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KENNY'S DEVELOPMENTS LIMITED

**River Mist Estates Development
Environmental Impact Assessment
Registration (Final)**

336 Highway 105, Maugerville, NB

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1.0 The Proponent

1.1 Proponent Name

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2.0 The Undertaking

2.1 Project Title

River Mist Estates Development, Maugerville, NB.

2.2 Project Overview

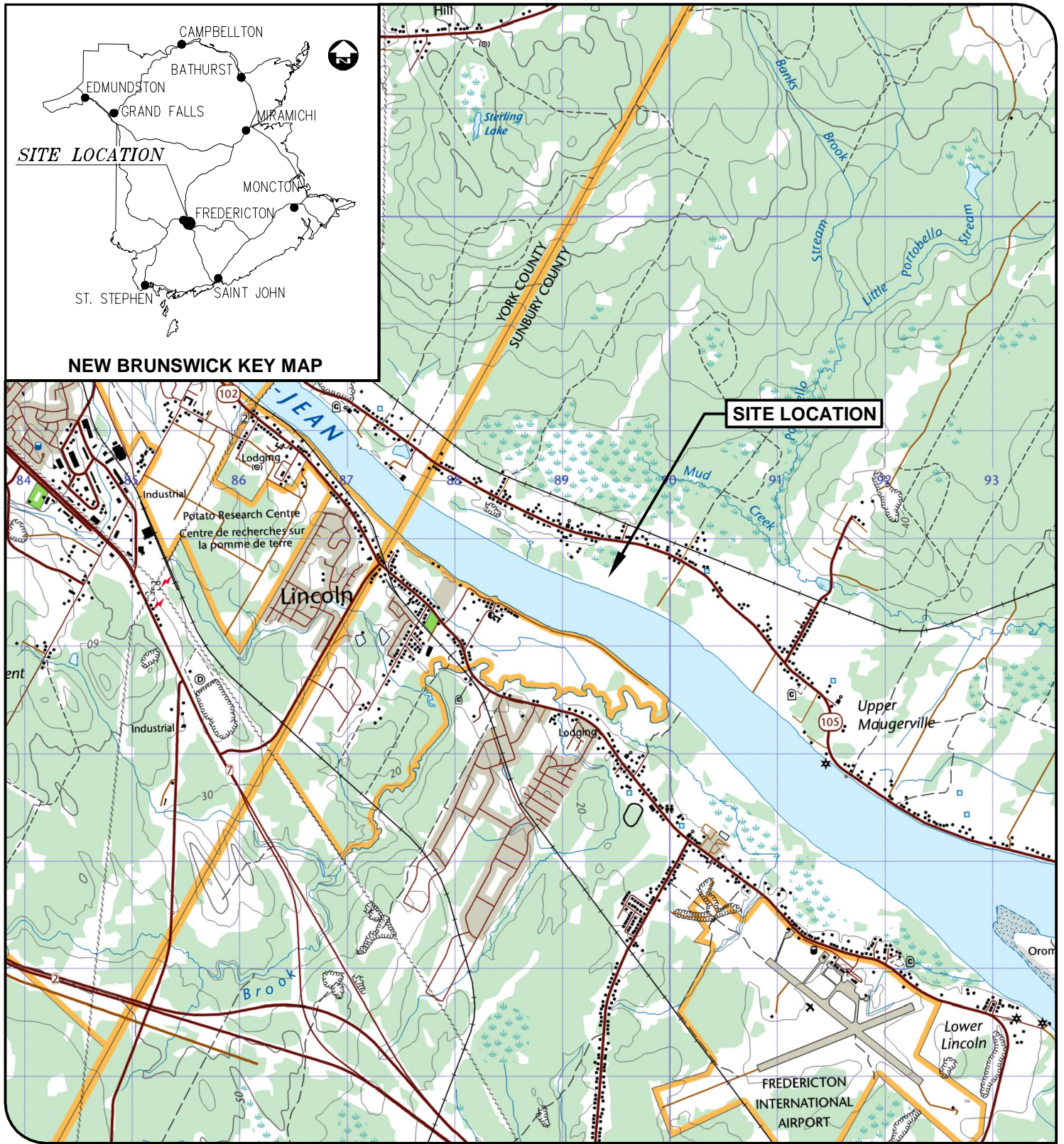
Kenny's Development Limited is proposing to construct a 44-unit residential condominium development ("the project") known as "River Mist Estates" on the properties identified by property identification (PID) numbers 60153483, 60153475, and 60153467 located at 336 Highway 105 in Maugerville, New Brunswick. The project area will encompass the entire area of all three PIDs, (**Figure 2-1**).

The townhouses will be constructed in three phases over the next five years and will be located in the central portion of the PIDs. Phase I consists of six attached townhouses, wastewater treatment system installation, and potable well and pumphouse installation. Phase II and III consist of 18 attached townhouses and 20 attached townhouses, respectively as well as connection to the utilities. Initially, the area to be developed will be filled in until the ground surface elevation is at least 0.6m above the 1973 flood level. Each unit will be one story wood frame construction supported on a concrete slab foundation with an attached one car garage. At the completion of the proposed project there is planned to be four rows of six connected units on the western side of the driveway with four rows of five connected units on the eastern side of the driveway. The project will require the installation of a wastewater treatment system and potable water. Refer to **Figure 2-2**.

It is estimated that the development will require approximately 40 m³/day (based on an assumption of 350L/day/person) of potable water which will be supplied by a well located along the western property boundary. As part of this project a Water Supply Source Assessment (WSSA) was required to determine if the local aquifer has the capacity to provide the development with sufficient potable water of an acceptable quality without impacting the local groundwater resources.

A wastewater treatment system will be constructed to accommodate the development and will consist of a private waste water tanks, a centralized wastewater treatment and disposal system. Refer to **Figure 2-2**.

Because the proposed projects is considered to be a major residential development outside of an incorporated are where wastewater treatment is required and potential water requirements could exceed 50 m³/day, an Environmental Impact Assessment (EIA) registration



ENVIRONMENTAL IMPACT
ASSESSMENT
RIVER MIST ESTATES
336 ROUTE 105
MAUGERVILLE, NB
EIA REGISTRATION No. 4561-3-1421
PID No. 60153475, 60153467, 60153483

SITE LOCATION MAP
FIGURE 2-1



MAP/DRAWING INFORMATION
National Topographic System Mapsheet 21G/16.

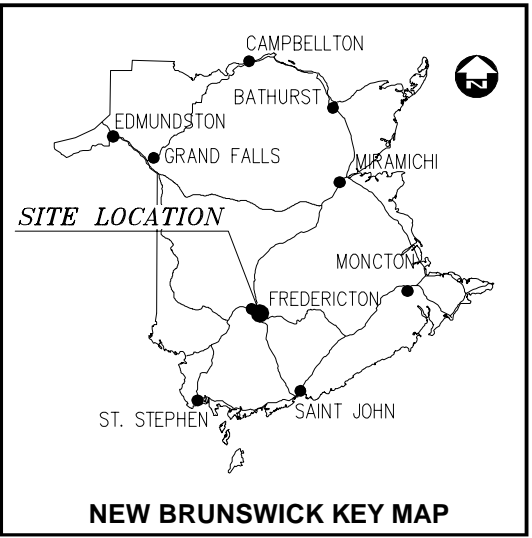
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PROJECT: 15 2555 STATUS: DRAFT DATE: 16/02/16 SITE: RIVER MIST



NAD 83 (CSRS) (GEOGRAPHIC)		
Point	Lat	Long
1	45° 54' 36.9823"	-66° 33' 27.0059"
2	45° 54' 36.4718"	-66° 33' 22.7815"
3	45° 54' 33.6918"	-66° 33' 25.2666"
4	45° 54' 33.5559"	-66° 33' 26.4731"
5	45° 54' 25.8320"	-66° 33' 33.3329"
6	45° 54' 26.7087"	-66° 33' 35.3574"
7	45° 54' 27.7548"	-66° 33' 37.9115"
8	45° 54' 28.6427"	-66° 33' 39.9005"
9	45° 54' 34.8663"	-66° 33' 34.2852"
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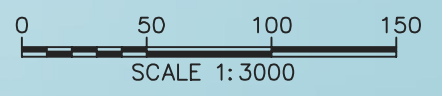
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PROPOSED SITE LOCATION
 FIGURE 2-2

- PROPOSED PROJECT AREA
- - - - - PROPERTY LINES
- WATERBODY

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under the Clean Environment Act is necessary. This document provides the information required for the EIA registration as set out in the New Brunswick Department of Environment and Local Government (NBDELG) "A Guide to Environmental Impact Assessment in New Brunswick (2012).

2.3 Purpose/Rationale/Need for the Undertaking

According to the report by the Premier's Panel on Seniors (GNB, 2012), in 2001, New Brunswick's population began to change as the province felt the triple impact of working age baby boomers retiring, a reduced birth rate and outmigration of youth. As of 2011, New Brunswick was home to approximately 375,000 people (approximately half of the province's population) aged 45 years and older with an expectation for the population of retirees (55 and older) to dramatically increase over the next two decades (New Brunswick's Population Growth Strategy, 2013).

Kenny's Development Limited has recognized the growing need for retirement living and has identified a market opportunity for retirement living in rural areas. Retirement living is generally considered to be smaller residential dwellings on a single level with assisted maintenance and upkeep.

This proposed development has been designed to provide safe, private, accessible, attractive and low maintenance homes (compared to traditional housing) and aims to provide homes that allow aging owners to maintain their independence and remain active members of their community.

In addition, the proposed development is located along the scenic Saint John River with waterfront access providing residents opportunities for recreational activities ranging from boating to photography. The central location between Fredericton and Oromocto also provides convenient access to public facilities, services and shopping.

2.4 Project Location

The proposed project site will encompass the three land parcels legally identified by PID Nos. 60153483, 60153475, and 60153467 and located at approximate latitude N45° 54' 30.0" and longitude W66° 33' 33.6", **Figure 2-1**. All three land parcels occupy an approximate total area of 6.5 hectares (ha) and are owned by Mr. Joseph Kenneth Cormier who is the owner of the proponent company; Kenny's Developments Limited.

The proposed project site is located in a rural area along the Saint John River south of Highway 105 in Maugerville, Sunbury County, New Brunswick, as illustrated on **Figure 2-1** and **Figure 2-2**.

2.5 Siting Considerations

The proposed project area is approximately 6.5 ha of relatively flat undeveloped river front land, located primarily in an agricultural setting within Maugerville, NB. All three properties included in the proposed project location are currently classified as having residential land usage. Historically, the proposed project area was farmed and used for agricultural purposes, however has remained vacant since the 1950's. There are two meadow wetlands located on the northern half of the proposed project area; however because they have been previously disturbed through historical land use they are considered to be low functioning. No watercourses have been identified within the proposed project boundaries.

The proposed project area is accessible from Highway 105 and includes an access road (driveway) which runs south from the Highway 105. The proposed location is not currently serviced with electricity; however, power distribution lines run adjacent to the property along Highway 105 and will be installed approximately parallel to the access road to reach the development.

Properties in the Maugerville area are supplied potable water by private wells. The project area is not currently supplied potable water and a supply is required. A supply well has been selected based on technical information gathered from the Water Supply Source Assessment (WSSA) completed in conjunction with this project (Appendix A). The proposed development was sited in such a way as to reduce distance to the potable wells. As well, consideration of the provincial regulations from a potable water source, dwellings and property boundaries were considered when locating the wastewater treatment system for the development.

Consideration of the adjacent land use and the surrounding biophysical environment was observed during the siting and design of the development. Where possible, the development was located and/or adjusted to avoid impacting the natural environment. Evidence of the thought process is as follows:

- To minimize environmental and potential cultural impacts, the proposed site location was selected due to its historical development activities;
- Development on previously farmed lands reduces and minimizes clearing/grubbing requirements;
- The proposed project will not change the current land use classification and will align well with the developed properties currently in the area;
- Riverfront properties in the Maugerville area are prone to flooding, the proposed project has been designed to withstand potential flood events from the Saint John River during the spring freshet;
- In consideration of the Saint John River applicable setbacks have been applied; and,
- Biophysical surveys were completed to avoid interaction with potential species at risk or species of conservation concern.

2.6 Regulatory Framework

The proposed project requires an EIA in accordance with the NB EIA Regulation – *Clean Environment Act* (NB Reg. 87-83) since the project proposes both a wastewater disposal system and drilled well with the potential capacity to exceed 50 m³ the EIA triggers involved are:

- (n.) “...all sewage disposal or sewage treatment facilities, other than domestic, on-site facilities”;
- (s) “...all waterworks with a capacity greater than fifty cubic metres of water daily”; and,
- (t) “...all major residential developments outside incorporated areas” as per Schedule A of NB Reg. 87-83.

As the water supply for the development will be obtained from a drilled well, a water source supply assessment (WSSA) is required. A WSSA application has been provided as part of this EIA registration (**Appendix A**). The proposed project is subject to a variety of federal and provincial regulatory requirements including but not limited to those summarized in **Appendix B**.

2.7 Physical Components and Dimensions of the Project

A preliminary site plan for the proposed project is provided in **Figure 2-3**. Construction of the 44-units and supporting structures (i.e. wastewater treatment system, pump house, etc.) will be phased over five years will consist of four rows of six attached townhouses and four rows of five attached townhouses. The phases of the development are graphically illustrated on **Figure 2-3**. Each townhouse will have a separate 750 gallon wastewater tank which will overflow to a larger 15000 gallon tank as depicted on **Figure 2-3**.

The proposed project phases will include:

- Phase I
 - Six approximately 150 m² attached townhouses (the foundation for one currently exists) ;
 - Potable well installation and connection to residential units;
 - Pumphouse around the potable well and storage tank;
 - Wastewater treatment system installation and connection to Phase I townhouses; and,
 - Access (“future driveway”) upgrades and parking.
- Phases II and III
 - Three rows of six approximately 150 m² attached townhouses;
 - Four rows of five approximately 150 m² attached townhouses;
 - Connections to the existing water and waste water systems;



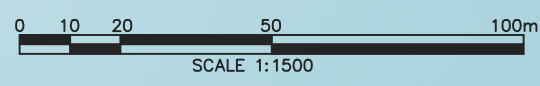
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SITE PLAN
 FIGURE 2-3

SUBJECT PROPERTY	EXISTING STRUCTURE A/G	FUTURE INFRASTRUCTURE U/G	POWER LINE
PROPERTY LINES	FUTURE INFRASTRUCTURE A/G	DRAINAGE DITCH	
WATERBODY	EXISTING INFRASTRUCTURE U/G	SANDPOINT WELL (SW)	

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- Repurposing of the meadow wetlands located within the proposed project area; and,
- Landscaping and paving.

The proposed project will make use of the existing access road, which egresses south off of Highway 105 highway by converting it to a driveway.

2.8 Construction Phase Details

The proposed project will consist of several concurrent construction components including site preparation and civil works, townhouse construction, and installation of water and waste water services. A description of the major components of the development is provided below.

2.8.1 Site Preparation and Civil Works

In preparation for preliminary site construction activities a portion of the site was previously cleared in 2012. It is expected that the remainder of the site preparation work will be completed in the area of northeast of the Phase I townhouses on either side of the access road and will involve the removal of organic material and unsuitable soil from the proposed project area. Material that cannot be used on site will be transported to a pre-approved disposal location.

Earthworks, including grading, will be required to prepare a generally level area for the construction of the development. The area to be developed as townhouses will be pre-loaded with engineered fill to expedite the settling process of the backfilled soil. A sufficient amount of engineered fill will remain in place to ensure that the foundation for each unit will be located 0.5m above the 1973 flood level. This work has already been completed for Phase I, and pre-loading has been completed for Phase II. Should additional materials be required for the earthworks and/or pre-loading of Phase III of the development, they will continue to be sourced locally. Material that has been used for pre-loading will be backfilled into the low functioning meadow wetlands located north of town house development on the proposed project PIDs to increase the usability of this area for future tenants (i.e. green space).

The majority of the project will be accessed using the existing access road (driveway). This road may require some minor improvements including widening and the addition of a sub-base/base and/or paving. The improvements will be identified following the final design.

It is anticipated that the access road and parking areas on the property will be paved following the final phase of construction. Other areas will be landscaped and re-vegetated to provide green space.

2.8.2 Facilities Construction

2.8.2.1 Townhouse Construction

The total footprint for each row of the six unit townhouses will be approximately 850 m² while the total footprint for each row of the five unit townhouses will be approximately 725 m². Each unit will be a single story (approximate height of 4.5 m) constructed on engineered fill that will raise the foundation of each unit to 0.5m above the 1973 flood level. Building characteristics include:

- Reinforced concrete slab on grade foundation;
- Wood frame construction;
- Concrete slab patio area;
- Sanitary and water connection lines;
- Power supply from overhead electrical lines;
- Electric heat source (baseboard heaters);and,
- Individual 750 gal sanitary tanks.

It is anticipated that building construction during each phase will occur during working hours during spring, summer and fall months. During subsequent Phases (i.e. Phases II and III) interior finishing (painting, cabinetry) of the units may be completed during winter months.

Construction activities are expected to be limited to the use of tools with the exception of the occasional piece of heavy equipment (i.e. excavator, etc.).

Building construction may generate recyclable materials that can be diverted from landfills and non-recyclable materials that must be disposed of in a construction and demolition or solid waste landfill.

2.8.2.2 Potable Water Supply

Potable water will be supplied to the subject site by a well located along the western side of the site, refer to **Figure 2-2**. A potable well and observation well were installed in 2015 by a licensed well driller under the supervision of Dillon personnel to approximate depths of 30 and 35 meters below ground surface. Details of the well construction and supply assessment are presented in **Appendix A**.

Following the approval of the Water Source Supply Assessment, both the potable and observation well will be completed with steel casing to at least 0.6m above the 1973 flood stage. During Phase II of the construction activities, a storage tank will be installed in the pump house to meet instantaneous demand by the tenants (the volume of the storage tank will be finalized during the final design). A wood framed pump house supported on a concrete slab foundation will then be constructed around the potable well and storage tank. The elevation of the floor for the pump house will also be 0.6 m above the 1973 flood stage.

2.8.2.3 Wastewater System Construction and Installation

Each residential unit will have a dedicated sewer service that discharges into individual 750 gal wastewater tanks. These individual tanks will provide the initial primary treatment of the wastewater where the heavier solids, fats, oils, greases and other floatables will be removed from the wastewater stream prior to entering the collection sewer. Due to the size of the units and the targeted demographic, it is anticipated that the average household size will be one or two adults, and each wastewater tank will be pumped out regularly (approximately 2-3 years). The individual tanks will be connected and wastewater will be collected in a buried PVC sewer system and conveyed to the secondary treatment system. As wastewater enters the treatment system, it will initially be collected in a gravity settling tank to remove remaining solids. The water will then pass through a filter and into a re-circulation 15,000 gal tank. A pumping system in the recirculation tank will dose the wastewater in a controlled manner into a series of fixed film media reactors where biological treatment of the wastewater occurs. A portion of the treated wastewater flows back to the re-circulation tank and gets reintroduced to the stream for further treatment, while the remaining flow is pumped to the on-site disposal field (approximately 25m x 15m) for subsurface disposal, refer to **Figure 2-1**.

Kenny's Developments Limited will oversee the operation and maintenance of the waste water treatment system until the all townhouses have been sold when ownership will be transferred to the association of elected townhouse owners.

2.9 Operation and Maintenance Details

Operation and maintenance of the development will be managed in two phases; Phase I which will run from the date that the first townhouse is purchased until the date that the last townhouse is sold; and, Phase II which will run in perpetuity after the last townhouse has been purchased. Kenny's Developments Limited will oversee the operation and maintenance of the development during Phase I while elected townhouse owners will form an association and will be responsible during Phase II.

It is anticipated that over the lifetime of the development maintenance will be required.

Maintenance is expected to include;

- Landscaping
- Snow removal
- Potable water monitoring and testing
- Unit maintenance
- Garbage collection
- Pest management
- Maintenance and repairs from accidents and natural disasters
- Maintenance/repairs to the wastewater treatment system

It is estimated that the completed townhouse development will require an average of 40m³/day of potable water based on a demand of 350L per person per day and every unit being occupied by two people. Based on the WSSA (Appendix A), the demand will be met by the potable well currently located on the subject site.

As during the construction phase, power for each unit will be supplied via overhead distribution lines. It is anticipated that power will be derived from the NB Power owned overhead distribution line along Highway 105.

It is expected that the development will remain in place and operational, for the foreseeable future.

2.10 Future Modifications, Extensions, or Abandonment

Future modifications, extensions or abandonment of the development is not anticipated at this time.

2.11 Accidents and Malfunctions

The project components will be designed or implemented in accordance with applicable Acts, regulations, guidelines, codes and standards for industrial plant; however, accidental events may still occur and some accidents may have significant consequences. To minimize environmental emergencies and health and safety risks, an Environmental Management Plan (EMP) and Emergency Response Plan (ERP) will be developed and implemented as part of the pre-construction planning. Accidental events may include but are not limited to:

- Hazardous material, chemical and fuel spills and fires;
- Traffic control and vehicle accidents; and,
- Discovery of Archaeological Resources or Human Remains.

3.0 Existing Environment

The following section describes the current environmental conditions at the subject site and includes the site specific information gathered through a desktop review and field investigation surveys. The site conditions are described in the following sections:

- Terrestrial Environment;
- Aquatic Environment;
- Atmospheric Environment;
- Species at Risk and of Conservation Concern (including habitat);
- Archaeological and Heritage Resources; and,
- Socio-Economic and Land use.

3.1 Methodology

3.1.1 Desktop Review

The desktop review consisted of an analysis of the biophysical and socio-economic setting based on available background information for the proposed project study area. The proposed study area was dependent on the parameter being evaluated, for example a larger study area was considered for atmospheric conditions due to the ease at which particulate matter can travel. The project study area for each site condition is indicated in the applicable section.

Prior to conducting field investigation studies, regional, federal and provincial databases were consulted to identify potential occurrences of rare and endangered flora and fauna, and unique or sensitive habitats that have been known to occur within a 500 m radius of the proposed project boundaries and identified as the “study area”. The following lists were reviewed to identify species and habitats of concern:

- Species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- Species listed under the *Species at Risk Act (SARA)*;
- Species listed under the *New Brunswick Species at Risk Act (NBSARA)*;
- Species ranked or identified by New Brunswick Department of Natural Resources (NBDNR) species at risk biologist; and,
- Species listed by the Atlantic Canada Conservation Data Center (ACCDC) as extremely rare (S1), rare (S2) and uncommon (S3). Refer to **Appendix C** for the complete report.

In addition, available background information was also obtained from the following sources to gather a thorough understanding of the proposed project study area:

- Nature NB;
- GeoNB;

- New Brunswick Department of Energy and Mines Surficial Geology and Bedrock Mapping;
- Aerial Photographs from Service New Brunswick and Google;
- Provincial Depth to Water Table Mapping;
- Important Bird Areas (IBA), the Ramsar Convention on Wetlands and federally recognized Migratory Bird Sanctuaries;
- Protected Wellfields and Watersheds;
- Protected Natural Areas; and,
- Interviews with persons knowledgeable of the study area (residents and government representatives).

Various data resources were consulted to conduct the desktop assessment for the atmospheric environment and are discussed further throughout this section.

3.1.2 Biophysical Field Surveys

Site surveys were carried out in August 2015. The surveys consisted of a topographical and environmental aspect review focused on identifying the existing environment and potential environmental constraints. Characterization of the existing conditions included:

- Watercourses/wetlands within the study area;
- Forest habitat and vegetation assessment;
- Migratory birds;
- Wildlife and wildlife habitat;
- Species at risk and of conservation concern; and,
- Land use, topography and existing structures.

Watercourses and wetland habitats initially identified through the desktop study were field verified using hydrophytic vegetation and/or the presence of water as key indicators during the site survey. Hydric soils information was not analyzed as part of the field identification surveys.

The goal of the wetland assessment was to identify wetlands and to evaluate for wetland functional value and importance to the surrounding environment.

To establish the level of breeding/foraging evidence for bird species within the study area, a breeding bird survey was conducted on August 25, 2015. Point count surveys of 5 minute intervals using the Canadian Bird Studies Point Count protocol were conducted at three locations. Survey stations were established with a minimum distance of 200 m between points to maximize coverage of the area as shown in the report in **Appendix D**. Subsequent to the 5 minute point count, a digital recording of various birds was played back for an additional 5 minutes with the objective to attract migratory birds potentially foraging/nesting in the area that may not be vocalizing during the 5 minute point count. Because the survey was

conducted late in the breeding bird season, the habitat in the area was also assessed to determine potential suitability for future nesting birds in the area.

During the field survey direct observations of wildlife signs (sightings, auditory detections, tracks, scat, and dens/nests) and habitat conditions were observed to indicate the absence/presence or potential of wildlife within the study area. The habitat was evaluated to determine if the proposed project area would provide unique or limited habitat for any species.

Vegetation surveys were conducted on August 31, 2015 and included recording tree, shrub and herbaceous species within the study area. The focus of the vegetation assessment was to determine the presence/absence of priority/at risk species, based on existing data and habitat suitability as identified by the ACCDC.

3.2 Terrestrial Environment

For the purposes of this EIA, the description of the terrestrial environment considers topography, geology, and flora and fauna (including species at risk) habitat/populations within 500m of the subject site, **Figure 3-1**.

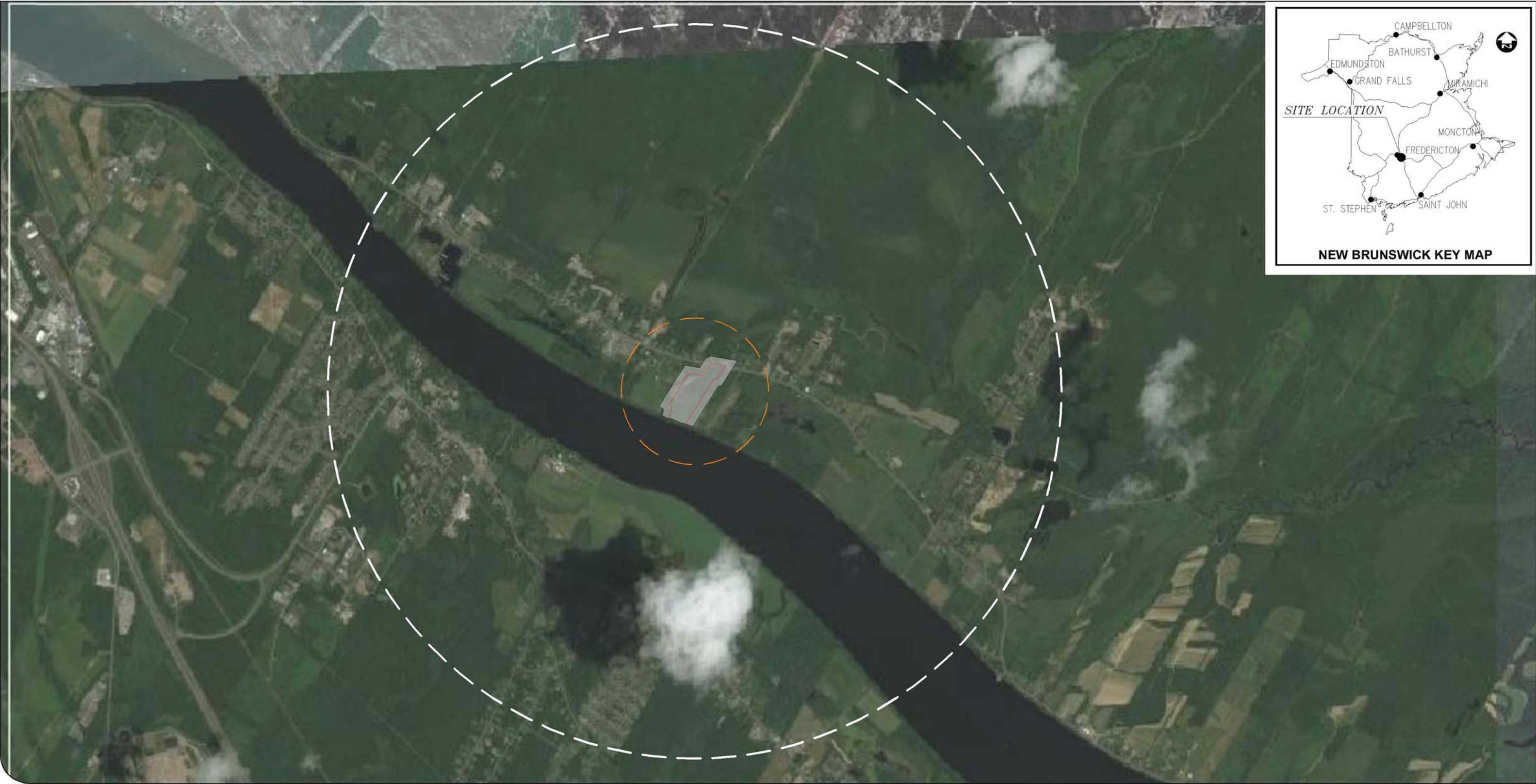
3.2.1 Site Topography and Physiography

The proposed project footprint area is located within the Grand Lake Lowlands Ecoregion, specifically the Aukpake Ecodistrict which encompasses the Grand Lake basin, the Oromocto River watershed, and the floodplains surrounding the mid-section of the lower Saint John River. The Aukpake Ecodistrict is a low-lying, gently rolling area that encompasses the Saint John River. The proposed project area is recognized to be highly disturbed by intensive settlement, logging activities, and farming activities.

The general topography in the area of the proposed project consists of low lying relatively flat fields gently sloping south towards the Saint John River. Immediately north of the proposed project area is a 2.5m high manmade embankment on which Highway 105 is constructed.

3.2.2 Hydrology and Hydrogeology

The proposed project area is located within the Saint John River watershed in the New Brunswick Lowland sub-region on the banks of the Saint John River. The mean annual discharge for the Saint John River is approximately 1100 m³ /s (CRI, 2012). Like most eastern Canadian rivers, its peak water levels and discharge occur in the late spring after the spring thaw. The river experiences a second, smaller pulse later in the fall. According to the Province's flood mapping information (<http://geonb.snb.ca/geonb/>), the proposed project location is within the flood zone (1973 and 2008) of the Saint John River. Refer to **Figure 3-2**.



ENVIRONMENTAL IMPACT ASSESSMENT
 RIVER MIST ESTATES
 336 ROUTE 105
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PROPOSED STUDY AREA
 FIGURE 3-1

- PROPOSED PROJECT AREA
- 500m TERRESTRIAL STUDY AREA
- 50m AQUATIC ENVIRONMENTAL STUDY AREA AND ARCHEOLOGICAL STUDY AREA
- 5km ATMOSPHERIC ENVIRONMENTAL STUDY AREA

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 DATE: 10/02/16

Regional groundwater flow is expected to flow south towards the Saint John River, located immediately south of the proposed project area.

The proposed study area is not located within a watershed protected area as outlined in the New Brunswick Watershed Protection Program or a wellfield protected area under the New Brunswick Wellfield Protection Program.

Based on interviews with local residents, the Cormier residence (PID No. 60153491) and a number of residential properties in the Maugerville area are supplied potable water by private sandpoint potable wells. The wells are typically installed to depths of less than 6m. It is assumed that other properties are supplied potable water by drilled potable wells.

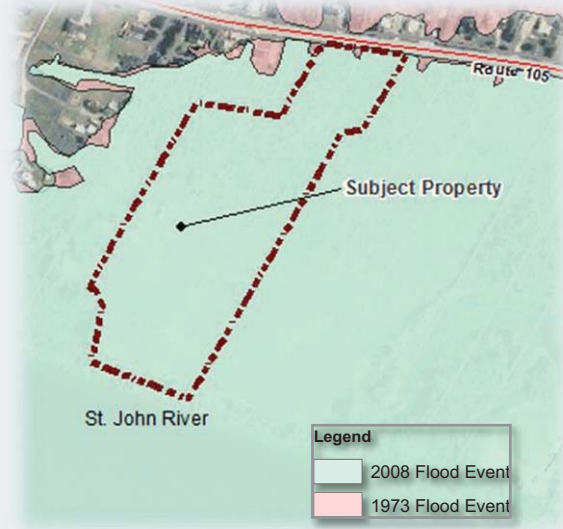


FIGURE 3-2: 1973 AND 2008 FLOOD LEVELS

In 2015 two wells (source and observation) were installed in the proposed project area by a licensed well driller (**Figure 2-2**) under the supervision of Dillon personnel to approximate depths of 30 and 35 meters below ground surface. Details of the well construction and supply assessment are presented in the WSSA in **Appendix A**. Concentrations of iron and manganese exceeding applicable Canadian Drinking Water Quality guidelines was identified in potable water samples collected during the assessment; concentrations of other trace metals, E. Coli and coliforms were below applicable guidelines.

3.2.3

Geology

Based on the Generalized Surficial Geology Map of New Brunswick (Rampton, V.N. 1984, 2002 Ed.), the surficial geology in study area is Holocene aged alluvial sediments comprised of terraces and floodplains of sand, gravel, and some silt. The deposits are generally greater than 2 m thick.

Based on the Department of Natural Resources Geological Map (St. Peter, C.J. and Fyffe, L.R, 2005), the regional bedrock geology in the study area is identified as the Minto Formation of the Pictou Group deposited during the Late Carboniferous period. The Minto formation is comprised of grey to red-brown feldspathic and quartzose arenites, round clasts conglomerate, fine grained sandstone or siltstone and to a lesser extent mudstones and shales. Thinly bedded coal seams have been identified within this unit.

3.2.4 Environmentally Sensitive Areas

The proposed project is located within the “Lower Saint John River (Sheffield/Jemseg) Important Bird Area (IBA) which extends 25 km along the Saint John River, from approximately 7 km northeast of the proposed project location to 20 km east of the proposed project location (**Figure 3-3**). Extensive annual spring flooding in the IBA has resulted in the creation of a unique hardwood and flora complex creating the single largest wetland complex in Atlantic Canada (CIBA, 2015). As a result the area provides important breeding habitat for a number of migratory birds including raptors, waterfowl, shorebirds and passerines (CIBA, 2015).

No other environmentally significant areas were identified within 500m of the proposed project location.

3.2.5 Vegetation (Flora) Assessments

The study area consists mainly of previously disturbed land through historical agricultural activities and residential development and consists primarily of weeds, grasses and small shrubs.

3.2.5.1 Forest Habitat

The proposed project area is located within the Grand Lake Lowlands Ecoregion, specifically the Aukpake Ecodistrict, however due to historical development in the proposed project area mature forested habitat was not identified on land parcels. Dominant forest compositions within the study area (i.e. within 100m of the proposed development but on adjacent PIDs) consisted primarily of alder scrub with some hardwood stands of sugar maple (*Acer saccharum*), white ash (*Fraxinus Americana*), and glossy buckthorne (*Frangula alnus*) located along the Saint John River shoreline.

3.2.5.2 Vegetation (Flora) Surveys

A review of the ACCDC data determined that one vegetation species of conservation concern, Ditch Stonecrop (*Penthorum sedoides*), had the potential to occur within the study area and had previously been identified 350m east of the proposed project area. Field surveys were targeted on the habitat potential for this identified priority species. A summary of flora species of conservation concern is presented in **Table 3-1** and in **Appendix E**.

Vegetation within the study area consists of four distinct vegetation communities on the property including shrub wetland, meadow, upland disturbed and floodplain (riparian) habitat. A total of 110 plant species were noted within the study area during the field survey of these, 81 (74%) are native and 29 (26%) are species considered by ACCDC to be non-native (exotic) (SE). All species noted during the survey were identified as being common and widespread (S4 to S5) to New Brunswick with the exception of two species of conservation concern: Hop Sedge (*Carex lupulina*) and Northern Meadow Rue (*Thalictrum confine*) which are both listed

regionally as S3 (uncommon) by the ACCDC. Both species were identified outside of the proposed development boundaries (**Figure 3-3**). The Hop Sedge was observed within the meadow/graminoid wetland to the east of the proposed development and the Meadow Rue located along the Saint John River shoreline southwest of the proposed development. Neither of these species are listed under COSEWIC, SARA or the NBSARA.

Ditch Stonecrop (*Penthorum sedoides*) was not identified within the study area during the field survey.

Refer to **Appendix ED** for the complete list of all plant species within the study area.

TABLE 3-1: SUMMARY OF FLORA SPECIES OF CONSERVATION CONCERN

Common Name	Scientific Name	ACCDC Status	COSEWIC/SARA Status	NBSARA Status	SITE LOCATION	TYPICAL HABITAT ¹
Ditch Stonecrop	<i>Penthorum sedoides</i>	S3	N/A	N/A	Noted by the ACCDC 350 m east of the proposed project (within the provincially significant wetland)	Aquatic - (Fresh water); found on muddy or gravelly shores
Northern Meadow Rue	<i>Thalictrum confine</i>	S3	N/A	N/A	Noted during field investigations along the Saint John River Shoreline, outside the southern property boundary	Found along calcareous shores and in alluvial meadows
Hop Sedge	<i>Carex lupulina</i>	S3	N/A	N/A	Noted during field investigations along outside the eastern property boundary	Forest – Swampy woods (Red and Silver Maple)

¹ Habitat information obtained from the NBDNR flora Vascular Plant Distribution list (2002) and Flora of New Brunswick (Hinds, 2000)

3.2.6 Wildlife (Fauna) and Wildlife Habitat

The subject area provides habitat that appears to be suitable for small mammals, including muskrat (*Ondatra zibethicus*), red fox (*Vulpes vulpes*), skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*) as well as other smaller mammals such as meadow voles (*Microtus pennsylvanicus*), American mink (*Neovison vison*), squirrels (*Sciurus vulgaris*) and chipmunk (*Tamias striatus*). The habitat in this area may also provide occasional foraging for other larger species such as white tailed deer (*Odocoileus virginianus*) and coyote (*Canis latrans*). There were no unique or special wildlife (excluding birds) habitat areas identified in the existing data or wildlife species of conservation concern identified as potentially occurring within the study area.

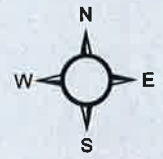
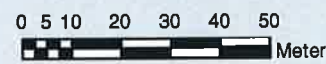


ENVIRONMENTAL IMPACT ASSESSMENT
 River Mist Estates
 336 Rte 105, Maugerville, NB
 EIA Registration No. 4561-3-14-21

Figure 3-3. Project Environmental Constraints

- PROPOSED DEVELOPMENT AREA
- PROPERTY BOUNDARIES
- PROPOSED HOUSING DEVELOPMENT
- PROPOSED WASTEWATER TREATMENT SYSTEM
- EXISTING INFRASTRUCTURE
- SAINT JOHN RIVER
- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- UNMAPPED WETLAND
- CLEARED DURING 2012 SITE ACTIVITIES
- + WELL
- SPECIES OF CONSERVATION CONCERN
- ACCESS ROAD

*Note: The proposed project area is located within the Lower Jemseg Important Bird Area (IBA)



MAP CREDITS: GEONB, SNB
 MAP CREATED BY: RMD
 MAP CHECKED BY: KDB
 MAP PROJECTION: NAD 1983 UTM Zone 19N

1:1,500



PROJECT: 152555
 STATUS: DRAFT
 DATE: 2/15/2016

During the field survey evidence of white tailed deer and red fox were observed (scat and tracks) within the study area. No other wildlife was observed. Given the limited availability of forest habitat and the level of development in the area there is limited potential for diverse wildlife habitat.

3.2.7 Birds and Bird Habitat

There are approximately 450 species of native birds which may nest and/or migrate through Canada, the majority of which are protected under the *Migratory Birds Convention Act*, 1994. Regulations associated with the *Migratory Birds Convention Act* state that “no person shall disturb, destroy, or take or have in their possession a migratory bird (alive or dead), or its nest or eggs, except under authority of a permit”.

3.2.7.1 Background Data Review

Important Bird Areas (IBA)

As outlined in **Section 3.2.4**, the proposed project area is located within the Lower Saint John River Sheffield/Jemseg IBA (NB010). There are approximately 250 migratory bird species known to migrate, roost, breed and/or nest in this IBA year round including waterfowl, shorebirds, upland birds, passerine, woodpeckers, raptors and owls.

Maritime Breeding Bird Atlas

The Maritime Breeding Bird Atlas (MBBA) database provides information on the presence of breeding bird species counts conducted between 2006-2010. During this period, a total of 99 species of birds were identified within their study area (which encompasses the proposed project location). Of these species, 31 were confirmed as breeding (including one species of conservation concern: Bald Eagle, Endangered under the NBSARA), two were probable breeders, and 45 were possible breeders.

Atlantic Canada Conservation Data Center (ACCDC)

The ACCDC database indicates that there are no bird species records of conservation concern within 500 m of the proposed project.

3.2.7.2 Breeding Bird Surveys

As previously noted, much of the original bird habitat (mature trees) had been disturbed beforehand through historical farming activities and initial earthworks completed in the proposed project area.

During the bird survey, a total of 20 different bird species were noted of the 51 individual birds observed. The most common species observed was the Mallard (11 individuals) and American Crow (9 individuals) as well as Song Sparrow (4 individuals), American Goldfinch (4 individuals), Double Crested Cormorant (3 individuals), and Black-capped Chickadee (3 individuals). These

species are considered to be common and widespread within New Brunswick. Most of the species were observed or heard along the eastern edge of the proposed project area as well as along the Saint John River. Very few birds were observed to be using the proposed project area. Refer to **Appendix D** for the complete bird report. It should be noted that a Bald Eagle was observed flying over (foraging) the study area.

During the assessments, there were no nests or other birds of prey noted within the study area and potentially sensitive or critical habitat was not identified. Other habitat along the Saint John River floodplain would provide more attractive nesting areas for migratory birds. However, gravel areas on site may attract potential ground nesting birds such as Killdeer and Common Nighthawk. Killdeer are identified by the ACCDC as S3B (Uncommon) and the Common Nighthawk is listed as Threatened under Schedule 1 of SARA and on the NBSARA.

Based on the available habitat in the area it is not expected that large numbers of migratory birds would use the study area for nesting habitat. As identified on Environment Canada's "nesting zone" calendar, the period between and April 1 to August 31 is the timing that has been identified as the most sensitive breeding/nesting periods in wetland, open and forest habitats for migratory birds in this region (Region C3).

3.3 Aquatic Environment

3.3.1 Wetlands

According to the GeoNB wetland mapping database and field studies conducted in 2015, there are no regulated wetlands or provincially significant wetlands (PSW) within the study area. A PSW has been identified approximately 55 m east of the proposed project area (**Figure 3-2**).

Although regulated wetlands were not identified within the property boundaries, two unmapped wetlands (WL1 and WL2) were identified as illustrated on **Figure 3-2**. These wetlands are not regulated under the New Brunswick *Clean Water Act*.

3.3.1.1 Wetland Delineation and Characterization

The wetlands were delineated using standard wetland delineation and functional assessment protocols based on Environment Canada's Wetland Ecological Functions Assessment: An Overview of Approaches (2008), then mapped using GPS points. The two wetlands identified were observed to be bisected by the existing access road. Refer to **Figure 3-2**.

High moisture levels in both of the identified wetlands have been promoted by topography and restricted drainage. These wetlands are in varying stages of succession and show evidence of in-filling originating from historical highway and access road construction and residential development on adjacent properties.

The wetland habitat located along the eastern side of the proposed development (WL1) is classified as a mixture of a shrub wetland and meadow with areas of saturation (0-5 cm) and hydrophytic vegetation indicative of wetland habitat. Dominant vegetation communities in this wetland consist of speckled alder and regenerating red maple, balsam fir, and gray birch along with a variety of common herbaceous vegetation such as ferns, raspberry, weeds, grasses and sedges. Refer to **Appendix E** for the complete plant list. There were no identified inlets or outlets of the wetland.

The wetland habitat located along the western side of the access road (WL2) is characterized as a meadow wetland, with observed areas of open standing water ranging from 0-20 cm in depth as well as saturated soils. The vegetation observed was dominated by hydrophytic grasses, rushes, weeds and sedge as well as some small patches of cattails and speckled alder. Similar to WL1, there were no identified inlets or outlets of the wetland and it was apparent that the wetland.

3.3.1.2

Wetland Functional Assessments

The functional value and importance of a wetland to the surrounding environment is evaluated by the following factors:

- Vegetative abundance, health and diversity (including rare species identified in the EIA documents and invasive species);
- Hydrological conditions (groundwater/surface water/water quality);
- Wildlife and fish habitat sustainability;
- Spring/snowmelt and storage attenuation;
- Adjacent impacting land use and anthropogenic activities; and,
- Scenic value (aesthetics), recreation, education and scientific purpose.

The study area has been extensively altered by past agricultural, highway and residential development activities, and therefore, the function of both unmapped wetlands has decreased. **Table 3-2** provides a summary of the functional assessment for both wetlands.

TABLE 3-2: SUMMARY OF WETLAND FUNCTION

Wetland ID	Wetland Type	Connected to other Watercourse or Wetland	Functional Assessment Summary							
			Vegetative Abundance and Health	Base Stream Flow Maintenance (Hydrology)	Water Quality Protection	Groundwater	Spring/Snowmelt Storage Attenuation	Habitat for Wildlife	Species at Risk or of Conservation Concern	Anthropogenic Influences
WL1	SW/ MW	WL2/ PSW	L	L	n/a	L	M	L	n/a	H
WL2	MW	WL1/PSW	L	L	n/a	L	M	L	n/a	H

SW=Shrub Wetland, MW=Meadow Wetland, PSW=Provincially Significant Wetland
n/a= not applicable, L=Low, M=Moderate, H=High

Vegetation diversity is ranked “Low” within both WL1 and WL2 as the vegetation communities observed had been previously disturbed from farming activities and demonstrated varying degrees of succession. The vegetative species identified were common and no observations of unique or sensitive species of concern were noted.

Hydrology (i.e., base stream flow maintenance, water quality protection, groundwater and spring/snowmelt storage attenuation) within the wetlands in the area would be geomorphically classified as depressional. The hydrology has likely been altered due to past development in the area and as a result has been ranked “Low - Moderate”. Hydrology indicators in the area consisted primarily of saturated soils and drainage patterns. These wetlands would be hydrologically connected through minor groundwater influences to the Saint John River and the Provincially Significant Wetland located 55 m east of the proposed development area. The unmapped wetlands also provide stormwater/snowmelt attenuation which provides some minor protection from stormwater runoff and flooding to the surrounding area.

Wildlife habitat within these wetlands is “Low” as these wetland areas are not large enough to support any sizeable wildlife communities. Given the size of these wetlands and the absence of a forest cover (i.e. mature trees); these wetlands would serve as small “stopover” feeding/drinking area for larger wildlife and serve as better habitat for smaller mammals, amphibians/reptiles and/or invertebrates. There were no identified species of conservation concern during the field assessments or through the ACCDC.

Based on the assessment of these wetlands, it has been likely that they do not perform any major functions within the watershed (i.e., Saint John River floodplain) nor to the adjacent PSW. Overall, WL1 and WL2 have been generally ranked as “Low to Moderate” functioning with high anthropogenic (man-made) influences indicating that these wetlands provide minimal functional value to the surrounding environment.

3.3.2 Watercourses

Provincial mapping and field studies conducted in August 2015 did not identify watercourses within the proposed project area. The Saint John River is located immediately south of the development properties, however, it is located 150 m from the proposed project construction area; refer to **Figure 2-2**.

3.4 Atmospheric Environment

For the purpose of this EIA, the atmospheric environment is confined to within 5km of the proposed project location, and is characterized by the following:

- Air quality – the chemical and physical properties of the air in the atmosphere that includes particulate contaminates;
- Climate – the composite or prevailing weather conditions in an area averaged over several years which generally includes the temperature, precipitation, winds and air pressure; and,
- Sound levels (noise quality) – any pressure variation (in air, water or other medium) that can be detected by the human ear. Noise is characterized as any unwanted sound.

The New Brunswick Department of Environment and Local Government (NBDELG) and industry maintain and operate a number of ambient air monitoring stations within the province to measure ground-level concentrations of a variety of air contaminants. The closest monitoring station in relation to the proposed project is located at the Fredericton Airport, approximately 5 km southeast of the project. An ozone monitoring station is located in Fredericton, approximately 10 km west of the project. As these monitoring stations are located in primarily commercial/ industrial areas the data from these locations is not considered to be representative of the proposed project area.

3.4.1 Climate

Canadian Climate Normals recorded from the Fredericton Airport climate station (Environment Canada, 2015) indicate an annual daily mean temperature of 5.6°C, with extremes ranging from -37.2°C to 37.2°C for the study area. Precipitation data from the Fredericton Airport climate station recorded a historical average of approximately 1100 mm of precipitation per year with approximately 850 mm falling as rain and 250 mm as snowfall. The extreme daily rainfall occurred on August 5, 1989 when approximately 150 mm of rain fell. The extreme daily snowfall occurred on December 4, 1967 when approximately 80 cm of snow fell.

According to the Climate Normals, the average annual wind speed at the Fredericton Airport is 12.0 km/h from the west with a maximum observed hourly wind speed of 80 km/h (February 3, 1970) and maximum gust speed of 132 km/h (June 30, 1971). The average monthly wind speeds tend to be highest between March and May and lowest between July and September. The prevailing winds are generally from the south in the summer and the west in the winter.

3.4.2 Ambient Sound Quality

The proposed project is located within a rural area of Maugerville, however small commercial businesses are located within 2.5km of the proposed project location along Highway 105. Given the setting, existing sound pressure levels in vicinity of the project are expected to be typical of sound pressure levels in a suburban mixed development area near at city outskirts. Based on data collected by the US EPA (1971) of typical background community noise, existing sound pressure levels in the area are likely in the (L_{10} to L_{90}) range of 39 to 52 dBa(A) as a 24-hour arithmetic average. Existing sound quality conditions in study area were not measured for this assessment.

3.5 Cultural Heritage Resources

There were no federal or provincial heritage resources identified within the proposed project footprint, or within 1 km of the proposed project area. However, the proposed project area is located within the Traditional Lands of the Maliseet Nation and it is assumed that hunting and gathering would have historically, and may still, occur in the area.

The Saint John River, located immediately adjacent to the proposed project area, supports a dynamic fishing and boating community during the spring, summer and fall months. No public docks or landing areas have been identified within 1 km of the proposed project location.

3.6 Archaeological and Cultural Features

Through a request to Archaeological Services, Heritage Branch within the New Brunswick Department of Tourism, Heritage and Culture, a copy of the archaeological and cultural resources GIS model was obtained and is provided in **Appendix F**. Based on the model information, there are no known registered archaeological sites within 1 km of the proposed project area.

When the modeling was applied to the proposed project location a band, totaling 80 m in width, extending perpendicular from the bank of the Saint John River was identified as having elevated potential for archaeological significance based on the "Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick" (2012). The 50 m nearest to the Saint John River are described as having high potential, while the following 30 m are described as having moderate potential. Construction and operation activities for the

proposed project are not expected to occur within the area of elevated potential for archaeological significance.

3.7 Socio-Economic Environment

The Maugerville area was first developed as a farming community in the late 1700's by Loyalists who had immigrated from the northern United States. Since that time the area has largely been used for agricultural purposes. In the late 20th century land development slowly changed to smaller residential properties, with agricultural properties being abandoned.

3.7.1 Population and Labour Force

The Maugerville Parrish is approximately 925km² in size and is centrally located between Fredericton, the provincial capital, and the Town of Oromocto.

The Parrish's population has remained relatively steady at approximately 1750 people since the early 2000's based on the 2001, 2006 and 2011 census' conducted by Statistics Canada. The average household size in the community is approximately 2.3 people with the mean age of the population being 45. Over half of the households have at least one child under the age of 18 (Statistics Canada, 2011).

In general, the labour force residing in the Maugerville community travels to the local communities of Fredericton or Oromocto for employment. Educational facilities are supplied by the City of Fredericton and school aged students are transported by a public bus system.

The community's population achieved higher educational attainment compared to the province as a whole. In 2011, approximately 75% of the population 15 years and over had certificates, diplomas or degrees, compared to 70.6% for New Brunswick (Statistics Canada, 2007).

In 2011, the median household income was slightly over \$75 000, which is higher than the provincial average of approximately \$50 000 (Statistics Canada, 2011). The majority of the population was employed in the business/finance or social science/educational disciplines.

3.7.2 Existing and Historic Land Use

The proposed project location is within a rural area of Maugerville, NB, however small commercial businesses have been identified within 2.5km of the proposed project location. The three land parcels included in the proposed project area are classified as having residential land use. Photographs of the proposed project area are presented in **Appendix G**.

The proposed project is bordered to the north by residential properties (PID Nos. 60093002, 60126091, 60071602) and the New Brunswick Department of Transportation right-of-way for

Highway 105. Beyond Highway 105 are additional residential properties and a vacant commercial property (PID No. 60149580) that formerly operated as a vehicle repair facility. There is a NBDELG remediation file associated with the commercial property; however, additional details were not available. Residential properties are located to the east (PID No. 60151628) and west (PID No. 60153491) of the proposed project. The Saint John River is located immediately south of the proposed project location.

3.7.3 **Aboriginal Communities**

The proposed project area is located within the Traditional Lands of the Maliseet Nation. Two First Nations communities, St Mary's First Nation and Oromocto First Nation are located within 10km of the proposed project area.

St Mary's First Nation is a Maliseet community with approximately 1850 members, half of which reside on the community land. The community is located on the north side of the Saint John River in Fredericton, N.B.

The Oromocto First Nation is a Maliseet community of 654 persons (304 on-reserve) (AANDC, 2014) located within Oromocto town limits. The First Nation provides 95 dwellings to 95 households, in developments north and south of Waasis Road (AANDC, 2014).

4.0 Assessment of Potential Environmental Impacts

An assessment of potential impacts has been undertaken in consideration of the proposed project, as well as potential accidental events/malfunctions.

4.1 Valued Components

Each component of the biophysical and socio-economic environment described above was assessed based on their intrinsic value to the ecosystem, heritage and culture, protection afforded by legislation, and professional judgment. Components deemed to have specific value to the ecosystem are identified as Valued Ecosystem Components (VEC) and Valued Socio-Economic Components (VSC's). In relation to the proposed project, the following have been identified as VECs/VSCs:

- Terrestrial Environment (flora, wildlife/wildlife habitat, birds/bird habitat and protected areas);
- Aquatic Environment (groundwater and wetlands);
- Atmospheric Environment (air quality, and sound quality);
- Archaeological and Cultural Resources; and,
- Socio-Economic Environment (First Nations/aboriginal interests and labour/economy).

4.2 Project Activities

As presented in **Section 2**, this EIA recognizes four distinct phases of the proposed project;

- *Site Preparation and Civil Works* – includes clearing/grubbing for the final phase of the proposed development, pre-loading and site grading, upgrading of the access road (if necessary) and paving;
- *Facilities Construction* – includes construction activities for the four rows of six unit attached townhouses and four rows of five unit attached townhouses, potable water system setup and connections, and wastewater treatment system installation;
- *Operations and Maintenance* – includes activities involved in the operation and maintenance of the development for the lifetime of the project; and
- *Accidents and Malfunctions* – includes any accidents, spills, leaks or other unplanned events that could potentially occur during the project components.

The site preparation and civil works and facilities construction phases have been grouped together under the *Construction Phase* of the project as they are expected to be occurring simultaneously. As the development is expected to operate for the foreseeable future, the decommissioning of the development was not considered in this EIA. Decommissioning of the

project would be subject to and assessed pursuant to the applicable regulatory environment of the day.

4.3 Project Interaction Matrix

Each project activity involved in the construction and operation of the proposed project was evaluated to identify potential for interactions with the identified VECs and VSCs. This step is shown in a simple matrix format (see **Table 4-1** in **Section 4.3**). In instances where an interaction was identified, further analysis was completed and is described in the following sections.

TABLE 4-1: PROJECT INTERACTION WITH ENVIRONMENTAL COMPONENTS

Environmental Components		Project Components			
		Construction Phase		Operations and Maintenance	Accidents and Malfunctions
		Site Preparation and Civil Works	Facilities Construction		
Terrestrial	<i>Environmentally Significant Area - Sheffield/Jemseg IBA</i>	✓			✓
	<i>Vegetation (Flora)</i>	✓			✓
	<i>Wildlife (Fauna)</i>	✓	✓		✓
	<i>Migratory Birds</i>	✓			✓
Aquatic	<i>Groundwater</i>			✓	✓
	<i>Wetlands</i>	✓			✓
	<i>Watercourses</i>				
Atmospheric	<i>Ambient Air Quality</i>	✓			
	<i>Ambient Sound Quality</i>	✓	✓		
Archaeological and Cultural	<i>Archaeological / Cultural Heritage Resources</i>				✓
Socio-Economic	<i>First Nations / Aboriginal Interests</i>	✓		✓	✓
	<i>Labour and Economy</i>	✓	✓	✓	

5.0 Environmental Effects Assessment and Mitigation

5.1 Methodology

5.1.1 Potential Impact from Interaction

Each action completed during each project phase (for example, digging a trench for the installation of the wastewater treatment system during the Construction Phase) was recognized and potential interactions with the VECs and VSCs were considered. If the interaction was expected to result in a net negative impact to the VEC it was included in the potential impact section and carried forward for mitigation and a residual effect was predicted.

Impacts that were not expected to pose a net change to the VECs and VSCs for the proposed project were not considered under the potential impact section.

5.1.2 Impact Effects Boundaries

5.1.2.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment (EEA) encompasses the physical or geographical limit for which impacts related to the proposed project will be considered and assessed. For the purpose of this assessment the spatial boundary for the EEA generally encompasses a 200 m area surrounding the proposed project. This area encompasses the Saint John River and a number of the residential/commercial properties within the community of Maugerville. Spatial boundaries were restricted or extended for certain VECs as indicated below;

- Terrestrial Environment encompasses the terrestrial environment within the proposed project footprint.
- The spatial boundaries for the atmospheric environment were selected by professional judgment and scientific literature review and were extended to approximately 500m from the proposed project area.
- Socio-Economic boundaries encompass a 1 km radius around the proposed project footprint within the community of Maugerville.

5.1.2.2 Temporal Boundaries

The temporal boundaries for the EIA define the time periods for which environmental effects are anticipated to occur, such as the duration of the construction phase of the proposed project or lifetime of the development. Temporal boundaries vary according to project phase. In the construction phase the temporal boundary has been set to the duration of construction

activities (five years). Effects associated with the operational of the development are anticipated to be long term.

Accidents and malfunctions could occur during either phase of the project lifecycle, and as their nature is unknown, the temporal boundary varies. However, most of these events are relatively short in duration and as such the effects are considered to be short-term unless otherwise stated.

5.1.3 Effect Prior to Mitigation

Following the identification of an interaction between the site activity and a VEC or VSC, the expected duration and potential effect is predicted using professional judgment. This predicted effect assumes no mitigation has been completed.

The predicted significance of the interaction is evaluated using the following questions as a guide;

1. What is the magnitude of the effect?
2. What is the geographic extent of the effect?
3. What is the duration (short or long term) and frequency of the effect?
4. How does the net effect compare to the existing environment? Does it represent a substantive or order of magnitude negative change in baseline conditions?
5. Is there a substantive public, government or agency concern?
6. What is the ecological and/or social context for the effect?
7. Is the effect reversible?

The predicted effect is then classified on the following scale;

- **Negligible** – the magnitude of the effect is relatively small spatially or temporally, the effect will not irreparably impact the surrounding environment, and there are no substantive public or ecological concerns;
- **Limited** – the magnitude or frequency of the effect is measurable either spatially or temporally, however effect will not irreparably impact the surrounding environment or an alternate environment is available, and there may be some public or ecological concerns. Species of conservation concern are not expected to be impacted;
- **Moderate** – the magnitude or frequency of the effect is relatively significant spatially and/or temporally, and is predicted to impact the surrounding environment, however similar habitat is available adjacent to the proposed project area. Species of conservation concern may be impacted. There may be substantive public or ecological concerns; and,

- **Significant** – the magnitude of the effect is significant spatially or temporally, the effect will irreparably impact the surrounding environment, and there are substantive public or ecological concerns.

5.1.4 Mitigation

Mitigation is identified for each negative and potential effect in an attempt to reduce the severity, magnitude or duration of the impact. In addition, several acts, codes, regulations and guidelines may require appropriate actions be conducted as mitigative measures prior to or during the interaction. **Appendix B** provides a summary of acts, codes, regulations and guidelines that have been reviewed in the development of the mitigative measures. To minimize impacts to the environment, an environmental management plan (EMP) consisting of environmental protection and mitigation measures, waste management planning and emergency response and contingency planning will be developed and implemented prior to construction.

5.1.5 Significance of Residual Effect

The significance of the residual effect of the interaction will be predicted and classified on the same scale as the effect prior to mitigation, see **Section 5.1.3**.

5.2 Terrestrial Environment

5.2.1 Construction Phase

5.2.1.1 Potential Effects

Vegetation within the proposed footprint of the project is expected to be disturbed through additional clearing/grubbing and backfilling of a portion of the low functioning meadow wetlands located north of the proposed townhouses (WL1 and WL2 on **Figure 3-2**). Local wildlife (including birds) within the study area have the potential to be temporarily or permanently affected by the site preparation activities. The construction has the potential to affect the following:

- Construction noise may lead to the temporary disturbance of terrestrial animals;
- Visual impacts from the presence of humans in the area, as well as vehicles and construction equipment, may cause disruption of wildlife activity such as breeding and/or feeding;
- Clearing and grubbing activities may remove or reduce the quantity and quality of habitat within, and in proximity to, the proposed project area and may result in the permanent displacement of wildlife and destruction of vegetation;
- Attraction of nuisance wildlife through unsuitable waste management;
- Heavy equipment use during the construction activities may cause direct injury or death of wildlife through collisions or destruction of dens and food sources; and,

- The construction of the project may interact or cause a temporary disruption in wildlife migration patterns such as amphibians, reptiles, small and/or large mammals during sensitive periods in particular feeding and breeding requirements.

5.2.1.2 Effect Prior to Mitigation

The effect of the potential impacts during construction prior to mitigation on the terrestrial environment is predicted to be limited. The construction has been planned in an already disturbed area and is expected to occur over a relatively short time period. It is not expected to result in lasting or irreparable damage to the terrestrial environment or significantly impact a wildlife (including bird) population.

5.2.1.3 Mitigation

The following mitigative measures will be employed to reduce the impact to the terrestrial environment during the construction phase of the project;

- Construction crews and machinery are to use the designated roadways and access-points to limit disturbance off the project footprint and minimize the interactions with wildlife and wildlife habitat;
- To minimize wildlife encounters site, working areas shall be kept clean of food scraps and garbage and will be removed from the site daily;
- In the case of wildlife encounters the following shall be implemented:
 - No attempt will be made by any worker at the project site to chase, catch, divert, follow or otherwise harass wildlife by vehicle or on foot;
 - Equipment and vehicles will yield the right-of-way to wildlife; and,
 - Any wildlife sightings or encounters shall be reported to the site supervisor as soon as possible.
- Workers will adhere to the Environment Canada's *Migratory Birds Convention Act, 1994* (MBCA) and the Migratory Birds Regulations (MBR);
- Grubbing will be initiated as early as possible in the calendar year, and must be completed in 30 days;
- No one shall disturb, move or destroy migratory bird nests. If a nest or young birds are encountered, the contractor shall cease work in the immediate area of the nest and contact a bird specialist or Environment Canada for further mitigation. A 20 m buffer zone will be flagged around identified active nests and work in the area may be delayed until after the birds have fledged; and,
- To minimize disruptions with bird activity at night, the project construction activities will be limited to daylight hours.

5.2.1.4 Significance of Residual Effects

With these mitigation measures in place, the potential environmental residual effects of construction activities during the project are reduced from limited (pre-mitigation) to negligible.

5.2.2 Operational Phase

5.2.2.1 Potential Effects

It is not anticipated that operation and maintenance of the development will result in a net increase in terrestrial environment interactions. It is expected that potential interactions would be comparable to current conditions at the proposed project location.

5.2.3 Accidents and Malfunctions

5.2.3.1 Potential Effects

During all phases of the project there is a potential for accidents to occur, and some have the potential to impact the local terrestrial environment. The following accidents and unplanned events are more likely to impact terrestrial environment and have been considered:

- Chemical and fuel spills – petroleum hydrocarbons and some chemicals have the potential to kill vegetation, resulting in a loss of habitat or food sources.
- Fires – Fire may result in a loss of vegetation which has the potential to impact riparian areas, food sources and nesting habitats.

5.2.3.2 Effect Prior to Mitigation

The effect of the potential impacts of accidents and other unplanned events prior to mitigation on the terrestrial environment is predicted to be moderate. Because the nature and outcome of unplanned events is difficult to predict the moderate effect was selected based on a worst case scenario in which a chemical spill could significantly damage the terrestrial environment (vegetation and habitat) for a significant period of time.

5.2.3.3 Mitigation

The following mitigative measures will be employed prior to, or during, construction to reduce the potential for the local terrestrial environment to be impacted by a chemical spill or fire;

- A spill response plan will be completed and detailed in the project EMP and the contractor will be required to provide spill response training to construction personnel;
- Prior to commencing construction, the contractor will be required to ensure that spill response equipment is readily available onsite and each piece of machinery is equipped with a spill response kit;
- Any spills or leaks that occur will be reported to the appropriate regulatory authorities, if applicable, as soon as possible;

- Remedial action, or engineered controls, for any spills or leaks that occur will be completed;
- Refueling, oiling, and maintenance of equipment will be completed in specifically designated to minimize the potential for terrestrial impacts;
- Servicing of equipment will be completed off-site by a licensed mechanic; however, if required to be completed onsite the work will be completed over an impervious surface or trap;
- Any chemicals stored on site will be kept in appropriate containers;
- Rubbish and waste materials will be kept at minimum quantities and burning of this material will be prohibited; and,
- Oily rags will be stored in approved receptacles and disposed of at approved waste facilities.

The following mitigative measures will be employed during the operational phase of the project;

- Rubbish and waste materials will be kept in a predetermined locations and will be managed on a regular basis;
- Any spills or leaks that occur will be reported to the appropriate regulatory authorities, if applicable, as soon as possible;
- Remedial action, or engineered controls, for any spills or leaks that occur will be completed; and
- Work entailing use of toxic or hazardous materials and/or chemicals, or otherwise creating hazard to life or health, will be conducted in accordance with National Fire Code of Canada to minimize the potential for spills or fires.

5.2.3.4 Significance of Residual Effects

With these mitigation measures in place, the potential environmental residual effects of chemical spills and/or fire incidents during all phases of the project are reduced from moderate (pre-mitigation) to negligible.

5.1 Aquatic Environment

5.1.1 Construction Phase

5.1.1.1 Potential Effects

Aquatic habitat (two unmapped wetlands, **Figure 3-2**) has been identified within the proposed project area. The planned repurposing of the unmapped wetlands has the potential to affect the local aquatic environment.

Construction activities have the potential to affect the following:

- Increased sediment loading in the adjacent wetlands resulting from construction and ground breaking activities due to improper stormwater management of the subject site during construction; and,
- The stormwater retention capacity in the remaining wetlands as a result of the repurposing of the unmapped wetlands identified in the proposed project area.

5.1.1.2 Effect Prior to Mitigation

The effect of the potential impacts during construction to the aquatic environment (unmapped wetlands) is predicted to be limited. The construction phase is expected to occur over a relatively short time period and is not expected to result in lasting or irreparable damage to the aquatic environment at the proposed project area.

Based on the functional assessment in **Section 3.3.1.2**, WL1 and WL2 have been ranked as a “Low to Moderate” functioning wetlands with high anthropogenic influences indicating that they provide minimal functional value to the environment with the exception of their capacity for stormwater retention. The repurposing of the wetlands is not expected to irreparably impact the surrounding environment as engineered controls (drainage ditch, surface topography and pond) have been included in the design to handle the additional stormwater. Therefore the potential impacts during construction to the aquatic environment are predicted to be limited.

5.1.1.3 Mitigation

The following mitigative measures will be employed prior to, or during, construction to reduce the potential for impact to the aquatic environment;

- A sediment erosion control plan will be developed and implemented prior to commencing construction activities and will include:
 - Appropriate erosion and sediment control measures designed and implemented to manage surface water drainage (i.e., check dams, off take ditches, ditching).
 - A drainage ditch will be constructed along the west side of the development to facilitate and direct surface runoff to the pond.
- Topography of the subject site will be sloped to increase drainage to the pond located south of the proposed development.
- Ground disturbance shall be minimized to reduce the potential for erosion and sedimentation to the aquatic environment.
- Natural vegetation (especially adjacent to the wetland) will be preserved as much as possible.
- Construction activities will not be completed outside of the proposed project area, i.e. within 80m of the Saint John River or 30m of the provincially significant wetland.

Equipment will not be permitted to enter a wetland with the exception of repurposing the unmapped wetlands identified in the proposed project area.

- Stock piled materials will be kept at a minimum of 80m away from the Saint John River.
- If practical, work will be scheduled so as to avoid outdoor work during periods of significant precipitation, defined as rainfall in excess of 25 mm in 12 hours, or an intensity of greater than 5 mm/hour for 2 or more hours. This shall be considered a minimum; conditions may require more stringent criteria to adequately control erosion and sedimentation.
- Prior to heavy rainfall events sediment control measures will be checked to ensure they are continuing to operate properly.

5.1.1.4 Significance of Residual Effects

With these mitigation measures in place the potential environmental residual effects on the aquatic environment at the proposed project area are reduced from moderate (pre-mitigation) to negligible.

5.1.2 Operational Phase

5.1.2.1 Potential Effects

Potential interactions between the aquatic environment (groundwater and surface water) and the proposed project during the operational and maintenance phase are expected. Drawdown of the groundwater table associated with use of the new potable well in the area is possible. Based on the results of the pumping test completed as part of the WSSA (**Appendix A**), a maximum pumping rate of 40 m³/day (anticipated to exceed the daily use requirements of the development) would result in a minimal drawdown of the local groundwater table (<2m).

An assessment of the groundwater quality as part of the WSSA indicated that concentrations of iron and manganese exceeded applicable Canadian Drinking Water Quality guidelines. These concentrations are attributed to the bedrock unit, not to proposed development activities, in which the aquifer is present.

5.1.2.2 Effect Prior to Mitigation

The effects of the potential impacts during the operation and maintenance phase prior to mitigation on the aquatic environment are predicted to be negligible.

5.1.2.3 Mitigation

The following mitigative measures will be employed prior to, or during, the operation and maintenance phase to reduce the potential for impact to the aquatic environment;

- Following the completion of Phase II of the development a water storage tank (volume yet to be determined) will be connected to the water system to meet instantaneous demand and reduce the stress on the aquifer; and,
- Treatment of the potable water, likely by water softener, prior to consumption will be completed.

5.1.2.4 Significance of Residual Effects

With these mitigation measures in place the potential environmental residual effects on the aquatic environment at the proposed project area continue to be negligible.

5.1.3 Accidents and Malfunctions

5.1.3.1 Potential Effects

During all phases of the project there is a potential for accidents to occur, and some have the potential to impact the local aquatic environment. The following accidents and malfunctions are more likely to impact the aquatic receptors and have been considered:

- Hazardous material spill – hazardous spills have the potential to impact groundwater as well as potential migration to the drainage channel and potentially the Saint John River.

5.1.3.2 Effect Prior to Mitigation

The effect of the potential impacts of accidents and malfunctions prior to mitigation on the aquatic environment is predicted to be moderate. Because the nature and outcome of unplanned events is difficult to predict the moderate effect was selected based on a worst case scenario in which a chemical spill reached the aquifer and/or watercourse. This scenario could significantly impact the potable water supply and surface water quality in the receiving environments.

5.1.3.3 Mitigation

The following mitigative measures will be employed prior to, and during, construction to reduce the potential for impact on the aquatic environment;

- A spill response plan will be completed and detailed in the project EMP and the contractor will be required to provide spill response training to construction personnel;
- Prior to commencing construction the contractor will be required to ensure that spill response equipment is readily available onsite;
- Proper labeling of chemical storage containers will be completed and appropriate MSDS will be stored onsite;
- Any spills or leaks that occur will be reported to the appropriate regulatory authorities, if applicable, as soon as possible;

- Remedial action, or engineered controls, for any spills or leaks that occur will be completed;
- Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety of health, will be conducted in accordance with National Fire Code of Canada to minimize the potential for spills or fires;
- Refueling, oiling, and maintenance of equipment will be completed in specifically designated areas at least 100 m from the Saint John River and 30 m from the drainage ditch located to the west of the proposed building footprint;
- Servicing of equipment will be completed offsite by a licensed mechanic; however if required to be completed onsite the work will be completed over an impervious surface or trap;
- The proposed project area will be kept clear of rubbish and construction debris;
- Ground surface coverage will be maintained with vegetation, crushed rock or other impermeable surfaces to reduce sediment erosion at the subject site;
- Sediment control measures will be installed along the drainage ditch; and,
- Prior to heavy rainfall events sediment control measures will be checked to ensure they are continuing to operate properly.

5.1.3.4 Significance of Residual Effects

With these mitigation measures in place the potential environmental residual effects on the aquatic environment are reduced from moderate (pre-mitigation) to negligible.

5.2 Atmospheric Environment Results

5.2.1 Construction Phase

5.2.1.1 Potential Effects

During the construction phase, the potential for adverse environmental effects to the atmospheric environment exists due to the release of combustion gases from vehicles and heavy equipment (including earth movers, excavation equipment and grading equipment), wind raised dust (particulate matter) from material handling or stockpiled soil, and noise from construction equipment and activities.

5.2.1.2 Effect Prior to Mitigation

The effect of the potential impacts identified above on the atmospheric environment (including air quality and noise) prior to mitigation is predicted to be limited. The construction phase is expected to occur over a relatively short time period and is not expected to result in lasting or irreparable damage to the atmospheric environment.

5.2.1.3 Mitigation

The following mitigative measures will be employed to reduce the impact to air quality and noise quality in the proposed project area prior to, or during, the construction phase of the project;

- As part of the EMP, a noise reduction plan will be established and communicated to the contractors prior to construction;
- Vehicles and equipment will be properly muffled and maintained according to emission and noise suppression standards;
- The estimated hours of construction will be 7am to 7pm. Longer hours may be required to meet the project schedule but will not go beyond the hours of 6am to 9pm (Monday to Saturday);
- All construction equipment will be turned off when not in active use to minimize emissions of NOX, CO, VOCs and SO₂ and noise levels near the proposed project area;
- Monitoring of weather (wind conditions) and stabilization of stockpiles and bare slopes will be conducted on an as needed basis. In windy conditions, stabilization or covering of stockpiles and bare slopes will be completed to reduce fine particulate matter uplift;
- Water will be used on gravel/dirt road and parking areas to reduce fugitive dust, when necessary;
- Exposed soils will be stabilized as soon as practical;
- Proper labeling of chemical storage containers will be completed and appropriate MSDS will be stored onsite;
- Burning of rubbish and waste within the proposed project area will be prohibited;
- Oily rags will be stored in approved receptacles onsite and disposed of at approved waste facilities;
- Operation requirements will be completed in accordance with the NBDELG Approval to Operate Certificate; and,
- Complaints related to noise from the construction will be addressed by the contractor.

5.2.1.4 Significance of Residual Effects

With these mitigation measures in place the potential atmospheric environmental residual effects during the construction phase of the proposed project are decreased from limited (prior to mitigation) to negligible.

5.2.2 Operational Phase

5.2.2.1 Potential Effects

It is not anticipated that operations will impact air quality or noise levels in and around the proposed project area.

5.2.3 Accidents and Malfunctions

5.2.3.1 Potential Effects

During all phases of the project there is a potential for accidents to occur, and some have the potential to impact the local aquatic environment. The following unplanned events are more likely to impact the atmospheric environment and have been considered:

- Fires – Fires may result in the release of toxic chemicals or smoke to the atmosphere.

5.2.3.2 Effect Prior to Mitigation

The effect of an unplanned event prior to mitigation on the atmospheric environment is predicted to be limited. Because the nature and outcome of unplanned events is difficult to predict the limited effect was selected based on a worst case scenario in which a significant fire occurs.

5.2.3.3 Mitigation

The following mitigative measures will be employed prior to, or during, construction to reduce the potential for the atmospheric environment to be impacted by a fire;

- An emergency response plan will be completed and the contractor will ensure that employees are aware of appropriate actions;
- Rubbish and waste materials will be kept at minimum quantities and burning of this material will be prohibited; and,
- Oily rags will be stored in approved receptacles and disposed of at approved waste facilities.

The following mitigative measures will be employed during the operational phase of the project;

- Rubbish and waste materials will be kept in a predetermined locations and will be managed on a regular basis; and,
- Work entailing use of toxic or hazardous materials and/or chemicals, or otherwise creating hazard to life or health, will be conducted in accordance with National Fire Code of Canada to minimize the potential for spills or fires.

5.2.3.4 Significance of Residual Effects

With these mitigation measures in place, the potential environmental residual effects of fires during all phases of the project are reduced from limited (pre-mitigation) to negligible.

5.3 Cultural and Heritage Resources Environment

5.3.1 Construction Phase

5.3.1.1 Potential Effects

The proposed project area is located within the Traditional Lands of the Maliseet First Nation and the communities may use area for traditional uses (gathering and fishing). Potential exists for First Nations to be impacted by the proposed construction activities.

5.3.1.2 Effect Prior to Mitigation

The effect of the potential impacts identified above on the First Nations prior to mitigation is predicted to be negligible because, as described in **Section 2**, the proposed project area is;

- located between Highway 105 and the Saint John River;
- surficial soil and vegetation has been previously disturbed through farming and the 2012 site clearing activities; and,
- no water courses have been identified on the subject site.

These site characteristics make areas adjacent to the proposed project area more desirable habitat for hunting and gathering.

5.3.1.3 Mitigation

The following mitigative measures will be employed to maintain a negligible impact to the natural environment in the proposed project area prior to, or during, the construction phase of the project;

- Construction crews and machinery are to use the designated roadways and access-points to limit disturbance off the project footprint;
- Workers will adhere to the Environment Canada's *Migratory Birds Convention Act, 1994* (MBCA) and the Migratory Birds Regulations (MBR);
- A sediment erosion control plan will be developed and implemented prior to commencing construction activities and will include:
 - Appropriate erosion and sediment control measures designed and implemented to manage surface water drainage (i.e., check dams, off take ditches, ditching).
 - A drainage ditch will be constructed along the west side of the development to facilitate and direct surface runoff to the pond.
- Topography of the subject site will be sloped to increase drainage to the pond located south of the proposed development;
- Ground disturbance shall be minimized to reduce the potential for erosion and sedimentation to the aquatic environment;
- Natural vegetation will be preserved as much as possible;

- Construction activities will not be completed outside of the proposed project area, i.e. within 80m of the Saint John River or 30m of the provincially significant wetland;
- Equipment will not be permitted to enter a wetland with the exception of repurposing the unmapped wetlands identified in the proposed project area;
- Stock piled materials will be kept at a minimum of 80m away from the Saint John River;
- If practical, work will be scheduled so as to avoid outdoor work during periods of significant precipitation, defined as rainfall in excess of 25 mm in 12 hours, or an intensity of greater than 5 mm/hour for 2 or more hours. This shall be considered a minimum; conditions may require more stringent criteria to adequately control erosion and sedimentation;
- Prior to heavy rainfall events sediment control measures will be checked to ensure they are continuing to operate properly;
- As part of the EMP, a noise reduction plan will be established and communicated to the contractors prior to construction;
- Vehicles and equipment will be properly muffled and maintained according to emission and noise suppression standards; and,
- Monitoring of weather (wind conditions) and stabilization of stockpiles and bare slopes will be conducted on an as needed basis. In windy conditions, stabilization or covering of stockpiles and bare slopes will be completed to reduce fine particulate matter uplift.

5.3.1.4 Significance of Residual Effects

With these mitigation measures in place the residual effects during the construction phase of the proposed project will remain negligible.

5.3.2 Operational Phase

5.3.2.1 Potential Effects

The proposed project area is located within the Traditional Lands of the Maliseet First Nation and communities may use area for traditional uses (gathering and fishing). Potential exists for First Nations to be impacted by the operation of the proposed development.

5.3.2.2 Effect Prior to Mitigation

The effect of the potential impacts identified above on the First Nations prior to mitigation is predicted to be negligible because areas adjacent to the proposed project area more desirable habitat for hunting and gathering.

5.3.2.3 Mitigation

The following mitigative measures will be employed to reduce the impact to the natural environment in the proposed project area prior to, or during, the construction phase of the project;

- Topography of the subject site will maintain a slope to increase drainage to the pond located south of the proposed development;
- Any further ground disturbance for maintenance of the development shall be minimized to reduce the potential for erosion and sedimentation to the aquatic environment;
- Natural vegetation will be preserved as much as possible;
- Construction activities will not be completed outside of the proposed project area, i.e. within 80m of the Saint John River or 30m of the provincially significant wetland; and,
- Vehicles will be properly muffled and maintained according to emission and noise suppression standards.

5.3.2.4 Significance of Residual Effects

With these mitigation measures in place the residual effects during the operational phase of the proposed project will remain negligible.

5.3.2.5 Potential Effects

It is not anticipated that construction activities will impact cultural and heritage resources in the proposed project area.

5.3.3 Accidents and Malfunctions

5.3.3.1 Potential Effects

During the construction and operational phases of the proposed project, there is a potential for an unplanned discovery of archaeological artifacts and/or human remains. The following accidents and unplanned events have been considered:

- Potential discovery and destruction or alteration of all or part of an archaeological resource; and,
- Potential discovery of human remains.

5.3.3.2 Mitigation

The following mitigative measures will be employed prior to and during construction activities to reduce the potential for destruction or alteration of an archaeological resource or human remains;

- Construction crews will be made aware of the potential for archaeological resources within the construction area;
- The contractor will be educated on the proper mitigative activities if an archaeological resource or human remains is unearthed;
- Should an archaeological resource be unearthed, work in the area will cease immediately and Archaeological Services New Brunswick (ASNB) will be contacted at (506) 453-3014 for further mitigation. Until a qualified archaeologist arrives at the

scene, no one shall disturb, move or rebury any uncovered artifact. Construction at the proposed project area will only resume when authorized by ASNB and once mitigative measures have been completed; and,

- Should human remains be unearthed, work in the area will cease and the RCMP will be notified immediately. No one will disturb, move or rebury any uncovered human remains. If it is a suspected First Nations burial site, the St Mary's and Oromocto First Nations will be contacted.

5.3.3.3 Significance of Residual Effects

With these mitigation measures in place, significance of residual to cultural and heritage resources from accidents and malfunctions during the construction and operational phases of the proposed project are rated negligible.

5.4 Socio-Economic Environment

5.4.1 Construction Phase

5.4.1.1 Potential Effects

The socio-economic environment has the potential to be positively affected by the construction related activities for the proposed project as local contractors and trades persons will be hired to complete the various phases of construction.

5.4.1.2 Effect Prior to Mitigation

The potential effects of the construction of the proposed project on the local socio-economic environment are expected to be positive due to job creation, but limited as the jobs created are expected to last for a relatively short period of time.

5.4.2 Operational Phase

5.4.2.1 Potential Effects

The socio-economic environment has the potential to be positively affected by the operational and maintenance activities for the proposed project because local companies will be hired to complete the required work (i.e. lawn care, snow removal, etc.).

5.4.2.2 Effect Prior to Mitigation

The potential effects of the construction of the proposed project on the local socio-economic environment are expected to be positive due to job creation, but limited as the jobs created are expected to be temporary or seasonal.

5.4.3 Accidents and Malfunctions

5.4.3.1 Potential Effects

It is not anticipated that activities completed during the construction or operational phases will impact the socio-economic resources for the proposed project and surrounding areas.

5.5 Effect of the Environment on the Project

5.5.1 Construction Phase

5.5.1.1 Potential Effects

According to the Province's flood mapping information (<http://geonb.snb.ca/geonb/>), the proposed project location is within the flood zone (1973 and 2008) of the Saint John River (Figure 3-2). Potential exists for the proposed project to be flooded during construction activities which could affect the following:

- Damage or loss of surficial materials (engineered backfill, vegetation, paved surfaces);
- Damage to equipment and materials located on the proposed project area; and,
- Damage or loss of infrastructure (partially or fully completed townhouses, wastewater system, etc.) present at the time of the event.

5.5.1.2 Effect Prior to Mitigation

The effect of the potential impacts to the proposed project during construction prior to mitigation is predicted to be moderate. The construction is not expected to result in lasting or irreparable damage to proposed project.

5.5.1.3 Mitigation

The following mitigative measures will be employed to reduce the impact to the proposed project;

- When possible, construction activities will be completed outside of the peak discharge periods for the Saint John River;
- Provincial websites, River Watch, (http://www2.gnb.ca/content/gnb/en/news/public_alerts/river_watch.html) will be monitored during the construction phase;
- When a flood is predicted, equipment and materials will be removed from the proposed project area where possible.

5.5.1.4 Significance of Residual Effects

With these mitigation measures in place, the potential environmental residual effects to the proposed project during construction are reduced from moderate (pre-mitigation) to limited

5.5.2 Operational Phase

5.5.2.1 Potential Effects

The proposed project location is within the flood zone (1973 and 2008) of the Saint John River and potential exists for the development to be flooded which could affect the following:

- Damage or loss of surficial materials (vegetation, paved surfaces);
- Damage or loss of infrastructure (townhouses, wastewater system, etc.) present at the time of the event; and,
- Health and safety risks to residents.

5.5.2.2 Effect Prior to Mitigation

The effect of the potential impacts to the proposed project during operation prior to mitigation is predicted to be moderate to significant. Potential flooding is not expected to result in lasting or irreparable damage to proposed project during operation.

5.5.2.3 Mitigation

The following mitigative measures will be employed to reduce the impact to the proposed project during operation;

- Backfilling with an engineered fill will be completed for the proposed project to ensure infrastructure (townhouses, wells, etc) will be installed at a minimum of 0.5m above the 1973 flood level.
- It will be recommended that purchasers of the townhouse monitor provincial websites, River Watch, (http://www2.gnb.ca/content/gnb/en/news/public_alerts/river_watch.html) will be follow recommendations by provincial officials posted there; and,
- When a flood is predicted materials will be stabilized or removed from the development where possible.

5.5.2.4 Significance of Residual Effects

With these mitigation measures in place, the potential environmental residual effects to the proposed project during operation are reduced from moderate to significant(pre-mitigation) to limited.

6.0

Public Consultation

INTRODUCTION

In accordance with the New Brunswick EIA Regulation (87-83), public notification of the proposed project is required. Evidence of notification will be provided to the NBDELG within 60 days of the submission of this EIA document.

Consultation with Other Departments

Federal and Provincial Departments that have been contacted through email communication and/or telephone:

1. Lee Swanson – Project Manager, NBDELG Environmental Assessment Section
2. Brent Suttie – Manager, NB Tourism, Heritage and Culture, Archeological Services Unit
3. Stewart Lusk – NBDNR Species at Risk Biologist
4. Mallory Gillis – Hydrogeologist, NBDELG Water and Wastewater Management Section

COMMUNICATIONS OBJECTIVES

The following objectives have been established by Kenny's Developments Limited to ensure effective communications with the stakeholders and public:

1. Keep the public informed about the proposed project through timely and meaningful information release(s).
2. Consult with affected stakeholders in a timely manner in an effort to mitigate impacts.
3. Provide the public and interested stakeholder groups with opportunities to be involved and learn more about the proposed project.

DIRECT WRITTEN COMMUNICATIONS TO AREA RESIDENTS

Direct written communications regarding the Undertaking and its location will be conducted with potentially affected local residents, landowners, business owners and individuals. The written notification, including the required content of Public Notices [NBDELG, 2012], will be sent through the mail. The letter will be directed to all residents, business owners and landowners within 200 m of the proposed project location.

Similar to Step 1, each letter will contain the following information:

- Brief description of the proposed project;
- Description of the location for the proposed project;
- Map showing the location of the proposed project;
- Status of the Provincial Regulatory Approval process;
- Statement indicating that members of the general public can ask questions and/or raise concerns with the Proponent regarding any and all environmental impacts; and,
- Date that the public comment period expires.

DIRECT WRITTEN COMMUNICATIONS TO FIRST NATIONS COMMUNITIES

Direct written communications regarding the Undertaking and its location will be conveyed to both St Mary's First Nation and Oromocto First Nation communities. The written notification, including the required content of Public Notices [NBDELG, 2012], will be sent through the mail.

Similar to Step 1, each letter will contain the following information:

- Brief description of the proposed project;
- Description of the location for the proposed project;
- Map showing the location of the proposed project;
- Status of the Provincial Regulatory Approval process;
- Statement indicating that members of the general public can ask questions and/or raise concerns with the Proponent regarding any and all environmental impacts; and,
- Date that the public comment period expires.

REGISTRATION DOCUMENT AVAILABILITY

Kenny's Developments Limited will provide a copy of the Registration document to the NBDELG office in Fredericton. Requests for copies from the public, stakeholders and First Nation communities will be honoured by providing a copy of the Registration document directly. Subsequent submissions in response to issues raised by the Technical Review Committee will be made available upon request.

Conclusions

This EIA registration has been prepared for the construction, operation and maintenance of the proposed project on behalf of Kenny's Developments Limited. The information provided in this document is based on the current available design/planning information and existing environment information obtained in 2016.

The applicable environmental components and potential project effects were assessed and presented with meaningful mitigation measures to minimize and in some cases eliminate the potential effects. Based on these interactions, it can be concluded that, with the proper mitigation and standard operating procedures as outlined in this document, the residual effects of the project would be considered not significant for all project components. The project would be considered to provide a net positive effect for the Fredericton area which includes a retirement housing facility and a potential regional employment increase.

8.0

Closure

This report was prepared by Dillon on behalf of the Kenny's Developments Limited. Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.

The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Yours Truly,

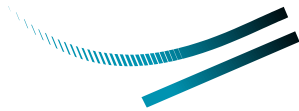
DILLON CONSULTING LIMITED

K.D. BANKS

Kristin Banks, P.Eng.
Project Manager

Appendix A

River Mist Estates – Water Supply Source Assessment



DILLON
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KENNY'S DEVELOPMENTS LTD.

River Mist Estates – Water Supply Source Assessment (Final)

336 Route 105, Maugerville, NB



February 2016 – 15-2555

February 8, 2016

New Brunswick Department of Environment and Local Government
20 McGloin Street
PO Box 6000, Fredericton, NB
E3B 5H1

Attention: Lee Swanson, B. Sc. M.A.
Project Manager

***Water Supply Source Assessment
River Mist Estates – Kenny’s Developments Ltd.
336 Route 105, Maugerville, NB
EIA Registration No. 4561-3-1421***

Dear Ms. Swanson,

We are pleased to present a final copy of this Water Supply Source Assessment document supporting the River Mist development. This document is being submitted on behalf of Kenny’s Developments Ltd. to the New Brunswick Department of Environment and Local Government as part of the application process for a water supply source assessment as part of the NBDELG EIA Registration process.

If you have any questions, please contact the undersigned.

Yours sincerely,

DILLON CONSULTING LIMITED

Kristin Banks, P.Eng.
Project Manager

Our file: 15-2555

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A	WSSA Initial Application
B	Boreholes and Water Well Drillers Reports
C	Laboratory Analytical Certificates
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References

1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by Kenny's Developments Limited (Kenny's) to complete an Environmental Impact Assessment (EIA) and Water Supply Source Assessment (WSSA) at the River Mist Development (proposed development) located at 336 Route 105 in Maugerville, New Brunswick (subject site, see **Figure 1**.) The assessment work was conducted in accordance with the "New Brunswick Department of Environment and Local Government (NBDELG), Environment Impact Assessment, Water Supply Source Assessment Guidelines (WSSA Guidelines)" issued by the NBDELG in March 2014.

The following sections of this report detail a project description, methodologies applied in the WSSA, results of this assessment, as well as conclusions. The initial WSSA application submitted to NBDELG is presented in Appendix A. Borehole logs and copies of the Water Well Drillers Reports from the subject site are located in Appendix B. Laboratory analytical certificates are included in Appendix C. The statements made in this report are subject to the limitations detailed in the disclaimer presented in Appendix D.

2.0 Project Description

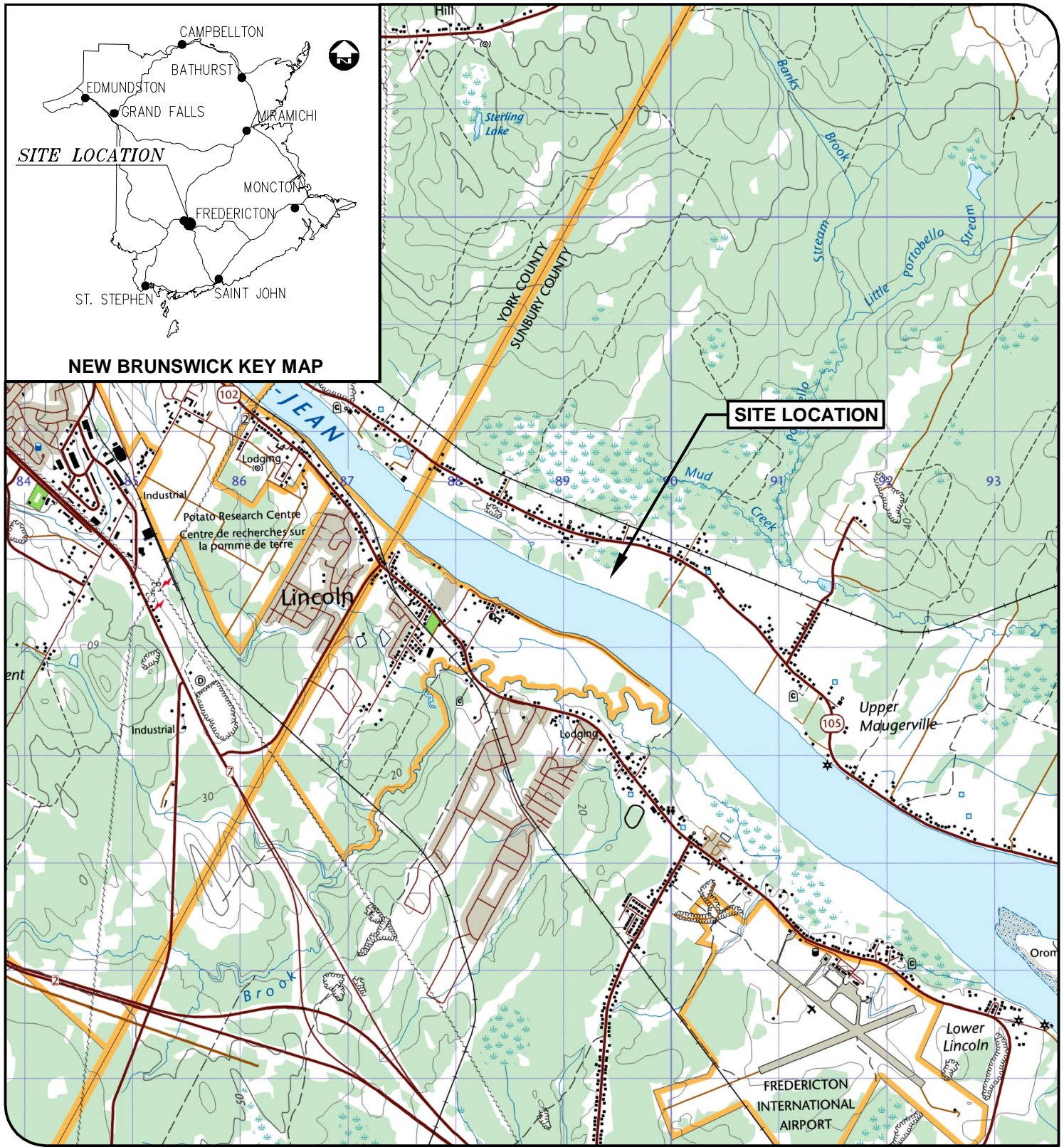
2.1 Site Description

The subject site is located in a residential/commercial area of Maugerville, New Brunswick and is illustrated on **Figure 2**. The subject site is currently owned by Kenny's (contact: Mr. Kenneth Cormier, 336 Route 105, Maugerville, NB, E3A 8G2, Tel: 506-260-2980) and is legally identified by property identification (PID) numbers 60153475, 60153467, and 60153483.

As shown on **Figure 2**, the subject site is bounded to the east and west by residential / agricultural properties. A New Brunswick Department of Transportation and Infrastructure (NBDTI) right-of-way (Route 105) is located along the northern limit of the subject site, while the Saint John River bounds the subject site to the south. One residence, owned by Mr. Kenneth Cormier, is situated on the adjacent parcel west of the subject site (PID No. 60153491).

2.2 Purpose/Rationale

The subject site is located approximately 3.5 kilometres (km) east of the City of Fredericton municipal limits, and therefore is located outside of the municipal services area. The subject site is classified as a major development (requiring an average of 40 m³/day of water) outside of an incorporated area, therefore the proposed development required registration under the EIA Regulation and as such a WSSA completed.



KENNY'S DEVELOPMENTS LTD.
 RIVER MIST ESTATES - WSSA
 330 ROUTE 105
 MAUGERVILLE, NB
 EIA REGISTRATION No. 4561-3-1421
 PID No. 60153475, 60153467, 60153483

SITE LOCATION MAP
 FIGURE 1



MAP/DRAWING INFORMATION
 National Topographic System Mapsheet 21G/16.

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 CHECKED BY: BCG
 DESIGNED BY: BCG

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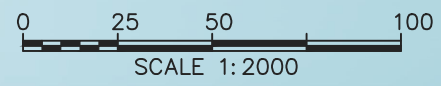
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 RIVER MIST ESTATES - WSSA
 330 ROUTE 105
 MAUGERVILLE, NB
 EIA REGISTRATION No. 4561-3-1421
 PID No. 60153475, 60153467, 60153483

SUBJECT and SURROUNDING PROPERTIES
 FIGURE 2

- SUBJECT PROPERTY
- PROPERTY LINES
- WATERBODY

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 DESIGNED BY: BCG



NOTE:
 INFRASTRUCTURE LOCATIONS ARE APPROXIMATE ONLY.

PROJECT: 15 2555
 STATUS: DRAFT
 DATE: 29/01/16

It is estimated that the proposed development will require an average of 40 m³/day of water. This volume is based upon an estimated demand of water of 350 L per person per day (ACWWA, 2004) and an assumed maximum of 88 people living in 44 condominiums. The proposed condominiums are intended to be sold to senior citizens; therefore it is assumed that a maximum of two people will reside in each condominium. Additionally, a safety factor of 25% was added to the calculated daily water demand for conservatism and to address likelihood that overnight visitors may occur.

2.3 WSSA Initial Application

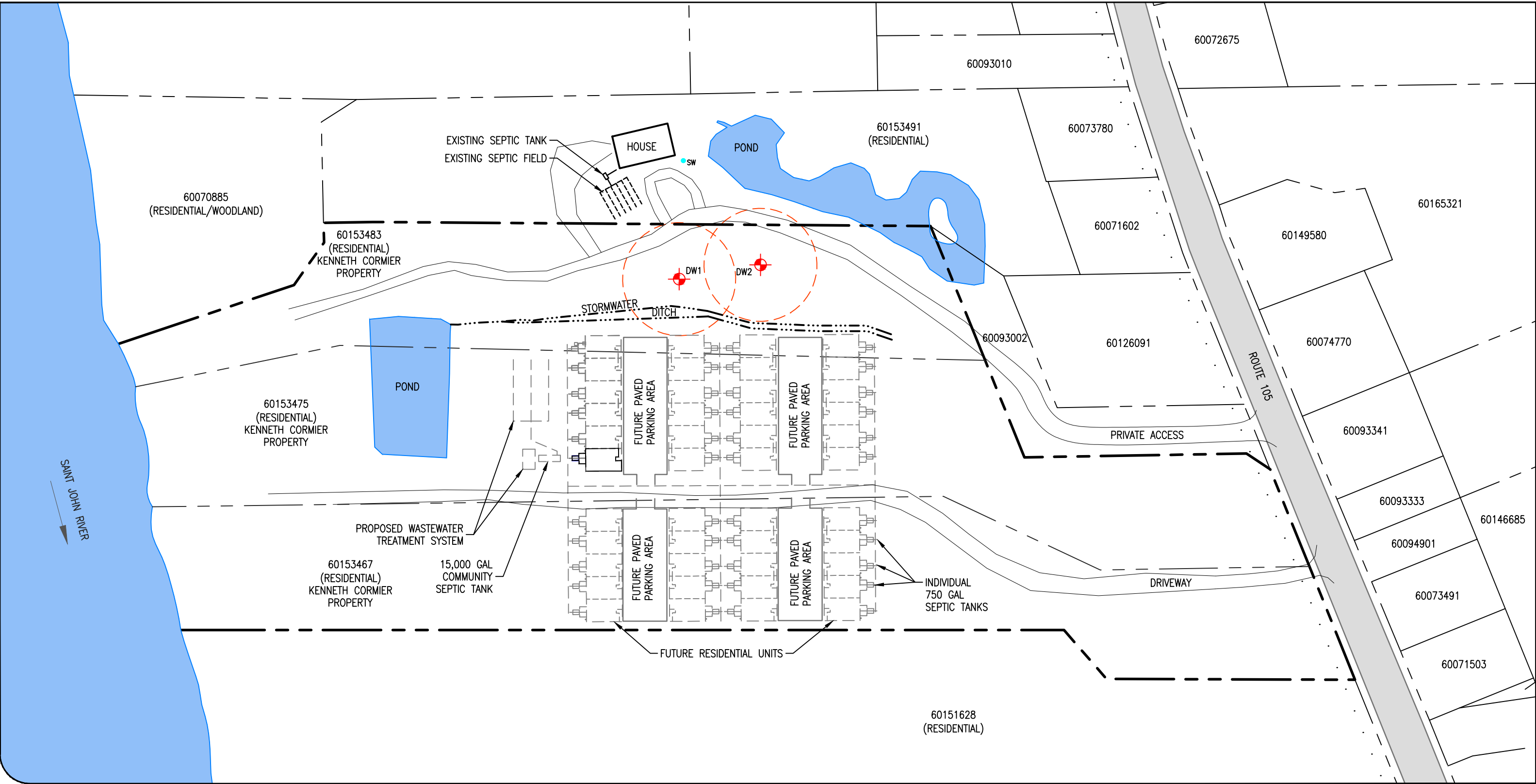
As per the WSSA Guidelines, a WSSA initial application was submitted to NBDELG by Dillon on September 23, 2015. Approval of the WSSA initial application was received on October 26, 2015. The NBDELG stated that the WSSA initial application provided sufficient information for their preliminary review of the project and that the EIA Registration document could be submitted following the WSSA.

The WSSA initial application and approval to proceed can be found in **Appendix A**.

2.4 Water Supply/Groundwater Usage

The Cormier residence and surrounding residential properties are serviced by private wells and septic systems. The Cormier residence utilizes a shallow installation sandpoint for a potable well installed to a depth of 5.1 metres below ground surface (mbgs). Interviews with residents located in proximity of the proposed development also described similar well construction details (sandpoint wells). These sandpoint wells are designed to be installed to relatively shallow depths, approximately 6 mbgs. Based on the anticipated depth of the sandpoint well on the subject site, inclusion of this well within the WSSA was not warranted, as it is likely sourcing from a shallow overburden aquifer and any observations made from this sandpoint would not be representative of the gravel aquifer examined during this assessment.

As part of the WSSA, two potable wells were installed on the subject site by a licensed well driller. The wells were installed with the intent of one providing a water supply for the proposed development, while the other was intended to act as an observation point for the WSSA. Furthermore, the observation well will continue to be utilized as an observation point during the next phases of the proposed development. Additional details regarding these wells are provided in **Section 3.2.1** of this report. Locations of these wells are illustrated on **Figure 3**. Approximate locations of proposed infrastructure (i.e. water line, septic system) for the proposed development are also provided on **Figure 3**.



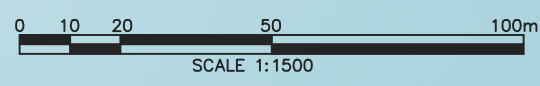
KENNY'S DEVELOPMENTS LTD.
 RIVER MIST ESTATES - WSSA
 330 ROUTE 105
 MAUGERVILLE, NB
 EIA REGISTRATION No. 4561-3-1421
 PID No. 60153475, 60153467, 60153483

SITE PLAN
 FIGURE 3

SUBJECT PROPERTY	EXISTING STRUCTURE A/G	FUTURE INFRASTRUCTURE U/G	DEVELOPMENT WELL
PROPERTY LINES	FUTURE INFRASTRUCTURE A/G	DRAINAGE DITCH	NBDELG REQUIRED SETBACK (23m)
WATERBODY	EXISTING INFRASTRUCTURE U/G	SANDPOINT WELL (SW)	POWER LINE

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MAP/DRAWING INFORMATION
 Property boundaries are based on service New Brunswick records and may not be exact. This is not a legal survey.
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 DESIGNED BY: BCG



NOTE:
 INFRASTRUCTURE LOCATIONS ARE APPROXIMATE ONLY.
 PROJECT: 15 2555
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 DATE: 29/01/16

The subject site is not located within a wellfield protection area under the New Brunswick Wellfield Protection Program or a designated watershed under the New Brunswick Watershed Protection Program. Further, the nearest wetland area (based on GeoSNB wetland mapping) was identified 300 metres (m) east of the potable wells installed during the WSSA.

2.5 Geology, Hydrogeology, Topography and Drainage

Based upon the New Brunswick Department of Energy and Mines Granular Aggregate Resource of Fredericton (21 G/15) map the proposed development is located within alluvium deposits of sand and gravel frequently capped with silt and/or fine sand. Based upon discussion with local land owners this is relatively consistent with what is found in the area. Clay and/or silty clay have also been observed across the site.

Based upon the New Brunswick Department of Energy and Mines bedrock geology of the Fredericton Area (NTS 21 G/15) map the proposed development is located within the Minto Formation of the Pictou Group. The Minto Formation consists of Late Carboniferous sedimentary deposits. The specific type of bedrock in the project area could not be verified as drilling associated with this assessment did not intercept bedrock.

During the potable well drilling activities, the observed stratigraphy consisted of the following:

- brown sand (to a max depth of 9.1 mbgs) overlying;
- grey clayey silts (to a max depth of 15.2 mbgs) overlying;
- grey sandy silts (to a max depth of 27.4 mbgs) overlying;
- fine/coarse gravels (to a maximum observed depth of 35.1 mbgs).

Descriptions of the observed stratigraphy during the WSSA can be found on the borehole logs and the water well driller's reports in **Appendix B**.

At the time of site activities, two ponds existed on the subject site. These ponds collect and retain surficial run-off water as a landscape feature. The Saint John River is located along the southern limit of the subject site, the nearest of the two potable wells installed during the WSSA is located approximately 175 m from the Saint John River. Local topography slopes gently to the south towards the Saint John River. Local surficial drainage is anticipated to occur in the same direction. Approximate locations of the ponds and Saint John River are presented on **Figure 3**.

2.6 Climate Conditions

The nearest Environment Canada weather station to the subject site is the Fredericton (Climate ID: 8101505) weather station located at the Fredericton International Airport. The weather station is located 4.5 km to the southeast of the subject site. The most recent climate data,

released by the Government of Canada, for the Fredericton weather station is presented in the Tables 1-3. A summary of average daily temperatures by month between 1980 and 2010 is found in **Table 1** while monthly precipitation total averages between 1980 and 2010 are found in **Table 2**. Monthly averages of days with precipitation are displayed in **Table 3**.

TABLE 1 - AVERAGE DAILY TEMPERATURE PER MONTH (1980-2010)

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average	-9.4	-7.9	-2.4	4.5	11.1	16.2	19.3	18.4	13.6	7.5	1.5	-5.7	5.6

(Source: Environment Canada, Climate Normals 1981-2010)

The warmest months are generally from June to August, with July being the warmest with an average daily temperature of 19.3°C. The coldest months are typically between December and February, with January being the coldest with an average daily temperature of -9.4°C.

TABLE 2 - AVERAGE MONTHLY PRECIPITATION (1980-2010)

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	38.0	31.4	46.7	68.3	94.5	82.4	88.3	85.6	87.5	88.2	92.9	55.3	859.1
Snowfall (cm)	69.9	47.5	49.4	18.6	1.4	0.0	0.0	0.0	0.0	0.8	14.3	50.5	252.3
Precipitation (mm)	95.3	73.1	93.2	85.9	96.2	82.4	88.3	85.6	87.5	89.1	106.3	94.9	1077.7

(Source: Environment Canada, Climate Normals 1981-2010)

TABLE 3 - AVERAGE NUMBER OF DAYS WITH PRECIPITATION PER MONTH (1980-2010)

Amount of Precipitation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
>= 0.2mm	14.2	11.3	13	13.2	13.9	12.2	12.3	10.6	10.3	11.4	13.2	13.4	148.9
>= 5mm	5.7	4.5	5.7	5.8	5.8	5.2	4.9	4.4	4.4	5	6.2	5.8	63.2
>= 10mm	3.4	2.6	3.2	2.8	3.7	2.9	2.9	2.6	2.8	3.2	3.7	3.1	36.8
>= 25mm	0.76	0.44	0.76	0.46	0.38	0.46	0.77	0.77	0.69	0.81	0.84	0.60	7.7

(Source: Environment Canada, Climate Normals 1981-2010)

Over the dataset, monthly averages totaled to 1077.7 mm of precipitation per year, with 859.1 mm of rain and 252.3 cm of snow falling per year. Generally, Fredericton saw 148 days with precipitation falling per year between 1980-2010. The highest monthly precipitation total was observed in November with 106.3 mm, while the lowest monthly precipitation total was observed in February with 73.1 mm.

Based on the climate data, the most surficial recharge to the source aquifer in the project area is expected to occur between November and December. However, the surficial recharge would be deemed negligible when compared to recharge from the constant head boundary represented by the Saint John River.

3.0 Water Supply Source Assessment

3.1 Field Work Scope

The WSSA completed at the subject site included the following field components:

- the installation of two test wells;
- a step-drawdown test;
- a 72 hour constant rate pumping test (pumping test); and,
- a water sampling program.

3.2 Methodology

3.2.1 Potable Well Installation

Between November 3 and November 6, 2015 two test wells (DW1 and DW2) were installed on the subject property under the supervision of Dillon personnel. Burpee TM Drilling Ltd. (Burpee) of Keswick Ridge, NB, was commissioned to drill the potable wells. Locations of DW1 and DW2 are presented on **Figure 3**.

Each well was drilled to such depth that the anticipated yield was deemed sufficient (DW1 yielded around 160 m³/day and DW2 yielded close to 320 m³/day). In both cases sufficient yield was achieved upon intersection with the respective observed coarse gravel layer. The coarse gravel layer was encountered at 33.5 mbgs in DW1 and was encountered at 27.1 mbgs in DW2. DW1 was installed to a depth of 35.1 mbgs, while DW2 was installed to a depth of 27.4 mbgs. Each well was installed using 0.15 m steel casing. Well construction details are provided on the borehole logs and water well driller's reports found in **Appendix B**.

Upon completing the potable wells, each well was developed via air lift for approximately 1-2 hours. Evidence of increased yield and clarity of return water was observed while developing

DW2 when compared to DW1. Based on the water return during development the estimated safe yield from DW1 was estimated to be 110 L/min (160 m³/day), and the estimated safe yield from DW2 was approximately 220 L/min (320 m³/day).

The differences in observed well characteristics could be attributed to minor differences in stratigraphy and/or amount of finer-grained materials within the formation. Based on these observations, it was recommended to Kenny's that DW2 be used as the primary pumping well for the proposed water system for the development. It was assumed at the time that DW2 would have sufficient yield to meet the estimated proposed development requirement of 38.5 m³/day. For the purpose of this WSSA, DW2 was utilized as the pumping well, while DW1 was used for water level observation.

Prior to the spring of 2016, casing above ground for both DW1 and DW2 will be extended to a height of 8.7 metres above sea level (masl). Following that, both well casings and a water storage tank will be enclosed by the construction of a well house. The grade of the area surrounding the future well house will be raised to 8.4 masl. Enclosure and casing extension of both wells will limit the risk of the wells being impacted by flood waters. Furthermore, DW1 will continue to be utilized as an observation point during the next phases of the proposed development.

3.2.2 Water Elevation Monitoring

Prior to the pumping test electronic pressure transducers (dataloggers®) were installed in both DW1 and DW2 on December 10, 2015 for 4 days. Over this span, the dataloggers were programmed to record relative water level readings every ten minutes. Both dataloggers were removed on December 14, 2015 to allow access for the pump installation in DW2. The dataloggers were installed on direct-read cables and connected to a data acquisition and telemetry unit such that water level readings could be reported wirelessly to a home station computer.

On December 16, 2015 the step-drawdown and pumping test were initiated on the subject property. During the step-drawdown test, dataloggers recorded relative water levels every second between 0900 until 1100. The pumping test then commenced at 1100; and relative water level readings were recorded every minute until the pump was turned off at 1100 on December 19, 2015. After the pump was turned off, relative water levels were recorded in DW1 and DW2 every minute for approximately 30 minutes, until sufficient recovery had been observed.

3.2.3 Step-Drawdown Test

A 3 horsepower (hp) variable frequency drive (VFD) pump was purchased by Kenny's to supply the proposed development, and was utilized for the step-drawdown and pumping test. The

VFD pump was designed to operate with a water pressure regulating switch and to discharge to a 4 cm polyline. The pressure regulating switch was bypassed using the pump control box to allow the pump to operate at a constant rate independent of pressure for the step-drawdown and pumping test.

The step-drawdown test commenced at 0900 December 16, 2015. A gate valve was installed along the discharge line to regulate flow from the pump. Relative water level observations were observed in real-time as the flow from the pump was altered. An analog flowmeter (2.5 cm diameter, supplied by Dillon) was installed along the discharge line to measure flow during the tests. The flow meter could not be utilized as flow from the pump was required at greater volumes and therefore turbulent flow through the meter would not allow for accurate measurement.

Results of the step-drawdown test are discussed in **Section 3.3.1**.

3.2.4 72 Hour Constant Rate Pumping Test

At approximately 1100 on December 16, the 72 hour constant rate pumping test was initiated. Based upon the results of the step-drawdown test (observed water level decreases at maximum pumping capacity), it was determined that the pump was likely capable of pumping from DW2 at its full capacity, approximately 200 L/min (290 m³/day) for the duration of the pumping test. A power outage occurred at the subject property on December 16 from around 1230 until 1330, resulting in pumping stoppage and subsequent recharge in relative water level data.

The flowmeter and valve were left installed along the discharge line throughout the pumping test. This assessment conservatively assumed that the head losses related to the pumping test setup would be less than or equal to the head losses associated with the connection of this well/pump to the proposed developments. Therefore, results observed were a conservative representation for the proposed development.

3.2.5 Laboratory Analytical Program

The laboratory analytical program for this assessment was developed based on the WSSA guidelines sampling requirements. Samples were collected, preserved (as directed by the laboratory), and submitted for laboratory analysis. Samples were submitted to Research and Productivity Council Inc. (RPC) in Fredericton, NB for microbial analysis (i.e. total coliforms and E. Coli), general chemistry and traces metals. RPC is accredited by the Standards Council of Canada (SCC) for each of the analytical methods utilized and have in-house QA/QC programs to govern sample analysis and analytical data quality assurance. The results of the analytical program are discussed in **Section 3.3.3** and laboratory analytical certificates are presented in **Appendix C**. The laboratory analytical program is summarized below in **Table 4**.

TABLE 4 - LABORATORY ANALYTICAL PROGRAM

	DW1	DW2
Microbial Analysis	0	1
General Chemistry/Metals	1	4
Total # Samples	1	5

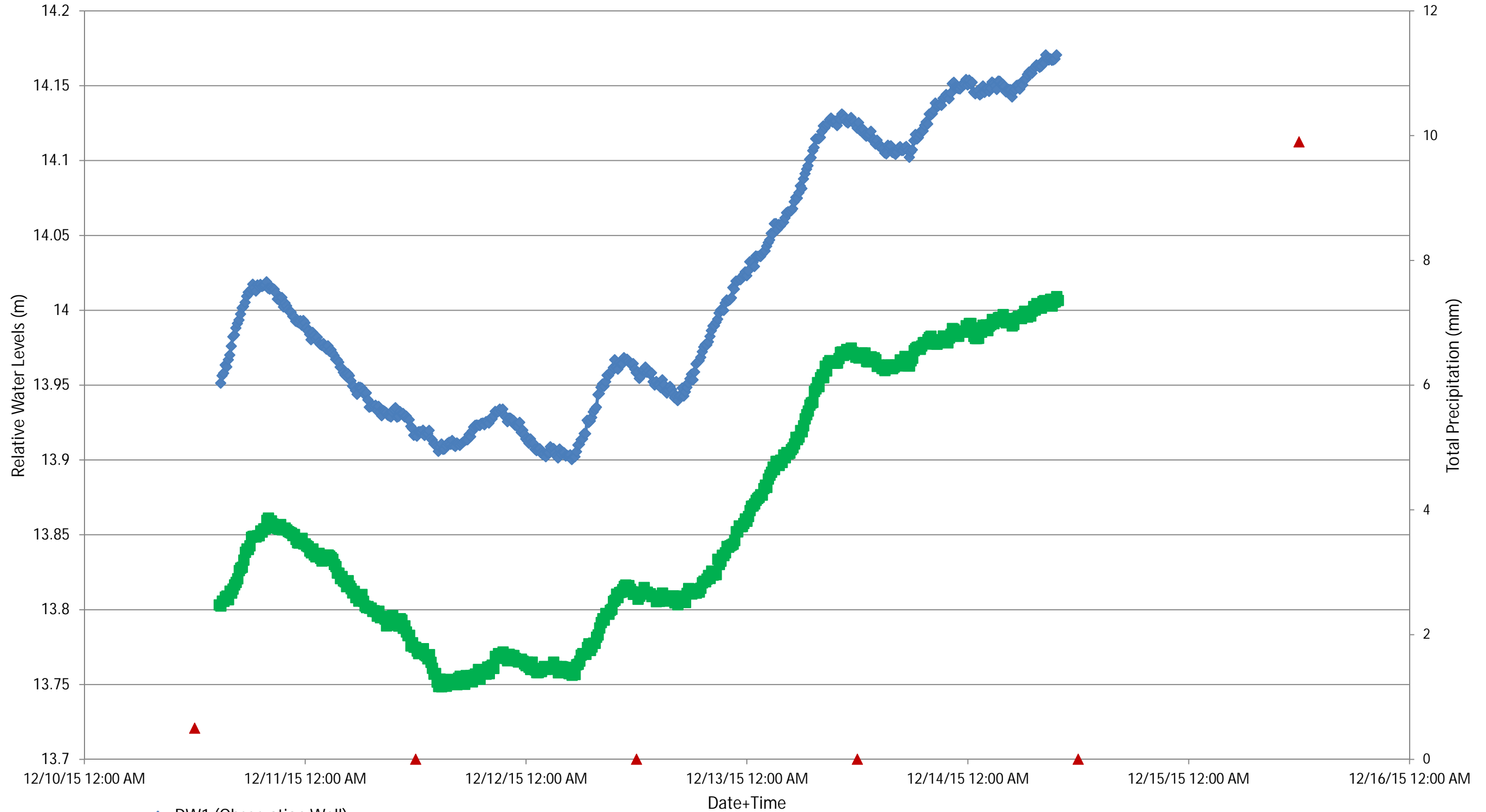
Samples collected from DW2 at the 0, 24, 48, and 72 hour marks of the pumping test were analyzed for general chemistry and metals. A sample was collected from DW2 at the 72 hour mark of the pumping test and analyzed for microbial content. The sample collected from DW1 was taken at the 72 hour mark of the pumping test and analyzed for general chemistry and metals. The NBDELG required water sample was not collected from DW2 at the completion of the pumping test as the NBDELG laboratory had closed for the holiday season by that time. An NBDELG required water sample will be submitted to the NBDELG prior to the commissioning of DW2 as a water supply source for the proposed development.

3.3 Results

3.3.1 Preliminary Relative Water Levels – Non Pumping Conditions

Relative water levels from DW1 and DW2 between December 10 and December 14 are displayed on **Figure 4**. Both DW1 and DW2 appear to follow similar trends under non-pumping conditions, which is to be expected as they source from similar depths and are located in close proximity to another.

River Mist - WSSA
Maugerville, NB



- DW1 (Observation Well)
- DW2 (Pumping Well)
- Total Precipitation (mm)

Figure 4
Relative Water Levels - Non Pumping Conditions

3.3.2 Step-Drawdown Test

Initially, the pump was discharging at its full capacity, approximately 200 L/min (290 m³/day) and an instantaneous drawdown of 2.5 m was observed in the pumping well (DW2). Review of the data, suggests that steady-state flow conditions were achieved 2-3 minutes after the pump in DW2 was turned on, this was replicated for three power cycles of the pump (i.e. turning it off and on) during the step-drawdown test. Nearly instantaneous recoveries (approximately 30 seconds) to the static level were observed in the water levels in DW2 after pump shutdown. Each pump cycle lasted approximately 10-20 minutes.

Discharge flow from the pump was also reduced to half of the pump capacity, approximately 100 L/min (140 m³/day), on the three occasions during the step-drawdown test to observe water level changes in DW1 and DW2. The water level in the observation well (DW1) remained constant with no observable drawdown during the step-drawdown test.

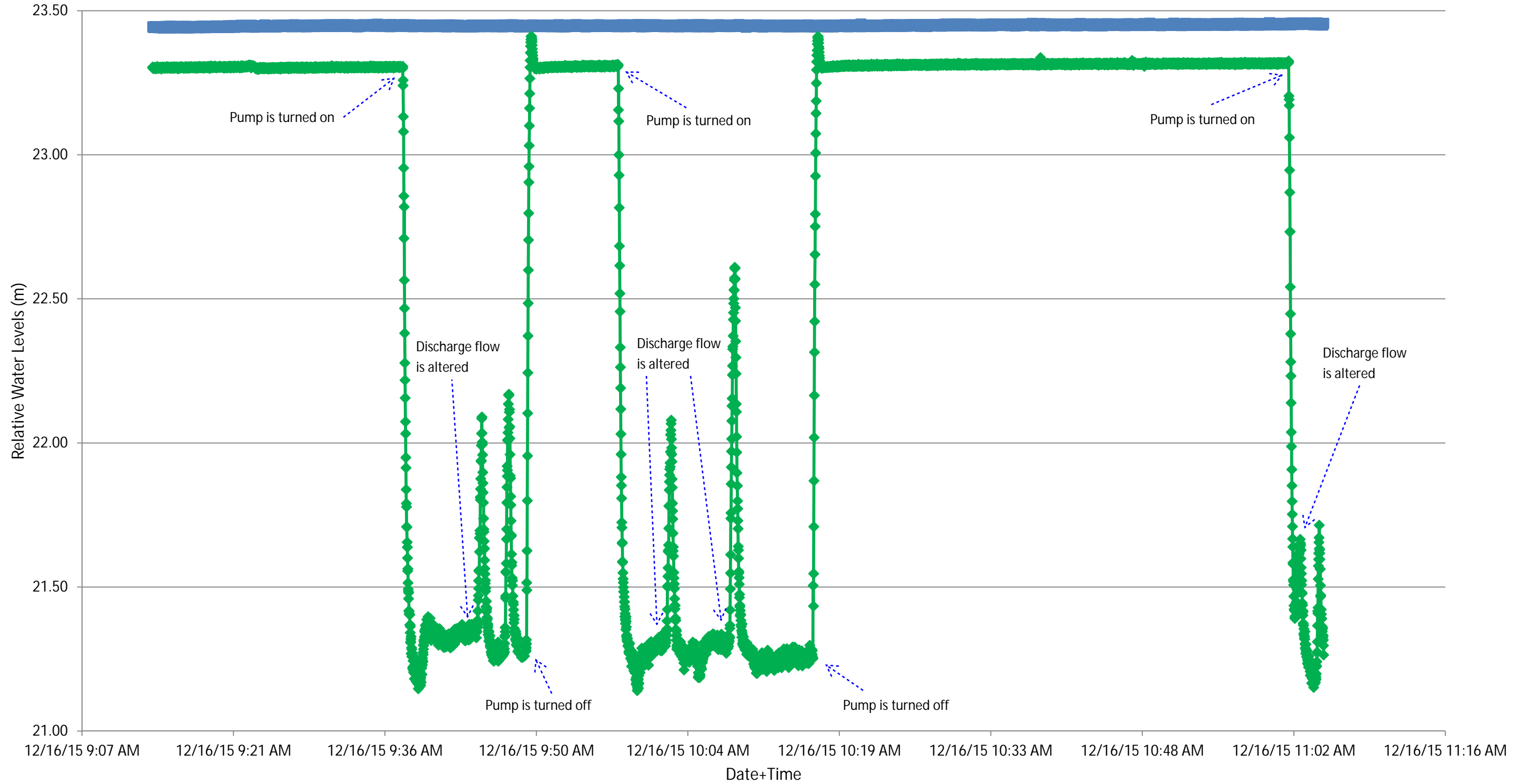
Based on these observations, it was anticipated that the pump would be able to discharge at the maximum capacity of the pump, approximately 200 L/min (290 m³/day) for the duration of the pumping test. Relative water levels from both wells observed during the step-drawdown test are provided on **Figure 5**.

3.3.3 72 Hour Constant Rate Pumping Test

On December 16 prior to the field activities, the static water level in DW2 was 4.88 metres below top of casing (mbtoc). Within minutes of the pump being turned on (200 L/min (290 m³/day)), the water elevation dropped to a maximum depth of approximately 7.11 mbtoc. The static water level in DW1 prior to the start of the pumping test was 4.85 mbtoc, and the water level dropped to maximum depth of 4.91 mbtoc shortly after the pump in DW2 was turned on. Measurements of flow rate observed throughout the pumping test remained relatively consistent at 200 L/min (290 m³/day). Over the pumping test, relative water level readings exhibited some fluctuation, but did appear to indicate that the water level was rising in both DW1 and DW2, this trend was confirmed with manual measurements from the wells. These increases in water levels are likely attributed to barometric pressure changes. The water level in DW1 was higher (4.59 mbtoc) at the conclusion of the pumping test than the static water level (4.85 mbtoc) on December 16.

Upon completion of the pumping test, water levels were observed in DW1 and DW2 for approximately 30 minutes. An instantaneous recovery (approximately 30 seconds) of approximately 1.9 m in the water level was observed in DW2. A recovery of 0.02 m in the water level in DW1 was observed within minutes of pumping test completion. A return to equilibrium conditions within DW1 and DW2 was observed within 2-3 minutes of turning the pump off.

River Mist - WSSA
Maugerville, NB



■ DW1 (Observation Well)
◆ DW2 (Pumping Well)

Figure 5
Relative Water Levels - Step-Drawdown Test

Relative water level data observed throughout the pumping test is displayed on **Figure 6**. Data collected over the course of the recovery period immediately after the pump was turned off is depicted on **Figure 7**.

3.3.3.1

Theoretical Assessment

The WSSA guidelines suggest that an appropriate analysis be completed on the data collected from the pumping test (i.e. Cooper-Jacob, Theis). Following the pumping test, the relative water level data was compiled and reviewed. Various Methods of analysis were evaluated based upon the recovered data and hydrogeological conditions. The following is a summary of hydrogeological conditions and assumptions applied to the conceptual site model with respect to data analysis:

- The aquifer is semi- confined and has an “apparent” infinite extent;
- The aquifer is homogeneous, isotropic, and uniform thickness over the area of influence by pumping;
- The piezometric surface was horizontal prior to pumping;
- The wells are partially penetrating and pumped at a constant rate;
- Water removed from storage is discharged instantaneously with decline in head; and,
- The discharge volume is high relative to well storage, and therefore well storage is negligible.

Upon reviewing the data and the conceptual site model, it was determined that a value of transmissivity could be estimated however, storativity would be considered negligible with respect to the volume of water that is being extracted as it would only account for a very small percentage of available yield. The increase in pumping infrastructure required to further test the limits of the aquifer (i.e. higher discharge rate from the pump) were deemed unnecessary as the pump installed in DW2 will be sufficient to meet the demand of the proposed development. Assessment of the overall capacity and efficiency of the aquifer can be considered conservative with respect to the estimated demand of the proposed development based upon the following:

Proposed Development Demand - It is estimated that the proposed development will require an average of 40 m³/day of water.

Aquifer Transmissivity – Based upon the near instantaneous drawdown and transition to steady-state conditions during the pumping test, additional stress could potentially be applied to the aquifer. Therefore, the available yield from the source aquifer has a greater capacity than the estimated demand of the proposed development.

Boundary Condition – DW1 and DW2 are located within 250 m of the Saint John River which is considered to represent a constant head boundary. The presence of gravel, available transmissivity, results from the pumping test, and knowledge of similar aquifers along the Saint John River suggest hydraulic connection to the source aquifer. This hydraulic connection provides a near infinite recharge component to the confined sand and gravel beneath it.

River Mist - WSSA
Maugerville, NB

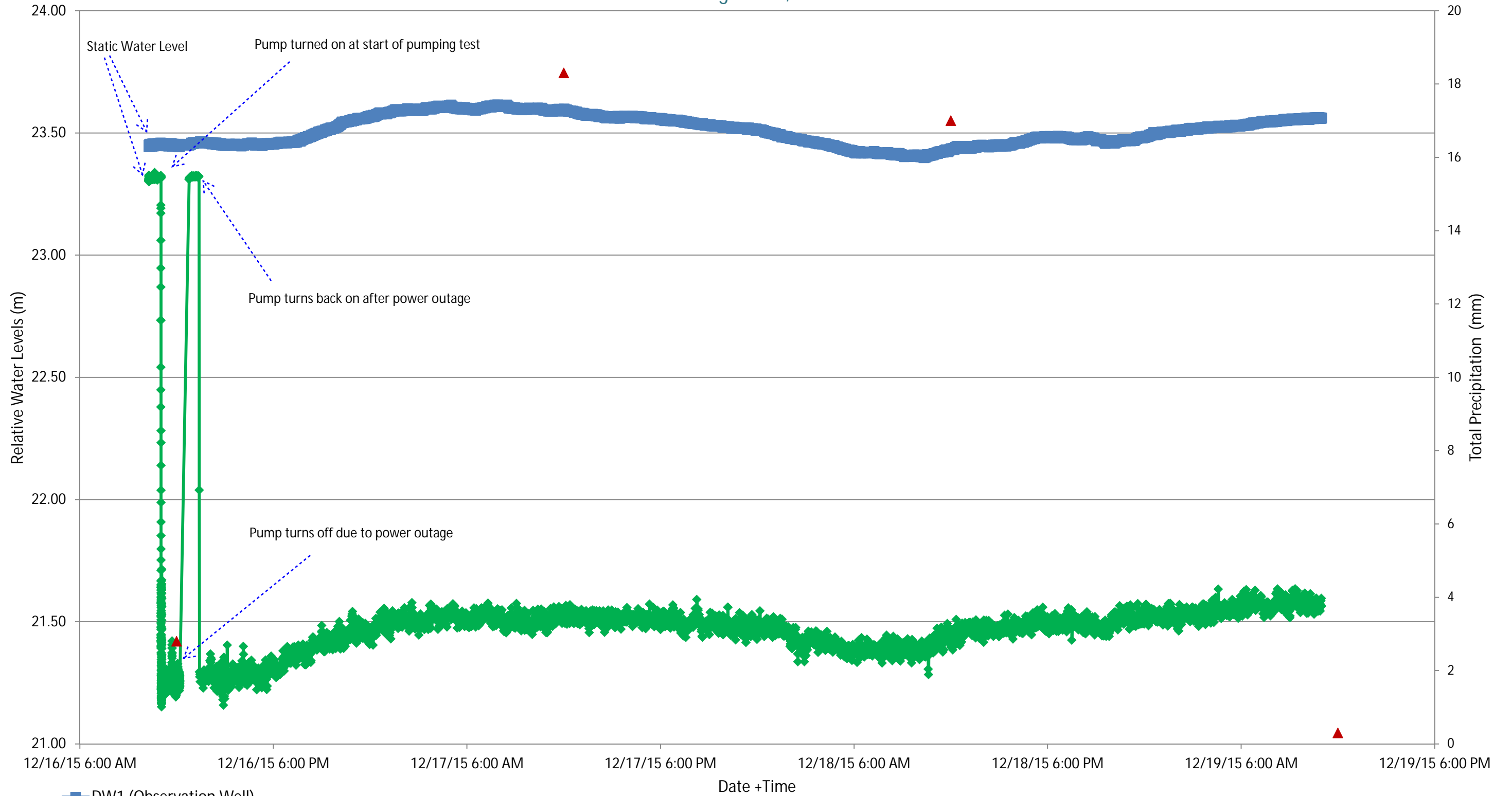
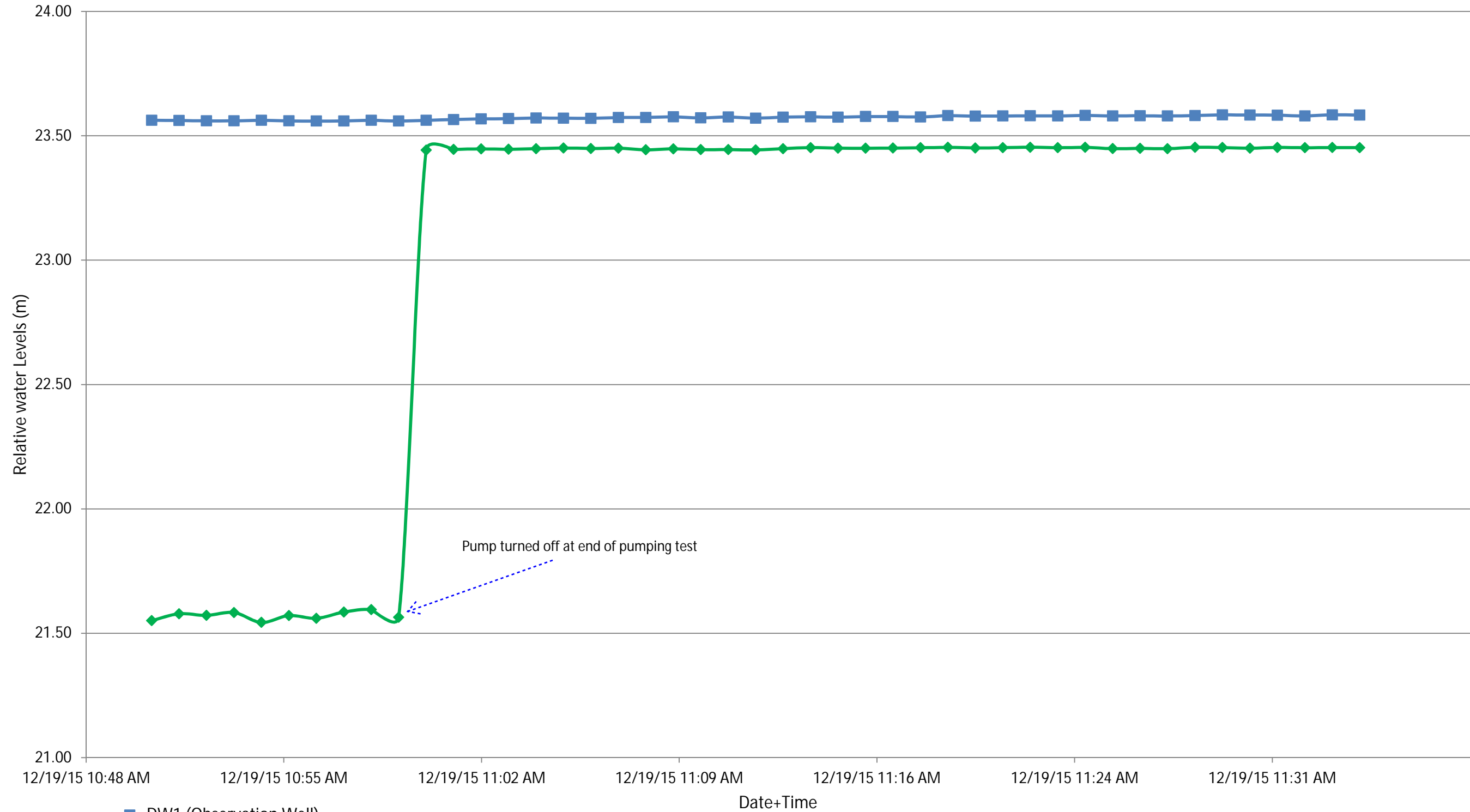


Figure 6
Relative Water Levels - Pumping Test

River Mist - WSSA
Maugerville, NB



■ DW1 (Observation Well)
◆ DW2 (Pumping Well)

Pump turned off at end of pumping test

Figure 7
Relative Water Levels - Recovery Period

3.3.3.2

Empirical Assessment

Based upon the results of the theoretical assessment Dillon suggests that a practical approach be taken in the determination of a safe yield for the proposed development. The following describes the evidence for determining the safe yield for the proposed development:

Boundary Condition – The hydrogeological assessment exhibited evidence of recharge to the aquifer from the Saint John River and as such can be considered a constant head boundary. On average the Saint John River at any given time yields a flow of approximately 900 m³/s (77.8 x10⁶ m³/day) which contributes to the source aquifer recharge.

Hydraulic Testing and Pump Capacity – The hydraulic testing demonstrated that the pump in DW2 has the capacity to extract water at approximately 200 L/min with limited stress on the aquifer. This discharge rate equates to an extraction volume per day (290 m³/day) of 7 fold higher than the estimated daily demand of the proposed development (40 m³/day).

Transmissivity – The results of the pumping test were used to estimate aquifer transmissivity and are considered conservative. Select relative water level data from DW2 was input into Aquifer Test Pro 2015.1. Data from DW2 while the water level was rising during the pumping test and data from DW1, as significant drawdowns were not experienced during the pumping test in DW1, was not input into the program as this data would provide little value in estimating aquifer transmissivity. The assumptions noted in Section 3.3.3.1 were applied to the analysis as well as the following:

- Discharge was constant at a rate of 200 L/min;
- Aquifer thickness is assumed to be 5 m; and,
- DW2 is partially penetrating.

Limitations with respect to the use of values calculated during this empirical assessment could be expected as significant drawdown was not experienced within DW2 following the initial drawdown (start of the pumping test). Therefore, Dillon recommends consideration of the theoretical assessment in order to assess the safe yield for the proposed development. The results of the pumping test analysis are displayed on **Figure 8**. Calculated values for transmissivity and hydraulic conductivity from DW2 are summarized in **Table 5**.

TABLE 5 - AQUIFER TEST RESULTS

Well ID	Hydraulic Conductivity (m/day)	Transmissivity (m ² /day)
DW2	1.2 x 10 ²	6.0 x 10 ²



Dillon Consulting Limited
 1149 Smythe Street, Suite 200
 Fredericton, NB
 E3B 3H4

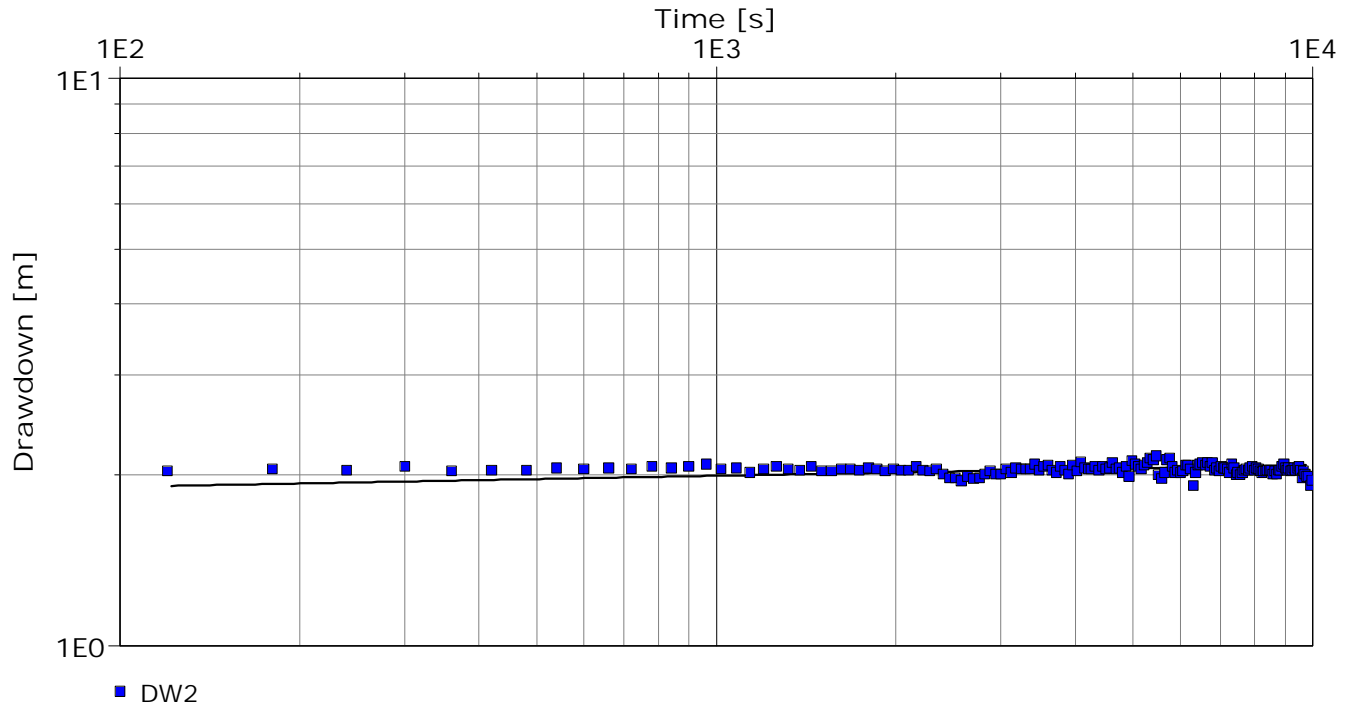
Figure 8 - Pumping Test Analysis

Project: River Mist - WSSA

Number: 15-2555

Client: Kenny's Developments Ltd.

Location: Maugerville, NB	Pumping Test: Pumping Test	Pumping Well: DW2
Test Conducted by: BCG		Test Date: 1/12/2016
Analysis Performed by: BCG	River Mist - WSSA	Analysis Date: 1/12/2016
Aquifer Thickness: 5.00 m	Discharge Rate: 0.2 [m ³ /min]	



Calculation using Theis					
Observation Well	Transmissivity	Hydraulic Conductivity	Storage coefficient	Radial Distance to PW	
	[m ² /d]	[m/d]		[m]	
DW2	6.0×10^2	1.2×10^2	5.4×10^{-20}		

3.3.4 Laboratory Analytical Results

3.3.4.1 Microbial Analysis (Total Coliforms and E. Coli)

Laboratory analytical results for total coliforms and E. Coli in the groundwater sample collected from DW2 are presented in **Table 6**. Laboratory analytical certificates are shown in **Appendix C**.

Total coliforms and E.Coli were not detected in the sample collected from DW2 at the conclusion of the pumping test. The sample was collected prior to disinfection of equipment and is representative of the natural groundwater conditions on the subject site.

A sample from DW1 was not analyzed for microbial content as DW1 had not been pumped during the pumping test and therefore results would not be representative of operational conditions.

Total Coliforms and E. Coli – DW2

- 1 Submitted (72 Hour sample)
 - 0 Exceeded GCDWQ
-

3.3.4.2 General Chemistry and Trace Metals

Laboratory analytical results for general chemistry and trace metals are displayed in **Table 7**. Laboratory analytical certificates are shown in **Appendix C**.

Analytical results of the samples collected from DW2 were below the GCDWQ guidelines. Concentrations of Iron and Manganese were found to be in excess of the GCDWQ guidelines in the samples collected from DW1. The GCDWQ guidelines for Iron and Manganese are aesthetic objectives, and therefore the

exceedences are not an indication of significant issues with water quality on the subject site. Minimal drawdown was observed in DW1 and water was not pumped from DW1 during the pumping test, therefore water within the well casing would have been stagnant since installation of the well, which could lead to elevated trace metals concentrations.

General Chemistry and Trace Metals – DW2

- 4 Submitted (0, 24, 48, 72 Hour Samples)
 - 0 Exceeded GCDWQ
-

General Chemistry and Trace Metals – DW1

- 1 Submitted (72 Hour Sample)
 - 1 Exceeded GCDWQ
-

TABLE 6
 Total Coliforms and E. Coli
 River Mist Estates - WSSA
 Maugerville, New Brunswick
 Dillon Project No. 15-1508

Parameter	Units	GCDWQ (2012)	Pumping Well (DW2)
			72 Hours (Dec 19/15)
E. Coli	MPN/100 mL	0 per 100 mL	0
Total Coliforms	MPN/100 mL	0 per 100 mL	0

Health Canada Federal-Provincial-Territorial Committee on Canadian Drinking Water (FTP CDW)
 Guidelines for Canadian Drinking Water Quality (GCDWQ, August 2012)

1

bold/shaded value denotes concentration exceeds GCDWQ

TABLE 7
 General Chemistry and Trace Metals in Groundwater
 River Mist Estates - WSSA
 Maugerville, New Brunswick
 Dillon Project No. 15-1508

Parameter	Units	GCDWQ (2014)	Pumping Well (DW2)				Observation Well (DW1)
			0 Hours (Dec 16/15)	24 Hours (Dec 17/15)	48 Hours (Dec 18/15)	72 Hours (Dec 19/15)	72 Hours (Dec 19/15)
General Chemistry							
Sodium	mg/L	200 ^{AO}	15.5	13.6	12.7	11.9	10.0
Potassium	mg/L	-	1.18	1.25	1.26	1.22	1.92
Calcium	mg/L	-	30.4	35.4	36.0	35.0	39.3
Magnesium	mg/L	-	3.90	4.44	4.53	4.36	5.50
Iron	mg/L	0.3 ^{AO}	0.21	0.09	0.10	0.06	2.94
Manganese	mg/L	0.05 ^{AO}	0.015	0.005	0.007	0.007	0.353
Copper	mg/L	1 ^{AO}	0.003	0.007	0.003	0.011	0.001
Zinc	mg/L	5 ^{AO}	0.005	0.018	0.009	0.032	0.003
Ammonia (as N)	mg/L	-	<0.05	< 0.05	< 0.05	< 0.05	< 0.05
pH	units	6.5-8.5	6.9	7.4	7.1	7.3	8.3
Alkalinity (as CaCO3)	mg/L	-	84	100	100	104	120
Chloride	mg/L	250 ^{AO}	29.2	25.0	20.0	20.5	27.2
Sulfate	mg/L	500 ^{AO}	10	9	9	9	8
Nitrate + Nitrite (as N)	mg/L	10	0.22	0.13	0.10	0.11	< 0.05
o-Phosphate (as P)	mg/L	-	<0.01	< 0.01	< 0.01	0.03	< 0.01
r-Silica (as SiO2)	mg/L	-	13.7	13.4	13.8	13.8	1.6
Total Organic Carbon	mg/L	-	0.6	0.8	0.7	0.7	0.9
Turbidity	NTU	-	2.4	1.0	0.6	0.7	17.4
Conductivity	µS/cm	-	262	275	280	284	337
Calculated Parameters							
Bicarbonate as CaCO3	mg/L	-	83.9	99.8	99.9	104	118
Carbonate as CaCO3	mg/L	-	0.063	0.236	0.118	0.195	2.21
Hydroxide as CaCO3	mg/L	-	0.004	0.013	0.006	0.010	0.100
Cation sum	meq/L	-	2.55	2.76	2.76	2.66	3.07
Anion sum	meq/L	-	2.73	2.90	2.76	2.85	3.33
% difference	%	-	-3.26	-2.46	0.05	-3.54	-4.11
Theoretical Conductivity	µS/cm	-	262	276	266	266	301
Hardness (as CaCO3)	mg/L	-	92.0	107	108	105	121
Ion Sum (mg/L)	mg/L	-	156	164	159	160	170
Saturation pH (5oC)	units	-	8.2	8.1	8.0	8.0	7.9
Langelier Index (5oC)	-	-	-1.29	-0.65	-0.95	-0.74	0.36

*Health Canada Federal-Provincial-Territorial Committee on Canadian Drinking Water (FTP CDW) Guidelines for Canadian Drinking Water Quality (GCDWQ, October 2014)

^{AO} indicates guideline is an aesthetic objective and is not health based

75

bold/shaded value denotes concentration exceeds GCDWQ

' - ' denotes no guideline, not analyzed, or not applicable

TABLE 7
 General Chemistry and Trace Metals in Groundwater
 River Mist Estates - WSSA
 Maugerville, New Brunswick
 Dillon Project No. 15-1508

Parameter	Units	GCDWQ (2014)	Pumping Well (DW2)				Observation Well (DW1)
			0 Hours (Dec 16/15)	24 Hours (Dec 17/15)	48 Hours (Dec 18/15)	72 Hours (Dec 19/15)	72 Hours (Dec 19/15)
Trace Metals							
Aluminum	µg/L	100 ^{AO}	32	9	12	6	8
Antimony	µg/L	6	<0.1	<0.1	<0.1	<0.1	0.3
Arsenic	µg/L	10	<1	<1	<1	<1	<1
Barium	µg/L	1000	38	37	37	36	210
Beryllium	µg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	-	<1	<1	<1	<1	<1
Boron	µg/L	5000	13	12	10	12	14
Cadmium	µg/L	5	<0.01	0.02	0.01	0.03	<0.01
Calcium	µg/L	-	30,400	35,400	36 000	35 000	39 300
Chromium	µg/L	50	<1	<1	1	1	1
Cobalt	µg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	µg/L	1000 ^{AO}	3	7	3	11	1
Iron	µg/L	300 ^{AO}	210	90	100	60	2940
Lead	µg/L	10	1.4	1.5	0.8	1.6	0.2
Lithium	µg/L	-	1.5	1.4	1.4	1.4	2.7
Magnesium	µg/L	-	3900	4440	4530	4360	5500
Manganese	µg/L	50 ^{AO}	15	5	7	7	353
Molybdenum	µg/L	-	0.2	0.6	0.8	0.9	0.6
Nickel	µg/L	-	<1	<1	<1	<1	<1
Potassium	µg/L	-	1180	1250	1260	1220	1920
Rubidium	µg/L	-	0.6	0.7	0.8	0.8	1.0
Selenium	µg/L	10	<1	<1	<1	<1	<1
Silver	µg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	µg/L	200000 ^{AO}	15,500	13,600	12,700	11,900	10,000
Strontium	µg/L	-	123	139	142	139	196
Tellurium	µg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1
Thallium	µg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	<0.1	<0.1	<0.1	0.1	0.5
Uranium	µg/L	20	0.1	0.5	0.5	0.6	<0.1
Vanadium	µg/L	-	<1	<1	<1	<1	<1
Zinc	µg/L	5000 ^{AO}	5	18	9	32	3

*Health Canada Federal-Provincial-Territorial Committee on Canadian Drinking Water (FTP CDW) Guidelines for Canadian Drinking Water Quality (GCDWQ, October 2014)

^{AO} indicates guideline is an aesthetic objective and is not health based

75

bold/shaded value denotes concentration exceeds GCDWQ

' - ' denotes no guideline, not analyzed, or not applicable

4.0

Conclusions and Recommendations

The results of the pumping test suggest that the aquifer is capable of meeting and exceeding the anticipated demand for the proposed development. A maximum drawdown of 2.1 m was observed in the pumping well (DW2) while minimal drawdowns were observed in the observation well (DW1) while pumping at approximately 200 L/min (290 m³/day) for 72 hours. Recoveries to equilibrium conditions were noted in DW1 and DW2 within approximately 30 seconds after completion of the pumping test. Testing of DW2 for this assessment was completed assuming as much as 290 m³/day could be withdrawn, this is approximately 7 times the estimated daily demand for the proposed development of 40 m³/day of water.

Based on the theoretical and empirical assessments and as a means to maintain a high level of conservatism, Dillon recommends that the allowable total maximum extraction rate from DW2 be not less than 40 m³/day. It is not anticipated that the proposed development will extract more than 40 m³/day, but should the development approach or surpass 50 m³/day, an application for Approval to Operate will be submitted to the NBDELG.

In order to reduce risk of impact from flood waters to the water supply for the proposed development, the following actions will be taken prior to the spring of 2016:

- Casing above ground for DW1 and DW2 will be extended to 8.7 masl.
- A water storage tank and both DW1 and DW2 will be enclosed within a well house to be constructed on the subject site.
- The grade of the area surrounding the future well house will be raised to 8.4 masl.

5.0

Closing Remarks

This report was prepared by Brennan Gourley, EIT, and reviewed by Parrish Arnott, P.Geo., Ryan Dunbar, M.Sc., P.Eng., and by Andrew Blackmer, M.Sc., P.Geo.

Dillon has prepared this report for the exclusive use of Kenny's Developments Ltd. for specific application to the subject site. The Dillon investigation was conducted in accordance with Dillon's scope of work and accepted environmental practices. Limitations to this report are included in this disclaimer presented in Appendix D. No other warranty, expressed or implied, is made.

Appendix A

WSSA Initial Application

October 23, 2015

Mr. K. Cormier
Kenny's Developments Ltd.
330 Route 105
Maugerville, NB E3A 8G2

Mrs. K. Banks
Dillon Consulting Ltd.
1149 Smythe Street, Suite 200
Fredericton, NB E3B 3H4

Mr. Cormier and Mrs. Banks:

RE: EIA Registration #4561-03-1421 – Rivermist Estates Condominium Development Registration Document and Water Supply Source Assessment Initial Application

The Technical Review Committee (TRC) has reviewed the document *WSSA Initial Application – River Mist Estates Development EIA* dated September 23, 2015. This letter hereby constitutes **approval to proceed with the Hydrogeological Assessment**, consisting of field investigations (including drilling wells and pumping tests) to determine the yield and quality of a water supply for the proposed development, **subject to the following conditions:**

- 1) Please ensure that the March 2014 version of the Department of Environment and Local Government (DELG) *Water Supply Source Assessment (WSSA) Guidelines* (available online here: <http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/WaterSupplyAssessmentGuidelines.pdf>) is followed for the well testing and reporting requirements.
- 2) Based on the information provided and the understanding that the activity will not occur within 30m of a watercourse, the Department of Fisheries and Oceans (DFO) has determined that a *Fisheries Act* authorization is not required for the proposed hydrogeological testing. In order to comply with the Act, it is recommended that you follow DFO guidance tools available at <http://www.dfo-mpo.gc.ca/pnw-ppe/measuremesures/index-eng.html>. Should your plans change or if you have omitted some information in your proposal such that your proposal meets the criteria for a site specific review, as described in DFO's web site (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>), you should complete and submit the request for review form available on the web site.



Should you have any questions or concerns about the compliance of your proposal with the *Fisheries Act* (and/or those prohibitions of the *Species at Risk Act* (SARA) that apply to listed aquatic species), you may wish to consult an environmental professional familiar with measures to avoid impacts to fish and aquatic habitat (see <http://www.dfo-mpo.gc.ca/pnw-ppe/env-pro-eng.html>).

- 3) It is our understanding that the well(s) will be drilled and cased above the current ground level (approximate elevation of 6.5 masl) for the hydrogeological assessment. Once the pump testing is complete a decision will be made to use the well(s) or to decommission the well(s) following NBDELG protocols for decommissioning potable wells. If the well(s) are determined to provide adequate yield and quality, the well casing(s) will be extended such that the top of the casing(s) are at an elevation of 8.7 masl and sealed with a 150mm diameter J-Plug. The area surrounding the well casing(s) will then be built up to an elevation of 8.4 masl at a later time to construct a well house which would be large enough for storage tank(s) to meet peak load requirements, if required. The well(s) would either be decommissioned or extend to the proposed elevation before the spring of 2016.

The following points and questions identify items that need to be addressed prior to this project being determined by the Minister and/or are for your information purposes:

- 4) Please provide an overall development/subdivision plan for the proposed project including property boundaries, lot dimensions, location of communal sewage treatment facility, well location(s), and identify neighbouring properties and their wells.
- 5) Regional Service Commission 11 (RSC 11) has advised that condominiums do not fall under the Provincial subdivision regulation; therefore, before construction of the development begins you must apply for a building permit and meet RSC 11's setback regulations and fire separation standards with the design. For further information please contact RSC 11 at (506) 453-2956.
- 6) The PIDs for this development are located within a mapped and consistently documented flood zone along the St. John River. Putting new infrastructure or development in this area might place such infrastructure and its inhabitants at risk of flooding and/or being stranded during flood conditions without access to emergency vehicles when the roads and surrounding accesses will be under water. There is also strong scientific evidence for future climate change impacts including the increased risk of more extreme flood events. Given the information above, how will you mitigate the potential impacts of flooding for this development and its infrastructure? How did you determine that proposed measures will be adequate?
- 7) The proposed development will increase the presence of hardened, impermeable surfaces in an area that is currently capable of storing floodwater. Removal of the floodwater storage/filtration capacity of this area may put greater flood pressure on the surrounding residents and businesses. What impact will the development have on nearby properties and how will these potential impacts be mitigated? Will there be any measures in place to prevent the development from being eroded by the flood waters?
- 8) Please provide detailed information on the proposed communal wastewater/sewage treatment system for the development. Also include a site plan and identify where the system will be located on the property as well as all set backs of the facility to; wells on site,

neighboring wells, watercourses, and property lines. Depending on the details, the system will either be regulated by the Department of Health (DOH) or DELG.

- 9) Will the communal sewage treatment system be designed by a Professional Engineer licensed through the Association of Professional Engineers and Geoscientists of New Brunswick?
- 10) The proposed consumption of water for the project is currently estimated in the document at 38.5 m³/day. If the project approaches or surpasses 50m³/day you must apply to DELG for an Approval to Operate.
- 11) Drilled well(s) must be tested for; bacteriological, inorganic and organic parameters. Results will be provided to DELG and DOH.
- 12) In the event of a flood, will you supply potable water to the residents?
- 13) If the water well(s) are impacted by a flood, then it is recommended that residents wait a minimum of 17 days before determining if their water is acceptable for drinking, based on DELG's procedure. Further, it is recommended to wait 10 days after the flood waters have begun to recede away from the well(s) before beginning the chlorination procedure. Once the well has been chlorinated, you must wait one week before collecting a sample and submitting it to the lab for microbiology analysis.
- 14) A Watercourse and Wetland Alteration Permit will be required prior to any work within 30 metres of the St. John River.
- 15) If you have any questions regarding the hydrogeological requirements for the assessment you can contact Mallory Gillis, DELG Hydrogeologist, directly at (506) 453-3624.
- 16) It is your responsibility to ensure that activities comply with all other applicable acts and regulations, such as the Migratory Birds Convention Act and *Regulations*, and the Species at Risk Act.

If you have any questions regarding the conditions and information in this letter, please feel free to contact me at (506) 453-7108.

Sincerely,



Lee Swanson
Project Manager

Cc. Mr. Parrish Arnott, Dillon Consulting Ltd.
Technical Review Committee

September 23, 2015



New Brunswick Department of Environment and Local Government
20 McGloin Street, Marysville Place
Fredericton, NB
E3B 5H1

Attention: Ms. Lee Swanson

WSSA Initial Application – River Mist Estates Development EIA

Dear Ms. Swanson,

Dillon Consulting Limited (Dillon) was retained by Kenny's Developments Limited (Kenny's) to complete an Environmental Impact Assessment (EIA) including a Water Supply Source Assessment (WSSA) in relation to their River Mist Estates development project (herein "the proposed development"). It is anticipated that the proposed development will include 44 condominium units to be built across the parcels of land legally identified by property identification (PID) numbers 60153483, 60153475, and 60153467, with the intent of selling the condominium units to senior citizens.

This document has been prepared as a means to satisfy the minimum requirements for a WSSA initial application, as per the NBDELG Environmental Impact Assessment WSSA Guidelines (Appendix B).

Name of Proponent

Client Contact

Mr. Kenneth Cormier
Kenny's Developments Ltd.
330 Route 105, Maugerville, NB
E3A 8G2
Tel: 506-260-2980

Consultant Contact

Mrs. Kristin Banks, P. Eng.
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1149 Smythe Street, Suite 200
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506.444.8820
Fax
506.444.8821



Fax: 506-444-8821
Email: KBanks@dillon.ca

Location of drill targets

As per the WSSA guidelines, a minimum of two water supply wells will be installed within the proposed development boundaries. The wells will be installed to diameters of 150 mm, at this time the required depths of the wells are not known. The depths and total numbers of wells needed to be installed will be finalized after the completion of the initial two wells, and will be based upon observed well yield measurements.

The locations of the two mandatory water supply wells have been determined, and the location of a third water supply well, should it be necessary, has also been determined. All three locations of drill targets are located within the proposed development on the parcel of land legally identified by PID number 60153483. Locations of the three drill targets are outlined, along an outline of the proposed development, on Figure 1.

Required Water Quantity

It is estimated that this development project will require a minimum of 38.5 m³/day. This volume is based upon an estimated demand of water of 350 L per person per day and an assumed maximum of 88 people living in 44 condominiums. A safety factor of 25% was added to the calculated daily water demand.

Alternate Water Supply Sources in Area

All residential and commercial properties within the limits of Maugerville are supplied potable water by private water wells. The proposed development is located approximately 0.5 kilometres from the City of Fredericton limits (Southside city limits across the Saint John River.) No other municipal water systems are known to exist within the area of the proposed development.

Hydrogeology as it relates to the project requirements

Based upon the New Brunswick Department of Energy and Mines bedrock geology of the Fredericton Area (NTS 21 G/15) map the proposed River Mist development is located within the Minto Formation of the Pictou Group. The Minto Formation



consists of Late Carboniferous sedimentary deposits. The specific type of bedrock in the project area is unknown.

Based upon the New Brunswick Department of Energy and Mines Granular Aggregate Resource of Fredericton (21 G/15) map the River Mist development is located within alluvium deposits of sand and sand and gravel frequently capped with silt and/or fine sand. Based upon discussion with local land owners this is relatively consistent with what is found in the area and specifically in the project area clay and/or silty clay have been observed across the site.

Outline of the proposed hydrogeological testing and work schedule

Test well drilling and hydraulic testing activities will be carried out by a licensed well driller, under the supervision of Dillon personnel, as per the New Brunswick Clean Water Act. Burpee TM Drilling Ltd. (Burpee), of Keswick Ridge, NB, has been identified as the licensed well driller for use on this project. Commencement of water supply well drilling on the proposed development will take place upon receipt and acceptance of this document by NBDELG representatives.

The following describes the work that is to be completed for the drilling of a new water supply well:

- Complete underground utility clearances prior to completing any drilling activities.
- Construction of two or three 150 mm diameter test wells at the proposed drill target locations with 150 mm steel casing. The geology/hydrostratigraphy will be logged by Dillon staff during the drilling process.
- A preliminary yield assessment will be completed using air lift methods following the construction of each well.
- Based upon the results of the preliminary yield assessment a third well may be drilled to meet the water quantity demands of the proposed development.
- The well(s) with the highest observed yield will undergo step-testing (30 min steps) and a long term pumping test (72 hours) as per the WSSA Guideline. Water levels will be measured in the pumping well(s) as well as the second or third well. Pressure transducers will be used in addition to manual water level measurements to record water levels in the pumping and observation well(s).
- Water samples will be collected from each well at the conclusion of the pump test and submitted to the Research and Productivity Council (RPC) for analysis of general chemistry and trace metals. Additionally, the required water quality samples from each well will be submitted to the NBDELG lab following the testing activities.



- The results of the pumping test will be presented in a report as per the New Brunswick WSSA to the NBDELG.
- The drilling of test/observation wells will be completed during daytime hours.
- Water discharged during the construction, development and testing activities will be managed as necessary to limit erosion and sedimentation.
- Refueling of equipment used during the construction activities will be completed off-site, where possible. Spill management kits will be available throughout construction and testing and authorities will be alerted if necessary.

Potential contamination hazards within 500 m of the proposed drill targets

The proposed development is bounded to the north by the Route 105 and to the south by the Saint John River. Potential contamination hazards in relation to the proposed drill targets could include the various residential properties located along Route 105 and the identified commercial properties located within 500 m of the proposed drill targets (see Table 1). However, it is unlikely that these identified contamination hazards will pose a risk to the proposed water supply.

TABLE 1 - NEARBY COMMERCIAL PROPERTIES

Company Name	Address	PID	Notes	Approximate distance to nearest well target (m)
Furniture Medic	262 Route 105, Maugerville, NB	60152337	N/A	550
Capital Auctions Ltd.	272 Route 105, Maugerville, NB	60152345	N/A	500
Riverside Equipment	280 Route 105, Maugerville, NB	60074853	N/A	450
ALPA Equipment Ltd.	289 Route 105, Maugerville, NB	60073913	Listed as a currently or formerly impacted site under the New Brunswick Remediation Sites Management System	350
Technical Heat Treatment Ltd.	325 Route 105, Maugerville, NB	60165321	N/A	200



Company Name	Address	PID	Notes	Approximate distance to nearest well target (m)
Boudreau Roofing and Sheet Metal Ltd.	327 Route 105, Maugerville, NB	60149580	Appears to be currently vacant and listed as a currently or formerly impacted site under the New Brunswick Remediation Sites Management System	150

Groundwater use problems that have occurred in the area

Based upon information gained during interviews with residents of the Maugerville area, some residences are provided potable water by sandpoint wells (sandpoints). These sandpoints are designed to be installed to relatively shallow depths (approximately 20 feet below ground surface) as a means to draw water from a shallow aquifer (contained within overburden). It was reported that at least one residence of the Maugerville area, with a sandpoint well installed on the property, requires treatment of iron. The presence of iron within a shallow water source is not uncommon and is not necessarily an indication of the presence of iron within a deeper water source (approximately 100 feet below ground surface). The total depth of the potable water supply wells to be installed on the proposed development is not currently known however, it is assumed that they will be installed to a depth of greater than 100 feet below ground surface. Groundwater quality samples will be collected from each well at the conclusion of the pumping test and submitted to the Research and Productivity Council (RPC) for analysis of general chemistry and trace metals.

Watercourse(s) within 60 m of the proposed drill targets

Based on GeoSNB wetland mapping, no wetland areas were identified within 60 metres of the proposed drill targets. The nearest wetland area was identified 300 metres to the east of the nearest drill target.



Site supervisory personnel

Consultant Field Staff

Mr. Parrish Arnott, P. Geo
Dillon Consulting Limited
1149 Smythe Street, Suite 200
Fredericton, NB
E3B 3H4
Tel: 506-444-8820
Fax: 506-444-8821
Email: PArnott@dillon.ca

Licensed Well Driller

Burpee TM Drilling Ltd.
545 Route 616
Keswick Ridge, NB
E6L 1S4
Tel: 506-3634348

Site Maps

A site plan showing the proposed drill target locations is attached.

Contingency plan for open loop earth energy systems

Not applicable.

NBDELG
Page 7
September 23, 2015



Should you have any questions, please do not hesitate to contact the undersigned.

Yours sincerely,

DILLON CONSULTING LIMITED

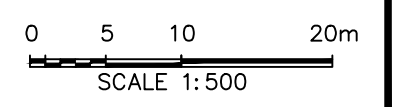
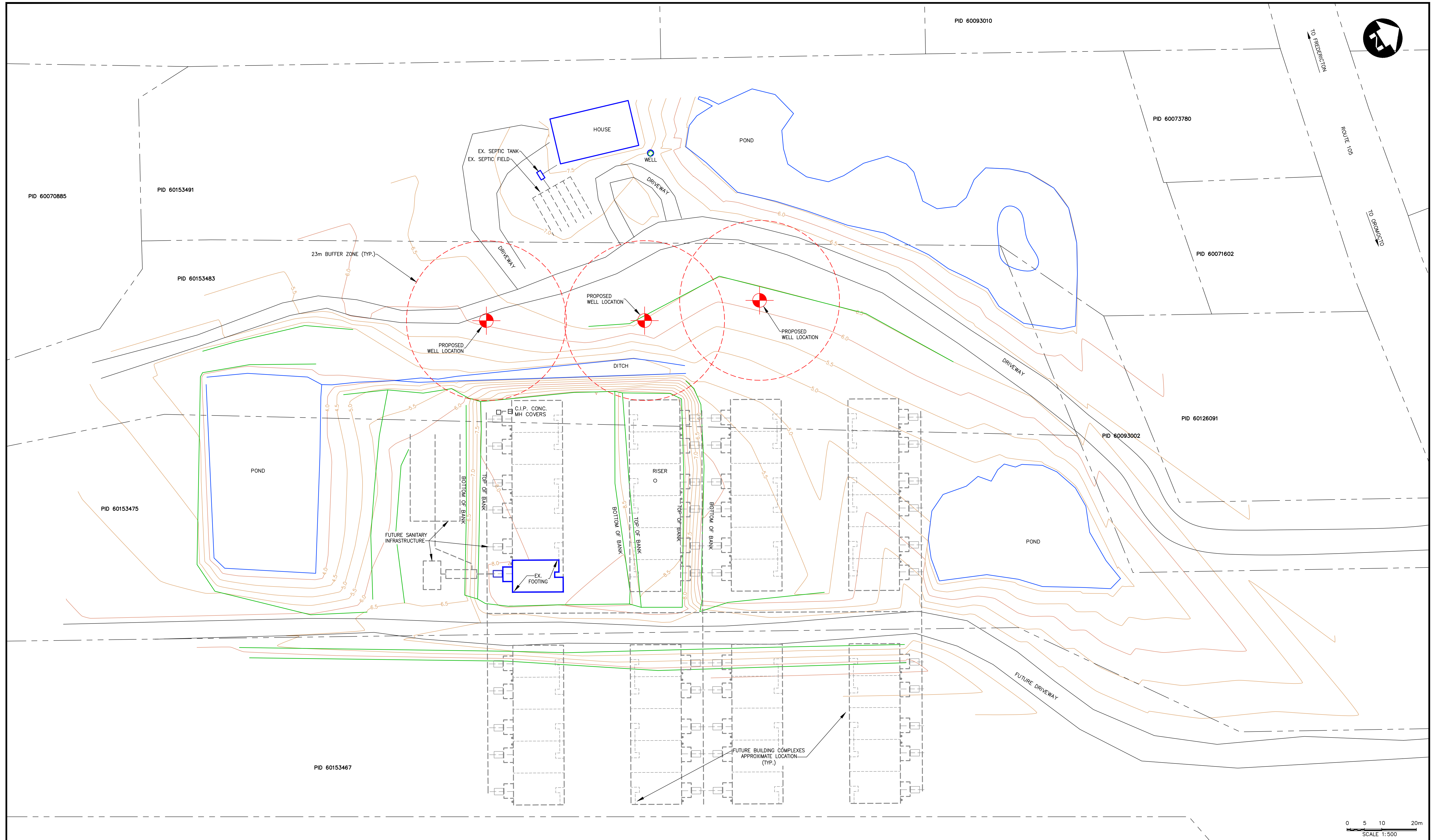
Kristin Banks, P.Eng.
Associate
Project Manager

BCG:trw

Enclosure(s)

cc: Mr. Kenneth Cormier

Our file: 15-2555



Conditions of Use
 Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.
 Do not scale dimensions from drawing.
 Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.



DESIGN	REVIEWED BY
DRAWN	CHECKED BY
DATE	
SCALE	1:500
No.	ISSUED FOR
	DATE
	BY

RIVER MIST ESTATES		PROJECT NO. 15-2555
PROPOSED WELL LOCATIONS		SHEET NO. 1 of 1

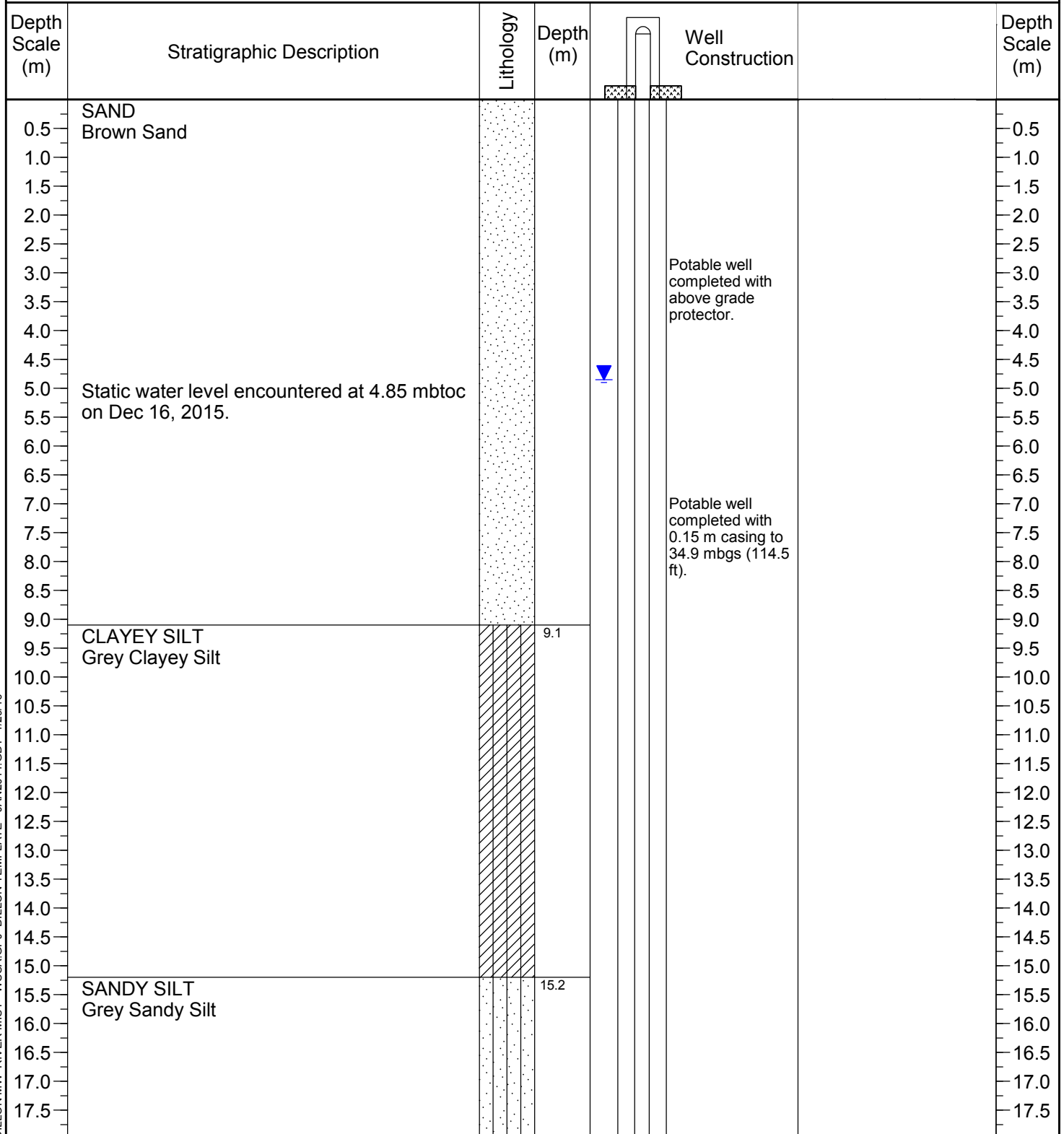
Appendix B

Boreholes and Water Well Drillers Reports



Dillon Consulting
 1149 Smythe Street
 Suite 200, Fredericton, NB
 E3B 3H4
 (506)444-8820
 (506)444-8821

Client: Kenny's Developments Ltd. Project: River Mist Estates - WSSA
 Project No.: 15-2555 Location: 336 Route 105, Maugerville, NB
 Drilling Co.: Burpee TM Drilling Drilling Method: Air Rotary Drill
 Field Representative: B. Gourley Date Started: 11/3/15 Date Completed: 11/4/15



DILLON MW RIVER MIST - WSSA.GPJ DILLON TEMPLATE - JAN2011.GDT 1/29/16

▼ Static Water Level

LITHOLOGY SYMBOLS

- [Dotted pattern] Sand
- [Diagonal lines] Clayey Silt
- [Vertical lines] Sandy Silt
- [Wavy lines] Gravel



Dillon Consulting
 1149 Smythe Street
 Suite 200, Fredericton, NB
 E3B 3H4
 (506)444-8820
 (506)444-8821

Client: Kenny's Developments Ltd. Project: River Mist Estates - WSSA
 Project No.: 15-2555 Location: 336 Route 105, Maugerville, NB
 Drilling Co.: Burpee TM Drilling Drilling Method: Air Rotary Drill
 Field Representative: B. Gourley Date Started: 11/3/15 Date Completed: 11/4/15

Depth Scale (m)	Stratigraphic Description	Lithology	Depth (m)	Well Construction	Depth Scale (m)
	(continued)				
18.5	SANDY SILT				18.5
19.0	Grey Sandy Silt(Continued)				19.0
19.5					19.5
20.0					20.0
20.5					20.5
21.0					21.0
21.5					21.5
22.0					22.0
22.5					22.5
23.0					23.0
23.5		23.5			
24.0		24.0			
24.5		24.5			
25.0		25.0			
25.5		25.5			
26.0		26.0			
26.5		26.5			
27.0		27.0			
27.5	FINE GRAVEL		27.4		27.5
28.0	Grey Fine Grained Gravel		28.0		
28.5			28.5		
29.0			29.0		
29.5			29.5		
30.0			30.0		
30.5			30.5		
31.0			31.0		
31.5		31.5			
32.0		32.0			
32.5		32.5			
33.0		33.0			
33.5	COARSE GRAVEL		33.5		33.5
34.0	Grey Coarse Grained Gravel		34.0		
34.5			34.5		
35.0			35.0		
End of well at 35.1 m (115 ft)			35.1		35.0

DILLON MW RIVER MIST - WSSA.GPJ DILLON TEMPLATE - JAN2011.GDT 1/29/16

Static Water Level

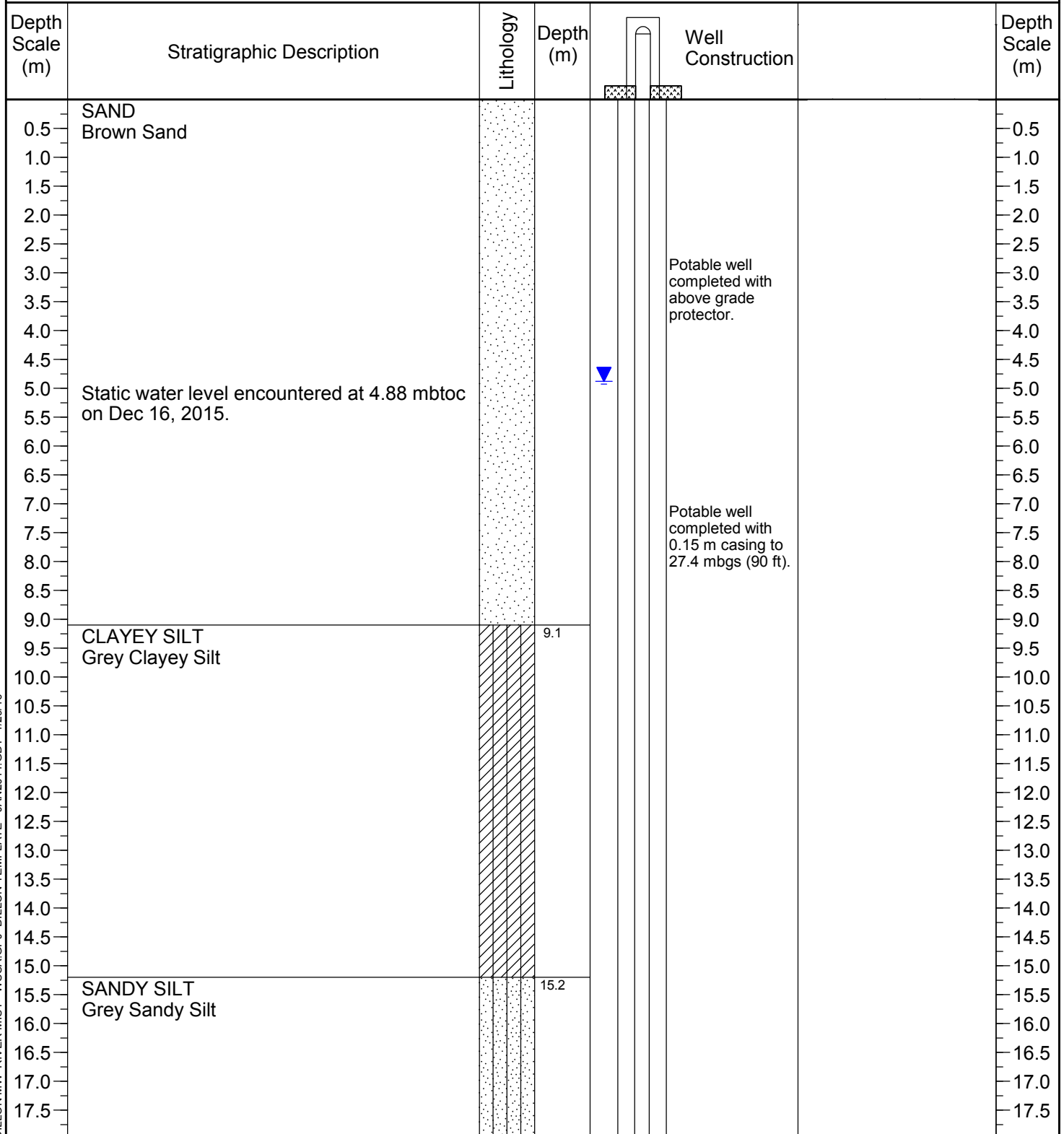
LITHOLOGY SYMBOLS

	Sand		Clayey Silt
	Sandy Silt		Gravel



Dillon Consulting
 1149 Smythe Street
 Suite 200, Fredericton, NB
 E3B 3H4
 (506)444-8820
 (506)444-8821

Client: Kenny's Developments Ltd. Project: River Mist Estates - WSSA
 Project No.: 15-2555 Location: 336 Route 105, Maugerville, NB
 Drilling Co.: Burpee TM Drilling Drilling Method: Air Rotary Drill
 Field Representative: B. Gourley Date Started: 11/5/15 Date Completed: 11/6/15



DILLON MW RIVER MIST - WSSA.GPJ DILLON TEMPLATE - JAN2011.GDT 1/29/16

▼ Static Water Level

LITHOLOGY SYMBOLS

- [Dotted pattern] Sand
- [Diagonal hatching] Clayey Silt
- [Vertical lines] Silty Sand
- [Wavy pattern] Gravel



Dillon Consulting
 1149 Smythe Street
 Suite 200, Fredericton, NB
 E3B 3H4
 (506)444-8820
 (506)444-8821

Client: Kenny's Developments Ltd. Project: River Mist Estates - WSSA
 Project No.: 15-2555 Location: 336 Route 105, Maugerville, NB
 Drilling Co.: Burpee TM Drilling Drilling Method: Air Rotary Drill
 Field Representative: B. Gourley Date Started: 11/5/15 Date Completed: 11/6/15

Depth Scale (m)	Stratigraphic Description	Lithology	Depth (m)	Well Construction	Depth Scale (m)
	(continued)				
18.5	SANDY SILT				18.5
19.0	Grey Sandy Silt (Continued)		19.0		
19.5			19.5		
20.0			20.0		
20.5			20.5		
21.0			21.0		
21.5			21.5		
22.0			22.0		
22.5			22.5		
23.0			23.0		
23.5			23.5		
24.0			24.0		
24.5			24.5		
25.0			25.0		
25.5		25.5			
26.0		26.0			
26.5		26.5			
27.0		27.0			
	COARSE GRAVEL		27.1	Submersible pump set at 22.9 mbgs (75 ft).	27.0
	Gray Coarse Gravel		27.4		27.0
	End of well at 27.4 m (90 ft)				

DILLON MW RIVER MIST - WSSA.GPJ DILLON TEMPLATE - JAN2011.GDT 1/29/16

Static Water Level

LITHOLOGY SYMBOLS

Sand	Clayey Silt
Silty Sand	Gravel

SAMPLE TYPE

* Indicates sample submitted for analysis

DW1 Driller's Report

ENVIRONMENT & LOCAL GOVERNMENT		WATER WELL DRILLER'S REPORT	00038740																								
OFFICE USE ONLY FIELD NO.: _____		HEALTH CODE: _____ LAB NO.: _____ HEALTH OFFICE: _____ EVENT NO.: _____	SAMPLE RECEIVED DATE: _____ YR: _____ MO: _____ DAY: _____																								
TESTING VOUCHER INFORMATION SEE BACK FOR DETAILS PLEASE PRINT INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING		MANDATORY FOR WATER TEST P.I.D. NO. <u>60153483</u>	WELL I.D. NO. <u>53905</u>																								
FIRST NAME: _____ LAST NAME: _____ ADDRESS (MAIL RESULTS TO): _____ CITY/TOWN/VILLAGE: _____ PROV: _____ POSTAL CODE: _____		WELL OWNER INFORMATION INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING FIRST NAME: <u>Ken Cormier</u> LAST NAME: _____ ADDRESS: <u>336 Rt 105</u> CITY/TOWN/VILLAGE: <u>Maugerville N.B.</u> PROVINCE: <u>N.B.</u> POSTAL CODE: <u>E3A 8G2</u>																									
DAYTIME PHONE: _____ FAX NO.: _____ TEL. NO.: _____		WELL LOCATION: SAME AS ABOVE OR CIVIC NUMBER: _____ STREET NAME: <u>Same</u>																									
DO YOU NEED A SAMPLE FOR YOUR MORTGAGE? IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:		CITY/TOWN/VILLAGE: _____ WELL PAID FOR BY PROVINCIAL DEPT. OF: _____ WELL ON RESERVE? YES <input type="checkbox"/> NO <input type="checkbox"/> WELL ALREADY TAGGED? YES <input type="checkbox"/> NO <input type="checkbox"/> OLD WELL I.D.: _____																									
ATTENTION OF: _____ TEL NO.: _____ FAX NO.: _____ SIGNATURE OF WELL OWNER: _____		DRILLER'S LOG * <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>FROM (FT.)</th> <th>TO (FT.)</th> <th>COLOUR</th> <th>ROCK TYPE</th> </tr> </thead> <tbody> <tr> <td>Ground Level</td> <td>30</td> <td>Brown</td> <td>Sand</td> </tr> <tr> <td>30</td> <td>50</td> <td>Grey</td> <td>hard pan</td> </tr> <tr> <td>50</td> <td>90</td> <td>Grey</td> <td>Sandy Silt</td> </tr> <tr> <td>90</td> <td>110</td> <td>Grey</td> <td>Fine Green</td> </tr> <tr> <td>110</td> <td>115</td> <td>Grey</td> <td>Course gravel</td> </tr> </tbody> </table>		FROM (FT.)	TO (FT.)	COLOUR	ROCK TYPE	Ground Level	30	Brown	Sand	30	50	Grey	hard pan	50	90	Grey	Sandy Silt	90	110	Grey	Fine Green	110	115	Grey	Course gravel
FROM (FT.)	TO (FT.)	COLOUR	ROCK TYPE																								
Ground Level	30	Brown	Sand																								
30	50	Grey	hard pan																								
50	90	Grey	Sandy Silt																								
90	110	Grey	Fine Green																								
110	115	Grey	Course gravel																								
WAS THE COST OF THIS WELL FINANCED BY NB HOUSING? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		WELL / WATER USE: INDUSTRIAL <input type="checkbox"/> ABANDONED <input type="checkbox"/> DOMESTIC <input checked="" type="checkbox"/> EXPLORATORY <input type="checkbox"/> MUNICIPAL <input type="checkbox"/> MONITORING <input type="checkbox"/> HEAT PUMP <input type="checkbox"/> OBSERVATION <input type="checkbox"/> OTHER <input type="checkbox"/>																									
TYPE OF WORK COMPLETED: NEW WELL <input checked="" type="checkbox"/> DEEPENED <input type="checkbox"/> OTHER: _____ METHOD: CABLE TOOL <input type="checkbox"/> ROTARY <input checked="" type="checkbox"/> OTHER _____		CASING INSTALLED: LENGTH OF CASING ABOVE GROUND: <u>1</u> FT. <u>6</u> IN. STEEL: <u>6</u> IN DIAM. FROM <u>0</u> FT. TO <u>14.5</u> FT. PVC: _____ IN DIAM. FROM _____ FT. TO _____ FT. SLOTTED _____ IN DIAM. FROM _____ FT. TO _____ FT.																									
SCREENS: TYPE: _____ SLOT SIZE: _____ _____ IN DIAM. FROM _____ FT. TO _____ FT. DRIVE SHOE: YES <input type="checkbox"/> NO <input type="checkbox"/>		SETBACKS: SEE BACK FOR DETAILS SEPTIC TANK (1) <u>N/A</u> FT. SEPTIC TANK (2) _____ FT. FIELD (2) _____ FT. FIELD (1) <u>N/A</u> FT. *RIGHT OF WAY OF ANY PUBLIC ROAD <input type="checkbox"/> (1) <u>500</u> ROAD (2) _____ CENTER OF ROAD <input type="checkbox"/> (1) _____ (2) _____ SETBACKS MEASURED _____ (NEW CONSTRUCTION) APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER _____ (EXISTING CONST.)																									
FLOWING WELL? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES - RATE: _____ igpm (approx.)		TOTAL WELL DEPTH: <u>115</u> FT. DEPTH TO BEDROCK: <u>117</u> FT. WATER BEARING 1 <u>25</u> igpm AT <u>115</u> FT. 2 _____ igpm AT _____ FT. FRACTURE ZONES: 3 _____ igpm AT _____ FT. 4 _____ igpm AT _____ FT.																									
AQUIFER TEST: METHOD: AIR <input checked="" type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> INITIAL WATER LEVEL: <u>10</u> FT. BELOW TOP OF CASING PUMPING RATE <u>27</u> igpm DURATION: <u>1</u> hrs. <u>30</u> min. FINAL WATER LEVEL: <u>10</u> FT. BELOW TOP OF CASING ESTIMATED SAFE YIELD: <u>25</u> igpm		PUMP INSTALLATION: INSTALLED <input type="checkbox"/> NOT INSTALLED <input checked="" type="checkbox"/> PUMP INTAKE SETTING: <u>80</u> FT. BELOW TOP OF CASING (Recommended) PUMP TYPE: SUBMERSIBLE <input checked="" type="checkbox"/> JET <input type="checkbox"/> TURBINE <input type="checkbox"/> OTHER: _____ WELL DISINFECTED? YES <input type="checkbox"/> NO <input type="checkbox"/> TYPE: <u>Chlorine</u>																									
WELL GROUTED? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> FROM _____ FT. TO _____ FT. GROUT TYPE: _____ DRILLING FLUIDS USED: YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> TYPE: _____		DRILLER'S COMMENTS: _____ DRILLING COMPANY: <u>Tom Bueper Drilling Ltd</u> COMPLETION DATE: <u>15/1/05</u> YR. MO. DAY LICENSE NO. <u>294</u>																									
G.P.S. (OPTIONAL) _____ I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT. Signature of Driller: <u>[Signature]</u> Signature of Helper: <u>[Signature]</u>		WHITE - NBELG BLUE - Homeowner / Voucher YELLOW - Homeowner PINK - Drilling Company KEEP THIS REPORT WITH YOUR IMPORTANT DOCUMENTS																									

DW2 Driller's Report

New Brunswick ENVIRONMENT & LOCAL GOVERNMENT		WATER WELL DRILLER'S REPORT	
OFFICE USE ONLY		HEALTH CODE	LAB NO.
FIELD NO.	HEALTH OFFICE	EVENT NO.	SAMPLE RECEIVED DATE
		YR	MO DAY
		SAMPLE RECEIVED BY:	
TESTING VOUCHER INFORMATION		P.I.D. NO.	WELL I.D. NO.
SEE BACK FOR DETAILS PLEASE PRINT		60153483	53906
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING			
FIRST NAME	LAST NAME	WELL OWNER INFORMATION	
ADDRESS (MAIL RESULTS TO:)		INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING	
CITY/TOWN/VILLAGE	PROV. POSTAL CODE	FIRST NAME	LAST NAME
DAYTIME PHONE	FAX NO.	AEN Cormier	
TEL. NO.	SAMPLE COLLECTED	ADDRESS	
YR MO DAY HR MIN AM PM	YR MO DAY HR MIN AM PM	330 Rt 105 Mouserville NB	
DO YOU NEED A SAMPLE FOR YOUR MORTGAGE?		CITY/TOWN/VILLAGE	
IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:		PROV. POSTAL CODE	
SEE BACK FOR DETAILS		E3A-8G2	
ATTENTION OF:		WELL LOCATION: SAME AS ABOVE OR	
TEL NO.	FAX NO.	CIVIC NUMBER STREET NAME	
SIGNATURE OF WELL OWNER		50m	
WAS THE COST OF THIS WELL FINANCED BY NB HOUSING?		CITY/TOWN/VILLAGE	
YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		WELL PAID FOR BY PROVINCIAL DEPT. OF	
WELL / WATER USE:		WELL ON RESERVE?	
INDUSTRIAL <input type="checkbox"/>	ABANDONED <input type="checkbox"/>	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
EXPLORATORY <input type="checkbox"/>	MUNICIPAL <input type="checkbox"/>	WELL ALREADY TAGGED?	
HEAT PUMP <input type="checkbox"/>	OBSERVATION <input type="checkbox"/>	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
DOMESTIC <input checked="" type="checkbox"/>		OLD WELL I.D.	
MONITORING <input type="checkbox"/>			
OTHER <input type="checkbox"/>			
TYPE OF WORK COMPLETED:		DRILLER'S LOG *	
NEW WELL <input checked="" type="checkbox"/> DEEPENED <input type="checkbox"/>		FROM (FT.)	TO (FT.)
OTHER:			COLOUR
METHOD:			ROCK TYPE
CABLE TOOL <input type="checkbox"/> ROTARY <input checked="" type="checkbox"/> OTHER		Ground Level	30
CASING INSTALLED:		30	51
LENGTH OF CASING ABOVE GROUND: 1 FT. 6 IN.		50	88
STEEL: 6 IN DIAM. FROM 0 FT. TO 90.5 FT.		89	90
PVC: IN DIAM. FROM FT. TO FT.			
SLOTTED IN DIAM. FROM FT. TO FT.			
SCREENS: TYPE: SLOT SIZE			
IN DIAM. FROM FT. TO FT.			
DRIVE SHOE: YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>			
SETBACKS: SEE BACK FOR DETAILS			
SEPTIC TANK (1) NA FT.			
SEPTIC TANK (2) FT. FIELD (2) NA FT. FIELD (1) FT.			
*RIGHT OF WAY OF ANY PUBLIC ROAD (1) 500 ROAD (2)			
CENTER OF ROAD (1) (2)			
SETBACKS MEASURED (NEW CONSTRUCTION)			
APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER (EXISTING CONST.)			
FLOWING WELL? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES - RATE: igpm (approx.)		IF INSUFFICIENT SPACE PLEASE USE ADDITIONAL SHEETS	
AQUIFER TEST: METHOD: AIR <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/>		TOTAL WELL DEPTH: 90 FT. DEPTH TO BEDROCK: NA FT.	
INITIAL WATER LEVEL: 10 FT. BELOW TOP OF CASING		WATER BEARING 1 50 igpm AT 90 FT. 2 igpm AT FT.	
PUMPING RATE 4 igpm DURATION: 1 hrs. 30 min.		FRACTURE ZONES: 3 igpm AT FT. 4 igpm AT FT.	
FINAL WATER LEVEL: FT. BELOW TOP OF CASING		PUMP INSTALLATION: INSTALLED <input type="checkbox"/> NOT INSTALLED <input checked="" type="checkbox"/>	
ESTIMATED SAFE YIELD: 50 igpm		PUMP INTAKE SETTING: 60 FT. BELOW TOP OF CASING (Recommended)	
WELL GROUTED? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		PUMP TYPE: SUBMERSIBLE <input checked="" type="checkbox"/> JET <input type="checkbox"/> TURBINE <input type="checkbox"/>	
FROM FT. TO FT. GROUT TYPE:		OTHER	
DRILLING FLUIDS USED: YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		WELL DISINFECTED? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
TYPE:		TYPE C Chlorine	
DRILLER'S COMMENTS		DRILLING COMPANY: Tim Bepko Drilling Ltd	
		COMPLETION DATE: 15/1/06	
		LICENSE NO. 294	
G.P.S. (OPTIONAL)		WHITE - NBELG	
		BLUE - Homeowner / Voucher	
		YELLOW - Homeowner	
		PINK - Drilling Company	
I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT.		KEEP THIS REPORT WITH YOUR IMPORTANT DOCUMENTS	
Signature of Driller: <i>Steve Beall</i>		Signature of Helper: <i>Mark Murphy</i>	
Vacant lot drilling to determine availability of water for housing project			

Appendix C

Laboratory Analytical Certificates

Report ID: 200849-ML-W1
Report Date: 22-Dec-15
Date Received: 21-Dec-15

CERTIFICATE OF ANALYSIS
for
Dillon Consulting Limited
1149 Smythe Street, Suite 200
Fredericton, NB E3B 3H4

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1368
Fax: 506.452.1395
www.rpc.ca

Attention: Joe Hoyt

Project/Job #: 15-2555
Client Location: River Mist
Microbiological Examination of Water

RPC Sample ID:				200849-1
Client Sample ID:				DW2-72 HR
Date Sampled:				19-Dec-15
Time Sampled:				12:00:00 PM
Analytes	Method ID	Date Analyzed	Units	
Total Coliforms	FFA01	21-Dec-15	MPN/100mL	
E. coli	FFA01	21-Dec-15	MPN/100mL	

This report relates only to the sample(s) and information provided to the laboratory.
Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.



Cornelia Maston
Acting Micro Supervisor
Food, Fisheries & Aquaculture



Gillian Hodges
Micro Technician
Food, Fisheries & Aquaculture

Report ID: 200849-IAS
 Report Date: 04-Jan-16
 Date Received: 21-Dec-15

CERTIFICATE OF ANALYSIS

for

Dillon Consulting Limited
 1149 Smythe Street, Suite 200
 Fredericton, NB E3B 3H4



921 College Hill Rd
 Fredericton NB
 Canada E3B 6Z9
 Tel: 506.452.1212
 Fax: 506.452.0594
 www.rpc.ca

Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Water

RPC Sample ID:			200849-1	200849-2
Client Sample ID:			DW2-72 HR	DW1-72 HR
Date Sampled:			19-Dec-15	19-Dec-15
Analytes	Units	RL		
Sodium	mg/L	0.05	11.9	10.0
Potassium	mg/L	0.02	1.22	1.92
Calcium	mg/L	0.05	35.0	39.3
Magnesium	mg/L	0.01	4.36	5.50
Iron	mg/L	0.02	0.06	2.94
Manganese	mg/L	0.001	0.007	0.353
Copper	mg/L	0.001	0.011	0.001
Zinc	mg/L	0.001	0.032	0.003
Ammonia (as N)	mg/L	0.05	< 0.05	< 0.05
pH	units	-	7.3	8.3
Alkalinity (as CaCO ₃)	mg/L	2	104	120
Chloride	mg/L	0.5	20.5	27.2
Sulfate	mg/L	1	9	8
Nitrate + Nitrite (as N)	mg/L	0.05	0.11	< 0.05
o-Phosphate (as P)	mg/L	0.01	0.03	< 0.01
r-Silica (as SiO ₂)	mg/L	0.1	13.8	1.6
Carbon - Total Organic	mg/L	0.5	0.7	0.9
Turbidity	NTU	0.1	0.7	17.4
Conductivity	µS/cm	1	284	337
Calculated Parameters				
Bicarbonate (as CaCO ₃)	mg/L	-	104.	118.
Carbonate (as CaCO ₃)	mg/L	-	0.195	2.21
Hydroxide (as CaCO ₃)	mg/L	-	0.010	0.100
Cation Sum	meq/L	-	2.66	3.07
Anion Sum	meq/L	-	2.85	3.33
Percent Difference	%	-	-3.54	-4.11
Theoretical Conductivity	µS/cm	-	266	301
Hardness (as CaCO ₃)	mg/L	0.2	105	121
Ion Sum	mg/L	-	160	170
Saturation pH (5°C)	units	-	8.0	7.9
Langelier Index (5°C)	-	-	-0.74	0.36

This report relates only to the sample(s) and information provided to the laboratory.

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Peter Crowhurst, B.Sc., C.Chem
 Analytical Chemist
 Inorganic Analytical Chemistry

Krista Skinner
 Chemical Technician
 Inorganic Analytical Chemistry

Report ID: 200849-IAS
 Report Date: 04-Jan-16
 Date Received: 21-Dec-15

CERTIFICATE OF ANALYSIS

for

Dillon Consulting Limited
 1149 Smythe Street, Suite 200
 Fredericton, NB E3B 3H4



921 College Hill Rd
 Fredericton NB
 Canada E3B 6Z9
 Tel: 506.452.1212
 Fax: 506.452.0594
 www.rpc.ca

Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Metals in Water

RPC Sample ID:		200849-1	200849-2
Client Sample ID:		DW2-72 HR	DW1-72 HR
Date Sampled:		19-Dec-15	19-Dec-15
Analytes	Units	RL	
Aluminum	µg/L	1	6
Antimony	µg/L	0.1	< 0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	36
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	12
Cadmium	µg/L	0.01	0.03
Calcium	µg/L	50	35000
Chromium	µg/L	1	1
Cobalt	µg/L	0.1	< 0.1
Copper	µg/L	1	11
Iron	µg/L	20	60
Lead	µg/L	0.1	1.6
Lithium	µg/L	0.1	1.4
Magnesium	µg/L	10	4360
Manganese	µg/L	1	7
Molybdenum	µg/L	0.1	0.9
Nickel	µg/L	1	< 1
Potassium	µg/L	20	1220
Rubidium	µg/L	0.1	0.8
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	11900
Strontium	µg/L	1	139
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	0.1
Uranium	µg/L	0.1	0.6
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	32

Report ID: 200849-IAS
Report Date: 04-Jan-16
Date Received: 21-Dec-15

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Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
Ammonia	4.M47	APHA 4500-NH ₃ G	"Phenate" Colourimetry
pH	4.M03	APHA 4500-H ⁺ B	pH Electrode - Electrometric
Alkalinity (as CaCO ₃)	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	4.M45	APHA 4500-SO ₄ E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO ₃ H	Hydrazine Red., Derivatization, Colourimetry
o-Phosphate (as P)	4.M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO ₂)	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report ID: 200826-IAS
 Report Date: 30-Dec-15
 Date Received: 18-Dec-15

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 www.rpc.ca

Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Water

RPC Sample ID:		200826-1	
Client Sample ID:		DW2-48 HR	
Date Sampled:		18-Dec-15	
Analytes	Units	RL	
Sodium	mg/L	0.05	12.7
Potassium	mg/L	0.02	1.26
Calcium	mg/L	0.05	36.0
Magnesium	mg/L	0.01	4.53
Iron	mg/L	0.02	0.10
Manganese	mg/L	0.001	0.007
Copper	mg/L	0.001	0.003
Zinc	mg/L	0.001	0.009
Ammonia (as N)	mg/L	0.05	< 0.05
pH	units	-	7.1
Alkalinity (as CaCO ₃)	mg/L	2	100
Chloride	mg/L	0.5	20.0
Sulfate	mg/L	1	9
Nitrate + Nitrite (as N)	mg/L	0.05	0.10
o-Phosphate (as P)	mg/L	0.01	< 0.01
r-Silica (as SiO ₂)	mg/L	0.1	13.8
Carbon - Total Organic	mg/L	0.5	0.7
Turbidity	NTU	0.1	0.6
Conductivity	µS/cm	1	280
Calculated Parameters			
Bicarbonate (as CaCO ₃)	mg/L	-	99.9
Carbonate (as CaCO ₃)	mg/L	-	0.118
Hydroxide (as CaCO ₃)	mg/L	-	0.006
Cation Sum	meq/L	-	2.76
Anion Sum	meq/L	-	2.76
Percent Difference	%	-	0.05
Theoretical Conductivity	µS/cm	-	266
Hardness (as CaCO ₃)	mg/L	0.2	108
Ion Sum	mg/L	-	159
Saturation pH (5°C)	units	-	8.0
Langelier Index (5°C)	-	-	-0.95

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A. Ross Kean, M.Sc.
 Department Head
 Inorganic Analytical Chemistry

Peter Crowhurst, B.Sc., C.Chem
 Analytical Chemist
 Inorganic Analytical Chemistry

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Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Metals in Water

RPC Sample ID:			200826-1
Client Sample ID:			DW2-48 HR
Date Sampled:			18-Dec-15
Analytes	Units	RL	
Aluminum	µg/L	1	12
Antimony	µg/L	0.1	< 0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	37
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	10
Cadmium	µg/L	0.01	0.01
Calcium	µg/L	50	36000
Chromium	µg/L	1	1
Cobalt	µg/L	0.1	< 0.1
Copper	µg/L	1	3
Iron	µg/L	20	100
Lead	µg/L	0.1	0.8
Lithium	µg/L	0.1	1.4
Magnesium	µg/L	10	4530
Manganese	µg/L	1	7
Molybdenum	µg/L	0.1	0.8
Nickel	µg/L	1	< 1
Potassium	µg/L	20	1260
Rubidium	µg/L	0.1	0.8
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	12700
Strontium	µg/L	1	142
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Uranium	µg/L	0.1	0.5
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	9

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<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
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Alkalinity (as CaCO ₃)	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	4.M45	APHA 4500-SO ₄ E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO ₃ H	Hydrazine Red., Derivatization, Colourimetry
o-Phosphate (as P)	4.M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO ₂)	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report ID: 200759-IAS
 Report Date: 23-Dec-15
 Date Received: 17-Dec-15

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Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Water

RPC Sample ID:		200759-1	
Client Sample ID:		DW2-24 HR	
Date Sampled:		17-Dec-15	
Analytes	Units	RL	
Sodium	mg/L	0.05	13.6
Potassium	mg/L	0.02	1.25
Calcium	mg/L	0.05	35.4
Magnesium	mg/L	0.01	4.44
Iron	mg/L	0.02	0.09
Manganese	mg/L	0.001	0.005
Copper	mg/L	0.001	0.007
Zinc	mg/L	0.001	0.018
Ammonia (as N)	mg/L	0.05	< 0.05
pH	units	-	7.4
Alkalinity (as CaCO ₃)	mg/L	2	100
Chloride	mg/L	0.5	25.0
Sulfate	mg/L	1	9
Nitrate + Nitrite (as N)	mg/L	0.05	0.13
o-Phosphate (as P)	mg/L	0.01	< 0.01
r-Silica (as SiO ₂)	mg/L	0.1	13.4
Carbon - Total Organic	mg/L	0.5	0.8
Turbidity	NTU	0.1	1.0
Conductivity	µS/cm	1	275
Calculated Parameters			
Bicarbonate (as CaCO ₃)	mg/L	-	99.8
Carbonate (as CaCO ₃)	mg/L	-	0.236
Hydroxide (as CaCO ₃)	mg/L	-	0.013
Cation Sum	meq/L	-	2.76
Anion Sum	meq/L	-	2.90
Percent Difference	%	-	-2.46
Theoretical Conductivity	µS/cm	-	276
Hardness (as CaCO ₃)	mg/L	0.2	107
Ion Sum	mg/L	-	164
Saturation pH (5°C)	units	-	8.1
Langelier Index (5°C)	-	-	-0.65

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A. Ross Kean, M.Sc.
 Department Head
 Inorganic Analytical Chemistry

Peter Crowhurst, B.Sc., C.Chem
 Analytical Chemist
 Inorganic Analytical Chemistry

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 Report Date: 23-Dec-15
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 www.rpc.ca

Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Metals in Water

RPC Sample ID:			200759-1
Client Sample ID:			DW2-24 HR
Date Sampled:			17-Dec-15
Analytes	Units	RL	
Aluminum	µg/L	1	9
Antimony	µg/L	0.1	< 0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	37
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	12
Cadmium	µg/L	0.01	0.02
Calcium	µg/L	50	35400
Chromium	µg/L	1	< 1
Cobalt	µg/L	0.1	< 0.1
Copper	µg/L	1	7
Iron	µg/L	20	90
Lead	µg/L	0.1	1.5
Lithium	µg/L	0.1	1.4
Magnesium	µg/L	10	4440
Manganese	µg/L	1	5
Molybdenum	µg/L	0.1	0.6
Nickel	µg/L	1	< 1
Potassium	µg/L	20	1250
Rubidium	µg/L	0.1	0.7
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	13600
Strontium	µg/L	1	139
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Uranium	µg/L	0.1	0.5
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	18

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Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
Ammonia	4.M47	APHA 4500-NH ₃ G	"Phenate" Colourimetry
pH	4.M03	APHA 4500-H ⁺ B	pH Electrode - Electrometric
Alkalinity (as CaCO ₃)	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	4.M45	APHA 4500-SO ₄ E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO ₃ H	Hydrazine Red., Derivatization, Colourimetry
o-Phosphate (as P)	4.M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO ₂)	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report ID: 200671-IAS
 Report Date: 23-Dec-15
 Date Received: 16-Dec-15

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 Fax: 506.452.0594
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Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Water

RPC Sample ID:		200671-1	
Client Sample ID:		DW2-OHR	
Date Sampled:		16-Dec-15	
Analytes	Units	RL	
Sodium	mg/L	0.05	15.5
Potassium	mg/L	0.02	1.18
Calcium	mg/L	0.05	30.4
Magnesium	mg/L	0.01	3.90
Iron	mg/L	0.02	0.21
Manganese	mg/L	0.001	0.015
Copper	mg/L	0.001	0.003
Zinc	mg/L	0.001	0.005
Ammonia (as N)	mg/L	0.05	< 0.05
pH	units	-	6.9
Alkalinity (as CaCO ₃)	mg/L	2	84
Chloride	mg/L	0.5	29.2
Sulfate	mg/L	1	10
Nitrate + Nitrite (as N)	mg/L	0.05	0.22
o-Phosphate (as P)	mg/L	0.01	< 0.01
r-Silica (as SiO ₂)	mg/L	0.1	13.7
Carbon - Total Organic	mg/L	0.5	0.6
Turbidity	NTU	0.1	2.4
Conductivity	µS/cm	1	262
Calculated Parameters			
Bicarbonate (as CaCO ₃)	mg/L	-	83.9
Carbonate (as CaCO ₃)	mg/L	-	0.063
Hydroxide (as CaCO ₃)	mg/L	-	0.004
Cation Sum	meq/L	-	2.55
Anion Sum	meq/L	-	2.73
Percent Difference	%	-	-3.26
Theoretical Conductivity	µS/cm	-	262
Hardness (as CaCO ₃)	mg/L	0.2	92.0
Ion Sum	mg/L	-	156
Saturation pH (5°C)	units	-	8.2
Langelier Index (5°C)	-	-	-1.29

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 Department Head
 Inorganic Analytical Chemistry

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 www.rpc.ca

Attention: Joe Hoyt

Project #: 15-2555

Location: River Mist

Analysis of Metals in Water

RPC Sample ID:			200671-1
Client Sample ID:			DW2-OHR
Date Sampled:			16-Dec-15
Analytes	Units	RL	
Aluminum	µg/L	1	32
Antimony	µg/L	0.1	< 0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	38
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	13
Cadmium	µg/L	0.01	< 0.01
Calcium	µg/L	50	30400
Chromium	µg/L	1	< 1
Cobalt	µg/L	0.1	< 0.1
Copper	µg/L	1	3
Iron	µg/L	20	210
Lead	µg/L	0.1	1.4
Lithium	µg/L	0.1	1.5
Magnesium	µg/L	10	3900
Manganese	µg/L	1	15
Molybdenum	µg/L	0.1	0.2
Nickel	µg/L	1	< 1
Potassium	µg/L	20	1180
Rubidium	µg/L	0.1	0.6
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	15500
Strontium	µg/L	1	123
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Uranium	µg/L	0.1	0.1
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	5

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<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
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pH	4.M03	APHA 4500-H ⁺ B	pH Electrode - Electrometric
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Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	4.M45	APHA 4500-SO ₄ E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO ₃ H	Hydrazine Red., Derivatization, Colourimetry
o-Phosphate (as P)	4.M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO ₂)	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
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Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Appendix D

Disclaimer

DISCLAIMER

The material in this report reflects Dillon's best judgement in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions based on this report.

References

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Appendix B

Regulatory Environment

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
PROVINCIAL (New Brunswick) LEGISLATION, GUIDELINES AND PERMITS		
<i>Clean Environment Act</i>	New Brunswick Department of Environment and Local Government (DELG)	Undertaking on Schedule A of the EIA Regulation.
<i>Clean Environment Act – Certificate of Approval to Construct and Operate</i>	DELG	The project must comply with provincial approvals to operate.
<i>Clean Environment Act - Water Quality Regulation</i>	DELG	The Water Quality Regulation (82-126) - Clean Environment Act requires owners or operators of a source of water contaminants to obtain an approval for the construction, operation, or modification of the source. This applies to anyone constructing, operating, and/or modifying a facility that is considered by the department to be a source of contaminant. This applies to most existing or new industrial and some commercial or institutional facilities in New Brunswick.
<i>Clean Air Act - Air Quality Regulation</i>	DELG	Every source of emissions in the province, whether it's an individual or company, must obtain an Air Quality Approval and specifies operating conditions and emission limits. Approvals are classified according to the volume of emissions released -- the lower the volume of emissions, the lower the class designation. Class 1 sources release the most emissions in the province. Other resources are designated as Class 2, 3 or 4 facilities, depending on the level of their emissions. Only Class 1 sources have a formal, public participation component in their approval process.
<i>Clean Water Act</i>	DELG	Wetland and Watercourse Alteration Regulation for working within 30 m of a wetland/watercourse.
<i>Clean Water Act - Potable Water Regulation</i>	DELG	An owner of a regulated water supply system shall have a sampling plan approved by the Minister and ensure that water in the system is collected and tested in accordance with the plan. The plan shall include frequency of testing, parameters to be tested for, description of sample collection locations, date sampling is to commence, and any other information the Minister considers necessary.
<i>Petroleum Product Storage and Handling Regulation</i>	DELG	Authorization to store and handle petroleum products above and below ground.
Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution, and Operation of Drinking Water Supply Systems 2004	DELG	Guide for developing and designing water supply projects in Atlantic Canada.
Guideline for Management of Contaminated Sites Version 2	DELG	Outlines roles and responsibilities for those involved with contaminated site management based on a risk-based approach. Addresses protection of human health and the environment.
Atlantic RBCA User Guidance (Revised January 2015)	DELG	Risk-Based approach to contaminated sites management and applicable criteria for site assessment.
<i>New Brunswick Species at Risk Act</i>	New Brunswick Department of Natural Resources	To prevent wildlife species from being extirpated from the Province, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to conserve species of special concern to prevent them from becoming endangered or threatened.
<i>New Brunswick Heritage Protection Act</i>	Tourism, Heritage and Culture	The Act explicitly confirms the Province's ownership of all archaeological, palaeontological and burial site heritage objects in New Brunswick. Any such objects determined to be of aboriginal origin are specifically 'held in trust' on behalf of First Nations people and their communities. The legislation requires mandatory reporting of all potential heritage object discoveries to provincial authorities, introduces regulations for heritage impact assessment, and prohibits the alteration of any heritage place in the Province without specific government approval.
Duty to Consult Policy	Aboriginal Affairs New Brunswick	Government of New Brunswick will consult with First Nations before an action or decision is taken that may adversely impact Aboriginal and treaty rights.
FEDERAL LEGISLATION, GUIDELINES AND PERMITS		
<i>Fisheries Act</i>	Fisheries and Oceans Canada (DFO)	Aims to provide for the sustainability and ongoing productivity of commercial, recreational and Aboriginal fisheries. The four factors to be taken into account by the Minister in decision-making (e.g. issuing authorizations) or making regulations are: <ul style="list-style-type: none"> • The contribution of the relevant fish to the on-going productivity of commercial, recreational or Aboriginal fisheries; • Fisheries management objectives; • Whether there are measures and standards to avoid, mitigate or offset serious harm to fish that are part of a commercial, recreational or Aboriginal fishery; and, • The public interest. Taken together, these provide a framework and direction to the Minister and Fisheries and Oceans Canada staff for decision-making, developing regulations and implementing the regulatory regime and program.
Guidelines for Canadian Drinking Water Quality Summary Table (October 2014)	Environment Canada	The Guidelines give specific limits for concentrations of water quality parameters including microbiological parameters, chemical and physical parameters, and radiological parameters.
Migratory Birds Convention Acts (MBCA) and Regulations	Environment Canada	Effects on migratory birds or their habitat.
Canadian Environmental Protection Act	Environment Canada/Health Canada	Accidents or spills leading to potential pollution or impacts to the environment and human health
<i>Canadian Environmental Protection Act</i> Environmental Emergency Regulations	Environment Canada/Health Canada	Aims at enhancing the protection of the environment and human health in environmental emergency situations by promoting prevention and ensuring preparedness, response and recovery. They will mandate persons who own or manage specified toxic and hazardous substances at or above the specified thresholds to provide required information on the substance(s), their quantities and to prepare and implement environmental emergency plans.
<i>Canada Labour Code</i>	Human Resources and Skills Development Canada	Provides direction on safety issues to ensure that all projects must be conducted in a safe manner and ensure that no environmental aspects infringe on the safety of a federal site, workers or occupants.
<i>Transportation of Dangerous Goods Act</i>	Transport Canada	The Act applies to all shipping and handling dangerous goods, offering for transport and transporting of dangerous goods by any means of transport whether or not the goods originate from or are destined for any place or places in Canada.
<i>Canadian Electrical Code</i>	Canadian Standards Association	Electrical fixtures and controls in screening areas where hazardous gases may accumulate shall comply.

Appendix C

Atlantic Canada Conservation Data Center (ACCDC) Report



DATA REPORT 5426: Maugerville, NB

Prepared 25 August 2015
by J. Churchill, Data Manager

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- 2.2 Fauna
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3.0 Special Areas

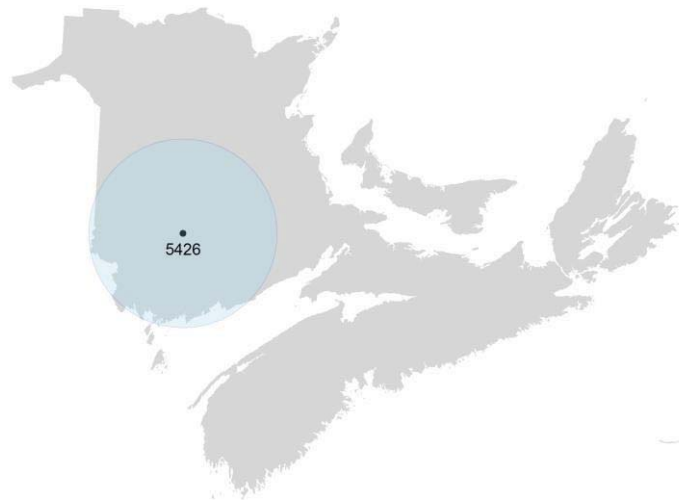
- 3.1 Managed Areas
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Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the ACCDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
MaugervilleNB_5426ob.xls	All Rare and legally protected <i>Flora and Fauna</i> within 5 km of your study area
MaugervilleNB_5426ob100km.xls	A list of Rare and legally protected <i>Flora and Fauna</i> within 100 km of your study area
MaugervilleNB_5426ma.xls	All <i>Managed Areas</i> in your study area
MaugervilleNB_5426sa.xls	All <i>Significant Natural Areas</i> in your study area
MaugervilleNB_5426ff.xls	Rare and common <i>Freshwater Fish</i> in your study area (DFO database)

1.2 RESTRICTIONS

The ACCDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting ACCDC data, recipients assent to the following limits of use:

- a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
- b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
- c) The ACCDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
- d) ACCDC data responses are restricted to the data in our Data System at the time of the data request.
- e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
- f) ACCDC data responses are not to be construed as exhaustive inventories of taxa in an area.
- g) The absence of a taxon cannot be inferred by its absence in an ACCDC data response.

1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

Please direct any additional questions about ACCDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries

Sean Blaney, Senior Scientist, Executive Director

Tel: (506) 364-2658

sblaney@mta.ca

Animals (Fauna)

John Klymko, Zoologist

Tel: (506) 364-2660

jklymko@mta.ca

Plant Communities

Sarah Robinson, Community Ecologist

Tel: (506) 364-2664

srobinson@mta.ca

Data Management, GIS

James Churchill, Data Manager

Tel: (902) 679-6146

jlchurchill@mta.ca

Billing

Jean Breau

Tel: (506) 364-2659

jrbreau@mta.ca

Questions on the biology of Federal Species at Risk can be directed to ACCDC: (506) 364-2657, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Stewart Lusk, Natural Resources: (506) 453-7110.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Sherman Boates, NSDNR: (902) 679-6146. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NSDNR Regional Biologist:

Western: Duncan Bayne

(902) 648-3536

baynedz@gov.ns.ca

Western: Donald Sam

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Eastern: Donald Anderson

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andersdg@gov.ns.ca

Eastern: Terry Power

(902) 563-3370

powertd@gov.ns.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Rosemary Curley, PEI Dept. of Agriculture and Forestry: (902) 368-4807.

2.0 RARE AND ENDANGERED SPECIES

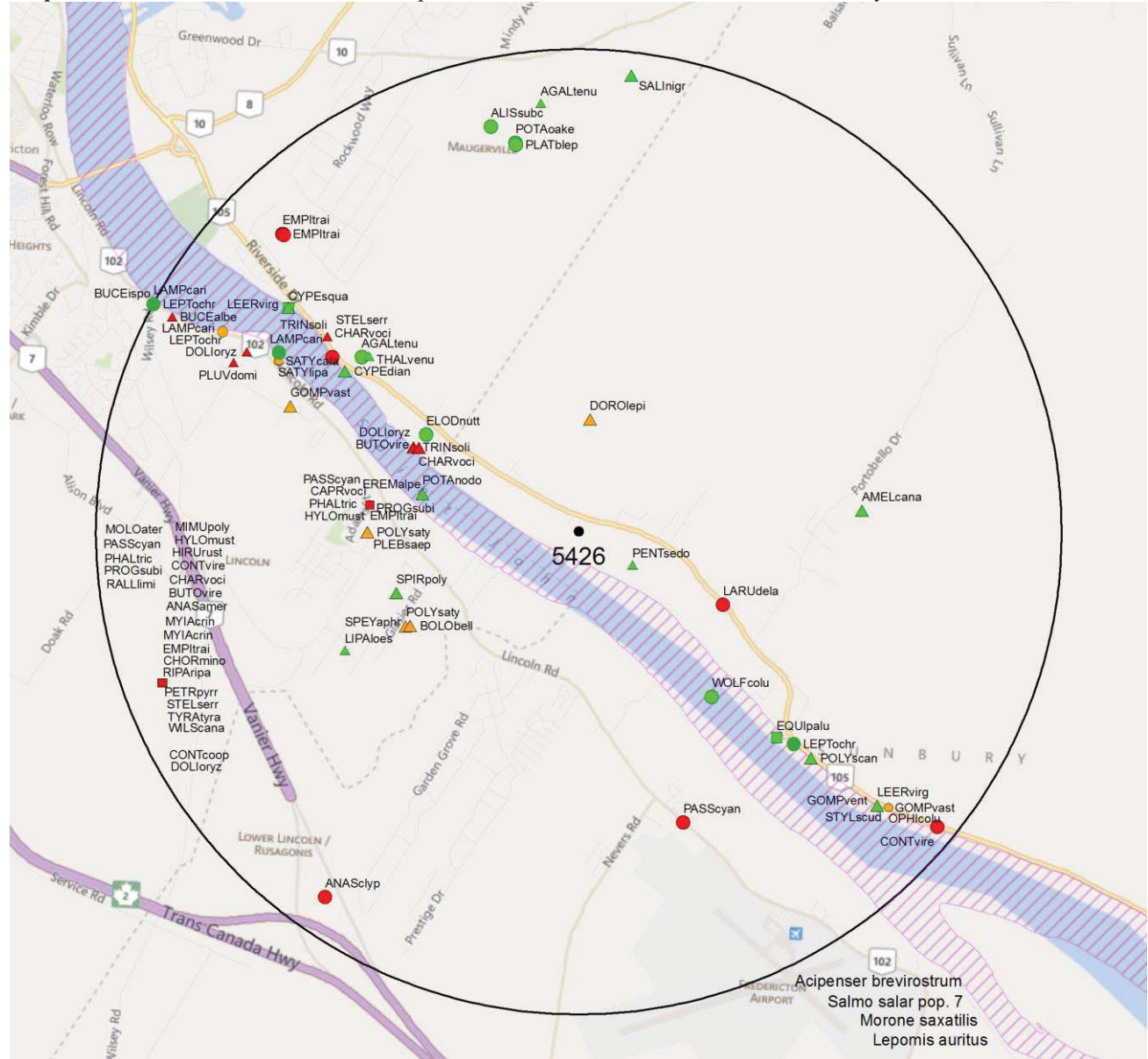
2.1 FLORA

A 5 km buffer around the study area contains 23 records of 18 vascular, no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

A 5 km buffer around the study area contains 101 records of 30 vertebrate, 25 records of 13 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within 5 km of the study area.



RESOLUTION

- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- △ 3.0 within kilometers
- △ 2.7 within 500s of meters
- ◇ 2.0 within 100s of meters
- ◇ 1.7 within 10s of meters

HIGHER TAXON

- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

Acipenser brevirostrum
Salmo salar pop. 7
Morone saxatilis
Lepomis auritus

3.0 SPECIAL AREAS

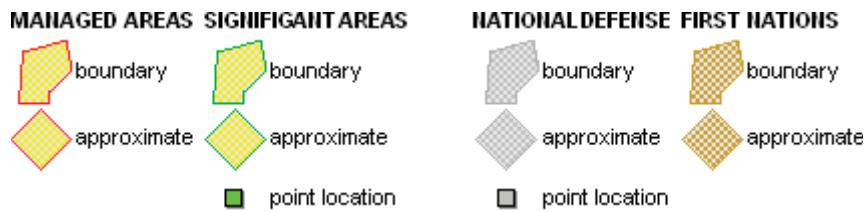
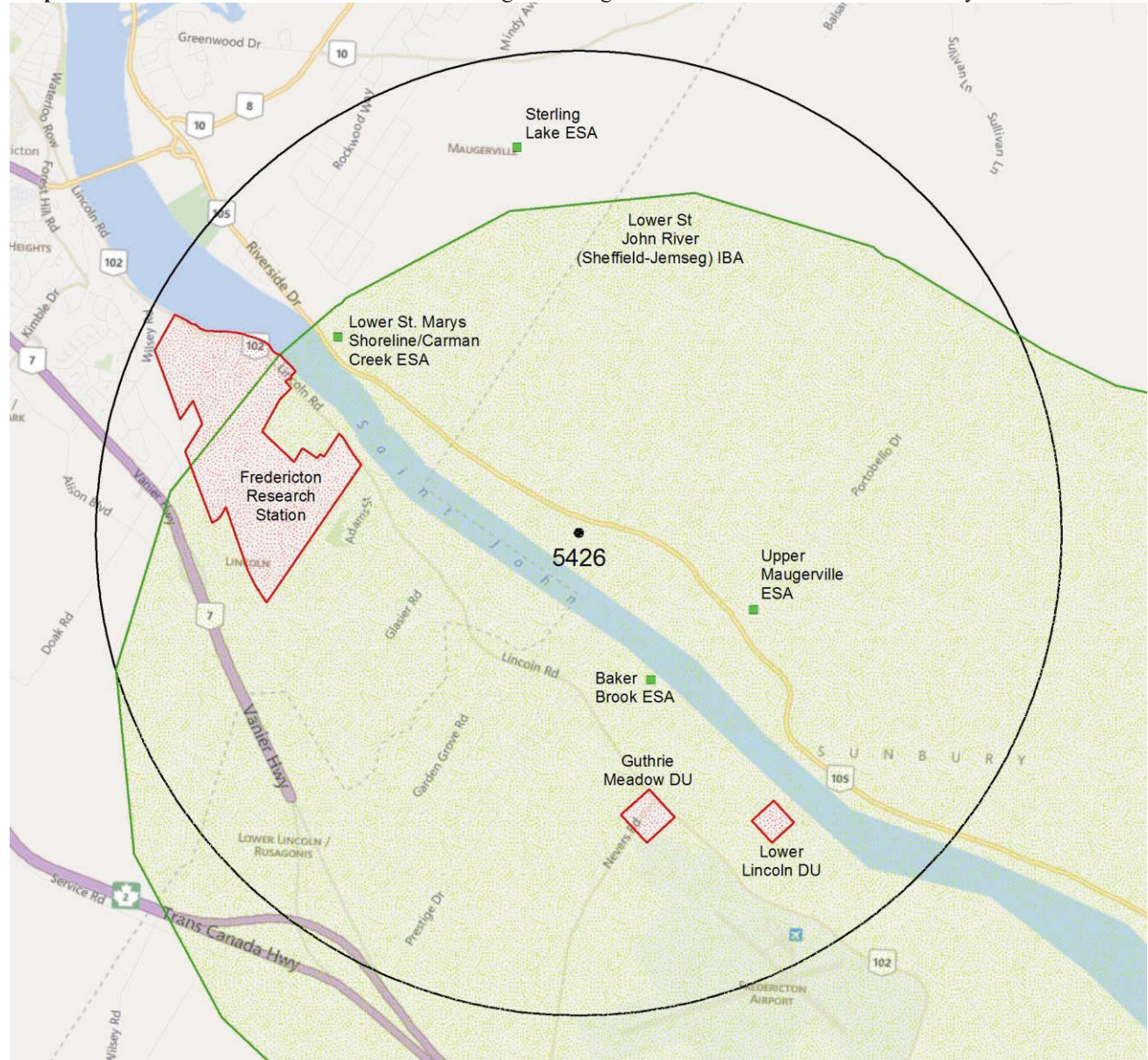
3.1 MANAGED AREAS

The GIS scan identified 3 managed areas in the vicinity of the study area (Map 3 and attached file: *ma*.xls)

3.2 SIGNIFICANT AREAS

The GIS scan identified 5 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.xls)

Map 3: Boundaries and/or locations of known Managed and Significant Areas within 5 km of the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding “location-sensitive” species, section 4.3) within the 5 km-buffered area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (\pm the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community.

4.1 FLORA

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Agalinis tenuifolia</i>	Slender Agalinis				S1	2 May Be At Risk	2	2.9 \pm 0.0
P	<i>Alisma subcordatum</i>	Southern Water Plantain				S1	5 Undetermined	1	4.3 \pm 0.0
P	<i>Cyperus diandrus</i>	Low Flatsedge				S1	2 May Be At Risk	2	2.9 \pm 1.0
P	<i>Potamogeton nodosus</i>	Long-leaved Pondweed				S1	2 May Be At Risk	2	1.7 \pm 1.0
P	<i>Wolffia columbiana</i>	Columbian Watermeal				S1?	2 May Be At Risk	1	2.2 \pm 0.0
P	<i>Cyperus squarrosus</i>	Awned Flatsedge				S2	3 Sensitive	1	3.8 \pm 10.0
P	<i>Elodea nuttallii</i>	Nuttall's Waterweed				S2	3 Sensitive	1	1.9 \pm 0.0
P	<i>Leersia virginica</i>	White Cut Grass				S2	2 May Be At Risk	3	3.8 \pm 1.0
P	<i>Penthorum sedoides</i>	Ditch Stonecrop				S3	4 Secure	1	0.7 \pm 0.0
P	<i>Polygonum scandens</i>	Climbing False Buckwheat				S3	4 Secure	1	3.4 \pm 1.0
P	<i>Thalictrum venulosum</i>	Northern Meadow-rue				S3	4 Secure	1	2.8 \pm 0.0
P	<i>Amelanchier canadensis</i>	Canada Serviceberry				S3	4 Secure	1	2.9 \pm 1.0
P	<i>Salix nigra</i>	Black Willow				S3	3 Sensitive	1	4.8 \pm 1.0
P	<i>Liparis loeselii</i>	Loesel's Twayblade				S3	4 Secure	1	2.7 \pm 0.0
P	<i>Platanthera blephariglottis</i>	White Fringed Orchid				S3	4 Secure	1	4.1 \pm 0.0
P	<i>Equisetum palustre</i>	Marsh Horsetail				S3	4 Secure	1	3.0 \pm 10.0
P	<i>Spirodela polyrrhiza</i>	Great Duckweed				S3S4	4 Secure	1	2.0 \pm 1.0
P	<i>Potamogeton oakesianus</i>	Oakes' Pondweed				S3S4	4 Secure	1	4.1 \pm 0.0

4.2 FAUNA

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Hyllocichla mustelina</i>	Wood Thrush	Threatened		Threatened	S1S2B	2 May Be At Risk	3	2.2 \pm 7.0
A	<i>Caprimulgus vociferus</i>	Whip-Poor-Will	Threatened	Threatened	Threatened	S2B	1 At Risk	6	2.2 \pm 7.0
A	<i>Chordeiles minor</i>	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	2	4.6 \pm 7.0
A	<i>Hirundo rustica</i>	Barn Swallow	Threatened		Threatened	S3B	3 Sensitive	5	4.6 \pm 7.0
A	<i>Riparia riparia</i>	Bank Swallow	Threatened			S3B	3 Sensitive	2	4.6 \pm 7.0
A	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3S4B	1 At Risk	1	4.6 \pm 7.0
A	<i>Wilsonia canadensis</i>	Canada Warbler	Threatened	Threatened	Threatened	S3S4B	1 At Risk	3	4.6 \pm 7.0
A	<i>Dolichonyx oryzivorus</i>	Bobolink	Threatened		Threatened	S3S4B	3 Sensitive	4	1.9 \pm 1.0
A	<i>Bucephala islandica</i> (Eastern pop.)	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2N	3 Sensitive	1	4.8 \pm 0.0
A	<i>Contopus virens</i>	Eastern Wood-Pewee	Special Concern		Special Concern	S4B	4 Secure	4	4.6 \pm 7.0
A	<i>Phalaropus tricolor</i>	Wilson's Phalarope				S1B	3 Sensitive	2	2.2 \pm 7.0
A	<i>Butorides virescens</i>	Green Heron				S1S2B	3 Sensitive	2	1.9 \pm 1.0
A	<i>Empidonax traillii</i>	Willow Flycatcher				S1S2B	3 Sensitive	9	2.2 \pm 7.0
A	<i>Progne subis</i>	Purple Martin				S1S2B	2 May Be At Risk	4	2.2 \pm 7.0
A	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow				S1S2B	2 May Be At Risk	2	3.1 \pm 0.0
A	<i>Anas clypeata</i>	Northern Shoveler				S2B	4 Secure	1	4.6 \pm 0.0
A	<i>Eremophila alpestris</i>	Horned Lark				S2B	2 May Be At Risk	1	2.2 \pm 7.0
A	<i>Tringa solitaria</i>	Solitary Sandpiper				S2B,S5M	4 Secure	8	1.9 \pm 1.0
A	<i>Anas americana</i>	American Wigeon				S3B	4 Secure	2	4.6 \pm 7.0
A	<i>Rallus limicola</i>	Virginia Rail				S3B	3 Sensitive	1	4.6 \pm 7.0
A	<i>Charadrius vociferus</i>	Killdeer				S3B	3 Sensitive	9	1.9 \pm 1.0
A	<i>Larus delawarensis</i>	Ring-billed Gull				S3B	4 Secure	1	1.7 \pm 0.0
A	<i>Myiarchus crinitus</i>	Great Crested Flycatcher				S3B	3 Sensitive	4	4.6 \pm 7.0

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S3B	3 Sensitive	3	4.6 ± 7.0
A	<i>Passerina cyanea</i>	Indigo Bunting				S3B	4 Secure	4	2.2 ± 7.0
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S3B	2 May Be At Risk	3	4.6 ± 7.0
A	<i>Pluvialis dominica</i>	American Golden-Plover				S3M	3 Sensitive	1	3.9 ± 0.0
A	<i>Bucephala albeola</i>	Bufflehead				S3N	3 Sensitive	1	4.8 ± 0.0
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3S4B	3 Sensitive	5	4.6 ± 7.0
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S3S4B	3 Sensitive	7	4.6 ± 7.0
I	<i>Gomphus ventricosus</i>	Skillet Clubtail	Endangered		Endangered	S1	2 May Be At Risk	1	4.3 ± 0.0
I	<i>Lampsilis cariosa</i>	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S2	3 Sensitive	4	3.6 ± 0.0
I	<i>Ophiogomphus colubrinus</i>	Boreal Snaketail				S1S2	2 May Be At Risk	1	4.3 ± 0.0
I	<i>Satyrrium calanus</i>	Banded Hairstreak				S2	3 Sensitive	2	3.6 ± 0.0
I	<i>Gomphus vastus</i>	Cobra Clubtail				S2	3 Sensitive	5	3.3 ± 1.0
I	<i>Plebejus saepiolus</i>	Greenish Blue				S3	4 Secure	1	2.2 ± 1.0
I	<i>Speyeria aphrodite</i>	Aphrodite Fritillary				S3	4 Secure	1	2.0 ± 1.0
I	<i>Boloria bellona</i>	Meadow Fritillary				S3	4 Secure	1	2.0 ± 1.0
I	<i>Polygonia satyrus</i>	Satyr Comma				S3	4 Secure	3	2.0 ± 1.0
I	<i>Dorocordulia lepida</i>	Petite Emerald				S3	4 Secure	1	1.2 ± 1.0
I	<i>Stylurus scudder</i>	Zebra Clubtail				S3	4 Secure	1	4.3 ± 0.0
I	<i>Leptodea ochracea</i>	Tidewater Mucket				S3	4 Secure	3	3.1 ± 0.0
I	<i>Satyrrium liparops</i>	Striped Hairstreak				S3S4	4 Secure	1	3.6 ± 0.0

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting a 5 km buffer of your study area are indicated below with “YES”.

New Brunswick

Scientific Name	Common Name	SARA	Prov Legal Prot	Known within 5 km of Study Site?
<i>Chrysemys picta picta</i>	Eastern Painted Turtle			No
<i>Chelydra serpentina</i>	Snapping Turtle	Special Concern	Special Concern	No
<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	YES
<i>Haliaeetus leucocephalus</i>	Bald Eagle		Endangered	YES
<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrus pop.	Special Concern	Endangered	No
<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	Endangered	Endangered	No
<i>Coenonympha nipisiquit</i>	Maritime Ringlet	Endangered	Endangered	No
<i>Bat Hibernaculum</i>		[Endangered]¹	[Endangered]¹	YES

¹ *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NB Species at Risk Act.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
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29	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
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2	Sollows, M.C., 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
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1	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
1	Erskine, A.J. 1999. Maritime Nest Records Scheme (MNRS) 1937-1999. Canadian Wildlife Service, Sackville, 313 recs.
1	Houston, J.J. 1990. Status of the Redbreast Sunfish (<i>Lepomis auritus</i>) in Canada. Can. Field-Nat. 104:64-68.
1	Litvak, M.K. 2001. Shortnose Sturgeon records in four NB rivers. UNB Saint John NB. Pers. comm. to K. Bredin, 6 recs.
1	Speers, L. 2001. Butterflies of Canada database. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 190 recs.
1	Tingley, S. (compiler). 2001. Butterflies of New Brunswick. , Web site: www.geocities.com/Yosemite/8425/buttrfly. 142 recs.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 16244 records of 133 vertebrate and 1104 records of 64 invertebrate fauna; 8411 records of 370 vascular, 258 records of 127 nonvascular flora (attached: *ob100km.xls).

Rare and/or endangered taxa within the 100 km-buffered area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (\pm the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Myotis lucifugus</i>	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	61	7.2 \pm 1.0
A	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	17	9.4 \pm 1.0
A	<i>Perimyotis subflavus</i>	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	8	71.7 \pm 100.0
A	<i>Eubalaena glacialis</i>	North Atlantic Right Whale	Endangered	Endangered	Endangered	S1		1	39.2 \pm 0.0
A	<i>Sterna dougallii</i>	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	2	99.1 \pm 0.0
A	<i>Dermodochelys coriacea</i> (Atlantic pop.)	Leatherback Sea Turtle - Atlantic pop.	Endangered	Endangered	Endangered	S1S2N	1 At Risk	3	84.7 \pm 50.0
A	<i>Morone saxatilis</i>	Striped Bass	Endangered			S2	2 May Be At Risk	9	23.7 \pm 0.0
A	<i>Salmo salar</i> pop. 1	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered	Endangered	S2	2 May Be At Risk	464	18.1 \pm 0.0
A	<i>Charadrius melodus melodus</i>	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S2B	1 At Risk	7	81.0 \pm 0.0
A	<i>Calidris canutus rufa</i>	Red Knot rufa ssp	Endangered		Endangered	S3M	1 At Risk	17	81.0 \pm 0.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Pagophila eburnea</i>	Ivory Gull	Endangered	Endangered		SNA	8 Accidental	2	98.3 ± 14.0
A	<i>Protonotaria citrea</i>	Prothonotary Warbler	Endangered	Endangered		SNA	8 Accidental	1	82.4 ± 2.0
A	<i>Rangifer tarandus pop. 2</i>	Woodland Caribou (Atlantic-Gasp [r-sie pop.]	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	4	61.6 ± 1.0
A	<i>Colinus virginianus</i>	Northern Bobwhite	Endangered	Endangered				4	50.9 ± 0.0
A	<i>Ixobrychus exilis</i>	Least Bittern	Threatened	Threatened	Threatened	S1S2B	1 At Risk	29	9.1 ± 7.0
A	<i>Hylocichla mustelina</i>	Wood Thrush	Threatened		Threatened	S1S2B	2 May Be At Risk	241	2.2 ± 7.0
A	<i>Sturnella magna</i>	Eastern Meadowlark	Threatened		Threatened	S1S2B	2 May Be At Risk	55	16.2 ± 7.0
A	<i>Caprimulgus vociferus</i>	Whip-Poor-Will	Threatened	Threatened	Threatened	S2B	1 At Risk	93	2.2 ± 7.0
A	<i>Chaetura pelagica</i>	Chimney Swift	Threatened	Threatened	Threatened	S2S3B	1 At Risk	354	7.2 ± 0.0
A	<i>Catharus bicknelli</i>	Bicknell's Thrush	Threatened	Special Concern	Threatened	S2S3B	1 At Risk	3	84.3 ± 1.0
A	<i>Acipenser oxyrinchus</i>	Atlantic Sturgeon	Threatened		Threatened	S3	4 Secure	1	33.1 ± 1.0
A	<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	Threatened	S3	1 At Risk	248	1.6 ± 1.0
A	<i>Chordeiles minor</i>	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	380	4.6 ± 7.0
A	<i>Hirundo rustica</i>	Barn Swallow	Threatened		Threatened	S3B	3 Sensitive	1103	4.6 ± 7.0
A	<i>Riparia riparia</i>	Bank Swallow	Threatened			S3B	3 Sensitive	335	4.6 ± 7.0
A	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3S4B	1 At Risk	520	4.6 ± 7.0
A	<i>Wilsonia canadensis</i>	Canada Warbler	Threatened	Threatened	Threatened	S3S4B	1 At Risk	1103	4.6 ± 7.0
A	<i>Dolichonyx oryzivorus</i>	Bobolink	Threatened		Threatened	S3S4B	3 Sensitive	931	1.9 ± 1.0
A	<i>Anguilla rostrata</i>	American Eel	Threatened		Threatened	S5	4 Secure	39	12.9 ± 0.0
A	<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	Threatened	Threatened		SNA	8 Accidental	5	9.9 ± 5.0
A	<i>Osmerus mordax pop. 2</i>	Lake Utopia Smelt large-bodied pop.	Threatened		Threatened			2	83.2 ± 10.0
A	<i>Coturnicops noveboracensis</i>	Yellow Rail	Special Concern	Special Concern	Special Concern	S1?B	2 May Be At Risk	3	23.8 ± 7.0
A	<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Endangered	S1B	1 At Risk	93	28.4 ± 7.0
A	<i>Histrionicus histrionicus pop. 1</i>	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S1B,S1N	1 At Risk	59	21.2 ± 0.0
A	<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	Special Concern	Special Concern	Special Concern	S2	3 Sensitive	7	22.9 ± 10.0
A	<i>Bucephala islandica (Eastern pop.)</i>	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2N	3 Sensitive	53	4.8 ± 0.0
A	<i>Balaenoptera physalus</i>	Fin Whale - Atlantic pop.	Special Concern	Special Concern	Special Concern	S2S3		2	88.3 ± 1.0
A	<i>Chelydra serpentina</i>	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	3 Sensitive	24	9.8 ± 1.0
A	<i>Asio flammeus</i>	Short-eared Owl	Special Concern	Special Concern	Special Concern	S3B	3 Sensitive	15	33.9 ± 7.0
A	<i>Euphagus carolinus</i>	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B	2 May Be At Risk	200	7.6 ± 2.0
A	<i>Phalaropus lobatus</i>	Red-necked Phalarope	Special Concern			S3M	3 Sensitive	4	83.4 ± 0.0
A	<i>Phocoena phocoena (NW Atlantic pop.)</i>	Harbour Porpoise - Northwest Atlantic pop.	Special Concern	Threatened		S4		47	81.8 ± 0.0
A	<i>Contopus virens</i>	Eastern Wood-Pewee	Special Concern		Special Concern	S4B	4 Secure	670	4.6 ± 7.0
A	<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper	Special Concern			SNA	8 Accidental	16	83.0 ± 1.0
A	<i>Falco peregrinus</i>	Peregrine Falcon	Special Concern					91	7.3 ± 0.0
A	<i>Lynx canadensis</i>	Canadian Lynx	Not At Risk		Endangered	S1	1 At Risk	20	21.4 ± 10.0
A	<i>Sorex dispar</i>	Long-tailed Shrew	Not At Risk	Special Concern		S1	3 Sensitive	4	52.3 ± 5.0
A	<i>Cistothorus platensis</i>	Sedge Wren	Not At Risk			S1B	5 Undetermined	3	25.9 ± 7.0
A	<i>Falco rusticolus</i>	Gyr Falcon	Not At Risk			S1N	5 Undetermined	3	79.1 ± 0.0
A	<i>Accipiter cooperii</i>	Cooper's Hawk	Not At Risk			S1S2B	2 May Be At Risk	17	11.8 ± 1.0
A	<i>Aegolius funereus</i>	Boreal Owl	Not At Risk			S1S2B	2 May Be At Risk	2	95.1 ± 0.0
A	<i>Buteo lineatus</i>	Red-shouldered Hawk	Not At Risk	Special Concern		S2B	2 May Be At Risk	56	12.6 ± 7.0
A	<i>Fulica americana</i>	American Coot	Not At Risk			S2B	3 Sensitive	4	37.8 ± 7.0
A	<i>Chlidonias niger</i>	Black Tern	Not At Risk			S2B	3 Sensitive	108	7.3 ± 1.0
A	<i>Globicephala melas</i>	Long-finned Pilot Whale	Not At Risk			S2S3		3	84.8 ± 1.0
A	<i>Desmognathus fuscus (QC/NB pop.)</i>	Northern Dusky Salamander - QC/NB pop.	Not At Risk			S3	3 Sensitive	91	9.4 ± 1.0
A	<i>Haliaeetus leucocephalus</i>	Bald Eagle	Not At Risk		Endangered	S3B	1 At Risk	719	1.1 ± 0.0
A	<i>Sterna hirundo</i>	Common Tern	Not At Risk			S3B	3 Sensitive	145	7.7 ± 0.0
A	<i>Podiceps grisegena</i>	Red-necked Grebe	Not At Risk			S3M,S2N	3 Sensitive	67	7.7 ± 0.0
A	<i>Lagenorhynchus acutus</i>	Atlantic White-sided Dolphin	Not At Risk			S3S4		1	84.7 ± 1.0
A	<i>Canis lupus</i>	Gray Wolf	Not At Risk		Extirpated	SX	0.1 Extirpated	4	39.3 ± 1.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Lepomis auritus</i>	Redbreast Sunfish	Data Deficient	Special Concern		S3?	4 Secure	28	8.9 ± 1.0
A	<i>Puma concolor pop. 1</i>	Cougar - Eastern pop.	Data Deficient		Endangered	SU,SH	5 Undetermined	70	12.7 ± 1.0
A	<i>Salvelinus alpinus</i>	Arctic Char				S1	3 Sensitive	1	87.9 ± 1.0
A	<i>Microtus chrotorrhinus</i>	Rock Vole				S1	5 Undetermined	5	97.6 ± 1.0
A	<i>Lasionycteris noctivagans</i>	Silver-haired Bat				S1?	5 Undetermined	4	56.9 ± 1.0
A	<i>Bartramia longicauda</i>	Upland Sandpiper				S1B	3 Sensitive	39	6.1 ± 7.0
A	<i>Phalaropus tricolor</i>	Wilson's Phalarope				S1B	3 Sensitive	42	2.2 ± 7.0
A	<i>Leucophaeus atricilla</i>	Laughing Gull				S1B	3 Sensitive	9	7.2 ± 1.0
A	<i>Sterna paradisaea</i>	Arctic Tern				S1B	2 May Be At Risk	4	92.2 ± 0.0
A	<i>Troglodytes aedon</i>	House Wren				S1B	5 Undetermined	32	14.8 ± 0.0
A	<i>Aythya marila</i>	Greater Scaup				S1B,S2N	4 Secure	30	15.9 ± 7.0
A	<i>Uria aalge</i>	Common Murre				S1B,S3N	4 Secure	4	99.1 ± 0.0
A	<i>Alca torda</i>	Razorbill				S1B,S3N	4 Secure	4	91.4 ± 2.0
A	<i>Oxyura jamaicensis</i>	Ruddy Duck				S1B,S4N	4 Secure	45	7.7 ± 0.0
A	<i>Rissa tridactyla</i>	Black-legged Kittiwake				S1B,S4N	4 Secure	2	7.2 ± 1.0
A	<i>Butorides virescens</i>	Green Heron				S1S2B	3 Sensitive	18	1.9 ± 1.0
A	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron				S1S2B	3 Sensitive	9	60.4 ± 0.0
A	<i>Gallinula chloropus</i>	Common Moorhen				S1S2B	3 Sensitive	21	9.1 ± 7.0
A	<i>Fratercula arctica</i>	Atlantic Puffin				S1S2B	3 Sensitive	4	98.6 ± 1.0
A	<i>Empidonax traillii</i>	Willow Flycatcher				S1S2B	3 Sensitive	84	2.2 ± 7.0
A	<i>Progne subis</i>	Purple Martin				S1S2B	2 May Be At Risk	283	2.2 ± 7.0
A	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow				S1S2B	2 May Be At Risk	24	3.1 ± 0.0
A	<i>Prosopium cylindraceum</i>	Round Whitefish				S2	4 Secure	3	21.8 ± 0.0
A	<i>Salmo salar</i>	Atlantic Salmon				S2	2 May Be At Risk	475	23.7 ± 0.0
A	<i>Eptesicus fuscus</i>	Big Brown Bat				S2?	3 Sensitive	46	1.2 ± 1.0
A	<i>Lasiurus borealis</i>	Eastern Red Bat				S2?	5 Undetermined	9	6.2 ± 0.0
A	<i>Lasiurus cinereus</i>	Hoary Bat				S2?	5 Undetermined	9	9.4 ± 1.0
A	<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel				S2B	3 Sensitive	2	7.2 ± 1.0
A	<i>Anas clypeata</i>	Northern Shoveler				S2B	4 Secure	72	4.6 ± 0.0
A	<i>Anas strepera</i>	Gadwall				S2B	4 Secure	77	8.5 ± 30.0
A	<i>Eremophila alpestris</i>	Horned Lark				S2B	2 May Be At Risk	27	2.2 ± 7.0
A	<i>Cistothorus palustris</i>	Marsh Wren				S2B	3 Sensitive	71	9.1 ± 7.0
A	<i>Toxostoma rufum</i>	Brown Thrasher				S2B	3 Sensitive	110	5.8 ± 0.0
A	<i>Poocetes gramineus</i>	Vesper Sparrow				S2B	2 May Be At Risk	82	27.1 ± 7.0
A	<i>Tringa solitaria</i>	Solitary Sandpiper				S2B,S5M	4 Secure	120	1.9 ± 1.0
A	<i>Chroicocephalus ridibundus</i>	Black-headed Gull				S2M,S1N	3 Sensitive	9	7.2 ± 1.0
A	<i>Somateria spectabilis</i>	King Eider				S2N	4 Secure	4	98.3 ± 32.0
A	<i>Asio otus</i>	Long-eared Owl				S2S3	5 Undetermined	15	16.3 ± 7.0
A	<i>Tringa semipalmata</i>	Willet				S2S3B	3 Sensitive	15	5.0 ± 0.0
A	<i>Pinicola enucleator</i>	Pine Grosbeak				S2S3B,S4S5N	3 Sensitive	50	16.6 ± 7.0
A	<i>Branta bernicla</i>	Brant				S2S3M,S2S3N	4 Secure	26	9.0 ± 0.0
A	<i>Uria lomvia</i>	Thick-billed Murre				S2S3N	5 Undetermined	8	95.2 ± 1.0
A	<i>Hyla versicolor</i>	Gray Treefrog				S3	4 Secure	96	5.9 ± 1.0
A	<i>Cephus grylle</i>	Black Guillemot				S3	4 Secure	54	82.1 ± 7.0
A	<i>Loxia curvirostra</i>	Red Crossbill				S3	4 Secure	111	9.1 ± 7.0
A	<i>Coregonus clupeaformis</i>	Lake Whitefish				S3	4 Secure	17	29.3 ± 10.0
A	<i>Salvelinus namaycush</i>	Lake Trout				S3	3 Sensitive	7	62.3 ± 0.0
A	<i>Sorex maritimensis</i>	Maritime Shrew				S3	4 Secure	1	33.1 ± 1.0
A	<i>Synaptomys cooperi</i>	Southern Bog Lemming				S3	4 Secure	74	9.8 ± 1.0
A	<i>Picoides dorsalis</i>	American Three-toed Woodpecker				S3?	3 Sensitive	26	8.7 ± 1.0
A	<i>Anas acuta</i>	Northern Pintail				S3B	3 Sensitive	50	7.6 ± 1.0
A	<i>Anas americana</i>	American Wigeon				S3B	4 Secure	373	4.6 ± 7.0
A	<i>Cathartes aura</i>	Turkey Vulture				S3B	4 Secure	286	7.5 ± 0.0
A	<i>Rallus limicola</i>	Virginia Rail				S3B	3 Sensitive	115	4.6 ± 7.0
A	<i>Charadrius vociferus</i>	Killdeer				S3B	3 Sensitive	660	1.9 ± 1.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Larus delawarensis</i>	Ring-billed Gull				S3B	4 Secure	175	1.7 ± 0.0
A	<i>Myiarchus crinitus</i>	Great Crested Flycatcher				S3B	3 Sensitive	277	4.6 ± 7.0
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S3B	3 Sensitive	122	4.6 ± 7.0
A	<i>Passerina cyanea</i>	Indigo Bunting				S3B	4 Secure	123	2.2 ± 7.0
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S3B	2 May Be At Risk	284	4.6 ± 7.0
A	<i>Mergus serrator</i>	Red-breasted Merganser				S3B,S4S5N	4 Secure	68	15.9 ± 7.0
A	<i>Pluvialis dominica</i>	American Golden-Plover				S3M	3 Sensitive	51	3.9 ± 0.0
A	<i>Phalaropus fulicarius</i>	Red Phalarope				S3M	3 Sensitive	2	94.5 ± 0.0
A	<i>Melanitta nigra</i>	Black Scoter				S3M,S2S3N	3 Sensitive	127	7.0 ± 0.0
A	<i>Calidris maritima</i>	Purple Sandpiper				S3M,S3N	4 Secure	95	83.4 ± 0.0
A	<i>Bucephala albeola</i>	Bufflehead				S3N	3 Sensitive	578	4.8 ± 0.0
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3S4B	3 Sensitive	587	4.6 ± 7.0
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S3S4B	3 Sensitive	536	4.6 ± 7.0
A	<i>Piranga olivacea</i>	Scarlet Tanager				S3S4B	4 Secure	333	8.1 ± 0.0
A	<i>Coccothraustes vespertinus</i>	Evening Grosbeak				S3S4B,S4S5N	3 Sensitive	332	9.9 ± 0.0
A	<i>Podiceps auritus</i>	Horned Grebe			Special Concern	S4M,S4N	4 Secure	84	9.0 ± 0.0
A	<i>Morus bassanus</i>	Northern Gannet				SHB,S5M,S5N	4 Secure	35	81.3 ± 0.0
C	<i>Thuja occidentalis</i> - <i>Picea glauca</i> / <i>Mitella nuda</i> - <i>Athyrium filix-femina</i> / <i>Mnium</i> spp. Forest	Eastern White Cedar - White Spruce / Naked Bishop's-Cap - Common Lady Fern / Calcareous Moss Forest				S3		1	91.9 ± 0.0
C	<i>Acer saccharum</i> - <i>Fraxinus americana</i> / <i>Polystichum acrostichoides</i> Forest	Sugar Maple - White Ash / Christmas Fern Forest				S3S4		1	73.3 ± 0.0
I	<i>Gomphus ventricosus</i>	Skillet Clubtail	Endangered		Endangered	S1	2 May Be At Risk	50	4.3 ± 0.0
I	<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	Endangered	Endangered	Endangered	S1?	1 At Risk	20	35.5 ± 0.0
I	<i>Ophiogomphus howei</i>	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S1	2 May Be At Risk	13	52.4 ± 0.0
I	<i>Alasmidonta varicosa</i>	Brook Floater	Special Concern		Special Concern	S1S2	3 Sensitive	1	52.4 ± 0.0
I	<i>Lampsilis cariosa</i>	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S2	3 Sensitive	103	3.6 ± 0.0
I	<i>Danaus plexippus</i>	Monarch	Special Concern	Special Concern	Special Concern	S3B	3 Sensitive	53	6.4 ± 0.0
I	<i>Lyogyrus granum</i>	Squat Dusksnail	Data Deficient			S2		33	63.3 ± 0.0
I	<i>Erynnis juvenalis</i>	Juvenal's Duskywing				S1	5 Undetermined	1	54.1 ± 1.0
I	<i>Lycaena dorcas</i>	Dorcas Copper				S1	2 May Be At Risk	2	98.3 ± 0.0
I	<i>Lycaena dorcas claytoni</i>	Clayton's Copper				S1	2 May Be At Risk	12	82.2 ± 0.0
I	<i>Somatochlora septentrionalis</i>	Muskeg Emerald				S1	2 May Be At Risk	1	44.3 ± 1.0
I	<i>Celithemis martha</i>	Martha's Pennant				S1	5 Undetermined	1	74.1 ± 0.0
I	<i>Pachydiplax longipennis</i>	Blue Dasher				S1	5 Undetermined	2	21.2 ± 0.0
I	<i>Coccinella transversoguttata richardsoni</i>	Transverse Lady Beetle				S1S2	2 May Be At Risk	2	70.7 ± 0.0
I	<i>Boloria eunomia</i>	Bog Fritillary				S1S2	5 Undetermined	2	43.4 ± 0.0
I	<i>Ophiogomphus colubrinus</i>	Boreal Snaketail				S1S2	2 May Be At Risk	35	4.3 ± 0.0
I	<i>Satyrrium calanus</i>	Banded Hairstreak				S2	3 Sensitive	13	3.6 ± 0.0
I	<i>Satyrrium calanus falacer</i>	Banded Hairstreak				S2	4 Secure	6	5.9 ± 1.0
I	<i>Callophrys henrici</i>	Henry's Elfin				S2	4 Secure	12	9.3 ± 10.0
I	<i>Strymon melinus</i>	Grey Hairstreak				S2	4 Secure	3	28.0 ± 1.0
I	<i>Cupido comyntas</i>	Eastern Tailed Blue				S2	4 Secure	9	17.5 ± 0.0
I	<i>Gomphus vastus</i>	Cobra Clubtail				S2	3 Sensitive	58	3.3 ± 1.0
I	<i>Aeshna clepsydra</i>	Mottled Darner				S2	3 Sensitive	12	51.2 ± 0.0
I	<i>Somatochlora tenebrosa</i>	Clamp-Tipped Emerald				S2	5 Undetermined	5	7.3 ± 1.0
I	<i>Ladona exusta</i>	White Corporal				S2	5 Undetermined	8	55.2 ± 0.0
I	<i>Hetaerina americana</i>	American Rubyspot				S2	3 Sensitive	15	51.0 ± 0.0
I	<i>Coenagrion interrogatum</i>	Subarctic Bluet				S2	3 Sensitive	1	82.8 ± 0.0
I	<i>Enallagma vesperum</i>	Vesper Bluet				S2	5 Undetermined	6	86.0 ± 0.0
I	<i>Ischnura posita</i>	Fragile Forktail				S2	2 May Be At Risk	5	7.8 ± 0.0
I	<i>Arigomphus furcifer</i>	Lilypad Clubtail				S2	5 Undetermined	6	10.6 ± 0.0
I	<i>Alasmidonta undulata</i>	Triangle Floater				S2	3 Sensitive	53	11.4 ± 0.0
I	<i>Anatis labiculata</i>	Fifteen-spotted Lady Beetle				S2S3	3 Sensitive	1	71.1 ± 0.0
I	<i>Chrysops indus</i>	a Tabanid Fly				S2S3	3 Sensitive	23	84.2 ± 0.0
I	<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail				S2S3	4 Secure	51	6.0 ± 0.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
I	<i>Lestes vigilax</i>	Swamp Spreadwing				S2S3	3 Sensitive	34	21.2 ± 0.0
I	<i>Hesperia sassacus</i>	Indian Skipper				S3	4 Secure	5	14.0 ± 2.0
I	<i>Euphyes bimaculata</i>	Two-spotted Skipper				S3	4 Secure	11	23.5 ± 1.0
I	<i>Lycaena hylus</i>	Bronze Copper				S3	3 Sensitive	5	37.8 ± 0.0
I	<i>Satyrium acadica</i>	Acadian Hairstreak				S3	4 Secure	22	20.1 ± 1.0
I	<i>Callophrys polios</i>	Hoary Elfin				S3	4 Secure	4	13.2 ± 0.0
I	<i>Plebejus idas</i>	Northern Blue				S3	4 Secure	6	80.0 ± 0.0
I	<i>Plebejus idas empetri</i>	Crowberry Blue				S3	4 Secure	8	81.4 ± 10.0
I	<i>Plebejus saepiolus</i>	Greenish Blue				S3	4 Secure	3	2.2 ± 1.0
I	<i>Speyeria aphrodite</i>	Aphrodite Fritillary				S3	4 Secure	18	2.0 ± 1.0
I	<i>Boloria bellona</i>	Meadow Fritillary				S3	4 Secure	38	2.0 ± 1.0
I	<i>Chlosyne nycteis</i>	Silvery Checkerspot				S3	4 Secure	5	9.1 ± 1.0
I	<i>Polygonia satyrus</i>	Satyr Comma				S3	4 Secure	15	2.0 ± 1.0
I	<i>Polygonia gracilis</i>	Hoary Comma				S3	4 Secure	4	9.4 ± 1.0
I	<i>Nymphalis l-album</i>	Compton Tortoiseshell				S3	4 Secure	14	9.1 ± 1.0
I	<i>Oeneis jutta</i>	Jutta Arctic				S3	4 Secure	22	8.5 ± 1.0
I	<i>Gomphaeschna furcillata</i>	Harlequin Darner				S3	5 Undetermined	11	7.3 ± 1.0
I	<i>Dorocordulia lepida</i>	Petite Emerald				S3	4 Secure	29	1.2 ± 1.0
I	<i>Somatochlora albicincta</i>	Ringed Emerald				S3	4 Secure	2	85.2 ± 1.0
I	<i>Somatochlora cingulata</i>	Lake Emerald				S3	4 Secure	11	33.0 ± 1.0
I	<i>Somatochlora forcipata</i>	Forcipate Emerald				S3	4 Secure	16	8.9 ± 1.0
I	<i>Williamsonia fletcheri</i>	Ebony Boghaunter				S3	4 Secure	22	8.9 ± 1.0
I	<i>Lestes eurinus</i>	Amber-Winged Spreadwing				S3	4 Secure	10	39.0 ± 1.0
I	<i>Enallagma geminatum</i>	Skimming Bluet				S3	5 Undetermined	13	20.6 ± 0.0
I	<i>Enallagma signatum</i>	Orange Bluet				S3	4 Secure	12	23.5 ± 0.0
I	<i>Stylurus scudderii</i>	Zebra Clubtail				S3	4 Secure	72	4.3 ± 0.0
I	<i>Leptodea ochracea</i>	Tidewater Mucket				S3	4 Secure	67	3.1 ± 0.0
I	<i>Pantala hymenaea</i>	Spot-Winged Glider				S3B	4 Secure	4	82.9 ± 0.0
I	<i>Satyrium liparops</i>	Striped Hairstreak				S3S4	4 Secure	2	3.6 ± 0.0
I	<i>Satyrium liparops strigosum</i>	Striped Hairstreak				S3S4	4 Secure	1	9.3 ± 10.0
N	<i>Pseudevernia cladonia</i>	Ghost Antler Lichen	Not At Risk			S3	5 Undetermined	12	52.0 ± 0.0
N	<i>Anomodon minor</i>	Blunt-leaved Anomodon Moss				S1	2 May Be At Risk	2	95.8 ± 1.0
N	<i>Anomodon viticulosus</i>	a Moss				S1	2 May Be At Risk	6	73.7 ± 0.0
N	<i>Atrichum angustatum</i>	Lesser Smoothcap Moss				S1	2 May Be At Risk	1	83.6 ± 2.0
N	<i>Bryum muehlenbeckii</i>	Muehlenbeck's Bryum Moss				S1	2 May Be At Risk	1	71.1 ± 1.0
N	<i>Calliergon trifarium</i>	Three-ranked Moss				S1	2 May Be At Risk	1	77.3 ± 0.0
N	<i>Dichelyma falcatum</i>	a Moss				S1	2 May Be At Risk	2	10.7 ± 10.0
N	<i>Dicranum bonjeanii</i>	Bonjean's Broom Moss				S1	2 May Be At Risk	1	8.2 ± 1.0
N	<i>Ditrichum pallidum</i>	Pale Cow-hair Moss				S1	2 May Be At Risk	4	37.2 ± 1.0
N	<i>Drummondia prorepens</i>	a Moss				S1	2 May Be At Risk	1	94.3 ± 1.0
N	<i>Entodon brevisetus</i>	a Moss				S1	2 May Be At Risk	1	80.0 ± 10.0
N	<i>Eurhynchium hians</i>	Light Beaked Moss				S1	2 May Be At Risk	2	9.4 ± 1.0
N	<i>Fissidens taxifolius</i>	Yew-leaved Pocket Moss				S1	2 May Be At Risk	4	82.7 ± 0.0
N	<i>Homomallium adnatum</i>	Adnate Hairy-gray Moss				S1	2 May Be At Risk	2	80.0 ± 10.0
N	<i>Meesia triquetra</i>	Three-ranked Cold Moss				S1	2 May Be At Risk	2	48.0 ± 100.0
N	<i>Plagiothecium latebricola</i>	Alder Silk Moss				S1	2 May Be At Risk	1	85.4 ± 0.0
N	<i>Racomitrium ericoides</i>	a Moss				S1	2 May Be At Risk	1	44.0 ± 3.0
N	<i>Rhytidium rugosum</i>	Wrinkle-leaved Moss				S1	2 May Be At Risk	1	95.1 ± 0.0
N	<i>Seligeria brevifolia</i>	a Moss				S1	3 Sensitive	1	86.6 ± 1.0
N	<i>Sphagnum macrophyllum</i>	Sphagnum				S1	2 May Be At Risk	2	55.8 ± 0.0
N	<i>Sphagnum subfulvum</i>	a Peatmoss				S1	2 May Be At Risk	4	87.2 ± 1.0
N	<i>Splachnum pennsylvanicum</i>	Southern Dung Moss				S1	2 May Be At Risk	2	22.4 ± 1.0
N	<i>Timmia norvegica</i>	a moss				S1	2 May Be At Risk	1	82.7 ± 0.0
N	<i>Tomentypnum falcifolium</i>	Sickle-leaved Golden Moss				S1	2 May Be At Risk	1	87.2 ± 1.0
N	<i>Syntrichia ruralis</i>	a Moss				S1	2 May Be At Risk	1	88.3 ± 0.0
N	<i>Pseudotaxiphyllum distichaceum</i>	a Moss				S1	2 May Be At Risk	1	9.7 ± 1.0
N	<i>Hamatocaulis vernicosus</i>	a Moss				S1	2 May Be At Risk	1	88.6 ± 100.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
N	<i>Coscinodon cribrosus</i>	Sieve-Toothed Moss				S1	2 May Be At Risk	1	82.3 ± 0.0
N	<i>Pohlia filum</i>	a Moss				S1?	5 Undetermined	2	38.2 ± 3.0
N	<i>Sphagnum platyphyllum</i>	Flat-leaved Peat Moss				S1?	5 Undetermined	3	37.2 ± 1.0
N	<i>Anomobryum filiforme</i>	a moss				S1?	5 Undetermined	1	9.4 ± 1.0
N	<i>Platylomella lescurii</i>	a Moss				S1?	5 Undetermined	1	80.7 ± 1.0
N	<i>Andreaea rothii</i>	a Moss				S1S2	3 Sensitive	1	92.1 ± 0.0
N	<i>Brachythecium digastrum</i>	a Moss				S1S2	3 Sensitive	2	9.4 ± 1.0
N	<i>Bryum pallescens</i>	Pale Bryum Moss				S1S2	5 Undetermined	2	45.6 ± 1.0
N	<i>Campylium radicale</i>	Long-stalked Fine Wet Moss				S1S2	5 Undetermined	1	9.4 ± 1.0
N	<i>Cynodontium strumiferum</i>	Strumose Dogtooth Moss				S1S2	3 Sensitive	1	93.1 ± 8.0
N	<i>Dichelyma capillaceum</i>	Hairlike Dichelyma Moss				S1S2	3 Sensitive	2	52.2 ± 4.0
N	<i>Dicranum spurium</i>	Spurred Broom Moss				S1S2	3 Sensitive	1	91.9 ± 0.0
N	<i>Didymodon ferrugineus</i>	a moss				S1S2	3 Sensitive	3	74.8 ± 1.0
N	<i>Anomodon tristis</i>	a Moss				S1S2	2 May Be At Risk	1	46.9 ± 1.0
N	<i>Hygrohypnum bestii</i>	Best's Brook Moss				S1S2	3 Sensitive	3	98.0 ± 0.0
N	<i>Schistostega pennata</i>	Luminous Moss				S1S2	3 Sensitive	3	9.4 ± 1.0
N	<i>Seligeria campytopoda</i>	a Moss				S1S2	3 Sensitive	2	85.9 ± 0.0
N	<i>Seligeria diversifolia</i>	a Moss				S1S2	3 Sensitive	1	36.5 ± 0.0
N	<i>Sphagnum angermanicum</i>	a Peatmoss				S1S2	3 Sensitive	3	58.7 ± 1.0
N	<i>Tortula mucronifolia</i>	Mucronate Screw Moss				S1S2	3 Sensitive	1	81.2 ± 0.0
N	<i>Plagiommium rostratum</i>	Long-beaked Leafy Moss				S1S2	3 Sensitive	1	83.0 ± 0.0
N	<i>Calypogeia neesiana</i>	Nees' Pouchwort				S1S3	6 Not Assessed	1	73.5 ± 1.0
N	<i>Cephaloziella elachista</i>	Spurred Threadwort				S1S3	6 Not Assessed	1	77.7 ± 5.0
N	<i>Cephaloziella spinigera</i>	Spiny Threadwort				S1S3	6 Not Assessed	2	91.8 ± 0.0
N	<i>Jungermannia obovata</i>	Egg Flapwort				S1S3	6 Not Assessed	1	70.4 ± 0.0
N	<i>Porella pinnata</i>	Pinnate Scalewort				S1S3	6 Not Assessed	2	69.6 ± 1.0
N	<i>Reboulia hemisphaerica</i>	Purple-margined Liverwort				S1S3	6 Not Assessed	1	97.2 ± 1.0
N	<i>Amphidium mougeotii</i>	a Moss				S2	3 Sensitive	1	93.1 ± 8.0
N	<i>Bryum uliginosum</i>	a Moss				S2	3 Sensitive	1	90.0 ± 4.0
N	<i>Buxbaumia aphylla</i>	Brown Shield Moss				S2	3 Sensitive	2	85.0 ± 15.0
N	<i>Campylium polygamum</i>	a Moss				S2	3 Sensitive	1	74.1 ± 1.0
N	<i>Cirriphyllum piliferum</i>	Hair-pointed Moss				S2	3 Sensitive	2	80.0 ± 1.0
N	<i>Cynodontium tenellum</i>	Delicate Dogtooth Moss				S2	3 Sensitive	1	87.6 ± 1.0
N	<i>Dicranella palustris</i>	Drooping-Leaved Fork Moss				S2	3 Sensitive	2	48.0 ± 100.0
N	<i>Fissidens bushii</i>	Bush's Pocket Moss				S2	3 Sensitive	3	86.7 ± 1.0
N	<i>Hypnum pratense</i>	Meadow Plait Moss				S2	3 Sensitive	2	77.8 ± 0.0
N	<i>Isopterygiopsis pulchella</i>	Neat Silk Moss				S2	3 Sensitive	1	92.8 ± 1.0
N	<i>Orthotrichum speciosum</i>	Showy Bristle Moss				S2	4 Secure	3	38.2 ± 3.0
N	<i>Physcomitrium immersum</i>	a Moss				S2	3 Sensitive	6	9.4 ± 1.0
N	<i>Physcomitrium pyriforme</i>	Pear-shaped Urn Moss				S2	3 Sensitive	5	9.4 ± 10.0
N	<i>Racomitrium fasciculare</i>	a Moss				S2	3 Sensitive	1	90.6 ± 0.0
N	<i>Scorpidium scorpioides</i>	Hooked Scorpion Moss				S2	3 Sensitive	5	76.1 ± 0.0
N	<i>Sphagnum centrale</i>	Central Peat Moss				S2	3 Sensitive	1	91.6 ± 0.0
N	<i>Sphagnum lindbergii</i>	Lindberg's Peat Moss				S2	3 Sensitive	6	77.5 ± 1.0
N	<i>Sphagnum flexuosum</i>	Flexuous Peatmoss				S2	3 Sensitive	1	95.5 ± 0.0
N	<i>Taxiphyllum deplanatum</i>	Imbricate Yew-leaved Moss				S2	3 Sensitive	2	85.8 ± 0.0
N	<i>Tayloria serrata</i>	Serrate Trumpet Moss				S2	3 Sensitive	2	93.3 ± 1.0
N	<i>Tetraplodon mnioides</i>	Entire-leaved Nitrogen Moss				S2	3 Sensitive	3	82.7 ± 0.0
N	<i>Thamnobryum alleghaniense</i>	a Moss				S2	3 Sensitive	2	82.8 ± 0.0
N	<i>Ulota phyllantha</i>	a Moss				S2	3 Sensitive	1	87.6 ± 1.0
N	<i>Zygodon viridissimus</i>	a Moss				S2	2 May Be At Risk	1	86.0 ± 5.0
N	<i>Schistidium agassizii</i>	Elf Bloom Moss				S2	3 Sensitive	2	82.7 ± 2.0
N	<i>Loeskeobryum brevirostre</i>	a Moss				S2	3 Sensitive	1	100.0 ± 2.0
N	<i>Calliergonella cuspidata</i>	Common Large Wetland Moss				S2S3	3 Sensitive	4	76.1 ± 0.0
N	<i>Didymodon rigidulus</i>	Rigid Screw Moss				S2S3	3 Sensitive	1	35.7 ± 8.0
N	<i>Ephemerum serratum</i>	a Moss				S2S3	3 Sensitive	2	88.4 ± 0.0
N	<i>Cephaloziella divaricata</i>	Common Threadwort				S2S4	6 Not Assessed	1	97.2 ± 1.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
N	<i>Riccia fluitans</i>	Floating Crystalwort				S2S4	6 Not Assessed	4	26.9 ± 0.0
N	<i>Anomodon rugelii</i>	Rugel's Anomodon Moss				S3	3 Sensitive	2	95.1 ± 0.0
N	<i>Aulacomnium androgynum</i>	Little Groove Moss				S3	4 Secure	2	84.8 ± 1.0
N	<i>Dicranella cerviculata</i>	a Moss				S3	3 Sensitive	2	87.6 ± 1.0
N	<i>Dicranum majus</i>	Greater Broom Moss				S3	4 Secure	3	82.7 ± 0.0
N	<i>Helodium blandowii</i>	Wetland-plume Moss				S3	4 Secure	1	92.8 ± 1.0
N	<i>Heterocladium dimorphum</i>	Dimorphous Tangle Moss				S3	4 Secure	1	82.7 ± 2.0
N	<i>Hypnum curvifolium</i>	Curved-leaved Plait Moss				S3	3 Sensitive	1	86.0 ± 5.0
N	<i>Pleuroidium subulatum</i>	a Moss				S3	3 Sensitive	3	8.4 ± 1.0
N	<i>Pogonatum dentatum</i>	Mountain Hair Moss				S3	4 Secure	1	87.6 ± 1.0
N	<i>Sphagnum torreyanum</i>	a Peatmoss				S3	4 Secure	4	84.1 ± 0.0
N	<i>Sphagnum austinii</i>	Austin's Peat Moss				S3	4 Secure	1	82.8 ± 1.0
N	<i>Splachnum rubrum</i>	Red Collar Moss				S3	4 Secure	1	97.2 ± 1.0
N	<i>Tetraphis geniculata</i>	Geniculate Four-tooth Moss				S3	4 Secure	4	76.3 ± 0.0
N	<i>Trichostomum tenuirostre</i>	Acid-Soil Moss				S3	4 Secure	3	85.8 ± 0.0
N	<i>Schistidium maritimum</i>	a Moss				S3	4 Secure	1	87.6 ± 1.0
N	<i>Rauvella scita</i>	Smaller Fern Moss				S3	3 Sensitive	2	90.2 ± 3.0
N	<i>Dicranella rufescens</i>	Red Forklet Moss				S3?	5 Undetermined	2	8.7 ± 4.0
N	<i>Sphagnum contortum</i>	Twisted Peat Moss				S3?	4 Secure	1	75.6 ± 0.0
N	<i>Sphagnum lescurii</i>	a Peatmoss				S3?	5 Undetermined	2	74.5 ± 0.0
N	<i>Atrichum tenellum</i>	Slender Smoothcap Moss				S3S4	4 Secure	3	38.2 ± 3.0
N	<i>Barbula convoluta</i>	Lesser Bird's-claw Beard Moss				S3S4	4 Secure	1	35.7 ± 8.0
N	<i>Brachythecium campestre</i>	Field Ragged Moss				S3S4	4 Secure	2	38.2 ± 3.0
N	<i>Brachythecium velutinum</i>	Velvet Ragged Moss				S3S4	4 Secure	5	40.8 ± 4.0
N	<i>Dicranella schreberiana</i>	Schreber's Forklet Moss				S3S4	4 Secure	1	9.4 ± 1.0
N	<i>Dicranella subulata</i>	Awl-leaved Forklet Moss				S3S4	4 Secure	1	36.5 ± 2.0
N	<i>Distichium capillaceum</i>	Erect-fruited Iris Moss				S3S4	4 Secure	1	45.3 ± 0.0
N	<i>Fissidens bryoides</i>	Lesser Pocket Moss				S3S4	4 Secure	3	48.5 ± 4.0
N	<i>Hypnum fauriei</i>	a Moss				S3S4	4 Secure	3	82.7 ± 0.0
N	<i>Isopterygiopsis muelleriana</i>	a Moss				S3S4	4 Secure	6	40.8 ± 4.0
N	<i>Myurella julacea</i>	Small Mouse-tail Moss				S3S4	4 Secure	1	93.1 ± 8.0
N	<i>Pohlia annotina</i>	a Moss				S3S4	4 Secure	2	36.5 ± 2.0
N	<i>Tortula truncata</i>	a Moss				S3S4	4 Secure	4	26.3 ± 1.0
N	<i>Racomitrium microcarpon</i>	a Moss				S3S4	4 Secure	1	87.2 ± 0.0
N	<i>Sphagnum majus</i>	Olive Peat Moss				S3S4	4 Secure	1	86.7 ± 5.0
N	<i>Tetraplodon angustatus</i>	Toothed-leaved Nitrogen Moss				S3S4	4 Secure	1	87.6 ± 1.0
N	<i>Tomentypnum nitens</i>	Golden Fuzzy Fen Moss				S3S4	4 Secure	1	81.8 ± 3.0
N	<i>Limprichtia revolvens</i>	a Moss				S3S4	4 Secure	2	86.2 ± 0.0
N	<i>Grimmia anodon</i>	Toothless Grimmia Moss				SH	5 Undetermined	2	80.4 ± 10.0
N	<i>Leucodon brachypus</i>	a Moss				SH	2 May Be At Risk	2	38.8 ± 10.0
N	<i>Orthotrichum gymnostomum</i>	a Moss				SH	2 May Be At Risk	1	40.5 ± 10.0
N	<i>Thelia hirtella</i>	a Moss				SH	2 May Be At Risk	1	48.0 ± 100.0
N	<i>Cyrtto-hypnum minutulum</i>	Tiny Cedar Moss				SH	2 May Be At Risk	3	74.5 ± 10.0
P	<i>Juglans cinerea</i>	Butternut	Endangered	Endangered	Endangered	S1	1 At Risk	294	6.2 ± 0.0
P	<i>Polemonium vanbruntiae</i>	Van Brunt's Jacob's-ladder	Threatened	Threatened	Threatened	S1	1 At Risk	72	82.2 ± 1.0
P	<i>Symphotrichum anticostense</i>	Anticosti Aster	Threatened	Threatened	Endangered	S1S3	1 At Risk	24	23.5 ± 1.0
P	<i>Symphotrichum praealtum</i>	Willow-leaved Aster	Threatened	Threatened		SNA	7 Exotic	1	97.3 ± 1.0
P	<i>Isoetes prototypus</i>	Prototype Quillwort	Special Concern	Special Concern	Endangered	S2	1 At Risk	23	12.4 ± 0.0
P	<i>Pterospora andromedeae</i>	Woodland Pinedrops			Endangered	S1	1 At Risk	24	17.2 ± 0.0
P	<i>Cryptotaenia canadensis</i>	Canada Honewort				S1	2 May Be At Risk	5	80.3 ± 1.0
P	<i>Sanicula trifoliata</i>	Large-Fruited Sanicle				S1	2 May Be At Risk	21	69.5 ± 5.0
P	<i>Antennaria parlinii</i>	a Pussytoes				S1	2 May Be At Risk	7	45.5 ± 1.0
P	<i>Antennaria howellii</i> ssp. <i>petaloidea</i>	Pussy-Toes				S1	2 May Be At Risk	2	70.0 ± 1.0
P	<i>Bidens discoidea</i>	Swamp Beggarticks				S1	2 May Be At Risk	3	21.4 ± 0.0
P	<i>Pseudognaphalium obtusifolium</i>	Eastern Cudweed				S1	2 May Be At Risk	2	46.0 ± 0.0
P	<i>Helianthus decapetalus</i>	Ten-rayed Sunflower				S1	2 May Be At Risk	20	21.0 ± 0.0
P	<i>Hieracium kalmii</i>	Kalm's Hawkweed				S1	2 May Be At Risk	4	8.5 ± 6.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Hieracium kalmii</i> var. <i>kalmii</i>	Kalm's Hawkweed				S1	2 May Be At Risk	4	8.6 ± 1.0
P	<i>Hieracium paniculatum</i>	Panicled Hawkweed				S1	2 May Be At Risk	4	26.1 ± 0.0
P	<i>Hieracium robinsonii</i>	Robinson's Hawkweed				S1	3 Sensitive	1	75.8 ± 0.0
P	<i>Solidago simplex</i> var. <i>monticola</i>	Sticky Goldenrod				S1	2 May Be At Risk	1	20.8 ± 0.0
P	<i>Symphotrichum laeve</i>	Smooth Aster				S1	5 Undetermined	6	65.8 ± 5.0
P	<i>Canadanthus modestus</i>	Great Northern Aster				S1	2 May Be At Risk	1	98.4 ± 0.0
P	<i>Cynoglossum virginianum</i> var. <i>boreale</i>	Wild Comfrey				S1	2 May Be At Risk	14	88.7 ± 0.0
P	<i>Cardamine parviflora</i> var. <i>arenicola</i>	Small-flowered Bittercress				S1	2 May Be At Risk	3	59.8 ± 0.0
P	<i>Draba arabisans</i>	Rock Whitlow-Grass				S1	2 May Be At Risk	3	68.6 ± 1.0
P	<i>Draba breweri</i> var. <i>cana</i>	Brewer's Whitlow-grass				S1	2 May Be At Risk	10	16.1 ± 0.0
P	<i>Draba glabella</i>	Rock Whitlow-Grass				S1	2 May Be At Risk	7	38.6 ± 1.0
P	<i>Minuartia groenlandica</i>	Greenland Stitchwort				S1	2 May Be At Risk	1	65.8 ± 0.0
P	<i>Chenopodium capitatum</i>	Strawberry-bite				S1	2 May Be At Risk	5	8.4 ± 6.0
P	<i>Chenopodium simplex</i>	Maple-leaved Goosefoot				S1	2 May Be At Risk	8	8.9 ± 5.0
P	<i>Callitriche terrestris</i>	Terrestrial Water-Starwort				S1	5 Undetermined	1	95.4 ± 0.0
P	<i>Triadenum virginicum</i>	Virginia St John's-wort				S1	2 May Be At Risk	7	58.3 ± 0.0
P	<i>Cuscuta pentagona</i>	Five-angled Dodder				S1	2 May Be At Risk	3	37.5 ± 10.0
P	<i>Drosera anglica</i>	English Sundew				S1	2 May Be At Risk	1	80.8 ± 0.0
P	<i>Drosera linearis</i>	Slender-Leaved Sundew				S1	2 May Be At Risk	1	80.8 ± 0.0
P	<i>Corema conradii</i>	Broom Crowberry				S1	2 May Be At Risk	1	82.3 ± 10.0
P	<i>Vaccinium boreale</i>	Northern Blueberry				S1	2 May Be At Risk	1	72.9 ± 0.0
P	<i>Vaccinium corymbosum</i>	Highbush Blueberry				S1	3 Sensitive	9	80.6 ± 0.0
P	<i>Desmodium glutinosum</i>	Large Tick-Trefoil				S1	2 May Be At Risk	6	72.0 ± 0.0
P	<i>Lespedeza capitata</i>	Round-headed Bush-clover				S1	2 May Be At Risk	5	34.8 ± 0.0
P	<i>Gentiana rubricaulis</i>	Purple-stemmed Gentian				S1	2 May Be At Risk	14	62.5 ± 0.0
P	<i>Proserpinaca pectinata</i>	Comb-leaved Mermaidweed				S1	2 May Be At Risk	1	76.3 ± 0.0
P	<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint				S1	2 May Be At Risk	4	58.9 ± 0.0
P	<i>Decodon verticillatus</i>	Swamp Loosestrife				S1	2 May Be At Risk	3	59.7 ± 0.0
P	<i>Polygala verticillata</i> var. <i>verticillata</i>	Whorled Milkwort				S1	5 Undetermined	2	88.6 ± 0.0
P	<i>Lysimachia hybrida</i>	Lowland Yellow Loosestrife				S1	2 May Be At Risk	2	92.4 ± 0.0
P	<i>Lysimachia quadrifolia</i>	Whorled Yellow Loosestrife				S1	2 May Be At Risk	14	57.9 ± 0.0
P	<i>Ranunculus lapponicus</i>	Lapland Buttercup				S1	2 May Be At Risk	1	97.7 ± 1.0
P	<i>Ranunculus sceleratus</i>	Cursed Buttercup				S1	2 May Be At Risk	6	8.2 ± 0.0
P	<i>Crataegus jonesiae</i>	Jones' Hawthorn				S1	2 May Be At Risk	5	7.0 ± 1.0
P	<i>Potentilla canadensis</i>	Canada Cinquefoil				S1	5 Undetermined	1	59.6 ± 0.0
P	<i>Rosa acicularis</i> ssp. <i>sayi</i>	Prickly Rose				S1	2 May Be At Risk	34	71.9 ± 0.0
P	<i>Waldsteinia fragarioides</i>	Barren Strawberry				S1	2 May Be At Risk	27	73.4 ± 0.0
P	<i>Galium brevipes</i>	Limestone Swamp Bedstraw				S1	2 May Be At Risk	3	55.8 ± 5.0
P	<i>Saxifraga paniculata</i> ssp. <i>neogaea</i>	White Mountain Saxifrage				S1	2 May Be At Risk	12	70.7 ± 0.0
P	<i>Agalinis paupercula</i> var. <i>borealis</i>	Small-flowered Agalinis				S1	2 May Be At Risk	7	7.7 ± 0.0
P	<i>Agalinis tenuifolia</i>	Slender Agalinis				S1	2 May Be At Risk	6	2.9 ± 0.0
P	<i>Gratiola aurea</i>	Golden Hedge-Hyssop				S1	3 Sensitive	2	70.4 ± 0.0
P	<i>Pedicularis canadensis</i>	Canada Lousewort				S1	2 May Be At Risk	3	17.2 ± 0.0
P	<i>Viola sagittata</i> var. <i>ovata</i>	Arrow-Leaved Violet				S1	2 May Be At Risk	10	12.2 ± 0.0
P	<i>Alisma subcordatum</i>	Southern Water Plantain				S1	5 Undetermined	8	4.3 ± 0.0
P	<i>Carex backii</i>	Rocky Mountain Sedge				S1	2 May Be At Risk	6	15.7 ± 1.0
P	<i>Carex cephaloidea</i>	Thin-leaved Sedge				S1	2 May Be At Risk	14	36.1 ± 0.0
P	<i>Carex comosa</i>	Bearded Sedge				S1	2 May Be At Risk	5	95.9 ± 0.0
P	<i>Carex merritt-fernaldii</i>	Merritt Fernald's Sedge				S1	2 May Be At Risk	2	96.4 ± 0.0
P	<i>Carex saxatilis</i>	Russet Sedge				S1	2 May Be At Risk	13	68.7 ± 10.0
P	<i>Carex sterilis</i>	Sterile Sedge				S1	2 May Be At Risk	3	26.2 ± 0.0
P	<i>Carex viridula</i> var. <i>elatior</i>	Greenish Sedge				S1	2 May Be At Risk	4	98.4 ± 0.0
P	<i>Carex grisea</i>	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	11	16.1 ± 1.0
P	<i>Cyperus diandrus</i>	Low Flatsedge				S1	2 May Be At Risk	7	2.9 ± 1.0
P	<i>Cyperus lupulinus</i>	Hop Flatsedge				S1	2 May Be At Risk	2	30.0 ± 0.0
P	<i>Cyperus lupulinus</i> ssp. <i>macilentus</i>	Hop Flatsedge				S1	2 May Be At Risk	16	29.8 ± 1.0
P	<i>Eleocharis olivacea</i>	Yellow Spikerush				S1	2 May Be At Risk	3	94.1 ± 1.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Rhynchospora capillacea</i>	Slender Beakrush				S1	2 May Be At Risk	3	22.7 ± 0.0
P	<i>Scirpus pendulus</i>	Hanging Bulrush				S1	2 May Be At Risk	5	99.4 ± 0.0
P	<i>Sisyrinchium angustifolium</i>	Narrow-leaved Blue-eyed-grass				S1	2 May Be At Risk	3	73.9 ± 0.0
P	<i>Juncus greenei</i>	Greene's Rush				S1	2 May Be At Risk	1	88.0 ± 0.0
P	<i>Juncus subtilis</i>	Creeping Rush				S1	2 May Be At Risk	1	42.8 ± 5.0
P	<i>Allium canadense</i>	Canada Garlic				S1	2 May Be At Risk	11	21.1 ± 1.0
P	<i>Goodyera pubescens</i>	Downy Rattlesnake-Plantain				S1	2 May Be At Risk	2	9.7 ± 0.0
P	<i>Malaxis brachypoda</i>	White Adder's-Mouth				S1	2 May Be At Risk	12	42.2 ± 0.0
P	<i>Platanthera flava</i> var. <i>herbiola</i>	Pale Green Orchid				S1	2 May Be At Risk	13	7.6 ± 10.0
P	<i>Platanthera macrophylla</i>	Large Round-Leaved Orchid				S1	2 May Be At Risk	4	9.8 ± 1.0
P	<i>Spiranthes casei</i>	Case's Ladies'-Tresses				S1	2 May Be At Risk	6	17.3 ± 0.0
P	<i>Spiranthes ochroleuca</i>	Yellow Ladies'-tresses				S1	2 May Be At Risk	2	62.5 ± 5.0
P	<i>Cinna arundinacea</i>	Sweet Wood Reed Grass				S1	2 May Be At Risk	6	28.6 ± 0.0
P	<i>Danthonia compressa</i>	Flattened Oat Grass				S1	2 May Be At Risk	3	58.0 ± 0.0
P	<i>Dichantherium dichotomum</i>	Forked Panic Grass				S1	2 May Be At Risk	5	64.2 ± 1.0
P	<i>Dichantherium xanthophyllum</i>	Slender Panic Grass				S1	2 May Be At Risk	6	76.3 ± 0.0
P	<i>Elymus wiegandii</i>	Wiegand's Wild Rye				S1	2 May Be At Risk	1	82.3 ± 0.0
P	<i>Elymus hystrix</i> var. <i>bigeloviana</i>	Spreading Wild Rye				S1	2 May Be At Risk	22	73.6 ± 0.0
P	<i>Festuca subverticillata</i>	Nodding Fescue				S1	2 May Be At Risk	3	96.3 ± 0.0
P	<i>Glyceria obtusa</i>	Atlantic Manna Grass				S1	2 May Be At Risk	6	62.1 ± 0.0
P	<i>Sporobolus compositus</i>	Rough Dropseed				S1	2 May Be At Risk	17	20.8 ± 0.0
P	<i>Potamogeton friesii</i>	Fries' Pondweed				S1	2 May Be At Risk	6	9.2 ± 5.0
P	<i>Potamogeton nodosus</i>	Long-leaved Pondweed				S1	2 May Be At Risk	11	1.7 ± 1.0
P	<i>Potamogeton strictifolius</i>	Straight-leaved Pondweed				S1	2 May Be At Risk	2	68.8 ± 0.0
P	<i>Xyris difformis</i>	Bog Yellow-eyed-grass				S1	5 Undetermined	3	64.2 ± 0.0
P	<i>Asplenium ruta-muraria</i> var. <i>cryptolepis</i>	Wallrue Spleenwort				S1	2 May Be At Risk	3	70.7 ± 0.0
P	<i>Cystopteris laurentiana</i>	Laurentian Bladder Fern				S1	2 May Be At Risk	1	95.1 ± 1.0
P	<i>Dryopteris clintoniana</i>	Clinton's Wood Fern				S1	2 May Be At Risk	1	96.1 ± 0.0
P	<i>Botrychium oneidense</i>	Blunt-lobed Moonwort				S1	2 May Be At Risk	8	9.0 ± 0.0
P	<i>Botrychium rugulosum</i>	Rugulose Moonwort				S1	2 May Be At Risk	5	66.1 ± 1.0
P	<i>Schizaea pusilla</i>	Little Curlygrass Fern				S1	2 May Be At Risk	16	83.0 ± 0.0
P	<i>Hieracium kalmii</i> var. <i>fasciculatum</i>	Kalm's Hawkweed				S1?	5 Undetermined	2	6.7 ± 1.0
P	<i>Cuscuta cephalanthi</i>	Buttonbush Dodder				S1?	2 May Be At Risk	2	69.4 ± 0.0
P	<i>Galium trifidum</i> ssp. <i>subbiflorum</i>	Three-petaled Bedstraw				S1?	5 Undetermined	1	92.4 ± 1.0
P	<i>Wolffia columbiana</i>	Columbian Watermeal				S1?	2 May Be At Risk	5	2.2 ± 0.0
P	<i>Humulus lupulus</i> var. <i>lupuloides</i>	Common Hop				S1S2	3 Sensitive	6	8.0 ± 0.0
P	<i>Rumex aquaticus</i> var. <i>fenestratus</i>	Western Dock				S1S2	2 May Be At Risk	1	9.9 ± 1.0
P	<i>Anemone multifida</i> var. <i>richardsiana</i>	Cut-leaved Anemone				S1S2	5 Undetermined	1	88.6 ± 5.0
P	<i>Saxifraga virginensis</i>	Early Saxifrage				S1S2	2 May Be At Risk	14	17.2 ± 0.0
P	<i>Viola canadensis</i>	Canada Violet				S1S2	2 May Be At Risk	72	86.1 ± 0.0
P	<i>Carex rostrata</i>	Narrow-leaved Beaked Sedge				S1S2	3 Sensitive	4	92.1 ± 0.0
P	<i>Potamogeton bicupulatus</i>	Snailseed Pondweed				S1S2	2 May Be At Risk	5	52.5 ± 0.0
P	<i>Selaginella rupestris</i>	Rock Spikemoss				S1S2	2 May Be At Risk	14	22.8 ± 1.0
P	<i>Thelypteris simulata</i>	Bog Fern				S1S2	2 May Be At Risk	7	20.8 ± 0.0
P	<i>Listera australis</i>	Southern Twayblade			Endangered	S2	1 At Risk	15	24.4 ± 0.0
P	<i>Sanicula odorata</i>	Clustered Sanicle				S2	2 May Be At Risk	21	27.1 ± 0.0
P	<i>Pseudognaphalium macounii</i>	Macoun's Cudweed				S2	3 Sensitive	12	14.5 ± 1.0
P	<i>Solidago altissima</i>	Tall Goldenrod				S2	4 Secure	11	8.3 ± 1.0
P	<i>Solidago simplex</i> var. <i>racemosa</i>	Sticky Goldenrod				S2	2 May Be At Risk	16	20.8 ± 1.0
P	<i>Solidago simplex</i> ssp. <i>randii</i>	Sticky Goldenrod				S2	2 May Be At Risk	2	19.8 ± 0.0
P	<i>Solidago simplex</i>	Sticky Goldenrod				S2	2 May Be At Risk	2	20.0 ± 0.0
P	<i>Ionactis linariifolius</i>	Stiff Aster				S2	3 Sensitive	25	13.9 ± 0.0
P	<i>Symphyotrichum racemosum</i>	Small White Aster				S2	3 Sensitive	9	10.4 ± 0.0
P	<i>Impatiens pallida</i>	Pale Jewelweed				S2	2 May Be At Risk	4	83.6 ± 0.0
P	<i>Alnus serrulata</i>	Smooth Alder				S2	3 Sensitive	35	30.3 ± 0.0
P	<i>Arabis drummondii</i>	Drummond's Rockcress				S2	3 Sensitive	13	16.1 ± 0.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Cardamine concatenata</i>	Cut-leaved Toothwort				S2	2 May Be At Risk	11	29.8 ± 1.0
P	<i>Sagina nodosa</i>	Knotted Pearlwort				S2	3 Sensitive	3	86.8 ± 1.0
P	<i>Sagina nodosa ssp. borealis</i>	Knotted Pearlwort				S2	3 Sensitive	1	88.3 ± 0.0
P	<i>Stellaria longifolia</i>	Long-leaved Starwort				S2	3 Sensitive	9	8.4 ± 10.0
P	<i>Atriplex franktonii</i>	Frankton's Saltbush				S2	4 Secure	1	97.3 ± 1.0
P	<i>Chenopodium rubrum</i>	Red Pigweed				S2	3 Sensitive	4	72.1 ± 1.0
P	<i>Callitriche hermaphroditica</i>	Northern Water-starwort				S2	4 Secure	6	40.7 ± 0.0
P	<i>Hypericum dissimulatum</i>	Disguised St John's-wort				S2	3 Sensitive	3	15.8 ± 0.0
P	<i>Lonicera oblongifolia</i>	Swamp Fly Honeysuckle				S2	3 Sensitive	106	69.0 ± 0.0
P	<i>Triosteum aurantiacum</i>	Orange-fruited Tinker's Weed				S2	3 Sensitive	68	22.9 ± 1.0
P	<i>Viburnum lentago</i>	Nannyberry				S2	4 Secure	38	53.0 ± 0.0
P	<i>Viburnum recognitum</i>	Northern Arrow-Wood				S2	4 Secure	40	64.5 ± 0.0
P	<i>Astragalus eucosmus</i>	Elegant Milk-vetch				S2	2 May Be At Risk	11	22.5 ± 1.0
P	<i>Oxytropis campestris var. johannensis</i>	Field Locoweed				S2	3 Sensitive	11	20.8 ± 0.0
P	<i>Quercus macrocarpa</i>	Bur Oak				S2	2 May Be At Risk	39	7.2 ± 0.0
P	<i>Gentiana linearis</i>	Narrow-Leaved Gentian				S2	3 Sensitive	18	8.8 ± 5.0
P	<i>Myriophyllum humile</i>	Low Water Milfoil				S2	3 Sensitive	10	15.8 ± 1.0
P	<i>Hedeoma pulegioides</i>	American False Pennyroyal				S2	4 Secure	14	32.9 ± 0.0
P	<i>Nuphar lutea ssp. rubrodiscalis</i>	Red-disked Yellow Pond-lily				S2	3 Sensitive	13	11.2 ± 10.0
P	<i>Orobanche uniflora</i>	One-Flowered Broomrape				S2	3 Sensitive	15	38.2 ± 1.0
P	<i>Polygala paucifolia</i>	Fringed Milkwort				S2	3 Sensitive	16	8.4 ± 1.0
P	<i>Polygala sanguinea</i>	Blood Milkwort				S2	3 Sensitive	22	5.8 ± 0.0
P	<i>Polygala senega</i>	Seneca Snakeroot				S2	3 Sensitive	22	35.7 ± 1.0
P	<i>Polygonum amphibium var. emersum</i>	Water Smartweed				S2	3 Sensitive	20	6.0 ± 1.0
P	<i>Polygonum careyi</i>	Carey's Smartweed				S2	3 Sensitive	15	8.5 ± 1.0
P	<i>Podostemum ceratophyllum</i>	Horn-leaved Riverweed				S2	3 Sensitive	31	27.4 ± 0.0
P	<i>Anemone multifida</i>	Cut-leaved Anemone				S2	3 Sensitive	3	24.0 ± 0.0
P	<i>Hepatica nobilis var. obtusa</i>	Round-lobed Hepatica				S2	3 Sensitive	53	17.2 ± 0.0
P	<i>Ranunculus flabellaris</i>	Yellow Water Buttercup				S2	4 Secure	17	8.8 ± 1.0
P	<i>Ranunculus longirostris</i>	Eastern White Water-Crowfoot				S2	5 Undetermined	8	16.6 ± 1.0
P	<i>Crataegus scabrida</i>	Rough Hawthorn				S2	3 Sensitive	9	39.2 ± 1.0
P	<i>Crataegus succulenta</i>	Fleshy Hawthorn				S2	3 Sensitive	1	9.4 ± 5.0
P	<i>Cephalanthus occidentalis</i>	Common Buttonbush				S2	3 Sensitive	51	25.3 ± 0.0
P	<i>Salix candida</i>	Sage Willow				S2	3 Sensitive	6	35.8 ± 1.0
P	<i>Castilleja septentrionalis</i>	Northeastern Paintbrush				S2	3 Sensitive	9	75.7 ± 0.0
P	<i>Euphrasia randii</i>	Rand's Eyebright				S2	2 May Be At Risk	2	88.4 ± 0.0
P	<i>Scrophularia lanceolata</i>	Lance-leaved Figwort				S2	3 Sensitive	11	21.0 ± 100.0
P	<i>Dirca palustris</i>	Eastern Leatherwood				S2	2 May Be At Risk	25	17.3 ± 0.0
P	<i>Phryma leptostachya</i>	American Lopseed				S2	3 Sensitive	56	23.4 ± 1.0
P	<i>Verbena urticifolia</i>	White Vervain				S2	2 May Be At Risk	21	17.9 ± 1.0
P	<i>Viola novae-angliae</i>	New England Violet				S2	3 Sensitive	7	59.5 ± 0.0
P	<i>Symplocarpus foetidus</i>	Eastern Skunk Cabbage				S2	3 Sensitive	70	49.9 ± 0.0
P	<i>Carex granularis</i>	Limestone Meadow Sedge				S2	3 Sensitive	8	7.2 ± 0.0
P	<i>Carex gynocrates</i>	Northern Bog Sedge				S2	3 Sensitive	32	79.0 ± 0.0
P	<i>Carex hirtifolia</i>	Pubescent Sedge				S2	3 Sensitive	55	25.5 ± 0.0
P	<i>Carex livida var. radicaulis</i>	Livid Sedge				S2	3 Sensitive	5	82.3 ± 2.0
P	<i>Carex prairea</i>	Prairie Sedge				S2	3 Sensitive	20	94.6 ± 0.0
P	<i>Carex salina</i>	Saltmarsh Sedge				S2	3 Sensitive	2	81.7 ± 1.0
P	<i>Carex sprengeii</i>	Longbeak Sedge				S2	3 Sensitive	39	17.9 ± 0.0
P	<i>Carex tenuiflora</i>	Sparse-Flowered Sedge				S2	2 May Be At Risk	18	61.2 ± 0.0
P	<i>Carex albicans var. emmonsii</i>	White-tinged Sedge				S2	3 Sensitive	6	35.6 ± 0.0
P	<i>Carex vacillans</i>	Estuarine Sedge				S2	3 Sensitive	2	91.0 ± 1.0
P	<i>Cyperus squarrosus</i>	Awned Flatsedge				S2	3 Sensitive	25	3.8 ± 10.0
P	<i>Eriophorum gracile</i>	Slender Cottongrass				S2	2 May Be At Risk	11	25.5 ± 0.0
P	<i>Elodea nuttallii</i>	Nuttall's Waterweed				S2	3 Sensitive	7	1.9 ± 0.0
P	<i>Juncus vaseyi</i>	Vasey Rush				S2	3 Sensitive	10	75.0 ± 0.0
P	<i>Lemna trisulca</i>	Star Duckweed				S2	4 Secure	17	42.4 ± 0.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Allium tricoccum</i>	Wild Leek				S2	2 May Be At Risk	22	73.5 ± 0.0
P	<i>Najas gracillima</i>	Thread-Like Naiad				S2	3 Sensitive	11	21.6 ± 0.0
P	<i>Calypso bulbosa</i> var. <i>americana</i>	Calypso				S2	2 May Be At Risk	39	9.8 ± 1.0
P	<i>Coeloglossum viride</i> var. <i>virescens</i>	Long-bracted Frog Orchid				S2	2 May Be At Risk	8	12.3 ± 5.0
P	<i>Cypripedium parviflorum</i> var. <i>makasin</i>	Small Yellow Lady's-Slipper				S2	2 May Be At Risk	10	19.0 ± 1.0
P	<i>Galearis spectabilis</i>	Showy Orchis				S2	2 May Be At Risk	54	73.5 ± 0.0
P	<i>Goodyera oblongifolia</i>	Menzies' Rattlesnake-plantain				S2	3 Sensitive	1	49.1 ± 0.0
P	<i>Spiranthes cernua</i>	Nodding Ladies'-Tresses				S2	3 Sensitive	13	5.3 ± 0.0
P	<i>Spiranthes lucida</i>	Shining Ladies'-Tresses				S2	3 Sensitive	22	12.6 ± 50.0
P	<i>Agrostis mertensii</i>	Northern Bent Grass				S2	2 May Be At Risk	1	75.9 ± 0.0
P	<i>Dichantherium linearifolium</i>	Narrow-leaved Panic Grass				S2	3 Sensitive	13	25.5 ± 0.0
P	<i>Elymus canadensis</i>	Canada Wild Rye				S2	2 May Be At Risk	19	7.9 ± 5.0
P	<i>Leersia virginica</i>	White Cut Grass				S2	2 May Be At Risk	41	3.8 ± 1.0
P	<i>Piptatherum canadense</i>	Canada Rice Grass				S2	3 Sensitive	5	27.7 ± 0.0
P	<i>Puccinellia phryganodes</i>	Creeping Alkali Grass				S2	3 Sensitive	8	87.0 ± 0.0
P	<i>Schizachyrium scoparium</i>	Little Bluestem				S2	3 Sensitive	44	9.2 ± 0.0
P	<i>Zizania aquatica</i> var. <i>aquatica</i>	Indian Wild Rice				S2	5 Undetermined	6	9.4 ± 5.0
P	<i>Piptatherum pungens</i>	Slender Rice Grass				S2	2 May Be At Risk	5	75.9 ± 0.0
P	<i>Stuckenia filiformis</i> ssp. <i>alpina</i>	Thread-leaved Pondweed				S2	3 Sensitive	9	76.2 ± 0.0
P	<i>Potamogeton richardsonii</i>	Richardson's Pondweed				S2	3 Sensitive	17	8.8 ± 5.0
P	<i>Potamogeton vaseyi</i>	Vasey's Pondweed				S2	3 Sensitive	10	45.6 ± 0.0
P	<i>Asplenium trichomanes</i>	Maidenhair Spleenwort				S2	3 Sensitive	9	31.3 ± 0.0
P	<i>Woodwardia virginica</i>	Virginia Chain Fern				S2	3 Sensitive	19	12.6 ± 0.0
P	<i>Woodsia alpina</i>	Alpine Cliff Fern				S2	3 Sensitive	5	70.8 ± 0.0
P	<i>Selaginella selaginoides</i>	Low Spikemoss				S2	3 Sensitive	4	76.4 ± 6.0
P	<i>Toxicodendron radicans</i>	Poison Ivy				S2?	3 Sensitive	15	9.2 ± 1.0
P	<i>Osmorhiza longistylis</i>	Smooth Sweet Cicely				S2?	3 Sensitive	7	27.2 ± 5.0
P	<i>Symphotrichum novi-belgii</i> var. <i>crenifolium</i>	New York Aster				S2?	5 Undetermined	3	9.7 ± 1.0
P	<i>Proserpinaca palustris</i> var. <i>crebra</i>	Marsh Mermaidweed				S2?	3 Sensitive	20	55.3 ± 0.0
P	<i>Eplobium coloratum</i>	Purple-veined Willowherb				S2?	3 Sensitive	10	9.9 ± 1.0
P	<i>Rubus pensilvanicus</i>	Pennsylvania Blackberry				S2?	4 Secure	13	8.1 ± 0.0
P	<i>Rubus recurvicaulis</i>	Arching Dewberry				S2?	4 Secure	5	37.1 ± 10.0
P	<i>Galium obtusum</i>	Blunt-leaved Bedstraw				S2?	4 Secure	6	20.6 ± 1.0
P	<i>Salix myricoides</i>	Bayberry Willow				S2?	3 Sensitive	14	20.8 ± 0.0
P	<i>Platanthera huronensis</i>	Fragrant Green Orchid				S2?	5 Undetermined	3	40.2 ± 0.0
P	<i>Eragrostis pectinacea</i>	Tufted Love Grass				S2?	4 Secure	14	6.0 ± 0.0
P	<i>Ceratophyllum echinatum</i>	Prickly Hornwort				S2S3	3 Sensitive	16	10.9 ± 0.0
P	<i>Elatine americana</i>	American Waterwort				S2S3	3 Sensitive	8	22.3 ± 1.0
P	<i>Bartonia paniculata</i>	Branched Bartonia				S2S3	3 Sensitive	4	87.2 ± 0.0
P	<i>Bartonia paniculata</i> ssp. <i>iodandra</i>	Branched Bartonia				S2S3	3 Sensitive	12	56.8 ± 0.0
P	<i>Geranium robertianum</i>	Herb Robert				S2S3	4 Secure	17	67.2 ± 1.0
P	<i>Myriophyllum quitense</i>	Andean Water Milfoil				S2S3	4 Secure	71	58.0 ± 0.0
P	<i>Rumex pallidus</i>	Seabeach Dock				S2S3	3 Sensitive	4	35.6 ± 1.0
P	<i>Galium labradoricum</i>	Labrador Bedstraw				S2S3	3 Sensitive	61	29.5 ± 0.0
P	<i>Valeriana uliginosa</i>	Swamp Valerian				S2S3	3 Sensitive	40	68.9 ± 0.0
P	<i>Carex adusta</i>	Lesser Brown Sedge				S2S3	4 Secure	6	21.8 ± 6.0
P	<i>Carex plantaginea</i>	Plantain-Leaved Sedge				S2S3	3 Sensitive	71	27.5 ± 1.0
P	<i>Juncus brachycephalus</i>	Small-Head Rush				S2S3	3 Sensitive	6	74.8 ± 0.0
P	<i>Corallorhiza maculata</i> var. <i>occidentalis</i>	Spotted Coralroot				S2S3	3 Sensitive	7	9.8 ± 1.0
P	<i>Corallorhiza maculata</i> var. <i>maculata</i>	Spotted Coralroot				S2S3	3 Sensitive	3	7.0 ± 1.0
P	<i>Listera auriculata</i>	Auricled Twayblade				S2S3	3 Sensitive	9	23.7 ± 0.0
P	<i>Potamogeton praelongus</i>	White-stemmed Pondweed				S2S3	4 Secure	20	63.0 ± 0.0
P	<i>Isoetes acadensis</i>	Acadian Quillwort				S2S3	3 Sensitive	10	26.5 ± 1.0
P	<i>Ophioglossum pusillum</i>	Northern Adder's-tongue				S2S3	3 Sensitive	11	34.4 ± 1.0
P	<i>Panax trifolius</i>	Dwarf Ginseng				S3	3 Sensitive	15	10.7 ± 1.0
P	<i>Arnica lanceolata</i>	Lance-leaved Arnica				S3	4 Secure	27	35.8 ± 0.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Artemisia campestris</i>	Field Wormwood				S3	4 Secure	5	20.0 ± 0.0
P	<i>Artemisia campestris ssp. caudata</i>	Field Wormwood				S3	4 Secure	80	17.9 ± 1.0
P	<i>Erigeron hyssopifolius</i>	Hyssop-leaved Fleabane				S3	4 Secure	15	42.1 ± 0.0
P	<i>Prenanthes racemosa</i>	Glaucous Rattlesnakeroot				S3	4 Secure	59	9.1 ± 100.0
P	<i>Tanacetum bipinnatum ssp. huronense</i>	Lake Huron Tansy				S3	4 Secure	29	17.4 ± 5.0
P	<i>Symphotrichum boreale</i>	Boreal Aster				S3	3 Sensitive	109	23.0 ± 10.0
P	<i>Betula pumila</i>	Bog Birch				S3	4 Secure	35	15.0 ± 0.0
P	<i>Arabis glabra</i>	Tower Mustard				S3	5 Undetermined	11	72.0 ± 0.0
P	<i>Arabis hirsuta var. pycnocarpa</i>	Western Hairy Rockcress				S3	4 Secure	20	15.9 ± 0.0
P	<i>Cardamine maxima</i>	Large Toothwort				S3	4 Secure	112	9.8 ± 0.0
P	<i>Subularia aquatica var. americana</i>	Water Awlwort				S3	4 Secure	18	41.0 ± 0.0
P	<i>Lobelia cardinalis</i>	Cardinal Flower				S3	4 Secure	306	27.4 ± 0.0
P	<i>Stellaria humifusa</i>	Saltmarsh Starwort				S3	4 Secure	5	83.2 ± 0.0
P	<i>Hudsonia tomentosa</i>	Woolly Beach-heath				S3	4 Secure	3	67.5 ± 0.0
P	<i>Cornus amomum ssp. obliqua</i>	Pale Dogwood				S3	3 Sensitive	124	30.4 ± 0.0
P	<i>Crassula aquatica</i>	Water Pygmyweed				S3	4 Secure	3	22.3 ± 1.0
P	<i>Rhodiola rosea</i>	Roseroot				S3	4 Secure	19	67.6 ± 5.0
P	<i>Penthorum sedoides</i>	Ditch Stonecrop				S3	4 Secure	50	0.7 ± 0.0
P	<i>Elatine minima</i>	Small Waterwort				S3	4 Secure	56	40.7 ± 0.0
P	<i>Astragalus alpinus var. brunetianus</i>	Alpine Milk-Vetch				S3	4 Secure	10	20.0 ± 0.0
P	<i>Hedysarum alpinum</i>	Alpine Sweet-vetch				S3	4 Secure	16	75.5 ± 0.0
P	<i>Gentianella amarella ssp. acuta</i>	Northern Gentian				S3	4 Secure	9	55.3 ± 0.0
P	<i>Geranium bicknellii</i>	Bicknell's Crane's-bill				S3	4 Secure	10	19.9 ± 5.0
P	<i>Myriophyllum farwellii</i>	Farwell's Water Milfoil				S3	4 Secure	22	30.5 ± 0.0
P	<i>Myriophyllum heterophyllum</i>	Variable-leaved Water Milfoil				S3	4 Secure	49	18.6 ± 0.0
P	<i>Myriophyllum verticillatum</i>	Whorled Water Milfoil				S3	4 Secure	22	6.4 ± 0.0
P	<i>Myriophyllum sibiricum</i>	Siberian Water Milfoil				S3	4 Secure	29	30.5 ± 0.0
P	<i>Stachys tenuifolia</i>	Smooth Hedge-Nettle				S3	3 Sensitive	14	17.0 ± 0.0
P	<i>Utricularia radiata</i>	Little Floating Bladderwort				S3	4 Secure	52	52.3 ± 0.0
P	<i>Nuphar lutea ssp. pumila</i>	Small Yellow Pond-lily				S3	4 Secure	20	15.7 ± 0.0
P	<i>Epilobium hornemannii</i>	Hornemann's Willowherb				S3	4 Secure	4	71.9 ± 1.0
P	<i>Epilobium strictum</i>	Downy Willowherb				S3	4 Secure	45	27.0 ± 1.0
P	<i>Polygonum arifolium</i>	Halberd-leaved Tearthumb				S3	4 Secure	23	23.9 ± 0.0
P	<i>Polygonum punctatum</i>	Dotted Smartweed				S3	4 Secure	2	23.5 ± 0.0
P	<i>Polygonum punctatum var. confertiflorum</i>	Dotted Smartweed				S3	4 Secure	11	9.4 ± 5.0
P	<i>Polygonum scandens</i>	Climbing False Buckwheat				S3	4 Secure	44	3.4 ± 1.0
P	<i>Littorella uniflora</i>	American Shoreweed				S3	4 Secure	30	23.5 ± 0.0
P	<i>Primula mistassinica</i>	Mistassini Primrose				S3	4 Secure	21	24.5 ± 1.0
P	<i>Pyrola minor</i>	Lesser Pyrola				S3	4 Secure	3	73.9 ± 0.0
P	<i>Clematis occidentalis</i>	Purple Clematis				S3	4 Secure	32	10.7 ± 0.0
P	<i>Ranunculus gmelinii</i>	Gmelin's Water Buttercup				S3	4 Secure	25	19.2 ± 1.0
P	<i>Thalictrum venulosum</i>	Northern Meadow-rue				S3	4 Secure	93	2.8 ± 0.0
P	<i>Agrimonia gryposepala</i>	Hooked Agrimony				S3	4 Secure	125	25.5 ± 0.0
P	<i>Amelanchier canadensis</i>	Canada Serviceberry				S3	4 Secure	17	2.9 ± 1.0
P	<i>Rosa palustris</i>	Swamp Rose				S3	4 Secure	43	29.8 ± 0.0
P	<i>Rubus chamaemorus</i>	Cloudberry				S3	4 Secure	46	75.4 ± 0.0
P	<i>Rubus occidentalis</i>	Black Raspberry				S3	4 Secure	97	21.8 ± 0.0
P	<i>Salix interior</i>	Sandbar Willow				S3	4 Secure	35	6.0 ± 0.0
P	<i>Salix nigra</i>	Black Willow				S3	3 Sensitive	123	4.8 ± 1.0
P	<i>Salix pedicellaris</i>	Bog Willow				S3	4 Secure	62	11.8 ± 0.0
P	<i>Comandra umbellata</i>	Bastard's Toadflax				S3	4 Secure	1	38.2 ± 10.0
P	<i>Geocaulon lividum</i>	Northern Comandra				S3	4 Secure	8	83.1 ± 0.0
P	<i>Parnassia glauca</i>	Fen Grass-of-Parnassus				S3	4 Secure	9	28.8 ± 10.0
P	<i>Limosella australis</i>	Southern Mudwort				S3	4 Secure	1	98.0 ± 5.0
P	<i>Veronica serpyllifolia ssp. humifusa</i>	Thyme-Leaved Speedwell				S3	4 Secure	6	8.4 ± 100.0
P	<i>Boehmeria cylindrica</i>	Small-spike False-nettle				S3	3 Sensitive	59	19.7 ± 0.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Pilea pumila</i>	Dwarf Clearweed				S3	4 Secure	47	9.4 ± 1.0
P	<i>Viola adunca</i>	Hooked Violet				S3	4 Secure	13	48.0 ± 1.0
P	<i>Viola nephrophylla</i>	Northern Bog Violet				S3	4 Secure	18	21.6 ± 0.0
P	<i>Carex arcta</i>	Northern Clustered Sedge				S3	4 Secure	40	7.7 ± 0.0
P	<i>Carex atratiformis</i>	Scabrous Black Sedge				S3	4 Secure	4	76.6 ± 0.0
P	<i>Carex capillaris</i>	Hairlike Sedge				S3	4 Secure	7	76.4 ± 0.0
P	<i>Carex chordorrhiza</i>	Creeping Sedge				S3	4 Secure	62	15.2 ± 5.0
P	<i>Carex conoidea</i>	Field Sedge				S3	4 Secure	21	26.9 ± 1.0
P	<i>Carex eburnea</i>	Bristle-leaved Sedge				S3	4 Secure	6	98.4 ± 0.0
P	<i>Carex exilis</i>	Coastal Sedge				S3	4 Secure	99	45.2 ± 0.0
P	<i>Carex garberi</i>	Garber's Sedge				S3	3 Sensitive	14	38.2 ± 1.0
P	<i>Carex haydenii</i>	Hayden's Sedge				S3	4 Secure	31	10.4 ± 1.0
P	<i>Carex lupulina</i>	Hop Sedge				S3	4 Secure	75	7.5 ± 1.0
P	<i>Carex michauxiana</i>	Michaux's Sedge				S3	4 Secure	59	47.6 ± 0.0
P	<i>Carex ormostachya</i>	Necklace Spike Sedge				S3	4 Secure	17	16.1 ± 0.0
P	<i>Carex rosea</i>	Rosy Sedge				S3	4 Secure	137	15.8 ± 0.0
P	<i>Carex tenera</i>	Tender Sedge				S3	4 Secure	42	10.2 ± 0.0
P	<i>Carex tuckermanii</i>	Tuckerman's Sedge				S3	4 Secure	57	7.5 ± 1.0
P	<i>Carex vaginata</i>	Sheathed Sedge				S3	3 Sensitive	14	68.6 ± 0.0
P	<i>Carex wiegandii</i>	Wiegand's Sedge				S3	4 Secure	37	13.1 ± 0.0
P	<i>Carex recta</i>	Estuary Sedge				S3	4 Secure	5	33.8 ± 0.0
P	<i>Cyperus dentatus</i>	Toothed Flatsedge				S3	4 Secure	128	15.8 ± 1.0
P	<i>Cyperus esculentus</i>	Perennial Yellow Nutsedge				S3	4 Secure	45	8.5 ± 5.0
P	<i>Eleocharis intermedia</i>	Matted Spikerush				S3	4 Secure	7	21.0 ± 0.0
P	<i>Eleocharis quinqueflora</i>	Few-flowered Spikerush				S3	4 Secure	8	19.8 ± 0.0
P	<i>Eriophorum chamissonis</i>	Russet Cotton-Grass				S3	4 Secure	9	27.5 ± 2.0
P	<i>Rhynchospora capitellata</i>	Small-headed Beakrush				S3	4 Secure	38	27.4 ± 0.0
P	<i>Rhynchospora fusca</i>	Brown Beakrush				S3	4 Secure	40	33.6 ± 1.0
P	<i>Trichophorum clintonii</i>	Clinton's Clubrush				S3	4 Secure	93	47.3 ± 1.0
P	<i>Schoenoplectus fluviatilis</i>	River Bulrush				S3	3 Sensitive	46	11.6 ± 0.0
P	<i>Schoenoplectus torreyi</i>	Torrey's Bulrush				S3	4 Secure	33	17.1 ± 0.0
P	<i>Triglochin gaspensis</i>	Gasp [r Arrowgrass				S3	4 Secure	11	83.6 ± 1.0
P	<i>Triantha glutinosa</i>	Sticky False-Asphodel				S3	4 Secure	68	21.8 ± 0.0
P	<i>Cypripedium reginae</i>	Showy Lady's-Slipper				S3	3 Sensitive	74	69.0 ± 0.0
P	<i>Liparis loeselii</i>	Loesel's Twayblade				S3	4 Secure	25	2.7 ± 0.0
P	<i>Platanthera blephariglottis</i>	White Fringed Orchid				S3	4 Secure	24	4.1 ± 0.0
P	<i>Platanthera grandiflora</i>	Large Purple Fringed Orchid				S3	3 Sensitive	35	28.3 ± 1.0
P	<i>Bromus latiglumis</i>	Broad-Glumed Brome				S3	3 Sensitive	16	23.7 ± 0.0
P	<i>Calamagrostis pickeringii</i>	Pickering's Reed Grass				S3	4 Secure	104	56.8 ± 0.0
P	<i>Dichanthelium depauperatum</i>	Starved Panic Grass				S3	4 Secure	16	33.7 ± 0.0
P	<i>Muhlenbergia richardsonis</i>	Mat Muhly				S3	4 Secure	22	21.2 ± 0.0
P	<i>Heteranthera dubia</i>	Water Stargrass				S3	4 Secure	55	6.9 ± 0.0
P	<i>Potamogeton obtusifolius</i>	Blunt-leaved Pondweed				S3	4 Secure	29	45.0 ± 1.0
P	<i>Xyris montana</i>	Northern Yellow-Eyed-Grass				S3	4 Secure	28	54.5 ± 0.0
P	<i>Zannichellia palustris</i>	Horned Pondweed				S3	4 Secure	5	68.8 ± 0.0
P	<i>Adiantum pedatum</i>	Northern Maidenhair Fern				S3	4 Secure	202	25.5 ± 0.0
P	<i>Cryptogramma stelleri</i>	Steller's Rockbrake				S3	4 Secure	1	80.8 ± 1.0
P	<i>Asplenium trichomanes-ramosum</i>	Green Spleenwort				S3	4 Secure	15	59.1 ± 0.0
P	<i>Dryopteris fragrans var. remotiuscula</i>	Fragrant Wood Fern				S3	4 Secure	20	30.4 ± 0.0
P	<i>Dryopteris goldiana</i>	Goldie's Woodfern				S3	3 Sensitive	166	22.7 ± 5.0
P	<i>Woodsia glabella</i>	Smooth Cliff Fern				S3	4 Secure	1	94.7 ± 1.0
P	<i>Equisetum palustre</i>	Marsh Horsetail				S3	4 Secure	8	3.0 ± 10.0
P	<i>Isoetes tuckermanii</i>	Tuckerman's Quillwort				S3	4 Secure	21	37.3 ± 0.0
P	<i>Lycopodium sabinifolium</i>	Ground-Fir				S3	4 Secure	12	19.9 ± 10.0
P	<i>Huperzia appalachiana</i>	Appalachian Fir-Clubmoss				S3	3 Sensitive	2	79.1 ± 1.0
P	<i>Botrychium dissectum</i>	Cut-leaved Moonwort				S3	4 Secure	50	6.9 ± 0.0
P	<i>Botrychium lanceolatum var.</i>	Lance-Leaf Grape-Fern				S3	3 Sensitive	18	9.4 ± 5.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>angustisegmentum</i>								
P	<i>Botrychium simplex</i>	Least Moonwort				S3	4 Secure	12	12.7 ± 0.0
P	<i>Polypodium appalachianum</i>	Appalachian Polypody				S3	4 Secure	22	7.0 ± 10.0
P	<i>Utricularia resupinata</i>	Inverted Bladderwort				S3?	4 Secure	16	45.2 ± 0.0
P	<i>Crataegus submollis</i>	Quebec Hawthorn				S3?	3 Sensitive	17	10.4 ± 1.0
P	<i>Lobelia kalmii</i>	Brook Lobelia				S3S4	4 Secure	41	8.8 ± 1.0
P	<i>Suaeda calceoliformis</i>	Horned Sea-blite				S3S4	4 Secure	3	8.1 ± 0.0
P	<i>Utricularia gibba</i>	Humped Bladderwort				S3S4	4 Secure	41	27.6 ± 0.0
P	<i>Potentilla arguta</i>	Tall Cinquefoil				S3S4	4 Secure	46	9.7 ± 1.0
P	<i>Cladium mariscoides</i>	Smooth Twigrush				S3S4	4 Secure	76	33.9 ± 0.0
P	<i>Spirodela polyrrhiza</i>	Great Duckweed				S3S4	4 Secure	38	2.0 ± 1.0
P	<i>Corallorhiza maculata</i>	Spotted Coralroot				S3S4	3 Sensitive	14	31.3 ± 0.0
P	<i>Distichlis spicata</i>	Salt Grass				S3S4	4 Secure	3	88.9 ± 1.0
P	<i>Potamogeton oakesianus</i>	Oakes' Pondweed				S3S4	4 Secure	35	4.1 ± 0.0
P	<i>Stuckenia pectinata</i>	Sago Pondweed				S3S4	4 Secure	62	21.9 ± 0.0
P	<i>Solidago caesia</i>	Blue-stemmed Goldenrod				SX	0.1 Extirpated	2	81.9 ± 1.0
P	<i>Oligoneuron album</i>	Upland White Goldenrod				SX	0.1 Extirpated	3	83.1 ± 1.0
P	<i>Celastrus scandens</i>	Climbing Bittersweet				SX	0.1 Extirpated	4	25.1 ± 1.0

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70	Scott, Fred W. 1998. Updated Status Report on the Cougar (Puma Concolor cougar) [Eastern population]. Committee on the Status of Endangered Wildlife in Canada, 298 recs.
66	McAlpine, D.F. 1998. NBM Science Collections: Wood Turtle records. New Brunswick Museum, Saint John NB, 329 recs.
64	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
59	Spicer, C.D. 2002. Fieldwork 2002. Atlantic Canada Conservation Data Centre. Sackville NB, 211 recs.
55	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
54	Bateman, M.C. 2001. Coastal Waterfowl Surveys Database, 1965-2001. Canadian Wildlife Service, Sackville, 667 recs.
54	Boyne, A.W. 2000. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 168 recs.
46	Clayden, S.R. 2012. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 57 recs.
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38	Doucet, D.A. & Edsall, J.; Brunelle, P.-M. 2007. Miramichi Watershed Rare Odonata Survey. New Brunswick ETF & WTF Report, 1211 recs.
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34	Blaney, C.S.; Mazerolle, D.M. 2010. Fieldwork 2010. Atlantic Canada Conservation Data Centre. Sackville NB, 15508 recs.
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29	Stewart, J.I. 2010. Peregrine Falcon Surveys in New Brunswick, 2002-09. Canadian Wildlife Service, Sackville, 58 recs.
28	Benedict, B. Connell Herbarium Specimens, Digital photos. University New Brunswick, Fredericton. 2005.
27	Hinds, H.R. 1999. Connell Herbarium Database. University New Brunswick, Fredericton, 131 recs.
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25	Kennedy, Joseph. 2010. New Brunswick Peregrine records, 2009. New Brunswick Dept Natural Resources, 19 recs (14 active).
25	Wilhelm, S.I. et al. 2011. Colonial Waterbird Database. Canadian Wildlife Service, Sackville, 2698 sites, 9718 recs (8192 obs).
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20	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
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10	Noseworthy, J. 2013. Van Brunt's Jacob's-ladder observations along tributary of Dipper Harbour Ck. Nature Conservancy of Canada, 10 recs. Wood Turtle (<i>Glyptemys insculpta</i>) Miramichi Watershed Synopsis 2013
10	Compiled by: Vladimir King Trajkovic, EPT Miramichi River Environmental Assessment Committee
9	Clayden, S.R. 2005. Confidential supplement to Status Report on Ghost Antler Lichen (<i>Pseudevernia cladonia</i>). Committee on the Status of Endangered Wildlife in Canada, 27 recs.
9	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
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8	Goltz, J.P. & Bishop, G. 2005. Confidential supplement to Status Report on Prototype Quillwort (<i>Isoetes prototypus</i>). Committee on the Status of Endangered Wildlife in Canada, 111 recs.
8	Pike, E., Tingley, S. & Christie, D.S. 2000. Nature NB Listserve. University of New Brunswick, listserv.unb.ca/archives/naturenb. 68 recs.

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6	Litvak, M.K. 2001. Shortnose Sturgeon records in four NB rivers. UNB Saint John NB. Pers. comm. to K. Bredin, 6 recs.
6	Marshall, L. 1998. Atlantic Salmon: Southwest New Brunswick outer-Fundy SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-13. 6 recs.
6	Newell, R.E. 2008. Vascular Plants of Muzroll Lake. Pers. comm. to C.S. Blaney, 1 pg. 43 recs.
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2	McAlpine, D.F. 2001. Lepomis auritus, 2 sites in Saint John County. New Brunswick Museum, Pers. comm. to K.A. Bredin. 2 recs.
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1	Jessop, B. 2004. Acipenser oxyrinchus locations. Dept of Fisheries & Oceans, Atlantic Region, Pers. comm. to K. Bredin. 1 rec.
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1	Madden, A. 1998. Wood Turtle records in northern NB. New Brunswick Dept of Natural Resources & Energy, Campbellton, Pers. comm. to S.H. Gerriets. 16 recs.
1	McAlpine, D.F. & Cox, S.L., McCabe, D.A., Schnare, J.-L. 2004. Occurrence of the Long-tailed Shrew (Sorex dispar) in the Nerepis Hills NB. Northeastern Naturalist, vol 11 (4) 383-386. 1 rec.

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1	Norton, Barb. 2010. Personal communication concerning <i>Botrychium oneidense</i> near Ayers Lake, NB. . One record.
1	Nye, T. 2002. Wood Turtle observations in Westmorland, Queens Cos., Pers. com. to S.H. Gerriets, Dec. 3. 3 recs.
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1	Sabine, D.L. 2004. Specimen data: Whittaker Lake & Marysville NB. Pers. comm. to C.S. Blaney, 2pp, 4 recs.
1	Sabine, D.L. 2012. Bronze Copper records, 2003-06. New Brunswick Dept of Natural Resources, 5 recs.
1	Sheppard, M. 2000. Annual Report . Nature Trust of New Brunswick, September 2000. 1 rec.
1	Singleton, J. 2004. <i>Primula mistassinica</i> record for Nashwaak NB. Pers. comm. to C.S. Blaney, 1 rec.
1	Taylor, Eric B. 1997. Status of the Sympatric Smelt (genus <i>Osmerus</i>) Populations of Lake Utopia, New Brunswick. Committee on the Status of Endangered Wildlife in Canada, 1 rec.
1	Toner, M. 2005. <i>Listera australis</i> population at Bull Pasture Plains. NB Dept of Natural Resources. Pers. comm. to S. Blaney, 8 recs.
1	Toner, M. 2009. Wood Turtle Sightings. NB Dept of Natural Resources. Pers. comm. to S. Gerriets, Jul 13 & Sep 2, 2 recs.
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1	Torenvliet, Ed. 2010. Wood Turtle roadkill. NB Dept of Transport. Pers. com. to R. Lautenschlager, Aug. 20, photos, 1 rec.
1	Tremblay, E. 2006. Kouchibouguac National Park Digital Database. Parks Canada, 105 recs.

Appendix D

Bird Survey Report, Jim Wilson, August 2015

JIM WILSON

2 Neck Road, Quispamsis, New Brunswick, E2G 1L3

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August 26, 2015

Ms Rhonda Dana
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Fredericton, N.B.
E3B 3H4

Subject - Bird Survey – Maugerville Townhouse Development Site

This is a report on a survey of the bird life within the Maugerville Townhouse construction area, as requested.

Overview

I conducted a survey of the site the morning of Tuesday, August 25, 2015. This information is intended to support a potential environmental impact assessment for the development of townhouses.

The survey area is nearly free of large trees and dense shrubbery as most of it had been cleared by heavy equipment or filled in with gravel or sand in preparation for construction.

No Species at Risk were detected and no stick nests were present in the remaining few trees along the banks of the Saint John River. One distant Bald Eagle was observed out over the river, travelling southeast and was not noted nesting or foraging within the area of the planned development.

The survey involved conducting specific ten-minute periods of listening and observing for bird species at three point count locations within the development area, a search of all large trees for stick nests and general listening and observing bird life within the site for the duration of a two-hour visit.

Weather conditions were heavy overcast with no wind, making for excellent listening conditions.

Twenty bird species were identified during the point counts and are summarized in the attached appendixes. A total of 51 individual birds were noted.

Survey Methods

The coordinates of three point count locations within the survey area were predetermined by Dillon Consulting Limited. The points were plotted to ensure relatively easy access, spread coverage across the survey site, be at least 200 meters apart and be located in a variety of habitat types. I travelled between locations using a handheld GPS. A map showing approximate locations of the point counts is attached as **APPENDIX 1**.

Conducting the point counts involved initial five-minute periods of quietly listening for the songs and calls of all birds in the area of each location as well as observing for the movements of birds within the area or flying overhead.

A second step at each point count involved playing a digital recording of an Eastern Screech Owl being mobbed by a flock of very vocal Black-capped Chickadees for a further period of five minutes. The maternal instincts of songbirds are very strong during the breeding season and into the early fall, and this recording has the potential to draw in most birds within earshot, providing an observer with an idea of what birds are around that might not have been vocalizing during the previous five minute period. Any new species or additional individuals of a previously-recorded species were then added to the point count inventory.

Bird Species Noted

A total of 20 bird species were identified and **APPENDIX 2 – Summary of Species by Relative Abundance** presents the list of birds by relative abundance, beginning with the most numerous. Because the visit was well past the peak of the summer nesting season most birds were not singing and had to be detected visually or by hearing their calls (not songs).

The survey area had been largely denuded of trees and shrubbery and some of the species noted were seen or heard calling at the eastern edge, where it meets the adjoining property that is still densely forested with thickets, mature trees and wetland sedges. Birds such as Swamp Sparrow, Veery, Purple Finch and American Goldfinch that responded there would not normally inhabit the open area of the survey footprint.

Similarly, species such as Mallard, Double-crested Cormorant and Bald Eagle would not normally be expected as they tend to feed or forage in and along the waters of the Saint John River.

APPENDIX 4 – *Summary of Point Count Surveys* provides details of the number and locations of individual bird species detected. A total of 51 individual birds were noted during these counts.

Weather

Weather conditions were heavy overcast with no wind, making for excellent listening conditions between 8 AM and 10 AM. The temperature ranged from +18C at the start to + 23C. With the open topography and no wind, it was a good morning to be doing the survey.

General Habitat

Much of the survey footprint had been cleared with heavy equipment within the recent past with the result that there are large areas of sand or gravel, including the main access roadway and offshoots from it. As part of the earlier site preparation a cement foundation footing had been poured and there are raised and levelled areas of sand and gravel.

The remaining portion of the site is still covered in grass and weeds, including a damp area toward the northern end and a grassy field at the southern (river) end that comprises approximately 20% of the development area.

Along the shore of the Saint John River are scattered mature maples and one large ash. These vary in height between an estimated 15 and 25 meters and are typical riparian trees.

To the east of the survey area and separate from it is a damp property covered with thickets of alder and willow, larger trees of birch and maple as well as abundant wetland sedges. In places there are small clumps of cattail, indicating standing water must be present during much of the year.

Photographs of habitat at various points within the development area are included in **APPENDIX 3**.

Conclusions

1. I did not detect any stick nests or any other birds of prey within the development area during the survey.
2. I did not detect any Species at Risk within the development boundaries during the survey.
3. I did not identify any habitat within the boundaries that might harbor bird Species at Risk now, or at other seasons of the year.

Future Construction Activity

It's my understanding that future landscape alteration and construction is planned at the site, although the timing of such renewed activity is not clear at this time.

Recommendations

1. That, if possible, remaining land clearing and site preparation work be done outside the spring/summer nesting period (April 1 to the end of August), to avoid the possibility of disturbing nesting migratory birds. Birds such as Killdeer, which prefer open sandy or gravel areas such as this one for their ground nests, can lay eggs before the end of April. Ground nesting American Woodcock and at least two duck species would also be possible by then.
2. That, if land clearing is required to take place between April 1 and August 31, a thorough check is made for the presence of nests, eggs or young of migratory birds by a person qualified to do such work.

3. That should any nest, eggs or young of any migratory bird be detected before land clearing begins, that plans for clearing operations be put on hold until the birds have fledged and moved out of the area and the area is re-checked to ensure other nests, eggs or young are not present.
4. That the clearing crew be advised to be vigilant for any indication of migratory bird nesting activity during the land clearing and site preparation work. That would include the consistent presence of a pair of birds in the immediate area showing obvious signs of agitation, birds carrying nesting material or food in their beaks to a location in the development area, or the presence of young birds on the ground or in adjacent shrubs and trees within the development area.
5. That should the clearing crew detect the presence of any nest, eggs or young of a migratory bird during the operations, that you contact me immediately. I would be happy do a quick evaluation of the situation, to avoid any problems.

I trust this report and these recommendations are helpful. If you have any questions or need additional information, please contact me by email or telephone at the addresses above.

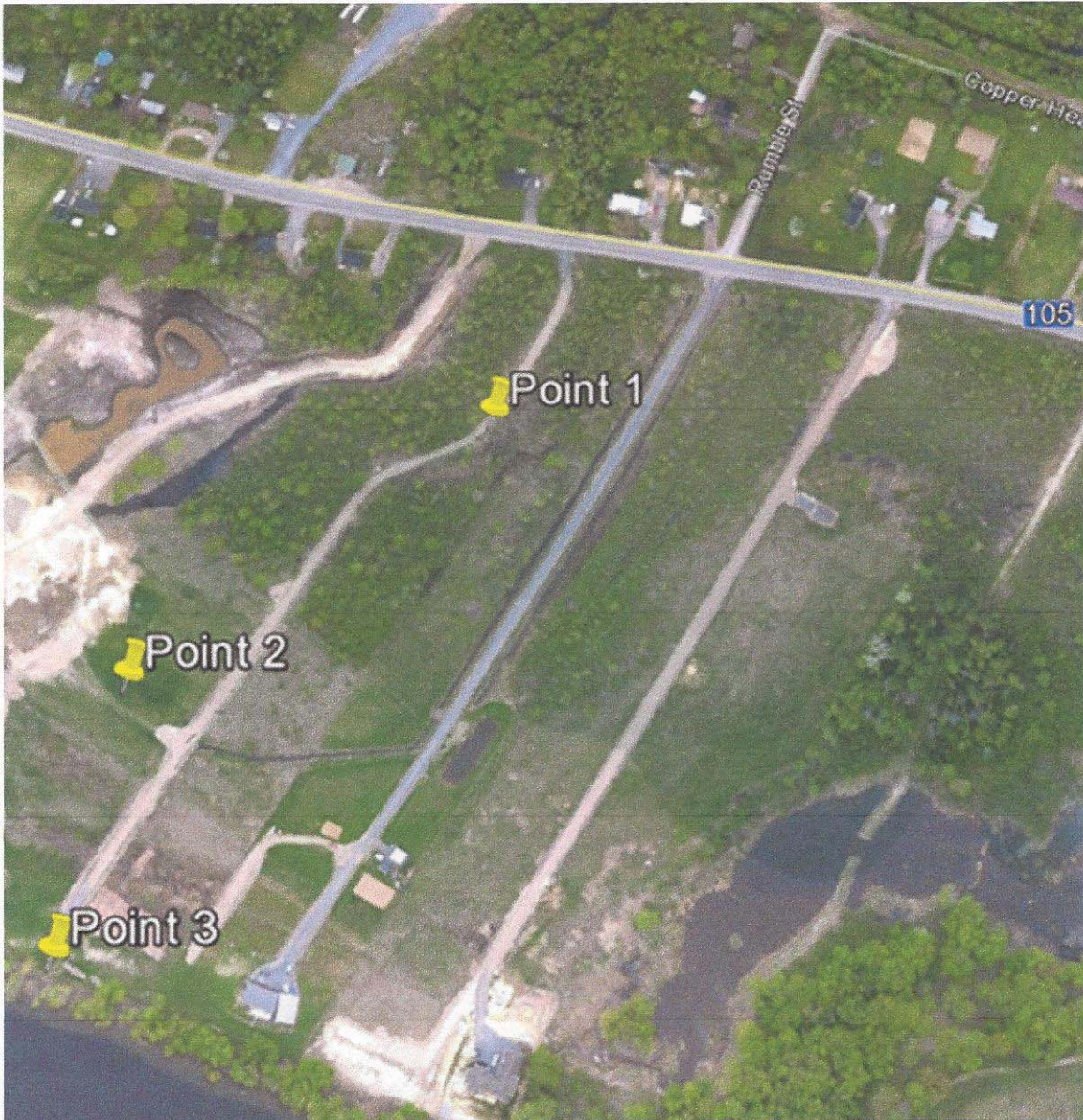
Sincerely,

A handwritten signature in black ink, appearing to read 'Jim Wilson', with a long, sweeping horizontal stroke extending to the right.

Jim Wilson

APPENDIX 1

Maugerville Townhouse Development Point Count Locations



Proposed Townhouse Development Site - Edgar & Anita Way, Maugerville, N.B.			
Summary of Bird Species by Relative Abundance			
Surveyed August 25, 2015			
Species Name	Total Individuals Counted	% of Total	Relative Abundance
Mallard	11	21.6%	1
American Crow	9	17.6%	2
Song Sparrow	4	7.8%	3
American Goldfinch	4	7.8%	3
Double-crested Cormorant	3	5.9%	4
Black-capped Chickadee	3	5.9%	4
Red-eyed Vireo	2	3.9%	5
White-breasted Nuthatch	2	3.9%	5
Swamp Sparrow	2	3.9%	5
Bald Eagle	1	2.0%	6
Mourning Dove	1	2.0%	6
Belted Kingfisher	1	2.0%	6
Hairy Woodpecker	1	2.0%	6
Northern Flicker	1	2.0%	6
Eastern Phoebe	1	2.0%	6
Common Raven	1	2.0%	6
Veery	1	2.0%	6
Warbler (species?)	1	2.0%	6
Bobolink	1	2.0%	6
Purple Finch	1	2.0%	6
Total Counted	51	100.0%	

Notes:
 1. The survey was done well after the peak of the nesting season and as a result there were very few birds actually singing. In fact, only Red-eyed Vireo, a prolific songster of summer, was singing actively.

Maugerville Townhouse Project – Maugerville, N.B.



Figure 1 – Point count location #1, main access road (Edgar & Anita Way), looking southwest.



Figure 2 – Point count location #1, main access road, looking west.

Maugerville Townhouse Project – Maugerville, N.B.



Figure 3 – Point count location #2, looking northwest.



Figure 4 – Main access road, looking south, toward Saint John River.

Maugerville Townhouse Project – Maugerville, N.B.



Figure 5 – Point count location #3, looking southwest, showing mature riparian trees.



Figure 6 – View from near point count #3 at river, looking north.

APPENDIX 4

Proposed Townhouse Development Site, Edgar & Anita's Way, Maugerville, N.B.

Summary of Bird Point Count Surveys - August 25, 2015

Surveyed and Summarized by Jim Wilson

Point Counts	North	West	Date Surveyed	Survey Start Time	Mallard	Double-crested Cormorant	Bald Eagle	Mourning Dove	Belted Kingfisher	Hairy Woodpecker	Northern Flicker	Eastern Phoebe	Red-eyed Vireo	American Crow	Common Raven	Black-capped Chickadee	White-breasted Nuthatch	Veery	Warbler (species?)	Song Sparrow	Swamp Sparrow	Bobolink	Purple Finch	American Goldfinch	Total Individuals	
1	45° 54' 33.60"	66° 33' 27.33"	August 25/15	8:15	0	0	0	0	0	0	0	0	2	3	0	2	0	1	0	1	1	0	0	0	2	12
2	45° 54' 29.04"	66° 33' 35.73"	August 25/15	8:45	0	0	0	1	0	1	0	0	0	4	0	1	1	0	1	1	1	1	1	1	2	15
3	45° 54' 24.61"	66° 33' 37.10"	August 25/15	9:13	11	3	1	0	1	0	1	1	0	2	1	0	1	0	0	2	0	0	0	0	24	
TOTALS					11	3	1	1	1	1	1	1	2	9	1	3	2	1	1	4	2	1	1	4	51	
TOTAL SPECIES AT POINT COUNTS =			20		(A)	(A)	(A)	(A)							(A)							(A)				
	Note A - (A) denotes birds seen or heard flying over the site but not landing, or water birds seen in the river.																									

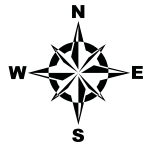
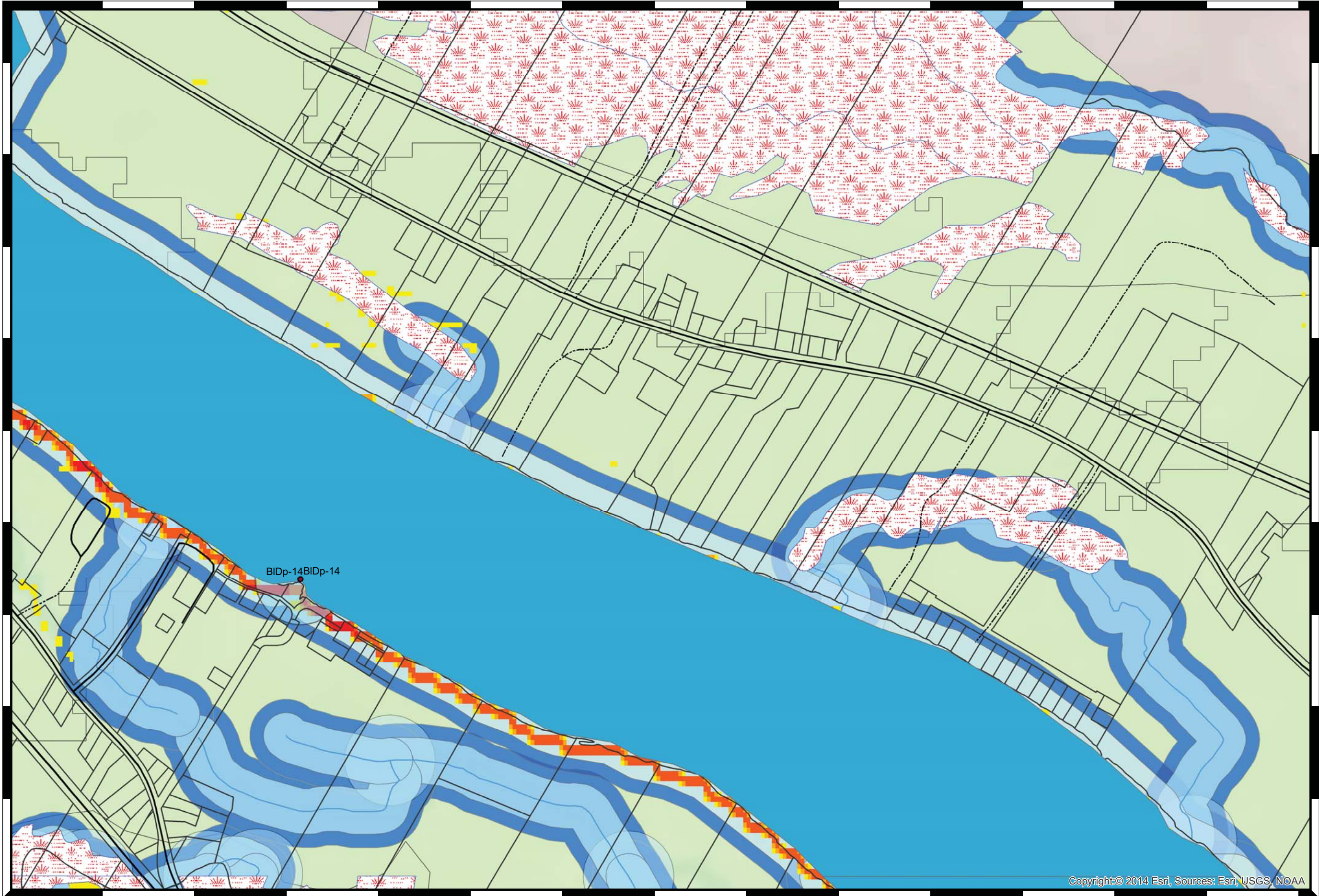
Appendix E

Plant Survey and Wetland Plant Information

<i>Lobelia inflata</i>	Indian-Tobacco	S5								x
<i>Lupinus polyphyllus</i>	Large-Leaved Lupine	SE						x		x
<i>Lycopus americanus</i>	American Bugleweed	S5		x	x	x			x	
<i>Lysimachia ciliata</i>	Fringed Loosestrife	S5		x		x			x	
<i>Lysimachia terrestris</i>	Swamp Loosestrife	S5		x	x	x			x	
<i>Lythrum salicaria</i>	Purple Loosestrife	SE		x	x	x			x	x
<i>Maianthemum trifolium</i>	Three-Leaf Solomon's-Plume	S5							x	
<i>Melilotus altissimus</i>	Tall Yellow Sweetclover	SE								x
<i>Nemopanthus mucronatus</i>	Mountain Holly	S5		x					x	
<i>Oenothera biennis</i>	Common Evening-Primrose	S5								x
<i>Onoclea sensibilis</i>	Sensitive Fern	S5		x	x	x			x	x
<i>Osmunda cinnamomea</i>	Cinnamon Fern	S5							x	
<i>Phalaris arundinacea</i>	Reed Canary Grass	S5			x					x
<i>Phleum pratense</i>	Meadow Timothy	SE								x
<i>Plantago major</i>	Nipple-Seed Plantain	SE			x	x				x
<i>Polygonum hydropiper</i>	Marshpepper Smartweed	SE				x			x	
<i>Polygonum persicaria</i>	Spotted Lady's-thumb	SE		x						x
<i>Polygonum sagittatum</i>	Arrow-Leaved Tearthumb	S5								
<i>Potentilla norvegica</i>	Norwegian Cinquefoil	S5						x		
<i>Ranunculus acris</i>	Tall Butter-Cup	SE						x	x	
<i>Ranunculus repens</i>	Creeping Butter-Cup	SE						x	x	
<i>Rubus pubescens</i>	Dwarf Red Raspberry	S5			x	x			x	
<i>Rumex crispus</i>	Curly Dock	SE		x	x	x				
<i>Sagittaria latifolia</i>	Broadleaf Arrowhead	S5								
<i>Salix sp</i>	Willow	not a sp at risk								
<i>Sambucus racemosa</i>	Red Elderberry	S5				x			x	x
<i>Scirpus cyperinus</i>	Cottongrass Bulrush	S5		x		x			x	
<i>Scirpus hattorianus</i>	Bulrush	S5		x						
<i>Scutellaria lateriflora</i>	Mad Dog Skullcap	S5		x						
<i>Silene vulgaris</i>	Maiden's Tears	SE				x				
<i>Sium suave</i>	Hemlock Water-Parsnip	S5		x		x				
<i>Spartina pectinata</i>	Fresh Water Cordgrass	S5						x		
<i>Spiraea alba</i>	Narrow-Leaved Meadow-Sweet	S5		x	x	x	x		x	
<i>Stachys palustris</i>	Marsh Hedge-Nettle	SE				x	x			
<i>Symphyotrichum cordifolium</i>	Heart-Leaf Aster	S5						x		x
<i>Symphyotrichum lateriflorum</i>	Farewell-Summer	S5						x		
<i>Symphyotrichum puniceum</i>	Swamp Aster	S5		x					x	
<i>Thalictrum confine</i>	Northern Meadow-rue	S3	19T 0689194 5086595					x		
<i>Thalictrum pubescens</i>	Tall Meadow-Rue	S5							x	x
<i>Thelypteris noveboracensis</i>	New York Fern	S5		x					x	
<i>Thelypteris palustris</i>	Marsh Fern	S5		x					x	
<i>Tragopogon pratensis</i>	Meadow Goat's-Beard	SE				x				x
<i>Triadenum fraseri</i>	Marsh St. John's-Wort	S5		x		x			x	
<i>Trifolium campestre</i>	Low Hop Clover	SE								x
<i>Trifolium pratense</i>	Red Clover	SE								x
<i>Tussilago farfara</i>	Colt's Foot	SE								x
<i>Typha latifolia</i>	Broad-Leaf Cattail	S5		x	x	x			x	
<i>Verbascum thapsus</i>	Great Mullein	SE			x					x
<i>Viburnum nudum</i>	Poosum-Haw Viburnum	S5		x					x	
<i>Vicia cracca</i>	Tufted Vetch	SE		x	x	x			x	x
<i>Viola sp</i>	Violet	not a sp at risk				x	x		x	

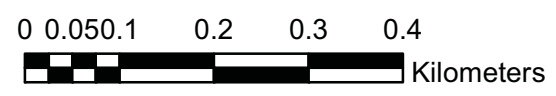
Appendix F

Archaeological and Cultural Resources Model



- Legend**
- June52012UndefinedSites
 - 2014Historic
 - June52012SuspectedShipwrecks
 - June52012Shipwrecks
 - June52012SuspectedPlaneCrash
 - June52012RecordedPlaneCrash
 - June52012ProtoHistoricSite
 - 2014PrecontactSites
 - June52012HistoricSites
 - June52012Cemeteries
 - New Brunswick Portage Routes
- waterbody**
- <all other values>
- WATER_CODE**
- AQ
 - LK
 - ON
 - PN
 - RV
 - SL
 - WA
- Roads**
- <all other values>
- TRANSPORTA**
- 1
 - 3
 - 2
- 2014HistoricBuffer
 - wetland
- watercourse**
- <all other values>
- WATERCOURS**
- 1
 - 2
- Slope_demnb2**
- <VALUE>**
- 0 - 25.36652904
 - 25.36652905 - 60.23010614
 - 60.23010615 - 72.92877099
 - 72.928771 - 77.50883873
 - 77.50883874 - 80.67965486
 - 80.67965487 - 83.85047099
 - 83.850471 - 89.83979034
 - High Potential
 - Medium Potential
- MarinePaleoShoreline**
- VALUE**
- 0 - 28
 - 28.00000001 - 38
 - 38.00000001 - 48
 - 48.00000001 - 810
 - Alluvial Sediments

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Time: 4:02:25 PM
Date: 8/26/2015

Appendix G

Site Photos



Open Wetland Looking SW 19 T 689449 5086959



Open Unmapped Wetland (WL2) Looking NE Towards Highway 105



Manmade Pond Edge 19 T 689263 5086692



River Edge 19 T 689193 5086596



Graminoid Meadow (Unmapped Wetland) – WL1 19 T 689429 5086826



Ditch SW of Graminoid Meadow (WL1) 19 T 689340 5086704

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