

Final Report: Environmental Assessment Registration for Mulgrave Quarry Fines Storage Development

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1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 PROPONENT INFORMATION

Name of the Proponent:

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Registry of Joint Stocks for the proponent company is included in Appendix A.

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Signature of Plant Manager

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1.2 PROJECT INFORMATION

Name of the Undertaking:

Mulgrave Quarry Fines Storage Project

Location of the Undertaking:

Mulgrave, Guysborough County, NS

2.0 PROJECT INFORMATION

2.1 DESCRIPTION OF THE UNDERTAKING

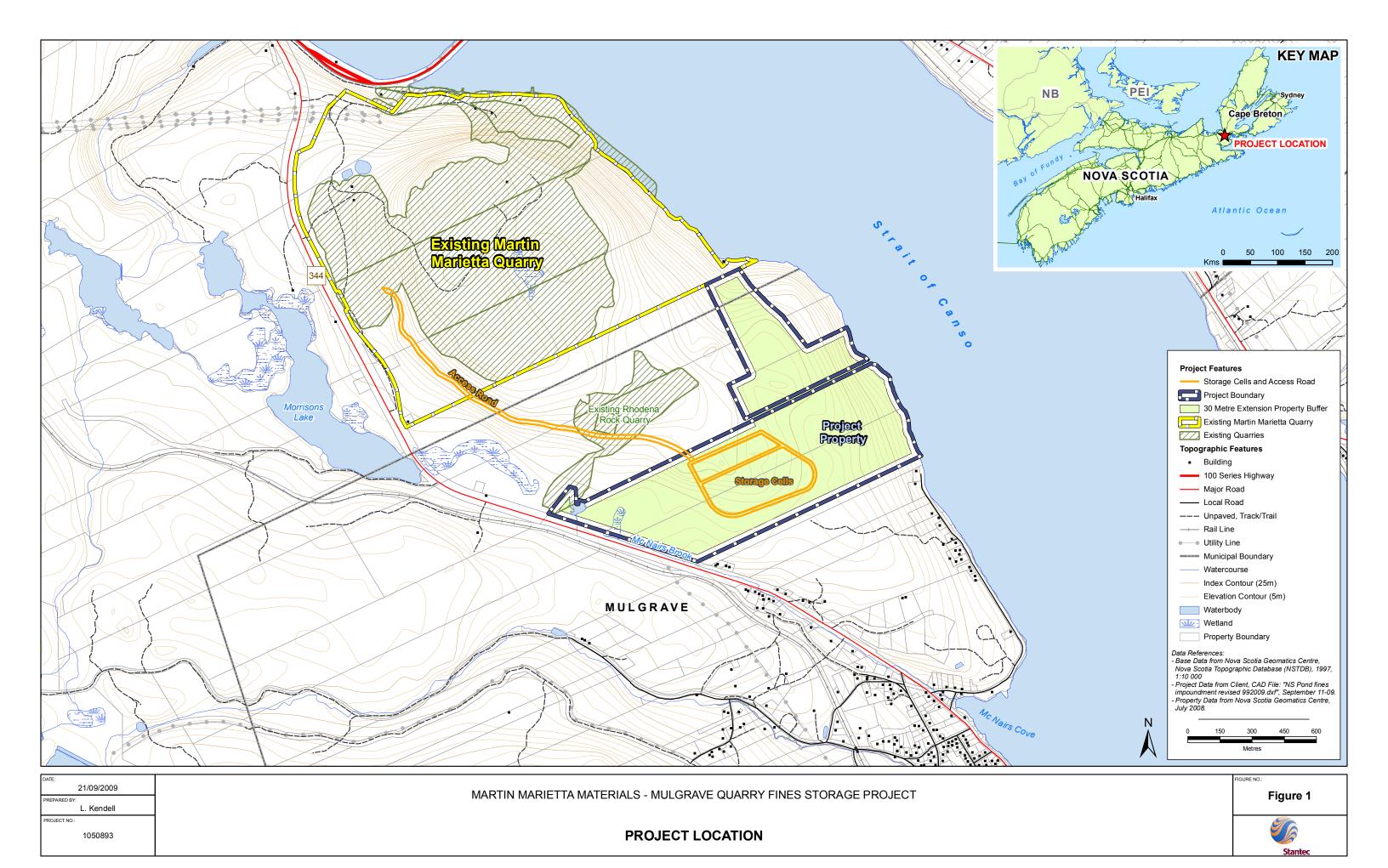
Martin Marietta Materials Limited (Martin Marietta; the Proponent) owns and operates the Mulgrave Quarry, located in Mulgrave, Guysborough County, Nova Scotia (Figure 1). The quarry property is in the Mulgrave municipal district. It is currently operating under an Industrial Approval (Approval No. 2000-016493) that was obtained from Nova Scotia Environment (NSE), pursuant to Division V of the Activities Designation Regulations (Nova Scotia Environment Act). The current Approval is effective from 2000 until December 31, 2010. A copy of the Approval permit is appended to this report (Appendix A).

Martin Marietta proposes to modify its quarry operation to allow for continual storage of fines produced during the washing of aggregate. The Proponent owns the existing quarry lands as well as the additional parcels of land proposed for the Project, which will effectively allow for development of the fines storage cells. The quarry modification on the new lands will include activities related to fines storage only and will not be operated for purposes of rock extraction (*i.e.*, drilling, blasting and crushing) at that site.

The current quarry operation includes an area of approximately 123 hectares (ha) (Figure 1). The proposed Project will incorporate an additional 90 ha of lands for a total size of approximately 213 ha. To date approximately 70,000,000 tonnes of aggregate have been processed since the facility opened in 1978 and an estimated two hundred and fifty million rock reserve remains on the existing site. The annual production rate at the existing facility is approximately 5,000,000 tonnes of granite per year. Most of the aggregate is removed from site by ship for export to Florida, South Carolina, Georgia and P.E.I, with lesser amounts taken by truck for local construction, such as road building. The existing quarry operates on a schedule of 24 hours per day, seven days a week, 52 weeks a year, although level of activity varies according to market demand. As the anticipated Project area will not be used for quarry development there will be no change in the facility's annual production or operating schedule.

Approximately 30,000 tonnes of fines will be stored per month at the proposed Project site in an engineered series of storage cells that will be designed to manage environmental issues such as site runoff. The proposed Project will also involve the construction of a 1.8 km access road, connecting the existing quarry site to the proposed fines storage property (Figure 1) through an easement obtained from the operator of the intervening quarry lands (Rhodena Rock Limited).

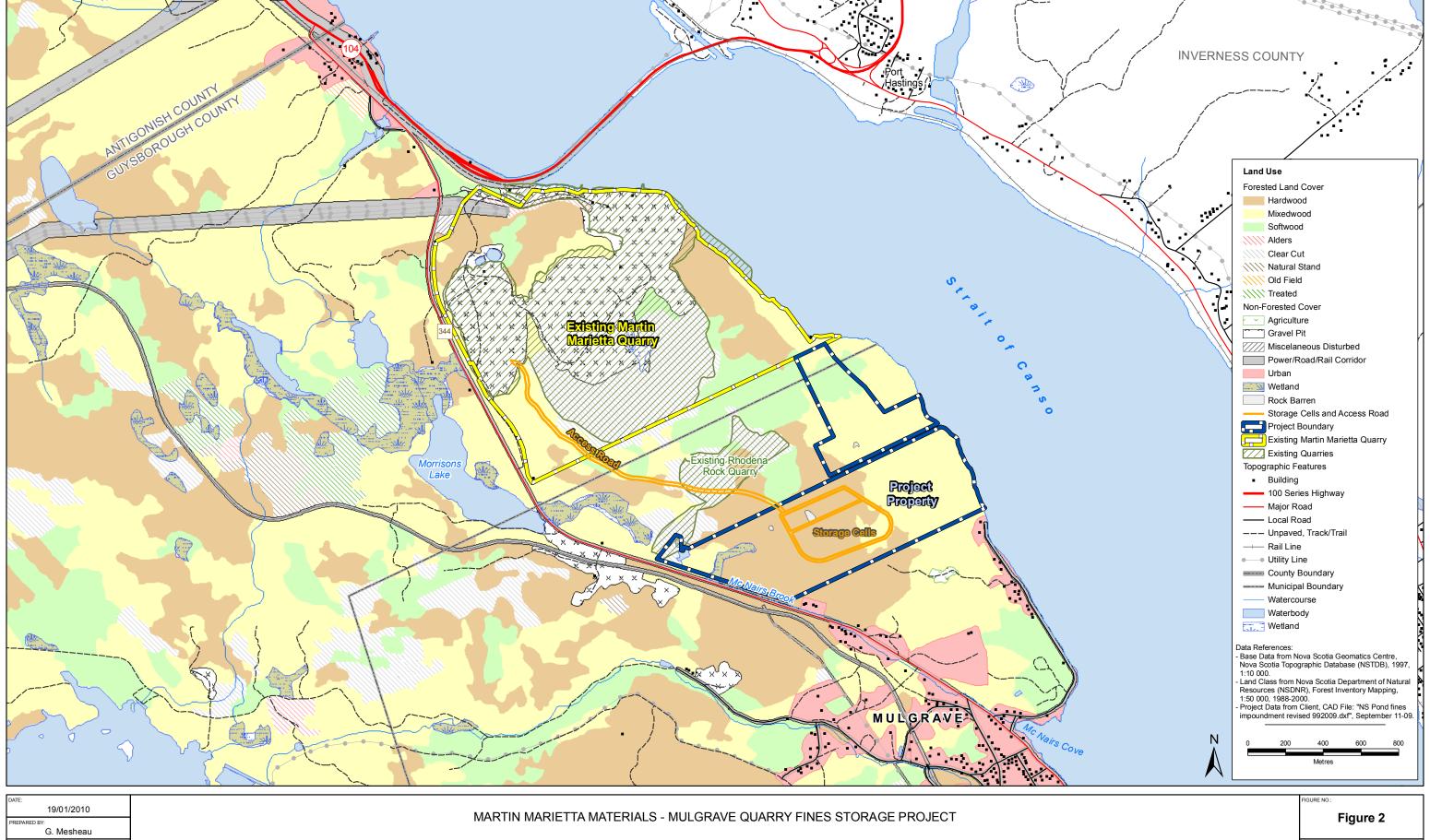
As a result of field and desktop studies undertaken in support of this environmental registration document, location and design of the fines storage cells has been carefully considered to minimize potential adverse environmental effects (*e.g.*, wetland and watercourse impacts) on the proposed Project site.



2.2 GEOGRAPHIC SETTING

Mulgrave Quarry is located just outside the small community of Mulgrave, Guysborough County, Nova Scotia (Figure 1). It includes Porcupine Mountain along route 344. Entrance to the quarry is via a private access road located off route 344. The quarry and proposed quarry fines storage area are situated on lands that are owned by the Proponent. The proposed Project site supports a number of habitat types including hardwoods, mixedwoods, barrens, and wetlands (Figure 2). Generally, the proposed fines storage land is bound to the north by lands owned by Rhodena Rock Limited, with an operational guarry to the northwest.

Mature stands of second growth hardwood provide cover over much of the property, particularly the large hill in the center of the Project area and its south-facing slopes. These mesic stands are dominated by a mixture of red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), paper birch (*Betula papyrifera*), and American beech (*Fagus grandiflora*). Mature second growth mixedwood forest is particularly prominent within the northern parcel of the property and throughout the lower slopes. These mesic mixedwood stands are composed of a combination of red maple, balsam fir (*Abies balsamea*), yellow birch, paper birch, white spruce, and red spruce (*Picea rubens*). These tree species also contribute to a moderate shrub layer throughout the mixedwood forest. The Project area also supports several stands of conifer-dominated forest. The center of the property supports patches of barrens habitat where areas of bedrock outcropping are located at the tops of hills and ridges. The barrens habitat is characterized by dense low-lying coverage of ericaceous shrubs, exposed bedrock, and a sparse cover of stunted trees.



JW PROJECT NO.: LAND CLASSIFICATION 1050893





Much of the area crossed by the proposed access road is comprised of mature mixedwood and deciduous forest, but a disturbed habitat is located in its northern extent. This area has been cleared of tree cover and is comprised of a diversity of early successional plant species. Smooth blackberry (*Rubus canadensis*) and red raspberry are the most dominant shrubby species, although a number of other taxa, including red maple, common elderberry (*Sambucus canadensis*), and heart-leaved paper birch (*Betula cordifolia*) are also present. Herbaceous cover is extensive and comprised of a diversity of graminoids and forbs. Prominent species include Canada goldenrod (*Solidago canadensis*), wild sarsaparilla, rough bentgrass (*Agrostis hyemalis*), farewell-summer (*Aster lateriflorus*), fowl manna-grass (*Glyceria striata*), fireweed (*Epilobium angustifolium*), poverty oat-grass, and soft rush (*Juncus effusus*).

Twenty four wetlands are found on the property and within close proximity to the proposed access road on the Rhodena Rock Quarry property. The majority of the wetlands are small treed swamps, but a tall shrub basin swamp, tall rush basin marsh and a larger wetland complex that includes both a treed swamp, shrub swamp, and a shrub-dominated bog are also present.

Based on available mapping and aerial photography, residential development in the immediate vicinity of the existing Martin Marietta Quarry is relatively low. There are approximately 64 structures within 1.0 km of the proposed Project lands (Figure 1). The majority of these structures are residential. The nearest communities are Port Hastings, approximately 2.5 km away (across the Strait of Canso), Aulds Cove, approximately 2.9 km to the north, and Mulgrave approximately 2.2 km to the south.

The proposed Project extension falls within the boundaries of the Town of Mulgrave on land is that is currently zoned as "Resource". Martin Marietta is currently preparing a municapl rezoning application.

2.3 PROJECT COMPONENTS

The existing quarry operations consist of blasting, a laydown area for the portable crushing equipment, aggregate screening and washing, various aggregate stockpiles, quarry floor and working face, settling ponds, weight scales, and a 500 m private access road off of route 344. The existing property currently does not have liquid asphalt permanently stored on site; it is delivered to the site while making asphalt and it is removed thereafter. No fuel oil or other hazardous materials are stored on-site.

Topsoil, grubbing material and overburden that have been stripped prior to drilling and blasting are stored on-site. These materials have been stabilized for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. Similar practices will continue throughout the development and operation of the proposed Project area.

The rock is processed by portable crushing equipment that is transported to the site as required (*i.e.*, after blasting). The existing quarry is built on the slope and the quarry operations are

dispersed throughout three levels. All of the processing material and aggregate stockpiles are located on what has been termed levels 1 and 2, and the existing quarry floor, as well as the settling ponds, is located on level 3.

Currently surface runoff and quarry drainage that is collected on the quarry floor is pumped to fresh water holding ponds for re-use during aggregate washing. The water/fines solution that results from the washing of aggregate is currently pumped to a series of settling ponds located on the quarry floor where it has a retention time of one to two weeks before it is removed by an excavator and hauled by trucks to its final storage area, a non-active area in the pit. Prior to being pumped to the settling ponds, a flocculant is added to the water/fines solution to enhance the water separation. The MSDS sheet for this chemical has been included in Appendix B.

The storage life of the current storage area for the settling pond fines will soon be exhausted; therefore Martin Marietta has proposed to develop a series of two storage cells on a nearby parcel of land to allow for continual storage (Figure 1). The total capacity of cells will be approximately 1,550,000 cubic yards. The footprint of the storage cells is approximately 520 m by 340 m. The Proponent previously considered a larger area for development; however, the Project footprint was revised in the interest of protecting wetland habitat on the proposed Project property Thirty metre vegetated buffers from property boundaries will be incorporated into the engineering of the cells. All material will be trucked to site via the proposed private connector road that will pass through adjacent quarry lands for which an easement has been obtained. Once the material has been stored, it will remain undisturbed for an indefinite period of time.

The nearest residence is approximately 50 m from the boundary of the Project property and approximately 240 m from the boundary of the storage cell.

2.4 SITE PREPARATION AND CONSTRUCTION

To prepare for the construction of the storage cells, the immediate cell area will be cleared and graded. Currently it is planned that the cells will be constructed using the overburden removed during site grading in addition to overburden material imported from the existing quarry along the private access road. The average height of the walls of the cells will be 18 m and the slope of the walls will be 2:1. There will be no need for blasting during the construction of the two storage cells.

During the construction of the Project, sediment and erosion measures will be in place. These will include the use of a silt fence, sediment ponds (located south east of the storage cells) to collect runoff that would otherwise erode the disturbed ground and the cells walls until grass has been established (through a hydroseeding program).

The connector road which will pass through the Rhodena Rock Quarry property will be constructed using an excavator and trucks. It is unknown at this point whether or not there will be a need to drill and/or blast to construct the road to suitable grades and geometry. The cut and fill slopes will be approximately 1:1 and 2:1, respectively. A temporary sediment barrier will

be installed downhill of all grading activity. The sediment barrier will be maintained throughout the construction until permanent vegetation as been established. Two culverts will also be installed once construction begins. The diameter of the culverts has yet to be determined. Down slope drains will be installed along the major fill sections and addition drains may need to tbe installed on a temporary basis if eroision issues arise during construction. Additional details regarding eroision control will be provided during the Industrial Approval amendment stage.

2.5 OPERATION AND MAINTENANCE

The proposed Project activities will be consistent with the current quarry operations Approval by NSE (Approval No. 2000-016493) and will be in accordance with the Pit and Quarry Guidelines (NSEL 1999) as applicible. These guidelines apply to all pit and quarry operations in the province of Nova Scotia and provide: separation distances for operations, including blasting; liquid effluent discharge level limits; suspended particulate matter limits; and requirements for a reclamation plan and security bond. Many of the provisions of the Pit and Quarry Guidelines will not apply to the fines storage facility since blasting and quarrying will not take place at the Project site.

Approximately 30, 000 tonnes of crusher fines per month will be transported from the existing quarry along the proposed connector road to the storage cells. Twenty truckloads of material will be transported daily using 50 tonne CAT trucks. The total capacity of the two cells is approximately 1,550,000 cubic yards. The monthly total is the same as the current volume currently stored on the existing quarry site.

Approximately 1.5 m of freeboard will be left between the fines material stored and the top of the cell wall to allow for stormwater. If by chance this area fills up, a low spot will be engineered into the storage cell design to handle the overflow and direct it into the settling ponds will remain from the constructionphase of the cells.

There will be no need for additional employees as a result of the operation of the fines storage site. However it is considered that the new fines storage capacity is critical to the long-term operating viability of the Mulgrave Quarry which employs 95 people and is an important generator of local and regional economic activity.

2.6 EFFLUENTS AND EMISSIONS

The implementation and use of environmental devices, techniques and regulations now used in the construction industry will minimize any potential environmental damage to the area. As at the existing Mulgrave Quarry operation, devices such as silt fences, siltation ponds and hydroseeding will be implemented at Project site as necessary to control sedimentation. All operations will be carried out in a controlled environment to ensure sound, vibration, dust and sediment parametres are satisfied according to all relevant Provincial and Federal guidelines and regulations.

In accordance with best practices and standard NSE requirements, runoff controls will be in place to ensure that effluent generated during Project activities is managed appropriately. Ditches will be installed along the access road to maintain drainage. The cell systems will maintain secure containment and will be designed and engineered so as to manage environmental issues such as site runoff. Development of the access road and fines storage cells will be conducted in accordance with NSE's Erosion and Sedimentation Control Handbook for Construction Sites (NSDOE 1988) and the quarry's approval to operate including that the sedimentation control devices will be installed prior to any excavation of material, and in consultation with NSE's engineers/inspectors. Details regarding erosion and sedimentation control measures will be further refined at the Industrial Approval amendment application stage. A stormwater management plan will also be submitted during the Industrial Approval amendment application process.

Dust emissions associated with the Project are not expected to be significant, as conventional quarrying activities will not take place at the fines storage site. Dust generated by truck movement along the access road will be minimized by speed control, proper truck loading, application of dust suppressants, proper construction of on-site roads, and/ or other means as required by NSE. Monitoring of airborne particulate emissions (dust) will be conducted at the request of NSE and in accordance with the Pit and Quarry Guidelines, the Nova Scotia Air Quality Regulations and the facilities Approval permit and shall not exceed the following limits:

- Annual Geometric Mean 70 μg/m³; and
- Daily Average (24 hrs) 120 μg/m³.

Combustion emissions will be generated from the operation of vehicles and equipment during Project activitiess. Given the scope of the planned operations, these emissions will be minimal, localized and similar in quantities to the operation of a small construction project using one or two pieces of heavy equipment. Emissions will be reduced through proper equipment maintenance and inspection practices to ensure efficient operation. Consideration will be given to methods to reduce idling, as feasible. Ambient air monitoring will be conducted at the request of NSE.

As per the Pit and Quarry Guidelines, sound levels from quarry operations, including activities associated with fines storage, will be maintained at a level not to exceed the following sound levels (L_{eg}) at the property boundaries (NSEL 2005):

L_{eq} 65dBA 0700-1900 hours (Days); 60dBA 1900-2300 hours (Evenings); and 55dBA 2300-0700 hours (Nights).

Sound monitoring will be conducted at the request of NSE.

Light emissions will be generated from road and parking lot lighting, exterior lighting, and for the safety of employees. Emissions will be minimized by shielding lights to shine down only where it is needed, without compromising safety. Road and parking lot lighting will also be shielded so that little escapes into the sky and it falls where it is required. Generally, exterior decorative lights such as spotlights or floodlights with a function of highlighting features of buildings, *etc.* will be avoided, or the time of their operation restricted to where only necessary to ensure safety of employees.

As there will not be permanent office or buildings located on this site, there will be minimal solid waste generated. All solid waste will be properly collected and stored until such time that it can be transported to a provincially approved waste disposal facility.

Details of any monitoring programs required by NSE (*e.g.*, surface water, noise, dust) will be developed in consultation with NSE and outlined in the Industrial Approval amendment application.

The only hazardous materials anticipated on-site as a result of the Project will be those associated with the normal operation of vehicles and machinery. These substances include: gasoline, diesel fuel, lubricants and antifreeze liquid. No on-site storage of such materials is anticipated, since all equipment maintenance will be carried out off-site.

Refueling of equipment will be conducted on-site on a regular basis, under contract by a tanker truck. Refueling activities will not be conducted within 100 m of any surface water, and equipment operators will remain with the equipment at all times during refueling, in accordance with the Petroleum Management Regulations of the *Nova Scotia Environment Act*.

In the event of a leak or spill during refueling, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material. All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations of the *Nova Scotia Environment Act*. A Spill Contingency Plan will be developed in support of the application for amendment to the existing Industrial Approval.

2.7 DECOMMISSIONING AND RECLAMATION

The Project site will be reclaimed once the fines storage cells have reached their capacity. The use of cleared overburden during cell construction will facilitate future rehabilitation of the site. Any excess grubbed material that is not used during cell construction will be stored on-site for future use in site reclamation. This stockpiled material will be hydroseeded to reduce potential for erosion and sedimentation.

Hydroseeding using native plant seed mixes will provide a source of native plant species well adapted to local soil and climatic conditions and will greatly reduce the need to fertilize the reclaimed land. In lieu of native species, seed mixes containing naturalized species that are

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well established in Nova Scotia and that are not aggressive weeds in local plant communities will be used for reclamation.

Once the fines storage site has become inactive, it will be graded to a stable slope (max 2:1) or rock slopes (max 1:1), where required, or leveled to allow future commercial, industrial, recreational, or residential land use. These inactive areas will be covered with overburden and seeded. Generally the rehabilitation will also consist of, but not be limited to: grading and contouring of all slopes and exposed rock faces in consideration of rock falls, slope stability, and safety; spreading existing stockpiled topsoil; and hydroseeding.

A reclamation plan will be developed for the Project site and submitted to NSE as part of the Industrial Approval amendment application. The reclamation plan will include information on such things as the proposed final topography, maximum slopes, revegetation plans and an outline of the plan for potential progressive reclamation at the site.

3.0 SCOPE

3.1 SCOPE OF THE UNDERTAKING

The proposed Project, as described in Section 2.0, consists of the development of a fines storage area and an access road. The following is a description of the spatial and temporal boundaries of the proposed Project to be considered in the assessment.

The scope of the proposed Project to be assessed is limited to construction and operation of Project works (*i.e.*, the access road and fines storage cells), as well as decommissioning of Project-related infrastructure, and reclamation of lands affected by Project activities.

The Project will be initiated following approval from NSE. The proposed storage cells will occupy a physical footprint of approximately 520 m by 340 m, and will be approximately 18 m above grade. The proposed access road corridor will be approximately 23 to 30 m. The Proponent previously considered a larger area for development; however, the Project footprint was revised in the interest of protecting wetland habitat on the proposed Project property.

The existing quarry operates on a schedule of 24 hours per day, 7 days a week, and 52 weeks a year, although the level of activity varies according to market demand. The current and anticipated production rate is approximately 5,000,000 tonnes per year. This Project will not result in any change to the facility's annual production or operating schedule. Approximately 30, 000 tonnes of fines will be stored per month at the proposed facility.

Martin Marietta will undertake reclamation activities at the quarry. Refer to Section 2.6 for additional information related to decommissioning and abandonment activities.

3.2 PURPOSE AND NEED FOR THE UNDERTAKING

The purpose of the Project is to allow for continual storage of fines produced during the washing of aggregate. To date, the Proponent has been storing fines on-site in previously quarried portions of the existing operation. However, there is insufficient storage capacity at the existing Mulgrave Quarry to continue this practice. It is therefore necessary to construct specialized fines storage cells on neighbouring lands owned by Martin Marietta and an access road between the two sites to accommodate transport of the material destined for storage.

3.3 PROJECT ALTERNATIVES

The fines cannot be processed into a marketable product, and storage or disposal is required. Other methods for carrying out the undertaking may include transporting the fines to an outside facility for storage or disposal. However, no suitable facility (*i.e.*, with sufficient capacity to reliably accept fines from Mulgrave Quarry on a regular, ongoing basis) has been identified. Long distance transportation of fines is not considered environmentally or economically feasible.

3.4 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The proposed Project must be registered for Environmental Assessment under the Environmental Assessment Regulations of the Nova Scotia *Environment Act* as a Class I Undertaking. This report fulfils the primary requirements for Project registration under this legislation, and includes revisions made as a result of government comments on the Draft EA document, which was submitted to NSE on November 24, 2009. A disposition table presenting all received government comments and comment responses has been included in Appendix C.

Other relevant provincial regulations and guidelines include the Nova Scotia Pit and Quarry Guidelines (NSEL 1999), the Activities Designation Regulation (GNS, 2007) and the Draft Nova Scotia Wetland Policy (NSE 2009b). Relevant federal legislation and policies include the *Fisheries Act, Species at Risk Act* and the Migratory *Birds Convention Act*.

The scope of the environmental assessment for the proposed Project has been determined by the Proponent and their consultant and is based upon the proposed Project elements and activities, the professional judgment and expert knowledge of the study team, consultations with the public and regulatory authorities on this and similar projects, and the results of field studies conducted in support of this environmental assessment. The Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSE 2008) was also used to determine/focus the scope of the assessment. The Proponent and their consultant met with NSE on May 12, 2009 to discuss the location of proposed fines storage cells, and elements and activities associated with the proposed Project, in an effort to further focus the scope of the assessment. Landowners adjacent to the existing quarry and Project site were also contacted (see Section 4.0) for the purpose of providing Project information and to identify issues of concern.

This environmental assessment evaluates the potential environmental effects of the proposed Project elements and activities, for all Project phases, with regard to each Valued Environmental Component (VEC) which includes aspects of the biophysical and socioeconomic environments valued by society and/or of ecological significance and stakeholder or professional concern. By assessing potential impacts on VECs within the study boundaries, a meaningful evaluation of project effects on relevant environmental aspects is achieved. The following VECs were identified based on government guidance, consultation, and professional judgment of the study team noted above:

- Surface Water Resources:
- Rare and sensitive flora;
- Wetlands:
- Wildlife;
- Groundwater;
- Archaeological and heritage resources;
- Air quality; and
- Socioeconomic environment.

4.0 PUBLIC INVOLVEMENT

4.1 METHODS OF INVOLVEMENT

On July 14, 2009 a Project Information Bulletin (Appendix D) was distributed to landowners and some local businesses within approximately 1.0 km of the quarry. A total of 26 bulletins were deposited in mail boxes. The purpose of the bulletin was to advise local residents and businesses immediately adjacent to the existing quarry and proposed Project site (*i.e.*, those who are potentially most affected) and provide them with and opportunity to comment on the proposed undertaking. Martin Marietta also attended a Mulgrave Town Council meeting on September 8, 2009 to further explain the Project. The information presented at this meeting has been included in this report in Appendix D.

Information letters were also sent, on September 18, 2009, to the Confederacy of Mainland Mi'kmaq, the Native Council, the Mi'Kmaq Rights Initiative, and the Union of Nova Scotia Indians, to encourage the submission of comments, concerns and questions regarding the Project (Appendix D).

4.2 STAKEHOLDER COMMENTS AND STEPS TAKEN TO ADDRESS ISSUES

On July 20, 2009 a call was received as a result of the distribution of the Public Information Bulletin from a family owning land adjacent to the proposed Project site. Their major concerns were related to property boundaries and potential buffers, whether or not they would experience any negative effects as a result of the Project, and they requested that the proponent hold a meeting to further explain the Project to the local landowners and residents. After the town council meeting was held on September 8, 2009, an article was posted in the Strait Area Reporter, on Wednesday September 16, 2009, which indicated that the presentation that the Proponent gave was effective at answering the public's questions and resolved their concerns regarding the potential for noise and dust effects as a result of increased blasting, which is not a part of the proposed Project (*i.e.*, it is for fines storage only).

To date, no comments have been received from the Confederacy of Mainland Mi'kmaq, the Native Council, the Mi'Kmaq Rights Initiative, or the Union of Nova Scotia Indians.

5.0 VALUED ENVIRONMENTAL COMPONENTS AND EFFECTS MANAGEMENT

5.1 ASSESSMENT METHODS

Field studies were conducted by Stantec between June and August 2009 to investigate and establish existing conditions in the Project area and to determine appropriate mitigation, if necessary, to minimize environmental effects from the proposed fines storage Project. The following surveys were undertaken by qualified terrestrial ecologists employed by Stantec: vegetation surveys; wetlands surveys; breeding bird surveys; mammal surveys; and herpetile surveys. Aquatic field surveys were undertaken by qualified aquatic biologists, and an assessment of potential archaeological and heritage resources was undertaken by a professional archaeologist. A water well "windshield" survey was conducted by Stantec on August 5, 2009. Additional information in support of the field studies and the assessment was gathered through a review of: air photos; site mapping; and other information sources, such as the Nova Scotia Museum, Statistics Canada, the Nova Scotia Department of Transportation and Public Works, the Nova Scotia Department of Natural Resources, and the Atlantic Canada Conservation Data Centre (ACCDC).

Temporal and spatial boundaries encompass those periods and areas within which the VECs are likely to interact with, or be influenced by, the Project. Both the temporal and spatial boundaries for the assessment vary according to the VEC. Temporal boundaries are generally limited to the duration of, and for a period of time after, the Project activities. Spatial boundaries are generally limited to the immediate project area unless otherwise noted.

To assess the potential environmental effects of a project and determine the significance of an effect, it is important to consider the magnitude, frequency, duration, geographical extent and reversibility of the potential effect. The study team has considered these elements for each VEC.

5.2 SURFACE WATER RESOURCES

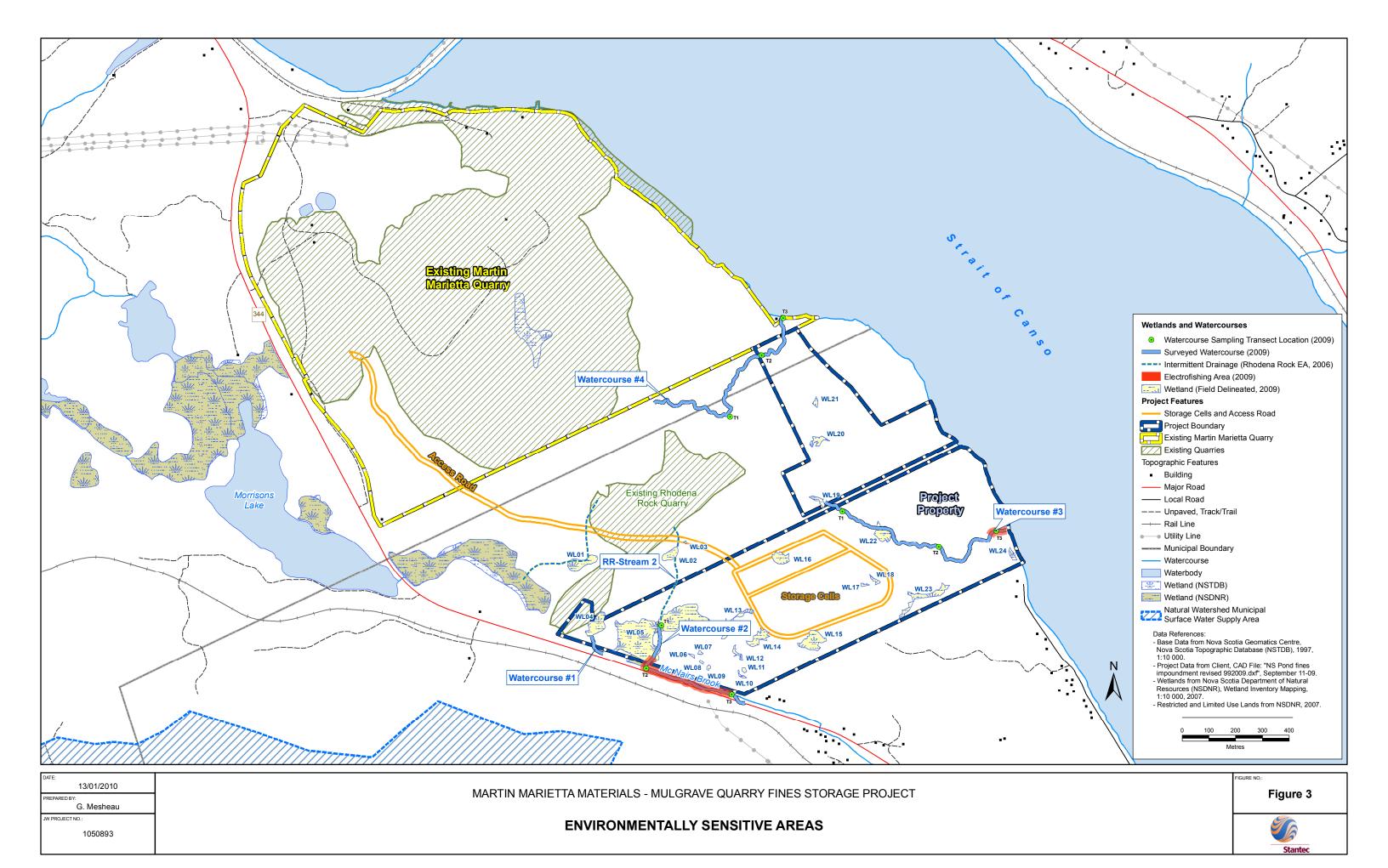
Surface Water Resources was selected as a VEC because of the potential for Project activities to interact with the freshwater environment. Indicators of the VEC include aquatic life, fish habitat and surface water quality as well as potential water uses for agriculture, recreation, industry or potability. There are no known agricultural, recreational, industrial or potable uses of the surface water located on the Martin Marietta Project Property. There is a possibility that McNairs Brook is used for recreational fishing in its downstream reach, closer to its output to the marine environment. The steep gradient and narrow channel of McNairs Brook as it drains to the ocean is anticipated to prevent other recreational use of the brook outside the Project property. The remainder of the Surface Water Resources VEC discussion will focus on surface water quality, aquatic life and fish habitat within all watercourses located in the Project property.

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5.2.1 Description of Existing Conditions

Fieldwork was conducted on June 11, 2009 by two Stantec Consulting Ltd (Stantec) aquatic scientists. Field-based stream assessments included a fish habitat survey and water quality sampling within the four defined watercourses inside the Project boundaries. Provincial mapping showed two watercourses on the site: a defined stream known as McNairs Brook and a small pond. Field investigation confirmed that the pond was in fact a wetland with open water, Wetland 4 (WL04), and that three additional watercourses existed on the site (see Figure 3). McNair's Brook (designated Watercourse 2) drains directly into the Strait of Canso, as do Watercourses 3 and 4 on the site. Watercourse 1 feeds a wetland area (WL04 and WL05).

A desktop review was completed of the Rhodena Rock Quarry Expansion Project EA (Jacques Whitford 2006) to collect information relating to the stream on the Rhodena Rock site which will be crossed by the proposed Martin Marietta Access Road. The watercourse in question was designated Stream 2 in the Rhodena Rock EA; therefore, in the current report it will be referred to as watercourse RR-Stream 2.



The habitat surveys were conducted based on internal Stantec sampling protocol and the Environment Canada CABIN protocol (Canadian Aquatic Biomonitoring Network; Reynoldson *et al.* 2007). Habitat surveying was also influenced by the Ontario Benthos Biomonitoring Network (OBBN) protocols (Jones *et al.* 2005). The stream assessment included the identification of physical units (*i.e.*, run, riffle, or pool), designation of substrate type, and description of the riparian zone. The presence or absence of macrophytes, algae, over-head cover, and woody debris was recorded. The depth, width, and velocity of the stream were also taken and the presence of existing anthropogenic impacts was noted. All measurements were taken at three transects in each stream that contained water. Transect 1 measurements were taken at the upstream end of the assessed area for each stream, Transect 2 measures were taken approximately mid-way along the assessed area and Transect 3 measurements were collected at the most downstream end of the assessed area of each watercourse (see Figure 3). All physical stream measurements reported represent the conditions during the single point-in-time survey. The physical conditions of moving water systems such as those found on the Martin Marietta Project property undergo seasonal and annual variation.

Watercourse descriptions are provided below for the four assessed streams, including the results of the fish presence-absence survey. This information details the watercourse survey results and characterizes each watercourse. By characterizing the watercourses, Martin Marietta can ensure that appropriate mitigation is implemented. Additionally, any site-specific concerns that may require special mitigation can be identified.

Key water quality results are outlined for each watercourse. The intent of the water quality discussion is to compare the results with applicable guidelines from the Canadian Council of Ministers of the Environment (CCME). Specifically, results are compared with the CCME guidelines for the protection of freshwater aquatic life (CCME-FAL 2007b) to determine the likelihood that each watercourse can or cannot support aquatic life. Additionally, the collection of water quality data prior to proposed Project activities helps to establish a baseline against which pre-, during-, and post-construction water quality data can be compared. The water quality parametres collected *in-situ* using a handheld multimetre (YSI 556) includes dissolved oxygen, pH, specific conductivity and water temperature. The *in-situ* water quality parameters were collected at the upstream and downstream transects (*i.e.*, T1 and T3, Figure 3) in each watercourse containing water at the time of the survey (see Table 5.1).

A water chemistry sample was also collected in McNairs Brook (in the vicinity of T3, Figure 3) since it was the watercourse on the Project Property that was most likely to have already been affected by anthropogenic influences (e.g., proximity to Marine Drive). The water chemistry analysis was carried out by a third party laboratory (Maxxam Analytics) and including general chemistry, a metals scan(including mercury), total suspended solids, hydrocarbons, biological oxygen demand, chemical oxygen demand, volatile organic compounds, and total Kjeldahl nitrogen. The *in situ* water quality parameters and the lab-based water chemistry parameters collected vary naturally on a seasonal and annual basis. The results presented in the current report represent the surface water quality in each watercourse at a single point in time.

The presence or absence of fish was confirmed using a backpack electrofishing unit (Model LR-24). Fish were identified to species and the fork length of each individual was taken. Fish presence-absence surveying was carried out in McNairs Brook (Watercourse 2) as well as in the lower reaches of Watercourse 3. Watercourse 1 was not fished because it was dry at the time of the survey. Watercourse 4 was not fished because the steep gradient at the downstream end of the stream was anticipated to prevent fish passage. Site photos were also taken along the stream reach and can be found in Appendix E.

Watercourse Descriptions

Watercourse 1 (WC-1) is a small drainage channel from a wetland (WL04). The upstream wetland (WL04) is an open water wetland but the watercourse channel was dry at the time of the survey (June 2009). The streambed showed signs of scouring, with the substrate being dominated by large pebbles in some areas and organic cover in others. This watercourse is not expected to support fish, even during high flow periods because of a lack of direct surface-based connection to fish bearing waters and its ephemeral, seasonal nature. The defined channel confirms that the watercourse has the potential to transport site run-off to the downstream wetland (WL05) if run-off were to occur. At the time of the survey, no defined channel through wetland 5 (WL05) was found connecting Watercourses 1 and 2.

Watercourse 2 (WC-2) is known as McNairs Brook in its downstream reach. At the time of the survey, the watercourse originated outside of the Project Area, close to the Rhodena Rock Quarry. It drained south through a wetland inside the Project Area and then fed into the Marine Drive (Highway 344) ditch system. WC-2 is meandering, perennial and well defined in the wetland and forest areas of its upstream reach. It becomes straight as it feeds into the current roadside ditch system and is known as McNairs Brook. McNairs Brook maintains a course alongside the road, crossing back and forth through a culvert system outside the subject property before making its way to the Strait of Canso. In the upstream reach of WC-2, the substrate is dominated by organic detritus while the ditch section of the stream is dominated by cobble substrate. Woody debris is present throughout and abundant in some areas. The stream is surrounded by mixed forest predominantly, when not running beside the highway.

There is evidence of anthropogenic effects on WC-2 resulting from the stream running alongside a major road. Garbage was present throughout the area surveyed and *in situ* water quality was markedly different in the stream section beside the road (see Table 5.1) compared to upstream within WC-2 or to that observed in WC-3 or WC-4. The *in situ* water quality results showed higher specific conductivity, pH, water temperature and dissolved oxygen at the roadside site, which is potentially the result of road salt, sedimentation and/or garbage input and accumulation. The elevated water quality results still fall within ranges known to support aquatic life in Nova Scotia. There is also evidence of recreational use of the WC-2 area upstream of Wetland 05 where multiple hunting tree stands were observed.

FINAL REPORT: ENVIRONMENTAL ASSESSMENT

To support the establishment of baseline measures prior to Project development, water chemistry samples were taken from McNairs Brook and analyzed for metals, hydrocarbons, and several other parameters as outlined above in the existing conditions methodology description. The results are presented in Table C-1 in Appendix E. The level of cadmium within the sample exceeded the CCME Canadain Water Quality Guidelines for the Protection of Aquatic Life.

Watercourses 3 and 4 (WC-3 and WC-4) can be characterized similarly. Both are steep, meandering, perennial watercourses dominated by bedrock, boulder and rocky substrates, cascading water, and upper reaches fed by wetlands. The flow in both streams becomes subterranean in places, and both feed into the Strait of Canso. WC-3 is entrenched up to 5 m in places, is surrounded by mainly coniferous forest and originates in the Project Area (see Figure 3). WC-4 is entrenched up to 15 m in places with a very steep gradient in the Project Area, but originates from a flat, wetland area outside the Project property.

Additional physical habitat features are summarized for each watercourse in Table 5.1.

Table 5.1 Summary of Stream Assessments

Date & Time	11-Jun-09	11-Jun-09			11-Jun-09		11-Jun-09				
Site Coordinates	623522E, 5053373N	623815E, 5053414N			624473E, 5053836N		624053E, 5054190N				
Site Description	WC-1 (Dry streambed between wetlands at southwest corner of Property)		2 (McNairs Brook - runs through a wetland, southwest of property and along highway ditch)			WC-3 (Stream entering the ocean on east side of the Property)			WC-4 (Stream enters the ocean from smaller Property near Rhodena Rock Quarry)		
Site Measurments and Characteristics		T1	T2	Т3	T1	T2	Т3	T1	T2	Т3	
Transect Location	NA	0623815E,5053414N	approximately 25 m DS of sharp turn into wetland	0624059E, 5053153N	0624473E, 5053836N	0624832E, 5053704N	0625047E, 5053764N	0624053E, 5054190N	Approximately 225 m US of ocean	0624251E, 5054559N	
Precipitation Previous 24 hours	light rain	light rain	light rain	light rain	light rain	light rain	light rain	light rain	light rain	light rain	
Physical unit	Dry	Run	Run	Run	Run/Natural Deadwater	Run	Run	Run	Pool	Run	
Wetted Width (m)	0	0.75	1.09	0.89	0.59	0.88	1.36	1.32	1.3	1.83	
Bankfull Width (m)	0.75	1.9	3.39	1.39	0.85	1.26	2.98	1.32	1.49	1.96	
Velocity (avg. in thalweg) (m/s)	Dry	0.11	-	-	0.13	-	-	-	-	0.113	
Depth (min max. range) (m)	Dry	0.03 - 0.22	0.125 - 0.17	0.015 - 0.08	0.015 - 0.06	0.02 - 0.04	0.02 - 0.075	0.08 - 0.11	0.089 - 0.248	0.076 - 0.1905	
Woody Debris	Present	Present	Abundant	Present	Abundant	Present	Present	Present	Present	Present	
Detritus	Present	Abundant	Abundant	Abundant	Abundant	Abundant	Absent	Absent	Present	Absent	
Macrophytes	NA	absent	Present	Absent	Absent	Abundant	Absent	Absent	Absent	Absent	
Algae	NA	Present	Absent	Absent	Present	Absent	Absent	Present	Absent	Absent	
Canopy Cover (%)	0 - 24	50 - 75	75-100	75-100	25 - 49	75 - 100	75 - 100	50 - 74	50 - 74	25 - 49	
Riparian Vegetation (Dominant)	Forest, Coniferous and Deciduous	Forest, Mainly Coniferous and Deciduous	Forest, Mainly Coniferous and Deciduous Left Bank. Highway 344 and shoulder on Right Bank.	Forest, Mainly Coniferous and Deciduous Left Bank. Highway 344 and shoulder on Right Bank.	Forest, Mainly Coniferous	Forest, Mainly Coniferous	Forest, Mainly Coniferous	Forest, Mainly Coniferous and Deciduous. Wetland on Right Bank.	Rock face immediately adjacent to stream. Forest, Mainly Coniferous and Deciduous beyond rock face.	Meadow on Left Bank. Forest, Mainly Coniferous and Deciduous on Right Bank.	
Water Quality		T1	T2	Т3	T1	T2	Т3	T1	T2	Т3	
DO (mg/L)	Dry	5.34	-	10.5	6.86	-	8.96	6.4	-	9.19	
DO(%)	Dry	46.8	-	93.2	59.5	-	77.7	57	-	80.7	
Water Temperature (°C)	Dry	9.62	-	10.09	9.13	-	9.14	10.12	-	9.68	
Specific Conductivity (µS/cm)	Dry	51	-	119	14	-	23	21	-	20	
рН	Dry	6.61	-	7.77	5.9	-	6.92	6.42	-	6.88	
TDS (g/L)	Dry	0.033	-	0.077	0.009	-	0.014	0.014	-	0.012	

TDS (g/L)
NA - Not Applicable

The *in situ* water quality results collected in each stream (Table 5.1) confirm that WC-2, WC-3 and WC-4 have the potential to support aquatic life when compared to the CCME-FAL guidelines for pH (6.5 – 9). pH did not meet the minimum recommended guideline in the upstream reach of each stream, likely as a result of the wetland influence in each of these areas. However, the pH level observed is known to support aquatic life such as fish and benthic invertebrates in Nova Scotia. The dissolved oxygen (DO) levels met the minimum recommended guidelines for cold and warm water species of aquatic organisms at early and late life stages (*e.g.*, 5.5 - 9.5 mg/L minimum).

The desktop review of the Rhodena Rock Quarry Expansion Project EA (Jacques Whitford 2006) confirmed that watercourse RR-Stream 2 was designated an intermittent drainage channel in 2005. A representative from Fisheries and Oceans Canada visited the site in March 2006 and agreed that the stream did not constitute fish habitat. The upstream reach of RR-Stream 2 (above WL02; see Figure 3) is anticipated to be crossed by the Martin Marietta access road. This portion of the stream was described in 2006 as flowing through gently sloping terrain, with a stream bed composed of gravel, sand and cobble derived from eriosion of a steep embankment along the Rhodena Rock quarry access road. At the time of the 2005 survey, the upstream section of the stream had a channel width that averaged approximately 2 m with an average depth of approximately 20 cm. Watercourse RR-Stream 2 fed downgradient in 2005, through two wetlands and eventually entered McNairs Brook (Jacques Whitford, 2006). During the 2009 watercourse assessment, McNairs Brook was found to originate in wetland WL-05. No defined channel was found further upgradient.

None of the watercourses identified on the Project property are known to interact with drinking water supplies or other protected surface waters. The groundwater section (*i.e.*, Section 5.6) of the current document addresses the presence of water supply wells within 800 m of the project site. All of the water supply wells identified within the 800 m assessment zone were associated with private residences. Multiple lakes in the Mulgrave area are designated as reservoirs (*e.g.*, Grant, Matties and Summers Lakes west of Mulgrave) (Service Nova Scotia, 2006). However, Morrisons Lake, which is located closest to the Project Property, is not a designated reservoir. There are no known Protected Water Areas (PWA) in the vicinity of the Project Property. Therefore, no impact to surface waters with reservoir, private supply, or protected area uses is anticipated to result from the proposed Project Activities.

Fish Survey Results

No fishing was carried out in WC-1 or WC-4. WC-1 was dry at the time of the survey and was not connected to any known fish bearing waters. The steep gradient from the outfall of WC-4 into the Strait of Canso is anticipated to be prohibitive to fish passage (see photo 14, Appendix E). Additionally, the flow pattern in the lower reach of the stream is characterized by cascades, shallow pools and subterranean sections, which is not considered desirable fish habitat. A resident fish population is not anticipated to inhabit WC-4.

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Backpack electrofishing was carried out in WC-2 (McNairs Brook) and WC-3. WC-2 was fished within the downstream reach where the water was of sufficient depth to immerse the anode. Fishing extended to the start of wetland 5, where heavy organic cover of the substrate prevented effective shocking of the water. Within WC-2, a single fish was caught in the downstream ditch section of the watercourse (*i.e.*, running alongside the highway) within the Project property. The fish was identified as a brook trout (*Salvelinus fontinalis*) parr, measuring 8 cm in fork length. The lower reach of WC-3 was fished where the gradient was gentler and there was sufficient water volume to support fish (see photo 11, Appendix E). No fish were caught during the June 2009 survey, although the habitat and water quality has the potential to support fish. Watercourse WC-3 may have the potential to support a resident fish population,

During the 2005 assessment of RR-Stream 2, no fish were observed (Jacques Whitford 2006). As discussed above, a representative from DFO determined that the stream did not constitute fish habitat.

Summary

Four distinct watercourses were confirmed in the Project Area based on the 2009 surface water assessment. WC-1 is a small, defined drainage channel that was dry at the time of the survey. WC-2 is a well-defined, meandering stream that originates off the property boundaries, but feeds a wetland in the Project property and becomes McNairs Brook. Within the Project property, McNairs Brook can be characterized as a roadside ditch heavily impacted by road run-off (e.g., garbage). A single brook trout was caught in McNairs Brook within the Project property, confirming that aquatic life can still be supported in WC-2.

WC-3 and WC-4 are both steep, meandering streams characterized by cascades, sections of subterranean flow, rocky substrate and deep entrenching. WC-3 is less steep than WC-4, with higher water volume in the lower reaches. Water quality and habitat observed during the assessment suggest that the streams have the potential to support aquatic life, although no fish were caught in WC-3 during the survey. The steep gradient and subterranean flow in the lower reach of WC-4 is anticipated to be prohibitive to fish passage. All three larger watercourses on the Project site (WC-2, WC-3, and WC-4) eventually feed into the Strait of Canso. WC-1 feeds a wetland which in turn feeds WC-2. Therefore, the potential for downstream effects in the Strait of Canso via each of the four watercourses on the Project Property must be mitigated. This includes the mitigation of potential effects in the downstream reach of McNairs Brook, outside the Project property boundaries.

Watercourse RR-Stream 2 was not found to connect directly to McNairs Brook during the 2009 field survey of McNairs Brook. However, it is anticipated that drainage from the Rhodena Rock quarry site maintains the potential to feed wetland WL05 via the intermittent channel described in the 2006 Rhodena Rock EA report. Therefore, mitigation of potential downstream effects in Wetland WL05 and McNairs Brook from the Martin Marietta access road crossing RR-Stream 2 is required.

5.2.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

As specified in Nova Scotia Pit and Quarry Guidelines, no active areas will be located within 30 m of the banks of all streams identified on the property (e.g., WC-1, WC-2, WC-3 and WC-4) and associated with the access road (RR-Stream 2) without prior approval from NSE. Natural vegetation will be maintained within this buffer for all identified watercourses. No Project-related vehicles will be driven through streams. Additionally, Fisheries and Oceans Canada (DFO) has developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all development and industrial projects, both large and small, in or near watercourses that could harmfully alter, disrupt, or destroy (HADD) fish habitat by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats.

Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition downgradient, particularly during periods of heavy rainfall or snow melt. These activities will also result in a reduction of evapotranspiration and a corresponding increase in surface runoff, which in turn increases potential for sediment erosion and deposition inall four watercourses identified on the Project property. The intermittent watercourse originating on the Rhodena Rock quarry site (RR-Stream 2) may be crossed by an access road in its uppermost reach. In the event of a watercourse crossing, it is anticipated that a culvert will be installed to facilitate the construction of the access road. Any culvert will be installed in accordance with all regulatory requirements (e.g., Watercourse Alteration Approval) and best construction practices (e.g., erosion and sedimentations control).

The use of properly sized flow retention structures are expected to mitigate erosion and sedimentation effects in all identified watercourses resulting from clearing, grubbing, topsoil stripping and culvert installation activities. Additionally, As the fines storage site develops, exposed soil capable of producing sediment laden-runoff will be stabilize, and stockpiles of topsoil and overburden will be stabilized with hydroseed. Additional retention capacity will be created as the storage cells develop and additional settling pond volume will be installed, as needed. A stormwater management plan will be submitted as part of the fines storage Project during the Industrial Approval amendment application process.

Surface runoff will be directed to the settling pond. Overflow from the final settling pond, in the event of significant rainfall, will be monitored and sampled in accordance with the terms and conditions of the existing Approval (and future updates) and the Pit and Quarry Guidelines to ensure suspended solids levels do not exceed the approved final effluent discharge limits. Details on proposed discharge locations and outlet structures will be submitted as part of the fines storage Project during the Industrial Approval amendment application process.

Linking the Project to environmental effects management performance criteria is also an effective mitigation strategy to deal with uncertainties and ensure sustainable development.

Based on the results of the surface water assessment including the fish and fish habitat survey and the mitigation proposed, there is very low potential for fines storage activities to interact with the surface water environment. Significant Project-related effects on fish, fish and aquatic life habitat, and surface water qualityare not likely to occur.

5.3 RARE AND SENSITIVE FLORA

5.3.1 Description of Existing Conditions

Information regarding rare and sensitive flora within the study area was derived from field surveys and reviews of existing data sources. The site was surveyed by professional biologists on two occasions, June 17 - 18, 2009 and August 7 - 10, 2009. Vascular plant inventories of the property were compiled on each of the surveys. The first visit was limited to the properties on which the proposed storage facility is to be located; the second also included the area of the planned access road. The Project area supports a number of habitat types, including stands of upland mature hardwood and mixedwood forest, coniferous forest, tall shrub thicket, barrens, and wetlands. Forest landcover mapping is presented in Figure 2.

Upland habitats

As stated in Section 2.2, mature stands of second growth hardwood provide cover over much of the property, particularly the large hill in the center of the Project area and its south-facing slopes. These mesic stands are dominated by a mixture of red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), paper birch (*Betula papyrifera*), and American beech (*Fagus grandiflora*). Stands of American beech are especially prominent throughout the hillsides. Striped maple (*Acer pensylvanicum*) and white spruce (*Picea glauca*) also contribute to the tree and shrub layers of the hardwood stands. The composition of herbaceous species throughout the hardwood forests is varied but common species include wild sarsaparilla (*Aralia nudicaulis*), eastern hay-scented fern (*Dennstaedtia punctilobula*), spinulose shield fern (*Dryopteris carthusiana*), wild lily-of-the-valley (*Maianthemum canadense*), and New York fern (*Thelypteris noveboracensis*). The forest floor is covered by an intermittent layer of mosses, including broom moss (*Dicranum spp.*), stair-step moss (*Hylocomium splendens*), braided moss (*Hypnum spp.*), and haircap moss (*Polytrichum spp.*).

Mature second growth mixedwood forest is particularly prominent within the northern parcel of the property and throughout the lower slopes. These mesic mixedwood stands are composed of a combination of red maple, balsam fir (*Abies balsamea*), yellow birch, paper birch, white spruce, and red spruce (*Picea rubens*). These tree species also contribute to a moderate shrub layer throughout the mixedwood forest. Common herbaceous species throughout the mixedwood forest include whorled aster (*Aster acuminatus*), goldthread (*Coptis trifolia*), spinulose shield fern, hay-scented fern, wild lily-of-the-valley, and bracken fern (*Pteridium aquilinum*). Moss cover is generally low and comprised of a mixture of broom moss, braided moss, red-stemmed moss (*Pleurozium schreberi*), and three-lobed bazzania (*Bazzania trilobata*).

The Project area also supports several stands of conifer-dominated forest. The north facing slope at the northern end of the property has been subject to considerable wind damage and much of this area is currently at an early stage of regeneration. Where stands of mixedwood were once present, dense areas of young balsam fir are now prominent. The vegetative composition of this area is quite variable as a result of the heterogenous nature of the disturbance and includes species typically associated with early seral stages, such as red raspberry (*Rubus idaeus*), as well as taxa characteristic of the previously described mixedwood forest. Some small conifer stands, formed by regenerating white spruce, are present at the western edge of the property, in close proximity to Highway 344. These patches were in association with old roadbeds and reflect a response to past anthropogenic disturbances within the area. Understory cover and diversity within these stands are low as a result of the dense nature of the white spruce. Additionally, small patches of coniferous forests, dominated by black spruce and lesser amounts of balsam fir, are found within imperfectly drained areas of the property.

The center of the property supports patches of barrens habitat where areas of bedrock outcropping are located at the tops of hills and ridges. The largest of these patches is approximately 25 m x 60 m, whereas others are much smaller size in size. The barrens habitat is characterized by dense low-lying coverage of ericaceous shrubs, exposed bedrock, and a sparse cover of stunted trees. White spruce, red maple, and paper birch comprise the intermittent tree cover within this habitat. Low-lying shrub coverage is predominantly comprised of late lowbush blueberry (*Vaccinium angustifolium*), black crowberry (*Empetrum nigrum*), and lesser amounts of and mountain cranberry (*Vaccinium vitis-idaea*). Downy goldenrod (*Solidago puberula*), dwarf dogwood (*Cornus canadensis*), and poverty oat-grass (*Danthonia spicata*) provide some scattered herbaceous cover throughout the barrens whereas patches of reindeer lichens (*Cladina spp.*) are prominent on the more exposed bedrock outcrops.

Much of the area crossed by the proposed access road is comprised of mature mixedwood and deciduous forest, but a disturbed habitat is located in its northern extent. This area has been cleared of tree cover and is comprised of a diversity of early successional plant species. Smooth blackberry (*Rubus canadensis*) and red raspberry are the most dominant shrubby species, although a number of other taxa, including red maple, common elderberry (*Sambucus canadensis*), and heart-leaved paper birch (*Betula cordifolia*) are also present. Herbaceous cover is extensive and comprised of a diversity of graminoids and forbs. Prominent species include Canada goldenrod (*Solidago canadensis*), wild sarsaparilla, rough bentgrass (*Agrostis hyemalis*), farewell-summer (*Aster lateriflorus*), fowl manna-grass (*Glyceria striata*), fireweed (*Epilobium angustifolium*), poverty oat-grass, and soft rush (*Juncus effusus*).

Patches of tall shrub thicket are present along the eastern end of the property. This habitat reflects an early stage of regeneration following anthropogenic disturbances within the area. The thickets are characterized by a dense covering of tall shrubs, particularly speckled alder (*Alnus incana*), common apple (*Pyrus malus*), choke cherry (*Prunus virginiana*), and hawthorn (*Crataegus sp.*). Ground vegetation is comprised of extensive red raspberry (*Rubus idaeus*) and herbaceous coverage, including Canada goldenrod (*Solidago canadensis*), black starthistle

(*Centaurea nigra*), rough-leaf goldenrod (*Solidago rugosa*), and flat-top fragrant-golden-rod (*Euthamia graminifolia*).

Although some of the upland habitats (*i.e.*, patches of white spruce, disturbed area, and tall shrub thicket) strongly reflect past anthropogenic activities, these areas are limited in size and restricted to the periphery of the property. The remaining upland habitats are relatively intact and "natural" in character, despite much of the forests being subject to past logging activities.

Wetland habitats

As noted in Section 2.2, twenty four wetlands are found on the property and within close proximity to the proposed access road on the Rhodena Rock Quarry property. Seven of these wetlands are located within the area of the proposed storage facility or access road. The majority of the wetlands are small treed swamps, but a tall shrub basin swamp, tall rush basin marsh and a larger wetland complex that includes both a treed swamp, shrub swamp, and a shrub-dominated bog are also present. The wetland complex appears on the NSDNR Wetland Atlas mapping (NSDNR 2007b) and is found along the western edge of the Project area. The other wetlands were not recognized by the NSDNR Wetland Atlas mapping but identified during field surveys and air photo interpretation.

Swamps are abundant throughout the property and are comprised of mixed, deciduous, and coniferous treed wetland types. These wetland types reflect the relative abundance of the dominant trees, particularly red maple, black spruce (*Picea mariana*), balsam fir, and yellow birch. These species also contribute to a well-developed shrub layer within the swamps, along with other woody taxa, particularly speckled alder and black holly (*Ilex verticillata*). Although the herbaceous vegetation is varied amongst the wetland types, cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), and fowl manna-grass (*Glyceria striata*) are common throughout. Other prominent herbs include rough sedge (*Carex scabrata*), creeping butter-cup (*Ranunculus repens*), and three-seed sedge (*Carex trisperma*). Peatmoss coverage is extensive throughout the swamps.

A tall shrub basin swamp is located at the eastern end of the property and runs along the edge of the Straight of Canso. Dense patches of willow (*Salix sp.*) and serviceberry (*Amelanchier sp.*) provide extensive shrub cover. The herbaceous vegetation is comprised of an almost continuous coverage of cinnamon fern. Other common herbaceous species include little prickly sedge (*Carex echinata*), sensitive fern, and soft rush. Peatmoss provides moderate ground coverage within the swamp.

The tall rush basin marsh is located at the western end of the property. Although identified as a waterbody by provincial mapping sources (NSDNR 2007b) the water levels within this habitat are sufficiently shallow to promote extensive coverage of emergent aquatic macrophytes. Broad-leaf cattail (*Typha latifolia*) dominates the marsh, although a number of other herbs, such as Canada rush (*Juncus canadensis*), are also present. In addition, a number of floating and

submerged aquatic plants are prominent, particularly yellow pond-lily (*Nuphar variegate*), slender naiad (Najas flexilis), and pondweeds (*Potomogeton spp.*).

The basin bog habitat within the larger wetland complex is by dominated by shrubs, particularly leatherleaf (*Chamaedaphne calyculata*), speckled alder, northern bayberry (*Myrica pensylvanica*), and stunted black spruce. Black spruce, along with lesser amounts of red maple, provides some minimal tree cover. A number of graminoids are prominent throughout the bog, including tussock sedge (*Carex stricta*), Canada rush, narrow-leaved cotton-grass (*Eriophorum polystachion*), and white beakrush (*Rhynchospora alba*). The forbs bog aster (*Aster nemoralis*) and cinnamon fern are also common throughout the bog and peatmoss coverage is extensive.

Rare Vascular Plants

A rare plant modeling exercise was performed to determine the likelihood of presence of rare or sensitive plants within the Project area. As part of the modeling exercise, all records of vascular plant species listed by the Nova Scotia Department of Natural Resources (NSDNR) as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2007a) within a radius of 100 km were compiled by means of an Atlantic Canada Conservation Data Center (ACCDC) data search. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present for these species. Knowledge of the habitats present within the Project area was determined through an interpretation of aerial photography, topographic and geological mapping. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present and the suitable habitat in the Project area was identified as a target for future field surveys. The seasonal aspects and ease of identification of each of the species potentially present in the Project area was also incorporated into the model in order to determine the best times to conduct the future field surveys.

A total of 166 Red or Yellow-listed vascular plant species have been recorded within 100 km of the Project area. Based on the results of the habitat model, 32 Red or Yellow-listed vascular plant species could potentially be present in the Project area, including 9 Red-listed and 22 Yellow-listed species. Table F-1, in Appendix F, lists these species and their habitat preferences. None of these species are considered "at risk" by COSEWIC (2004) or by the provincial government (NSDNR 2007c). The results of the model suggest that there is potential for all habitats in the Project area to support rare or sensitive vascular plant species. However, certain areas are more likely to support rare and sensitive species than others (Figure 3), including the wetlands, areas of bedrock outcropping, and the riparian zones of small streams that drain the Project area.

All species of vascular plant encountered during the surveys were identified and their population statuses in Nova Scotia determined through a review of the species status reports prepared by NSDNR (NSDNR 2007a), ACCDC (ACCDC 2009), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2004), and the provincial Endangered Species Act (NSDNR

2007c). No species considered as "at risk" by COSEWIC (2004) or the provincial government (NSDNR 2007c) were found during the surveys, but a number of species of conservation concern were identified. A list of the 313 vascular plant taxa found on the site during field surveys is provided in Appendix F.

Purple-leaf willow-herb (*Epilobium coloratum*) is considered sensitive by NSDNR (2007a). Several individuals of purple-leaf willow-herb were encountered within a tall shrub basin swamp (Wetland 24) at the eastern end of the property. Within Nova Scotia, this species is known to be scattered throughout mainland where it is associated with low-lying areas and springy slopes (Zinck 1998). Because purple-leaf willow-herb was found outside the area to be disturbed by the proposed Project it is not expected that development of the fines storage site will have an adverse effect on its population.

Although considered "secure" by NSDNR, several other species may be considered of conservation concern, based on the rankings of the ACCDC (2009). Species encountered during field surveys which are considered rare or uncommon by the ACCDC include Kalm's hawkweed (*Hieracium kalmii*), Hickey's clubmoss (*Lycopodium hickeyi*), early coralroot (*Corallorhiza trifida*), bladderfern (*Cystopteris tenuis*), trailing clubmoss (*Diphasiastrum complanatum*), dwarf ginseng (*Panax trifolius*), large round-leaved orchid (*Platanthera orbiculata*), and small bur-reed (*Sparganium natans*).

Both Kalm's hawkweed and Hickey's clubmoss are given a ranking of "S2?" by the ACCDC (2009), indicating that they are expected to be rare within the province but that there is considerable uncertainty regarding their population status. Similarly, NSDNR has assigned an "undetermined" status to these species. Kalm's hawkweed was encountered with the disturbed portion of the Rhodena Rock Quarry property through which the proposed access road is located. Several observations of Hickey's clubmoss were made among the drier portions of the upland forests of the property. Although the current lack of information regarding the distribution and abundance of these species may reflect their uncommonness within the province, both of these species are easily confused with others in their respective taxonomic groupings, and as such, they may be more abundant within the province than is currently documented.

Bladderfern, and trailing clubmoss are both assigned a ranking of "S3?" within the province indicating that they are expected to be uncommon but that there is considerable uncertainty regarding their population status. NSDNR considers the populations of both of these species to be secure. Bladderfern was present on shaded outcrops of a ravine at the eastern end of the property. Trailing clubmoss was found growing in well-drained mixed forest towards the northern end of the property.

The populations of early coralroot, dwarf ginseng, large round-leaved orchid and small bur-reed are all considered secure by NSDNR but are assigned a ranking of "S3" by the ACCDC indicating that they are uncommon within the province. Approximately 25 individuals of early coralroot were encountered during the field surveys, the majority of which were distributed

throughout several of the treed swamps (Wetlands 13, 14, 15, and 22). Dwarf ginseng was found in patches up to approximately 50 individuals and was associated with the deciduous forests of the property. Approximately 25 individuals of round-leaved orchid were encountered within deciduous forests of the property. Small bur-reed was present within a tall-rush dominated marsh at the western end of the property (Wetland 4).

In addition to the species of conservation concern encountered during the field surveys, a population of small yellow lady's-slipper (*Cypripedium calceolus*) is known to reside within a wetland (Wetland 1) located on the adjacent Rhodena Rock Quarry property (JWL 2006a). This species is considered S2/S3 by the ACCDC (2009) and is regarded as sensitive by NSDNR (2007a). The population consists of approximately 100 stems in the eastern area of the wetland and one clump noted from the adjacent upland along the intermittent stream flowing into the wetland. Although this wetland will not be directly affected by the Project, the population of small yellow lady's-slipper could be indirectly influenced by hydrological or nutrient changes resulting from the proposed access road which will cross the intermittent channel that feeds the wetland.

5.3.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The Project has the potential to influence the populations of several of the rare or uncommon plant species as a result of direct habitat loss and indirectly through changes in habitat conditions, such as may be brought about by altered hydrological regimes. Of greatest concern are the populations of purple-leaf willow-herb and small yellow lady's-slipper, both of which are considered "sensitive" within the province (NSDNR 2007a). However, because purple-leaf willow-herb was only found outside of the proposed fines storage area, the Project is not expected to have a significant negative effect on its population. The proposed access road on the Rhodena Rock Quarry property crosses the intermittent drainage that enters the wetland in which small yellow lady's-slipper is located. As such, the Project has the potential to influence this species through changes by altering the hydrological or nutrient conditions of its habitat. However, care will be taken during the construction of the access road to neither cut off the intermittent stream flow to the wetland nor see the basin become a repository of significantly increased water flow, nutrients, or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures. Similar mitigative measures have been undertaken as part of the activities on the Rhodena Rock Quarry property and have proved so far been effective in allowing the small yellow lady's-slipper population to persist (JWL 2006b).

Standard mitigative measures to minimize the environmental effects of the Project on plant communities include the use of seed mixtures free of noxious weeds during site reclamation. Wherever practical, native plants should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species which are well established in Nova Scotia and which are not aggressive weeds in the barrens, wetland and forest plant communities which are present in the area should be used for reclamation.

In summary, significant Project-related effects on rare or uncommon flora are not likely to occur.

5.4 WILDLIFE

5.4.1 Description of Existing Conditions

Information regarding use of the study area by wildlife was derived from several sources including field surveys and reviews of existing data. Field surveys were conducted by professional terrestrial ecologists on two occasions, June 17 - 18 and August 7 - 10, 2009. During these surveys, information was collected regarding the presence of birds, mammals and herpetiles (amphibians and reptiles). An ACCDC data search was conducted to determine if any rare or sensitive wildlife species have been recorded in the vicinity of the Project area. The ACCDC data were incorporated into a wildlife model to determine the likelihood that rare or sensitive wildlife species might inhabit the Project area. As part of the modeling exercise, all records of wildlife species listed by the NSDNR as at risk (Red listed) or sensitive to human activities or natural events ("Yellow" listed) (NSDNR 2007a) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present for these species. In instances where appropriate habitat was present for a particular species, it was considered to be potentially present. The potential habitat of any rare or sensitive wildlife species was identified as a target for field surveys. Additional references, such as the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992) and Amphibians and Reptiles of Nova Scotia (Gilhen 1984), were also consulted to provide records of wildlife in the vicinity of the study area and to help direct field surveys.

The Project area has moderate habitat diversity. Softwood, mixedwood, and deciduous forest stands, as well as barren rock outcrops and a variety of wetland types are found in the Project area. Much of the Project area is comprised of intact mature forest and may be considered to provide interior forest conditions. Twenty four wetlands are present within the Project area (Figure 3). The majority of the wetlands are treed swamps, but a tall shrub basin swamp, tall rush basin marsh and a larger wetland complex that includes both a treed swamp, shrub swamp, and a shrub-dominated bog are also present. Wetlands are considered in more detail in Section 5.5 of this document. Sensitive areas within and around the Project area are indicated in Figure 3.

Birds

The Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992, MBBA 2009) provides information on the distribution and abundance of birds across the Maritime Provinces of Canada. The breeding bird atlas data may be used to provide an indication as to which species may be expected in the Project area. However, this reference is of limited usefulness because that data is recorded in 10 km X 10 km census squares, making it difficult to determine whether a particular species has been observed in close proximity to the Project area. As such, information on the distribution and abundance of birds in the vicinity of the Project area was supplemented with a breeding bird survey.

The MBBA square in which the project is located was used to determine the approximate number of breeding birds that may be found within the vicinity of the Project area. The breeding status of each species was determined from the criteria used in the MBBA (Erskine 1992). "Possible" breeders are generally those birds that have been observed or heard singing in suitable nesting habitat. "Probable" breeders are those birds that have exhibited any of the following: courtship behavior between a male and female; visiting a probable nest site; displaying agitated behavior; and/or male and female observed together in suitable nesting habitat. "Confirmed" breeders are those birds that exhibited any of the following: nest building or adults carrying nesting materials; distraction display or injury feigning; recently fledged young; occupied nest located; and/or adult observed carrying food or fecal sac for young.

Prior to conducting the field bird survey, recent air photography of the study area was reviewed to determine what habitat types were present. Habitats noted on the air photography included stands of hardwood, mixedwood, and softwood forest; as well as barrens and wetlands. Examples of each habitat type were visited during the field survey. The route walked during the field survey was selected to maximize the number of habitat types visited. The field survey was conducted on June 17 and 18, 2009. The survey began at approximately 5:00 AM and was completed by 11:30 AM. Additional observations were made during wetland and vegetation surveys in August of 2009. Birds recorded during the surveys were not limited to breeding birds only; all bird observations were recorded to increase the knowledge base of avian species inhabiting or transiting the Project area. The breeding status of each species was determined with the criteria used in the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). During the surveys, most birds were identified by listening to their song.

The population status of each encountered species was determined from existing literature. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2007a), Species at Risk in Nova Scotia (NSDNR 2007c), and the ACCDC database (ACCDC 2009). The statuses of nationally rare species were obtained from COSEWIC (2004).

A total of 93 bird species have been recorded in the Atlas square for the Project Area, 51 of which were identified during the site visits. Three species identified during the field surveys were not recorded by the MBBA: rose-breasted grosbeak (*Pheucticus Iudovicianus*); black-backed woodpecker (*Picoides arcticus*); and yellow-bellied sapsucker (*Sphyrapicus varius*). Of the species encountered during the field surveys, the breeding status of six were confirmed, 11 identified as probable, and 26 classified as possible. An additional eight species were observed on site which exhibited no indication of breeding. Appendix G lists all bird species identified within the breeding bird Atlas square and the field surveys.

Of the species encountered during the field surveys, common loon (*Gavia immer*) may be considered of greatest conservation concern. Common loon is given a ranking of "Yellow" by NSDNR indicating that its population status is considered sensitive to human activities or natural events. The ACCDC classifies common loon as "S4B, S4N" indicating that both breeding and

non-breeding populations are generally widespread and common throughout the province. A male common loon was heard singing during June and a pair was observed flying over the Project area in August. As such, common loon is considered a possible breeder within the Project Area. Loons are relatively common in Nova Scotia and are associated with large areas of open water. They nest on lakes and occasionally large rivers, generally on small islands where their nests are safe from predators. Adult loons along with their fledged young move to the coast in mid-September and remain in unfrozen coastal waters until the lakes are ice-free in the spring. However, a few nonbreeding adults remain in coastal waters throughout the year. Despite their commonness, loons are sensitive to a variety of human activities, particularly around their breeding sites. For example, their nests, which are located close to the edge of the water, can be swamped by the wakes of motor boats or by water level fluctuations in reservoirs. Common loons are also susceptible to ingestion of lead in fishing sinkers, accumulation of mercury in freshwater fish and loss or reduction in food supplies as a result of acidification of freshwater bodies. The property borders the Straight of Canso and therefore provides some potential breeding habitat for the common loon. However, because Project activities are not planned to take place in close proximity to the coast, it is unlikely that any populations of common loon will be adversely affected by the Project. The populations of all other species recorded during the breeding bird survey are considered to be secure in Nova Scotia by NSDNR and none are regarded as rare or uncommon by the ACCDC.

The MBBA and ACCDC data sources identified a number of other species of conservation concern that could occupy the project area. Four "Yellow" listed species were identified by the MBBA: common nighthawk (*Chordeiles minor*); gray jay (*Perisoreus canadensis*); boreal chickadee (*Poecile hudsonica*); and common tern (*Sterna hirundo*). The ACCDC data search identified a total of 21 rare or uncommon avian species which have been recorded within 100 km of the Project site. Of these, two "Yellow" listed species were identified during the modeling exercise as being potentially in the Project area: northern goshawk (*Accipiter gentilis*); and purple sandpiper (*Calidris maritime*).

Common nighthawks are typically associated with forested areas with barren outcrops or clearings formed as a result of fire or clearcutting. They usually nest on bare ground, sometimes in raised locations such as in stumps. They may also be found in urban areas where they can nest on flat gravel-covered roofs. The rock outcrops that are found amongst the forests at the center of the property provide potentially good nesting habitat for common nighthawks. Because they are generally nocturnal and best observed in flight at dusk, the timing of the breeding bird surveys was not ideal for confirming whether this species occupies the Project area. However, because bird observations were also made during the late afternoon and early evening (during vegetation surveys) and common nighthawks were not encountered at this time, it is unlikely that they inhabit the property.

Gray Jays are fairly common in coniferous woodlands of Nova Scotia's interior. Due to being associated with boreal habitat conditions, they are potentially sensitive to anthropogenic global warming at the southern end of their range (which includes Nova Scotia). Although some conifer

dominated stands were present within the Project area, mixed and deciduous stands dominate. Due to the lack of appropriate forest conditions and the conspicuous nature of gray jays, it is unlikely that they reside in the Project area.

Boreal chickadees are found throughout the province in young or mature coniferous forest. Although they may inhabit mixed forests, their preference is for solid coniferous stands which provide suitable tree cavities for nesting. Although some small conifer dominated stands were present within the Project area, mixed and deciduous stands dominate. Due to the lack of appropriate forest conditions, it is unlikely that boreal chickadees reside in the Project area.

Common terns are relatively uncommon within Nova Scotia where they nest on coastal islands, sand spits, beaches, and occasionally in salt marshes. Their populations are adversely affected by disturbance of nesting colonies, predation of eggs and young by gulls, and loss of prime nesting sites to gulls which typically begin nesting earlier than terns. There is a low probability for common terns to nest in the vicinity of the Project area due to a lack of suitable nesting sites, and as such, they are unlikely to inhabit the area.

Northern goshawks prefer to nest in mature mixedwood or hardwood stands generally away from areas heavily used by humans. The mature mixedwood and hardwood stands located in the central and western portions of the property would have the highest potential to provide nesting habitat for this species. However, northern goshawks are unlikely to occupy the Project area due to not being encountered during field surveys (their conspicuous nature makes them hard to miss).

Purple sandpipers do not breed in Nova Scotia but do spend their winter along rocky sections of the Atlantic and Fundy coasts. Although the shoreline along the eastern boundary of the Project Area could provide suitable habitat for purple sandpipers during the winter, the timing of the field surveys did not coincide with this time period. As such, it is unknown whether purple sandpipers may frequent the shoreline of the property. Project activities are not planned to take place along the coast, and as such, it is unlikely that any populations of common loon would be adversely affected by the Project.

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the study area was derived from field surveys and a review of the Nova Scotia significant habitat mapping data base (NSDNR 2007b). Field surveys were conducted concurrently with vegetation and breeding bird surveys in June and August of 2009. The field surveys provide a good indication of the presence of large mammal species in the study area. Knowledge of the distribution of small mammals in the study area is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements, which can be used to predict areas where they are likely to be found.

Mammal species recorded in the study area are generally typical of woodland habitats. During the field surveys, evidence of American Porcupine (*Erithizon dorsatum*), black bear (*Ursus americanus*), eastern chipmunk (*Tamias striatus*), eastern coyote (*Canis latrans*), northern raccoon (*Procyon lotor*), red squirrel (*Tamiasciurus hudsonicus*), smoky shrew (*Sorex fumeus*), snowshoe hare (*Lepus americanus*), star-nosed mole (*Condylura cristata*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), and woodchuck (*Marmota monax*) were recorded. None of these species are considered "rare", "sensitive", or "at risk" within the province.

A review of the NSDNR significant habitat mapping database (NSDNR 2007b) did not reveal the presence of any rare or sensitive mammal species in the vicinity of the Project area or critical habitat such as deer wintering areas. The ACCDC modeling exercise did not identify any rare or sensitive mammal species as being potentially present in the study area. Furthermore, all of the habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Herpetiles

Information regarding amphibians and reptiles within the project area was also collected during the field surveys. Field surveys were conducted concurrently with vegetation and bird surveys during June and August of 2009.

Seven herpetile species were encountered during the site visits. Six of these were amphibians, including green frog (*Rana clamitans*), northern leopard frog (*Rana pipiens*), pickerel frog (*Rana palustris*), spring peeper (Pseudacris crucifer) wood frog (*Rana sylvatica*) and yellow spotted salamander (*Ambystoma maculatum*). One reptile, common garter snake (*Thamnophis sirtalis*) was also encountered. None of these species are considered "rare", "sensitive", or "at risk" within the province. Furthermore, the ACCDC habitat model did not identify any rare or sensitive herpetile species as being potentially present in the study area.

Although not found during the site visits, the four-toed salamander (*Hemidactylium scutatum*) is known to reside on the adjacent Rhodena Rock Quarry site (JWL 2006a) and is likely present amongst the wetlands of the Project area. The population of this species is considered secure by NSDNR (2007a), but the ACCDC has assigned it a ranking of S3, indicating that it is uncommon within the province and may be considered of conservation concern. However, the four-toed salamander is cryptic and as such, its population status is somewhat uncertain. Females nest in sphagnum moss hummocks during the breeding season and may be found under stones, logs and other cover in forest habitats during the rest of the year. They emerge from cover only at night to forage are therefore often overlooked. Critical habitat requirements for this species are sphagnum moss in which to lay eggs and a semi-permanent or permanent, soft bottomed pond or slow flowing stream adjacent to the sphagnum moss in which the hatched larvae can develop.

Other Wildlife

Results from the modeling exercise suggest that the Property may provide suitable habitat for two Yellow-listed freshwater mussel species. Both triangle floater (*Alasmidonta undulata*) and brook floater (*Alasmodonta varicosa*) have been recorded within 100 km of the Project area (ACCDC 2009). Both species are found in streams and rivers with sand and gravel substrates. Several streams are present within the Project area which maintain year-round flow and could therefore provide habitat for these species. However, field visits did not search for the presence of the mussels, and as such it is unknown if they reside within the Project area.

5.4.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Of the birds identified within the Project area, only common loon is considered sensitive to anthropogenic activities (NSDNR 2007a). However, because Project activities are not planned to take place in close proximity to the coast, it is unlikely that any populations of common loon will be adversely affected by the Project.

Migratory birds are protected under the *Migratory Birds Convention*. As such, it is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. Other bird species not protected under the federal Act, such as raptors, are protected under the provincial *Wildlife Act*. In order to avoid contravening these regulations, clearing of areas to be used for the Project will be conducted outside of the breeding season of most bird species (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed. If clearing has to occur during the breeding season, a contingency plan will be applied including nest surveys and exclusion of activities from active nesting areas to ensure compliance with MBCA.

No critical areas for mammals such as deer wintering areas or critical herpetile habitats are known to exist in the study area. The field survey and the rare taxa modeling exercise did not reveal the presence of any rare mammal or herpetile species in the vicinity of the study area. The habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

In summary, assuming recommended mitigative measures are applied (*i.e.*, clearing outside bird breeding season), significant Project-related effects on wildlife are not likely to occur.

5.5 WETLANDS

5.5.1 Description of Existing Conditions

Twenty four wetlands are found on the property or in close proximity to the proposed access road (Table 5.2) (Figure 3). The majority of the wetlands are treed swamps, but a tall shrub swamp, tall rush basin marsh and a larger wetland complex that includes both a treed swamp, shrub swamp, and a shrub basin bog are also present. The wetland complex (Wetland 5) appears on the NSDNR Wetland Atlas mapping (NSDNR 2007b) and is found along the western

edge of the Project area. The other wetlands were not recognized by the NSDNR Wetland Atlas mapping but identified during field surveys and air photo interpretation. Seven of the wetlands would be directly affected by the proposed storage facility (Table 5.2). In addition, at least three other wetlands have the potential to be indirectly impacted through changes in hydrology and nutrient inputs (Table 5.2) because they are fed by watercourses which will be crossed by the proposed Project. Information about the wetlands, including their general character, socio-economical value, ecological functions, vegetative composition, and anthropogenic influences, are organized according to the three wetland classes that are present within the Project area: swamps; marsh; and bog.

Table 5.2 Wetlands within Project area and information on their type, area, plant richness, and likely Project effects

	•	•	•		
Wetland	Wetland type	Area (ha)	Plant species richness	Percent of wetland to be directly impacted by the Project	Potential to be indirectly influenced by the Project ²
11	Mixed treed basin swamp	0.34	96	-	Yes
2 ¹	Deciduous treed stream/basin swamp	0.18	41	-	Yes
3	Deciduous treed basin swamp	0.01	50	100 %	Yes
4	Tall rush basin marsh	0.38	63	-	-
5	Complex: basin bog, shrub swamp and treed swamp	3.14	133	-	Yes
6	Mixed treed basin swamp	0.01	42	-	-
7	Mixed treed basin swamp	0.02	27	-	-
8	Mixed treed basin swamp	0.01	24	-	-
9	Mixed treed basin swamp	0.02	40	-	-
10	Deciduous treed basin swamp	0.02	32	-	-
11	Deciduous treed basin swamp	0.02	25	-	-
12	Deciduous treed drainageway swamp	0.06	40	-	-
13	Mixed treed drainageway swamp	0.20	48	3 %	Yes
14	Mixed treed basin swamp	0.24	39	1 %	Yes
15	Deciduous treed basin swamp	0.43	63	5%	Yes
16	Coniferous treed basin swamp	0.21	30	100%	Yes
17	Deciduous treed drainageway swamp	0.02	27	100 %	Yes

Table 5.2	Wetlands within Project area and information on their type, area, plant
	richness, and likely Project effects

Wetland	Wetland type	Area (ha)	Plant species richness	Percent of wetland to be directly impacted by the Project	Potential to be indirectly influenced by the Project ²
18	Deciduous treed drainageway swamp	0.04	23	100 %	Yes
19	Deciduous treed basin swamp	0.08	30	-	-
20	Mixed treed basin swamp	0.13	47	-	-
21	Mixed treed basin swamp	0.05	33	-	-
22	Mixed treed basin swamp	0.33	65	-	-
23	Deciduous treed drainageway swamp (with a wet meadow component)	0.35	72	-	-
24	Tall shrub basin swamp	0.07	39	-	-

¹ Data for Wetlands 1 and 2 supplemented with information from existing EA on Rhodena Rock Quarry property (JWL 2006a)

Swamps

Swamps are mineral wetlands or peatlands with standing water or water flowing slowly through pools or channels. The water table is generally at or near the surface of the swamp. There is internal water movement from the margin of the swamp or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat. The vegetation typically consists of a dense cover of trees or shrubs, herbs and some mosses.

Swamps are abundant throughout the Project area and include basin, stream, and drainageway forms, as identified in the Canadian Wetland Classification System (Warner and Rubec 1997). Basin swamps occur in topographically defined basins where the water is derived locally and by drainage from other parts of the watershed. Drainageway swamps have a sloping surface and are found in confined drainageways or water tracks. Water movement is generally as unilateral sheet flow but intermittent channels are often present. Stream swamps occur on the banks of permanent or semi-permanent streams. The high water table within these wetlands is maintained by the level of water in the stream which floods during periods of high precipitation. Surface water within the swamps was variable but generally low (< 5%) and confined to small pools (approximately 1 m² or less), such as may be found at the base of trees and along intermittent drainage channels. Larger areas of exposed substrate were present during the site visits however, indicating that the amount of surface water varies throughout the year and is often much greater than was observed. Peat depths within the swamps were generally 20-30 cm towards their edges and 40-60 cm closer to their centers.

² Based on infilling of wetland or crossing of watercourses which feed into them

Anthropogenic factors have had an important influence on the character of several of the wetlands. Wetland 10 is anthropogenic in origin, having developed from a borrow pit used to provide substrate to an old roadbed. Some of the substrate has been mounded at the northern end of the wetland and provides an upland barrier between it and Wetland 11. Although Wetland 11 is likely natural in origin, its hydrology and size have probably been influenced by the excavation activities. Similarly, the southwestern edges of Wetlands 9 and 24 are bordered by old roadbeds and these features have likely been important influences on their character. Highway 344 defines the western border of Wetland 5 and has appears to have resulted in changes to its hydrology and vegetation – as evidenced by considerable amounts of pooling and development of marsh-like vegetation in close proximity to the road.

Wetland 3 is situated along the flood banks of a stream that comes from the Rhodena Rock Quarry. Considerable amounts of gravel have been carried from the quarry and deposited within the channel and along the banks of the stream which flow through the swamp. Although the gravel itself provides a very minimal alteration to the character of the wetland, it indicates that Wetland 3, as well as Wetland 2 which is located further downstream, likely receive large amounts of sediment from the nearby quarry during periods of high surface water flow.

The swamps have relatively little socio-economic value except for some recreational usage. ATV trails were observed to cross several of the wetlands (Wetlands 5, 13, and 14) and hunting stands were present within two of them (Wetlands 5 and 14). Although there was very little evidence of recent tree harvesting activities within the swamps, some cut stumps were observed at the eastern end of Wetland 23.

The swamps are moderately important for providing hydrological and biogeochemical functions. They contribute to surface water flow regulation by slowly releasing their stored water during dry periods, thereby augmenting the flow of watercourses. They may also help to reduce flooding by acting as a reservoir and by slowing surface flow when water levels are high. Many of the swamps may also help improve local water quality. In particular, several of the swamps are fed (at least in part) by streams or intermittent drainages that originate within or cross the existing Rhodena Rock Quarry (Wetlands 1, 2, 3, and 5). Sediments or other contaminants carried by the surface waters could be retained within the swamps. Although wetlands are known to be quite efficient at removing sediment and metals from surface water, they are generally poor at retaining hydrocarbons, sodium and chloride ions. The ability of the swamps to provide such functions varies with their size and form. For example, Wetland 5 would be especially important for providing hydrological and biogeochemical functions as a result of its large size and connectedness to Mc Nairs Brook. Conversely, many of the smaller basin swamps (Wetlands 6, 7, 8, 9, 10, and 11) would have very minimal value.

Four types of basin swamp are present within the Project area including: mixedwood treed basin swamp, coniferous treed basin swamp, deciduous treed basin swamp, and tall shrub basin swamp. Mixedwood treed basin swamps were the most abundant type of wetland on the Property. They are characterized by a tree canopy dominated by red maple, yellow birch,

balsam fir, and black spruce. These species also contribute to a moderately developed shrub layer, along with speckled alder, black holly, and lesser amounts of striped maple (Acer pensylvanicum). Whereas cinnamon fern is the most herbaceous species, fowl manna-grass, sensitive fern, creeping butter-cup (Ranunculus repens), three-seed sedge, and little prickly sedge (Carex echinata) are also prominent and peatmoss coverage is extensive. A single coniferous treed basin swamp was present on the property. This wetland was dominated by black spruce trees, although red maple and balsam fir were also common. The shrub understory is similar in species composition to the mixedwood treed basin swamp and the herbaceous vegetation was also dominated by cinnamon fern. Three-seed sedge, New York fern, and dwarf dogwood (Cornus canadensis) were also common components of the ground vegetation along with peatmoss. The deciduous treed basin swamps are characterized by a tree canopy dominated by yellow birch and red maple, whereas striped maple, large-tooth aspen (Populus grandidentata), and white ash (Fraxinus americana) may also be common. Understory shrub coverage was sparse and mainly comprised of and striped maple and balsam fir saplings. Peatmoss coverage was extensive within these swamps, as were the herbs rough sedge, cinnamon fern, sensitive fern, and spotted jewel-weed (Impatiens capensis). The tall shrub basin swamp was characterized by lack of tree cover and dense but intermittent patches of willow (Salix sp.) and serviceberry (Amelanchier sp.). Cinnamon fern cover is extensive and little prickly sedge, sensitive fern, and soft rush are common. Peatmoss provides moderate ground coverage within the tall shrub basin swamp.

A small mixedwood treed stream swamp is located in the area of the proposed access road on the Rhodena Rock Quarry property. This swamp is found at the junction of three streams which drain from both the Rhodena Rock and Martin Marietta properties. Tree cover is comprised of approximately equal amounts of yellow birch, balsam fir, striped maple, white ash, and red maple. Striped maple and balsam fir also contribute to the low shrub coverage within the swamp. Fowl manna-grass is dominant within the swamps understory, although rough sedge, cinnamon fern, New York Fern, and other sedges (particularly *Carex gynandra*) are also prominent.

The majority of the drainageway swamps of the property are deciduous treed swamps, but a mixed treed drainageway swamp is also present. Tree cover within the deciduous treed drainageway swamps is predominantly comprised of red maple and yellow birch, although lesser amounts of other species such as white spruce, balsam fir, and striped maple may also be present. Shrub cover is generally low and comprised of tree species, particularly balsam fir, red maple, white spruce, and striped maple. Cinnamon fern and sensitive fern are the dominant herbaceous taxa, although a number of other species may also be found, including creeping butter-cup, rough sedge, New York fern, and spotted jewel-weed. Red maple and balsam fir are the most abundant trees within the mixed treed drainageway swamp, but yellow birch, striped maple, white spruce, and white ash were also common. Herbaceous vegetation is primarily comprised of cinnamon fern, New York fern, and northern beech fern, but sensitive fern, fowl manna-grass, and wild sarsaparilla are also prominent. Peatmoss coverage is extensive in both the mixed and deciduous treed drainageway swamps.

Although the majority of Wetland 7 is comprised of mixed treed swamp, shrub swamp is found at its eastern end. This area is dominated by sweet bayberry (*Myrica gale*), although other shrub species such as large cranberry (*Vaccinium macrocarpon*) are also common. Considerable amounts of pooling are found within this habitat and patches of broad-leaf cattail are present. In addition, the exotic plant purple loosestrife (*Lythrum salicaria*) is also abundant in close proximity to the road.

A wet meadow component was present at the lower end of a deciduous treed drainageway swamp (Wetland 23). This habitat was characterized by a lack of tree and shrub coverage, except for some scattered occurrences of balsam fir, red maple, and white spruce. Herbaceous vegetation dominates the wet meadow. Cinnamon fern, sensitive fern, parasol white-top, and soft rush cover were particularly extensive. The cover of cottongrass bulrush (*Scirpus cyperinus*), American water-pennywort (*Hydrocotyle americana*), common boneset (*Eupatorium perfoliatum*), and little prickly sedge were also prominent within the wet meadow habitat.

Five of the surveyed wetlands were found to provide habitat for uncommon plant species. Purple-leaf willow-herb was encountered in the tall shrub basin swamp (Wetland 24). This species is considered sensitive by NSDNR (2007a) and is given a ranking of "S2?" by the ACCDC. Early coralroot was encountered in four of the treed swamps (Wetlands 13, 14, 15, and 22). Its population is considered secure by NSDNR but it is ranked as "S3" by the ACCDC.

In addition, small yellow lady's-slipper is known to be present in a wetland located on the adjacent Rhodena Quarry property (Wetland 1) (JWL 2006a). This species is considered S2/S3 by the ACCDC (2009) and is regarded as sensitive by NSDNR (2007a). The population consists of approximately 100 stems in the eastern area of the wetland and one clump noted from the adjacent upland along the intermittent stream flowing into the wetland. Although this wetland will not be directly affected by the Project, the population of small yellow lady's-slipper could be indirectly influenced by hydrological or nutrient changes resulting from the proposed access road which will cross the intermittent channel that feeds the wetland.

In general, the swamps are moderately important for providing wildlife habitat. However, their ability to support a diversity of wildlife varies considerably with the size of the wetlands and the availability of appropriate microhabitats, such as those formed by the pooling of surface water. Herpetiles were abundant within the swamps, with green frogs being particularly abundant. Northern leopard frog, pickerel frog, spring peeper, wood frog, yellow spotted salamander, and a common garter snake were also observed within the swamps. A total of 29 bird species were identified within the swamps of the property. A table of bird species found within each of the wetlands is provided in Appendix H.

Marshes

Marshes are mineral wetlands or peatlands that are periodically inundated by standing or slow flowing water. Surface water levels generally fluctuate seasonally. During drier periods

declining water levels may expose areas of matted vegetation or mud flats. The surface waters are typically rich in nutrients. The substrate is usually mineral material although well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees.

A tall rush basin marsh is located at the western end of the property. This marsh is confined to a topographically defined depression. It collects surface water runoff and may receive some input through groundwater seepage. During the site visit, approximately 50 % of the marsh was covered in surface water. The marsh discharges into McNair's Brook and would be an important determinant of water quality for this watercourse. During high precipitation events such as storms, the wetland would moderate water flow by acting as a reservoir for flood waters. The marsh may also act to improve water quality by acting as a reservoir for particulate matter carried in surficial runoff from the adjacent Rhodena Rock Quarry. Because primary production from emergent and submergent macrophytes is expected to be high, the wetland is likely an important sink for nutrients which have been washed from the surrounding topography.

The marsh is dominated Broad-leaf cattail although a number of other herbs, such as Canada rush, are also present. In addition a number of floating and submerged aquatic plants are prominent, particularly yellow pond-lily, slender naiad, nuttall pondweed (*Potamogeton epihydrus*), and slender pondweed (*Potamogeton pusillus*).

The marsh is unique among the wetlands encountered within the Project area and is therefore important in contributing to the habitat diversity of the area. A number of plants are associated with the marsh which were not encountered elsewhere on the property and one provincially uncommon species, small bur-reed, was present. Small bur-reed is given a ranking of "S3" by the ACCDC (2009) but is considered secure by NSDNR (2007a). The open water and emergent rush cover of the marsh provides high quality herpetile and waterfowl habitat. During the site visit, green frogs were abundant, a pair of American black ducks (*Anas rubripes*) was observed, and cedar waxwings (*Bombycilla cedrorum*) were common along the edges of the marsh.

Bogs

Bogs are peat wetlands which are raised or level with the surrounding terrain and are unaffected by runoff waters or groundwater from the surrounding mineral soils. Water levels are generally at or slightly below the surface of the bog. Because they receive their nutrient and water input atmospheric deposition, they are typically nutrient poor and have a low pH. They typically have a well developed peat layer comprised of peatmoss and the woody remains of shrubs.

The relatively large wetland complex located at the western end of the property (Wetland 5) includes a basin bog within its center. This form of bog is characteristically located in basins and has flat surfaces which are even with the surrounding terrain. Peat accumulation is generally

greater in the centre of the basin. The bog is surrounded by mixed treed swamp on all sides except for its western end which grades into shrub swamp.

The bog is isolated from surface water inputs and therefore provides limited hydrological functions related to water flow moderation or water quality treatment. Although peat depths were observed to be >1 m, the small size of the bog limits its value for carbon sequestration and would prevent it from providing commercial peat harvesting opportunities.

The bog is dominated by shrubs such as leatherleaf, speckled alder, northern bayberry, and stunted black spruce. Black spruce, along with lesser amounts of red maple, provides some minimal tree cover. A number of graminoids are prominent throughout the bog, including tussock sedge, Canada rush, narrow-leaved cotton-grass, and white beakrush. American burreed (*Sparganium americanum*) is common towards the edges of the bog where it grades into the surrounding mixed treed swamp. The forbs bog aster and cinnamon fern are also common and peatmoss cover is extensive throughout the bog.

The bog is unique among the wetlands encountered within the Project area and is therefore important in contributing to the habitat diversity of the area. Although many plant species not observed elsewhere on the property were encountered within this habitat, none are considered to be rare or uncommon within the province.

5.5.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The Project would result in the complete or potential loss of the seven wetlands located within the proposed Project area (Wetlands 3, 13, 14, 15, 16, 17 and 18). In Nova Scotia, wetlands are protected under the Activities Designation Regulations made pursuant to the provincial *Environment Act.* Any loss of wetland habitat either through direct infilling or indirectly through alteration of wetland hydrology requires preparation of a wetland evaluation to establish the functional attributes of the wetland. If NSE grants permission to infill or alter the hydrology of any wetland in the Project area, it will be necessary to develop a compensation plan to replace the wetland functions lost as a result of damage to or loss of the wetland.

At least three additional wetlands could be indirectly influenced through changes in hydrology, nutrients, or sediment input. However, mitigative measures will be taken during Project activities to prevent cutting off any watercourses that flow into to the wetlands or see them become repositories of significantly increased water flow, nutrients, or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures.

Therefore the Project will cause approximately 0.31 ha of direct wetland alteration, as well as potential indirect impacts to partially altered wetlands and wetlands downstream of altered watercourses. Assuming a 3:1 ratio for the direct wetland alteration compensation, approximately 0.93 ha of wetland habitat compensation would be required.

Enhancement or restoration of wetlands onsite is one option for compensation. The construction of Marine Drive, on the southern boundary of the property, has impacted McNairs Brook (Watercourse 2) and associated wetlands. Where McNairs Brook exits Wetland 5 to the south, the brook flows along a degraded roadside ditch. There may be an opportunity to reroute the brook onto the property (away from the road and power lines, which have nearby vegetation routinely cut), and have it meander south-east until it is re-connected to the original watercourse in the southern most corner of the property. The watercourse would likely pass nearby Wetlands 8 and 9, which are small (both are 0.02 ha), and therefore they could be enhanced to increase the size of wetland habitat, and therefore increase wetland functioning. The hydrology to support this wetland habitat enhancement can be supplied by the re-routed McNairs Brook. There may be an opportunity to restore and enhance Wetland 5, depending on the extent the road has impacted this wetland.

Another option may be to create an independent onsite wetland. Any site chosen would need to be held in perpetuity to ensure the wetland won't be affected by future developments. The size of the created wetland can be adapted to compensation requirements for direct and indirect wetland habitat compensation, as directed by NSE. The creation of a wetland should replicate natural systems as much as possible. This includes three important wetland components: hydrology; hydric soils; and vegetation. The creation of a wetland onsite will be able to make use of salvaged wetland material from the proposed altered wetlands. This will provide a seed bank for wetland vegetation to develop from, as well help develop the hydric soils typical of wetland habitat. Site selection within the property will need to ensure there is a reliable hydrological source, and ideally be a natural low lying area to minimize the need for dredging and soil movement, which will reduces environmental impacts. Another consideration is access to the site, as heavy machinery will typically need to access the site; if the chosen site is close to road access, this will also reduce environmental impacts, such as clearing.

Further details regarding wetland compensation will be outlined in the wetland alteration application, which will be submitted to NSE prior to any wetland habitat alteration. When conceptual compensation has been agreed upon by the proponent and NSE, a formal wetland compensation plan will also be submitted to NSE.

In summary, assuming the application of proposed mitigation measures, including maintaining existing site drainage conditions and providing compensation for loss of wetland functions, significant Project-related effects on wetland functional attributes are not likely to occur.

5.6 GROUNDWATER RESOURCES

5.6.1 Description of Existing Conditions

Groundwater, an integral component of the hydrologic cycle, originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The

upper surface of the saturated zone is called the water table. The water table intersects the surface at springs, lakes and streams where interaction between the groundwater and the surface water environment can occur. Groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where it exits the sub-surface as springs, streams, and lakes. There is a dynamic interaction between groundwater resources and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

Groundwater yield to dug or drilled wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers. An aquifer is a formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. Natural groundwater quality is directly influenced by the geochemical composition of the aquifer materials through which it passes, and the time the water resides within that material.

The groundwater resource is a VEC because it provides potable water supply to approximately half of the total population of Nova Scotia, and to almost all of the unserviced rural residences. Groundwater, as an integral component of the hydrologic cycle, and can interact with and indirectly affect fresh water resources, fresh water ecosystems and estuarine ecosystems at points of discharge.

Spatial boundaries for the assessment of groundwater resources are based on a combination of topography, aquifer hydraulic properties, expected groundwater flow directions, and the distance between the proposed storage cells and residential supply wells that may be affected by the storage cell activities. For example, the capture area of a typical low yield domestic water well is usually less than about 100 m, and generally in a direction hydraulically upgradient of the well. A large impermeable construction located in the recharge area could locally affect water levels, and any releases from this facility could theoretically migrate vertically downward to the water table, and hence laterally towards the Strait of Canso and receiving waters or wells.

Project-related contamination (*e.g.*, accidental petroleum hydrocarbon spills from machinery could theoretically leave the construction site, and could potentially affect well water quality down gradient of the proposed storage cells. Acid rock drainage (ARD) is also a potential issue if the cells are excavated into bedrock, and if a significant degree of sulfide mineralization is encountered.

Vibration damage to a drilled or dug well is generally a function of the distance between the energy source and the receptor well, and the seismic properties of the intervening aquifer materials. With respect to rock type, risk of water well damage is greater for acoustically transmissive fractured crystalline bedrock than for overburden wells or soft bedrock (e.g., sandstone or shale) wells. Based on experience, the risk of water supply well damage from

blasting or major excavation is considered to be greatest within 50 m, moderate from 50 to 200 m, and is expected to be minimal beyond about 200 m; however, the noise and vibration effects of blasting could be felt by persons at greater distances.

Blasting effects are conservatively considered for drilled wells located within 800 m of the proposed Project (*i.e.*, the minimum distance from structures allowed for blasting specified by the Nova Scotia Pit and Quarry Guidelines). Potential effects of accidental spills and ARD are considered for all wells located hydraulically downgradient of the proposed storage cell facility. The extent of the area potentially affected is dependent on surface drainage and surficial geology, and can generally extend 200 m in sand and gravel, and up to 50 m in glacial till. Minimal or no blasting is anticpated for Project development; however an 800 m groundwater assessment area has been included to be conservative.

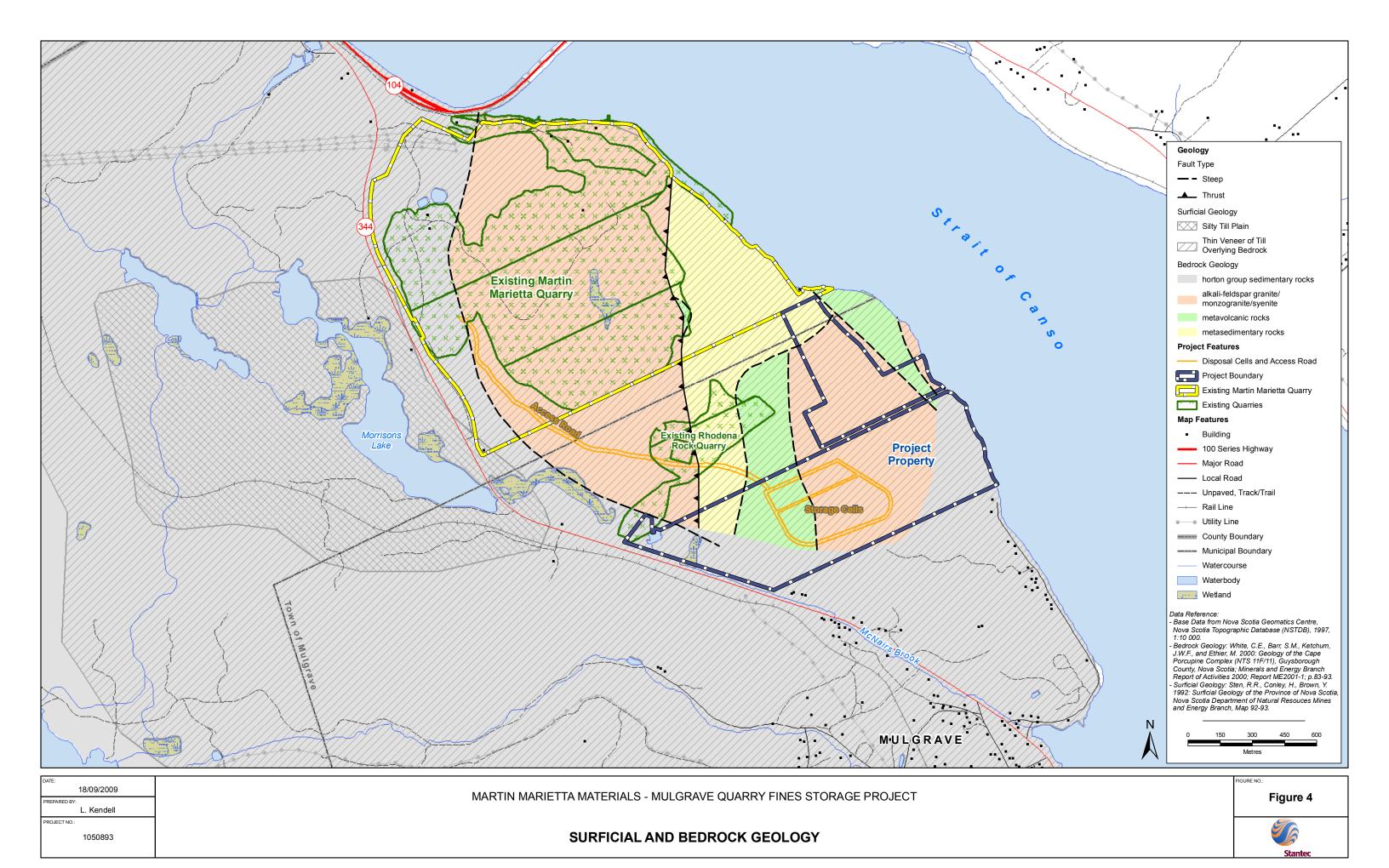
Hydrogeologic Setting

The following discussion of the local groundwater resources and hydrogeology is based on a desktop study and a "windshield" survey of an 800 m assessment area, but does not include any water well inspection, groundwater sampling and analysis, or groundwater depth measurements.

The Project property area is comprised of two irregular-shaped areas (Figure 1). The area where the proposed storage cell is to be located is approximately 550 m wide (north-northwest/south-southeast) and 1,650 m long (east-northeast/west-southwest) at its longest points. The second area, located north of the proposed storage cell is approximately 600 m wide and long at its longest points.

The topography of the Project Area consists of a bedrock controlled ridge which extends northwestward up the southeast side of Porcupine Mountain. Elevations on the site range from approximately sea level at Strait of Canso to 105 m above sea level.

The surficial geology consists of a thin veneer of brown, loose, cobbly sand glacial till (Figure 4). In general, the till contains more than 90% local clasts formed from the local bedrock (Stea and Fowler 1979). Based on this soil description, the thin overburden would be expected to be moderately permeable to rainfall infiltration. Based on five water well logs within 800 m of the site, the overburden thickness can be expected to range from 1.2 to 10.7 m, averaging 4.0 m (NSE 2009a) (Table 5.3), and is expected to become thinner with elevation.



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The bedrock underlying the site consists mainly of Late Neoproterozoic aged metavolcanic/metasedimentary rocks of the Cape Porcupine Complex and granitoid rock. Cape Porcupine is a prominent hill adjacent to the Canso Causeway and consists of varied igneous and metamorphic rocks termed the Cape Porcupine Complex by White and Barr (White, Barr *et al.* 2000). The rocks of this complex are generally separated by either steep subvertical faults or thrust faults (White *et al.* 2000). The complex is in faulted contact to the north, east, and west with sedimentary rocks of the Early Carboniferous including sandstone, conglomerate, shale and arkose of the Horton Group (Donohoe *et al.* 2005).

The Cape Porcupine Complex is divided into five map units, as described by White, Barr, Ketchum and Ethier, 2001, including the metasedimentary unit, metavolcanic unit, alkali-granite unit, monzogranite unit and quartz alkali-feldspare syenite.

The main body of the metasedimentary rocks occupies the central area of the Cape Porcupine Complex, and a small portion of the western portion of the Project area. It is mainly fault bounded. The metasedimentary unit consists mainly of grey to black, fine-grained and strongly foliated metasiltstone with well-developed stretching lineation. The quartzite is light to dark grey, fine-grained, heavily fractured and featureless. (White, Barr *et al.* 2001).

The metavolcanic unit outcrops in the eastern part of the complex, and in the central portion of the Project Area, and is mainly fault-bounded. The metavolcanic unit is contact with the metasedimentary unit to the west and the Eastern Granitoid Complex (alkali-feldspar granite) to the west. The metavolcanic unit consists dominantly of white-weathered, grey to dark grey crystal to crystal-lithic rhyolitic tuff (White, Barr *et al.* 2001).

Granitoid rocks form both the western and eastern parts of the Cape Porcupine Complex, as depicted by the alkali-feldspar granite/monzogranite/syenite map unit shown in Figure 4. The granitoid unit is fault-bounded with the metsedimentary and metavolcanic units (Figure 4). The western granitoid area represents the area of existing quarrying operations by the Proponent which consists of mainly pink to pink and grey granite, mixed with abundant enclaves of more mafic plutonic rocks and metavolcanic rocks of andesitic to rhyolitic composition. The granite in this area appears to vary gradationally in composition from monzogranite to syenogranite, and alkali-feldspar granite (White, Barr *et al.* 2001). The eastern granitoid unit underlies a majority of the Project Area and consists of mainly alkali-feldspar granite with local areas of monzogranite and quartz diorite. It is similar in composition to western granitoid rocks and is assumed to be of similar age. However, the alkali-feldspar granite in the eastern granitoid belt is more deformed than in the western belt and in places discrete mylonite zones are present. (White, Barr *et al.* 2000).

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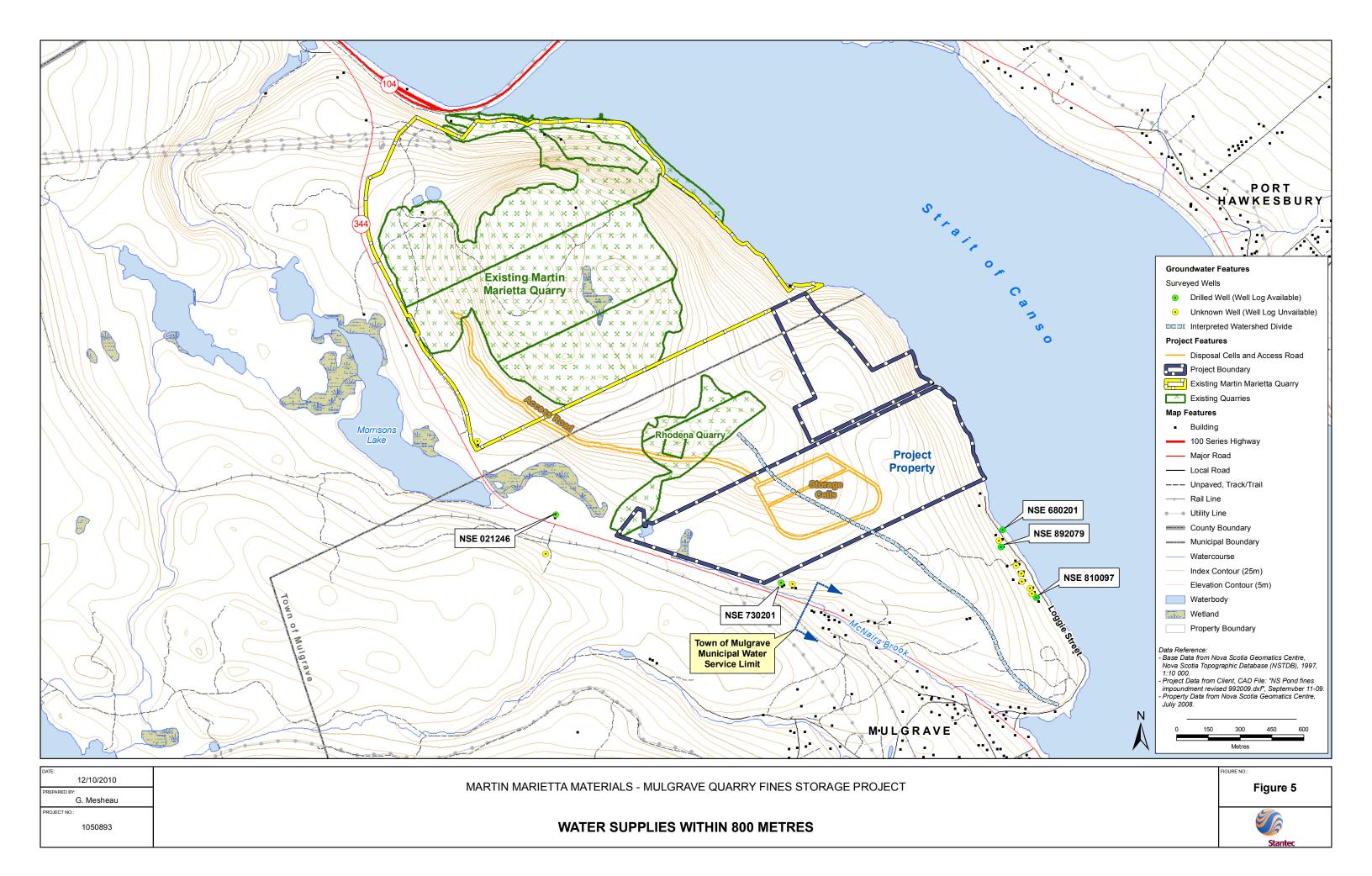
FINAL REPORT: ENVIRONMENTAL ASSESSMENT

The proposed storage cell location is situated on a topographic watershed divide between the Strait of Canso on the east, and McNair's Brook on the west. Due to its location, the site is expected to lie within a groundwater recharge area, and an inference of the regional groundwater flow direction has been made based on topography. Because of the location of the ridge, surface water runoff (*i.e.*, apparent shallow groundwater flow direction) radiates out from the ridge to the southwest, southeast and northeast depending on the specific area of the site. Eventually, groundwater is expected to discharge into streams and wetlands feeding McNairs Brook, small streams draining to the Strait of Canso, or directly into the Strait.

The potable water supply for residences located along Highway 344 north of the Town of Mulgrave service boundary (shown on Figure 5), as well as along Loggie Street are derived primarily from privately-owned drilled or dug wells. The Town of Mulgrave municipal water supply is derived from surface water reservoirs located approximately 2.5 km southwest of the Project area.

The location of the water wells servicing residential homes located nearest the Project area (*i.e.*, within 800 m) were determined during a windshield survey conducted on August 5, 2009 (Figure 5). The closest residential well is located approximately 185 m southwest of the proposed storage cells at the NSE well no. 730201.

A review of available NSE well records provided information on five of the estimated fourteeen water wells identified in the area (NSE 2009a). Refer to Table 5.3, below and Figure 5, for a summary and locations of domestic water well records within 800 m of the Project area. The NSE well no.021246 is located approximately 990 m northwest and upgradient of the proposed storage cell location, however it is located south and downgradient of the proposed access road. The NSE well no. 730201 well is located approximately 185 m southwest and downgradient of the proposed storage cell. Three additional well logs for NSE well no. 680201, NSE well no. 892074, and NSE well no. 810097 were retrieved. These wells are located southeast and hydraulically downgradient of the proposed storage location, with the closest well to the storage cells located approximately 540 m away.



The well construction details for the five drilled wells are summarized in Table 5.3. The wells average 33.9 m in depth, have an average 8.3 m of casing, and yield in the range of 1.5 to 8.0 igpm, with an average value of 3.2 igpm. The depth to the water table ranges from 2.4 m to 6.7 m below grade.

Table 5.3 Summary of Available Domestic Water Well Records within 800 m of the Project

	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
NSE 680201 - Brophyville Road	36.9	12.0	5.0	6.7	10.7
NSE 730201 - Marina Drive	29.6	6.7	1.5	2.4	1.2
NSE 021246 - 48 Main Street	37.5	6.1	3.0	3.0	4.0
NSE 810097 –104 Loggie Street	29.6	13.41	8	3.0	10.1
NSE 892074 –134 Loggie Street	37.2	6.1	2	3.0	2.1
Minimum	29.6	6.1	1.5	2.4	1.2
Maximum	37.5	13.4	8.0	6.7	10.7
Geomean	33.9	8.3	3.2	3.4	4.0
Median	36.9	6.7	3.0	3.0	4.0
STD	4.2	3.6	2.7	1.7	4.5
Number	5	5	5	5	5

Note: Information was obtained from the Well Log Database (NSE 2009a) including wells constructed between 1940 and 2004. STD = standard deviation; igpm = imperial gallons per minute; m = metres; NSE = Nova Scotia Environment Well Log Reference No.

In addition to wells in the area, there are four watercourses within Project area (Figure 3) which may be partially fed from groundwater springs that may occur near the base of the mountain

Groundwater Quality

The water quality from wells constructed in Horton Group and granite bedrock is expected to be good, with most parameters meeting the Canadian Drinking Water Guidelines (Health Canada 2008). The Strait of Canso Environment Committee Water Resources inventory (SCEC 1975) suggests that Horton Group aquifers should provide a relatively good groundwater quality with low to moderate degree of dissolved solids and alkalinity, and a tendency towards hardness. Iron and manganese in excess of respective aesthetic values are possible issues. The crystalline bedrock of the granite and metamorphic bedrock is expected to yield good to excellent water chemistry, with a low degree of hardness and total dissolved solids (TDS) (SCEC 1975). Rare occurrences of arsenic, uranium, radon gas, iron and manganese are possible under some hydrogeological conditions, or in the presence of mineralized zones. With respect to elevation, groundwater at the top of the mountain would be expected to be more dilute, less hard, and lower in dissolved solids than groundwater farther down the groundwater flow path along the coastline.

5.6.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The potential effects, proposed mitigation, monitoring and follow-up section has been prepared assuming that no active quarrying operations such as blasting or crushing activities will take place in the proposed Project area. Stockpiling of aggregate wash fines within an engineered storage cell is the main quarry-related activity proposed for this Project property.

The potential environmental effects on groundwater quality and quantity due to the presence of the access road and storage cell include: temporary siltation of nearby wells due to heavy equipment operation (Construction Stage), possible water quality deterioration at down-gradient wells from accidental releases of deleterious substances such as petroleum hydrocarbons and possible water quality deterioration at down-gradient wells due to metals leaching from material placed within the storage cell into groundwater (Operational Stage).

In addition, there is a potential environmental hazard relating to a potential slope stability failure of the engineered storage cell, due to the topographical location of the cells, the steep change in topography (elevation) within the proposed storage cell location, the unknown permeability and grain size distribution of the wash fines, the proposed volumes of wash fines to be stored and the proposed height of the storage cell (18 m).

Potential impacts to domestic water wells are a function of distance between a well and the Storage cell site with respect to groundwater flow directions, and individual well construction methods.

Water Quantity Effects

It is anticipated that the cells would be constructed near or slightly below existing grade, with no excavation below the local water table, which would be expected to be at least 10 m below grade in the bedrock. Silt fences and sediment ponds would likely be installed to divert overland flow and shallow groundwater interflow. No known residential wells exist within 50 m of the proposed operation, and therefore any minor water level lowering caused by the presence of the storage cells should not lead to decreased well yield (temporary or permanent) at existing groundwater wells in the area. The closest domestic water well to the storage cells is the NSE well no. 730201 (Figure 5) located 185 metres south of the storage cell. No spring-fed wells or spring-fed streams are known to be present within 800 m upgradient of this storage cell facility.

Due to the unknown depositional permeability of the wash fines material (expect low to moderate), there is a potential for water table mounding to occur within and immediately upgradient of the storage cell. Water table mounding in this area could affect the stability of the deposited waste materials, and shallow groundwater flow direction in the vicinity of the storage cells. Attention to drainage and shallow groundwater control in the vicinity of these storage cells is needed, more for physical stability concerns than an environmental effect.

Water Quality Effects

Changes in water quality at down-gradient wells may theoretically occur as a result of accidental releases of deleterious substances such as petroleum hydrocarbons within the storage cell area or along the access road during construction and operation. In addition, possible water quality deterioration at down-gradient wells due to metals leaching from the material placed within the storage cells into groundwater is possible.

Acid Drainage

A possible long term impact of well water quality is decreased pH or increased dissolved solids from attenuation of acidic drainage from exposed sulfide-rich bedrock. Although there is no known significant acid generation from the quarries in the area, quartz-carbonate veins containing abundant pyrite are common in the Cape Porcupine Complex and minor chalcopyrite also occurs as finely disseminated grains in the granitoid and metavolcanic units (White et al. 2000). Based on information provided to Stantec by Martin Marietta, seven (7) gravel aggregate samples of various ASTM sieves sizes were subjected to acid producing/consumption potential and % total sulphur analysis in 2001. Stantec reviewed the results of this testing which confirms the % total sulphur content in each of the samples analyzed was less than 0.4% (range < 0.001 to 0.05, mean 0.018 %). Net acid producing potential ranged from <0.06 to 1.38 kg/tonne, mean 0.55 kg/tonne as H₂SO₄; no acid consumption data was available. The Sulphide Bearing Material Disposal Regulations (1995) indicate that a sulphide bearing material is one that has a sulphide sulphur (not total sulphur) content of greater than 0.4% as sulphide sulphur or >12.51 kg/tonne as H₂SO₄. Considering the low magnitude of the % total sulphur and acid producing potential results for the aggregate samples analyzed, acid generation is not considered to be an issue in this case. Due to the fine grained nature of the wash fines, further testing is recommended to confirm that the % sulphide sulphur levels in the wash fines is consistent with the levels detected in the aggregate samples tested in 2001.

Leachate

It has been assumed that placement of these fines on grade without a base liner and within an uncapped earthen berm could allow mounding of rainfall infiltration within the stored fines, and create the potential for metals to leach into groundwater and eventually impact potable groundwater or discharge to adjacent surface water bodies. To further evaluate the potential for leaching metals into groundwater and surface waters, three wash fine samples were collected by Martin Marietta in May 2009 and submitted to Maxxam Analytics for laboratory testing of total metals using three methods: an acid extraction method, available metals using the USEPA (United States Environmental Protection Agency) Method 1312 synthetic precipitation leaching procedure (SPLP) analysis (Alforque 1996), and a 10x dilution of the SPLP results to simulate expected natural attenuation of a leachate from the fine materials (OMOE, 1996). The total methods analysis provides an indication of relative metals content of the sample. The SPLP method is used to evaluate the potential for leaching metals from the material into ground and

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surface waters under conditions of natural rainfall. This method provides a more realistic assessment of metal mobility under actual field conditions when it rains or snows. The SPLP is a method of choice when evaluating fate and transport of metals in a properly engineered waste land disposal facility from which municipal solid waste is excluded.

Results of the metals and SPLP analysis are summarized in Tables I-1 and I-2 in Appendix land can be summarized as follows:

Results of the available metals analysis do not exceed CCME Soil Quality Guidelines (CCME 2007a) for commercial land use in the three samples analyzed.

Of the three leachate samples analyzed, only aluminum, barium and iron were detected in the leachate above the laboratory reportable detection limits (RDL). All other parametres were non-detect above respective laboratory RDL.

- 1. As it has also been assumed that there would be some attenuation of leachate quality between the source and any potential receptors. The leachate quality was therefore divided by a factor of 10 and then compared to applicable guidelines for the protection of fresh water aquatic life, marine aquatic life and drinking water. No drinking water, freshwater aquatic life (FAL) or marine aquatic life water quality guidelines are exceeded when the 10x dilution attenuation factor is applied to the leachate results (Table I-2).
- 2. While all other parameters were non-detect some leachate RDLs are above the FAL water quality guidelines even when the attenuation factor is applied. These parametres include cadmium and silver. However, these apparent exceedances are not considered significant based on the low concentrations of available metals within the raw pond fines material (non-detect in all but one sample).
- 3. Based on the results of the available metals and SPLP analysis of the three wash fine samples analyzed, the risk of impacts to groundwater quality due to metals leaching from the storage cells is considered to be low.

Slope Stability Effects

Although, not directly related to groundwater, there is a potential environmental and safety effect relating to slope stability failure of the engineered storage cell, considering the steep change in topography in the vicinity of the proposed storage cells and the unknown physical properties of the wash fines. It is our understanding that the steepness of the property, the grain size distribution, permeability and water content of the wash fines, and the proposed wash fine volumes will be factored into the storage cell design. Furthermore, drainage control and settlement ponds are also to be included in the design (refer to Section 2.4).

Mitigation of Effects

Due to distance, significant impacts on existing groundwater supply wells are not anticipated due to separation distance, anticipated minimal or no excavation blasting, low potential for ARD, low potential for metals mobility, and natural attenuation primarily by dilution and dispersion along the groundwater pathways. In the unlikely event of persisting long-term degraded water quality, or a well yield loss event, the proponent will investigate, and if necessary, replace or repair any water supply well found to be adversely affected by their storage cells to the satisfaction of the owner.

Due to the unknown physical properties of the wash fines, further testing including grain size analysis, hydrometre and moisture content is recommended, to understand the grain size distribution, permeability and water content of the wash fines. In addition, further testing is recommended to confirm that the % sulphide sulphur levels in the wash fines is consistent with the levels detected in the gravel aggregate samples tested in 2001, and do not exceed the 0.4% sulphide sulphur limit.

Depending on site-specific conditions, provisions should be made for the prevention of materials saturation by percolating rainfall infiltration and up-gradient runoff and groundwater interflow. Standard procedures such as diversion berms, upgradient drainage interception structures and effluent control should mitigate this concern.

Monitoring

It is recommended that groundwater monitoring wells be installed in the vicinity of the proposed storage cells to determine depth to water table, local groundwater quality, and to act as long term monitoring for seepages from the system. Locations should be between the cells and identified domestic wells or receptor streams. These wells could also be used to monitor the elevation of the groundwater table across the proposed storage cells. The wells should incorporated into the existing Marietta Quarry environmental monitoring systems, and be periodically measured for water level, pH and other water quality parametres to further confirm absence of potential ARD or cell seepage concerns.

Summary

In summary, significant Project-related effects on groundwater resources are not likely to occur because excavation dewatering, blasting vibration, ARD and significant metals seepage are not considered to be a problem, and due to the distance to separation distances from sensitive groundwater receptors. A groundwater monitoring program will be developed and implemented to permit the collection of site-specific groundwater data (*i.e.*, depth and chemistry). Details of the monitoring program (*i.e.*, monitoring parameters and frequency) will be developed in consultation with NSE.

5.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.7.1 Description of the Existing Environment

For the purposes of this assessment, archaeological and heritage resources are defined as physical remains that inform us of the human use of and interaction with the physical environment. These resources may be above or below the surface of the ground and cover the earliest Pre-Contact times to the relatively recent past.

Heritage resources are generally considered to include historic period sites such as cemetreies, heritage buildings and sites, monuments, and areas of significance to First Nations or other groups. Pre-Contact refers to the time before the arrival of non-Aboriginal peoples.

The assessment of heritage resources potential within the proposed Project area incorporated sources that included archaeological site records at the Nova Scotia Museum and archival resources.

Background research was conducted using the records at the Public Archives of Nova Scotia, the Nova Scotia Museum, as well as those available on the Internet. Maps consulted included those by A.F. Church (1876) and Fletcher (1884), and Ferguson (1950).

The Nova Scotia Museum's Archaeological Site Database shows no recorded pre-Contact archaeological sites within the study area. It does have record of two historic sites very close to, but just outside of the Project area, along the shoreline north and northwest of the proposed Project area. The sites, BjCi-06 and BjCi-07, are associated with James and Alexander Legertwood, who were the original grantees in the area prior to Confederation.

The potential for a site to contain First Nations archaeological resources is generally determined by the presence of resources that the Mi'kmaq people depended upon, such as food and water, as well as proximity to watercourses that were large enough to be used as a transportation route or were used to access such a route. Given the location of the Project area the potential for it containing pre-Contact archaeological resources should be considered low. The nearest watercourse is the Strait of Canso, which is a major watercourse, but it is unlikely the Mi'kmaq would have been up in such an elevated area when there were more desirable places next to the shore. The western edge of the Project area skirts McNairs Brook, which runs from Morrison Lake; but it is more likely the Mi'kmaq were to be found along the shores of McNairs Cove.

The historic settlement of the Project area is not well documented, but it is known that Legertwood brothers were granted the land encompassing the study area in the late eighteenth century, when the United Empire Loyalists were settling Guysborough County. The area prospered to a certain degree in the nineteenth century during the heyday of fishing and lumbering. With the relative demise of both industries the quarry is the largest remaining industrial development in the area.

Based on the background research the historical archaeological potential for the Project area is considered moderate to high. The research showed that there were two recorded archaeological sites located very close to the Project area and that a small section of the Project area, along the access road, has not been subjected to an archaeological survey at this time. This area was however assessed as part of the Rhodena Rock Quarry Expansion Environmental Assessment Registration (JWL 2006a), and it was determined that the area has a low potential for containing archaeological or heritage resources.

5.7.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Certain activities associated with the Project (*i.e.*, storage cell and road construction), could affect archaeological or heritage sites if they were present within the zone of surficial and subsurface disturbance. These disturbances, if unmitigated, could result in the loss of resources and the potential knowledge to be gained from its interpretation.

The Project area has low potential for identifiable human use in the pre-Contact and moderate to high potential for identifiable human use in the historic periods. It is assumed that no areas beyond the Project area will be disturbed during the development and operation of the proposed fines storage facility. As such, Project development may have adverse environmental effects on unknown heritage resources. It is therefore recommended that an archaeologist conduct an archaeological impact assessment of the Project area, which must include a pedestrian survey of the site.

If archaeological or heritage resources are discovered during Project development, the find will be immediately reported to the Curator of Archaeology and the Manager Special Places at the Nova Scotia Museum. If the resources are thought to belong to First Nations, the Chief of the nearest Mi'kmaq band will also be contacted. The appropriate authorities will determine further actions to be undertaken which could include avoidance and further assessment.

In summary, it is recommended that an archaeological impact assessment be undertaken to identify unknown heritage resources and to ensure that significant Project-related effects on these resources are not likely to occur.

5.8 AIR QUALITY

5.8.1 Description of Existing Conditions

The Project area and Nova Scotia in general, has good air quality due to the combination of maritime climate and relatively small population and industrial bases (NSDOE 1998). Climatic conditions provide good dispersion of air contaminants. The ambient air quality also benefits from the infusion of relatively clean polar and arctic air masses. Occasionally, however, long-range transport of air masses from central Canada or the eastern seaboard may transfer contaminants into the area, causing occasions of poorer air quality.

Ambient air quality is monitored in Nova Scotia with a network of 13 sites, operated by NSE and Environment Canada. Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province Common air pollutants monitored regularly are SO₂, total particulate matter (TPM), particulate matter less than 2.5 microns in diameter (PM_{2.5}), particulate matter less than 10 microns in diameter (PM₁₀), carbon monoxide (CO), ground-level ozone (O₃), nitrogen dioxide (NO₂), hydrogen sulphide (H₂S) and total reduced sulphur (TRS). The closest NSE monitoring site to the Project site is located in Port Hawkesbury at the old Post Office. In 2005 and 2006 sulphur dioxide was the only contaminat measured. The annual average for 2005 (based on 10 months of data) was 2.8 ppm and the average for 2006 was also 2.8 ppm (Environment Canada 2008).

In June of 2009 the Government of Nova Scotia, in calabration with Environment Canada and other non-government organizations, introduced a new air quality health tool, the Air Quality Health Index (AQHI), in four communities in Nova Scotia, Halifax, Greenwood, Kentville and Sydney. It is intended that the AQHI will also be available in Port Hawkesbury and Pictou at a later date. The AQHI measures the current levels of outdoor air pollution and related human health risks using a scale of 1 to 10 representing low to very high risk levels. Three air pollutants are measured in order to calculate the AQHI and include ground-level ozone (O_3) , particulate matter $(PM_{2.5})$ and nitrogen dioxide (NO_2) (Government of Nova Scotia 2009).

The Project site is located in a rural setting with little industrial development within a distance of 5 km except for the existing Martin Marietta quarry and neighboring Rhondena Rock Quarry. It is not anticipated that the common air pollutants are exceeded at the quarry location due to the separation distance from any large urban centre. In 2008 Martin Marietta reported, to the National Pollutant Release Inventory, relasing approximately 108 tonnes of PM₁₀ and 11 tonnes of PM_{2.5} (Environment Canada 2009).

Ambient air quality in Canada is regulated by the provincial government. The federal government has set objectives for air quality, which are taken into account by federal agencies in a project review. These objectives form the basis for the air quality regulations of several provinces, including Nova Scotia. The Nova Scotia regulated limits correspond to the upper limit of the Maximum Acceptable category for air quality, which are set under the *Canadian Environmental Protection Act (CEPA)*. These guidelines may have also been used as a reference by provincial or federal regulators. The air quality guidelines of tolerable, acceptable, and desirable, as defined under *CEPA*, will be used in the evaluation of significance (Table 5.4). The maximum tolerable level denotes a concentration beyond which appropriate action is required to protect the health of the general population. The maximum acceptable level is intended to provide protection against effects on soil, water, vegetation, visibility, and human wellbeing. The maximum desirable level is the long-term goal for air quality. Additional guidelines are under development by the Canadian Council of Ministers of the Environment (CCME), and ultimately this body will develop Canada-Wide Standards (CWS) that harmonize the regulations in all jurisdictions.

Table 5.4 Nova Scotia Air Quality Regulations (*Environment Act*) and *Canadian Environmental Protection Act* Ambient Air Quality Objectives

Pollutant	Averaging	Nova Scotia	Canada				
and units		Maximum	Canada	Ambient Air Quality Objectives			
(alternative units in brackets)	Time Period	Permissible Ground Level Concentration	Wide Standards (pending)	Maximum Desirable	Maximum Acceptable	Maximum Tolerable	
Nitrogen	1 hour	400 (213)	-	-	400 (213)	1000 (532)	
dioxide µg/m ³	24 hour	-	-	-	200 (106)	300 (160)	
(ppb)	Annual	100 (53)	-	60 (32)	100 (53)	-	
Sulphur	1 hour	900 (344)	-	450 (172)	900 (344)	-	
dioxide µg/m ³	24 hour	300 (115)	-	150 (57)	300 (115)	800 (306)	
(ppb)	Annual	60 (23)	-	30 (11)	60 (23)	-	
Total	24 hour	120	-	-	120	400	
Suspended Particulate Matter (TSP) µg/m³	Annual	70	-	60	70	-	
PM2.5 μg/m ³	24 hour, 98 th percentile over 3 consecutive years	-	30 (by 2010)	-	-	-	
PM10-2.5 μg/m ³		-	Recommended in 2003	-	-	-	
Carbon	1 hour	35 (31)	-	15 (13)	35 (31)	-	
Monoxide mg/m ³ (ppm)	8 hour	15 (13)	-	6 (5)	15 (13)	20 (17)	
	1	160 (82)	-	100 (51)	160 (82)	300 (153)	
Oxidants – ozone µg/m³ (ppb)	8 hour, based on 4 th highest annual value, averaged over 3 consecutive years 24 hour	-	128 {by 2010} (65)	30 (15)	- 50 (25)	-	
	Annual	-	-	- ′	30 (15)	-	
Hydrogen	1 hour	42 (30)	-	-	-	-	
sulphide µg/m³ (ppb)	24 hour	8 (6)	-	-	-	-	

The spatial boundary for the assessment of air quality is the approximate zone of influence affected by the quarrying activities. This zone lies within close proximity of the Canso Causeway and Port Hawkesbury, Cape Breton.

Temporal boundaries for the assessment of air quality have been developed in consideration of those time periods during which Project air emissions have the potential to degrade ambient air quality. In general, any emissions that could affect air quality will be relatively temporary from construction activities; however, emissions from such sources as vehicles will be fairly regular.

Other temporal considerations for atmospheric emissions include variations in meteorological conditions, which are related to the capacity for contaminant transport. Sensitivity of receptors to certain atmospheric contaminants (*e.g.*, dust) may also vary by season (*i.e.*, more sensitive in warm weather with increased outdoor activities).

5.8.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Quarrying activities can generate dust (*i.e.*, particulate emissions) which has the potential to be transported offsite. There are a variety of activities that can lead to the generation of particulate matter on the fines storage site and access road. The primary potential sources of TSP include:

- Exhaust gas emissions due to incomplete combustion from diesel compression engine;
- Road dust;
- Material transport; and
- Truck loading / truck unloading.

The wash fines material contain high moisture content; it is therefore unlikely that particulate will be emitted from the transport or truck loading or unloading. Particulate emissions can occur whenever vehicles travel over both paved and unpaved surfaces primarily due to resuspension of loose material on the road surface. Although there are also emissions of combustion gases and products of incomplete combustion from the exhaust of the on-site vehicles and equipment, these are considered nominal. Monitoring of particulate emissions (dust) will be conducted at the request of NSE.

Dust generated by truck movement will be minimized by speed control, proper truck loading, application of dust suppressants, proper construction of on-site roads, and/ or other means as required by NSE.

The air quality impacts of the fines storage cells and access road can be controlled by standard mitigation practices and the Project is not likely to create significant adverse effects on air quality.

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

The existing Mulgrave Quarry is located in Guysborough County, just north of the Town of Mulgrave, adjacent to Cape Porcupine. The proposed fines storage site is in the Town of Mulgrave, approximately 1 km southeast of the existing quarry. The quarry and proposed Project area are situated in a rural setting. Approximately 17 residences are located within 800 m of the existing quarry site, and approximately 67 are located within 800 m of the proposed storage site.

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The population in the general area (*i.e.*, Guysborough County) is 9,058 (Statistics Canada 2006). The population in this area decreased by 7.8% between 2001 and 2006. The employment rate in the County is 46.4% and the unemployment rate is 15.2% (Statistics Canada 2006). Over half of the experienced labour force consists of trades, transport and equipment operators and related occupations (21%); sales and service occupations (19%); and occupations unique to the primary industry (18%) (Statistics Canada 2006).

The closest town is Mulgrave. In fact, the Mulgrave town line runs through the proposed Project property (Figure 1). Between 2001 and 2006, the town's population decreased 2.8% to 879 residents (Statistics Canada 2006). The employment rate in Mulgrave is 59.7% and the unemployment rate is 10.6%. Approximately half of the labour force consists of trades, transport and equipment operators and related occupations (28%), and sales and service occupations (25%).

The existing quarry currently employs 110 people. Drilling and blasting activities are sub-contracted to a professional blasting company. Hauling materials from the quarry is also contracted. To date, most of the aggregate extracted from the quarry has been exported out of province. The majority is transported from the site via ships and barges, and hauling is typically arranged through the customers. Small amounts are hauled by truck and used for local construction projects, such as road building and municipal, residential, and commercial developments.

Land Use

Mining

The Guysborough County Regional Development Authority (GCRDA) adopts a pro-development approach to adding value to natural resources, including mineral resources in the County (GCRDA 2003 and GPCEL 2007). A Visioning Audit undertaken in 2003 by the GCRDA's Strategic Planning Advisory Committee identified key challenges faced by the County with respect to local population, business and industry. The audit concluded that increased unemployment, loss of young people, and economic stagnation were expected to occur unless demographic and economic trends within the County changed. The GCRDA committed to encouraging opportunistic growth to offset the undesirable trends and promote community well-being (GCRDA 2005). Mineral resource extraction is one of GCRDA's strategies for adding value to natural resources. The proposed quarry fines storage project is therefore consistent with expressed GCRDA strategic planning and business development approaches.

A review of the NSDNR Abandoned Mine Openings Database (2006) indicates that there are 11 mine shafts within a 10 km radius of the boundaries of the Project property. These shafts are located in the following areas:

Eight shafts at Little River Reservoir (Coal); and

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Three shafts at Caribou Cove (Coal).

The statuses of these mine shafts are not known. However, they are all of sufficient distance from the Mulgrave Quarry and proposed fines storage property that they are not anticipated to interact in any way with the Project.

Agriculture

The Project is not located in a region where conflict with current and future agricultural practices is anticipated. The land on which the proposed storage site will be located is currently owned by Martin Marietta.

Forestry

Intensive forestry or silviculture operations have not been identified in the region within and surrounding the Project area.

Transportation

The Mulgrave Quarry is located adjacent to Route 344, approximately 2.3 km south of the Highway 104 intersection at Auld Cove.

A transportation assessment was not conducted in support of this environmental registration. Such a study was not deemed necessary given that Project activities include the development of a private access road between the existing Mulgrave Quarry and the proposed storage site. The Project is therefore not anticipated to result in any significant increase in the volume of truck traffic on public roads compared to current levels.

Truck traffic to and from the existing Mulgrave Quarry is minimal; 95% of the aggregate produced by the quarry is hauled directly from the site via ships and barges. Current hauling practices are not anticipated to change as a result of the Project since the proposed fines storage area will only be used as a fines storage site and will not contribute to an increase in overall aggregate production volumes.

Recreation and Tourism

Recreational fishing and hunting are permitted in the region surrounding the Project area. However, recreational fishing records were not available and the lakes surrounding the Project area are not included in the Provincial recreational fish stocking program. While moose hunting is not permitted in the region surrounding the Project area, deer hunting is allowed. The Mulgrave Quarry is situated in Deer Management Zone 4. Zone 4 is the largest deer hunting zone and has the largest number of stamps available; 7,000 stamps were issued for this zone in 2008 (NSDNR 2009). The seasons for hunting deer during 2009 are as follows: the special youth season runs from October 16 to October 24; the general open season runs from October 30 to December 5;

and the bowhunting season runs from September 26 to October 29 and December 7 to December 12. All of these deer hunting seasons exclude Sundays (NSDNR 2009).

There are no designated parks within or surrounding the Project area.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality. Air quality is addressed in Section 5.7.

5.9.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Population and Employment

The direct and indirect employment associated with current operation of Mulgrave Quarry may be considered a benefit, or positive effect, to the regional economy. Employment levels will increase temporarily during Project construction, but is expected to remain similar to current job levels at the quarry over the long term. Project-related employment effects may therefore be considered positive during Project construction.

Exported quarry products are a source regional economic growth. Local use of quarry products supports regional development and infrastructure. The proposed fines storage Project will not result in additional products but is considered vital to the long term prosperity of the quarry operation. Project-related economic effects may therefore be considered positive.

Land Use

Due to the existing industrial activity in the vicinity of the Project area, (*i.e.*, the existing Mulgrave Quarry and Rhodena Rock Quarry) the distance of the proposed storage site from most residences and groundwater receptors, and proposed tree buffers, impacts on existing and future adjacent land uses are not expected. All activities at the existing quarry and the proposed storage site will be conducted in accordance with the Pit and Quarry Guidelines (as applicable).

The proposed Project area will be developed for use as a storage site, and conventional quarrying activities will not take place at the site. Therefore, noise emissions associated with quarry operations (*i.e.*, blasting, crushing and stockpiling) will not be generated as a result of the Project. The proposed storage site is located approximately 220 m from the nearest building. The potential for noise from the Project site to have a significant effect on residents is minimal.

As per the requirements of standard provincial guidelines, sound levels at the storage site will be maintained at a level not to exceed the following sound levels (L_{eq}) (NSEL 2005):

L_{eq} 65dBA 0700-1900 hours (Days);

60dBA 1900-2300 hours (Evenings); and

55dBA 2300-0700 hours (Nights).

Transportation

The Project is not anticipated to result in an increase in truck traffic on public roads above that associated with the existing Mulgrave Quarry operation. The majority of aggregate produced by the existing quarry will continue to be transported directly from the site via ships and barges.

Development of a new private access road is required for this Project for the purpose of transporting aggregate fines destined for storage at the proposed facility. This road will run between the existing Mulgrave Quarry and the proposed storage site and will be maintained by Martin Marietta. Approximately 20 truckloads of material will be transported along the private access road daily using 50 tonne CAT trucks. The road will not affect the level of performance or safety of Route 344 and will be inaccessible to the public, thus avoiding any public transportation impacts.

Recreation and Tourism

The existing quarry and proposed fines storage Project are not likely to have an impact on hunting and recreational fishing in the general area. Two active quarries (*i.e.*, Mulgrave Quarry and Rhodena Rock Quarry) are presently operational in the vicinity of the Project site. It is therefore likely that wildlife has already adjusted to these disturbances. Although the quarry is situated in a hunting management zone, the Project is not located on Crown land and thus hunters will require permission from Martin Marietta to pursue their activities in the area. Fishing may occur in the tributary to Morrisons Lake or in McNairs Brook; however, the Project is not expected to have an impact on these activities due to the enclosed nature of the storage facility (*i.e.*, containment cells) as well as the distance of the facility from these potential recreational fishing locations.

Human Health

Project activities may result in a slight increase in air emissions; however, these impacts will be temporary and localized and are not expected to result in any significant effects on human health. Human health related issues pertaining to air quality are discussed in more detail in Section 5.7. The Project will not result in any impacts on the safety of travelers, as it will not entail any significant effects on traffic on public roads. The health and safety of nearby residences is not expected to be affected by the Project.

5.10 OTHER UNDERTAKINGS IN THE AREA

5.10.1 Description of the Existing Environment

The Proponent is not aware of any active pit operations licensed to operate within a 10 km radius of the Project. One active quarry operation is licensed to operate within a 10 km radius of the Project. Rhodena Rock Limited operates a quarry at Porcupine Mountain, on property immediately adjacent to Mulgrave Quarry that extracts approximately 300,000 tonnes per year. The quarried material consists of various aggregate types and will be primarily used for general construction purposes.

The Rhodena Rock Quarry stockpiles products at the quarry site until they are sold and transported to local markets via tandem trucks or tractor trailer trucks. An average of approximately five trucks hauls material from the site daily. The primary markets for the products are general construction and development projects (*i.e.*, highway construction and maintenance) and municipal water and sewer projects in Nova Scotia.

5.10.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The proposed fines storage site will not compete with the Rhodena Rock Quarry in terms of trucking traffic, water withdrawal, *etc.* The Rhodena Quarry markets are primarily local while the Mulgrave Quarry relies on its proximity to the Strait of Canso for national and international shipments. All operations are currently functioning without any issues in terms of noise, dust, emissions, traffic, *etc.* As the proposed Project does not include an increase in production, and assuming the effective application of mitigative measures, significant adverse Project-related effects regarding other undertakings in the area are not likely to occur.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Activities associated with the existing Mulgrave Quarry operation are conducted in accordance with terms and conditions of the existing Industrial Approval and the Pit and Quarry Guidelines. These activities will be unaffected by construction and operation of the proposed storage cells. An Industrial Approval amendment application will be filed for the storage site, and the facility will operate in accordance with terms and conditions of the amended Approval. Project construction activities will be carried out in compliance with appropriate environmental regulations as well as standard safe work and environmentally responsible practices.

Although the potential for encountering acid rock in the Project area is low, discovery of localized acid generating bedrock is possible within mineralized zones. Any such material present on the site during construction or operation of the storage cells will be managed according to provincial regulations and best practices pertaining to sulphide-bearing material and the prevention of acid drainage, if applicable.

Environmental effects associated with developing the storage site will include the loss of terrestrial habitat within the proposed Project footprint. The Proponent is committed to wetland compensation for the loss of any wetland habitat as a result of the Project. Field surveys conducted to date indicate that this area does not include unique or critical habitat for rare or sensitive species; therefore, these effects are not anticipated to be significant. Recommended mitigative measures include conducting clearing activities outside of the bird breeding season and using seed mixtures that are free of noxious weeds, and contain native plants or naturalized species, wherever practical, during site reclamation.

Effects on local surface and groundwater are anticipated to be not significant. The facility will consist of an engineered structure designed to manage environmental issues such as site runoff and groundwater flows and secure fines containment.

Minor impacts on air quality can be expected during construction activities as a result of emissions from cranes, vehicles, and heavy equipment. Project activities and associated air emissions will be temporary and localized. Equipment required for this Project will be appropriately selected and/or properly maintained, and will represent only a small increase in total potential air emissions above those that are currently generated by local sources on an ongoing basis (*i.e.*, traffic on Route 344, existing operations at Mulgrave Quarry and Rhodena Rock Quarry).

Assuming the mitigative measures specified in this report are implemented, and the proposed facility is operated according to existing provincial guidelines and pending approvals, no significant adverse residual environmental or socio-economic effects are likely. Continued operation of the quarry will result in economic benefits, including employment and ongoing business opportunities of regional importance.

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7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The definition of an environmental effect often includes any change to the project that may be caused by the environment. In the case of the proposed storage site, potential effects of the environment on the Project include climate and meteorological conditions (e.g., precipitation, storms and extreme weather events, and climate change) and natural disasters such as earthquakes.

Precipitation and runoff may cause temporary delays in construction activities. Wet weather or snow may also affect hauling of material from the existing Mulgrave Quarry to the storage site. On a national basis, Canada shows a warming and cooling pattern with a higher overall warming trend of approximately 1.1 °C since 1895. The Atlantic Region, however, shows a warming trend from 1895 which peaked in the mid 1950s followed by a cooling trend in the 1990s. The overall warming trend of 0.4 °C in Atlantic Canada since 1895 is not statistically significant. With respect to precipitation, the Atlantic Region shows an overall increasing trend in precipitation since 1948, with an increasing trend in the number of daily precipitation events above 20 mm and a very slightly increasing trend in the number of daily snowfall events above 15 cm (Lewis 1997).

There are a number of planning, designs, and construction strategies intended to minimize the potential effects of the environment on the Project so that the risk of damage to the Project or interruption of operation can be reduced to acceptable levels. Mitigation measures include, but are not limited to, designing the structure to manage site runoff and groundwater flows resulting from precipitation, and considering weather conditions when scheduling activities, including scheduling of activities to accommodate weather interruptions. In summary, climate and meteorological conditions, including climate change, are not anticipated to significantly affect development of the storage site or its operation over its proposed lifetime.

If an earthquake or other unforeseen extreme event were to occur at the Project site, the integrity of the storage facility could conceivably be compromised, thus potentially resulting in the release of aggregate fines into the environment and/or disruption of design features to manage site runoff and groundwater flows. This is very unlikely to occur, however and the cells will be designed to all applicable design codes considering a range of geological risks. Potential environmental impacts arising from such an event could be mitigated through implementation of an Emergency Response Plan.

8.0 OTHER APPROVALS REQUIRED

The Proponent is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other releveant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from NSE for operation of the Project (which could be a modification of the quarry's existing Approval), and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Saftety Act* (1996). Wetland Alteration and Watercourse Alteraton approvals will also be required according to the Activities Designation Regulations. Provincial guidelines to be adhered to include, the *Pit and Quarry Guidelines* (NSE 1999). Examples of other relevant federal legislation include the *Migratory Birds Convention Act* and the *Species at Risk Act*.

FINAL REPORT: ENVIRONMENTAL ASSESSMENT

9.0 FUNDING

The proposed fines storge Project will be 100 % privately funded.

10.0 ADDITIONAL INFORMATION

No additional information is provided in support of this document.

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12.0 Appendices

APPENDIX A	Registry of Joint Stocks and Industrial Approval
APPENDIX B	MSDS Sheet
APPENDIX C	Government Comments Draft EA - Disposition Table
APPENDIX D	Project Information Bulletin and Letters
APPENDIX E	Freshwater Chemistry Analysis and Aquatic Photo Appendix
APPENDIX F	Vascular Plants Recorded in Study Area
APPENDIX G	Breeding and Population Status of Birds Recorded in the Project Area
	and the Breeding Bird Atlas Square
APPENDIX H	Plant and Bird Species Recorded by Wetland
APPENDIX I	Fines Leachate Analysis

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APPENDIX A
Registry of Joint Stocks and Industrial Approval



Print

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PROFILE - MARTIN MARIETTA MATERIALS CANADA LIMITED - as of: 2009-11-03 02:03 PM

Company/Society Name:	MARTIN MARIETTA MATERIALS CANADA LIMITED	
Registry ID:	2481447	
Type:	N.S. Limited Company	
Nature Of Business:		
Status:	Active	
Jurisdiction:	Nova Scotia	
Registered Office:	900-1959 UPPER WATER ST HALIFAX NS Canada B3J 3N2	
Mailing Address:	P O BOX 997 HALIFAX NS Canada B3J 2X2	

PEOPLE

Name	Position	Civic Address	Mailing Address
ROSELYN R. BAR	Director	2710 WYCLIFF ROAD	
		RALEIGH NC 27607	
C. HOWARD	Divoctor	2710 WYCLIFF ROAD	
NYE	Director	RALEIGH NORTH CAROLINA 27607	

ANNE H.	Director	2710 WYCLIFF ROAD	
LLOYD	Birector	RALEIGH NC 27607	
STEPHEN P.		2710 WYCLIFF ROAD	
ZELNAK, JR.	Director	RALEIGH NORTH CAROLINA 27607	
R. PAXTON	ASSISTANT	2710 WYCLIFF ROAD	
BADHAM, JR.	SECRETARY	RALEIGH NORTH CAROLINA 27607	
ANN M.	ASSISTANT	2710 WYCLIFF ROAD	
CONNICK	SECRETARY	RALEIGH NORTH CAROLINA 27607	
ROSELYN R.	VP & SECRETARY	2710 WYCLIFF ROAD	
BAR		RALEIGH NORTH CAROLINA 27607	
PAMELA M.	ASSISTANT	2710 WYCLIFF ROAD	
KELLY	SECRETARY	RALEIGH NORTH CAROLINA 27607	
ANNE H.	VICE PRESIDENT	2710 WYCLIFF ROAD	
LLOYD	AND TREASURER	RALEIGH NC 27607	
WILLIAM A.	PRESIDENT	2710 WYCLIFF ROAD	
DiRICO, JR.		RALEIGH NORTH CAROLINA 27607	
DAVID A. STEWART	Recognized Agent	900-1959 UPPER WATER ST	BOX 997, 800- 1959 UPPER WATER ST
		HALIFAX NS B3J	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

	3N2	HALIFAX NS B3J
		2X2

ACTIVITIES

Activity	Date
Annual Statement Filed	2009-10-26
Annual Renewal	2009-10-23
Annual Renewal	2008-10-27
Annual Statement Filed	2008-10-27
Change of Directors	2008-05-22
Annual Renewal	2007-09-07
Annual Statement Filed	2007-09-07
Annual Renewal	2006-10-27
Annual Statement Filed	2006-10-27
Annual Statement Filed	2005-09-20
Annual Renewal	2005-09-19
Annual Statement Filed	2004-10-05
Annual Renewal	2004-10-04
Annual Renewal	2003-10-31
Annual Statement Filed	2003-10-31
Annual Renewal	2002-10-03
Annual Statement Filed	2002-10-03
Change of Directors	2001-11-30
Annual Renewal	2001-10-29
Annual Statement Filed	2001-10-29
Change of Directors	2000-12-15
Annual Statement Filed	2000-11-01
Annual Renewal	2000-10-31

Annual Renewal	1999-10-01
Annual Statement Filed	1999-10-01
Annual Statement Filed	1998-10-29
Annual Renewal	1998-10-28
Change of Directors	1998-01-21
Annual Renewal	1997-10-21
Annual Statement Filed	1997-10-20
Annual Renewal	1996-09-20
Annual Statement Filed	1996-09-20
Change of Directors	1995-10-13
Registered Office Change	1995-09-25
Agent Filed	1995-09-25
Special Resolution	1995-09-25
Incorporated	1995-09-20
Registered	1995-09-20

RELATED REGISTRATIONS

There are no related registrations on file for this company.

P.O. Box 806 Port Hawkeebury, Nove Scotia Tel: (802) 625-0781 Bob 2V0 Fax: (902) 625-3722

File No: 92100-30 App. No: 2000-016493

November 10, 2000

Martin Marietta Materials Canada Limited P. O. Box 278 Mulgrave, Guys. Co. Nova Scotia B0E 2G0

Attention; Mr. Donnie France

Dear Mr. Fraser:

Attached is your approval under the Environment Act authorizing the operation of a quarry at Aulds Cove, Guysborough County, Nova Scotia.

This approval or a copy is to be kept on-site at all times. All personnel involved in the project must be made fully aware of the terms and conditions of this approval. The terms and conditions are shown on the approval and it is your responsibility to ensure that they are followed. Failure to comply with the terms and conditions is an offence.

It is your duty to advise the Department of any new and relevant information respecting any adverse effect that results or may result from the approved activity, which comes to your attention after the issuance of the approval. This is required under Section 60 of the Environment Act.

If you alter, extend or modify the activity beyond the description given in your approval, you should reapply because a new approval may be required.

-2-

Please call at once if you have any questions about the conditions of this approval, especially those pertaining to the actual construction. You may reach me at (902) 625-0791.

Yours truly,

Don Feldman, C.E.T. District Manger Eastern Region

LM:dm

NOV-10-2000 17:23

cc: Mr. Lorne MacNeil

TERMS AND CONDITIONS OF APPROVAL

NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT

Project:

Martin Marietta Materials Canada Ltd.

P. O. Box 278, Mulgrave, Guys. Co., N. S., B0E 2G0

Quarry, Aulds Cove, Guys. Co., N. S.

Approval No.

2000-016493

File No.

92100-30

Conditions:

This application is recommended for approval subject to the following terms and conditions:

1. Scope of Approval

This approval relates to <u>Martin Marietta Materials Canada Limited</u>, hereafter called the "proponent" and their request to operate a <u>quarry</u> at Aulds Cove, Guysborough County, Nova Scotia. This approval includes renewal of the existing quarry approval and expansion of the quarry to the adjacent property as detailed in the Environmental Assessment Registration document submitted on July 17, 2000.

2. Conditions of Release

The proponent shall comply with all Conditions of Environmental Assessment Approval issued on August 11, 2000.

3. General Terms and Conditions

- a) The proponent shall conduct its' quarry in accordance with provisions of the:
 - i) Environment Act, SNS 1994-95 C. 1;
 - ii) Regulations pursuant to the above Act;
 - iii) Local municipal environmental bylaws, zoning restrictions.
- b) The Minister reserves the right to modify, amend, or add terms and conditions to this Industrial Approval at any time provided that any modification, addition, or amendment is deemed necessary to ensure adequate environmental protection.
- c) This Industrial Approval is not transferrable without the written permission of the Minister.

- d) If the Minister determines that there has been non-compliance with any or all of the terms and conditions provided in this Approval issued pursuant to Section 56(1) of the *Environment Act*, the Minister may in accordance with Section 58 (2)(b) cancel or suspend, the approval until such time as the Minister is satisfied that all terms and conditions have been met.
- e) The proponent shall notify the Nova Scotia Department of the Environment prior to any process changes or changes to waste disposal practices not approved under authorization of this approval.
- f) The proponent shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this approval.
- g) The proponent shall develop the site in such a manner as to expose only the areas that are currently being used/excavated.
- h) The proponent shall ensure that this approval or a copy is kept on-site at all times and that personnel directly involved in the project are made fully aware of the terms and conditions which pertain to this approval.
- i) The proponent shall submit a legal property boundary survey outlining the active area of the pit site by December 31, 2000.

4. Particulate Emissions

a) Particulate emissions shall not exceed the following limits at the site property boundaries:

Annual Geometric Mean 70 ug/m³
Daily Average (24 hrs) 120 ug/m³

- b) The generation of fugitive dust from the site will be suppressed by the application of water sprays, or the application of other suitable dust suppressants approved by the Department.
- c) A spray bar system shall be used to apply water to control dust from crushing plants and conveyor belts. Additional spray bars shall be installed as required for dust suppression. The water supply to the spray bars shall be monitored to ensure that dust suppression is maintained.
- d) The Proponent shall provide details of their dust control and monitoring plan for review by the Department prior to December 31, 2000.

- 3 -

e) Site access road(s) shall be maintained to minimize dust generation. The use of waste oil is <u>not</u> permitted.

NOTE:

Monitoring of Particulate Emissions shall be at the request of the Nova Scotia Department of the Environment and Labour District Office.*

Sound Levels

Sound levels measured at the property boundaries shall not exceed the following equivalent sound levels (leq):

Leq 65 dBA 0700-1900 hours (Days)

60 dBA 1900-2300 hours (Evenings) 55 dBA 2300-0700 hours (Night)

NOTE:

Monitoring shall be at the request of the Nova Scotia Department of Environment and Labour District Office.*

6. Effluent Discharge Water

Any effluent discharges from gravel washing to the Strait of Canso must be sampled prior to release and be in compliance with the Total Suspended Solids and pH limits listed in term and condition 7(b). A quarterly summary of results shall be submitted to the Nova Scotia Department of Environment and Labour District Office,*

7. Surface Water

- a) The site shall be maintained to prevent siltation of the surface water which is discharged from the property boundaries into the nearest watercourse. This includes the installation of soil erosion and sedimentation control designed to meet the specifications of this Department.
- b) All erosion and sedimentation control devices shall be installed prior to any excavation of material.
- c) If it becomes necessary to drain the pit workings, the wastewater shall be drained to settling ponds for appropriate treatment to meet the suspended solids limits outlined in condition 7 (d).
- d) The proponent shall sample and ensure the following liquid effluent levels are met:

- 4 Final Effluent Discharge Limits

Parameters	Maximum in a Grab Sample	Monthly Arithmetic Mean	Monitoring Frequency
Total suspended solids	50 mg/l	25 mg/l	each precipitation discharge event
рН	5-9	6-9	each precipitation discharge event

- e) Non-compliance of the above final effluent discharge limits shall be immediately reported to the Nova Scotia Department of Environment and Labour District Office.*
- f) Monitoring stations for liquid effluent shall be determined by the Nova Scotia Department of the Environment and Labour District Office* following a final inspection of the site.
- g) A summary of results of monitoring shall be submitted to the Nova Scotia Department of the Environment and Labour District Office* upon request.

8. Groundwater

The proponent shall investigate and replace, at their expense, any water supply which has been lost or damaged as a result of activities associated with this aggregate operation, in accordance with their Water Supply Policy.

9. Separation Distances

- a) The proponent shall maintain a 30 m (100 feet) separation distance from the excavation to the road allowance of any common or public highway.
- b) The proponent shall not locate any buildings, product stockpiles, plant or structures within 30 m (100 feet) of the boundary of the quarry property.
- c) The proponent shall maintain a 90 m (300 feet) separation distance from the working face of the quarry, any building, product stockpiles, plants or structures to the nearest offsite structure.

- d) The proponent shall maintain an 800 m (0.5 mile) separation distance from any blast site to the nearest off-site structure or obtain written consent from the structure owners.
- e) The proponent shall maintain a 30 m (100 feet) separation distance from the pit or quarry excavation and associated works from the bank top or high water mark of any surface watercourse.
- f) The proponent shall maintain a 15 m (50 feet) separation distance from the quarry excavation to any other property boundary.

10. Blasting

- a) The proponent shall have a blast design prepared by a qualified consultant and the design sent to the Nova Scotia Department of the Environment for review prior to any blasting.
- b) Any updates of the submitted pre-blast survey must be filed with the Department.
- c) The proponent shall call the nearest weather office, to assess the climatic conditions prior to conducting any blasting. No blasting will be permitted if a thermal inversion is anticipated at the time of the proposed blast.
- d) The proponent shall ensure that all blasts are monitored at the three designated locations approved by the Department. The proponent shall notify the local broadcast media and the local Department of Environment and Labour office three hours prior to setting off the blast charge. The following limits for blasting shall not be exceeded:

Air Blast 128 dBL Ground Vibration 12.5 mm/sec

NOTE: All blasts are to be monitored by a person acceptable to the

department and the results sent to the Nova Scotia Department of Environment and Labour District Office* on a monthly basis.

11. Reclamation

a) The proponent shall submit an updated preliminary reclamation plan to the Nova Scotia Department of the Environment and Labour District Office* for approval by March 31, 2001.

- b) The site shall be progressively reclaimed and rehabilitated where possible by grading, contouring and re vegetating the disturbed land as identified in the plan required under condition 11 (a).
- c) The proponent shall rehabilitate the site within six (6) months of abandonment and in accordance with the approved reclamation plan or other terms as specified by the Department.
- d) The proponent shall post a security in a form acceptable to the Department in the amount of \$2,500.00 an acre of active area. The existing security bond shall be adjusted to reflect the active area identified in the Site Development Plan, Drawing No: 062-300. The proponent shall provide the revised bond by December 31, 2000.
- e) The Nova Scotia Department of the Environment and Labour shall release the security to the proponent after rehabilitation of the active area has been completed to the satisfaction of the Minister of the Environment and Labour.
- f) The proponent shall ensure that any security posted for rehabilitation be kept valid for the term of the approval.

12. Gravel Wash Sludge

The proponent shall investigate long term options for the use or disposal of the sludge produced during gravel washing operations. Disposal shall meet with the approval of the Department*.

13. Record Keeping

The proponent shall maintain all monitoring reports for a minimum of two years.

14. Transportation

Prior to leaving the quarry site, all trucks which are owned by or under contract to the proponent shall:

- a) Be fitted with tarpaulins to cover loads.
- b) Have property functioning engine noise muffling devices and other operating equipment.
- c) Be cleaned of loose materials and inspected.

-7-

15. Expiry Date

This approval shall expire on December 31, 2010.

Port Hawkesbury District Office*

FINAL REPORT: ENVIRONMENTAL ASSESSMENT

APPENDIX B MSDS Sheet

MATERIAL SAFETY DATA SHEET

PAGE: 1 of 5

Date Reviewed: October 8, 2008

1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

MWML CA 4500 MWML CB480B

Supplier: Millennium Water Management Ltd

65 Coventry Lane Dartmouth NS 902-462-3868 Manufacturer:

SNF Inc. PO Box 250 Riceboro Ga 912-884-3366

2. COMPOSITION/INFORMATION ON INGREDIENTS

Identification of the preparation :

Cationic water-soluble polymer

The product is not considered hazardous in accordance with OSHA Federal Regulation 29 CFR

1910.1200.

Identification of the substance:

3. HAZARDS IDENTIFICATION

Aqueous solutions or powders that become wet render surfaces extremely slippery.

4. FIRST AID MEASURES

Inhalation:

Move to fresh air.

Skin contact:

Wash with water and soap as a precaution. In case of persistent skin irritation, consult a

physician.

Eye contact:

Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation,

consult a physician.

Ingestion:

The product is not considered toxic based on studies on laboratory animals.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media:

water, water spray, foam, carbon dioxide (CO2), dry powder

Fire extinguishing agents to avoid:

None.

Special fire-fighting precautions:

Aqueous solutions or powders that become wet render surfaces extremely

slippery.

Protective equipment for firefighters:

No special protective equipment required.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:

No special precautions required.

Environmental precautions:

Do not contaminate water.

Methods for cleaning up:

Do not flush with water. Clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling:

Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Wash hands before

breaks and at the end of workday.

Storage:

Keep in a dry, cool place $(0 - 35^{\circ}C)$.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls:

Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.

Personal protection equipment

- Respiratory protection :

Dust safety masks are recommended where concentration of total dust is more than 10

- Hand protection:

mg/m³. Rubber gloves.

- Eye protection :

Safety glasses with side-shields. Do not wear contact lenses.

- Skin protection :

No special protective clothing required.

Hygiene measures:

Wash hands before breaks and at the end of workday. Handle in accordance with good

industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:

granular solid

Color:

white

Odor:

none

pH:

2.5 - $4.5\ @\ 5g/l\ _{for\ product\ series.}$ See Technical Bulletin for specific value.

Melting point (°C):

Not applicable.

Boiling point/range (°C):

N/A

Flash point (°C):

Not applicable.

Autoignition temperature (°C):

Not applicable.

Vapour pressure (mm Hg):

Not applicable.

Bulk density:

See Technical Bulletin

Water solubility:

See Technical Bulletin

Viscosity (mPa s):

See Technical Bulletin

10. STABILITY AND REACTIVITY

Stability:

Product is stable, No hazardous polymerization will occur..

Materials to avoid

Oxidizing agents may cause exothermic reactions.

Hazardous decomposition

products:

Thermal decomposition may produce: hydrogen chloride gas, nitrogen oxides (NOx),

carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

- Oral :

LD50/oral/rat > 5000 mg/kg

- Dermal:

The results of testing on rabbits showed this material to be non-toxic even at high dose levels.

- Inhalation :

The product is not expected to be toxic by inhalation.

Irritation

- Skin :

The results of testing on rabbits showed this material to be non-irritating to the skin.

- Eyes :

Testing conducted according to the Draize technique showed the material produces no corneal

or iridial effects and only slight transitory conjuctival effects similar to those which all

granular materials have on conjuctivae.

Sensitization:

The results of testing on guinea pigs showed this material to be non-sensitizing.

Chronic toxicity:

A two-year feeding study on rats did not reveal adverse health effects. A one-year feeding

study on dogc did not reveal adverse health effects.

12. ECOLOGICAL INFORMATION

Ecotoxicity:

The aquatic toxicity is highly mitigated by the presence of dissolved organic carbon in the water. Results obtained using the US EPA "Dirty Water" test show that irreversible adsorption onto suspended matter and dissolved organics (such as humic and other organic acids) present in natural waters, reduces the toxicity to aquatic organisms by a factor of over

Environmental fate:

The product is rapidly eliminated from the aquatic medium through irreversible adsorption onto suspended matter and dissolved organics.

Bioaccumulation:

The product is not expected to bioaccumulate.

Persistence / degradability :

No data available

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused

products:

In accordance with federal, state and local regulations.

Contaminated packaging:

Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local

regulations.

14. TRANSPORT INFORMATION

Not regulated by DOT.

15. REGULATORY INFORMATION

All components of this product are on the TSCA and DSL inventories.

RCRA status:

Not a hazardous waste.

Hazardous waste number:

Not applicable

Reportable quantity (40 CFR 302):

Not applicable

Threshold planning quantity (40 CFR 335):

Not applicable

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PAGE;	5015

California Proposition 65 information:

The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known to the State of California to cause cancer: acrylamide.

IMIS & NFPA Ratings	HMIS	NFPA	
Health :	1	1	
Flammability :	1	1	
Reactivity :	0	0	

16. OTHER INFORMATION

Person to contact:

Regulatory Affairs Manager

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release, and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process unless specified in the text.

MWML CA 4600 MWML CB480B



FINAL REPORT: ENVIRONMENTAL ASSESSMENT

APPENDIX C
Government Comments Draft EA - Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
1	NSE – Andrew Murphy, Manager Air Quality Branch	On page 5.38, it says "Port Hawkesbury is the only area in the province that experiences periodic exceedences in air quality". This is not correct and also seemingly in contradiction with the next sentence that says "All other air quality exceedences in the province are caused by ground level ozone"	Comment acknowledged and Section 5.8.2 (Description of Existing Conditions – Air Quality) has been revised.
2	NSE – Andrew Murphy, Manager Air Quality Branch	On page 5.38, it says "Ambient air quality is monitored in Nova Scotia with a network of 28 sites, operated by NSE, Environment Canada, and Nova Scotia Power Inc." This is not an accurate statement. The provincial air quality monitoring network consists of 13 sites and operated jointly by NSE and Environment Canada. There are other monitors across in Nova Scotia operated by private companies, such as but not limited to Nova Scotia Power, but these sites are not considered part of the provincial network and are not reported on by NSE.	Please refer to the response to Comment #1.
3	NSE – Andrew Murphy, Manager Air Quality Branch	On page 5.38 it says "Since 1997, the province began continuous reporting of an air quality index for the Port Hawkesbury region." The air quality index has now been replaced by the Air Quality Health Index (AQHI). The AQHI for Port Hawkesbury will be available in May 2010	Please refer to the response to Comment #1.
4	NSE – Andrew Murphy, Manager Air Quality Branch	Many of the references used are old (for example, NSDOE 1995) and perhaps no longer valid. Updated references should be used. The references given also sometimes do not match up with the associated facts. For example, there is a reference to NSEL 2004, which in the literature cited section is described as the air monitoring network map. The data given in association with this reference could not have been obtained from this map.	Please refer to the response to Comment #1.
5	NSE – Dave Briggins, Manager Water and Wastewater Branch	The document references the NS Well Log Database (2008) as a source of information on local water wells. Note that a new version of the database is available for 2009 which includes more recently constructed wells. The most recent version of the database can be downloaded from the following address: http://www.gov.ns.ca/nse/groundwater/welldatabase.asp	Comment acknowledged. An additional search of the 2009 Well Log Database was conducted to confirm that no new logs were added to the database since the 2008 version. Stantec was able to retrieve the well log for a well described in the Draft EA document as "Unknown NSE No.". The groundwater section has been revised with this information. It should be noted that the groundwater section was written in July, 2009, when the 2009 database was not available.
6	NSE – Dave Briggins, Manager Water and Wastewater Branch	On page 5.33, it is indicated that the SPLP results should be adjusted by a factor of 10 to account for natural attenuation and the following reference is given to support this: Alforque, 1996. Note that this reference does discuss the SPLP procedure, however, it does not mention using dilution factor of 10. Is this the correct reference?	The Alforque, 1996 reference supports the use of SPLP analysis as representative for the Martin Marietta scenario and was not intended to support the use of an attenuation factor of 10. Refer to the response below to comment # 37, inquiry regarding use of 10 as an attenuation factor and excerpt from OMOE, 1996 reference. The OMOE, 1996 reference has been added and the sentence revised.

Comment No.	Comment Issuer	Comment Received	Comment Response
7	NSE – Dave Briggins, Manager Water and Wastewater Branch	Figure 5 shows 2 locations for Well No. 680201, but does not provide a label for Well No. 730201.	Figure 5 has been revised.
8	NSE – Dave Briggins, Manager Water and Wastewater Branch	On Figure 5, one well is labelled as "Unknown HSE Well No." Was this meant to read "Unknown NSE Well No."?	Figure 5 has been revised.
9	NSE – Dave Briggins, Manager Water and Wastewater Branch	The notes in Table 5.3 state that the Well Logs Database (2008) includes information on wells constructed between 1940 and 2004. Note that this database includes data from wells constructed between 1940 and 2008. As mentioned above, there is a more recent database now available, which includes data from wells constructed between 1940 and 2009.	Please refer to the response to comment #5.
10	NSE – Dave Briggins, Manager Water and Wastewater Branch	There are some typographic errors on page 5.26: •paragraph 2, 3rd sentence: "risk or water" should read "risk of water"; •paragraph 3, last sentence: "assessment" should read "assessment".	Correct – should read, "risk of water" Correct – should read, "assessment" The typographic errors on page 5.26 have been revised.
11	NSE - Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	From a tourism perspective, the main areas of interest regarding the proposed modification to the existing quarry operation are truck traffic, visual aesthetics, noise, and a consideration of whether the expansion would negatively affect tourism in the region and / or in Nova Scotia.	Comment acknowledged.
12	NSE - Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	The quarry modification will include activities related to fines storage only and will not be operated for the purposes of rock extraction. Therefore, noise emissions associated with quarry operations will not be generated as a result of the project.	Comment acknowledged.
13	NSE - Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Truck traffic to and from the existing Mulgrave Quarry is minimal. Project activities include the development of a private access road between the existing quarry and the proposed storage site. The project is not anticipated to result in an increase in truck traffic on public roads above that are associated with the existing Mulgrave Quarry operation. The majority of aggregate produced by the existing quarry will continue to be transported directly from the site via ships and barges.	Comment acknowledged.
14	NSE - Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Approximately 17 residences are located within 800 m of the existing quarry site, and approximately 67 are located within 800 m of the proposed storage site. There are no known tourism businesses in the immediate area of the quarry.	Comment acknowledged.
15	NSE - Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Discussions with representatives from the Antigonish Eastern Shore Tourism Association indicate no negative feedback at this point as a result of this project.	Comment acknowledged.

Comment	Comment Issuer	Comment Received	Comment Response
No. 16	NSE - Donald A. MacLean, Assistant Director Inland Fisheries Division Nova Scotia Fisheries and Aquaculture	We do not have any concerns at this time. Re. the NS Pit and Quarry Guidelines, no active areas will be located within 30 m of the banks of all streams identified on the property and natural vegetation will be maintained within this buffer. No project-related vehicles will be driven through streams. Of the 4 watercourses survey, 2 were dry at the time of assessment and only one of the other 2 had a single brook trout. The proposed mitigation and follow-up monitoring in place and outlined in their EIA will help ensure problems are dealy with in a timely manner if they grise.	Comment acknowledged.
17	NSE - David Fougere, Inspector Specialist	are dealt with in a timely manner if they arise. Compensation Program for Wetland Loss needs to be defined.	Addition information regarding compensation for wetland loss as been added to the EA. Refer to Section 5.5.2.
18	NSE - David Fougere, Inspector Specialist	A Flocculant / coagulant are used to help settle the fines. MSDS Sheets could probably be included in the EA. We have copies included in their EMP for the quarry.	The MSDS sheet for the flocculant has been added to the EA. Refer to Appendix B.
19	NSE - David Fougere, Inspector Specialist	Because of the flocculant / coagulant, the fines tend to retain water and remain "goopy". It is not clear what the safety implications are for an 18 m depth of this material, how long it will take to stabilize, and how the site can be rehabilitated.	As stated in Section 2.3, Site Preparation and Construction, a temporary settling pond will be developed with the storage cells to handle excess water, and will remain in place until all slopes of the cell walls have been seeded and permanent vegetation has been established. Once the pond has reached final capacity it will be left to stabilize for a few years and then it will be capped with overburden and seeded.
20	NSE - David Fougere, Inspector Specialist	We spoke with Ian Campbell this afternoon, he was wondering if the company would be doing baseline water chemistry / quantity etc. for the existing wells on Logie street. There may have been some sampling done by Rhodena Rock previously.	Currently there are no plans to undertake such testing; however the proponent is willing if a need arises in the future.
21	NSE - Darrell Taylor, Environmental Analyst	Surface water generally should be recognized as a VEC with all potential water uses assessed - as opposed to just one possible use (fish habitat). Other potential water uses include drinking water supply, agricultural, recreational, or industrial water uses. This project is sited very near residential development and the potential exists for several water uses to exist. Consideration of all potential uses should be included in this assessment.	Comment acknowledge and the text has been updated, refer to Section 5.2.
22	NSE - Darrell Taylor, Environmental Analyst	The assessment of impacts to surface waters should include whether any water withdrawals exist near or downstream of the project area, and if so, potential to impact, as well as proposed measures to protect such withdrawals.	The Surface Water Resources VEC has been cross-referenced with the Groundwater VEC concerning private wells in the area. Comments have also been added concerning designated reservoirs and drinking water supply protected areas. Refer to Section 5.2.1.
23	NSE - Darrell Taylor, Environmental Analyst	The report states that 24 wetlands exist in the project area and 7 will be impacted (page 5.8). Compensation is proposed for the loss of these wetlands, with no details provided.	Please refer to the response to comment #17.

Comment No.	Comment Issuer	Comment Received	Comment Response
24	NSE - Darrell Taylor, Environmental Analyst	Fish Habitat -Summary - page 5.5 - states that "potential for downstream effects in Mac Nairs Brook and the Strait of Canso must be mitigated." I would suggest that it would be appropriate to mitigate downstream effects in all identified watercourses, as well as remaining wetlands and marine receiving waters - not just those indicated as being fish habitat. Amphibians and other wetland species were identified in the baseline studies and should be protected to largest degree possible.	This was the intent of the statement and the text has been clarified. Refer to Section 5.2.1.
25	NSE - Darrell Taylor, Environmental Analyst	Surface water sampling is undertaken not only to assess suitability for freshwater aquatic life, but as baseline studies for water quality and quantity to assess post development impacts and predictions of this report. This doesn't seem to be generally recognized in the report.	Surface water quality was included as a point-in-time measurement of baseline conditions which will experience seasonal and annual variation. The text has been updated to clarify this (refer to Section 5.2.1). Additional water quality monitoring will be undertaken by the proponent if necessary and as requested by NSE.
26	NSE - Darrell Taylor, Environmental Analyst	Although watercourse #4 has barriers to fish migration identified in its lower reaches, this should not preclude this stream from being protected using appropriate mitigation measures - so as to protect other aquatic life or any other water uses.	It was not intended that this watercourse not be protected. Changes to the text have been made to clarify this. Refer to Section 5.2.1.
27	NSE - Darrell Taylor, Environmental Analyst	Appendix C - Table C-1- A CCME guideline for nitrate-nitrite for protection of aquatic life is erroneously shown as "13060". Table entries of "ND" are also shown, but no explanation of the term is provided. It is assumed that this indicates "Non-Detectable" concentrations as opposed to "Not Determined". This should be clarified.	The Table has been able updated with ND and RDL footnotes (Appendix E – Table E-1). Additional text has been added to Section 5.2.1 to introduce water chemistry as part of the baseline.
28	DFO – Josh Brading	Section 2.1, Paragraph 4. Will Rhodena Rock Quarry be using the fines storage cells?	No.
29	DFO – Josh Brading	Section 2.3. What are the proposed start and end dates of the construction? Can more information be provided on the design and construction of the connector road? What sediment and erosion mitigation methods will be used in construction of the connector road? Will the connector road be crossing any watercourses? Will the connector road cross any watercourses outside the property boundaries? A surface water management plan should be developed.	Clearing for the Project is anticipated to start during the 4th quarter of 2010 and continue into 2011. Addition information regarding the Construction of the Project has been added to Section 2.3. Further details will be provided as a part of the Part 5 Application.
30	DFO – Josh Brading	Section 2.4, Paragraph 2 & Section 2.5, Paragraph 3. Will there be any restrictions on the amount of airborne dust that can enter a watercourse? Best management practices should be used to reduce airborne dust entering watercourses.	Comment acknowledged and best management practices will be employed to minimize the amount of airborne dust in general which will also prevent dust from entering watercourses.
31	DFO – Josh Brading	In Section 2.1, Paragraph 5 states "location and design of fines storage cells has been carefully considered to minimize potential adverse environmental effects." In Paragraph 2 of Section 2.5, "The cell systems will maintain secure containment and will be designed and engineered so as to manage environmental issues such as site runoff." Are the cells already designed? Will they be built/designed as the project progresses? Can more information be provided on the design and construction of the storage cells?	The cells are being designed as the Project progresses. Additional design information will be provided as available and as requested by NSE as Part 5 application Refer to Section 2.3 and response to comment #19.

Comment No.	Comment Issuer	Comment Received	Comment Response
32	DFO – Josh Brading	1/ Section 5.2.1. Speaks to the different watercourse descriptions and their respective water quality test results. The results and sampling locations are confusing, specifically WC2. Were the streams only sampled/fished in one area? Were reaches in the upstream and downstream sampled? Can we get a location where each sample was completed with corresponding water quality test results? What are the physical units of the stream (i.e., pool/run/riffle)? 2/ Watercourse I - Section 5.2.1, Paragraph 6. If WCI has the potential to be connected to the downstream wetland (WL5), is it not then connected to WC2? Could WCI connect directly to WC2 at high flows? 3/ Section 5.2.2, Paragraph I, states that WCI is a concern from the "potential sedimentation effects on fish habitat present in the downstream section of the on-site stream (WCI) and Indian River, to which WC-I connect." Where is Indian River in proximity to the proposed project area? Could Indian River be considered Fish Habitat? Was Indian River sampled? 4/ Watercourse 2 - Is there potential for fish to utilize Wetland 5? 5/ It appear, from Figure 3, the access road will be built across Watercourse 2? It is important to get an accurate depiction of the watercourse (WC 2) habitat in the upstream area, specifically in the area where the access road will potentially cross. Provided there will be a crossing of the watercourse, what would be the mitigation measures for the proposed crossing? What methods would be used in the event of a watercourse crossing? How far upstream would be considered Fish Habitat?	1/ Given the limitations associated with single point-in-time measurements and the natural variation that occurs in moving water systems such as small streams, overall site conditions are described on a semi-quantitative basis only. Table 5.1 has been updated, however, to show the results per transect within each watercourse and Figure 3 has been updated to display the sampling locations. Addition text has been added to Section 5.2.1 to clarify the sampling approach (fish and water) and includes caveats that these are single point-in-time measures only and are subject to natural variation. 2/ This was already specified in the report: "This watercourse is not expected to support fish, even during high flow periods because of a lack of direct connection to fish bearing waters and its ephemeral, seasonal nature." An additional statement was added at the end of the WC-1 description to further clarify, Section 5.2.1. 3/ Indian River is not located on the Project property. This was a typo. The information in Section 5.2.2 Paragraph one has been updated. 4/ At the time of the survey, no defined channel through wetland 5 (WL05) was found connecting watercourses 1 and 2. The text in section 5.2.1 has been clarified. 5/ This part of the watercourse was not surveyed during this assessment, but was as a part of the Rhodena Rock EA (2006). At the time that this survey was taken (June 2009) the defined channel for WC-2 ended within WL5. The text under Section 5.2.1 has been updated to clarify this as has Figure 3. Stream crossing mitigation measures have also been added. Refer to Section 5.5.2.

Comment No.	Comment Issuer	Comment Received	Comment Response
33	DFO – Josh Brading	Section 5.2.2, Paragraph 3. Hydroseeding is a useful erosion and sediment mitigation measure; however, it is not always immediate. Other erosion mitigation measures would be necessary until hydroseeding is established. At what time of year would hydroseeding be used? Hydroseeding will not work during certain times of the year, because the vegetation will not root. Erosion and Sediment control measures for overburden and stockpiles will need to be maintained at all times.	Hydroseeding will be implemented during the growing season (up to mid October). An Erosion and Sediment Control Plan will be developed in detail as a part of the Part 5 Application process.
34	DFO – Josh Brading	Section 5.5.2, Paragraph 1 reads, "Any loss of wetland habitat either through direct infilling or indirectly through the alteration of wetland hydrology requires preparation of a wetland evaluation to establish the functional attributes of the wetland." DFO will require a copy of any wetland evaluation documentation produced.	Comment acknowledged. Copies of wetland applications can be obtained from NSE who is the administrator of most legislation pertaining to wetland alterations in Nova Scotia.
35	DFO – Josh Brading	Section 5.6.2, Paragraph 3. This should be listed under the Potential Effects, Proposed Mitigation, Monitoring and Follow-up in the Fish Habitat Section. Slope stability failure of the storage cells would be a potential environment hazard to fish habitat. Failure in storage cells could result in a deleterious substance entering a fish bearing watercourse, which is a contradiction of Section 36 of the Fisheries Act. Contingency plans should be developed.	Emergency Response and Contingency Plans will be developed during the Part 5 Application process and will cover such events as potential slope stability failure and release of impounded materials to aquatic systems.
36	DFO – Josh Brading	Section 5.6.1, Paragraph 5. Acid Rock Drainage (ARD) is a concern for Fish Habitat. ARD is devastating to watercourses (i.e., pH decrease). A contingency plan should be developed in case Sulphide bearing rocks are encountered. Testing discussed in section 5.6.2, Acid Drainage, is recommended. Nova Scotia Sulphide Bearing Material Disposal Regulations should be consulted.	Comment acknowledged and a Contingency Plan pertaining to ARD will be developed.
37	DFO – Josh Brading	Section 5.6.2, Leachate Section. Why was the magnitude of 10 chosen for the dilution attenuation factor? Why could cadmium testing find 0.026 µg/L in McNair's Brook, but be non-detectable at 0.3 µg/L in the leachate?	An attenuation factor of 10 is generally accepted and it in use by provinces such as British Columbia and Ontario. Nova Scotia will also be using this same attenuation factor between groundwater and surface water. The following is from the Rationale for the Development and Application of Generic Soil, Groundwater and Sediment Criteria for use at Contaminated Sites in Ontario for GW 3 which is groundwater to surface water. For each contaminant, the lowest environmentally-based U.S. EPA Ambient Water Quality Criterion (AWQCs), from among fresh water acute, marine acute, fresh water chronic and marine chronic values is used in the criteria development process. Each AWQC is based on either a final acute criterion (FAC) or final chronic criterion (FCC) from the U.S. EPA "Gold Book". The Massachusetts DEP reasoned that chemical concentrations present in the groundwater aquifer underlying a clean-up site will undergo a degree of dilution by the time they reach surface water bodies. For this reason, a dilution factor of 10 was applied to the AWQCs in developing

Comment	C Disposition 1		
No.	Comment Issuer	Comment Received	Comment Response
			GW-3 criteria. This is the same approach being taken by the "Nova Scotia Numeric Standards and Site Assessment Methodology Working Group" who are supporting the development of new Contaminated Sites Regulations. Reference: OMOE, 1996 - Rationale for the Development and Application of Generic Soil, Groundwater and Sediment Criteria for use at Contaminated Sites in Ontario, Report prepared by: Standards Development Branch, Ontario Ministry of Environment and Energy, December 1996 Report prepared for: Ontario Ministry of Environment and Energy RE: Laboratory Detection Limit for Cadmium According to Maxxam Analytics, "the standard reportable detection limits (RDLs) for metals in leachate are 10 times the standard RDLs for metals in water. The leachate samples very often contain high levels of metals and high levels of calcium which interfere with the analysis." It should be noted that leachate analysis is generally conducted on waste materials, which often contain high levels of metals and other compounds. Stantec recognized that the RDLs were elevated for these samples and contacted the laboratory after the samples were analyzed to inquire as whether the RDLs could be lowered. Maxxam indicated that on select instances they may be able to lower the RDLs to 5 times the standard RDLs for metals in water, but they could not go any lower. Due to the high iron and strontium concentrations in several of the samples submitted, RDLs were raised due to matrix interferences. Lowering (i.e., 5X RDLs) the leachate RDLs were not possible in this situation. Reference: Email correspondence with Michelle Hill, Maxxam Analytics, dated July
38	NSE – Andrew Paton, Municipal Services Division	It is unclear, unless for example the matter relates to land ownership and the expansion of the existing Martin Marietta operation. why the more northerly, somewhat "L" shaped area of land is identified as a "project property", since it is not apparent that any aspect of the project is proposed to take place on this land, Still, if the intent is to include the "L" shaped area of land as "project property" in the EA Registration document, then it would seem to make sense to combine the two "project properties" into one area of land on the map.	29, 2009. The area has been included in the EA to provide baseline data for potential future expansion. It is understood that additional assessments and permitting would be required if further expansion took place however.

Appendix C Disposition Table

	C Disposition is		
Comment No.	Comment Issuer	Comment Received	Comment Response
39	NSE – Andrew Paton, Municipal Services Division	The proposed undertaking, in contrast to the existing Martin Marietta Quarry, is located within the boundaries of the Town of Mulgrave. The Town has planning documents (Municipal Planning Strategy and Land Use By-law) in effect. It is our understanding that the proponent would require a development permit for the proposed undertaking, and that amendment of the planning documents would be needed in order to enable this. This matter is not mentioned in the current draft.	A statement regarding this has been added to Section 2.2.
40	NS Department of Natural Resources – Sarah MacKay	DNR staff request more comprehensive descriptions of terrestrial ecosystems in the project area. The draft document includes excellent wet-ecosystem summaries; however, similar overviews of terrestrial ecosystem composition, diversity, and geography are required for an adequate review of habitat and biodiversity values.	As a result of provincial regulations pertaining to the alteration of wetlands, and their general treatment within EA's as a VEC, descriptions of wetlands ecosystems remain more thorough then upland ones. Whereas the EA does provide information on the "composition, diversity, and geography" of upland habitats, this information is integrated into the VEC on Rare and Sensitive Flora (section 5.3) and the VEC on Wildlife (section 5.4). Updates have been made to these sections. In particular, additional notes on the distribution and character of upland habitats have been added to section 5.3 and associated figures have been updated to more clearly present their distribution within the Project area.
41	NS Department of Natural Resources – Sarah MacKay	The review process would also be facilitated by the provision of geo-coordinates for all species listed S1 - S3S4 by the Atlantic Canada Conservation Data Centre.	This information can be provided separately to NSDNR on request.
42	NS Department of Natural Resources – Sarah MacKay	Seven wetlands in the area (see page 5.24) will be completely or partially lost because of this project. The document indicates that a compensation plan will be provided after NSE approves wetland infilling or alteration. It would be helpful to have an outline and more information regarding proposed compensation plans	Please refer to the response to comment #17.
43	NS Department of Natural Resources – Sarah MacKay	Pages 2.5 and 2.6: There appears to be a conflict in the capacity of the two cells. The figures do not add up, even if the 1,550,000 cubic yards on page 2.5 refers to the capacity of one cell. This should be clarified.	This has been clarified. Refer to Section 2.2.1 and 2.4.

Appendix C Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
44	NS Department of Natural Resources – Sarah MacKay	Section 3.3, Page 3.0: The report states that the "fines cannot be processed into a marketable product". Although this statement is likely accurate (given the large quantity of waste being generated), has the possibility of alternative products been researched? Reports and research conducted by aggregate producer associations in the US suggests possible uses including products directed at the conditioning of soils to improve nutrient capabilities. A study of rock dust from quarries in Nova Scotia in the 1990's suggested that these fines act as a slow release fertilizer. A survey of organic growers at the time indicated that they were interested in obtaining these benign materials for their farms. Although the scale of this use may be small as a product in the region, allowing their use for this purpose by farmers in the Maritimes may be of value to communities. And even if the materials can't be used for product at this time, this "fines deposit" may have value for making synthetic soils in the future (for example). Therefore, DNR suggests that the proponent consider protecting the materials from contaminants while they are in these cells.	Martin Marietta has conducted preliminary research into potential alternatives for the fines material but has not found any feasible options. Liability associated with use by third parties is also an issue of concern to the owner. Martin Marietta is interested in any specific applications that may be presented by credible stakeholders, including NSDNR. The fines storage area will be protected from the introduction of contaminants.
45	NS Department of Natural Resources – Sarah MacKay	Pages 5.26, 5.27 & 5.28: DNR is disappointed in the discussion of geology in the document. Despite the critical role that the rocks play in the operation of this mine, including the generation of fines, the entire surficial and bedrock geology is found in one paragraph. DNR suggests that this aspect of the report could be improved by conducting a literature search as well as a proper field investigation of the property by a qualified geoscience professional. Ultimately, this work could provide details important to the assessment of the project.	The text has been revised, refer to Section 5.6.1.
46	NS Department of Natural Resources – Sarah MacKay	Page 5.33: Seven coarse-grained "gravel aggregate samples" were collected for acid producing/consumption potential, as well as three samples of fines for leachate testing. The document also mentioned that further testing of the fines is recommended in the future. Although this is a reasonable approach, DNR suggests that the sampling and testing of the fines should be a priority. This applies to both the acid drainage and the leachate/metals potential. The fines being produced from the crushing, sizing and washing process will preferentially remove mineralized zones which commonly occur along fault zones and fracture planes that typically contain softer rock composed of sulfides or alteration minerals. Although it is important to test the solid coarse aggregate products for problem mineralization, one would expect that the main concern would be the fines that are the focus of this undertaking. DNR suggests that representative samples of the fines should be collected and tested on an ongoing basis during the use of these cells to ensure that the fines continue to be environmentally benign. DNR acknowledges that this component of the process may be implied; however, reviewers did not feel it was clearly articulated.	Comment acknowledged. Fines will be tested as indicated in Section 5.6.2 and as required by NSE.

Appendix C Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
47	NS Department of Natural Resources – Sarah MacKay	Page 5.28 (Geological Map): This figure suggests that the storage cells may be covering a valuable mineral resource that could have economic significance in the future, given that it is on tidewater and may have potential as a future export product. If the underlying geology is the same as the Martin Marietta quarry and in a location far enough away from homes to be mined, it may have future resource value. DNR suggests that this should be addressed as part of the study. DNR notes that these cells could be treated as a thick overburden in the future and removed to access the stone. Has this been considered or is the plan to merely dump it in an available spot without considering the underlying resource?	This area was chosen as it is the least likely area to be mined in the future by Martin Marietta on lands it currently owns.

FINAL REPORT: ENVIRONMENTAL ASSESSMENT

APPENDIX D
Project Information Bulletin and Letter

MARTIN MARIETTA MATERIALS

Mulgrave Quarry Expansion Project Project Information Sheet

Project Overview

Martin Marietta Materials proposes to expand the existing operation at its existing facility at Mulgrave Quarry, Guysborough County, Nova Scotia, at a nearby parcel of land. (refer to Figure 1 on reverse). The current operation includes an area of 123 hectares. The proposed extension will incorporate lands 90 hectares in size and increase the total size of the operation to approximately 213 hectares. The proposed extension will not be used for typical quarry operations (i.e. blasting, crushing and stockpiling); instead it will be used as a storage site for fines produced from the washing of the aggregate at the existing site.

The existing facility operates according to an approval issued by Nova Scotia Environment (NSE) and the Nova Scotia Pit and Quarry Guidelines (NSE 1999). Approximately 70,000,000 tonnes of aggregate have been processed since the facility opened in 1978 and an estimated two hundred and fifty million rock reserve remains on the existing site. Most of the aggregate is removed from site by ship for export with lesser amounts taken by truck for local construction, such as road building. The existing quarry operates on a schedule of 24 hours per day, 7 days a week, and 52 weeks a year although level of activity varies according to market demand. The anticipated extension will not be used for quarry development and therefore there will be no change in the facilities annual production or operating schedule.

Approximately 30, 000 tonnes of fines will be stored per month at the proposed facility in an engineered structure that will be designed to manage environmental issues such as site runoff and groundwater flows. The proposed Project will also involve the construction of an access road, connecting the existing site to the proposed extension property.

Environmental Assessment Process

Martin Marietta Materials is required to register this project as a Class I Undertaking pursuant to the Nova Scotia Environment Act and Environmental Assessment Regulations. The environmental assessment registration currently being prepared by environmental consultants Jacques Whitford Stantec Limited (JWSL), on behalf of Martin Marietta Materials, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation.as well approval for wetland and watercourse alteration. Relevant Provincial guidelines include the Nova Scotia Pit and Ouarry Guidelines.

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it finalized and filed with NSE (anticipated Fall 2009).

Environmental Assessment Components

The environmental assessment document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- Rare and sensitive flora;
- Wildlife:
- Surface water resources
- Groundwater resources:
- Wetlands:
- Archaeological and heritage resources;
- Atmospheric environment (includes dust and noise); and
- Socio-economic environment.

Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified at least one waterbody/watercourse on the property and several wetlands. To date, no other sensitive features have been identified onsite; however, field investigations are ongoing. Assuming the implementation of standard mitigative measures and government guidelines and approvals, no significant adverse environmental or socio-economic effects are considered likely.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Donnie Fraser Martin Marietta Materials P.O. Box 278, Mulgrave, NS B0E 2G0 Tel: (902) 747-2882

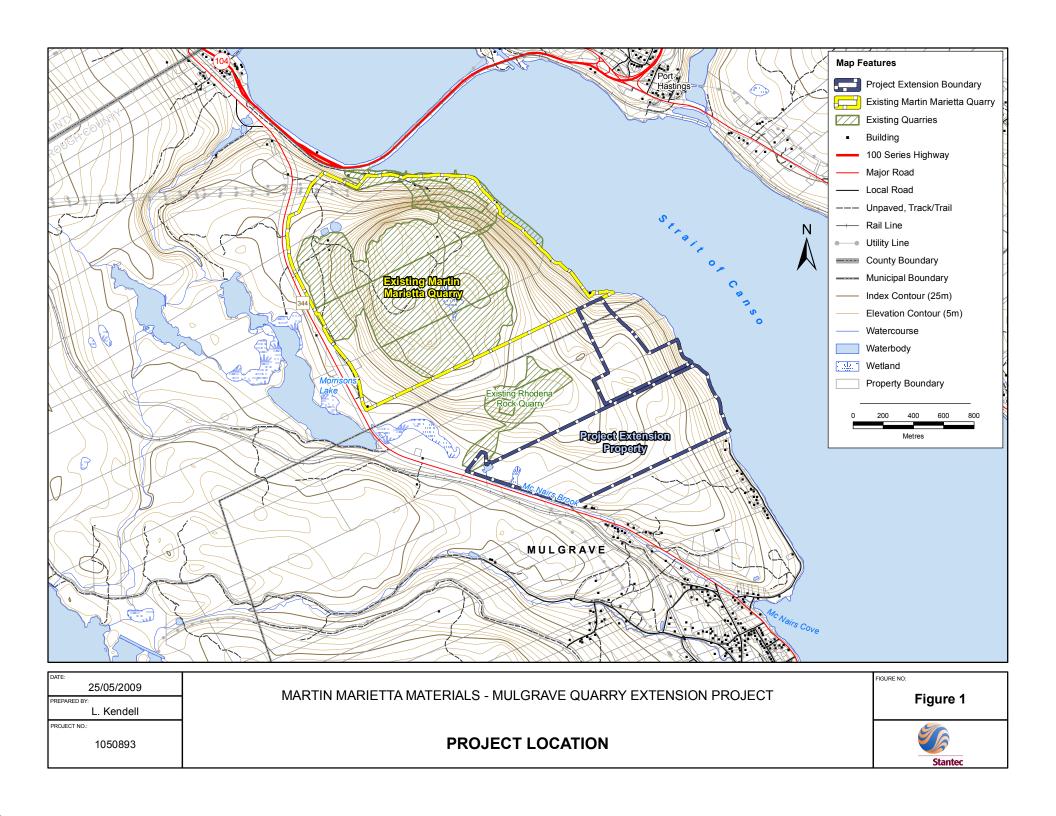
E-mail:Donnie.Fraser@MartinMarietta.com

Gillian Asche, Project Scientist Stantec

3 Spectacle Lake Drive, Dartmouth, NS B3B 1W8

Tel: (902) 468-7777

E-mail: Gillian. Asche@Stantec.com





September 18, 2009 File: 1050893

Native Council 324 Abenaki Road, Box 1320 Truro, NS, B2N 5N2

Attention: Ms. Grace Conrad

Dear Ms. Conrad:

Reference: Martin Marietta Materials Limited Fines Storage Project

This letter is to inform you of a proposed Project near the town of Mulgrave, Guysborough County, Nova Scotia.

The Project consists of the development of a series of storage cells on a parcel of land near the existing Mulgrave Quarry, in Mulgrave, Nova Scotia. The storage cells will be used to store fines produced from the washing of aggregate at the existing facility. The proposed development will not be used for typical quarry operations (i.e. blasting, crushing, and stockpiling). Martin Marietta Materials Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and the corresponding Figure, which provide more details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

JACQUES WHITFORD STANTEC LIMITED

ORIGINAL SIGNED BY

Robert Federico Senior Project Manager robert.federico@stantec.com

Cc. Gillian Asche, JWSL



September 18, 2009 File: 1050893

Confederacy of Mainland Mi'kmaq 57 Martin Crescent P.O. Box 1590 Truro, NS, B2N 5V3

Attention: Mr. Donald M. Julien

Dear Mr. Julien:

Reference: Martin Marietta Materials Limited Fines Storage Project

This letter is to inform you of a proposed Project near the town of Mulgrave, Guysborough County, Nova Scotia.

The Project consists of the development of a series of storage cells on a parcel of land near the existing Mulgrave Quarry, in Mulgrave, Nova Scotia. The storage cells will be used to store fines produced from the washing of aggregate at the existing facility. The proposed development will not be used for typical quarry operations (i.e. blasting, crushing, and stockpiling). Martin Marietta Materials Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

JACQUES WHITFORD STANTEC LIMITED

ORIGINAL SIGNED BY

Robert Federico Senior Project Manager robert.federico@stantec.com

Cc. Gillian Asche, JWSL



September 18, 2009 File: 1050893

Mi'kmaq Rights Initiative Kwikmug Maw-Klusuag 851 Willow Street Truro. NS B2N 6N8

Attention: Ms. Janice Maloney

Dear Ms. Maloney:

Reference: Martin Marietta Materials Limited Fines Storage Project

This letter is to inform you of a proposed Project near the town of Mulgrave, Guysborough County, Nova Scotia.

The Project consists of the development of a series of storage cells on a parcel of land near the existing Mulgrave Quarry, in Mulgrave, Nova Scotia. The storage cells will be used to store fines produced from the washing of aggregate at the existing facility. The proposed development will not be used for typical quarry operations (i.e. blasting, crushing, and stockpiling). Martin Marietta Materials Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

JACQUES WHITFORD STANTEC LIMITED

ORIGINAL SIGNED BY

Robert Federico Senior Project Manager robert.federico@stantec.com

Cc. Gillian Asche, JWSL



September 18, 2009 File: 1050893

Union of Nova Scotia Indians 47 Maillard Street Membertou, NS B1S 2P5

Attention: Mr. Joe B. Marshall

Dear Mr. Marshall:

Reference: Martin Marietta Materials Limited Fines Storage Project

This letter is to inform you of a proposed Project near the town of Mulgrave, Guysborough County, Nova Scotia.

The Project consists of the development of a series of storage cells on a parcel of land near the existing Mulgrave Quarry, in Mulgrave, Nova Scotia. The storage cells will be used to store fines produced from the washing of aggregate at the existing facility. The proposed development will not be used for typical quarry operations (i.e. blasting, crushing, and stockpiling). Martin Marietta Materials Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and the corresponding Figure, which provide more details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

JACQUES WHITFORD STANTEC LIMITED

ORIGINAL SIGNED BY

Robert Federico Senior Project Manager robert.federico@stantec.com

Cc. Gillian Asche, JWSL

FINAL REPORT: ENVIRONMENTAL ASSESSMENT

APPENDIX E
Freshwater Chemistry Analysis and Photo Appendix

Table E-1 Water Chemistry Analysis, McNairs Brook

Parameter	Units	RDL^1	McNairs Brook	CCME Guidelines ²
Inorganics	Office		Mortan's Brook	
Total Alkalinity (Total as CaCO ₃)	mg/L	5	63	
Carbonaceous BOD	mg/L	5	ND ³	
Total Chemical Oxygen Demand	mg/L	5	11	
Dissolved Chloride (CI)	mg/L	1	93	
Colour	TCU	5	20	
Nitrate + Nitrite	mg/L	0.05	0.11	13.06
Nitrite (N)	mg/L	0.03	ND	0.06
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	ND	0.00
Total Organic Carbon (C)	mg/L	0.5	ND	
Orthophosphate (P)	mg/L	0.01	ND	
рН	pH	N/A	7.71	6.5-9
Reactive Silica (SiO ₂)	mg/L	0.5	5.3	0.0-9
Total Suspended Solids	mg/L	1	ND	
Dissolved Sulphate (SO ₄)	mg/L	2	20	
Turbidity	NTU	0.1	0.2	
Conductivity	uS/cm	1	460	
Metals	u3/cm	ı	400	
Total Aluminum (Al)	ug/L	5.0	10.6	
Total Antimony (Sb)	ug/L	2.0	ND	
Total Arsenic (As)	ug/L	2.0	ND	5
Total Barium (Ba)	ug/L	5.0	19.0	<u> </u>
Total Beryllium (Be)	ug/L	2.0	ND	
Total Bismuth (Bi)	ug/L	2.0	ND ND	
Total Boron (B)	ug/L	5.0	12.7	
Total Cadmium (Cd)	ug/L ug/L	0.017	0.023	0.017
Total Calcium (Ca)	mg/L	0.017	26	0.017
Total Chromium (Cr)	ug/L	1.0	ND	1
Total Cobalt (Co)	ug/L	0.40	ND ND	<u> </u>
Total Copper (Cu)	ug/L	2.0	ND	2
Total Iron (Fe)	ug/L	50	ND	300
Total Lead (Pb)	ug/L	0.50	ND	2
Total Mangnesium (Mg)	mg/L	0.10	3.4	
Total Manganese (Mn)	ug/L	2.0	27.4	
Total Mercury (Hg)	ug/L ug/L	0.013	ND	0.026
Total Molybdenum (Mo)	ug/L ug/L	2.0	ND ND	73
Total Nickel (Ni)	ug/L	2.0	ND	65
Total Phosphorus (P)	mg/L	0.1	ND ND	
Total Potassium (K)	mg/L	0.1	0.9	
Total Selenium (Se)	ug/L	1.0	ND	1
Total Silver (Ag)	ug/L ug/L	0.10	ND ND	0.1
Total Sodium (Na)	mg/L	0.10	58	0.1
Total Strontium (Sr)		5.0	69.3	
rotal Strolliulli (SI)	ug/L	ა.0	09.3	

Table E-1 Water Chemistry Analysis, McNairs Brook

Parameter	Units	RDL ¹	McNairs Brook	CCME Guidelines ²
Total Thallium (TI)	ug/L	0.10	ND	0.8
Total Tin (Sn)	ug/L	2.0	ND	
Total Titanium (Ti)	ug/L	2.0	ND	
Total Uranium (U)	ug/L	0.10	ND	
Total Vanadium (V)	ug/L	2.0	ND	
Total Zinc (Zn)	ug/L	5.0	6.9	30
Petroleum Hydrocarbons				
Benzene	mg/L	0.001	ND	370
Toluene	mg/L	0.001	ND	2
Ethylbenzene	mg/L	0.001	ND	90
Xylene (Total)	mg/L	0.002	ND	
C6 - C10 (less BTEX)	mg/L	0.01	ND	
>C10-C21 Hydrocarbons	mg/L	0.05	ND	
>C21- <c32 hydrocarbons<="" td=""><td>mg/L</td><td>0.1</td><td>ND</td><td></td></c32>	mg/L	0.1	ND	

¹ RDL = Reportable Detection Limit

² Canadian Water Quality Guidelines for the Protection of Aquatic Life

³ ND = Not detected



Photo 1: Wetland area at head of WC-1



Photo 3: WC-1 dry channel



Photo 5: WC-2, McNairs Brook – Downstream section (in Project Area)



Photo 2: WC-1 defined channel



Photo 4: WC-1 - Scoured substrate



Photo 6: WC-2, McNairs Brook – Downstream section (in Project Area)



Photo 7: WC-2, McNairs Brook – Defined channel through wetland



Photo 8: WC-2, McNairs Brook – Upstream Section



Photo 9: WC-3 – Steep gradient and deeply entrenched



Photo 10: WC-3 – Defined channel in lower gradient area



Photo 11: WC-3 – Downstream section, higher water volume, wider.



Photo 12: WC-3 - substrate in area fished



Photo 13: WC-3 - downstream of culvert under old road at ocean outfall.



Photo 14: WC-4 - Immediately upstream of output to ocean, showing steep gradient.



Photo 15: WC-4 – Deeply entrenched, steep gradient section at T2



Photo 16: WC-4 - Pool sampled above cascade (T2).



Photo 17: WC-4 – Headwater area, outside Project Area

FINAL REPORT: ENVIRONMENTAL ASSESSMENT

APPENDIX F
Vascular Plants Recorded in Study Area

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Table F-1 AC	ODO Mare and	i Selisitive Flants Poten	tidily i receilt	0,000	71100
Binomial	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Carex haydenii	Cloud Sedge	Swamps	July to September	S1	RED
Carex hystericina	Porcupine Sedge	Swamps, swales, and along brooks	June to October	S1S2	RED
Carex pellita	Woolly Sedge	Swamps and bogs, often in wooded areas	May to July	S1	RED
Listera australis	Southern Twayblade	Among the shaded sphagnum moss of bogs or damp woods	June. Quickly senesces after flowering	S1	RED
Malaxis brachypoda	White Adder's- Mouth	Moss cushions and wet, mossy cliff-edges where there is little competition from other plant species	Late May and June	S1	RED
Montia fontana	Fountain Miner's-Lettuce	Springy or seepy slopes, wet shores, and brackish spots; coastal areas	Most noticeable when flowers June to September	S1	RED
Selaginella selaginoides	Low Spike- Moss	Moist areas bordering bog tussocks, peat bogs, and stream margins	Produces spores in July and August. Likely identifiable when not snow covered, but very easily overlooked.	S2	RED
Triantha glutinosa	Sticky False- Asphodel	Swamps, bogs, and rocky beaches	Flowers June to August. Not readily noticeable until bloom, and likely later with fruit.	S1	RED
Vaccinium boreale	Northern Blueberry	Exposed headlands and barrens; has been found in drier open bog near Moose River Gold Mines	Not given for NS. Likely identifiable in early summer through to October	S2	RED
Ageratina altissima	White Snakeroot	Woods, thickets	July to October	S1	YELLOW
Arabis drummondii	Drummond Rockcress	Usually on dry slopes and talus, but occasionally in more fertile locations at lower elevations	May to July	S2	YELLOW
Betula michauxii	Michaux's Dwarf Birch	Peat and sphagnous bogs	June and July (later than most birches)	S2	YELLOW
Botrychium simplex	Least Grape- Fern	Usually on lakeshores or the mossy edges of streams or waterfalls, although it has been reported in a wide variety of habitats	Late May and June	S2S3	YELLOW

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Binomial	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Carex adusta	Crowded Sedge	Dry, open places; rocky coastal, non-forested, upland areas	June to September	S2S3	YELLOW
Carex comosa	Bristly Sedge	Swamps and shallow water	June to August	S2	YELLOW
Cypripedium parviflorum var. pubescens	Large Yellow Lady's-Slipper	Rich calcareous woodlands; also in drier sections of seepage fed wetlands or old beaver pond woodlands	Flowers in June. Plant identifiable from late May to October	S2	YELLOW
Dryopteris fragrans var. remotiuscula	Fragrant Fern	Dry, overhanging cliffs, and in cliff crevices along streams or near waterfalls	June to September. Can be identified without sporangia.	S2	YELLOW
Epilobium coloratum	Purple-Leaf	Low-lying ground, springy slopes, and similar locations	July and October. Seeds required for identification.	S2?	YELLOW
Eriophorum gracile	Slender Cotton- Grass	Wet peat and inundated shores	Flowers and fruits early summer	S2	YELLOW
Fraxinus nigra	Black Ash	Low ground, damp woods, and swamps	May and June. Can be identified without flowers.	S3	YELLOW
Geocaulon lividum	Northern Comandra	Sterile soils and damp sands; in acid or peaty locations, drier bog areas, and mesic lichen barrens	Late May to early August. Identifiable from May into October	S2S3	YELLOW
Goodyera oblongifolia	Giant Rattlesnake- Plantain	Deciduous climax forest; slopes in damp, mixed forests, and ravines	Flowers in late summer. Identifiable earlier and into fall by its long leaf blades with white midvein and sparse blotching.	S2S3	YELLOW
Goodyera repens	Dwarf Rattlesnake- Plantain	Under conifers, growing with very few other plants	Flowers July and August	S2S3	YELLOW
Hieracium robinsonii	Robinson's Hawkweed	Rock crevices and cliffs, cobble shores, and along streams	Flowers July and August	S2	YELLOW
Poa glauca	White Bluegrass	Cliff crevices, on shelves, and talus slopes	July and August. Can be identified post flowering until early October	S2S3	YELLOW

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Binomial	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Rhamnus alnifolia	Alderleaf Buckthorn	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Flowers mid - May to June. Identifiable from May to October and potentially year-round.	S3	YELLOW
Sparganium hyperboreum	Northern Bur- Reed	Peaty pools	Not given for NS. Likely identifiable in late summer.	S1S2	YELLOW
Symphyotrichum boreale	Boreal American-Aster	Gravelly soil of lake beaches, along streams, and the edges of bogs	August and September	S2?	YELLOW
Teucrium canadense	American Germander	Gravelly seashores, generally at crest of beach, above direct tidal influence	Identifiable from June to October, but easiest to identify when flowers July to September.	S2S3	YELLOW
Vaccinium caespitosum	Dwarf Blueberry	Rocky cliffs and rock crevices; dry or wet acidic sites	Not given for NS. Likely identifiable from early summer through to October	S2	YELLOW
Vaccinium uliginosum	Alpine Blueberry	Cool coastal bogs and on subalpine summits; dry or wet organic and inorganic soils; tolerant of high copper concentrations	Not given for NS. Likely identifiable from early summer through to October	S2	YELLOW
Viola nephrophylla	Northern Bog Violet	Cool mossy bogs, the borders of streams, and damp woods	May to July	S2	YELLOW
Atlantic Canada Co		entre (ACCDC) Species Rank			
S1	few remaining inc	roughout its range in the provindividuals). May be especially v	ulnerable to extirpa	ation.	
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.				
S 3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations. (21 to 100 occurrences).				
S4	Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the Element is of long-term concern (e.g., watch list).				
S5	essentially inerac	despread, abundant, and secu dicable under present condition	S.		
S#S#		ank: A range between two cons t the exact rarity of the species		nks. Denote	s
S#?	Inexact or uncert		· · · · · · · · · · · · · · · · · · ·		

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Binomial	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Nova Scotia Departr	artment of Natural Resources (NSDNR) General Status Rank Definitions				
Red	Known to be or thought to be at risk.				
Yellow	Sensitive to human activities or natural events.				
Green	Not believed to b	e sensitive or at risk.		•	

Source: ACCDC 2009; NSDNR 2007

Table F-2 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Balsam Fir	Abies balsamea	S5	GREEN
Striped Maple	Acer pensylvanicum	S5	GREEN
Red Maple	Acer rubrum	S5	GREEN
Sugar Maple	Acer saccharum	S5	GREEN
White Baneberry	Actaea alba	S4	GREEN
European Grovebur	Agrimonia eupatoria	SE	EXOTIC
Colonial Bentgrass	Agrostis capillaris	SE	EXOTIC
Rough Bentgrass	Agrostis hyemalis	S5	GREEN
Perennial Bentgrass	Agrostis perennans	S4S5	GREEN
Spreading Bentgrass	Agrostis stolonifera	S5SE	GREEN
Speckled Alder	Alnus incana	S5	GREEN
Green Alder	Alnus viridis	S5	GREEN
Allegheny Service-Berry	Amelanchier laevis	S5	GREEN
Serviceberry	Amelanchier sp.	n/a	n/a
Pearly Everlasting	Anaphalis margaritacea	S5	GREEN
Bog Rosemary	Andromeda glaucophylla	S5	GREEN
Angelica	Angelica lucida	S4S5	GREEN
Sweet Vernal Grass	Anthoxanthum odoratum	SE	EXOTIC
Wild Sarsaparilla	Aralia nudicaulis	S5	GREEN
Black Chokeberry	Aronia melanocarpa	S5	GREEN
Whorled Aster	Aster acuminatus	S5	GREEN
White Panicled American-Aster	Aster lanceolatus	S4S5	GREEN
Farewell-Summer	Aster lateriflorus	S5	GREEN
Bog Aster	Aster nemoralis	S5	GREEN
New Belgium American-Aster	Aster novi-belgii	S5	GREEN
Swamp Aster	Aster puniceus	S5	GREEN
Rough-Leaved Aster	Aster radula	S5	GREEN
Parasol White-Top	Aster umbellatus	S5	GREEN
Lady-Fern	Athyrium filix-femina	S5	GREEN
Yellow Birch	Betula alleghaniensis	S5	GREEN
Heart-Leaved Paper Birch	Betula cordifolia	S5	?
Paper Birch	Betula papyrifera	S5	GREEN
Gray Birch	Betula populifolia	S5	GREEN
Beggar-Ticks	Bidens sp.	n/a	n/a
Bearded Short-Husk	Brachyelytrum septentrionale	S4S5	GREEN
Awnless Brome	Bromus inermis	SE	EXOTIC
American Sea-Rocket	Cakile edentula	S5	GREEN
Blue-Joint Reedgrass	Calamagrostis canadensis	S5	GREEN
Hedge Bindweed	Calystegia sepium	S5	GREEN
Black Sedge	Carex arctata	S5	GREEN
Brownish Sedge	Carex brunnescens	S5	GREEN
Hoary Sedge	Carex canescens	S5	GREEN
Fibrous-Root Sedge	Carex communis	S5	GREEN
Crawford Sedge	Carex crawfordii	S5	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Study Area

Table 1-2 Topulation	otatus or vascular rilants Neco		71100
Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
White-Edge Sedge	Carex debilis	S5	GREEN
Softleaf Sedge	Carex disperma	S5	GREEN
Little Prickly Sedge	Carex echinata	S5	GREEN
Yellow Sedge	Carex flava	S5	GREEN
Long Sedge	Carex folliculata	S5	GREEN
Graceful Sedge	Carex gracillima	S4S5	GREEN
A Sedge	Carex gynandra	S5	GREEN
Bladder Sedge	Carex intumescens	S5	GREEN
Slender Sedge	Carex lasiocarpa	S5	GREEN
Bristly-Stalk Sedge	Carex leptalea	S5	GREEN
Finely-Nerved Sedge	Carex leptonervia	S5	GREEN
Shallow Sedge	Carex lurida	S5	GREEN
Black Sedge	Carex nigra	S5	GREEN
New England Sedge	Carex novae-angliae	S5	GREEN
Pale Sedge	Carex pallescens	S5	GREEN
Cyperus-Like Sedge	Carex pseudocyperus	S4S5	GREEN
Rough Sedge	Carex scabrata	S5	GREEN
Stalk-Grain Sedge	Carex stipata	S5	GREEN
Tussock Sedge	Carex stricta	S5	GREEN
Three-Seed Sedge	Carex trisperma	S5	GREEN
Black Starthistle	Centaurea nigra	SE	EXOTIC
Mouse-Ear Chickweed	Cerastium arvense	S4?	GREEN
Leatherleaf	Chamaedaphne calyculata	S5	GREEN
White Turtlehead	Chelone glabra	S5	GREEN
Common Wintergreen	Chimaphila umbellata	S4	GREEN
Oxeye Daisy	Chrysanthemum leucanthemum	SE	EXOTIC
American Golden-Saxifrage	Chrysosplenium americanum	S5	GREEN
Slender Wood Reedgrass	Cinna latifolia	S5	GREEN
Small Enchanter's Nightshade	Circaea alpina	S5	GREEN
Creeping Thistle	Cirsium arvense	SE	EXOTIC
Clinton Lily	Clintonia borealis	S5	GREEN
Goldthread	Coptis trifolia	S5	GREEN
Spotted Coralroot	Corallorhiza maculata	S4	GREEN
Early Coralroot	Corallorhiza trifida	S3	GREEN
Alternate-Leaf Dogwood	Cornus alternifolia	S5	GREEN
Dwarf Dogwood	Cornus canadensis	S5	GREEN
Beaked Hazelnut	Corylus cornuta	S5	GREEN
Miss Jones Hawthorn	Crataegus chrysocarpa	S?	UNDETERMINE
Pink Lady's-Slipper	Cypripedium acaule	S5	GREEN
Fragile Fern	Cystopteris fragilis	S4	GREEN
A Bladderfern	Cystopteris tragilis Cystopteris tenuis	S3?	GREEN
	1	\$3 <i>?</i>	GREEN
Flattened Oatgrass	Danthonia compressa	S5	GREEN
Poverty Oat-Grass	Danthonia spicata	SE SE	
Wild Carrot	Daucus carota		EXOTIC
Eastern Hay-Scented Fern	Dennstaedtia punctilobula	S5	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Study Area

Table 1-2 Topulation 3	·					
Common Name	Scientific Name	ACCDC Rank	NSDNR Rank			
Silvery Spleenwort	Deparia acrostichoides	S4	GREEN			
Crinkled Hairgrass	Deschampsia flexuosa	S5	GREEN			
Northern Bush-Honeysuckle	Diervilla Ionicera	S5	GREEN			
Trailing Clubmoss	Diphasiastrum complanatum	S3?	GREEN			
Roundleaf Sundew	Drosera rotundifolia	S5	GREEN			
Mountain Wood-Fern	Dryopteris campyloptera	S5	GREEN			
Spinulose Shield Fern	Dryopteris carthusiana	S5	GREEN			
Crested Shield-Fern	Dryopteris cristata	S5	GREEN			
Evergreen Woodfern	Dryopteris intermedia	S5	GREEN			
Marginal Wood-Fern	Dryopteris marginalis	S5	GREEN			
Three-Way Sedge	Dulichium arundinaceum	S5	GREEN			
Slender Spike-Rush	Eleocharis tenuis	S5	GREEN			
Wild Rye/American Dune Grass	Elymus mollis	S5	GREEN			
Quackgrass	Elymus repens	SE	EXOTIC			
Black Crowberry	Empetrum nigrum	S5	GREEN			
Beechdrops	Epifagus virginiana	S4S5	GREEN			
Trailing Arbutus	Epigaea repens	S5	GREEN			
Fireweed	Epilobium angustifolium	S5	GREEN			
Hairy Willow-Herb	Epilobium ciliatum	S5	GREEN			
Purple-Leaf Willow-Herb	Epilobium coloratum	S2?	YELLOW			
Linear-Leaved Willow-Herb	Epilobium leptophyllum	S5	GREEN			
Marsh Willow-Herb	Epilobium palustre	S5	GREEN			
Field Horsetail	Equisetum arvense	S5	GREEN			
Woodland Horsetail	Equisetum sylvaticum	S5	GREEN			
Fireweed	Erechtites hieraciifolia	S5	GREEN			
Narrow-Leaved Cotton-Grass	Eriophorum polystachion	S5	GREEN			
Tawny Cotton-Grass	Eriophorum virginicum	S5	GREEN			
Spotted Joe-Pye Weed	Eupatorium maculatum	S5	GREEN			
Common Boneset	Eupatorium perfoliatum	S5	GREEN			
Flat-Top Fragrant-Golden-Rod	Euthamia graminifolia	S5	GREEN			
American Beech	Fagus grandifolia	S5	GREEN			
Red Fescue	Festuca rubra	S5	GREEN			
Woodland Strawberry	Fragaria vesca	S4	GREEN			
Virginia Strawberry	Fragaria virginiana	S5	GREEN			
White Ash	Fraxinus americana	S5	GREEN			
Brittle-Stem Hempnettle	Galeopsis tetrahit	SE	EXOTIC			
Rough Bedstraw	Galium asprellum	S5	GREEN			
Stiff Marsh Bedstraw	Galium tinctorium	S5	GREEN			
Creeping Snowberry	Gaultheria hispidula	S5	GREEN			
Teaberry	Gaultheria procumbens	S5	GREEN			
Black Huckleberry	Gaylussacia baccata	S5	GREEN			
Herb-Robert	Geranium robertianum	S4	GREEN			
Herb-Robert	Geranium robertianum	S4S5	GREEN			
Large-Leaved Avens	Geum macrophyllum	S5	GREEN			
Purple Avens	Geum rivale	S5	GREEN			
i nibie vielio	Geath Hvale	33	UNLLIN			

Table F-2 Population Status of Vascular Plants Recorded in Study Area

-	Status of Vascular Plants Rec	ACCDC	
Common Name	Scientific Name	Rank	NSDNR Rank
Canada Manna-Grass	Glyceria canadensis	S5	GREEN
Fowl Manna-Grass	Glyceria striata	S5	GREEN
Northern Oak Fern	Gymnocarpium dryopteris	S5	GREEN
American Witch-Hazel	Hamamelis virginiana	S5	GREEN
Orange Daylily	Hemerocallis fulva	SE	EXOTIC
Kalm's Hawkweed	Hieracium kalmii	S2?	UNDETERMINE
Common Hawkweed	Hieracium lachenalii	SE	EXOTIC
Wall Hawkweed	Hieracium murorum	SE	EXOTIC
Smoothish Hawkweed	Hieracium x floribundum	SE	EXOTIC
American Water-Pennywort	Hydrocotyle americana	S5	GREEN
Black Holly	llex verticillata	S5	GREEN
Spotted Jewel-Weed	Impatiens capensis	S5	GREEN
Blueflag	Iris versicolor	S5	GREEN
Sharp-Fruit Rush	Juncus acuminatus	S3S4	UNDETERMINE
Baltic Rush	Juncus arcticus	S5	GREEN
Narrow-Panicled Rush	Juncus brevicaudatus	S5	GREEN
Canada Rush	Juncus canadensis	S5	GREEN
Soft Rush	Juncus effusus	S5	GREEN
Black-Grass Rush	Juncus gerardii	S5	GREEN
Rush	Juncus sp.	n/a	n/a
Slender Rush	Juncus tenuis	S5	GREEN
Ground Juniper	Juniperus communis	S5	GREEN
Sheep-Laurel	Kalmia angustifolia	S5	GREEN
Pale Laurel	Kalmia angustirolia Kalmia polifolia	S5	GREEN
Wild lettuce		n/a	n/a
American Larch	Lactuca sp. Larix laricina	S5	GREEN
			1
Common Labrador Tea	Ledum groenlandicum	S5	GREEN
Scot's Lovage	Ligusticum scoticum	S5	GREEN
Butter-And-Eggs	Linaria vulgaris	SE	EXOTIC
Twinflower	Linnaea borealis	S5	GREEN
Heartleaf Twayblade	Listera cordata	S4	GREEN
Indian-Tobacco	Lobelia inflata	S5	GREEN
Mountain Fly-Honeysuckle	Lonicera caerulea	S4S4	GREEN
American Fly-Honeysuckle	Lonicera canadensis	S5	GREEN
Hairy Woodrush	Luzula acuminata	S5	GREEN
Common Woodrush	Luzula multiflora	S5	GREEN
Bog Clubmoss	Lycopodiella inundata	S5	GREEN
Stiff Clubmoss	Lycopodium annotinum	S5	GREEN
Running Pine	Lycopodium clavatum	S5	GREEN
Hickey's Clubmoss	Lycopodium hickeyi	S2?	UNDETERMINE
Tree Clubmoss	Lycopodium obscurum	S5	GREEN
American Bugleweed	Lycopus americanus	S5	GREEN
Northern Bugleweed	Lycopus uniflorus	S5	GREEN
Swamp Loosestrife	Lysimachia terrestris	S5	GREEN
Purple Loosestrife	Lythrum salicaria	SE	EXOTIC

Table F-2 Population Status of Vascular Plants Recorded in Study Area

Table 1 -2 Topulation (71.00
Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Wild Lily-of-The-Valley	Maianthemum canadense	S5	GREEN
Indian Cucumber-Root	Medeola virginiana	S5	GREEN
American Cow-Wheat	Melampyrum lineare	S5	GREEN
Corn Mint	Mentha arvensis	S5	GREEN
Mint	Mentha sp.	n/a	n/a
Partridge-Berry	Mitchella repens	S5	GREEN
Naked Bishop's-Cap	Mitella nuda	S5	GREEN
One-Flower Wintergreen	Moneses uniflora	S5	GREEN
Indian-Pipe	Monotropa uniflora	S5	GREEN
Fall Dropseed Muhly	Muhlenbergia uniflora	S5	GREEN
Small Forget-Me-Not	Myosotis laxa	S5	GREEN
Sweet Bayberry	Myrica gale	S5	GREEN
Northern Bayberry	Myrica pensylvanica	S5	GREEN
Northern Bayberry	Myrica pensylvanica	S5	GREEN
Slender Naiad	Najas flexilis	S5	GREEN
Mountain Holly	Nemopanthus mucronata	S5	GREEN
Yellow Pond-Lily	Nuphar variegata	S5	GREEN
Common Evening-Primrose	Oenothera biennis	S5	GREEN
Sensitive Fern	Onoclea sensibilis	S5	GREEN
Cinnamon Fern	Osmunda cinnamomea	S5	GREEN
Interrupted Fern	Osmunda claytoniana	S5	GREEN
Royal Fern	Osmunda regalis	S5	GREEN
White Wood-Sorrel	Oxalis acetosella	S5	GREEN
Dwarf Ginseng	Panax trifolius	S3	GREEN
Northern Beech Fern	Phegopteris connectilis	S5	GREEN
Meadow Timothy	Phleum pratense	SE	EXOTIC
White Spruce	Picea glauca	S5	GREEN
Black Spruce	Picea mariana	S5	GREEN
Red Spruce	Picea rubens	S5	GREEN
Eastern White Pine	Pinus strobus	S5	GREEN
Nipple-Seed Plantain	Plantago major	SE	EXOTIC
leafy northern green orchis	Platanthera aquiilonis	S4?	GREEN
Small Green Woodland Orchid	Platanthera clavellata	S5	GREEN
Leafy White Orchis	Platanthera dilatata	S4S5	GREEN
Large Roundleaf Orchid	Platanthera orbiculata	S3	GREEN
Small Purple-Fringe Orchis	Platanthera psycodes	S4	GREEN
Canada Bluegrass	Poa compressa	SE	EXOTIC
Kentucky Bluegrass	Poa pratensis	S5	GREEN
Rose Pogonia	Pogonia ophioglossoides	S4	GREEN
Fringed Black Bindweed	Polygonum cilinode	S5	GREEN
Lady's Thumb	Polygonum persicaria	SE	EXOTIC
Arrow-Leaved Tearthumb		S5	GREEN
	Polygonum sagittatum Polypodium virginianum	S5	GREEN
Rock Polypody Christmas Fern	· · · · · · · · · · · · · · · · · · ·	S5	
	Polystichum acrostichoides		GREEN
Braun's Holly-Fern	Polystichum braunii	S3S4	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC	NSDNR Rank
Pickerel Weed	Pontederia cordata	Rank S5	GREEN
Balsam Poplar	Populus balsamifera	S4	GREEN
Large-Tooth Aspen	Populus grandidentata	S5	GREEN
Quaking Aspen	Populus tremuloides	S5	GREEN
Balm-Of-Gilead	Populus x jackii	SE	EXOTIC
Nuttall Pondweed	Potamogeton epihydrus	S5	GREEN
Slender Pondweed	Potamogeton pusillus	S4	GREEN
Silverweed	Potentilla anserina	S5	GREEN
Norwegian Cinquefoil	Potentilla norvegica	S5	GREEN
Tall Rattlesnake-root	Prenanthes altissima	S4S5	GREEN
Three-Leaved Rattlesnake-root	Prenanthes trifoliolata	S5	GREEN
Self-Heal	Prunella vulgaris	S5	GREEN
Fire Cherry	Prunus pensylvanica	S5	GREEN
Choke Cherry	Prunus virginiana	S5	GREEN
Bracken Fern	Pteridium aquilinum	S5	GREEN
Shinleaf	Pyrola elliptica	S5	GREEN
Pyrola	Pyrola sp.	n/a	n/a
Common Apple	Pyrus malus	SE	EXOTIC
Tall Butter-Cup	Ranunculus acris	SE	EXOTIC
Creeping Butter-Cup	Ranunculus repens	SE	EXOTIC
Rhodora	Rhododendron canadense	S5	GREEN
White Beakrush	Rhynchospora alba	S5	GREEN
Brown Beakrush	Rhynchospora fusca	S4	GREEN
Bristly Black Currant	Ribes lacustre	S5	GREEN
Current	Ribes sp.	n/a	n/a
Rambler Rose	Rosa multiflora	SE	EXOTIC
Shining Rose	Rosa nitida	S4	GREEN
a bramble	Rubus alleghaniensis	S?	UNDETERMINE
Smooth Blackberry	Rubus canadensis	S5	GREEN
Bristly Dewberry	Rubus hispidus	S5	GREEN
Red Raspberry	Rubus idaeus	S5	GREEN
Dwarf Red Raspberry	Rubus pubescens	S5	GREEN
Bramble	Rubus sp.	n/a	n/a
Alpine Dock	Rumex acetosella	SU	EXOTIC
Curly Dock	Rumex crispus	SE	EXOTIC
Seabeach Dock	Rumex pallidus	S4?	GREEN
Bebb's Willow	Salix bebbiana	S5	GREEN
Prairie Willow	Salix humilis	S5	GREEN
Willow	Salix sp.	n/a	n/a
Common Elderberry	Sambucus canadensis	S5	?
Red Elderberry	Sambucus racemosa	S5	GREEN
Northern Pitcher-Plant	Sarracenia purpurea	S5	GREEN
Black-Girdle Bulrush	Scirpus cyperinus	S5	GREEN
Small-Fruit Bulrush	Scirpus microcarpus	S5	GREEN
Hooded Skullcap	Scutellaria galericulata	S5	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Study Area

		ACCDC	
Common Name	Scientific Name	Rank	NSDNR Rank
Mad Dog Skullcap	Scutellaria lateriflora	S5	GREEN
Tansy Ragwort	Senecio jacobaea	SE	EXOTIC
Woodland Groundsel	Senecio sylvaticus	SE	EXOTIC
Solomon's-Plume	Smilacina racemosa	S4S5	GREEN
Three-Leaf Solomon's-Plume	Smilacina trifolia	S4S5	GREEN
Climbing Nightshade	Solanum dulcamara	SE	EXOTIC
Black Nightshade	Solanum nigrum	SE	EXOTIC
Canada Goldenrod	Solidago canadensis	S5	GREEN
Broad-Leaved Goldenrod	Solidago flexicaulis	S5	GREEN
Smooth Goldenrod	Solidago gigantea	S5	GREEN
Downy Goldenrod	Solidago puberula	S5	GREEN
Rough-Leaf Goldenrod	Solidago rugosa	S5	GREEN
Bog Goldenrod	Solidago uliginosa	S5	GREEN
Field Sowthistle	Sonchus arvensis	SE	EXOTIC
Spiny-Leaf Sowthistle	Sonchus asper	SE	EXOTIC
American Mountain-Ash	Sorbus americana	S5	GREEN
Northern Mountain-Ash	Sorbus decora	S4	GREEN
American Bur-Reed	Sparganium americanum	S5	GREEN
Small Bur-Reed	Sparganium natans	S3	GREEN
Narrow-Leaved Meadow-Sweet	Spiraea alba	S5	GREEN
Ladies'-Tresses	Spiranthes lacera	S5	GREEN
Common Dandelion	Taraxacum officinale	SE	EXOTIC
Canadian Yew	Taxus canadensis	S5	GREEN
Tall Meadow-Rue	Thalictrum pubescens	S5	GREEN
New York Fern	Thelypteris noveboracensis	S5	GREEN
Marsh Fern	Thelypteris palustris	S5	GREEN
Marsh St. John's-Wort	Triadenum fraseri	S5	GREEN
Marsh St. John's Wort	Triadenum virginicum	S4S5	GREEN
Northern Starflower	Trientalis borealis	S5	GREEN
Painted Trillium	Trillium undulatum	S5	GREEN
Colt's Foot	Tussilago farfara	SE	EXOTIC
Broad-Leaf Cattail	Typha latifolia	S5	GREEN
American Elm	Ulmus americana	S4	GREEN
Hidden-Fruited Bladderwort	Utricularia geminiscapa	S4	GREEN
Late Lowbush Blueberry	Vaccinium angustifolium	S5	GREEN
Large Cranberry	Vaccinium macrocarpon	S5	GREEN
Velvetleaf Blueberry	Vaccinium myrtilloides	S5	GREEN
Small Cranberry	Vaccinium oxycoccos	S5	GREEN
Mountain Cranberry	Vaccinium vitis-idaea	S5	GREEN
Gypsy-Weed	Veronica officinalis	S5SE	EXOTIC
Alderleaf Viburnum	Viburnum alnifolium	S5	GREEN
Possum-Haw Viburnum	Viburnum nudum	S5	GREEN
Marsh Blue Violet	Viola cucullata	S5	GREEN
Violet	Viola sp.	n/a	n/a
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APPENDIX G Breeding and Population Status of Birds Recorded in the Project Area

Breeding and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square

Table G-1 Breeding Status and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square within which the Project Area is Located (20PR25)

	. (===,				
Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (BBA Data)	Breeding Status (Field Surveys)
Spotted Sandpiper	Actitis macularia	Green	S5B	Confirmed	Possible
Northern Saw-whet Owl	Aegolius acadicus	Green	Green	Possible	Not Observed
Red-winged Blackbird	Agelaius phoeniceus	Green	S5B	Confirmed	Not Observed
Green-winged Teal	Anas crecca	Green	S5B	Confirmed	Not Observed
American Black Duck	Anas rubripes	Green	S5B	Confirmed	Probable
Ruby-throated Hummingbird	Archilochus colubris	Green	S5B	Confirmed	Possible
Great Blue Heron	Ardea herodias	Green	S5B	Observed	Not Observed
Ring-necked Duck	Aythya collaris	Green	S5B	Confirmed	Not Observed
Cedar Waxwing	Bombycilla cedrorum	Green	S5B	Probable	Possible
Ruffed Grouse	Bonasa umbellus	Green	S5	Confirmed	Confirmed
American Bittern	Botaurus Ientiginosus	Green	S4B	Possible	Not Observed
Pine Siskin	Carduelis pinus	Green	S5	Confirmed	Not Observed
American Goldfinch	Carduelis tristis	Green	S5	Confirmed	Probable
Purple Finch	Carpodacus purpureus	Green	S5B	Confirmed	Possible
Hermit Thrush	Catharus guttatus	Green	S5B	Possible	Confirmed
Swainson's Thrush	Catharus ustulatus	Green	S5B	Possible	Probable
Black Guillemot	Cepphus grylle	Green	S3	Possible	Not Observed
Belted Kingfisher	Ceryle alcyon	Green	S5B	Probable	Observed
Killdeer	Charadrius vociferus	Green	S5B	Confirmed	Not Observed
Common Nighthawk	Chordeiles minor	Yellow	S4B	Confirmed	Not Observed
Northern Harrier	Circus cyaneus	Green	S5B	Probable	Not Observed
Northern Flicker	Colaptes auratus	Green	S5B	Confirmed	Possible
Eastern Wood-Pewee	Contopus virens	Green	S4B	Probable	Possible
American Crow	Corvus brachyrhynchos	Green	S5	Confirmed	Observed
Common Raven	Corvus corax	Green	S5	Confirmed	Observed
Blue Jay	Cyanocitta cristata	Green	S5	Possible	Possible
Bay-breasted Warbler	Dendroica castanea	Green	S5B	Possible	Not Observed
Blackburnian Warbler	Dendroica fusca	Green	S4S5B	Probable	Possible
Magnolia Warbler	Dendroica magnolia	Green	S5B	Confirmed	Possible

Table G-1 Breeding Status and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square within which the Project Area is Located (20PR25)

	,				
Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (BBA Data)	Breeding Status (Field Surveys)
Palm Warbler	Dendroica palmarum	Green	S5B	Probable	Not Observed
Chestnut-sided Warbler	Dendroica pensylvanica	Green	S5B	Confirmed	Not Observed
Yellow Warbler	Dendroica petechia	Green	S5B	Confirmed	Probable
Blackpoll Warbler	Dendroica striata	Green	S4B	Probable	Not Observed
Black-throated Green Warbler	Dendroica virens	Green	S5B	Possible	Probable
Pileated Woodpecker	Dryocopus pileatus	Green	S5	Probable	Possible
Gray Catbird	Dumetella carolinensis	Green	S5B	Confirmed	Not Observed
Alder Flycatcher	Empidonax alnorum	Green	S5B	Probable	Possible
Yellow-bellied Flycatcher	Empidonax flaviventris	Green	S5B	Possible	Possible
Yellow-rumped Warbler	Empidonax flaviventris	Green	S5B	Confirmed	Not Observed
Least Flycatcher	Empidonax minimus	Green	S5B	Possible	Not Observed
Spruce Grouse	Falcipennis canadensis	Green	S5	Possible	Not Observed
American Kestrel	Falco sparverius	Green	S5B	Possible	Not Observed
Wilson's Snipe	Gallinago delicata	Green	S5B	Probable	Not Observed
Common Loon	Gavia immer	Yellow	S4B,S4N	Possible	Possible
Common Yellowthroat	Geothlypis trichas	Green	S5B	Confirmed	Possible
Bald Eagle	Haliaeetus leucocephalus	Green	S5B	Possible	Not Observed
Dark-eyed Junco	Junco hyemalis	Green	S5	Confirmed	Confirmed
Herring Gull	Larus argentatus	Green	S5B	Possible	Not Observed
Great Black-backed Gull	Larus marinus	Green	S5B	Observed	Not Observed
Red Crossbill	Loxia curvirostra	Undetermi ned	S3S4	Observed	Not Observed
Swamp sparrow	Melospiza georgiana	Green	S5B	Probable	Possible
Lincoln's Sparrow	Melospiza lincolnii	Green	S5B	Confirmed	Not Observed
Song Sparrow	Melospiza melodia	Green	S5B	Confirmed	Possible
Common Merganser	Mergus merganser	Green	S5B	Confirmed	Not Observed
Northern Mockingbird	Mimus polyglottos	Green	S3B	Possible	Not Observed
Black-and-white Warbler	Mniotilta varia	Green	S5B	Possible	Probable

Table G-1 Breeding Status and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square within which the Project Area is Located (20PR25)

Brown-headed Cowbird Mo	cientific Name blothrus ater borornis iladelphia	NSDNR Rank	ACCDC Rank	Breeding Status (BBA Data)	Breeding Status (Field
On	orornis	Green	CAD		Surveys)
On			S4B	Observed	Not Observed
		Green	S5B	Possible	Possible
Osprey Pa.	ndion haliaetus	Green	S5B	Confirmed	Not Observed
Northern Parula Warbler Pa	rula americana	Green	S5B	Probable	Possible
Black-capped Chickadee Pal	rus atricapillus	Green	S5	Confirmed	Confirmed
House Sparrow Pa	sser domesticus	Exotic	SE	Confirmed	Not Observed
I Grav Jav	risoreus nadensis	Yellow	S4	Probable	Not Observed
L DOUDIA-CRESTAN COMPORANT L	alacrocorax ritus	Green	S5B	Possible	Not Observed
L Rosa-brasstad (-rosbask	eucticus Iovicianus	Green	S4B	Not Observed	Possible
Black-backed Woodpecker Pic	coides arcticus	Green	S4	Not Observed	Possible
Downy Woodpecker Pic	coides pubescens	Green	S5	Confirmed	Not Observed
Hairy Woodpecker Pic	coides villosus	Green	S5	Possible	Observed
Boreal Chickadee Po	ecile hudsonica	Yellow	S4	Confirmed	Not observed
Common Grackle Qu	iscalus quiscula	Green	S5B	Confirmed	Observed
Ruby-crowned Kinglet Re	gulus calendula	Green	S5B	Confirmed	Possible
Golden-crowned Kinglet Re	gulus satrapa	Green	S5B	Probable	Possible
Eastern Phoebe Sa	yornis phoebe	Green	S2S3B	Confirmed	Not Observed
American Woodcock Sco	olopax minor	Green	S4S5B	Probable	Not Observed
Ovenbird Sea	iurus aurocapillus	Green	S5B	Confirmed	Confirmed
Northern Waterthrijen	iurus veboracensis	Green	S5B	Possible	Possible
American Redstart Se	tophaga ruticilla	Green	S5B	Confirmed	Probable
Red-breasted Nuthatch Site	ta canadensis	Green	S5	Probable	Possible
Yellow-bellied Sapsucker Sp.	hyrapicus varius	Green	S5B	Not Observed	Observed
Chipping Sparrow Sp.	izella passerina	Green	S5B	Confirmed	Not Observed
Common Tern Ste	erna hirundo	Yellow	S3B	Confirmed	Not Observed
Barred Owl Str	rix varia	Green	S5	Possible	Not Observed
European Starling Stu	ırnus vulgaris	Exotic	SE	Confirmed	Not Observed
Tree Swallow Tae	chycineta bicolor	Green	S5B	Confirmed	Observed

Table G-1 Breeding Status and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square within which the Project Area is Located (20PR25)

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (BBA Data)	Breeding Status (Field Surveys)
Willet	Tringa semipalmata	Green	S4B	Possible	Not Observed
Winter Wren	Troglodytes troglodytes	Green	S5B	Possible	Possible
American Robin	Turdus migratorius	Green	S5B	Confirmed	Probable
Eastern Kingbird	Tyrannus tyrannus	Green	S4B	Possible	Not Observed
Tennessee Warbler	Vermivora peregrina	Green	S5B	Possible	Not Observed
Nashville Warbler	Vermivora ruficapilla	Green	S5B	Confirmed	Possible
Red-eyed Vireo	Vireo olivaceus	Green	S5B	Confirmed	Confirmed
Solitary Vireo	Vireo solitarius	Green	S5B	Confirmed	Probable
Canada Warbler	Wilsonia canadensis	Green	S4B	Probable	Not Observed
Wilson's Warbler	Wilsonia pusilla	Green	S4B	Possible	Possible
Mourning Dove	Zenaida macroura	Green	S5B	Confirmed	Not Observed
White-throated Sparrow	Zonotrichia albicollis	Green	S5B	Confirmed	Probable

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APPENDIX H
Plant and Bird Species Recorded by Wetland

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Common	Scientific											We	etlanc										
Name	Name	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Balsam Fir	Abies balsamea	Р		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	
Striped Maple	Acer pensylvanicum	Р		Р	Р		Р		Р		Р	Р	Р		Р	Р		Р	Р		Р		
Red Maple	Acer rubrum	Р	Р	Р	Р	Р	Р	Р		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р
Sugar Maple	Acer saccharum			Р						Р	Р							Р					
European Grovebur	Agrimonia eupatoria																					Р	
Rough Bentgrass	Agrostis hyemalis	Р	Р	Р	Р			Р													Р		
Perennial Bentgrass	Agrostis perennans	Р															Р	Р	Р	Р			
Spreading Bentgrass	Agrostis stolonifera																					Р	
Speckled Alder	Alnus incana		Р					Р	Р					Р					Р				
Green Alder	Alnus viridis			Р																			Р
Allegheny Service- Berry	Amelanchier laevis										Р											Р	
Serviceberry	Amelanchier sp.	Р		Р			Р	Р	Р	Р	Р		Р	Р	Р					Р	Р		Р
Bog Rosemary	Andromeda glaucophylla			Р																			
Wild Sarsaparilla	Aralia nudicaulis	Р		Р	Р		Р	Р		Р	Р	Р	Р		Р		Р		Р	Р			
Black Chokeberry	Aronia melanocarpa		Р	Р																		Р	Р
Whorled Aster	Aster acuminatus	Р	Р	Р	Р		Р	Р		Р	Р			Р	Р	Р	Р	Р			Р		
White Panicled American-Aster	Aster lanceolatus		Р	Р																			
Farewell-Summer	Aster lateriflorus	Р			Р		Р	Р	Р	Р	Р	Р		Р			Р	Р		Р	Р		
Bog Aster	Aster nemoralis			Р																			
New Belgium American-Aster	Aster novi-belgii	Р	Р	Р																Р			
Swamp Aster	Aster puniceus	Р		Р										Р					Р			Р	Р
Rough-Leaved Aster	Aster radula			Р							Р	Р	Р	Р	Р	Р			Р		Р	Р	Р
Aster	Aster sp.																					Р	
Parasol White-Top	Aster umbellatus	Р		Р	Р		Р	Р	Р	Р		Р	Р	Р		Р			Р		Р	Р	
Lady-Fern	Athyrium filix-femina	Р		Р		Р		Р	Р		Р					Р		Р				Р	
Yellow Birch	Betula alleghaniensis	Р	Р	Р	Р	Р	Р	Р	Р		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	
Heart-Leaved Paper Birch	Betula cordifolia		Р	Р																	Р	Р	
Paper Birch	Betula papyrifera																					Р	
Beggar-Ticks	Bidens sp.		Р																				
Bearded Short-Husk	Brachyelytrum erectum	Р		Р						Р		Р											
Blue-Joint Reedgrass	Calamagrostis canadensis		Р	Р	Р															Р			
Black Sedge	Carex arctata																						
Brownish Sedge	Carex brunnescens			Р	Р	Р								Р									Р

Common	Scientific											We	etland	d									
Name	Name	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hoary Sedge	Carex canescens		Р	Р	Р			Р												Р		Р	
Crawford Sedge	Carex crawfordii															Р							
Softleaf Sedge	Carex disperma				Р		Р				Р			Р									
Little Prickly Sedge	Carex echinata	Р	Р	Р															Р	Р	Р	Р	Р
Yellow Sedge	Carex flava			Р	Р																		
Long Sedge	Carex folliculata			Р																			
A Sedge	Carex gynandra	Р		Р	Р			Р	Р		Р	Р		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р
Bladder Sedge	Carex intumescens	Р		Р	Р		Р	Р	Р	Р		Р		Р		Р							
Slender Sedge	Carex lasiocarpa		Р																				
Bristly-Stalk Sedge	Carex leptalea			Р							Р		Р	Р								Р	
Finely-Nerved Sedge	Carex leptonervia												Р										
Shallow Sedge	Carex lurida																					Р	
Black Sedge	Carex nigra								Р													Р	Р
Cyperus-Like Sedge	Carex pseudocyperus		Р																				
Rough Sedge	Carex scabrata	Р		Р							Р			Р				Р			Р		
Tussock Sedge	Carex stricta			Р												Р							
Three-Seed Sedge	Carex trisperma	Р		Р	Р	Р	Р				Р	Р	Р	Р	Р		Р		Р	Р	Р	Р	
Leatherleaf	Chamaedaphne calyculata		Р	Р																			
White Turtlehead	Chelone glabra	Р	Р	Р										Р							Р		
American Golden-	Chrysosplenium	Р		Р		Р						Р							Р			Р	
Saxifrage	americanum	P		Р															P				
Slender Wood Reedgrass	Cinna latifolia										Р			Р				Р					
Small Enchanter's Nightshade	Circaea alpina		Р									Р				Р		Р	Р				
Creeping Thistle	Cirsium arvense	Р																					
Clinton Lily	Clintonia borealis			Р	Р	Р					Р	Р	Р	Р					Р	Р			
Goldthread	Coptis trifolia			Р	Р	Р	Р					Р		Р	Р			Р			Р		
Spotted Coralroot	Corallorhiza maculata										Р												
Early Coralroot	Corallorhiza trifida											Р	8	10							Р		
Dwarf Dogwood	Cornus canadensis		Р	Р	Р	Р		Р				Р			Р				Р	Р	Р		
Beaked Hazelnut	Corylus cornuta									Р	Р	Р		Р									
Pink Lady's-Slipper	Cypripedium acaule			Р		Р		Р				Р	Р	Р	Р				Р	Р			
Northern Bush- Honeysuckle	Diervilla lonicera			Р										Р									
Roundleaf Sundew	Drosera rotundifolia			Р											Р				Р		Р		

Common	Scientific												etland										
Name	Name	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mountain Wood-Fern	Dryopteris campyloptera													Р				Р	Р				
Spinulose Shield Fern	Dryopteris carthusiana	Р		Р	Р	Р	Р	Р							Р				Р				
Crested Shield-Fern	Dryopteris cristata			Р				Р				Ρ		Р					Р	Р	Р	Р	Ρ
Evergreen Woodfern	Dryopteris intermedia			Р				Р		Р								Р					
Marginal Wood-Fern	Dryopteris marginalis																					Р	
Three-Way Sedge	Dulichium arundinaceum		Р																				
Spike-Rush	Eleocharissp.																					Р	
Hairy Willow-Herb	Epilobium ciliatum	Р																	Р	Р			
Purple-Leaf Willow- Herb	Epilobium coloratum																						Р
Linear-Leaved Willow- Herb	Epilobium leptophyllum		Р																			Р	Р
Marsh Willow-Herb	Epilobium palustre																				Р		
Willow-Herb	Epilobium sp.																					Р	
Field Horsetail	Equisetum arvense			Р					Р	Р				Р		Р	Р				Р	Р	
Woodland Horsetail	Equisetum sylvaticum		Р	Р							Р			Р			Р		Р		Р		
Narrow-Leaved Cotton-Grass	Eriophorum polystachion			Р																			
Tawny Cotton-Grass	Eriophorum virginicum			Р															Р		Р		
Spotted Joe-Pye Weed	Eupatorium maculatum																					Р	
Common Boneset	Eupatorium perfoliatum																				Р	Р	
Flat-Top Fragrant- Golden-Rod	Euthamia graminifolia		Р																		Р	Р	Р
American Beech	Fagus grandifolia														Р	Р		Р				Р	
Red Fescue	Festuca rubra																					Р	
Woodland Strawberry	Fragaria vesca																						Р
Virginia Strawberry	Fragaria virginiana			Р	Р				Р												Р		
White Ash	Fraxinus americana	Р		Р							Р	Р	Р	Р							Р		
Rough Bedstraw	Galium asprellum																					Р	
Bedstraw	Galium sp.						Р	Р	Р														
Stiff Marsh Bedstraw	Galium tinctorium		Р	Р	Р							Р	Р	Р		Р		Р		Р	Р		Р

Common	Scientific												etland										
Name	Name	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Creeping Snowberry	Gaultheria hispidula	Р	Р	Р		Р							Р	Р					Р				
Teaberry	Gaultheria procumbens			Р																			
Black Huckleberry	Gaylussacia baccata			Р																		Р	
Large-Leaved Avens	Geum macrophyllum																					Р	
Purple Avens	Geum rivale																					Р	
Canada Manna-Grass	Glyceria canadensis			Р																		Р	
Fowl Manna-Grass	Glyceria striata	Р		Р	Р	Р		Р	Р		Р	Р	Р	Р			Р		Р	Р		Р	Р
Northern Oak Fern	Gymnocarpium dryopteris			Р										Р									
American Witch-Hazel	Hamamelis virginiana												Р										
Common Hawkweed	Hieracium lachenalii			Р	Р				Р	Р		Р		Р					Р				
American Water- Pennywort	Hydrocotyle americana																					Р	
Black Holly	llex verticillata		Р	Р	Р	Р		Р						Р	Р				Р				
Spotted Jewel-Weed	Impatiens capensis	Р	Р															Р				Р	Р
Blueflag	Iris versicolor			Р		Р			Р														
Sharp-Fruit Rush	Juncus acuminatus																					Р	
Baltic Rush	Juncus arcticus		Р	Р																			
Narrow-Panicled	Juncus			Р																			
Rush	brevicaudatus																						
Canada Rush	Juncus canadensis		Р	Р																	Р		
Soft Rush	Juncus effusus		Р	Р	Р																Р	Р	Р
Ruch	Juncus sp.			Р																	Р		
Sheep-Laurel	Kalmia angustifolia		Р	Р				Р					Р	Р	Р						Р	Р	
Pale Laurel	Kalmia polifolia			Р																			
Wild lettuce	Lactuca sp.																					Р	
American Larch	Larix laricina		Р	Р																			
Common Labrador Tea	Ledum groenlandicum		Р	Р																			
Twinflower	Linnaea borealis			Р								Р	Р		Р				Р		Р		
Heartleaf Twayblade	Listera cordata												Р										
Mountain Fly- Honeysuckle	Lonicera caerulea			Р																	Р		
American Fly- Honeysuckle	Lonicera canadensis			Р								Р											
Bog Clubmoss	Lycopodiella inundata			Р																			
American Bugleweed	Lycopus americanus																					Р	

Common	Scientific											We	etland										
Name	Name	3	4	5	6	7	8	9	10	11	12		14		16	17	18	19	20	21	22	23	24
Northern Bugleweed	Lycopus uniflorus	Р	Р	Р	Р			Р	Р			Р		Р		Р	Р	Р	Р	Р	Р	Р	كنات
Swamp Loosestrife	Lvsimachia terrestris		P	P	•			P								<u> </u>	<u> </u>	<u> </u>	•	<u> </u>		•	Р
Purple Loosestrife	Lythrum salicaria			P																			
Wild Lily-of-The-	Maianthemum			_	-	-	1	_		1			-			_	1		_		-		
Valley	canadense			Р	Р	Р	Р	Р		Р	Р		Р			Р	Р		Р		Р		l
Indian Cucumber-	Medeola virginiana																	Р					
Root	<u> </u>				ļ		-								ļ							1	
Corn Mint	Mentha arvensis											_		_								Р	
Naked Bishop's-Cap	Mitella nuda											Р		Р									
One-Flower Wintergreen	Moneses uniflora			Р			Р		Р			Р	Р							Р			
Fall Dropseed Muhly	Muhlenbergia uniflora			Р																			
Small Forget-Me-Not	Myosotis laxa		Р											Р								Р	
Sweet Bayberry	Myrica gale			Р																			
Northern Bayberry	Myrica pensylvanica			Р				Р							Р						Р	Р	
Slender Naiad	Najas flexilis		Р																				
Mountain Holly	Nemopanthus mucronata			Р		Р							Р		Р								
Yellow Pond-Lily	Nuphar variegata		Р																				
Sensitive Fern	Onoclea sensibilis	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р				Р	Р			Р	Р		<u> </u>
Cinnamon Fern	Osmunda cinnamomea	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р
Interrupted Fern	Osmunda claytoniana			Р								Р		Р			Р			Р		Р	
Royal Fern	Osmunda regalis			Р		Р																Р	
White Wood-Sorrel	Oxalis acetosella	Р		Р	Р						Р	Р			Р			Р	Р		Р		
Northern Beech Fern	Phegopteris connectilis			Р						Р	Р					Р		Р					
White Spruce	Picea glauca			Р							Р			Р		Р	Р	Р			Р	Р	Р
Black Spruce	Picea mariana	Р	Р	P	Р	Р	Р	Р	Р		P		Р		Р				Р	Р	P	P	
Eastern White Pine	Pinus strobus											Р	Р										
Small Green Woodland Orchid	Platanthera clavellata		Р	Р	Р							Р		Р					Р	Р	Р		
Leafy White Orchis	Platanthera dilatata			Р	1		1								1	1	1	1		1	Р		
Small Purple-Fringe	Platanthera dilatata	_												_			_				-	_	
Orchis	psycodes	Р										Р		Р			Р				Р	Р	Р
Orchid	Platanthera sp.																					Р	
Rose Pogonia	Pogonia ophioglossoides																				Р		

Common	Scientific											We	etland	1									
Name	Name	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Arrow-Leaved Tearthumb	Polygonum sagittatum		Р					Р														Р	Р
Rock Polypody	Polypodium virginianum					Р																	
Christmas Fern	Polystichum acrostichoides	Р										Р				Р							
Pickerel Weed	Pontederia cordata		Р																				
Large-Tooth Aspen	Populus grandidentata								Р														
Quaking Aspen	Populus tremuloides												Р										Р
Nuttall Pondweed	Potamogeton epihydrus		Р																				
Slender Pondweed	Potamogeton pusillus		Р																				
Tall Rattlesnake-root	Prenanthes altissima									Р	Р			Р		Р		Р			Р		
Three-Leaved Rattlesnake-root	Prenanthes trifoliolata										Р							Р			Р		
Self-Heal	Prunella vulgaris											Р		Р							Р	Р	
Choke Cherry	Prunus virginiana			Р																			
Bracken Fern	Pteridium aquilinum	Р		Р													Р			Р			
Shinleaf	Pyrola elliptica																					Р	
Pyrola	Pyrola sp.	Р								Р		Р								Р			Р
Tall Butter-Cup	Ranunculus acris																					Р	
Creeping Butter-Cup	Ranunculus repens			Р	Р	Р	Р	Р	Р	Р	Р	Р		Р		Р	Р		Р			Р	Р
Rhodora	Rhododendron canadense		Р	Р																			
White Beakrush	Rhynchospora alba			Р															Р				
Brown Beakrush	Rhynchospora fusca			Р																			
Bristly Black Currant	Ribes lacustre																					Р	
Currant	Ribes sp.																		Р				
Rambler Rose	Rosa multiflora			Р																			
Shining Rose	Rosa nitida			Р															Р		Р		
a bramble	Rubus alleghaniensis																						Р
Smooth Blackberry	Rubus canadensis			Р																			
Bristly Dewberry	Rubus hispidus			Р				Р											Р		Р	Р	Р
Red Raspberry	Rubus idaeus	Р	Р																				Р
Dwarf Red Raspberry	Rubus pubescens	Р		Р						Р	Р	Р		Р					Р	Р	Р	Р	Р
Bebb's Willow	Rubus sp.			P																			
Prairie Willow	Salix bebbiana																					Р	

Common	Scientific											We	etland										
Name	Name	3	4	5	6	7	8	9	10	11	12		14		16	17	18	19	20	21	22	23	24
Common Elderberry	Salix humilis																				Р		
Willow	Salix sp.		Р	Р					Р											Р	P	Р	Р
Northern Pitcher-Plant	Sambucus canadensis								-													-	
Black-Girdle Bulrush	Sarracenia purpurea			Р																			
Cottongrass Bulrush	Scirpus cyperinus	Р		P																	Р		Р
Small-Fruit Bulrush	Scirpus microcarpus		Р	-																	P	Р	
Hooded Skullcap	Scutellaria galericulata		-	Р																		Р	
Mad Dog Skullcap	Scutellaria lateriflora		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р							Р			Р	
Tansy Ragwort	Senecio jacobaea																						Р
Solomon's-Plume	Smilacina racemosa	Р																					
Three-Leaf Solomon's-Plume	Smilacina trifolia			Р																			
Climbing Nightshade	Solanum dulcamara	Р		Р																			
Canada Goldenrod	Solidago canadensis	Р	Р																				
Broad-Leaved Goldenrod	Solidago flexicaulis	Р										Р											
Smooth Goldenrod	Solidago gigantea																						Р
Rough-Leaf Goldenrod	Solidago rugosa	Р	Р	Р	Р			Р	Р		Р			Р		Р	Р				Р	Р	Р
Bog Goldenrod	Solidago uliginosa			Р																			
American Mountain- Ash	Sorbus americana										Р								Р	Р	Р		Р
American Bur-Reed	Sparganium americanum		Р	Р																			
Small Bur-Reed	Sparganium natans		Р																				
Narrow-Leaved Meadow-Sweet	Spiraea alba		Р	Р				Р	Р														
Canadian Yew	Taxus canadensis			Р																			
Tall Meadow-Rue	Thalictrum pubescens	Р		Р				Р															
New York Fern	Thelypteris noveboracensis	Р		Р	Р		Р		Р	Р	Р	Р	Р	Р	Р		Р	Р	Р		Р		
Marsh Fern	Thelypteris palustris			Р																			
Marsh St. John's-Wort	Triadenum fraseri			Р																			
Marsh St. John's Wort	Triadenum virginicum		Р																				
Northern Starflower	Trientalis borealis			Р	Р			Р		Р		Р		Р	Р			Р			Р		
Colt's Foot	Tussilago farfara	Р		Р																			

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Table H-1 Vascular Plants Recorded Within Wetlands¹ of the Project Area

Common	Scientific											We	etland										
Name	Name	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Broad-Leaf Cattail	Typha latifolia		Р	Р																			
American Elm	Ulmus americana			Р																			
Hidden-Fruited Bladderwort	Utricularia geminiscapa		Р																				
Late Lowbush Blueberry	Vaccinium angustifolium		Р	Р		Р		Р				Р		Р	Р				Р		Р		
Large Cranberry	Vaccinium macrocarpon		Р	Р																			
Velvetleaf Blueberry	Vaccinium myrtilloides			Р	Р	Р			Р				Р		Р						Р		Р
Small Cranberry	Vaccinium oxycoccos			Р											Р								
Gypsy-Weed	Veronica officinalis								Р							Р							
Alderleaf Viburnum	Viburnum alnifolium			Р																			
Possum-Haw Viburnum	Viburnum nudum		Р	Р	Р		Р	Р					Р		Р								
Marsh Blue Violet	Viola cucullata			Р																			
Violet	Viola sp.	Р	Р	Р	Р				Р		Р	Р		Р				Р	Р	Р	Р	Р	Р
	Total	5 0	63	13 3	4 2	2 7	2 4	4 0	32	25	40	48	39	63	30	27	23	30	47	33	65	72	39

¹ Plant inventories were not conducted for Wetlands 1 and 2 because these were already performed under an existing EA for the Rhodean Rock Quarry property (JWL 2006a)

Table H-2 Bird species encountered in wetlands¹

Common Nama	Caiantifia Nama												We	etla	nds									
Common Name	Scientific Name	1	2	3	4	5	6	7 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
American Black Duck	Anas rubripes				1																		Ĩ	
Cedar Waxwing	Bombycilla cedrorum				1	1																		
Ruffed Grouse	Bonasa umbellus																						1	
American Goldfinch	Carduelis tristis	1																						1
Hermit Thrush	Catharus guttatus					1		1							1								1	
Swainson's Thrush	Catharus ustulatus																					1		
Northern Flicker	Colaptes auratus						1																	
Blue Jay	Cyanocitta cristata																					1		
Blackburnian Warbler	Dendroica fusca													1	1									
Magnolia Warbler	Dendroica magnolia															1								
Yellow Warbler	Dendroica petechia					1																		1
Black-throated Green Warbler	Dendroica virens																				1	1		
Yellow-bellied Flycatcher	Empidonax flaviventris					1															1			
Common Yellowthroat	Geothlypis trichas					1																		
Dark-eyed Junco	Junco hyemalis															1								
Belted Kingfisher	Megaceryle alcyon					1																		
Swamp sparrow	Melospiza georgiana					1																		
Song Sparrow	Melospiza melodia					1																		
Black-and-white Warbler	Mniotilta varia											1			1						1	1	1	1
Hairy Woodpecker	Picoides villosus		1	1												1							1	
Black-capped Chickadee	Poecile atricapillus					1			1				1			1						1	1	1
Golden-crowned Kinglet	Regulus satrapa						·	1																
Ovenbird	Seiurus aurocapilla	1				1						1		1						1		1	1	
American Redstart	Setophaga ruticilla																						1	
Red-breasted Nuthatch	Sitta canadensis					1																		
American Robin	Turdus migratorius					1																		
Nashville Warbler	Vermivora ruficapilla															1								
Red-eyed Vireo	Vireo olivaceus					1									1							1	1	
Solitary Vireo	Vireo solitarius		1				1								1							1		
White-throated Sparrow	Zonotrichia albicollis					1									1							1		
•	To	tal 2	2	1	2	14	2 2	2 0	1	0	0	2	1	2	6	5	0	0	0	1	3	9	8	4

¹ Wetland 1 and 2 include information from existing EA on Rhodena Rock Quarry Property (JWL 2006a)

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APPENDIX I Fines Leachate Analysis

Table I-1 MATERIALS INORGANIC CHEMISTRY
Martin Marietta Materials
Mulgrave, Nova Scotia

	RDL	CCME Guideline		Sample ID	
Parameters	(mg/kg)	s (mg/kg)	Pond Fines	Sample #1	Sample #2
	Dat	te collected:	13-May-09	14-May-09	14-May-09
Aluminum	10	-	17000	16000	13000
Antimony	2	40	nd	nd	nd
Arsenic	2	12	4	3	nd
Barium	5	2000	59	71	17
Beryllium	2	8	4	3	4
Bismuth	2	-	nd	nd	nd
Boron	5	-	nd	nd	nd
Cadmium	0.3	22	nd	0.4	nd
Chromium	2	87	12	16	10
Cobalt	1	300	9	12	7
Copper	2	91	17	38	11
Iron	500	-	57000	52000	53000
Lead	0.5	600	13	21	11
Lithium	2	-	21	22	16
Manganese	2	-	2100	2100	1500
Mercury	0.1	50	nd	nd	nd
Molybdenum	2	40	nd	3	nd
Nickel	2	50	9	11	7
Rubidium	2	-	nd	nd	nd
Selenium	2	2.9	nd	nd	nd
Silver	0.5	40	nd	nd	nd
Strontium	5	-	nd (50)	nd (50)	nd (50)
Thallium	0.1	1	nd	nd	nd
Tin	2	300	5	4	5
Uranium	0.1	300	1.8	1.8	1.6
Vanadium	2	130	46	53	30
Zinc	5	360	140	190	100

Notes:

- 1. RDL = laboratory's reportable detection limit
- 2. nd = parameter not detected above RDL; nd (0.1) = parameter not detected above the elevated RDL in parentheses
- 3. ' -' = no guideline available
- CCME Guidelines = Canadian Council of Ministers of the Environment Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (1999; last updated 2008); industrial land use

								Sample	ID		
			CCME	CCME		Pond	l Fines	Samp	le #1	Sam	ple #2
			Freshwater	Marine		13-M	lay-09	14-Ma	ay-09	14-N	/lay-09
Parameter	Units	RDL	Aquatic Life	Aquatic Life	GCDWQ	SPLP Method	SPLP - 10X Attenuation Factor	SPLP Method	SPLP - 10X Attenuatio n Factor	SPLP Method	SPLP - 10X Attenuatio n Factor
Aluminum	ug/L	100	5 to 100	-	-	<u>350</u>	35	<u>600</u>	60	<u>530</u>	53
Antimony	ug/L	20	-	-	6	nd	nd (2)	nd	nd (2)	nd	nd (2)
Arsenic	ug/L	20	5	12.5	10	<u>nd</u>	nd (2)	<u>nd</u>	nd (2)	<u>nd</u>	nd (2)
Barium	ug/L	50	-	-	1000	nd	nd (5)	61	6.1	nd	nd (5)
Beryllium	ug/L	20	-	-	-	nd	nd (2)	nd	nd (2)	nd	nd (2)
Boron	ug/L	500	-	-	5000	nd	nd (50)	nd	nd (250)	nd	nd (250)
Cadmium	ug/L	3	0.017	0.12	5	<u>nd</u>	nd (0.3)	<u>nd</u>	nd (0.3)	nd	nd (0.3)
Chromium	ug/L	20	-	-	50	nd	nd (2)	nd	nd (2)	nd	nd (2)
Cobalt	ug/L	10	-	-	-	nd	nd (1)	nd	nd (1)	nd	nd (1)
Copper	ug/L	20	2 to 4	-	1000	<u>nd</u>	nd (2)	<u>nd</u>	nd (2)	<u>nd</u>	nd (2)
Iron	ug/L	500	300	-	300	<u>nd</u>	nd (50)	920	92	nd	nd (50)
Lead	ug/L	5	1 to 7	-	10	nd	nd (0.5)	nd	nd (0.5)	nd	nd (0.5)
Lithium	ug/L	20	-	-	-	nd	nd (2)	nd	nd (2)	nd	nd (2)
Manganese	ug/L	20	-		50	nd	nd (2)	54	5.4	nd	nd (2)
Mercury	ug/L	0.01	0.026	0.016	1	-	-	-	-	-	-
Molybdenum	ug/L	20	73	-	-	nd	nd (2)	nd	nd (2)	nd	nd (2)
Nickel	ug/L	20	25 to 150	-	-	nd	nd (2)	nd	nd (2)	nd	nd (2)
Selenium	ug/L	20	1	-	10	<u>nd</u>	nd (2)	<u>nd</u>	nd (2)	<u>nd</u>	nd (2)
Silver	ug/L	5	0.1	-	-	<u>nd</u>	nd (0.5)	<u>nd</u>	nd (0.5)	<u>nd</u>	nd (0.5)
Strontium	ug/L	500	-	-	-	nd	nd (50)	nd	nd (50)	nd	nd (50)
Thallium	ug/L	1	0.8	-	-	<u>nd</u>	nd (0.1)	<u>nd</u>	nd (0.1)	<u>nd</u>	nd (0.1)
Tin	ug/L	20	-	-	-	nd	nd (2)	nd	nd (2)	nd	nd (2)
Uranium	ug/L	1	-	-	20	nd	nd (0.1)	nd	nd (0.1)	nd	nd (0.1)
Vanadium	ug/L	20	-	-	-	nd	nd (2)	nd	nd (2)	nd	nd (2)
Zinc	ug/L	50	30	-	5000	<u>nd</u>	nd (5)	<u>nd</u>	nd (5)	<u>nd</u>	nd (5)

Notes:

- 1. RDL = laboratory's reportable detection limit
- 2. nd = parameter not detected above RDL; nd (0.1) = parameter not detected above the elevated RDL in parentheses
- 3. '-' = no guideline available
- 4. CCME Freshwater Aquatic Life = Canadian Council of Ministers of the Environment guidelines for the protection of freshwater aquatic life (2008 update).
- 5. CCME Marine Aquatic Life = Canadian Council of Ministers of the Environment guidelines for the protection of marine aquatic life (2008 update).
- 6. GCDWQ = Guidelines for Canadian Drinking Water Quality, Health Canada (2008, update).
- 7. SPLP = Synthetic Precipitation Leaching Procedure
- 8. Attenuation Factor = 10
- 9. Bold & Underlined = parameter concentration exceeds the applicable guideline