DILLON CONSULTING

HAMMOND RIVER HOLDINGS LIMITED

Environmental Impact Assessment (EIA) Registration

Proposed Upham East Gypsum Quarry Project, Upham, New Brunswick

October 2018 – 18-8346

October 30, 2018

1149 Smythe Street
Suite 200
Fredericton
New Brunswick
Canada
E3B 3H4
Telephone
506.444.8820
Fax
506.444.8821

New Brunswick Department of Environment and Local Government
Environmental Impact Assessment Branch
P.O. Box 6000
20 McGloin Street, 3rd Floor
Fredericton, NB
E3B 5H1

Attention: Mr. Paul Vanderlaan, P.Eng.
Director, Environmental Impact Assessment Branch

RE: Environmental Impact Assessment (EIA) Registration: Proposed Upham East Gypsum Quarry Project, Upham, New Brunswick

On behalf of Hammond River Holdings Limited, Dillon Consulting Limited (Dillon) is pleased to submit this environmental impact assessment (EIA) registration document for the proposed Upham East Gypsum Quarry Project, for your review and consideration.

Dillon looks forward to your timely review of the documentation. Please contact the undersigned if you have any questions or require additional information.

Sincerely,

DILLON CONSULTING LIMITED

Denis L. Marquis, M.Sc.E., P.Eng.
Associate, Project Manager

DLM:trw
Enclosure
cc: R. Bruce Eddy

Our file: 18-8346

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1.0 Introduction

This document is an environmental impact assessment (EIA) registration for the proposed Upham East Gypsum Quarry Project (the Project) proposed by Hammond River Holdings Limited (Hammond River Holdings) in the community of Upham, Kings County, New Brunswick. The Project consists of the development of a new open pit quarry for the extraction of gypsum to be used in the production of gypsum wallboard at manufacturing facilities in New Brunswick. The Project location is shown in **Figure 1.1.1**.

The Project is an "undertaking" under item (a) of Schedule A of the New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act* (EIA Regulation) ["*(a) all commercial extraction or processing of a mineral as defined in the Mining Act"*]. As such, the Project must be registered under Section 5(1) of the EIA Regulation, and at minimum a determination review will be conducted.

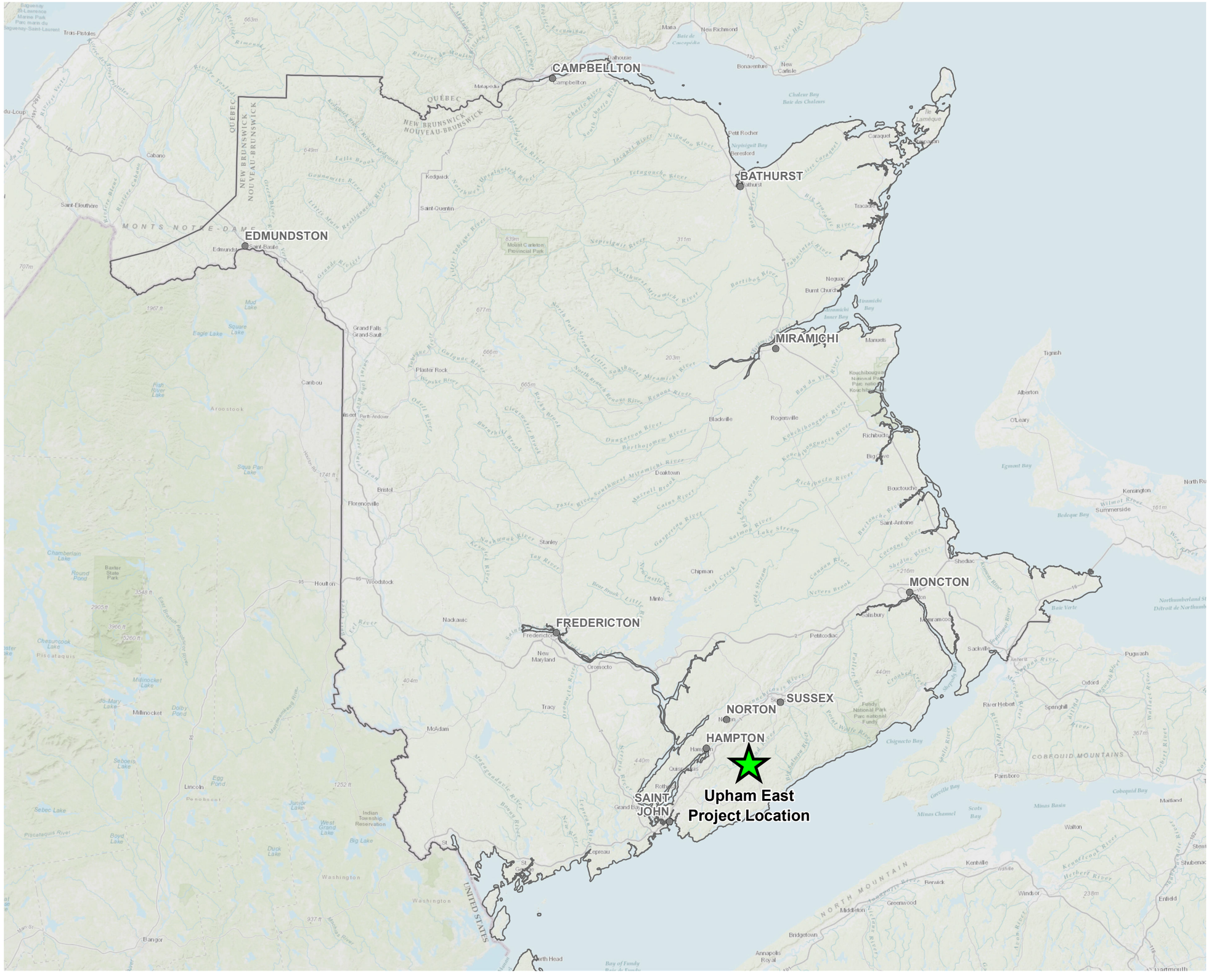
This EIA Registration document is submitted to the New Brunswick Department of Environment and Local Government (NBDELG) under Section 5(2) of the New Brunswick *Environmental Impact Assessment Regulation* 87-83 of the *Clean Environment Act*. It has been prepared by Dillon Consulting Limited (Dillon) on behalf of Hammond River Holdings to provide information to the NBDELG and its associated Technical Review Committee (TRC) to assist in the EIA review of the Project.

1.1 Proponent Information

The Project may be identified as the "Upham East Gypsum Quarry Project". The proponent of the Project is Hammond River Holdings Limited. The Proponent's contact information is provided in **Table 1.1.1** below.

Table 1.1.1: Proponent Information

Name of Project:	Upham East Gypsum Quarry Project
Name of Proponent:	Hammond River Holdings Limited
Mailing Address of Proponent:	210-65 Regent Street Fredericton, NB E3B 7H8
Proponent's Contact Person for the purposes of this EIA Registration:	R. Bruce Eddy Tel: 506.632.4494 Email: info@hammondriverholdings.com Website: www.hammondriverholdings.com (link available after November 13, 2018)
Environmental Consultant that led the preparation of this EIA Registration:	Denis L. Marquis, M.Sc.E., P.Eng. Associate, Project Manager Dillon Consulting Limited 1149 Smythe Street, Suite 200 Fredericton, NB E3B 3H4 Tel.: 506.476.8276 Email: uphameastproject@gmail.com



HAMMOND RIVER HOLDINGS LIMITED
PROPOSED UPHAM EAST GYPSUM QUARRY

PROJECT LOCATION
FIGURE 1.1.1

- PROVINCIAL BOUNDARY
- PROJECT LOCATION
- MAJOR CITIES AND TOWNS

0 12.5 25 50 km

SCALE 1:1,500,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED,
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: BQS
MAP REVISED BY: JH
MAP CHECKED BY: DM
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

FILE LOCATION: \\DILLON.CA\DILLON_DFS\FREDERICTON\FREDERICTON CAD\CAD\GIS\188346 UPHAM GYPSUM QUARRY\MXD

DILLON CONSULTING

PROJECT: 18-8346
STATUS: FINAL
DATE: OCT 2018

1.2 The Undertaking

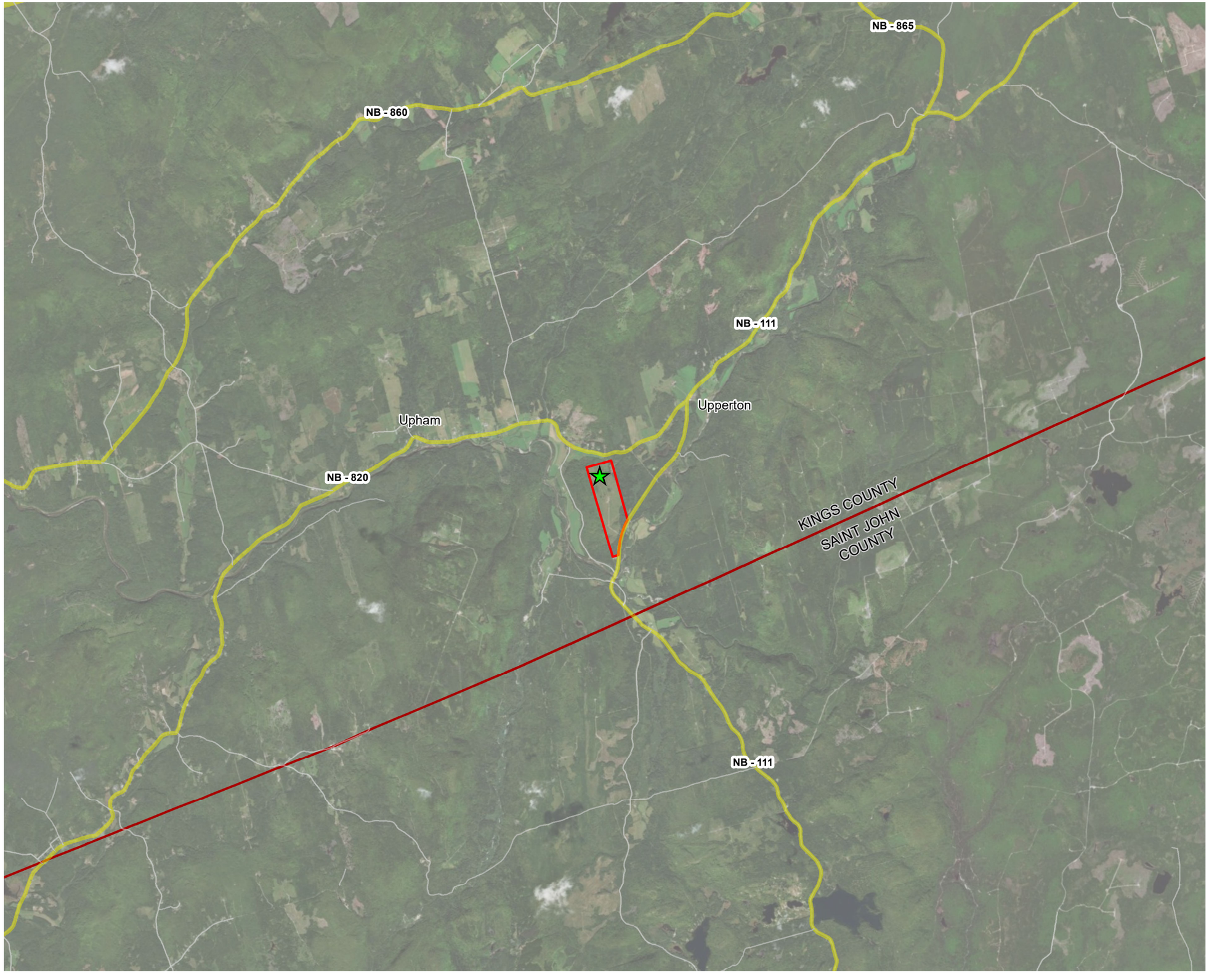
A high-level description of the undertaking is provided in this section.

1.2.1 Project Overview (Nature of the Undertaking)

For some time, Hammond River Holdings has been conducting an exploration program for the potential quarrying of gypsum for use by other parties as a raw material in the production of gypsum wallboard. Through this exploration program, the Upham East property (**Figure 1.2.1**) has been identified as holding a reserve of approximately 2.5 million metric tonnes of suitable quality gypsum rock located near ground surface that could reasonably be extracted in an open pit configuration for subsequent processing and sale to customers.

Although Project planning and development is at an early stage, it can be expected that the Project would consist of many of the following components, subject to further design and confirmation by Hammond River Holdings:

- an open pit (quarry), for extracting approximately 250,000 metric tonnes per year (t/yr) of gypsum rock;
- use of explosives, for blasting the open pit to extract gypsum rock;
- portable crushing equipment, for primary crushing of extracted gypsum rock to a diameter of approximately 15-20 cm (6-8 inches);
- heavy mobile equipment (e.g., front end loader, excavators, bulldozer, dump trucks) for moving gypsum rock, topsoil and overburden on-site and for loading gypsum into trucks for transportation to customers;
- a storage area, for temporary storage of crushed gypsum while awaiting transportation;
- possible conveying and/or stacking equipment at the storage area, to stockpile crushed gypsum;
- storage areas for overburden and topsoil, for use in later site reclamation;
- facilities for pit dewatering and runoff management, consisting of a sump at the bottom of the open pit, a water management pond (settling pond), and associated perimeter and drainage channels, for collecting and storing contact water from the site (including from pit dewatering) to allow for settling of suspended sediments prior to release to the natural environment;
- an optional truck scale, for weighing trucks entering and leaving the property;
- a security gate, for controlling access to the site;
- an optional portable trailer, to serve as a site office/lunch room; and,
- an existing access road from the provincial Route 111 to the site, and internal roads between various components of the Project.



HAMMOND RIVER HOLDINGS LIMITED
PROPOSED UPHAM EAST GYPSUM QUARRY

SITE LOCATION PLAN
FIGURE 1.2.1

SITE LOCATION
PROJECT DEVELOPMENT AREA
COUNTIES

0 0.25 0.5 1 Kilometers

SCALE 1:65,000

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: BQS
MAP REVIEWED BY: CS
MAP CHECKED BY: DM
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

DILLON CONSULTING

PROJECT: 18-8346
STATUS: FINAL
DATE: OCT 2018

Blasting will be conducted by a licensed explosives contractor who will either bring the required amount of explosives to the site, or store them in an on-site explosives magazine (managed by the contractor). Transport trucks will be used to transport gypsum to customers.

Construction has been assumed to take approximately 6 months beginning in the second quarter of 2019, with operation (production) beginning in approximately the fourth quarter of 2019 for an estimated 10 years of production, subject to further confirmation of the resource.

Once overburden materials are removed and stockpiled, gypsum rock will be blasted and/or excavated in the open pit, crushed to a manageable size for transport using portable crushing equipment on-site, temporarily stored on-site in a designated storage area pending transportation, and transported to future customers for use in the production of gypsum wallboard.

Due to the nature of the gypsum deposit as currently understood, the Project has an estimated lifespan of approximately 10 years. Hammond River Holdings will continue to explore gypsum supply options (either domestic or otherwise) that may supplement the current gypsum supply option. The scope of this EIA Registration document is limited to the Project as currently proposed at the Upham East property; other potential future gypsum deposits that may become commercially viable over time would be subjected to a separate EIA registration, at the appropriate time.

1.2.2 What is Gypsum?

Gypsum is a soft, inert, sulphate-based mineral. It can appear as a white or grey coloured rock. It can take two forms:

- Natural gypsum, which is quarried as a naturally-occurring mineral; or,
- Synthetic gypsum, which is a by-product of flue gas desulphurization in fossil fuel-fired power plants.

Gypsum that is heated at low temperatures is called calcined gypsum. Uncalcined, or raw, gypsum is used as: an additive in the cement industry; a raw material for construction; as a fertilizer; and a filler for paints, toothpaste and shampoo. Calcined gypsum is heavily used in the wallboard industry.

The mineral formula for gypsum is calcium sulphate dehydrate, or $CaSO_4 \bullet 2H_2O$.

1.2.3 Purpose/Rationale/Need for the Project

The Project is intended to supply natural gypsum rock for the production of gypsum wallboard at New Brunswick facilities.

As noted above, wallboard production can use either natural gypsum or synthetic gypsum as a raw material. Some New Brunswick wallboard manufacturing facilities began operations using primarily synthetic gypsum originating from the nearby Coleson Cove Generating Station west of Saint John; however, with a decrease in the use of Coleson Cove to supply electricity in New Brunswick occurring over time due to fuel costs and environmental factors, the local supply of synthetic gypsum has become quite limited. The only other power plant that produces synthetic gypsum in New Brunswick is the

Belledune Generating Station in northern New Brunswick, although the available supply is insufficient to meet local market needs and the transportation costs from Belledune are not economically feasible. With a planned phase-out of coal use for power generation by 2030, the supply of synthetic gypsum is expected to become even more limited in the coming years.

In response to this decreasing supply, the local market has been gradually replacing synthetic gypsum with natural gypsum imported via rail from the National Gypsum quarry in Milford, Nova Scotia, for use as a raw material in wallboard production. Natural gypsum represents the majority of raw material supply to the local wallboard market, supplemented by the opportunistic use of synthetic gypsum when available.

Reductions in the available supply of synthetic gypsum, coupled with recent North American wallboard industry growth of 5.6%, has increased overall market demand for natural gypsum. There is no natural gypsum quarrying in New Brunswick currently. The nearest operating gypsum quarry is the National Gypsum quarry in Milford, Nova Scotia. Other organizations have identified potential Nova Scotia-based gypsum quarries (such as Knauf and Nova Construction), in response to the growing market demand. Despite the increasing supply regionally, the market demand is still outpacing the local supply in a manner that threatens the viability of the local wallboard business. In addition, securing a long-term supply of this important raw material is imperative to the long-term success of the local wallboard production industry.

As such, the Project is intended to supply gypsum for New Brunswick-based wallboard manufacturing facilities, thereby ensuring a local, long-term, and secure gypsum supply as well as offsetting escalating transportation costs.

1.2.3.1 Alternatives to the Project

The Project is intended to provide a technically and economically feasible source of gypsum for producing gypsum wallboard at New Brunswick-based manufacturing facilities. Though there are technically feasible alternatives to the Project which could include securing other, more distant, sources of synthetic gypsum elsewhere in New Brunswick or importing natural gypsum from other jurisdictions, those alternatives would be cost-prohibitive (or, in the case of synthetic gypsum, of limited and decreasing supply), and thus would not be economically feasible. Recycling of used wallboard is not practical as typical demolition projects do not normally segregate demolition wastes to the extent that wallboard (or the gypsum contained in it) can be efficiently recovered. As such, there are no known alternatives to the Project that would meet the Project purpose.

1.3 Regulatory Context

The anticipated regulatory framework that is expected to apply to the Project, based on Dillon's current understanding of the Project, is discussed below.

1.3.1 Provincial Legislation

The Project is subject to the New Brunswick *Environmental Impact Assessment Regulation* under the *Clean Environment Act*. In addition, several other authorizations, approvals, permits, licenses, and leases from provincial government agencies are required for the Project to proceed. Further information on the applicable provincial regulatory framework for the Project is provided below.

1.3.1.1 Environmental Impact Assessment Regulation

The New Brunswick *Environmental Impact Assessment Regulation* 87-83 under the *Clean Environment Act* (EIA Regulation) establishes the EIA process in New Brunswick. The EIA Regulation requires that all "undertakings" listed on Schedule A of the EIA Regulation (including their proposed construction, operation, modification, extension, abandonment, demolition, or rehabilitation) require registration.

Schedule A of the EIA Regulation establishes 24 categories of developments that are considered undertakings. The Project is an undertaking according to item (a) of Schedule A of the EIA Regulation, as follows:

> *"(a) all commercial extraction or processing of a mineral as defined in the Mining Act."*

Although quarries are not typically subject to the EIA regulation, because the gypsum is being calcined (i.e., heated for water removal) for the purpose of wallboard production (i.e., used for its mineral properties), the Project will need to be registered under Section 5(1) of the EIA Regulation, and an EIA review will be conducted by selected provincial and federal government agencies (referred to as the Technical Review Committee, or TRC) under the direction of the NBDELG.

The requirements for EIA review of a registration document are described in the EIA Guide titled *A Guide to Environmental Impact Assessment in New Brunswick* (NBDELG 2018a). Following submission of a complete EIA registration document, the TRC will review the submitted information and may require additional information or response to questions arising from their review. At the conclusion of the determination review, the TRC will make a recommendation to the New Brunswick Minister of Environment and Local Government (the Minister) as to whether a proposed undertaking can proceed, with or without conditions, or whether it requires a more formal EIA (referred to as a "comprehensive review"). The Minister's decision is at his/her sole discretion in view of the environmental features of the area, the nature and extent of the anticipated environmental effects of the Project, proposed mitigation, and/or other factors.

1.3.1.2 Other Potential Provincial Authorizations, Approvals, Permits, Licenses, and Leases

In addition to the provincial EIA review of the Project, other provincial authorizations, approvals, permits, licenses, and leases may be required for the Project, including but not limited to those in **Table 1.3.1** below.

Table 1.3.1: Other Potential Provincial Authorizations, Approvals, Permits, Licenses, or Leases

Name of Authorization, Approval, Permit, License, or Lease	Purpose	Enabling Legislation/Regulation	Issuing Provincial Agency
Archaeological Field Research Permit (AFRP)	For conducting an archaeological impact assessment (AIA) of the Project site (walkover, shovel testing, monitoring) (likely required)	New Brunswick *Heritage Conservation Act*	New Brunswick Department of Tourism, Heritage and Culture (NBTHC)
Watercourse and Wetland Alteration (WAWA) Permit	For alterations within a watercourse or wetland, or within 30 m of a watercourse or wetland (likely required)	*Watercourse and Wetland Alteration Regulation* under the New Brunswick *Clean Water Act*	New Brunswick Department of Environment and Local Government (NBDELG)
Mining Lease	For extracting and processing of a mineral resource (likely required)	New Brunswick *Mining Act*	New Brunswick Department of Energy and Resource Development (NBDERD)
Approval to Construct	For construction activities that release contaminants to the environment (likely required)	*Air Quality Regulation* under the New Brunswick *Clean Air Act* and/or *Water Quality Regulation* under the New Brunswick *Clean Environment Act*	New Brunswick Department of Environment and Local Government (NBDELG)
Approval to Operate	For operation activities that release contaminants to the environment (likely required)	*Air Quality Regulation* under the New Brunswick *Clean Air Act* and/or *Water Quality Regulation* under the New Brunswick *Clean Environment Act*	New Brunswick Department of Environment and Local Government (NBDELG)

In addition to the above, depending on the final Project design and configuration, additional permits, approvals, or authorizations may be required, should Hammond River Holdings decide to proceed with certain optional components of the Project (e.g., petroleum storage license, approval of a water well, approval of a septic system); the need for such additional permits, approvals, or authorizations will be confirmed as part of the permitting phase of the Project (following the EIA review).

1.3.2 Federal Legislation

The Project is not believed to require an environmental assessment (EA) under the *Canadian Environmental Assessment Act, 2012* (as discussed below). However, some federal permits, approvals, authorizations, or licenses may be required from one or more federal government agencies. The regulatory framework that is believed to apply to the Project is discussed below.

1.3.2.1 Canadian Environmental Assessment Act, 2012

The requirements for federal EA are defined by the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). CEAA 2012 applies to "designated projects," which are physical activities listed under the

Regulations Designating Physical Activities under CEAA 2012, as well as to those activities being carried out on federal land.

The *Regulations Designating Physical Activities* identify 48 physical activities that require an EA under CEAA 2012. Mining and quarrying activities are addressed as items 16 and 17 of these Regulations, as follows:

> *"16 The construction, operation, decommissioning and abandonment of a new*
>
> *(a) metal mine, other than a rare earth element mine or gold mine, with an ore production capacity of 3 000 t/day or more;*
>
> *(b) metal mill with an ore input capacity of 4 000 t/day or more;*
>
> *(c) rare earth element mine or gold mine, other than a placer mine, with an ore production capacity of 600 t/day or more;*
>
> *(d) coal mine with a coal production capacity of 3 000 t/day or more;*
>
> *(e) diamond mine with an ore production capacity of 3 000 t/day or more;*
>
> *(f) apatite mine with an ore production capacity of 3 000 t/day or more; or*
>
> *(g) stone quarry or sand or gravel pit, with a production capacity of 3 500 000 t/year or more.*
>
> *17 The expansion of an existing*
>
> *(a) metal mine, other than a rare earth element mine or gold mine, that would result in an increase in the area of mine operations of 50% or more and a total ore production capacity of 3 000 t/day or more;*
>
> *(b) metal mill that would result in an increase in the area of mine operations of 50% or more and a total ore input capacity of 4 000 t/day or more;*
>
> *(c) rare earth element mine or gold mine, other than a placer mine, that would result in an increase in the area of mine operations of 50% or more and a total ore production capacity of 600 t/day or more;*
>
> *(d) coal mine that would result in an increase in the area of mine operations of 50% or more and a total coal production capacity of 3 000 t/day or more;*
>
> *(e) diamond mine that would result in an increase in the area of mine operations of 50% or more and a total ore production capacity of 3 000 t/day or more;*
>
> *(f) apatite mine that would result in an increase in the area of mine operations of 50% or more and a total ore production capacity of 3 000 t/day or more; or*
>
> *(g) stone quarry or sand or gravel pit that would result in an increase in the area of mine operations of 50% or more and a total production capacity of 3 500 000 t/year or more."*

Since the Project is not a mine, a stone quarry, or a sand or gravel pit as defined above, it is not a designated project under CEAA 2012. Further, as no aspect of the Project will be built on federal land, it is not expected that the components of the proposed Project will require an EA under CEAA 2012.

1.3.2.2 Other Potential Federal Authorizations, Approvals, Permits, Licenses, or Leases

There are few federal authorizations, approvals, permits, licenses, and leases that are believed to be required for the Project. The potential federal authorizations, approvals, permits, licenses, and leases that may be required for the Project are listed in **Table 1.3.2** below.

Table 1.3.2: Other Potential Federal Authorizations, Approvals, Permits, Licenses, or Leases

Name of Authorization, Approval, Permit, License, or Lease	Purpose	Enabling Legislation/Regulation	Issuing Federal Agency
Section 35(2) Authorization for Serious Harm to Fish	For temporary or permanent alterations to fish habitat (likely required)	*Fisheries Act*	Department of Fisheries and Oceans Canada (DFO)

In addition to the above, should Hammond River Holdings decide to proceed with installing an on-site explosives magazine (to be managed by a licensed explosives contractor), a magazine license under the *Explosives Act* would be required; the need for this license, or for other permits, approvals, or authorizations will be confirmed as part of the permitting phase of the Project (following the EIA review).

1.3.3 Other Requirements

Other requirements may include a development planning approval under the New Brunswick *Community Planning Act*, as administered by Regional Service Commission 8 (RSC8). There may also be local planning requirements for excavation activities, to be confirmed in consultation with RSC8 and/or the local service district of Upham.

1.4 Purpose and Organization of this Document

The purpose of this EIA Registration document is to provide information to the NBDELG and its TRC as part of its review of the environmental effects of the Project in accordance with the EIA Regulation. The EIA Registration document provides a description of the Project, describes existing environmental conditions, identifies mitigation to be employed to minimize the environmental effects of the Project, and characterizes residual environmental effects of the Project during construction, operation, and ultimate closure following the application of mitigation measures and best management practices.

This EIA Registration document is organized in 14 chapters, as follows:

- Chapter 1 provides an introduction to the Project, including proponent information, a Project overview, the purpose/rationale/need for the Project, and an overview of the applicable regulatory framework;
- Chapter 2 provides a Project description of the proposed elements of the Project as currently conceived, and describes how the Project will be constructed, operated, and ultimately reclaimed and closed at the end of mine life. Alternative means of carrying out the Project that

are technically and economically feasible are discussed. Emissions and wastes from the Project are also described;

- Chapter 3 provides a summary of the environmental setting of the Project;
- Chapter 4 provides information on the methods that were used to evaluate the potential environmental effects of the Project, and the scope of the EIA;
- Chapter 5 provides the assessment of potential environmental effects of the Project, on various valued components (VCs) of the environment of relevance and importance to this EIA, for all Project phases;
- Chapter 6 provides an assessment of potential effects of the environment on the Project;
- Chapter 7 provides an assessment of accidents, malfunctions, and unplanned events that could arise in respect of the Project;
- Chapter 9 summarizes the residual environmental effects of the Project, and planned mitigation;
- Chapter 10 describes planned Aboriginal consultation activities in respect of the Project;
- Chapter 11 provides a description of planned public and stakeholder engagement activities in respect of the Project;
- Chapter 12 provides a summary of the EIA Registration, and resulting conclusions;
- Chapter 13 provides closing remarks; and,
- Chapter 14 provides the references and personal communications cited in this EIA Registration document.

Additional supporting information is provided in the appendices to this EIA Registration document.

2.0 Project Description

This section provides a description of the facilities and equipment that will comprise the Project, as currently conceived and based on the available information at the time of writing. The Project, as described in this document, is likely to evolve as Project planning and engineering design is completed. So as to not understate the potential environmental consequences of the Project at this planning stage, the Project Description provided in this Section presents an "outer envelope" or conservative estimate of the scope, footprint, and environmental effects of the Project. The Project will ultimately be built and operated within the outer envelope as presented in this EIA Report.

The key aspects of the Project are described below, including:

- the Project components, including the likely infrastructure and associated facilities, and planned mitigation for potential environmental effects;
- the activities that will be carried out during construction, operation, and eventual reclamation and closure of the Project;
- alternative means of carrying out the Project; and,
- Project-related emissions, wastes, and other requirements, and their management.

2.1 Project Location

The Project will be carried out near the community of Upham, in Kings County, New Brunswick. The parcel identifier (PID) of the property, as referenced by Service New Brunswick, is PID No. 00149013. The geographic centre of the property is at coordinates N 7386845.13 and E 2561169.61. The property (**Figure 1.2.1**) has an area of approximately 61.81 hectares (ha), and is easily accessible via the existing provincial highway network via Route 111 to the southeast of the Project site (where the current site access road is located).

The Project Development Area (PDA) is defined as the area of physical disturbance associated with construction and operation of the Project. Specifically, the PDA consists of an area of approximately 61.81 ha (i.e., conservatively assumed to be the entirety of PID No. 00149013) that includes the open pit and all related surface facilities located on the property. The PDA consists of a near-rectangular-shaped property with approximate dimensions of 425 m wide by 1,450 m deep. The PDA is the area represented by the physical Project footprint. The subject and neighbouring properties are shown on **Figure 2.1.1.**

The nearest major watercourse to the property is the Hammond River, which surrounds the Project site in a "U" shape to the west, south and east of the site. The distance between the Project site boundaries and the Hammond River is approximately 600 m to the west, 250 m from the south, and 100 m or more to the east of the site.

HAMMOND RIVER HOLDINGS LIMITED
PROPOSED UPHAM EAST GYPSUM QUARRY

SUBJECT AND NEIGHBOURING PROPERTIES
FIGURE 2.1.1

- SITE LOCATION
- WATERCOURSE
- PROPERTY BOUNDARIES

SCALE 1:10,143
0 125 250 500 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
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MAP REVISED BY: JH
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FILE LOCATION: \\DILLON.CA\DILLON_DFS\FREDERICTON\FREDERICTON CAD\CAD\GIS\188346 UPHAM GYPSUM QUARRY\MXD

DILLON CONSULTING

PROJECT: 18-8346
STATUS: FINAL
DATE: OCT 2018

2.1.1 Siting Considerations

The selection of a candidate site for quarrying is dictated by favourable geology that indicates the potential presence of the mineral resource. The selection of the subject property for development as a gypsum quarry has been guided by a mineral exploration program carried out by Dillon on behalf of Hammond River Holdings. In the course of this exploration program, a search of provincial mineral databases was conducted for southern New Brunswick based on surficial and bedrock geology maps of Energy, Mines and Resources Canada as well as the New Brunswick Department of Energy and Resource Development (NBDERD), combined with other sources of information. This initial screening returned a number of potential candidate sites in southern New Brunswick with potential to contain gypsum resources. From this, the search was narrowed down by considering known information about the mineral resource, proximity to major roads and infrastructure, proximity to receiving markets, property ownership, and overall potential development. The Upham East was identified as a candidate site for further exploration due to a number of these favourable characteristics, in addition to the presence of gypsum outcrops visible on the property surface. Exploration drilling was then conducted in 2018 to characterize the mineral resource at the proposed site, and the results of those drilling activities have shown promise in meeting the quality specifications for gypsum used in wallboard manufacturing. As a result, Hammond River Holdings decided to proceed to the EIA and permitting of the site based on the drilling results.

As mentioned previously, the Upham East Gypsum Quarry Project is one of several other potential gypsum deposits that may be explored for future consideration by Hammond River Holdings. Although those other potential gypsum deposits may constitute a future phase of the Project, the scope of this EIA Registration document is limited to the Project as currently proposed at the Upham East property. Other potential future gypsum deposits that may become commercially viable over time would be subjected to a separate EIA registration, at the appropriate time.

2.1.2 Property Ownership

The subject property is owned by Hammond River Holdings Limited.

2.2 Geology of the Upham East Deposit

The geology of the Upham East deposit is discussed below.

2.2.1 Regional Geology

The Project area lies near the southwestern extremity of the Late Devonian to Early Permian Maritimes Basin and is assigned to the Moncton Sub-basin of southern New Brunswick. This sub-basin is defined by partly structurally controlled depositional centres filled with a variety of mostly terrestrial clastic sedimentary rock units that were mainly derived from surrounding basement uplifts (Horton and Sussex groups). Basin-wide inversion tectonism deformed those units and prepared the region for subsequent depositional cycles through the preservation of some parts of existing depositional centres, initiation of

new centres and renewed basement uplifts. A rapid marine incursion blanketed much of lowlands in the region and locally transgressed over higher ground immediately after this event during middle Early Carboniferous time, yielding mostly carbonate- and evaporite-bearing units (Windsor Group) that rest with marked unconformably on all older units and that host the Upham East gypsum deposit. Renewed deposition of mainly terrestrial clastic sedimentary rock sequences (Mabou, Cumberland, and Pictou groups) ensued for the rest of Carboniferous and Early Permian time with major units separated by basin-wide disconformable to unconformable contacts (e.g., St. Peter and Johnson 2009).

The Upham East property occurs along the southern margin of the Moncton Sub-basin, which in this area is a northeast-trending half-graben formed along the northern margin of Late Neoproterozoic to Cambrian basement rocks assigned to the Caledonia Uplift. This half-graben is defined by a shallowly northwest-dipping unconformity at the base of the Windsor Group rocks to the southeast, as exemplified at Upham East, and a near vertical major fault along its northwestern flank. Overall, the graben constitutes a Windsor Group-filled basin several kilometres wide and tens of kilometres long, gradually deepening to over a kilometre to the northwest.

2.2.2 Property Geology – Bedrock

The Windsor Group at Upham East comprises thin basal units a few tens of metres thick comprising red pebble conglomerate of the Hillsborough Formation overlain by laminated carbonates of the Macumber Formation. These basal units unconformably rest upon Cambrian-aged clastic sedimentary basement rocks of the Caledonia Uplift along the southern part of the property. The carbonates are, in turn, overlain by Upperton Formation sulphates that appear to range in thickness from a few metres near the Windsor-basement unconformity to several tens of metres at the northern part of the property. However, basal units have not been intersected in drilling in the central and northern part to date. To the north of the property, red and minor grey sandstones and some coarser clastic rocks of the Mabou Group overlie the sulphates with a shallow, more northerly dipping unconformable contact (McCutcheon 1981; Barr and White 2005).

Work to date on the property indicates gypsum formed by waters hydrating primary anhydrite of the Upperton Formation and infiltrating as fronts through a combination of top down water movement and/or migration along internal dissolution zones, some of which may have been generated by faulting (see models by Boehner [2003]). The former mechanism is clearly evidenced in the field by the present karst topography-gypsum distribution relationships, and the later in drill core by the presence of leached zones at depth and by drill intersections where post Upperton-age material partly to totally fills cavities in and near gypsum zones.

2.2.3 Property Geology – Surficial

Surficial materials in the planned development area consists of a thin veneer of rubble under which highly variable thicknesses of red and greyish brown to black mud and clay with or without variable amounts of randomly distributed angular fragments and debris. Where present, the fragments range in size from pebbles to cobbles and are typically calcareous red to grey sandstones. The finer debris usually

consists of calcareous red mudstone and siltstone fragments and chips, and rare pieces of carbonate or volcanic rocks.

The wide range in thicknesses for the overburden is a function of the obvious karst topography that signifies underlying sulphates of the Windsor Group on the property. Unfilled sinkholes reveal gypsum outcrops among stacks of gypsum on the northwestern part of the property, while they are mostly filled on the remainder of the property. Overburden thickness normally range from about 6 m to 20 m in drill holes that intersected gypsum, and one hole over the sulphate unit bottomed in overburden at about 26 m. The holes drilled south of the sulphate unit typically have deeper overburden up to 35 m thick. Thicknesses over the basement unit further south will likely be less and more consistent, as indicated by the one drilled into that unit that cut only about 6 m of overburden and because it is devoid of karsting.

2.2.4 Mineralization

Good quality gypsum intervals in drill core either completely replacing anhydrite sections or interspersed with anhydrite occur in seven holes on the property. Intersections range from a few metres to about 16 m in width on the southern, central and western parts of the property, while one hole near the northern property boundary intersected a total of about 67 m of gypsum in two sections separated by about 19 m of anhydrite. This hole and one other in the central part of the property bottomed in high-grade gypsum. Two surface samples from the northwest corner of the property also returned good grade gypsum. The other six holes drilled to date intersected either basal carbonate units or basement or were stopped in thick overburden.

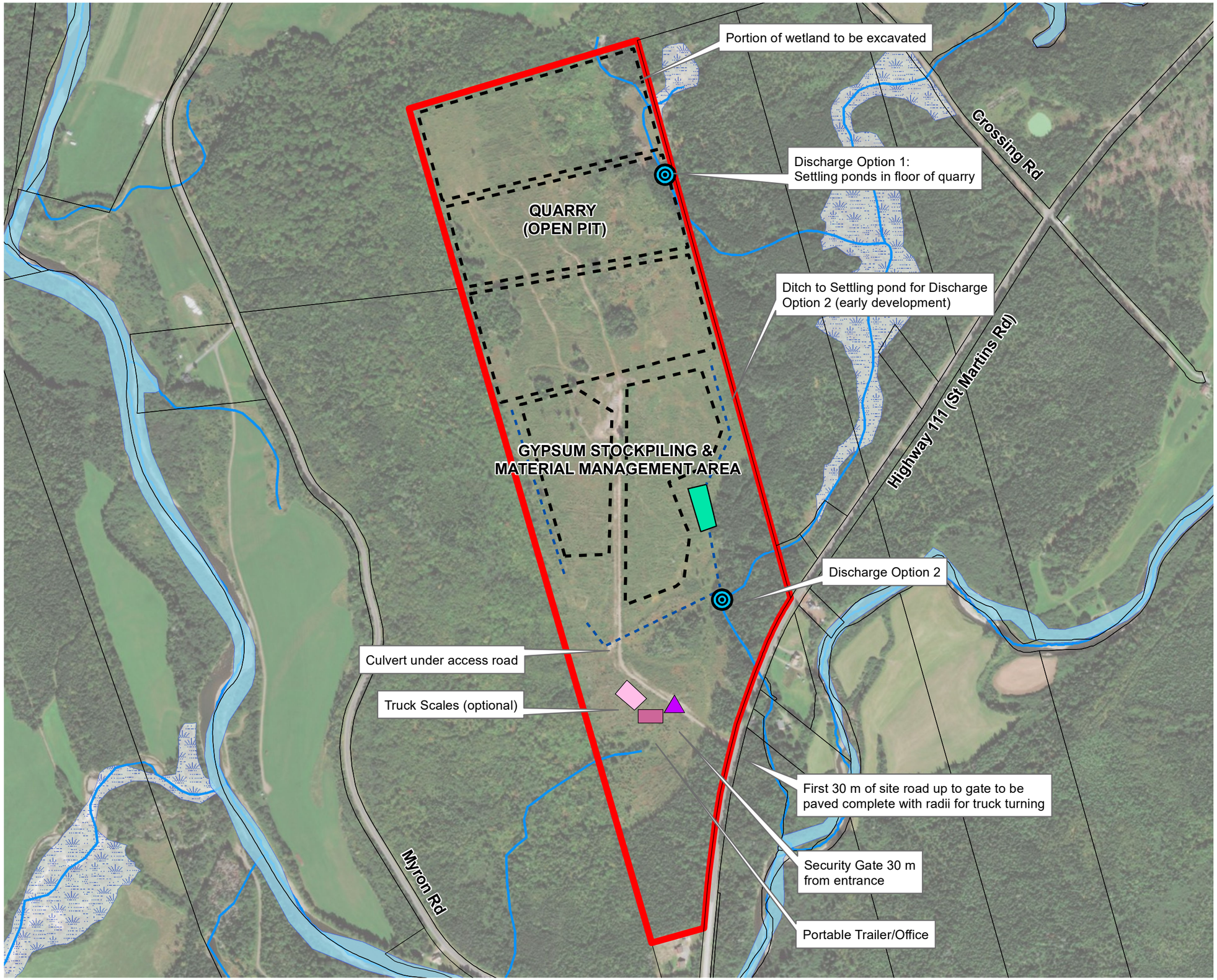
2.3 Description of Project Components

The Project will include an open pit quarry and associated materials handling, primary crushing, storage, water management, and related facilities. In the sections below, each of the major components and facilities for the Project is described. The specific locations of the various Project facilities are shown in the conceptual site layout plan as **Figure 2.3.1**.

2.3.1 Open Pit

The key component of the Project is the open pit, which is an excavation in the ground surface for the purpose of extracting the target mineral (in this case, gypsum), and which is open to the surface for the duration of active quarrying at the site.

The layout of the open pit is developed to facilitate gypsum extraction. As mentioned in **Section 2.2** above, the gypsum deposit on the Upham East site is located largely to the north and centre of the property as shown in **Figure 2.3.1**, with the northernmost portion of the site hosting the thickest portion of the gypsum deposit (approximately 60 m thick, underneath approximately 15 m of overburden), and with the thickness of the mineral deposit progressively decreasing as one moves towards the central portion of the site, which hosts gypsum mineral to a thickness of approximately 20 m covered by approximately 10 m of overburden.



HAMMOND RIVER HOLDINGS LIMITED
PROPOSED UPHAM EAST GYPSUM QUARRY

CONCEPTUAL SITE LAYOUT PLAN
FIGURE 2.3.1

- PROPERTY BOUNDARY
- PROJECT DEVELOPMENT AREA
- WATERBODY
- WATERCOURSE
- REGULATED

PROPOSED SITE FEATURES

- DITCH
- TRUCK SCALE (OPTIONAL)
- SITE AREAS
- SETTLING POND
- DISCHARGE POINT
- SECURITY GATE
- PORTABLE TRAILER/OFFICE

0 50 100 200 m

SCALE 1:7,000

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: BQS
MAP REVISED BY: JH
MAP CHECKED BY: DM
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

FILE LOCATION: \\DILLON.CA\DILLON_DFS\FREDERICTON\FREDERICTON CAD\CAD\GIS\188346 UPHAM GYPSUM QUARRY\MXD

DILLON CONSULTING

PROJECT: 18-8346
STATUS: FINAL
DATE: OCT 2018

Based on the geology of the Project site and the nature of the deposit, quarrying will occur in zones, with topsoil and overburden being removed progressively over the life of the Project to access the underlying gypsum deposit in phases in the open pit/quarry area. As such, the area and depth of the open pit will become progressively greater over time as the pit expands to access other portions of the gypsum deposit. Efforts will be undertaken to maintain treed buffers along property lines to the extent possible, and the "Rock Quarry Siting Standards" published by NBDELG (NBDELG 2014) will be observed.

The open pit will be developed in each zone as benches, with associated internal haul roads. A bench is a term used for each ledge that forms a single level of operation within the pit, above which mineral is quarried back to the bench face. Following blasting and/or rock breaking, the mineral is excavated in successive layers, each of which is a bench. Several benches may be in operation simultaneously in different parts of, and at different elevations in, the open pit.

Extraction in the open pit will occur up to 5 days a week (excluding weekends), for up to 12 hours a day during daytime, for approximately 200 days per year. The pit will be excavated by drilling and blasting successive benches, and removing the broken rock with a wheeled loader or excavator.

Blasting is anticipated to occur up to 25 times per year as an annual average (excluding nights, weekends, and statutory holidays) using emulsion explosives managed by a licensed explosives contractor. If an on-site explosives magazine is ultimately determined to be required, the licensed explosives contractor will obtain the appropriate authorization under the federal *Explosives Act* and appropriate setback distances as specified in the *Explosives Act* will be observed. The broken rock will be delivered to the on-site primary crusher. Alternatively, where physical characteristics of gypsum allow and it is deemed economically viable, blasting may be substituted with mechanical rock breaking.

The ultimate extent of the open pit at the end of quarry life will be approximately 23 ha. At its deepest point, the open pit will be approximately 75 m deep below ground surface (m bgs), compared to the current surface elevation of the site.

The bottom of the open pit will act as a sump to store water infiltrating into the pit while excavation work is being carried out at more elevated benches. The sump will be periodically dewatered when stored water meets discharge standards, and released to the receiving environment directly into a drainage channel that leads to a receiving watercourse.

2.3.2 Primary Crusher

Blasted gypsum rock extracted from the open pit will be crushed on-site to approximately 15-20 cm (6-8 inch) diameter size using a jaw-type portable, diesel-powered crusher. On average, the crusher is expected to operate approximately 1,000 hours per year during site operations, and its operation will occur only during daytime on weekdays. The crusher will most often be located within the open pit, although at times it may be located at surface, outside the pit (e.g., during dewatering, or when new benches are being excavated). Locating the crusher within the open pit is highly desirable as it minimizes material handling, and because it is located at depth, it reduces the potential for dust and noise to cause off-site impacts at neighbouring residences.

Portable conveyors or stackers will be used to reduce on-site haulage of materials, where practical. Following crushing, the crushed rock will be directed to the gypsum storage area, either using a stacker or loaded onto articulated rock trucks.

2.3.3 Gypsum Storage Area

Following primary crushing, the gypsum rock will be stored in the gypsum storage area while awaiting transportation to customers.

The storage area, as shown on **Figure 2.3.1**, will have an approximate area of 9 ha. It is anticipated that up to 50,000 tonnes of gypsum rock could be stored in the storage area at any given time. The gypsum storage pile(s) will remain open to the air, uncovered, as fugitive dust from 15-20 cm diameter materials is not expected.

Runoff from the gypsum storage area arising from precipitation will be collected and directed to a settling pond to allow for suspended sediments contained in the runoff to settle out, prior to its release to the natural environment.

2.3.4 Topsoil and Overburden Storage Area

To expose and extract the gypsum mineral, it is first necessary to remove surface materials including grubbings and soils (i.e., topsoil and overburden) above the gypsum deposit. Based on exploration and drilling work conducted on the site, it is anticipated that approximately 10-20 m of topsoil and overburden will need to be removed in the area of the open pit. Topsoil and overburden will be stored in a designated area on or near the storage area shown in **Figure 2.3.1**, for later use in site reclamation at the end of the Project life. Topsoil or overburden resulting from levelling or reshaping of other areas of the site will also be stored in these designated areas for future use. Storage piles of topsoil and overburden will remain open to the air, uncovered, since fugitive dust from these piles over time is not expected to require active management. Seeding of the storage piles using native species may be considered if there is a concern for erosion and sedimentation from the storage piles, though it is expected that vegetation will naturally grow on these piles over time.

As with the gypsum storage area, runoff from the topsoil and overburden storage area will be collected and directed to a settling pond or other sediment control structures to allow for settling or removal of suspended sediments that might be contained in the runoff prior to its release to the natural environment.

2.3.5 Facilities for Pit Dewatering and Runoff Management

The water management plan for the Project has not yet been fully developed and will evolve as site planning and design is conducted. The conceptual plans for pit dewatering and runoff management, as currently conceived at this early planning stage, are described below. These will be confirmed as part of the water management plan, as it is finalized.

Since the open pit will be located at depth below the surrounding ground elevation, it is expected that surface water (from precipitation and spring snow melt) as well as groundwater seepage will collect at

the bottom of the open pit, thereby requiring periodic dewatering of the open pit so as to manage water volumes and minimize interference with operations occurring within it. To this end, the open pit will be developed in such a manner that the active bench being worked on to extract gypsum rock will be located at a higher elevation than the bottom of the open pit, so that the deepest portion of the open pit serves as a sump to store water infiltrating into the open pit until such time as it is removed by pumping. It is expected that most of the storage will be provided by the pit sump, which will require active pumping to control water levels.

Water contained in the deep portion of the open pit will be periodically pumped using one or more suitably sized portable pumps and flexible hoses directly to receiving drainage channels and ultimately released to the natural environment when the suspended solids content is suitable for direct discharge. Pumping will occur at a rate such that discharged water does not overwhelm the capacity of the receiving watercourse. Pumping will occur prior to (and following, as necessary) major precipitation events as well as at times when water levels may begin interfere with operations in the active working area. Water levels within the open pit will also be closely monitored and managed during the spring freshet and fall recharge period, with more frequent pumping as required.

A series of drainage channels will be constructed on-site to direct site runoff from active working areas of the site, and from storage areas, to the settling pond for further settling of suspended sediments. Perimeter channels constructed around the perimeter of the site will prevent water from neighbouring properties from entering the site, so as to minimize the amount of water needing management on-site.

Finally, at this time, it is expected that a water management (settling) pond will be constructed on-site, as shown on **Figure 2.3.1**, to temporarily store water from site runoff and pit dewatering prior to release to the natural environment. The specific location of the settling pond will be determined as part of the development of the water management plan for the Project, in parallel to the EIA review. The settling pond will not be lined with a compacted clay or geo-synthetic liner, since the only potential contaminant of concern in the stored water is suspended solids which will remain in the settling pond; this will allow some stored water (free of suspended sediments) to naturally infiltrate to groundwater through the bottom of the pond. The settling pond will have anticipated surface area of up to 6 ha (depending on how much water can be stored in the open pit sump), and combined with the pit sump, will be designed to store the volume of water generated by the 100-year, 24-hour rainfall event and to allow for a minimum 24-hour residence time for stored water, to enable natural, gravity-based settling of sediment suspended in the water. Water will not be discharged when downgradient infrastructure is already at capacity as a result of a major precipitation event.

The pond will discharge via an overflow weir or similar device, and with overflow water directed to a drainage channel to the natural environment. To maintain safe operation of the pond, water levels will be actively monitored and managed so as to prevent overtopping of the pond or an uncontrolled release of sediment-laden water, with excess water pumped, as necessary, to the natural environment, if water quality is suitable, or back to the open pit sump if suspended sediment concentrations are unsuitable for discharge. Collected sediments at the bottom of the settling pond will be removed at least once per year (or more frequently as required) by drawing down the settling pond to near dry conditions when

weather conditions are suitable (e.g., during the dry summer months) and removing the collected sediments using an excavator.

Water released to the natural receiving environment will have a target concentration of total suspended sediments (TSS) of less than 25 mg/L above background levels in the receiving environment (measured as a monthly average of grab samples). Water will be released at a rate that does not overwhelm the capacity of the receiving structures or watercourse.

2.3.6 Truck Scale (Optional)

As an optional component, a truck scale may be installed on-site to allow for weighing of incoming and outgoing trucks to determine the weight of their cargo. This is not only to enable a proper accounting of the weight of gypsum being sold to customers, but also to assist in meeting seasonal highway weight restrictions.

Alternatively, the loaders will be fitted with scales to measure the weight of the load being placed on the trucks. Additionally, trucks will be weighed upon arriving and when leaving wallboard facilities.

2.3.7 Portable Trailer/Office (Optional)

An optional portable trailer will serve as a site office and lunch room at the Project site.

2.3.7.1 Potable Water and Sanitary Sewer

During construction, sanitary needs will be met by using bottled water and a portable toilet (managed and periodically serviced by a third party company).

During operation, consideration will be given to installing a potable water well and septic tank and sub-surface disposal field for the duration of the Project. If they are required, the well will be approved under the *Potable Water Regulation* under the *Clean Water Act*, and the septic tank and disposal field will be approved under the *On-site Sewage Disposal System Regulation* under the *Public Health Act*. Water consumption would be expected to be modest (approximately 50 L/day per person on site, for approximately 6-10 people). Alternatively, sanitary needs could be met in a manner similar to during construction (i.e., bottled water and portable toilets).

2.3.7.2 Electrical Power Supply

The electrical power needs for the Project are relatively modest, and electrical service is required only for the portable trailer/office. Electrical power will be supplied by constructing a short power line (approximately 30-50 m in length) to connect the portable trailer to the existing electrical grid located along Route 111. The power line will consist of conventional wooden poles, conductors, and insulators, and will be similar to that required for residential service, providing single-phase alternating current at a voltage of 220 V. Electrical needs may be supplemented using solar panels or portable generators, as required.

Other than the short power line discussed above, no upgrades to existing transmission lines or distribution lines currently on the New Brunswick electrical grid are required for the Project.

2.3.8 Security Gate

Though the entire Project site will not be fenced, a security gate with appropriate fencing at and near the entry point to the site will be established to control access to the site. The security gate will remain locked to prevent unauthorized entry after hours, or during periods when the site is inactive. The security gate will be located on the access road to the site, approximately 30 m from Route 111.

A number of warning signs will be installed throughout the perimeter of the site to prevent unauthorized entry to the site by would-be trespassers and to warn individuals about the dangers that maybe present within the perimeter of the site (i.e., blasting, presence of moving heavy vehicles, large excavations, etc.).

2.3.9 Site Access and Internal Site Roads

As shown on **Figure 2.3.2**, access to the Project site will be provided via the south of the site using an existing access road off Route 111 that will be upgraded to suit the Project purposes. The existing access road for the Project site was developed for the purpose of logging the subject property in the early 2010s.

Various internal site roads will be developed to access the active areas of the Project site and to facilitate the movement of materials on-site. The internal site roads will be unpaved, although consideration will be given to watering down the internal site roads or using other approved dust suppressants during extreme dry periods to reduce fugitive dust.

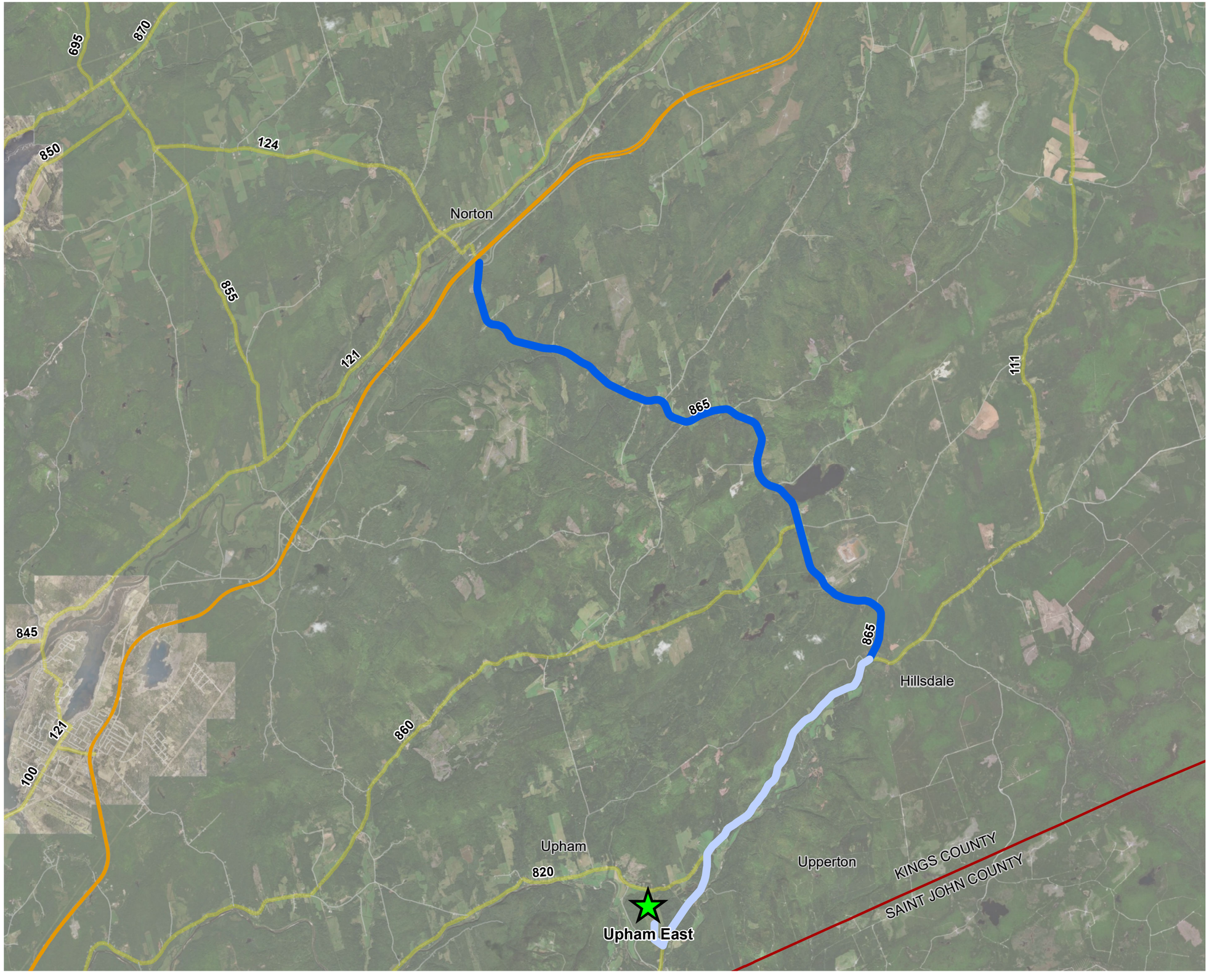
The initial 30 m of access road to the site (i.e., between Route 111 and the security gate) will be paved to minimize the transport of dust and mud from internal site roads onto the provincial highway network. The access road will be appropriately flared in both directions at an appropriate radius to facilitate the turning movements of heavy trucks entering and leaving the Project site.

2.3.10 Preferred Transportation Route

The preferred transportation route from the site to connect to Saint John is shown in **Figure 2.3.2**. From the site access road, trucks will enter the provincial highway network via Route 111 in a northeasterly direction until it intersects with Route 865 at Hillsdale, then onto Route 865 in a northwesterly direction until it intersects with Route 1 at Norton, then onto Route 1 where trucks will then follow the provincial highway system to deliver product to customers. Route 111/Route 865/ Route 1 is preferred since it enables the transportation of larger payloads for most of its length (i.e., 62,500 kg gross vehicle mass [GVM]) compared to other trucking routes, although a 9 km section of Route 111 (as shown in the light blue colour on **Figure 2.3.2**) will require a condition assessment by the New Brunswick Department of Transportation and Infrastructure (NBDTI) to confirm the weight bearing capacity of the route and determine its suitability to meet the Project needs.

2.3.11 Hazardous Materials Use and Storage

As the Project involves little material handling and no chemical processing, there are no chemicals required for the Project operation, nor any chemical storage required on the Project site.



HAMMOND RIVER HOLDINGS LIMITED
PROPOSED UPHAM EAST GYPSUM QUARRY

PREFERRED TRANSPORTATION ROUTE
FIGURE 2.3.2

- PROJECT LOCATION (TRANSPORTATION ROUTE END POINT)
- SECTION OF PREFERRED TRANSPORTATION ROUTE RATED AT 62,500 KG GVM
- SECTION OF PREFERRED TRANSPORTATION ROUTE RATED AT 43,500 KG GVM
- HIGHWAY 1 GATEWAY TO MAJOR CENTERS
- NB ROAD NETWORK - HIGHWAY/EXPRESSWAY
- NB ROAD NETWORK - LOCAL STREETS
- COUNTIES

0 1.25 2.5 SCALE 1:95,897 5 km

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: BQS
MAP REVIEWED BY: JH
MAP CHECKED BY: DM
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

FILE LOCATION: \\DILLON.CA\DILLON_DFS\FREDERICTON\FREDERICTON CAD\CAD\GIS\188346 UPHAM GYPSUM QUARRY\MXD

DILLON CONSULTING

PROJECT: 18-8346
STATUS: FINAL
DATE: OCT 2018

Fuel for the crusher, mobile equipment, and trucks on-site will be supplied by third party owned mobile tankers who will refuel mobile equipment on-site on a daily basis, then leave. There is no planned fuel storage on-site at this time. In the unlikely event of a future decision to store fuels on-site, they would be stored in a self-contained tank(s) equipped with secondary containment ("con-tanks") owned, operated, and serviced by third parties. Tanks would be licensed under the New Brunswick *Petroleum Product Storage and Handling Regulation.* In such an unlikely case, no more than 10,000 litres of fuel would be expected to be stored on-site at any given time.

2.3.12 Mobile Equipment

Trucks and other mobile equipment will be located on site to assist with construction activities and subsequent operation. A summary of the anticipated needs for mobile equipment on-site during construction and operation is provided in **Table 2.3.1**.

Table 2.3.1: On-site Mobile Equipment Use During Construction and Operation

Equipment Type	Number Used
45-tonne excavator	2
35-tonne articulated rock truck	5
D6-sized bulldozer	1
980-sized front end wheeled loader	1
Water truck	1
Portable jaw crusher	1
Air track drill (for blasting)	1

In addition, transportation of gypsum rock from the Project site will be accomplished using transport trucks.

2.4 Description of Project Phases and Activities

A description of the various phases of the Project, and the activities associated with each phase, is provided in this section.

2.4.1 Construction Phase

The construction phase will be initiated following the completion of the EIA review and the receipt of all required permits, approvals, licenses, authorizations, or leases for the Project. A high-level description of each of the activities associated with the construction of the Project is provided below.

2.4.1.1 Vegetation Clearing

Most of the site was cleared of mature vegetation in the early 2010s for the purpose of logging; therefore, clearing of the site will be relatively modest and straightforward and will focus on the removal of immature trees, shrubs, and other ground vegetation to make way for the Project facilities. Limited clearing of immature vegetation present in the active areas at the southern portion of the site (e.g., storage area and other active areas) will occur first so as to allow for the preparation of the storage area prior to removing topsoil and overburden in the open pit area. Efforts will be made to maintain as much mature vegetation that remains along the edges of the site as possible, so as to act as a tree and watercourse/wetland buffer. Clearing of immature vegetation in the open pit area will then be initiated when the storage area has been developed, and will occur progressively in phases as the size of the open pit increases over time during operation.

Limited clearing will be completed largely using a bulldozer supplemented by manual methods (e.g., chain saws, brush saws) supplemented, as necessary, by forest harvesting machinery if required. Mature trees along the perimeter of the site will be maintained as a tree buffer to the extent possible, and as much mature vegetation and trees as possible will be maintained along wetlands and watercourses that are not required to be disturbed for the Project (particularly at the southern and of the site). Clearing near watercourses and wetlands, if necessary, will be conducted manually.

Clearing activities will be conducted outside of normal bird breeding season (early April to end of August) to the extent possible, to prevent the undue disturbance of migratory birds or their nests (including those that nest in trees as well as on the ground). Should clearing be required within this season, these areas will be surveyed to determine if nesting is occurring within these areas, any nests flagged for avoidance until the young have fledged.

All cleared merchantable timber will be sold, but non-merchantable cleared vegetation will remain on-site and be used as fill material during reclamation and closure.

Erosion and sedimentation control techniques will be employed throughout the clearing phase as well as for subsequent construction activities discussed below, as required, to minimize erosion of exposed areas and sedimentation in surface water runoff on the site. Dust suppression will also be employed during construction activities to minimize the potential environmental effects of fugitive dust to offsite locations.

2.4.1.2 Grubbing

Grubbing includes the removal and disposal of stumps and roots remaining after clearing. Grubbing will be conducted using a skidder or bulldozer to remove the roots and stumps of cleared vegetation. The entire cleared portion of the site will be grubbed, progressively as the size of the open pit increases over time during operation.

Grubbings will be stored on-site in an inactive area and used as fill material during construction or reclamation and closure.

2.4.1.3 Levelling and Contouring

Once the southern portions of the Project site are cleared and grubbed, location of the surface facilities to be located on the southern half of the site (as shown in **Figure 2.3.1**) will be prepared by levelling of the areas using mobile equipment such as excavators, front end loader, bulldozer, and articulated dump trucks. Since the quarry area on the northern half of the site will eventually be stripped of topsoil and overburden, levelling of this area is not required.

Contouring and shaping of the levelled areas will be conducted to maintain stable slopes and facilitate proper drainage to the drainage channels and settling pond.

2.4.1.4 Construction of Storage Area

Following grading and levelling, the sub-base for the storage area will be prepared as necessary using some of the native soils from the levelling activities on-site, supplemented by materials from approved local borrow sources where required. If the natural soils are not of a suitable nature to be used as the sub-base, locally-sourced till or clay will be used. A geo-synthetic liner is not required underneath the storage area, given the inert nature of gypsum.

The final storage area will be graded to create the desired grade for drainage capture, and drainage collection works for the area will be installed.

2.4.1.5 Removal and Stockpiling of Topsoil and Overburden

The overburden in the open pit area generally consists of a veneer of organic matting and topsoil over till. The overburden thicknesses generally range from 10 to 15 m in depth below ground surface. Topsoil and overburden removal in the open pit area will be initiated during construction, and will continue progressively throughout operation of the Project as the size of the open pit increases over time.

Topsoil will first be removed and stored in a designated location at the storage area. Following this, overburden will be excavated until bedrock is reached, and similarly stored in a designated location at the storage area. Topsoil and overburden will be stockpiled for future reuse during site reclamation at the end of quarry life.

Sediment control fencing will be installed and maintained at all stockpiles that are up-gradient of a watercourse to prevent the down-slope transport of sediment into watercourses.

2.4.1.6 Construction of Perimeter Channels, Drainage Channels, and Settling Pond

Engineered perimeter channels will be constructed along the perimeter of the site to divert non-contact surface water from the surrounding watershed and mitigate inflow to the Project site. Similarly, a number of drainage channels will be constructed on-site to direct surface runoff generated within the Project site to the settling pond. These features are intended to minimize the amount of water to be collected and treated as well as to prevent the release of potentially sediment-laden water from entering watercourses and wetlands untreated. Perimeter and drainage channels will be excavated using an excavator or backhoe, and lined with riprap or vegetated to limit erosion within the channels.

The settling pond will be excavated using an excavator or backhoe, and excavated soils will be temporarily stored for reuse on-site. A compacted clay or geo-synthetic liner underneath the settling pond is not expected to be required, given that gypsum is inert and the sediments contained in the settling pond are likely of a similar composition to gypsum. The ability for some amount of stored water to naturally infiltrate the bottom of the pond is a beneficial feature that minimizes the volume of water to be released to receiving watercourses and minimizes effects on groundwater levels.

On-site storage facilities (including the settling pond and open pit sump) will be sized to store the runoff volume generated by the 100-year, 24-hour rainfall event. It is anticipated that the open pit may be used for supplemental storage during periods of intense rainfall. For example, during high intensity rainfall events (e.g., 100-year storm), pumping from the open pit will cease until rainfall has subsided and sufficient storage is available in the settling pond.

Sizing of the settling pond and outlet facilities will be completed using hydrologic/hydraulic dynamic simulation and will consider the impacts of climate change. The hydraulic operation of the pond will be designed to ensure that sufficient storage capacity is available to allow for a minimum 24-hour residence time for stored water under normal operating conditions. Overflow from the settling pond will be released via an armoured weir or similar outfall device to an engineered channel that discharges to one of the small watercourses on the southern end of the site. The outflow channel will be designed to limit discharge velocities and protect the downstream natural channels from erosion.

The perimeter channels, drainage channels, and settling pond will remain in place throughout the construction and operation phases of the Project.

2.4.1.7 Development of Internal Site Roads, and Paving of Access Road

Internal site roads connecting the various areas of the Project will be developed and/or upgraded as necessary to meet the Project needs. Native soils and gravel from other earth moving activities on the Project site will be used for road development, supplemented as necessary by gravel and crushed rock sourced from approved local borrow pits.

Finally, the first 30 m of the site access road will be paved to prevent the undue release of dust from unpaved roads near the highway system. The end of the access road will be flared to a suitable radius to facilitate truck turning movements.

2.4.1.8 Installation of Optional Truck Scale, Optional Portable Trailer/Office, and Security Gate

Once all other surface facilities have been developed, the optional truck scale (if required) will be installed. An optional portable trailer to be used as a site office/lunch room will be brought to the site and installed. The security gate and other security signage will be installed.

2.4.2 Operation Phase

The operation phase will begin immediately following the completion of construction activities, for an approximate duration of 10 years or until the mineral resource has been depleted. Operation of the

Project is relatively straightforward, and most activities take place within the open pit. A brief description of the activities that will be conducted during the operation phase is provided below.

2.4.2.1 Open Pit Operation (Drilling, Blasting, Excavation, Hauling, Crushing)

Open pit operations will include drilling, blasting, excavation, hauling of rock, and crushing. Open pit operations (e.g., blasting, excavation, crushing) will be carried out up to 5 days a week (excluding weekends), for up to 12 hours a day during daytime, for approximately 200 days per year. Activities in the open pit will be as follows.

- Following construction, the open pit will be excavated by drilling and blasting successive benches and removing the broken rock with a hydraulic shovel and/or wheeled loaders.
- Blasting will occur approximately 25 times per year as an annual average (excluding nights, weekends, and statutory holidays) using explosives by a licensed blasting contractor.
- The broken rock will be excavated from the active pit area and delivered to the portable crusher.
- Gypsum will be loaded into the portable crusher and will be crushed to an approximate diameter of 15-20 cm.

2.4.2.2 On-site Transportation, Storage, Loading, and Transportation to Customers

Following crushing, the operations on the site are limited to the on-site hauling, storage, loading, and transportation of gypsum to customers. These activities will be as follows.

- Crushed gypsum will be loaded onto articulated rock trucks using a wheeled loader and trucked to the storage area.
- Gypsum will be stored on the storage area for a short period of time (up to a few months), pending transportation.
- A wheeled loader will load crushed gypsum from the storage area onto transport trucks in preparation for transportation.
- Gypsum will be transported to customers using the preferred transportation route shown in **Figure 2.3.2**.

Approximately 250,000 t/yr of gypsum will be transported to customers. Assuming the use of trucks carrying approximately 22 tonnes of material at a time, and assuming 300 days of year of potential trucking, approximately 35-40 trucks per day on average would be required to carry the annual production of natural gypsum to markets. In the event that the entire preferred trucking route is able to sustain loads of up to 62,500 kg GVM, larger trucks (e.g., “B-train” tandem trucks) could be used to reduce the number and frequency of shipments, should highway conditions permit.

While open pit operations (i.e., excavation, crushing) will be limited to up to five days a week during weekdays (up to 12 hours a day during daytime) for up to 200 days a year, loading of trucks and transportation of gypsum to customers could occur throughout the day, year-round, as highway restrictions permit.

2.4.2.3 Surface Water Management

Surface water and groundwater infiltrating into the open pit will be stored in a sump at the bottom of the open pit, below the working bench, and periodically pumped to receiving waters to manage water levels within the pit. In rare situations where dewatering of the open pit is required to maintain acceptable water levels in the pit but suspended sediment concentrations are at levels unsuitable for direct discharge to the environment, consideration will be given to directing the water from the open pit to the settling pond, if feasible.

All other surface water from runoff on the site will be directed via constructed drainage channels to the settling pond. Water will be stored in the settling pond for an approximate minimum residence time of 24 hours to allow for the natural gravity sedimentation of suspended sediments contained in the surface water prior to release to the environment. Overflow from the settling pond will be discharged to a drainage channel using via an armoured weir or similar outfall device, to a drainage channel that releases to a small watercourse located on the southeastern portion of the site. Periodic monitoring of pH and suspended solids concentrations in the surface water will be conducted to verify that water quality meets the target discharge concentration of less than 25 mg/L of total suspended solids above background levels of the receiving watercourse, measured as a monthly average of grab samples.

2.4.3 Reclamation and Closure Phase

The New Brunswick *Mining Act* requires that a Reclamation and Closure Plan be developed for the Project as part of its obtaining a mining lease under that Act.

The conceptual approach to completing reclamation and closure of the Project as currently conceived at this early stage of Project development includes:

- removal of all materials and surface facilities on the site;
- re-contouring and reshaping the site;
- re-vegetating the site as much as possible with native species as appropriate; and,
- allowing the open pit to fill with water from natural precipitation (over time).

Prior to allowing the open pit to fill with water, its edges will be reshaped to an appropriate slope to allow for safe entry and egress of the pit lake by animals or humans. Additionally, appropriate signage and other safety measures will be put in place to warn individuals about the potential safety hazards arising from the presence of the pit lake.

This conceptual plan will be updated as part of the process to obtain a mining lease for the Project under the *Mining Act*, which requires a reclamation and closure plan to be developed as a pre-requisite to obtaining a mining lease.

High-level details of the activities to be conducted during the reclamation and closure phase are provided in the sub-sections that follow.

2.4.3.1 Decommissioning

As a first step in decommissioning the site, any remaining gypsum material located in the storage area will be removed and transported to customers, or returned to the open pit. The surface facilities and infrastructure will then be decommissioned and removed, including the removal of all pumps, hoses, portable crusher, optional portable office/trailer, optional truck scale, mobile equipment, and any other machinery. All site access roads, internal roads, power supplies, and other utilities will be decommissioned, unless required for closure of the site.

2.4.3.2 Reclamation

Reclamation will involve the restoration of the Project site to as near natural conditions as possible. In general, disturbed areas of the site including the storage areas and other active areas of the site will be graded and shaped. The settling pond will either remain as a water feature or be infilled with on-site fill material and the site will be levelled using mobile equipment. Slopes will be graded to merge naturally into adjacent undisturbed areas. Grading may include decommissioning drainage channels and other water management facilities that are no longer needed, or enhancing them to provide natural swales for channelling surface water into nearby watercourses. The former storage area and other active areas of the site will be covered with stored overburden, then covered with topsoil.

Since gypsum rock will be trucked off-site during operation, there will be insufficient material remaining on site to fill the open pit at closure, and trucking in of fill material for such purpose is not economically feasible. As such, other than for some minor residual materials (e.g., grubbings, off-specification gypsum) not used on site that will be disposed of in the former open pit, it will not be possible to reclaim the open pit other than as an open-water landscape feature once a pit lake has been established. Similarly, there are no reclamation options for the bare rock faces, and some of the upper benches of the open pit may remain exposed above the pit lake water level. Reclamation will consider implementing feasible measures to mitigate potential hazards to humans and wildlife (e.g., risks potentially posed by vertical rock faces in the open pit, or from deep water in the open pit with no easy exit), subject to further definition as part of reclamation planning throughout the Project life.

The focus for reclamation will be to encourage natural re-vegetation of the site, with limited intervention. Over time, some natural habitats will emerge, such as rock outcrop on the pit rim and walls, possibly wetland habitat on shallow, submerged rock terraces, and upland forest in areas surrounding the pit. Exposed areas will be re-vegetated with native species of hydroseed as necessary to accelerate natural regrowth. Once the areas are stable, it is expected that native shrubs will quickly invade the site, providing natural vegetation cover for the site.

2.4.3.3 Closure

During closure, the surface water drainage channels on the site as well as the settling pond will be removed, but the perimeter channels along the edges of the site will be maintained. Any drainage channels within the site itself will be directed if possible towards the open pit to direct runoff to the open pit to enable its filling with water.

2.5 Project Schedule

The anticipated Project schedule is as follows.

- **Construction:** Construction will proceed for a period of up to 6 months, commencing as soon as the EIA review has been completed and the applicable permits, approvals or other forms of authorization have been obtained. For the purpose of this EIA Registration, it has been assumed that construction will begin in the second quarter of 2019. Clearing of trees and vegetation from the site would be conducted outside of the normal breeding bird season (early April to end of August).
- **Operation:** Operation will commence immediately following the construction phase and will continue for approximately 10 years or until the mineral resource is depleted. For the purpose of this EIA Registration, it has been assumed that the operation phase will begin in the fourth quarter of 2019.
- **Reclamation and closure:** Decommissioning of Project facilities and reclamation and closure of the Project site will occur following the completion of the operation phase. Closure will commence during the initial reclamation period and will be complete when the open pit is full of water.

2.6 Workforce

The workforce required for constructing and operating the Project is relatively modest, given the simple nature of the Project and its intended operations.

During construction, activities will be carried out largely by a third party heavy equipment contractor who will implement site clearing, earth moving, leveling, contouring, storage area preparation, development of water management features, and related construction activities for the Project. The contractor will work under the supervision of a Hammond River Holdings representative (or designate). It is expected that the contractor would be able to carry out these construction activities with its existing staff (although additional staffing is possible).

During operation, a modest workforce is required on-site while quarrying and related activities are taking place. It is expected that approximately 6-10 personnel would be located on-site at any given time (either Hammond River Holdings employees, or contractors, or both), supplemented by an explosives contractor and trucking contractors involved in the trucking of gypsum to customers.

Reclamation and closure activities will be conducted by the same workforce and contractors as during the operation phase, for a short period of time until the site is reclaimed and ultimately abandoned.

2.7 Emissions and Wastes

The anticipated emissions and wastes associated with the Project are discussed in this section. Hammond River Holdings, through the conditions of the various permits and approvals it will receive to enable construction and operation of the Project, will meet or exceed the compliance standards

outlined in applicable regulations and guidelines with respect to waste, emissions and discharges from the Project. Where no such standards exist, industry best practices will be adopted, where applicable. Emissions and wastes will be reduced through best management practices, following applicable legislation, and mitigation planning including the development of an Environmental Protection Plan (EPP).

2.7.1 Air Contaminant Emissions

Air contaminant emissions from the Project will mostly occur during the construction and operation phases. The potential air contaminant emissions of concern include primarily particulate matter (PM, including its common size fractions PM_{10} and $PM_{2.5}$) from fugitive sources (e.g., unpaved roads, crushing, material handling, storage piles) as well as combustion gas emissions such as carbon monoxide (CO), nitrogen oxides (NO_X), and sulphur dioxide (SO_2) from the combustion of fossil fuel by site equipment. Given the relatively straightforward nature of the Project, measurable emissions of other air contaminants (other than greenhouse gases, discussed below in **Section 2.7.2**) are not expected.

Emissions during construction are generally related to the generation of dust from earth moving activities and unpaved roads, and routine combustion gas emissions from construction equipment. Equipment used for construction will generally consist of dump trucks, excavators, wheeled loaders, bulldozers, and other mobile equipment, similar to what may be seen on many other commercial or industrial construction sites. Control measures, such as use of water sprays on roads during dry periods or other dust suppression techniques, will be used as required to reduce the fugitive dust, and routine inspection and maintenance of construction equipment as well as the implementation of a no-idling policy will reduce exhaust fumes.

Though the Project site is isolated from nearby residences and within a significant tree buffer (thereby reducing the potential off-site transport of dust), the timing of construction activities will also be important to avoid undue nuisance to off-site receptors. It is planned to limit intrusive activities to daylight hours during weekdays only. The burning of waste brush/slash material or grubbings will not be permitted.

Emissions during the operation phase are expected to be largely similar to those arising during construction, consisting primarily of dust from crushing, material handling, storage piles, and unpaved roads, some minor blasting residues during blasting events (once or twice per week for an instantaneous period), as well as routine combustion gas emissions from the burning of fossil fuels used in trucks and mobile equipment. Equipment used during operation will be similar to that used during construction, including trucks, excavators, wheeled loaders, the primary crusher, and other mobile equipment; equipment will be routinely inspected and maintained in good working order to reduce combustion gas emissions, and the implementation of a no-idling policy will further avoid emissions. Active operations will be limited to daytime during weekdays only, up to 200 days per year.

Water sprays or other dust suppressants will be used on internal site roads during dry periods as required to reduce fugitive dust, and if required, consideration will be given to using water sprays on the primary crusher if dust levels become of concern. Water for spraying roads will be sourced from the pit

sump and/or settling pond. Though the gypsum storage pile(s) will be an active area that may generate some limited dust during material handling, dust emissions from stored gypsum (with a diameter of 15-20 cm) are not expected to be substantive.

Dust emissions from the topsoil and overburden storage piles are not expected since these will become naturally vegetated over time, thereby minimizing soil erosion and dust from wind entrainment. Similar to construction, the Project site is isolated from, and relatively distant from nearby residences, and the presence of a significant tree buffer will reduce the potential for off-site transport of dust. As well, dust-producing site activities will be limited to daytime during weekdays only so that the Project does not cause undue nuisance to off-site receptors. There may be nominal combustion gas emissions from delivery of supplies and equipment to the site, which in general should not be measurable above background levels.

Potential air contaminant emissions during reclamation and closure will be similar in nature to, but lower in magnitude and duration than, emissions associated with construction of the Project.

An assessment of the environmental effects of the Project on the atmospheric environment is provided in **Section 5.2**.

2.7.2 Greenhouse Gas (GHG) Emissions

Greenhouse gas (GHG) emissions from the Project will mostly occur during construction and operation, consisting of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as carbon dioxide equivalents (CO_2e), from fossil fuel combustion in trucks and mobile equipment. Given the relatively straightforward nature of the Project, these emissions are not expected to be substantive.

The Project will interact with the atmospheric environment through the release of GHGs into the atmosphere as described above for air quality. An assessment of the environmental effect of the Project on the atmospheric environment due to Project-related GHG emissions is provided in **Section 5.2**.

2.7.3 Noise and Vibration Emissions

Noise emissions from the Project will occur primarily during construction and operation, and are generally associated with the operation of mobile equipment, the primary crusher, material handling operations, and blasting activities. Vibration will also occur from these same operations, although to a lesser extent during the construction phase than during operation.

Noise and vibration during both construction and operation will be intermittent, as equipment is operated on an as-needed basis while site operations are taking place. Noise sources will be mitigated through the use of mufflers on all equipment, carrying out routine maintenance of equipment to maintain it in good working order, and limiting noise producing operations to daytime during weekdays only. The Project site is isolated from, and relatively distant from, nearby residences, and the existing presence of a significant tree buffer will reduce the potential off-site effects of noise and vibration emissions such that the Project does not cause undue nuisance to off-site receptors.

In addition to the above potential sources of noise and vibration emissions during construction, further noise and vibration emissions could result during operation due to blasting, crushing, and material handling activities within the open pit. Blasting activities will be limited to approximately 25 blasts per year as an annual average (excluding nights, weekends, and statutory holidays), and a communication plan will be developed for residents who wish to be notified. Crushing operations will be conducted mostly within the open pit to minimize noise levels. Given that blasting, crushing, and material handling operations within the open pit will be conducted at depth (i.e., on benches within the pit and below the surrounding ground surface, rather than at ground surface), topography and the presence of the pit walls will further reduce the off-site transport of noise emissions. Periodic pre-blast surveys will be conducted at the nearest residences, and blasts will be periodically monitored using seismographs, to ensure that concussion noise levels do not exceed a peak pressure level limit of 128 decibels (dBL) and that peak particle velocities (PPV) remain within 1.25 cm/s, as a best industry practice for quarry operations.

An assessment of the environmental effects of the Project arising from noise and vibration emissions is provided in **Section 5.2**.

2.7.4 Liquid Wastes

Given the relatively simple nature of the Project, liquid wastes (except for site runoff, discussed below in **Section 2.7.5**) are not expected to be generated during any phase of the Project. There are no transformation processes associated with the construction or operation of the Project, and the Project is not a consumer or generator of water or liquid wastes. There will be no permanent buildings, permanent fuel storage, or equipment maintenance on-site; as such, the generation of liquid wastes (including liquid hazardous wastes) from the Project is not expected. Should the decision be made to install a septic system on-site, it will be designed to meet the requirements of the *Public Health Act*.

2.7.5 Pit Dewatering and Surface Runoff

Surface runoff may result during construction and operation of the Project due to natural precipitation (including during the spring freshet) falling on the Project site, thus requiring management. Additionally, water from periodic dewatering of the open pit will require management during operation. As discussed in **Section 2.4.1**, the Project will be leveled and contoured during construction, and on-site drainage channels will be constructed to convey water from the site to the settling pond for settling prior to natural discharge. Perimeter ditches around the Project site will prevent off-site water from entering the site, thereby reducing the amount of water that would otherwise need to be managed.

Further, the deepest part of the open pit will act as a sump for containing precipitation and seepage water that enters the pit (with the active working area of the quarry at a higher elevation so that pit water does not interfere with site operations). The sump will need to be periodically pumped as water levels rise, if water quality is suitable for discharge.

All other surface runoff on-site will be directed to the settling pond to allow for suspended sediments to settle via gravity sedimentation prior to overland release to the receiving environment. Released water

will be periodically tested to verify that water quality meets the target discharge concentration of less than 25 mg/L of total suspended solids above background levels, measured as a monthly average of grab samples. Other contaminants in released water are not expected.

The water management plan for the Project will be developed in parallel to the EIA review (as part of site engineering), with these goals in mind. Additional measures to minimize potential effects due to surface runoff will be detailed in the EPP. An assessment of the environmental effects of the Project on water resources is provided in **Section 5.3**.

2.7.6 Solid Wastes

Given the relatively simple nature of the Project as a quarry with no transformation processes on site, few solid wastes are expected to be generated from the Project.

During construction, topsoil and overburden will be removed from the open pit area and stored for later use in site reclamation. Materials from earth moving activities on the remainder of the site during grading and levelling will be reused in shaping and contouring the site. Grubbings and non-merchantable timber from clearing will be stored for future use as fill during site reclamation (e.g., partial filling of the open pit at closure). There will be no waste rock expected from the Project.

During operation, all material excavated from the open pit as gypsum will be trucked to customers for production of wallboard. Any excavated rock that does not meet product specifications would be stored on-site for other uses and/or reused in site reclamation (with possible disposal in the open pit at closure). There is no physical or chemical transformation occurring on-site that would result in the generation of solid wastes.

Any garbage and other refuse would be managed by storage in an on-site dumpster and periodically trucked away by a waste disposal contractor for disposal at the Fundy Region Solid Waste Commission landfill.

2.8 Alternative Means of Carrying out the Project

This section discusses the various alternative means of carrying out the Project that are technically and economically feasible that have been considered, and their environmental effects (as applicable).

2.8.1 Alternative Project Locations

The Project location is fixed by the location of the gypsum mineral deposit. As the location of the mineral deposit is on the subject property and not elsewhere, there are no technically or economically feasible alternative locations for this Project as currently conceived. The Project is located at a suitable distance from the Hammond River and in a relatively sparsely populated rural community, representing favourable characteristics from a site selection perspective.

However, as mentioned previously, other potential gypsum deposits that may be explored for future consideration by Hammond River Holdings.

2.8.2 Alternative Extraction Methods

Since the gypsum mineral deposit at the Project site is near surface with only 10-15 m of overburden, surface extraction is the only technically and economically feasible means of accessing the gypsum deposit. Underground gypsum extraction is not technically and economically feasible. Thus, in terms of the quarrying method, there are no technically and economically feasible alternative means of carrying out the Project.

Though other methods could be used, the development of the quarry through excavation in benches is the most common method of excavating rock quarries. The environmental effects of quarrying in benches or by other methods would not likely be distinguishable from each other.

2.8.3 Alternative Locations for Surface Facilities

The principal factor that governs the location of the surface facilities (including the portable crusher, storage area, and water management facilities) is the distance between them and the open pit. Minimizing the distance between site operations reduces the distances for hauling and conveying material from the pit to the other on-site facilities, and resulting in more efficient movement of materials on-site. Given that the surface area of the Project site is relatively compact for the required operations, the surface facilities will be located as close as possible to the open pit and in a configuration as was conceptually shown in **Figure 2.3.1**. This configuration also affords the ability to maintain tree buffers (where they already exist) along the perimeter of the site as well as around watercourses and wetlands on the southern end of the site, thereby minimizing the footprint of the Project and associated environmental effects.

Though it could be technically feasible to construct these surface facilities elsewhere (or not at all), the increased hauling distance between the open pit and other possible locations would not be economically feasible in comparison to the Project as planned.

Thus, in terms of the location of the surface facilities on the site, there are no technically and economically feasible alternative means of carrying out the Project.

2.8.4 Alternative Water Management Methods

Given the relatively simple nature of the Project and its related activities, water management and treatment requirements for the Project are very straightforward. Gypsum, by its very nature, is an inert mineral that does not result in the generation of acid rock drainage or the related leaching of trace metals; thus, the sole objective of the water management facilities for the Project is to treat for the removal of suspended sediments contained in pit water and site runoff so that their release does not result in undue siltation of nearby watercourses and wetlands.

While there are other methods available for removal of suspended sediments in water that would be technically feasible (including filtration, centrifuging, decantation, or other methods), their removal by gravity sedimentation in a suitably sized sump and settling pond (with verification of discharged water

quality through periodic grab sampling and analysis for total suspended sediments and pH) is the most technically and economically feasible means of carrying out the Project.

2.8.5 Alternative Options for Reclamation and Closure

Hammond River Holdings will consider in detail various options to achieve reclamation and closure of the Project site at the end of quarry life to meet the requirements of the *Mining Act*. The conceptual reclamation and closure plan, described in **Section 2.4.3** above, describes the conceptual approach to completing reclamation and closure of the Project as currently conceived at this early stage of Project development. The conceptual reclamation and closure plan includes removal of all materials and surface facilities on the site, re-contouring and reshaping the site, re-vegetating the site as much as possible with native species as appropriate, disposal of unusable fill (from grubbings, non-merchantable timber, and other soils) in the open pit, and allowing the open pit to fill with water from natural precipitation (over time). This conceptual plan will be updated as part of the process to obtain a mining lease for the Project under the *Mining Act*, which requires a reclamation and closure plan to be developed as a pre-requisite to obtaining a mining lease.

Alternative methods of reclaiming the site would normally include the steps mentioned above in addition to giving consideration to backfilling the open pit with stored fill material or waste rock. However, given that the majority of the gypsum deposit will have been quarried and removed from the site for other purposes, there would be insufficient material on-site to fill the open pit. Bringing in fill material from other sources to fill the open pit would not be economically feasible.

As such, subject to confirmation through the development of the Reclamation and Closure Plan for the Project, there are no technically or economically feasible alternatives to accomplish reclamation and closure of the Project.

2.8.6 Alternative Transportation Routes

The Project is nestled between two major transportation routes, with Route 820 located to the north of the Project site and Route 111 located to the south and east of the site. Myron Road, located to the west of the site, connects Route 820 and Route 111. An existing access road for the Project site was developed for the purpose of logging the subject property in the early 2010s, which accesses the Project site from the south of the property via Route 111.

The preferred transportation route was shown in **Figure 2.3.2**. From the site access road, trucks will enter the provincial highway network via Route 111 in a northeasterly direction until it intersects with Route 865 at Hillsdale, then onto Route 865 in a northwesterly direction until it intersects with Route 1 at Norton, then onto Route 1 to access the remainder of the provincial highway network for delivery of material to customers. In general, residences located along Route 111/Route 865 tend to be located at a greater distance from the road compared to other routes, thereby minimizing the effects of trucking operations along this route. Route 111/Route 865/Route 1 is preferred since it enables the transportation of larger payloads for most of its length (i.e., 62,500 kg GVM) compared to other trucking routes, although a 9 km section of Route 111 will need to be evaluated by the NBDTI to confirm the

weight bearing capacity of the route and to determine its suitability for the Project needs. Further information on these other routes is as follows.

- Route 111 is a paved road, designated as a provincial collector highway, connecting the Village of Sussex Corner in a north-south direction to the Village of St. Martin's (it also has an east-west component connecting St. Martin's to Rothesay). Route 111 has a weight bearing capacity of 43,500 kg GVM, thus using this road will require a 9 km length between the Project site and Route 865 to be upgraded to 62,500 kg GVM.
- Route 865 is a paved road, designated as a local highway, connecting the community of Hillsdale and the Village of Norton. It is rated for a gross vehicle mass of 62,500 kg GVM along its entire length.
- Route 1 is a paved four-lane provincial arterial highway that is a major thoroughfare from St. Stephen to River Glade. Route 1 is designated for highway speeds up to 110 km/h and has a weight bearing capacity of 62,500 kg GWM along its entire length.

An alternative transportation route could include accessing the highway network via Route 820, in a westerly direction to Route 111 at Loch Lomond, and finally either continuing on Loch Lomond Road to east Saint John or towards Route 1 at Rothesay and then onto Route 1. Route 820 is a secondary paved road, designated as a local highway, connecting the Loch Lomond area of Saint John and running in an east-west direction, terminating at Route 111 at the community of Upperton, east of Upham. Route 820 has a weight bearing capacity of 43,500 kg GVM. Approximately 23 km of Route 820 would need to be upgraded to 62,500 kg GVM for use by the Project. Given the longer length of road to be upgraded and the lower speed limits along its entire length, though technically feasible, it would not be an economically feasible alternative.

2.9 Environmental Planning and Management

Hammond River Holdings is committed to developing the Project in an environmentally responsible manner consistent with good environmental management principles and retaining the rural character of the community while meeting the market demand for gypsum. To this end, Hammond River Holdings will develop and carry out the Project in a manner that avoids or minimizes the adverse environmental effects of the Project, and enhances positive ones, in a manner that complies with applicable laws and regulations.

Several environmental protection and management measures will be implemented to guide the construction, operation, and reclamation and closure of the Project, as follows.

- Employing good planning, design, and management practices to comply with regulated and/or industry design and management standards to satisfactorily deal with environmental risks such as seismicity, unusual weather events, flooding, and erosion.
- Siting facilities to avoid sensitive areas such as wetlands, watercourses and important habitat types, where possible, and maintaining as much of a mature tree buffer as possible surrounding these features.

- Minimizing the footprint of Project facilities and activities to consequently reduce the amount of disturbed land, wetlands, and water resources.
- Employing good planning, design and management practices to comply with standards and objectives for air contaminant emissions, noise, vibration, and surface runoff.
- Implementing progressive environmental protection, mitigation, and management strategies that avoid or minimize adverse environmental effects, and maintain or enhance positive effects.
- Preparing and implementing an Environmental Protection Plan (EPP), which will contain mitigation measures to avoid and reduce potential adverse environmental effects that might otherwise occur from routine Project activities, including emergency response and contingency procedures. The EPP will include procedures related to, but not limited to, the following:
    - management of emissions and noise;
    - management of surface water runoff;
    - heritage resources (including procedures for chance encounters of heritage resources during construction);
    - erosion and sediment control;
    - spill prevention and management;
    - transportation; and,
    - training and awareness.
- Preparing and implementing Project-specific emergency response and contingency procedures as part of the EPP to advise Project personnel on how to implement specific actions to respond to accidents, malfunctions, or unplanned events.
- Completing Aboriginal engagement, and public/stakeholder consultation, as described in **Sections 9.0** and **10.0**, such that, wherever possible, concerns about the Project are accommodated in its design, construction, operation, and reclamation and closure.

3.0 Summary of Environmental Setting

The Project is located in southern New Brunswick approximately 16 km east of the Town of Hampton, New Brunswick, within the Hammond River watershed. A high-level overview of the environmental setting for the Project is provided in this section.

3.1 Physical Setting

3.1.1 Physiography and Geography

The Project area lies near the southwestern extremity of the Late Devonian to Early Permian Maritimes Basin and is assigned to the Moncton Sub-basin of southern New Brunswick. This sub-basin is defined by partly structurally controlled depositional centres filled with a variety of mostly terrestrial clastic sedimentary rock units that were mainly derived from surrounding basement uplifts (Horton and Sussex groups).

The Upham East property occurs along the southern margin of the Moncton Sub-basin, which in this area is a northeast-trending half-graben formed along the northern margin of Late Neoproterozoic to Cambrian basement rocks assigned to the Caledonia Uplift.

3.1.2 Topography and Drainage

The topography of the Project site rises to over 105 m above mean sea level (m amsl) in the central portion of the Project site, and slopes downward to the east, south, and west towards the Hammond River (approximately 70 m amsl), and slopes upward in the north towards Route 820 (approximate maximum elevation of 99 m amsl). Drainage from the site is anticipated to flow to the east, south, and west, and ultimately into the Hammond River.

3.1.3 Surficial Geology

The surficial geology of the LAA consists of Late Wisconsonian glaciofluvial sediments deposited consisting of hummocky, ribbed, and rolling ablation till, some lodgement till, clay, minor silt, sand, gravel, and boulders, generally consisting of 1.5 m in thickness (Rampton 1984). Surficial materials in the Project area consists of a thin veneer of rubble under which highly variable thicknesses of red and greyish brown to black mud and clay with or without variable amounts of randomly distributed angular fragments and debris. Where present, the fragments range in size from pebbles to cobbles and are typically calcareous red to grey sandstones. The finer debris usually consists of calcareous red mudstone and siltstone fragments and chips, and rare pieces of carbonate or volcanic rocks.

3.1.4 Bedrock Geology

The bedrock geology of the area is made up of the Gays River Formation and the Macumber Formation. These formations are early Carboniferous aged, sedimentary deposits that form part of the Windsor

Group. The Gays River Formation is grey to brown or black fossiliferous and algal limestones. The Macumber Formation is grey to black sparsely fossiliferous, interclastic and/or pelletoidal limestone with minor intraformational breccia (Barr and White 2004).

From a recharge to groundwater perspective, the PDA is situated at a topographic divide whereby precipitation in this area is draining to the east and west into the Hammond River. Water for domestic purposes in the area is supplied by private wells.

3.2 Biophysical Setting

3.2.1 Climate

New Brunswick has a humid continental climate, with slightly milder winters on the Gulf of St. Lawrence coastline. Northern New Brunswick experiences a subarctic climate, particularly in the more elevated area in the far north. Southern New Brunswick experiences a more moderate maritime climate than the northern or central parts of the province as the Bay of Fundy never fully freezes, thus moderating the winter temperatures and providing generally cooler summer temperatures compared to other inland locations. The cold Bay of Fundy air combining with the inland warmer temperatures often creates onshore winds and periods of fog.

Monthly mean wind speeds measured at the Saint John weather station (the nearest weather station to the Project) range from 11.3 to 17.5 km/h, with an annual mean wind speed of 15.2 km/h. From May to August, the dominant wind direction is from the south, with winds predominantly blowing from the southwest and northwest from September to February (GOC 2018). Maximum hourly wind speeds, averaged from 1981 to 2010 for each month, range from 61 km/h to 111 km/h, while maximum wind gusts for the same period range from 96 km/h to 148 km/h. The region receives an average of 1,295.5 mm of precipitation per year, with 1,076.0 mm as rain and 239.6 mm as snowfall (as water equivalent) (GOC 2018).

3.2.2 Atmospheric Environment

The Saint John and southern New Brunswick areas may experience some short-term challenges with ambient air quality due to their location downwind of large urban centres in eastern North America (as a result of long-range transport of air contaminants), their proximity to the Bay of Fundy (a large body of cool water that may produce weather conditions that inhibit dispersion), and the presence of several large emission sources in the area (particularly from heavy industry). Despite this, air quality in the region has improved considerably in the past decades and continues to improve. Based on the data from NAPS (2018), in general, air quality in Saint John (i.e., an urban area subject to occasional air quality challenges) can be characterized as good to very good, most of the time, with occasional short-term periods of poor air quality (particularly in summer). By extension, ambient air quality in more rural areas of Southern New Brunswick (such as the Upham area) can be inferred to be equivalent to, or better than, that in Saint John.

The Project is located in a rural, mostly forested area with limited residential dwellings nearby. Sound quality in the area of the Project can be characterized as typical of a rural, sparsely populated area of New Brunswick, and mainly influenced by human activities and road traffic.

3.2.3 Freshwater Environment

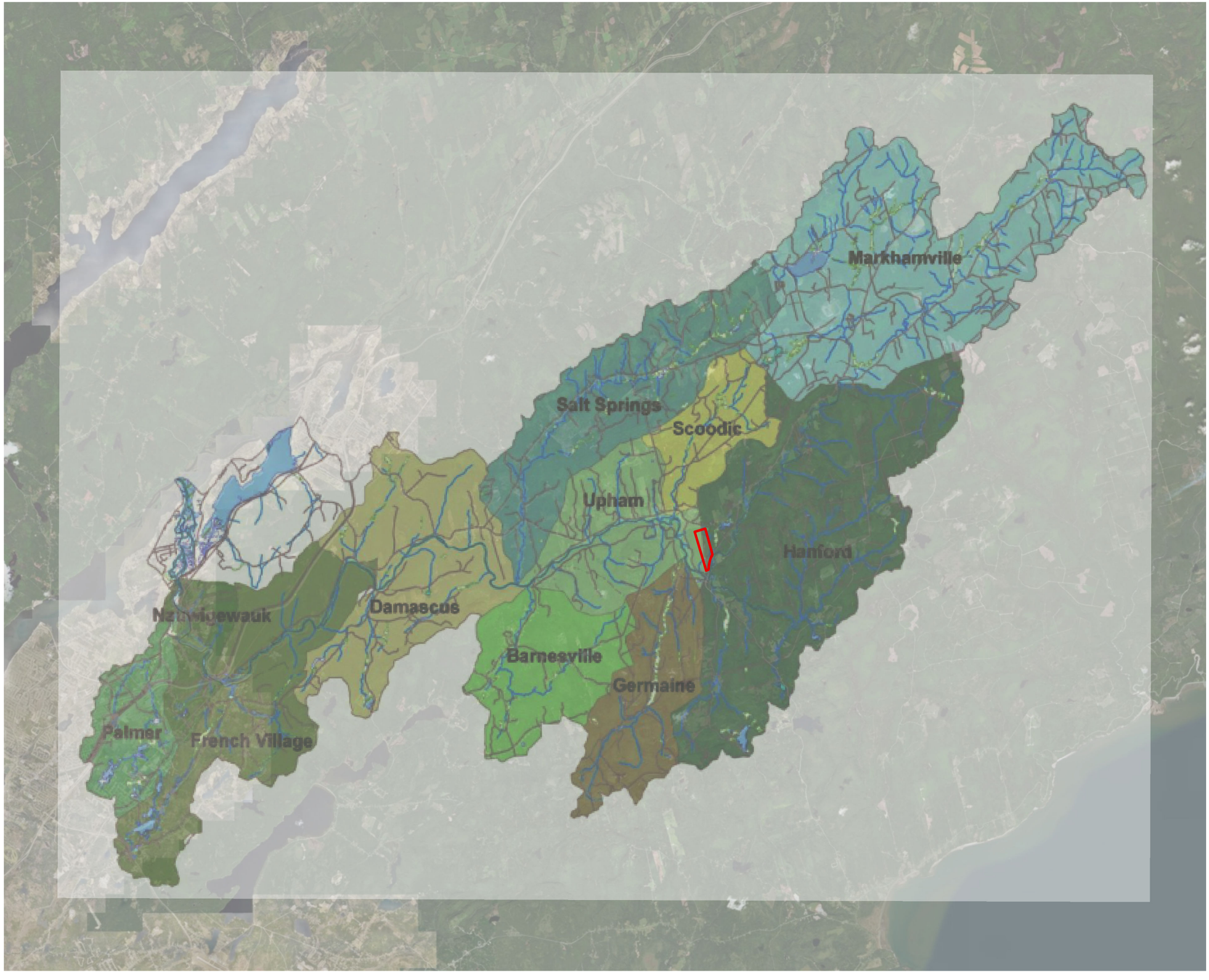
The Project is located in southern New Brunswick, approximately 16 km east of the Town of Hampton and lies within the Hammond River watershed. The Hammond River ultimately discharges into the Kennebecasis River which is part of the lower Saint John River. The Hammond River, shown in **Figure 3.2.1**, has a total drainage area of approximately 513 km^2 (NBDOE 2007). The Hammond River originates in the Caledonia Highlands near the rural community of Hammondvale and runs in a westerly direction for a distance of approximately 40 km into the Kennebecasis River at Nauwigewauk/Darlings Island. The Hammond River flows from the eastern side of the LAA, around the south and flows away from the LAA towards the Kennebecasis River to the west. The mapped watercourses (as mapped on the GeoNB website) that intersect with the PDA include the reaches of three small unnamed tributaries to the Hammond River, which are generally associated with wetland features on the Project site.

Fish species that typically reside in the Hammond River include Atlantic salmon (*Salmo salar*), brook trout (*Salvelinus fontinalis*), smallmouth bass (*Micropterus dolomieu*), rainbow smelt (*Osmerus mordax*), striped bass (*Morone saxatilis*), and shortnose sturgeon (*Acipenser brevirostrum*) (NBDOE 2007).

3.2.4 Terrestrial Environment

The Project is located within the Valley Lowlands ecoregion and, more specifically, within the Anagance ecodistrict, which hosts rugged terrain consisting of steep river valleys that bisect rugged hills and mountains (Zelazny 2007). This ecoregion is characterized by dramatic influence of major watercourses and large lakes (such as the Saint John River and its tributaries). The interaction of flood events through these major watercourses with the varied topography of the ecoregion creates a wide spectrum of flood and substrate conditions, with a corresponding diversity of wetland types (Zelazny 2007).

Within this ecoregion, tolerant hardwood stands dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) sit on ridge tops with fertile soils. On less fertile ridges, hardwoods tend to be dominated by American beech, red maple (*Acer rubrum*), and trembling aspen (*Populus tremuloides*). Softwood forests in the area tend to be associated with lower slopes and shallow soils. The softwood forests are dominated by red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and white spruce (*Picea glauca*), with occasional Eastern hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) (Zelazny 2007).



HAMMOND RIVER HOLDINGS LIMITED
PROPOSED UPHAM EAST GYPSUM QUARRY

HAMMOND RIVER WATERSHED AND SUBCATCHMENTS
FIGURE 3.2.1

SITE LOCATION

0 1.25 2.5 5 km

SCALE 1:150,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC, HAMMOND RIVER ANGLING ASSOCIATION
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: BQS
MAP REVISED BY: JH
MAP CHECKED BY: DM
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

FILE LOCATION: \\DILLON.CA\DILLON_DFS\FREDERICTON\FREDERICTON CAD\CAD\GIS\188346 UPHAM GYPSUM QUARRY\MXD

DILLON CONSULTING

PROJECT: 18-8346
STATUS: FINAL
DATE: OCT 2018

3.3 Socioeconomic Setting

3.3.1 Demographic Overview

According to the Statistics Canada 2016 Census Profile for Upham Parish Census Subdivision (the smallest census division available for the Project location), the total population in 2016 was 1,269, down 2.8% from 1,306 in 2011. The population density of the parish is 6.7 persons per square kilometre, compared to 10.5 for the province. The age distribution of people living in Upham Parish for the 2016 Census indicates that the largest proportion of the population is in the 25-54 age group, followed by the 0-24 age group. The number of dwellings occupied by usual residents in Upham Parish is 521, while the total number of private dwellings is 579 (Statistics Canada 2017).

3.3.2 Economic Activity

The Project is located in the Southwest Economic Region which includes Saint John, Kings, and Charlotte Counties. The City of Saint John is the economic centre of the region and holds the largest population in the Southwest Region. The Upham area itself is a sparsely populated rural area of southern New Brunswick, with agriculture and forestry as the primary economic activities of the local area.

Few people living in Upham Parish work in the parish. The majority (94%) of residents who commute to their place of employment travel outside of the parish to work, and approximately 55% commute outside of Kings County to work.

Statistics Canada employment figures for the 2016 Census indicate that the construction industry is the largest employment sector for Upham Parish at 21%, followed by health care and social assistance care and retail trade sectors at 11% and 10%, respectively (Statistics Canada 2017).

3.3.3 Land Use

The Project is located in the small community of Upham, Upham Parish, Kings County, in Southern New Brunswick. Like other communities in the area, Upham is a sparsely populated rural community with land use generally focused on residential, forestry, and agricultural uses.

The PDA is located within the Regional Service Commission (RSC) 8, which is comprised of 14 local service districts (LSDs), the Villages of Norton and Sussex Corner, and the Towns of Sussex and Hampton. The Project site is located within the LSD of Upham. Development in Upham Parish is not guided by a Rural Plan or Basic Planning Statement; however, development projects are subject to provincial regulations and permitting and inspections is managed by RSC 8.

Residential land use in the vicinity of the PDA is a linear pattern along the main roads, primarily Route 820 and Route 111. Approximately 20 residential dwellings are located within a 1 km radius of the Project site.

3.3.4 Infrastructure and Services

The Upham area is a sparsely populated rural area of southern New Brunswick, and few infrastructure and services are located nearby. The Upham Volunteer Firefighter Hall is located at 2268 Route 820 in Upham, approximately 4 km from the Project site. Other institutional land uses within the general vicinity are limited to local churches and community halls.

Policing services in the area are provided by the Royal Canadian Mounted Police (RCMP), with the nearest detachments located in Hampton and Sussex. Emergency medical services are provided by Ambulance New Brunswick with stations in Hampton, Sussex, and St. Martins. Health Services are provided by the Horizon Health Network, with the nearest hospitals located in Saint John.

Route 111 is the primary transportation route through Upham Parish. Route 111 runs between Sussex and St. Martins and connects with Loch Lomond Road in the City of Saint John. Secondary routes include Route 820 which connects Loch Lomond and Upperton east of the PDA, and Route 865 connecting Norton to Hillsdale.

There are no active rail lines or airfields in Upham Parish. The nearest operational rail line is a Canadian National (CN) Rail line, which runs between Moncton and Saint John. The Saint John Airport is located in Loch Lomond, approximately 25 km west of Upham.