (Patterson Group – October 24, 2014)

From this study, it was concluded that localized recharge and discharge within the topsoil and silty sand layers was occurring, with the silty clay layer preventing significant recharge to the bedrock aquifer within Woodlot S20. Any areas of discharge and recharge between overburden and bedrock units are considered to be highly localized, due to the prevalence of the low-conductivity silty clay and glacial till layers throughout the subject site.

Watercourses

Tributary 2 and the Main Branch of Shirley's Brook serve to intercept shallow overburden groundwater moving laterally with the topography, either through the upper zones of the soil matrix or along the overburden and bedrock interface. The presence of low permeable surficial soils where the bedrock is not shallow or exposed suggests that the overburden groundwater flow will follow the topographic relief of the land towards Shirley's Brook and its tributaries.

Field investigations indicate no significant groundwater discharge contributions to baseflow in the Northwest Branch Tributaries of Shirley's Brook. Excepting the spring freshet, water levels are generally quite low and there is very little baseflow during the summer months.

3.8.2 Aquifer Vulnerability

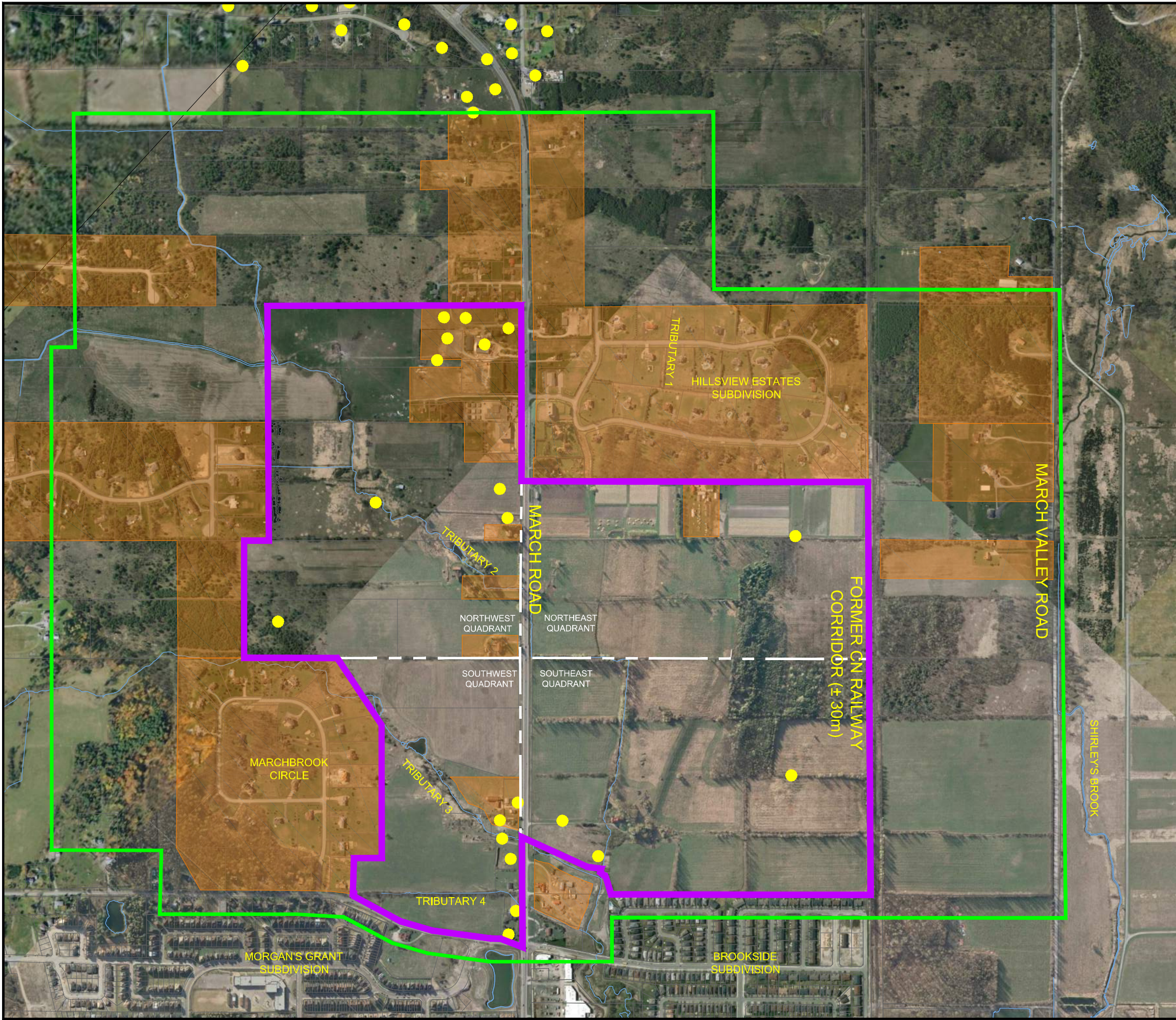
Aquifer vulnerability is assessed based on methodology provided by the Ministry of the Environment and Climate Change, and the intrinsic susceptibility index for the KNUEA was calculated based on the conditions on site. Given the depth of the surficial soils within the study area and the low permeability of said soils, combined with the thickness of competent bedrock which overlies the confined aquifer systems of the March/ Nepean Formation and the Oxford Formation, these bedrock aquifer systems are considered to be of low intrinsic vulnerability.

No concerns were identified with respect to actual or potential sources of contamination at the time of completion of the hydrogeological investigation.

3.8.3 Water Supply Wells

For the properties that are adjacent to the KNUEA, primary source of drinking water is varied. For the rural properties each dwelling has its own private water supply well, whereas the urban properties are serviced with municipally supplied drinking water. The known locations of existing water supply wells for surrounding properties are shown on **Figure 3.6**.

M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.6 Water Supply Wells.dwg, FIG-3.6, Jun 24, 2016 - 10:17am, kbranks



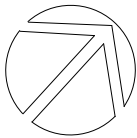
LEGEND

- KNUEA
- BASELINE WELL MONITORING STUDY AREA (±500m)
- WATER SUPPLY WELL LOCATION WITHIN STUDY AREA (FROM MOE WELL RECORDS)
- ADJACENT AREAS SERVICED BY WELLS



KANATA NORTH COMMUNITY DESIGN PLAN

FIGURE NO. 3.6 WATER SUPPLY WELLS



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