

## APPENDIX A

A.1

MILLER'S CREEK MINE UPDATE NEWSLETTER

# FUNDY GYPSUM COMPANY

PO Box 400  
Windsor, Nova Scotia  
B0N 2T0

Residents of the Poplar Grove/Avondale/Belmont loop

December 7, 2005

Dear Resident:

Since mid-September, when we sent our first letter to you about Fundy Gypsum's announcement to continue with its Miller's Creek operation, a number of forward steps have taken place. At that time, we wanted residents to be amongst the first to know about the company announcement. Again with this update, we want to keep local residents aware of progress.

Here is the update:

## 1. Physical Works:

Fundy Gypsum is intending to continue with its Miller's Creek mine. Over the past twenty-five years, mining activity has been moving in a westerly direction towards Ferry Road. Ferry Road will remain as is with the continuation of mining. The Provincial Department of Transportation and Public Works has approved a level crossing which will allow uninterrupted local use of Ferry Road. You may have noticed that some work is ongoing with this project in the form of earthworks and surveying.

## 2. Environmental Review:

We have been in discussions with Federal and Provincial authorities about the types of studies and regulatory approvals required for the environmental review. Discussions are ongoing and we expect that in several months the regulatory process will be clarified. Various Federal and Provincial authorities will be involved in the review, with most reviews likely to be complete in 2006.

## 3. Studies Underway:

There are a number of environmental and technical studies underway at the site. These include flora and fauna, archeological, and habitat studies, as well as drilling programs to better learn of the nature of soils, rock, and gypsum in the area. Information will also be gathered on surface and groundwater flows in the area. You may have noticed staff and consultants taking water flow and water chemistry

measurements from various streams in the area, in particular Fish Brook and Shaw Brook.

4. Mine Planning:

In several months, we will be in a position to determine what adjacent areas to the existing Miller's Creek site will be mined and used for stockpile areas. The drilling program and survey work is ongoing and will be used to develop a preliminary mine plan.

5. Time Frame:

As results of environmental and technical studies are gathered and as plans are drafted, we will be in a better position to respond to questions. We expect the full process of studies and community consultation to take another thirteen months.

Our first letter to residents, September 15, 2005, resulted in a number of inquiries from residents. While it is still early in the process, we were very pleased to have a number of follow-up one-on-one meetings. We are very interested in receiving these inquiries and encourage more of them.

Thank you for your interest in Fundy Gypsum and its continued plans for the Miller's Creek Operation.

Yours Sincerely,



Mike Bishop  
Plant Manager, Fundy Gypsum Company

For more information please phone: 1-888-798-0977 (please leave a phone number so that a representative of Fundy Gypsum Company can contact you) or email: [millerscreek@usg.com](mailto:millerscreek@usg.com)

# FUNDY GYPSUM COMPANY

P.O. Box 400  
Windsor, Nova Scotia  
B0N 2T0

Thursday, September 15, 2005

Residents of Avondale/Belmont/Lawrence Road loop

Dear Resident:

Since Fundy Gypsum began working in this area nearly 50 years ago, we have enjoyed a positive relationship with the residents here and in the other communities in which we work. We have always attempted to keep the community abreast of new developments and answer any questions that have arisen.

That is the purpose of this letter...we want you to be among the first to know about a positive decision recently made by Fundy Gypsum. Here are some of the details.

Fundy Gypsum Company has decided to proceed with planning and initial development, including permitting and local community consultation, related to the development of the next phase of our existing Miller's Creek operation. The next phase involves extraction of gypsum from an area west of the existing operations at Miller's Creek.

Some prior regulatory approvals exist for this next phase including the non-mineral registration (Number 002), the building of a level crossing on Ferry Road and core drilling.

We are at a very early stage of development and are just now beginning to gather detailed information about the site, such as flora and fauna, archaeological and other physical and historical information, to help with the planning. As these plans develop, we will be in a better position to answer questions you may have about the project. We expect the community consultation and environmental review of the project to take about a year and a half.

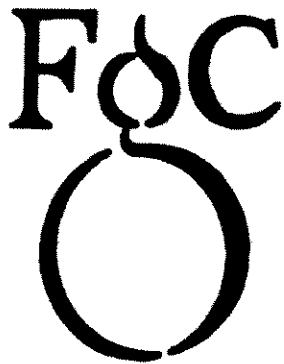
Through this letter, we want you to know that you and all residents of the area will have a full opportunity to see and discuss the draft plans for the project.

For more information please contact:

1-888-798-0977

[millerscreek@usg.com](mailto:millerscreek@usg.com) (please leave a  
phone number so that a representative of  
Fundy Gypsum Company can contact you)

# Miller's Creek Mine Update



**March 2006**

**From:**

**Fundy Gypsum  
Company**

**Address:**  
PO Box 400  
Windsor, NS  
B0N 2T0

**Email:**  
millerscreek@usg.com

**Call:**  
1-888-798-0977

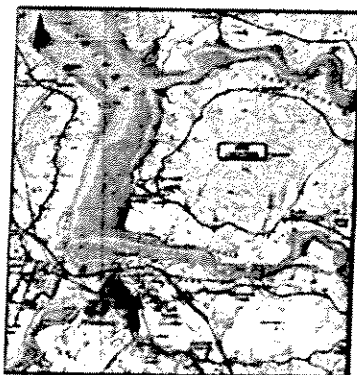
## Introduction

Over the past several months, there have been a number of meetings and letters to local residents about the Miller's Creek Mine. The purpose of this newsletter, and others that will follow over the next year, is to keep residents informed about news of the site. These newsletters are directed to residents of Poplar Grove, Avondale, Belmont Loop and to other people who may have an interest.

## Fundy Gypsum Company and the Miller's Creek Mine

Fundy Gypsum Company has been working in the Miller's Creek area for fifty years. Gypsum mining was carried out by other companies in the same general area for one hundred and fifty years prior to Fundy.

Over the years, mining at Fundy's Miller's Creek site has progressed slowly northwest towards Ferry Road. In September 2005, Fundy Gypsum announced that it has decided to continue with its Miller's Creek mine site and in future years plans to slowly commence mining on the other side of Ferry Road.



One of the first things residents want to know is...what will happen to this road?

Residents' use of the road will not be impaired. The provincial Department of Transportation and Public Works has approved a road intersection which will require Fundy's vehicles to come to a stop before crossing. Ferry Road is a provincially registered and owned road.

## Environmental Assessment

A number of people have asked about the nature of the Environmental Assessment for the continuation of the mine. It is still early, but here is what is known to date about this assessment:

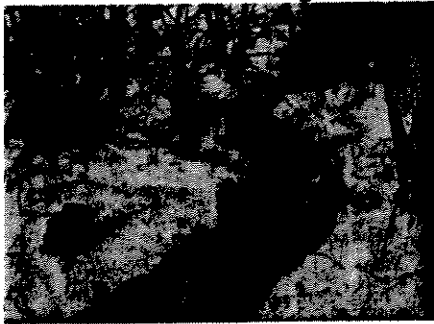
- It will likely be a Provincial level assessment with a supporting role by Federal Government agencies such as Department of Fisheries and Oceans with input and review by other provincial departments.
- The assessment will likely be headed up by the Nova Scotia Department of Environment and Labour.
- The environmental assessment document, prepared by the Company and its environmental consultants, will be filed in early 2007. Authorities typically take twenty-five days to review the document.

So, as we are still early in the process, there is a lot of work ahead. This includes environmental baseline work, special studies, and community consultations.

## Environmental Baseline Study Components

Due to the winter conditions, the amount of baseline data collection has been limited to occasional surface water chemistry and flow when the watercourses were ice-free and some animal presence/absence studies. Ongoing discussion with residents, regulators and organizations with knowledge of the area have aided in advance planning for the spring, summer, fall, and winter 2006 programs. We look forward to additional discussions and revising programs using local knowledge.

### Waterflow Monitoring at Site



A hydrogeological drilling and monitoring well installation program will occur late spring/early summer after the drill site locations are assessed for rare plants and archaeological and cultural resources. This program will involve using track-mounted drill rigs to collect rock cores and information on the geology of the area, and installing long term monitoring wells to use for measuring water levels for baseline and during mining operations. The water level and geology information is used to assist in determining the degree that the groundwater and surface water systems are connected, as well as importance for local water supplies, agriculture, and aquatic habitat health.

### Key Dates

#### Upcoming Field Work

##### Environmental Baseline Data Collection

Terrestrial and Aquatic Biology .....	May 2006 – August 2006
Mi'kmaq Knowledge Study.....	January 2006 – August 2006
Pre-Development Structural Survey.....	July 2006 – September 2006
Pre-Development Water Well Survey.....	July 2006 – September 2006
Archaeology Survey.....	July 2006 – September 2006

Additional aquatic habitat (wetlands, watercourses) and terrestrial habitat survey work will be completed in 2006 as well as field surveys and assessment of species presence/absence, locations, and populations for plants and animals. Local knowledge is important for this component as well.

This spring, Fundy Gypsum will also be obtaining updated aerial photos and topographic information of our operations. This work is expected to take place after the middle of April, as weather permits, and will involve some low-level flying with a small aircraft over the area.

## Community Consultations

During the past month, we have met with community representatives. These representatives were appointed at the February and March community meetings. Fundy Gypsum believes that this is a constructive approach to learning of community questions about the project and how these questions can best be answered. We look forward to our upcoming meetings with the community representatives.

An opinion survey with residents of the area is being developed. Our objective is to find out what questions residents have about the project and how best to answer these. Through our meetings with the community representatives, we are aware that residents have questions and they want answers.

These questions will help with the design of upcoming environmental studies and ultimately the project itself.

## For More Information

More information will become available as studies are completed. In the interim, should you have any inquiries, please leave a message on our toll-free line-1-888-798-0977, or email us at [millerscreek@usg.com](mailto:millerscreek@usg.com). A representative of Fundy Gypsum will return your inquiry.



# Miller's Creek Mine Update



**June 2006**

From:

**Fundy Gypsum  
Company**

**Address:**  
PO Box 400  
Windsor, NS  
B0N 2T0

**Email:**  
millerscreek@usg.com

**Call:**  
1-888-798-0977

## Introduction

A lot has been happening over the past several months with Fundy Gypsum Company (FGC) and the Miller's Creek Mine extension project. We are now pleased to provide the residents of Avondale, Belmont, Mantua, and Poplar Grove with an update. Please give us a call at the telephone number noted in this newsletter if you have any questions.



**Fundy Gypsum Company mining in the Wentworth quarry ... circa 1940.**

## We Asked Your Opinion and the Results are ....

Most people like to know what their friends and neighbors think about important matters. Both FGC and the Warden and Councilors of the Municipality of the District of West Hants felt the same way about the Miller's Creek mine extension project.

Let's find out what the residents 'around the loop' think about the Fundy Gypsum Company ... that was the word out there!

So, FGC hired Dr. Peter Butler to do just that.

Dr. Butler is a Professor of Sociology at Dalhousie University and one of the

most respected opinion researchers in Atlantic Canada. During his career he has designed and directed many public opinion surveys with local and national research organizations.

Dr. Butler's survey was conducted in the first part of May with a sample of the 276 homes that are along the 20 km loop of local roads that surround the Miller's Creek mine site.

He found that residents indicate that the mining industry in the province is generally well perceived and FGC is equally well perceived in the local community. The Company is also well known in the community and nearly three-quarters of the respondents near the Miller's Creek Mine have a favorable opinion of the Company. Further, a majority either agree or strongly agree that FGC is a good employer. Respondents perceive mining, oil and gas, fishing, and the forestry industries as having a poor environmental record. However, mining is perceived to have a better safety record than the other resource industries mentioned.

Results of the opinion survey indicate that local residents put the economic value of mining on par with the oil and gas industry and the forestry industry, with the agriculture industry leading the results.

The Company was particularly interested in the opinions of local residents about its recent announcement regarding the continuation of its existing Miller's Creek operation.

The opinion survey indicated that while FGC is perceived as

more believable in its communications than other groups, more information is needed to address questions. Dr. Butler sees a relationship between a resident's knowledge of the project and a resident's opinion of the project. In other words, the more information residents have, the less concern they have. The survey found that two-thirds of the residents have concerns and questions about the project and this is rooted in concerns and questions about domestic and agricultural water supplies in the area. That is the number one item that has to be addressed according to the research conducted by Dr. Butler.

Full results of the survey will be presented in the near future to the Warden and Councilors of the Municipality of the District of West Hants.

## Fundy is Listening and Learning

So, here is what FGC is now doing in response to the survey findings;

(1): **INFORMATION:** The survey indicates that we should get even more information to local residents about the project. Fundy has a good reputation in the community ... the survey clearly shows this ... and we have to continue to earn this good reputation. We are going to upgrade our information to the residents.

(2): **DOMESTIC WELL SURVEY:** Conestoga-Rovers and Associates (CRA), the company who has been managing the environmental baseline study, will be completing a domestic well survey of approximately 150 homes on the Avondale, Belmont, and Ferry Road Loop. The survey involves voluntary participation by homeowners and will take place during the summer of 2006.

In the next several months, a letter will be sent to each homeowner asking for their voluntary participation. This survey will provide excellent baseline information and we encourage homeowners to participate.

For those homes that wish to participate, a member of CRA will visit for approximately one hour. Wells will be sampled for water quality, measured for flow rate and water depth and other information will be collected, such as date drilled or dug. Homeowners will be forwarded a copy of the report about their well(s) upon the completion of the study.

During the door-to-door survey, CRA will be asking residents if they wish to be involved in a longer-term monitoring program. Participants would be provided with all data collected from their wells including water chemistry and water levels

The public opinion survey indicated that agricultural water users, homes with multiple wells, and higher demand users want assurances of continued water supply and thus special attention will be paid to this in the well water survey program.

(3): **HYDROGEOLOGICAL PROGRAM:** An important element of the environmental baseline program is to determine the groundwater conditions at and near the site of the mine extension project. Hydrogeology is the study of subsurface or ground water including how water moves underground, the quality of the water and the effects that pumping and changing the land surface might have on groundwater.

This program will involve installing monitoring wells in and around the site area, gathering and reviewing published information, and talking to residents about their domestic well water survey and water level and water chemistry monitoring programs. Drilling of the monitoring wells should start within 2 months, and it is expected that 6 - 12 wells will be installed. The wells will be permanent installations to allow long term

monitoring of the groundwater conditions during the life of the mine.

Specific information on the localized groundwater quality and hydrogeology in the vicinity of the residential and agricultural water supplies will be gathered as part of the hydrogeological program.

(3): **SURFACE WATER PROGRAM:** FGC has increased the amount of baseline monitoring of surface water in the vicinity of the site. Surface water quality and flow measurements are being measured at many locations throughout the year. Particular attention is being paid to possible changes in flow rates and water chemistry.



### Ongoing Evaluation of Water Courses at the Site.

FGC encourages residents' participation in the baseline water studies.

## For More Information

Should you have any inquiries, please leave a message on our toll-free line-1-888-798-0977, or email us at [millerscreek@usg.com](mailto:millerscreek@usg.com).

A representative of Fundy Gypsum will return your inquiry.

# Miller's Creek Mine Update



**September  
2006**

From:

**Fundy Gypsum  
Company**

**Address:**  
PO Box 400  
Windsor, NS  
B0N 2T0

**Email:**  
millerscreek@usg.com

**Call:**  
1-888-798-0977

Now that summer has come to an end, and fall is in the air, we'd like to present an update on where we are with the Miller's Creek Mine Extension project.



*A view of one of our duck ponds in the old Miller's Creek Quarry*

## What is Ahead - Water Well Study

Many site studies have been underway as part of the environmental assessment for the Miller's Creek Mine Extension project. You may have seen some of the field specialists in the area collecting information.

One important study has just begun involving homes in the area. You may have already received some information about this in the mail. This information was sent out about three weeks ago.

This is a study of domestic wells for homes surrounding the area of the proposed Miller's Creek Mine Extension Project. This includes the communities of Poplar Grove and Belmont, west of Ferry Road, and Avondale, including Newport Landing. Homes along Ferry Road are also included.

Residents are being asked to voluntarily allow a well water specialist to examine and test their wells for such things as flow rate and quality of water.

This information is very useful in the event that the quality or flow rate of water changes as the Miller's Creek

Mine Extension Project gets underway. The home owner will receive a copy of the survey and results of the water quality test at the completion of the study.

One item to note is that over the past fifty years Fundy has been operating in the Miller's Creek area, we have never had to fix or replace a neighboring well.

So, with that good news, we hope that you will participate in the well water study.

Again, if you live in the loop area of Ferry Road, Poplar Grove, Avondale, Belmont, as well as Newport Landing, you are invited to be part of the study. If you have not already received the letter and wish to participate, please call ...

**Heather Sutherland,  
Project Hydrogeologist,  
Conestoga-Rovers and Associates  
(CRA)  
902-468-1248**

## There are Things We Want to Tell You Item #1: The Future

Representatives of Fundy Gypsum attended a presentation (July 6, 2006) given to the local Municipal Council. Some views about the Miller's Creek Extension Project were raised at this presentation that we now wish to add to.

Fundy Gypsum is one of the longest standing and largest employers (approximately 160 employees) in West Hants. It is also one of the largest taxpayers. In short, it is a significant economic contributor and many people depend on Fundy Gypsum for their livelihood.

A mining company can not continue to operate without finding new rock deposits. The supply of rock from the Miller's Creek quarry is critical to the continued operation of both the Wentworth quarry and Hantsport ship loading facility, not just the Miller's Creek facility. It impacts all of Fundy Gypsum's operations.

Some people say "we are not opposed to Fundy Gypsum Company, just the Miller's Creek Mine Extension Project"; however the negative outcome is the same. Fundy Gypsum will close without the Miller's Creek Mine Extension Project.

Although you may not work at the mine site, as a taxpayer you should be concerned. Everybody has to pitch-in to pay taxes. When one of biggest taxpayers leaves, it can negatively impact the remaining taxpayers.

People have lived next to Fundy Gypsum's operating sites for many, many years. Any issues that we are made aware of are taken very seriously and promptly acted on. It is very important to us that we maintain good relationships with our neighbors, now and in the future. This will not change.

## Item #2: The Environmental Review

There is another important item that needs to be addressed, and this relates to the environmental evaluation that will be undertaken for the Miller's Creek Mine Extension Project. A few people say that there is little value in the Environmental Assessment (EA) Process conducted by the Nova Scotia Department of Environment and Labour. They indicate that the process is no good and that most companies can somehow 'steer around' the review process.

Any notion that Fundy Gypsum will be able to avoid or 'steer around' the Environment Assessment (EA) Process of the Provincial Department of Environment and Labour represents a very clear misunderstanding of what is involved in today's environmental review process.

Other companies operating within Nova Scotia will tell you that the Environmental Assessment Process in this Province is one of the most comprehensive in North America. Other countries come to this Province to study our EA Process. It is a world class model! More information can be obtained about the Process at:

[www.gov.ns.ca/enla/ess/ea](http://www.gov.ns.ca/enla/ess/ea)

## Item #3: About the Top Issue ... Water!

We do agree with one point that is being talked about a lot ... water! Our research indicates that there are residents who have questions about their well water. Will the water supply remain the same? Will the quality remain the same? It is the number one question of the abutting residents.

To this end, we have upgraded all of our water-related studies for the project in order to get accurate answers to these important questions.

Within the next six to eight months, we expect to have the answers to these important questions about water supply and quality. We will use scientific information to develop and present plans to make sure that residents' existing water supplies are maintained. We have a lot of study work underway on this subject.



*Heather Sutherland, Project Hydrogeologist, sampling water in one of our new observation wells.*

Fundy Gypsum has always operated with a "if we break it, we fix it" policy. If someone experiences damage to their residence as a result of our operations, we fix it. This will not change.

## For More Information

In closing, we hope you have had a great summer and if you have any questions about our project ... please call 798-0977 or email us at [millerscreek@usg.com](mailto:millerscreek@usg.com).

A representative of Fundy Gypsum will return your inquiry.

# Miller's Creek Mine Update



**December  
2006**

**From:**

**Fundy Gypsum  
Company**

**Address:**

PO Box 400  
Windsor, NS  
B0N 2T0

**Email:**

[millerscreek@usg.com](mailto:millerscreek@usg.com)

**Call:**

1-888-798-0977

## ***Introduction***

During the time since our last newsletter, a number of studies for the Miller's Creek Mine Extension Project, particularly those related to the important matter of well water, have been progressing. In the next few months, we hope to have many of the environmental studies completed.

## ***Mine Planning***

One of the most important aspects of the project is the mine planning – determining the most likely location of the mine in relation to the surrounding area. This has involved the review of a lot of information, from core drill logs to biological studies.

We know that a lot of people have been asking the question ... "where is the mine site going to be?" That is a fair question and we would like to present a preliminary conceptual outline of the site, Fundy Gypsum's Proposed Miller's Creek Mine Extension, which is based on the information available to date (please see reverse side).

## ***Important Things To Know About the Mine Location***

We feel that it is important to provide as accurate information as we can at this point. There has been

a lot of speculation about where the Miller's Creek Mine Extension will be located. We hope that the map helps to clarify some of the important facts about the Miller's Creek Mine Extension Project, particularly its location.

The following points offer additional information about the proposed site.

Area A represents the area where rock will be removed, to be hauled by trucks across Ferry Road to the existing mill and train loading operation.

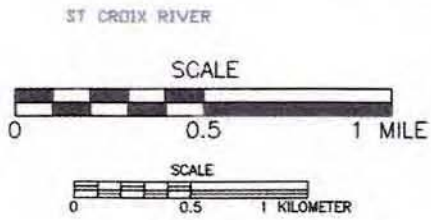
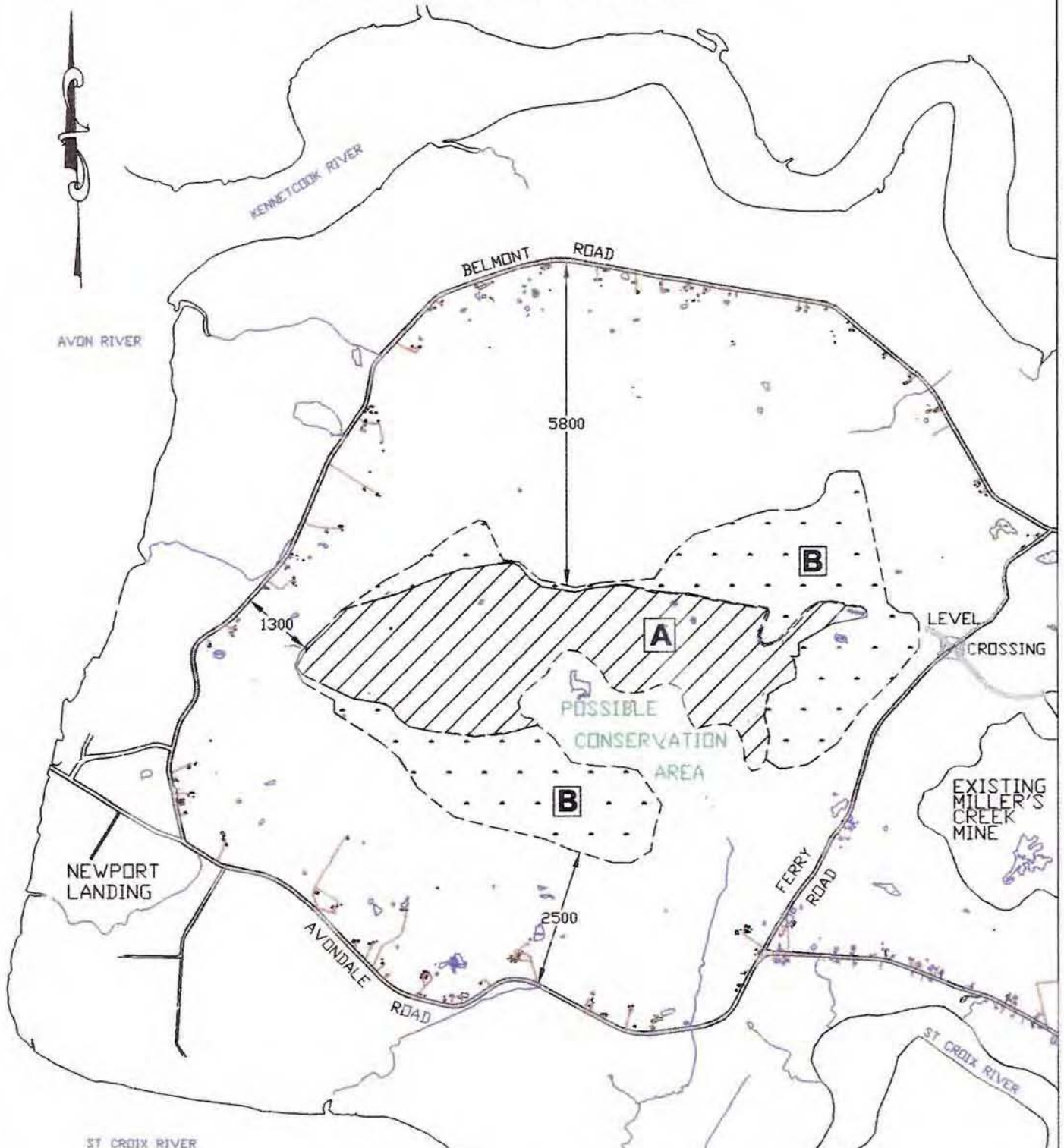
Area B represents the area surrounding the mine, which will be used for stockpiling soil and rock that does not go to the mill operations. Some of the considerations that go into planning the stockpile areas are the presence of mineable gypsum, drainage paths, existing topography and view planes, and property boundaries.

Please note that the map represents the full extent of mining proposed for the extension area. The progression of the mine to the stage shown will be gradual over many decades.

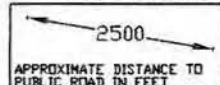
## ***For More Information***

In closing, we welcome any questions you may have, particularly with regard to this conceptual outline of the mine site. Please call 798-0977 or email us at [millerscreek@usg.com](mailto:millerscreek@usg.com). A representative of Fundy Gypsum will return your call.

# FUNDY GYPSUM'S PROPOSED MILLER'S CREEK MINE EXTENSION AT FULL DEVELOPMENT (30-50 YEARS)



- A** GYPSUM EXTRACTION AREA
- B** AREAS FOR STOCKPILES OF SOIL AND ROCK, ENVIRONMENTAL CONTROLS, ROADS, AND BERMS



This is a conceptual presentation that is subject to final confirmation at a later date.

# Miller's Creek Mine Update



**March  
2007**

From:

**Fundy Gypsum  
Company**

**Address:**

PO Box 400  
Windsor, NS  
B0N 2T0

**Email:**

millerscreek@usg.com

**Call:**

1-888-798-0977

## **Introduction**

It has been eighteen months since Fundy Gypsum Company first announced its decision to commence the necessary studies to continue with its mining operations on the west side of Ferry Road. At that time, we indicated that there would be a requirement to undertake many environmental and technical studies for the project.

We knew that the community would want to see the results of these studies and we asked for patience while these were being completed. In many cases, studies have taken months and, in some cases, years to complete.

Finally, we have reached the point where the studies are now complete and we would like to share the results with you. To the many people who have waited in patience, we extend our thanks.

## **An Invitation to The Public Information Session**

As mentioned above, we now have many project details and study results to share with the community. We plan to do this at our Public Information Session scheduled for early next month. The details are as follows:

### **Public Information Session**

Belmont Community Hall  
1090 Belmont Road  
Tuesday, April 3<sup>rd</sup>, and  
Wednesday, April 4<sup>th</sup>  
12:00 pm. to 9:00 pm, daily

Light refreshments will be served.

The Public Information Session is an opportunity for members of the community and other interested parties to meet with people who are knowledgeable about our proposed project and current operations. Representatives from Fundy Gypsum and the various professionals that have conducted studies for the project will be available throughout the day to meet one-on-one with individuals.

Some of the professionals that have worked on the project include:

- Hydrogeologists
- Archaeologists
- Biologists
- Engineers
- Geologists
- Confederacy of Mainland Mi'kmaq

People who attend the Information Session are encouraged to spend as much time as they wish with any of these individuals. Information gained from the community will be used for further mine development planning and will be incorporated into the Environmental Assessment submission to the Province.

We understand that the community is very interested in this project. In order to give people sufficient opportunity to attend, we are holding the Public Information Sessions over a two day period.

We hope to see you there!



## **Fundy Gypsum and Agricultural Lands**

Of late, we have heard and noticed some writings about agricultural lands and the Miller's Creek Mine Extension Project. Perhaps there is a misconception on the part of some people that Fundy is taking up valuable agricultural lands for the project.

We hope that the following information will clarify some important facts about this matter.

Fundy Gypsum has always purchased and traded land around its operations. The land we have acquired west of the existing Miller's Creek site has not been used in recent record for agricultural purposes.

The land proposed for this project has features which are generally considered to be unsuitable for agricultural purposes. It is characterized by sinkholes, outcrops, wetlands, tight clay soils, steep slopes, and uneven terrain. In the area surrounding our proposed mine extension, there is abundant land more suited to agricultural use that is not currently being used for farming.

During our past 50 years of operation in this community, Fundy Gypsum has maintained positive relationships with farmers who border our existing site. In addition to a good rapport, we have assisted local farmers with farm water supply and field development. Many acres of land owned by Fundy Gypsum have been leased by local farmers.

In short, Fundy Gypsum's proposed Miller's Creek Mine Extension Project is not taking

land from the agricultural land base.

## **Mining and Reclamation**

The principle of reclamation is to produce a landscape that is safe, stable, and compatible with the surrounding landscape and final land use. This is generally achieved by grading, contouring, capping with soil, revegetating and flooding mined areas.

Fundy Gypsum has been turning previously mined or disturbed land back to a natural state for decades – land that is now used for wildlife, farming and recreation.

The Meadow Pond, which is on land owned by Fundy Gypsum, is an example of how an area that was previously mined can have an alternate, compatible land use. It is regularly used by the public for hiking and fishing.



*Meadow Pond*

At our existing Miller's Creek site, we have progressively reclaimed areas that are no longer in use. Stockpiles have been contoured and revegetated, and thousands of trees have been planted to create natural habitats that blend in with the surroundings.

At the northwest corner of the Miller's Creek existing site, where Ferry Road meets Belmont Road, there is a large stockpile that has been used to place material that is unsuitable for production. It consists of rock, soil and organic

material. In the spring of 2006, this stockpile reached its capacity and regrading began. In the summer of 2006, the slope that was prepared was seeded with a mixture of grasses and wildflowers. This spring, we expect that the initial growth of vegetation will spread and thicken up nicely. At this point, approximately 20 percent of the west slope of the stockpile is completed.



*Revegetated Area of the Belmont  
Stockpile, July, 2007*



*Cattails at the Base of the Belmont  
Stockpile, September, 2007*

This summer, we will continue along the slope to the south, regrading and shaping the pile, then seeding it. When the reclamation of this area is complete, it will be much less visible from the surrounding area.

## **For More Information**

Again, we thank you for your patience and welcome any questions you may have. Please call 798-0977 or email us at [millerscreek@usg.com](mailto:millerscreek@usg.com).

A representative of Fundy Gypsum will return your call.



A.2

RESULTS OF MILLER'S CREEK PUBLIC OPINION STUDY 2006

# STATEMENT

## Fundy Gypsum Company, Windsor, Nova Scotia

**Dated:**                   **May 19, 2006**

**Windsor, Nova Scotia:** Results of a just completed opinion survey of residents living near the Miller's Creek mine site of Fundy Gypsum Company, Windsor, Nova Scotia indicate that the mining industry in the province is generally well perceived and Fundy Gypsum Company is equally well perceived in the local community.

The survey, under the direction of Dr. Peter Butler and conducted by KLJ Field Services, is one of the first public opinion surveys related to mining and a local community in Nova Scotia. The study was conducted with a sample of the 276 homes that live along the 20 Km loop of local roads that surround the Miller's Creek mine site. The survey has a margin of error of 4.7%, nineteen times out of 20.

“One item that Fundy Gypsum Company is pleased to see is that we are well known in the community and particularly pleasing is that nearly three-quarters of the respondents near our operations have a favorable opinion of our company”, indicates Mike Bishop, Plant Manager. “Further, a majority either agree or strongly agree that we are a good employer.” Respondents perceive mining, oil and gas, fishing, and the forestry industries as having a poor environmental record. However, mining is perceived to have a better safety record than the aforementioned resource industries.

Results of the opinion survey indicate that local residents put the economic value of mining on par with the oil and gas industry and the forestry industry with the agriculture industry leading the results. A study undertaken by Gardner Pinfold Consulting for the Nova Scotia Department of Natural Resources and released May 11, 2006 ranked fishing, mining, agriculture, and forestry (in that order) as the top contributors to GDP in the province's resource sector. The Gardner Pinfold study indicated that the mining industry has the highest average weekly wage of the resource sector in the province. The gypsum producers lead the mining industry with an annual value of primary production of \$80M with the next being crushed stone producers at \$56M. Also, mining has an economic wage multiplier effect, thus Mr. Bishop indicates, “with 180 full-time jobs associated with Fundy Gypsum Company, we know that a lot of households in Hants West depend on incomes from our operations”.

The company was particularly interested in the opinions of local residents about its recent announcement regarding the continuation of its existing Miller's Creek operation.

The opinion survey indicated that while Fundy Gypsum Company is perceived as more believable in its communications than other groups, more information is needed to address questions. "We see a correlation between stated knowledge of the project and a resident's opinion of the project", states Dr. Butler. "The more information residents have, the less concern they have". "Two-thirds of the residents have concerns and questions about the project. Domestic and agricultural water supplies in the area are the key matter that has to be addressed. This is the principle matter by a two fold factor over a broad grouping of matters related to environmental damage."

Over the past several months, Fundy Gypsum Company has been meeting with residents on a one-on-one basis as well as with community representatives. "We were aware that the community values the quality and quantity of its water supply and the survey of opinion confirms its importance", indicates Mr. Bishop

Fundy Gypsum Company has been collecting water related information specific to the mine continuation area for several years. "We had previously identified the need to address the matter of local watersheds and water supplies in the local area, particularly in the areas immediately adjacent to the mine continuation such as Avondale and Belmont. We are committed to completing detailed preparatory studies, including a groundwater study of the area, a domestic well survey of homes and a surface water study. We need to get answers to the local residents in order to maintain the positive record we have with this community", states Mr. Bishop. The study program will be conducted over the next 7 months.

In closing, "we are very pleased to have undertaken this opinion survey and express our thanks to all of those people who participated. We have learned a great deal and are acting on this information.", states Mr. Bishop.

Detailed results of the opinion survey will be made available in the next several weeks to the Municipality of the District of West Hants.

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For more information contact:

Mike Bishop, Plant Manager  
1-888-798-0977

A.3

RESULTS OF MILLER'S CREEK PUBLIC OPINION STUDY 2007

# FUNDY GYPSUM COMPANY

## NEWS RELEASE

**FOR IMMEDIATE RELEASE: DATE: April 19<sup>th</sup>, 2007**

**Windsor, Nova Scotia:** A survey of public opinion has found that residents of West Hants indicate majority support for Fundy Gypsum Company and its proposed extension to the Miller's Creek Mine site. The findings come by way of a public opinion survey carried out for the company by NRG Research Group with offices in Vancouver, Calgary and Winnipeg. The telephone survey was conducted April 10th through April 12th, and involved four hundred and one (401) adults. The margin of error for the survey was 4.83%, nineteen times out of twenty and thus falls within the normal parameters for a professional survey of public opinion.

Mr. Mike Bishop, Plant Manager for Fundy Gypsum Company, indicated "the survey was sourced out of the region in order to negate any possible biases". Dr. Peter Butler, a public opinion consultant in Halifax was also retained as a methodological advisor for the survey.

Mr. Bishop said, "We are pleased that the residents of West Hants recognize us as a good neighbour who has been operating here for over 80 years. They recognize the well-paying jobs and economic benefits that we bring to the area and have expressed their majority support for the continuation of our Miller's Creek Mine site. We have spent more than two years of intensive work undertaking the necessary environmental studies and planning for this project. We are pleased that the people of West Hants have been watching and informing themselves of the project, as the survey results indicate, and they view our Company and this project as something environmentally sound for the area."

"The overall results of the survey are really quite clear", comments survey advisor, Dr. Butler, "In the majority, people of the area have a favorable opinion of Fundy Gypsum Company, are aware of and feel informed of the proposed project, and indeed support the project. By larger margins, people believe that the proposed project can provide a workplace that is environmentally safe for the people of the area and also it can offer good jobs for people of the area." Dr. Butler also noted that ... "in terms of priority concerns for the people of West Hants, the results of the survey

indicate that road maintenance (9.2%), the general state of the environment (8.0%), employment and the economy (7.0%) are of concern, while only a relative few (1.5%) are actually expressing top-of-mind concern about the Miller's Creek Mine Extension Project.”

Highlights of the survey are as follows:

(a): Over three-quarters of respondents (80%) indicated familiarity with Fundy Gypsum Company.

(b): Nearly ninety per cent of respondents (89.3%) have a favorable opinion of the Company.

(c): More than eighty percent (81%) of respondents agree the Company is a good employer.

(d): Eighty-five percent (85%) of respondents agree or strongly agree that the Company is an important contributor to the local economy.

(e): More than one half of the respondents (57%) are aware of the Company's proposed Miller's Creek Mine Extension Project and of these:

(f): Two thirds (66.1%) support the Project and, just over 75% believe that the proposed project can provide a workplace that is environmentally safe for the people of the area, as well as provide good jobs for the people of the area.

Fundy Gypsum Company recently completed a two day series of Public Information Sessions for the proposed project. These were held at the Belmont Community Hall on April 3rd and 4th. More than 140 people attended the sessions.

In September 2005, Fundy Gypsum Company announced its decision to commence the planning and necessary environmental studies for the proposed project. The Company has been working in West Hants for the past 80 years and currently employs over 150 people.

-30-

For more information contact:  
Mr. Mike Bishop, Plant Manager  
Fundy Gypsum Company, Windsor  
1 902 798 0977  
millerscreek@usg.com

A.4

MUNICIPAL MOTIONS OF SUPPORT

**Local Council Resolutions**  
**May/June 2007**  
**Support for Fundy Gypsum Plant**

As passed by:      a) May 8, 2007 – Town of Windsor  
                             b) May 22, 2007 – Municipality of the District of West Hants  
                             c) June 5, 2007 – Town of Hantsport

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Whereas the (Town of Windsor), (Town of Hantsport) (Municipality of the District of West Hants) desire to have a vibrant and healthy economy;

And whereas (the three municipalities all) desire that the economy of the Hants Region stays strong and supportive of the interests of the community;

And whereas (the three municipalities) agree that Fundy Gypsum has been an outstanding corporate citizen in our community;

Be it resolved that (the three municipalities) give their support to the Fundy Gypsum expansion plans, and, furthermore would assist and encourage Fundy Gypsum to continue its dialogue with those communities who may continue to have some concerns on the project.



A.5

PUBLIC INFORMATION SESSION - APRIL 2007

# Fundy Gypsum - Miller's Creek Mine Extension

## History of Avondale

The Avondale peninsula has a long and varied history. Gypsum mining has played an important role in that history since the mid 18th century.

### Facts

- Part of the greater Mi'kmaw territory known as Pisiquid.
- Acadian settlement of the area began in the late 17th century. Built dykes then cultivated the reclaimed marshland.
- Following the Deportation of Acadians in 1755, New England Planters resettled area in 1760.
- Planters developed agriculture and mined local gypsum for use as fertilizer.
- In the 19th century, Avondale became the scene of a major wooden shipbuilding enterprise.
- Gypsum mining emerged as an important economic factor to the Avondale area in the early 20th century.
- Fundy Gypsum Company began operations in 1926. The Miller's Creek gypsum mine opened in the 1950's.



Hamilton, 1753 "View of Fort Edward" National Archives



Macintosh, "Mosher Shipyard" Avon River Heritage Society



1908, "Gypsum Quarry, Windsor" Nova Scotia Museum

# Fundy Gypsum - Miller's Creek Mine Extension

## Fundy Gypsum Background

The first mining of gypsum in North America was in Nova Scotia around the year 1770. The early producers were almost all farmers from the Hants County area who owned land where gypsum occurred. They quarried the rock and took it via horse and wagon to the nearest shipping terminal. In the 1800's, as the industry developed, several mining companies operated in the Avondale area. They included names such as:

- Newport Plaster, Mining and Manufacturing Company
- Avondale Plaster Company
- Shaw Plaster Quarry
- Haliburton Quarry

Infrastructure for these operations included railways, tunnels, and buildings. Some early photos of mining in the Avondale area, circa 1912/1913, are shown below.



B. Shows above as well as mining, Newport Plaster Mining and Manufacturing Company's quarry, Avondale, N.S.



A. Upper section in lower level, Newport Plaster Mining and Manufacturing Company's quarry, Avondale, N.S.

In 1926, the Canadian Gypsum Company purchased the Wentworth Gypsum Company, the Newport Plaster, Mining and Manufacturing Company, and the Gypsum Packet Company.

The pictures below show some of the earlier mining in the Wentworth quarries.



In 1956, land and gypsum rights were purchased at Miller's Creek and the construction of a new crushing, screening, storage shed and railcar loading facility took place.

In 1959, Fundy Gypsum Company was incorporated as a subsidiary of the United States Gypsum Company.

Today, Fundy Gypsum employs 150-160 employees at three facilities in Hants County:

- Miller's Creek Mine
- Wentworth
- Hantsport Ship Loading Facility



Employee safety is the number one priority of Fundy Gypsum. The Company has been the recipient of the John T Ryan National Trophy for Select Mines seven times since its inception in 1970.

Fundy Gypsum has a very skilled and experienced workforce. Employee turnover is very low - over 30% of employees have over twenty-five years of experience.

Recent capital upgrades to its facilities include:

- The Miller's Creek Crushing and Screening Plant (>\$20 Million)
- The Hantsport Shiploading Facility (>\$40 million)
- Employee and Storeroom Facilities (>\$2 Million)



Today, The Miller's Creek Operation annually supplies 1 500 000 to 2 000 000 tons of dark gypsum to five United States Gypsum wallboard plants on the eastern seaboard.

- Boston, Massachusetts
- Stoney Point, New York
- Baltimore, Maryland
- Norfolk, Virginia
- Jacksonville, Florida



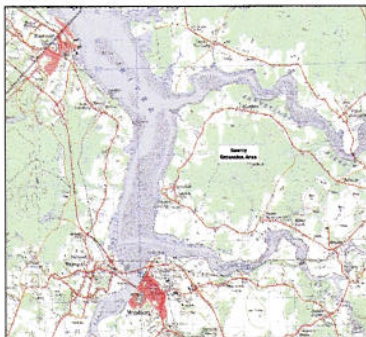
# Fundy Gypsum - Miller's Creek Mine Extension

## The Project

Fundy Gypsum Company is proposing to develop an extension to its existing Miller's Creek surface gypsum mine in the Avondale Area. The project is generally described below. Project details are contained in the many Panels and Supplementary Information provided at this Public Information Session.

### Project Overview

- surface gypsum mine located west of Ferry Road on Avondale Peninsula.
- mine life is projected to be between 30 and 50 years depending on extraction rate.
- site will be progressively reclaimed when portions of the mine reach final limits (depth and area).
- mine depth will be up to 70 metres below ground but typically less than 50 metres.
- extraction rate will be the same as existing - in the 2 million tonnes per year range.
- the mine would allow for continued employment of approximately 150 fulltime persons.
- haul trucks and other mobile equipment will access the extension site from the existing Miller's Creek Mine.
- haul trucks will use a level crossing on Ferry Road and will stop for local traffic - local traffic has the right of way.
- land area for the mine after 50 years will be approximately 180 hectares for the extraction area and 200 hectares for overburden piles, settling ponds and roads.
- the proposed mine extension plan includes a proposed Conservation Area for rare plants of approximately 30 hectares.
- transport of gypsum from Miller's Creek would continue to be through the existing railway.
- all crushing activities and rail loading would occur at the existing Miller's Creek site.
- if Environmental Assessment Approval is granted in 2007 the mine would begin development in 2008.



# Fundy Gypsum - Miller's Creek Mine Extension

## The Mining Process



### Exploration

The first stage of the mining process is typically exploration. This is done to delineate the mineral deposit. This is done by core drilling, surveying, rock sampling, quality testing and, more recently, computer modeling. Core drilling in the Miller's Creek extension area has been carried out in the 1950's, 1990's and 2000's.

### Mine Planning

The results of the exploration program are used in mine planning - defining the feasible extraction area, stockpile placement, water management, mine life and future land use.



### Stripping

Once the extraction area is defined, removal of the overburden (stripping) begins. Organic material and soil is removed with dozers and excavators down to the surface of the rock. This material is placed in stockpiles outside of the extraction area. The placement of stockpiles around the perimeter of a mine site also helps to reduce noise levels from the operation, limits view planes into the site and restricts access for public safety.



### Drilling and Blasting

The exposed rock is drilled with blasthole drills and blasted by certified blasters using ammonium nitrate/fuel oil (ANFO) and non-electric detonators and caps. Blasting operations are regulated by both the federal and provincial governments.



The gypsum deposit at Fundy Gypsum's Miller's Creek site is intermixed with a variety of other seams (siltstone, limestone, dolomite, anhydrite). In order to maintain rock quality necessary for wallboard manufacturing, the gypsum must be separated from the other rock types and constantly blended. This makes it necessary to constantly work many different areas of the quarry to optimize the deposit.

### Transportation

After it is drilled and blasted, the gypsum is loaded into 50 and 100 ton haul trucks with loaders and hauled to the mill for processing. After being sized and screened, the finished product, 6" minus dark gypsum, is conveyed to the rock storage shed for shipment to Hantsport by railcar.



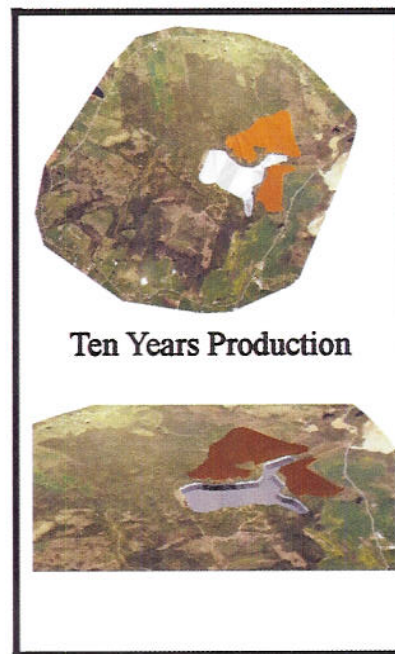
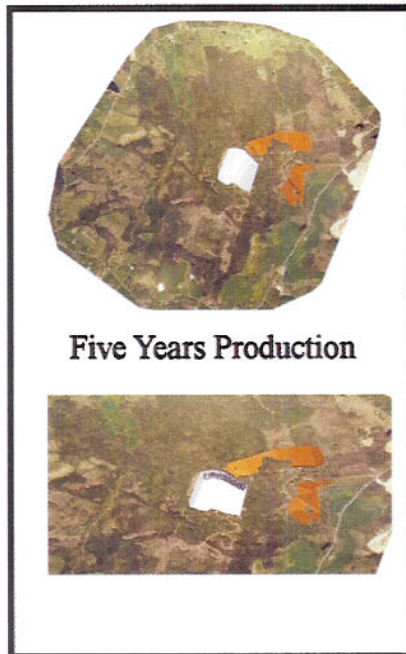
From Hantsport, the gypsum is loaded by two of the fastest Shiploaders in the world onto 20,000 ton and 40,000 ton ocean-going vessels. Because of the enormous tides in the Bay of Fundy, the Shiploaders must be capable of loading a ship in less than 3 hours. The rock from the Miller's Creek operation supplies 5 wallboard plants along the eastern seaboard of the United States. The finished product includes USG brand sheetrock and joint compound.



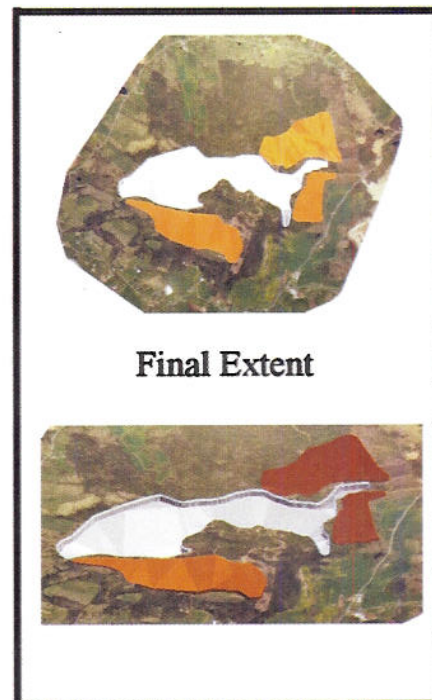
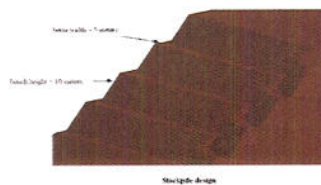
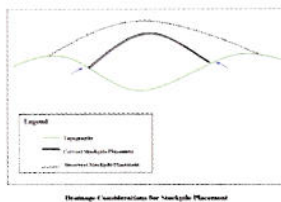
# Fundy Gypsum - Miller's Creek Mine Extension

## Mine Planning

- Mining will begin in the eastern area and progress westerly.



- Depth of overburden ranges from 0 to approximately 30 metres.
- Stockpile placement will ensure that existing drainage volume and patterns are maintained.



- Water from the extraction area will be directed to settling ponds, before being discharged to natural drainage waterways.
- View planes have been considered for stockpile placement and all efforts will be made to keep stockpile heights below the tops of the treeline.

Images are conceptual. Actual limits may vary slightly.

# *Fundy Gypsum - Miller's Creek Mine Extension*

## **Land Use**

### **Facts**

- The mining footprint contains no agricultural lands currently in use.
- There are abundant, previously used agricultural lands on the peninsula which are of a better quality than those located within the mining footprint.
- Existing agricultural uses of lands in the vicinity of Fundy Gypsum operations include beef, dairy, sheep, greenhouses and vineyards.
- FGC will continue to be open to discussions with anyone wishing to lease lands not in the extraction or stockpile areas for agricultural, forestry, or other purposes

### **Fundy Gypsum Operations**

- The existing Miller's Creek operation occupies just over 400 hectares, or approximately 30% of the existing land mass bordered by Lawrence Road, Ferry Road, and the Kennetcook and St. Croix Rivers.
- The proposed mine extension will occupy 380 hectares, or 15% of the land mass bordered by Ferry Road and the Kennetcook, Avon, and St. Croix Rivers.
- Combined, Fundy operations will occupy 20% of the Avondale Peninsula

# Fundy Gypsum - Miller's Creek Mine Extension

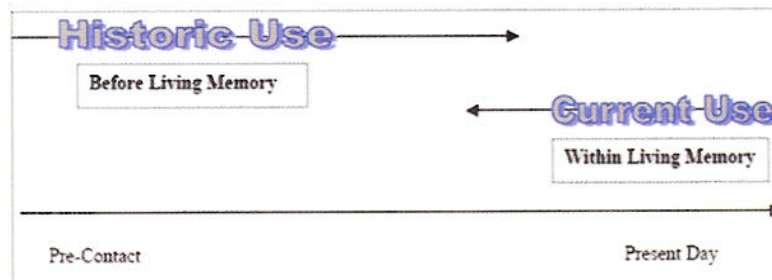
## Mi'Kmaq Knowledge Study

### The study included:

- Historic and current Mi'kmaq land and resource use in the study area.
- An evaluation of the potential impacts and significance of the Project on Mi'kmaq use.
- Recommendations to proponents and regulators.

### **Historic Use:**

- Mi'kmaq likely settled in the study area due to natural features including the proximity of the site to a navigable body of water and spawning runs
- Mi'kmaq pursued hunting and fishing in the Minas Basin and its rivers, camping regularly at headwaters around the Minas Basin. Deer and moose were among the Mi'kmaq foods and their name for this region was *Kakagwek*, which meant "Where meat is sliced and dried".
- Two known archaeological sites are located within the study area; the first is located along the east bank of the St. Croix River and the second is near Windsor.



### **Current Use:**

- Fishing activity is concentrated north of the project area in the Kennetcook River.
- Trapping occurred to the east of the project area.
- Known burial sites are not located within the mine extension area.
- A population of medicinal plants were identified surrounding the "Dump" Pond feeding into Shaw Brook.

### **Potential Project Impacts on Mi'kmaq Land and Resource Use:**

- Disturbance of archaeological resources
- Loss of medicinal plants



# *Fundy Gypsum - Miller's Creek Mine Extension*

## **Archaeological & Cultural Resources**

Between 2004-2006, Cultural Resource Management Group Limited undertook an archaeological assessment of the study area in order to locate and identify archaeological resources and to offer resource management recommendations.

### **Facts**

- Archaeological assessment is undertaken in phases: Research, Reconnaissance, Shovel Testing, Test Excavation and Recording.
- Research: To gather historic, cartographic and archival information, including interviews with members of the community.
- Reconnaissance: To locate potential archaeological features.
- Shovel Testing: To confirm or refute the presence of potential archaeological resources.
- Test Excavation: To investigate age, function and integrity of identified sites.
- Recording: To accurately document all identified archaeological features through field notes, photographs and sketches.



# Fundy Gypsum - Miller's Creek Mine Extension

## Baseline Studies

### Rare Plant Surveys

- Plant surveys were conducted on the site beginning in Summer 2005 and Spring and Summer 2006.

### Archaeological and Cultural Resource Study

- The history of the proposed site and Avondale Area were studied including on the ground surveys and limited shovel testing of historical features.

### Domestic Well Survey

- Water quality and/or a well assessment were completed at the participating homes to determine pre-mining conditions.
- CRA visited 128 homes and completed domestic well surveys at 69 of those.
- All collected information was shared with the homeowner.



### Groundwater Study

- CRA drilled a series of 10 groundwater monitoring wells in 2006 to characterize the groundwater quality and quantity in the area of the mine extension.

### Surface Water Study

- The study area has been surveyed to characterize surface water bodies and watersheds and to determine the potential impact of the project.

### Fish Habitat Survey

- Fish habitat surveys were completed on Shaw Brook and Fish Brook.

### Mi'kmaq Knowledge Study (MKS)

- Confederacy of Mainland Mi'kmaq completed a MKS for the proposed site area that involved documenting past use of the site by Mi'kmaq.

### Migratory Bird Survey

- A breeding bird survey was conducted in July 2006 within the study area by an experienced birder.
- Fifty two species of birds were identified and were present in all habitat types.
- No at risk bird species were identified for the study area

### Bat Survey

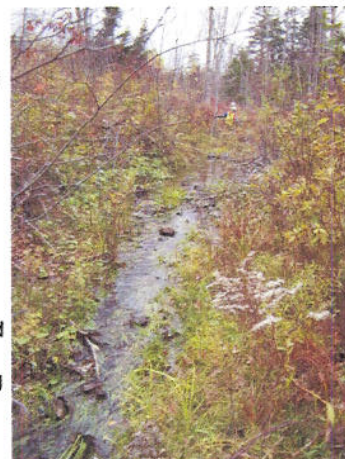
- The nearest known bat habitat is located over 5 kilometres from the study area.
- Surveys were conducted in March 2006 within the mine extension area but no deep caves or bat droppings were observed in the areas identified as potential habitat.

### Herpetile Survey

- Surveys were conducted by a herpetile expert in June 2006. There were no rare reptiles or amphibians observed on the mine extension site.

### Pre-blast Survey

- A survey of approximately 150 homes on the Avondale Peninsula will be completed to collect information from willing participants on the current structural integrity of basements, wallboards, foundations and other aspects of the home prior to blasting and mining in the mine extension area.



# *Fundy Gypsum - Miller's Creek Mine Extension*

## Rare Plants

### Survey Work Completed

- Consultation with local experts and review of documentation from Acadia University, Nova Scotia Department of Natural Resources, Nova Scotia Environment and Labour, the Atlantic Canada Conservation Data Council, the Nature Trust, and the Nova Scotia Museum to obtain information on rare plants in the area.
- Plant surveys were conducted on the site beginning in summer 2005 and spring and summer 2006.
- Fundy Gypsum has collaborated with NSDNR to develop a candidate Conservation Area in order to protect rare plants in the area.
- A long term research program will be developed with NSDNR to monitor rare plants in the area
- Conducted one of the most comprehensive Ram's Head Lady Slipper surveys ever in Nova Scotia
- Fundy Gypsum has shared information with NSDNR to be included in the Species at Risk status report.

### Explanation of DNR Rankings

- Species ranked as Yellow are considered to be Sensitive to natural or human events in Nova Scotia
- Species ranked as Red species are known to be At-risk in Nova Scotia

### Rare Species Identified on the Site

Leatherwood	Red
Ram's Head Lady Slipper	Red
Yellow Lady's Slipper	Yellow
Round-Lobed Hepatica	Red
Thimbleweed	Yellow
Canada Buffalo-Berry	Yellow



# *Fundy Gypsum - Miller's Creek Mine Extension*

## **Monitoring Programs**

**Monitoring Programs** are typically either for "Baseline" to determine background conditions before mining occurs or for "Compliance" to determine if operations are meeting all of the guidelines established by regulators. Another type of monitoring is "Environmental Effects" which measures certain items (often biological indicators such as plants and aquatic insects) to see what effects are occurring that do not have an established guideline.

### **Environmental Baseline Monitoring Program**

A comprehensive environmental baseline program has been completed at the Extension site starting in 2004 and included the programs noted on the Baseline Studies Panel.

### **Existing Compliance Monitoring Program**

Fundy Gypsum completes compliance monitoring at the existing Miller's Creek Site for:

1. Surface Water Quality
2. Potable Water
3. Noise Associated with Blasting Operations
4. Ground Vibration



### **Future Compliance Monitoring Program**

Fundy Gypsum anticipates completing the following compliance monitoring, at a minimum, should the project get EA approval.

1. Surface Water - water quality and flow monitoring
2. Groundwater - water quality and water level monitoring
3. Particulate - monitoring for airborne particulates
4. Ground Vibration - monitoring for ground vibration
5. Noise - monitoring for noise associated with blasting and operations (equipment)

### **Future Environmental Effects Monitoring Program**

Fundy Gypsum anticipates completing the following environmental effects monitoring, at a minimum, should the project get EA approval.

1. Aquatic - habitat, species present and species distribution monitoring
2. Terrestrial - habitat, species present and population health
3. Visual Impacts - periodic review of view planes

# *Fundy Gypsum - Miller's Creek Mine Extension*

## Water Supplies

### Water Facts :

#### **Average Yearly Precipitation:**

- 1308 mm (52 inches), with about 1074 mm (43 inches) (82%) falling as rain, and 234 mm (9 inches) (water equivalent) falling as snow
- ranges from low of about 75 mm (3 inches) in August to 143 mm (6 inches) in January

#### **Runoff amount is about 790 mm/year, or 60% of all precipitation**

- runoff is surplus water not used by plants or absorbed into the ground
- runoff amounts for the Peninsula are nearly 5 billion gallons per year
- runoff amounts range from about 9,000 gallons/acre in September, to about 118,000 gallons/acre in April
- total runoff volume each year would be about 705,000 gallons/acre of land on the Peninsula
- typical farm operations will use 10,000 gallons per day
- typical households use 400 gallons per day
- the total farm and household use is only 5.6% of total run-off



### Water Related Studies

#### **Surface Water Study**

- measured nearly 20 points on Peninsula from 2004 to 2007 for flow and chemistry on a routine basis plus during storm events.
- baseline flow and chemistry is well documented and understood

#### **Domestic Well Survey**

- 128 homes visited with 69 homes participating
- baseline well information collected

#### **Watershed Mapping**

- approximately 15 catchment areas identified

#### **Results of Studies**

- mining will occur mainly in 1 of the 15 areas
- abundant water for all domestic and agricultural uses currently and future



### Water Supply Replacement Policy

Fundy Gypsum will develop a Water Supply Replacement Policy for all homes and businesses on the Peninsula west of current activities and Ferry Road. The Policy will be developed with NSDEL and involve investigating well damage claims, providing potable water while the investigation occurs, a damage report by a third party investigator, a replacement supply if Fundy Gypsum is deemed to be at fault by third party investigator and an Arbitration Policy if the owner does not agree with third party report or Fundy Gypsum's proposed replacement supply.



## *Locust Cove Reclamation*

- These two photos show the reclamation of Locust Cove, a United States Gypsum mine that operated from 1961 to 2000.
- USG was the recipient of the Virginia Statewide Reclamation Award for its role in the reclamation of the site, which far surpassed government standards.



# Fundy Gypsum - Miller's Creek Mine Extension

## Reclamation - Past

The goal of reclamation is to produce a landscape that is safe, stable, and compatible with the surrounding landscape and final land use. This is generally achieved by grading, contouring, capping with soil, revegetating, flooding mined areas and time.

Fundy Gypsum has been turning previously mined or disturbed land back to a natural state for decades – land that is now used for wildlife, farming and recreation. Some examples of progressive reclamation at Fundy Gypsum's existing mine sites are shown below:



1983



1992



2006

Capping of Fines Pile

This pile is located across from Fundy Gypsum's main office, along Wentworth Road. In the 1980's, it was an exposed pile of fine gypsum and soil. In the early 1990's, overburden was hauled from the Wentworth Quarry to cap the pile so it could be vegetated. After vegetation was established, the local Boy Scouts planted 5,000 trees to assist with naturalization. Today, the pile is covered with mature trees and a variety of grasses and shrubs.

### Capping of Fines Pond

This project is similar to the above, where soil was hauled from the quarry and spread over a tailings area that had reached capacity. The area was seeded and today is a large, grassy field across from the Wentworth Quarry mobile maintenance operations.



### Miller's Creek Duck Pond

This large wetland is located at the top of a screened fines pile adjacent to the Miller's Creek Quarry. In the late 1990's the area that was no longer in use was graded, contoured, and hydroseeded with a mixture of grasses, fertilizer, and paper mulch (to aid in moisture retention). Ditches and ponds were constructed to control run-off and prevent erosion. In 2003, after vegetation was established, the local Boy Scouts planted 5,000 trees in the area. Today, the wetland is home to a variety of ducks, deer, hawks, and killedeer.



1997



2006



# Fundy Gypsum - Miller's Creek Mine Extension

## Reclamation - Present



April 2006

The large stockpile visible from Ferry and Belmont Roads has been used to place rock and soil from the Bailey Quarry that is unsuitable for production. In 2006, this area reached its maximum height and progressive reclamation began. In April, 2006, two D9 dozers and a Hitachi 300 excavator went to work cutting down the slope and contouring it in preparation for seeding.

In July, approximately 20 percent of the west slope was seeded with a mixture of grasses and wildflowers.



July 2006



September 2006

This picture, taken in September, shows early vegetation growth on the slope of the dump.

This close-up shows more grass growth, and the emergence of wildflowers, which attract a diverse range of birds and animals.



September 2006



October 2006

At the base of the pile there is a large wetland that is home to beavers, ducks, deer, and a variety of birds. The nature of this site makes it ideally suited for wildlife and recreation.





# Fundy Gypsum - Miller's Creek Mine Extension

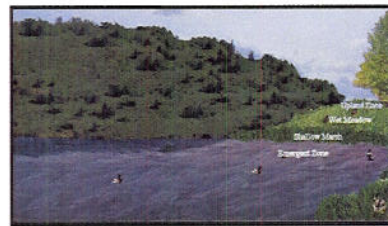
## Reclamation - Future

### Miller's Creek Quarry

The Miller's Creek Quarry was mined from 1957 to the mid-1970's. Although it is not being actively mined, portions of the site are being backfilled with soil and rock from the active Bailey Quarry. It is also necessary to keep the old quarry dewatered to prevent the existing mill facilities from being flooded. Future reclamation plans for this site include the creation of shoreline with areas of flatter slopes, revegetation, and flooding to create a lake or lakes. After reclamation, this site would be ideally suited for wildlife and recreation, such as hiking, fishing, and boating. The size of the lake(s) will depend on the amount of backfill material and the water level, but could easily be 30 to 50 acres. The photos below present a west view of the quarry today and a conceptual view of what it could look like in the future after reclamation is completed.

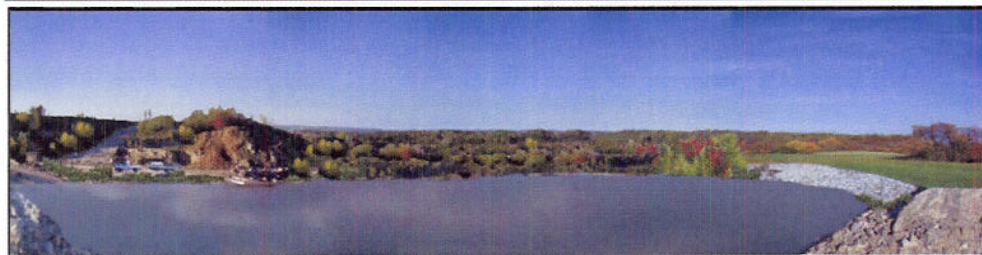


Several important types of habitat will be created in the process, including: Emergent zone, Shallow Marsh, Wet Meadow and Upland. This diverse ecosystem and flatter slopes will sustain many plants and animals, and allow easy access to the water's edge for humans and animals.



### Bailey Quarry

The Bailey Quarry has been mined since 1973. Reclamation plans for this quarry are similar to those proposed for the Miller's Creek Quarry. The following photos present a view of what the Bailey Quarry looks like today, and a conceptual view of what it could look like in the future, after reclamation is complete.



## APPENDIX B

B.1

SURFACE WATER BASELINE FLOW MONITORING DATA

**TABLE B.1: SUMMARY OF STREAM DISCHARGE MEASUREMENTS**

Stream No. <sup>(1)</sup>	Measured Stream Discharge (L/s)								Range
	10/21/2005	12/21/2005	5/23/2006	6/16/2006	8/15/2006	9/29/2006	11/3/2006	12/22/2006	
1	19.4	67.1	45.1	326.5	7.1	6.2	13.4	20.7	6.2 - 326.5
2	N/R <sup>(2)</sup>	19.1	11.9	134.0	+/- 0 <sup>(3)</sup>	+/- 0	0.90	0.83	0 - 134.0
3	N/R	0.83	0.16	6.0	+/- 0	+/- 0	+/- 0	+/- 0	0 - 6.0
4	N/R	+/- 0	1.3	8.3	+/- 0	+/- 0	+/- 0	+/- 0	0 - 8.3
5	N/R	4.6	2.6	18.4	+/- 0	+/- 0	+/- 0	+/- 0	0 - 18.4
6	0.97	9.7	9.7	61.8	0.33	0.20	0.94	2.7	0 - 61.8
7	N/R	7.7	1.2	10.7	+/- 0	+/- 0	+/- 0	2.6	0 - 10.7
8	N/R	+/- 0	+/- 0	6.5	+/- 0	+/- 0	+/- 0	+/- 0	0 - 6.5
9	N/R	+/- 0	3.5	21.1	+/- 0	+/- 0	+/- 0	+/- 0	0 - 21.1
10	N/R	4.6	4.2	18.8	+/- 0	+/- 0	+/- 0	+/- 0	0 - 18.8
11	N/R	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	0
12	N/R	+/- 0	0.19	2.1	+/- 0	+/- 0	+/- 0	+/- 0	0 - 2.1
13	+/- 0	6.1	3.5	36.9	+/- 0	+/- 0	+/- 0	+/- 0	0 - 36.9
14	N/R	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	0
15	N/R	+/- 0	0.85	5.5	0.28	0.11	0.33	+/- 0	0 - 5.5
16	N/R	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	+/- 0	0
17	+/- 0	28.7	33.6	125.0	+/- 0	+/- 0	1.5	8.3	0 - 125.0
18	N/R	9.3	12.8	80.8	0.83	0.39	0.83	2.2	0 - 80.8
19	N/R	N/R	0.84	6.1	+/- 0	+/- 0	+/- 0	0.11	0 - 6.1

**Notes:** 1. Refer to Figure 6.2-1 for stream locations.

2. Values shown as N/R indicate no measurement recorded.

3. Values shown as +/- 0 indicate zero flow or minor flows too small to measure.

B.2

STREAM WATER QUALITY DATA

2005		S1			S2			S3			S4			S5		
		X	min	max	X	min	max	X	min	max	X	min	max	X	Min	Max
Sodium	mg/L	7.6	5.2	9.5	11.8	3.4	37.0	6.8	3.7	13.0	17.0	3.8	40.0	18.0	8.6	23.0
Potassium	mg/L	1.5	1.0	3.0	1.1	0.7	1.6	1.4	1.0	2.1	1.8	0.6	4.7	1.0	0.7	1.3
Calcium	mg/L	378.0	100.0	580.0	329.2	59.0	590.0	207.0	36.0	480.0	65.2	16.0	130.0	78.1	49.0	110.0
Magnesium	mg/L	12.2	3.8	20.0	8.8	2.3	15.0	9.7	2.6	21.0	7.0	1.7	15.0	5.1	3.6	8.1
Alkalinity (as CaCO3)	mg/L	133.2	38.0	190.0	114.3	32.0	180.0	108.1	29.0	170.0	47.3	10.0	88.0	53.0	19.0	80.0
Sulfate	mg/L	796.0	190.0	1200.0	684.0	110.0	1300.0	411.9	59.0	970.0	134.9	31.0	320.0	135.5	0.0	260.0
Chloride	mg/L	10.1	7.1	12.0	23.4	5.0	72.0	6.7	5.3	9.3	21.0	6.0	51.0	24.0	9.8	34.0
Reactive Silica (as SiO2)	mg/L	5.6	2.6	7.6	6.2	3.2	8.3	6.0	3.3	7.9	3.5	0.6	5.8	5.8	1.4	10.0
Ortho Phosphate (as P)	mg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Phosphorus	mg/L	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate + Nitrite (as N)	mg/L	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.4	0.1	0.1	0.2	0.5	0.1	1.1
Nitrate (as N)	mg/L	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.5	0.0	1.0
Nitrite	mg/L	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.4	0.0	0.0	0.1	0.1	0.0	0.1
Ammonia (as N)	mg/L	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Color	TCU	15.5	8.0	28.0	14.6	7.0	30.0	30.1	10.0	55.0	22.9	11.0	40.0	15.8	6.0	27.0
Total Org. Carbon (by UV)	mg/L	3.9	2.2	7.3	4.0	2.3	7.0	6.2	3.1	11.0	5.9	3.3	7.1	4.7	2.1	7.9
Turbidity	NTU	19.4	1.1	140.0	8.0	0.9	16.0	6.8	1.9	17.0	6.6	0.8	19.0	1.6	0.4	6.5
Conductance (RCap)	uS/cm	1524.0	630.0	2100.0	1351.0	380.0	2400.0	926.0	210.0	1800.0	426.0	120.0	890.0	497.8	360.0	626.0
pH	pH	7.6	6.9	8.2	7.5	7.0	7.9	7.5	7.0	8.2	7.4	6.9	7.8	7.2	6.4	7.7
Hardness (as CaCO3)	mg/L	993.0	270.0	1500.0	864.0	160.0	1500.0	554.2	100.0	1300.0	192.3	48.0	400.0	217.3	140.0	310.0
Bicarbonate (as CaCO3)	mg/L	132.4	37.8	188.0	114.1	31.9	179.0	108.5	28.7	174.0	47.1	10.3	87.4	53.0	19.3	80.0
Carbonate (as CaCO3)	mg/L	1.6	1.0	3.0	1.0	1.0	1.0	2.0	2.0	2.0	ND	0.0	0.0	ND	0.0	0.0
TDS (calculated)	mg/L	1287.8	334.0	1940.0	1135.6	201.0	2120.0	715.0	133.0	1610.0	278.7	72.4	611.0	302.5	136.0	450.0
Total Suspended Solids	mg/L	3.8	0.0	11.0	1.6	0.0	5.3	2.5	0.0	11.0	2.2	0.0	6.4	1.1	0.0	4.2
Aluminum	µg/L	1310.0	0.0	5300.0	223.0	0.0	600.0	283.3	0.0	640.0	280.1	0.0	1100.0	51.0	0.0	240.0
Antimony	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium	µg/L	31.7	0.0	72.0	45.5	0.0	85.0	38.1	0.0	98.0	31.4	0.0	69.0	25.3	0.0	39.0
Beryllium	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bismuth	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boron	µg/L	21.0	0.0	51.0	47.3	0.0	140.0	25.6	0.0	84.0	22.6	0.0	54.0	33.9	0.0	46.0
Chromium	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - OWQP	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	µg/L	ND	0.0	0.0	29.0	29.0	29.0	2.9	2.9	2.9	ND	0.0	0.0	ND	0.0	0.0
Iron	µg/L	1550.5	0.2	8400.0	426.0	0.1	1700.0	293.1	0.5	760.0	211.2	0.1	810.0	113.1	0.1	310.0
Lead	µg/L	3.0	0.0	8.2	1.0	0.0	2.0	0.5	0.0	0.9	0.3	0.0	0.5	0.4	0.0	0.7
Manganese	µg/L	94.2	0.1	480.0	75.8	0.0	310.0	110.4	0.1	390.0	65.3	0.0	210.0	79.4	0.1	240.0
Molybdenum	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - OWQP	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver - OWQP	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Strontium	µg/L	2650.0	0.0	4900.0	2041.4	0.0	4300.0	2142.5	0.0	6100.0	610.0	0.0	1500.0	632.5	0.0	880.0
Thallium	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tin	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Titanium	µg/L	28.0	0.0	65.0	14.4	0.0	28.0	10.6	0.0	21.0	8.4	0.0	23.0	3.3	0.0	7.1
Uranium	µg/L	1.2	0.0	1.9	0.8	0.0	1.8	0.6	0.0	1.8	0.1	0.0	0.3	0.0	0.0	0.0
Vanadium	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc	µg/L	20.0	0.1	51.0	172.0	0.1	510.0	8.2	6.0	11.0	5.3	5.1	5.5	14.0	14.0	14.0
Cadmium	µg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ND = Not detected

2006		S1			S2			S3			S4			S5		
		X	Min	Max	X	Min	Max	X	Min	Max	X	Min	Max	X	Min	Max
Sodium	mg/L	7.5	5.2	11.0	5.4	2.7	14.0	5.9	2.7	13.0	7.0	3.4	19.0	21.6	11.0	79.0
Potassium	mg/L	1.4	0.7	2.5	1.0	0.6	2.0	1.7	0.9	5.5	1.0	0.5	2.5	1.0	0.6	1.9
Calcium	mg/L	290.4	65.0	580.0	198.6	35.0	580.0	169.0	27.0	540.0	37.6	10.0	82.0	81.6	64.0	120.0
Magnesium	mg/L	9.6	3.7	18.0	5.8	1.7	14.0	8.6	2.4	25.0	4.1	1.4	8.2	5.8	4.1	9.0
Alkalinity (as CaCO3)	mg/L	119.4	52.0	180.0	84.1	26.0	170.0	99.1	36.0	190.0	40.7	12.0	120.0	55.8	24.0	100.0
Sulfate	mg/L	611.7	110.0	1200.0	412.4	69.0	1300.0	332.0	38.0	1100.0	66.3	14.0	180.0	160.0	120.0	250.0
Chloride	mg/L	10.9	7.0	19.0	8.8	4.0	22.0	6.7	3.0	10.0	10.2	4.0	28.0	20.3	12.0	31.0
Reactive Silica (as SiO2)	mg/L	5.6	3.5	7.1	6.0	3.7	8.1	6.1	3.5	8.3	4.6	2.4	5.9	5.4	0.9	9.9
Ortho Phosphate (as P)	mg/L	0.1	0.1	0.1	0.0	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Phosphorus	mg/L	0.1	0.1	0.1	0.2	0.2	0.2	1.2	1.2	1.2	0.1	0.1	0.1	ND	0.0	0.0
Nitrate + Nitrite (as N)	mg/L	0.1	0.1	0.4	0.2	0.1	0.3	0.2	0.1	0.4	0.2	0.1	0.4	0.4	0.1	1.0
Nitrate (as N)	mg/L	0.1	0.1	0.4	0.2	0.1	0.3	0.2	0.1	0.4	0.2	0.1	0.4	0.4	0.1	1.0
Nitrite	mg/L	ND	0.0	0.0	0.0	0.0	0.1	ND	0.0	0.0	ND	0.0	0.0	0.3	0.3	0.3
Ammonia (as N)	mg/L	0.1	0.1	0.1	0.3	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Color	TCU	19.9	9.0	43.0	22.4	9.0	48.0	38.5	10.0	92.0	31.3	11.0	75.0	22.8	8.0	64.0
Total Org. Carbon (by UV)	mg/L	5.5	2.9	11.0	5.8	3.0	13.0	8.2	3.1	18.0	7.0	3.1	15.0	6.3	2.8	16.0
Turbidity	NTU	21.3	0.6	200.0	11.7	0.4	100.0	11.5	2.4	68.0	11.5	0.9	44.0	4.3	0.1	16.0
Conductance (RCAp)	uS/cm	1206.7	400.0	2100.0	850.8	210.0	2200.0	745.0	170.0	2000.0	244.1	79.0	500.0	498.3	430.0	680.0
pH	pH	7.8	7.5	8.2	7.8	7.4	8.2	7.7	7.5	8.2	7.4	7.1	8.1	7.3	6.9	7.9
Hardness (as CaCO3)	mg/L	768.3	180.0	1500.0	521.3	95.0	1500.0	457.3	77.0	1500.0	111.2	31.0	240.0	226.7	180.0	340.0
Bicarbonate (as CaCO3)	mg/L	118.4	52.0	176.0	84.7	26.0	172.0	98.3	36.0	191.0	40.0	12.0	115.0	55.6	24.0	99.0
Carbonate (as CaCO3)	mg/L	1.8	1.0	3.0	1.7	1.0	3.0	3.0	3.0	3.0	1.0	1.0	1.0	ND	0.0	0.0
TDS (calculated)	mg/L	1008.1	248.0	1910.0	693.2	136.0	2020.0	595.3	102.0	1850.0	156.2	48.0	329.0	326.3	251.0	479.0
Cation Sum		15.7	4.1	31.0	10.7	2.1	30.8	9.5	1.7	30.0	2.6	0.8	5.2	5.3	4.0	7.8
Anion Sum		15.4	3.9	28.4	10.6	2.1	30.5	9.2	1.7	27.5	2.5	0.7	5.1	5.1	3.7	7.3
Total Suspended Solids	mg/L	16.6	1.0	120.0	23.2	2.0	170.0	8.8	1.0	60.0	5.0	1.0	25.0	5.1	1.0	24.0
Aluminum	µg/L	251.7	110.0	390.0	312.9	63.0	570.0	391.3	140.0	610.0	591.4	41.0	1700.0	74.4	11.0	190.0
Antimony	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Arsenic	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Barium	µg/L	34.5	17.0	52.0	32.7	16.0	81.0	33.6	14.0	96.0	21.6	11.0	45.0	32.1	20.0	47.0
Beryllium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Bismuth	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Boron	µg/L	13.0	13.0	13.0	23.5	7.0	68.0	25.4	8.0	68.0	16.3	7.0	31.0	56.2	42.0	77.0
Chromium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	2.0	2.0	2.0	ND	0.0	0.0
Cobalt - OWQP	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Copper	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	4.0	4.0	4.0	ND	0.0	0.0
Iron	µg/L	270.0	270.0	270.0	314.6	78.0	870.0	537.8	220.0	1200.0	399.1	70.0	1200.0	194.3	52.0	360.0
Lead	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	0.5	0.5	0.5	ND	0.0	0.0
Manganese	µg/L	86.3	31.0	130.0	37.1	7.0	160.0	138.8	16.0	560.0	50.5	13.0	180.0	130.4	17.0	480.0
Molybdenum	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Nickel	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Selenium - OWQP	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Silver - OWQP	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Strontium	µg/L	2208.3	400.0	4400.0	1375.0	180.0	4300.0	1878.3	210.0	6200.0	386.3	86.0	880.0	782.5	610.0	1100.0
Thallium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Tin	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Titanium	µg/L	19.7	16.0	22.0	13.9	7.0	26.0	14.8	8.0	20.0	17.5	2.0	55.0	5.0	2.0	13.0
Uranium	µg/L	1.0	0.1	2.0	0.4	0.1	1.0	0.3	0.1	0.6	0.2	0.1	0.4	0.2	0.2	0.2
Vanadium	µg/L	30.0	30.0	30.0	ND	0.0	0.0	ND	0.0	0.0	3.0	3.0	3.0	ND	0.0	0.0
Zinc	µg/L	6.0	6.0	6.0	5.0	5.0	5.0	86.0	86.0	86.0	6.5	5.0	8.0	10.0	10.0	10.0
Cadmium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0

ND = Not Detected

2007		S1			S2			S3			S4		
		X	Min	Max	X	Min	Max	X	Min	Max	X	Min	Max
Sodium	mg/L	7.6	5.0	8.7	5.5	3.7	9.2	6.0	3.0	7.5	7.1	5.6	9.3
Potassium	mg/L	1.5	1.0	2.4	1.1	0.9	1.9	1.6	1.0	2.8	1.0	0.7	1.4
Calcium	mg/L	294.0	110.0	410.0	208.8	63.0	400.0	134.4	22.0	230.0	35.8	19.0	52.0
Magnesium	mg/L	9.1	4.5	12.0	6.1	2.6	10.0	6.7	2.5	11.0	3.8	2.6	5.6
Alkalinity (as CaCO <sub>3</sub> )	mg/L	124.8	69.0	170.0	104.1	46.0	190.0	104.3	33.0	170.0	47.4	18.0	92.0
Sulfate	mg/L	671.7	220.0	870.0	502.9	110.0	1000.0	314.0	24.0	630.0	79.4	32.0	150.0
Chloride	mg/L	10.5	9.0	12.0	22.7	6.0	110.0	8.0	6.0	11.0	10.6	8.0	17.0
Reactive Silica (as SiO <sub>2</sub> )	mg/L	5.0	3.4	6.5	6.1	3.9	8.4	4.9	2.2	7.8	3.4	2.3	4.8
Ortho Phosphate (as P)	mg/L	0.0	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	0.0	0.0	0.0
Phosphorus	mg/L	0.1	0.1	0.1	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Nitrate + Nitrite (as N)	mg/L	0.1	0.1	0.2	0.2	0.1	0.3	0.1	0.1	0.2	0.2	0.1	0.4
Nitrate (as N)	mg/L	0.1	0.1	0.2	0.2	0.2	0.3	0.2	0.1	0.2	0.2	0.1	0.4
Nitrite	mg/L	0.0	0.0	0.0	0.2	0.2	0.2	ND	0.0	0.0	ND	0.0	0.0
Ammonia (as N)	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	ND	0.0	0.0	0.1	0.1	0.1
Color	TCU	12.0	8.0	17.0	13.1	6.0	22.0	23.2	16.0	32.0	20.4	12.0	26.0
Total Org. Carbon (by UV)	mg/L	3.9	2.6	5.4	4.1	2.5	6.0	6.1	4.6	7.0	5.9	3.4	8.1
Turbidity	NTU	3.8	0.9	13.0	11.2	0.5	55.0	8.4	0.7	35.0	10.7	2.3	34.0
Conductance (RCap)	uS/cm	1346.7	580.0	1800.0	1025.7	350.0	1800.0	763.3	140.0	1400.0	296.0	140.0	560.0
pH	pH	7.9	7.6	8.1	7.8	7.5	8.0	7.7	7.3	7.9	7.4	7.1	7.5
Hardness (as CaCO <sub>3</sub> )	mg/L	836.7	300.0	1100.0	650.0	170.0	1300.0	444.2	65.0	850.0	135.2	59.0	260.0
Bicarbonate (as CaCO <sub>3</sub> )	mg/L	123.8	68.0	171.0	104.0	46.0	188.0	102.5	33.0	170.0	47.4	18.0	92.0
Carbonate (as CaCO <sub>3</sub> )	mg/L	1.3	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	ND	0.0	0.0
TDS (calculated)	mg/L	1100.7	394.0	1450.0	869.0	219.0	1820.0	569.0	84.0	1090.0	184.6	89.0	344.0
Total Suspended Solids	mg/L	8.7	3.0	26.0	19.7	1.0	90.0	21.0	1.0	88.0	14.4	2.0	54.0
Aluminum	µg/L	72.0	72.0	72.0	131.3	74.0	200.0	128.3	55.0	180.0	161.3	37.0	290.0
Antimony	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Arsenic	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Barium	µg/L	16.0	16.0	16.0	22.7	17.0	26.0	22.3	11.0	29.0	21.5	14.0	31.0
Beryllium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Bismuth	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Boron	µg/L	13.0	13.0	13.0	13.3	10.0	17.0	15.3	7.0	20.0	12.0	7.0	16.0
Chromium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Cobalt - OWQP	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Copper	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Iron	µg/L	60.0	60.0	60.0	160.0	160.0	160.0	137.0	81.0	210.0	175.0	130.0	220.0
Lead	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Manganese	µg/L	93.8	54.0	170.0	21.4	9.0	35.0	88.8	28.0	240.0	362.8	31.0	1300.0
Molybdenum	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Nickel	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Selenium - OWQP	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Silver - OWQP	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Strontium	µg/L	2230.0	850.0	3400.0	1405.0	370.0	2700.0	1454.0	170.0	2900.0	355.0	160.0	500.0
Thallium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Tin	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Titanium	µg/L	7.0	7.0	7.0	9.0	6.0	11.0	6.7	4.0	10.0	6.8	4.0	11.0
Uranium	µg/L	1.1	0.4	2.0	0.5	0.1	1.0	0.5	0.4	0.5	0.1	0.1	0.1
Vanadium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0
Zinc	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	23.0	23.0	23.0
Cadmium	µg/L	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0	ND	0.0	0.0



M140 - Bailey Quarry - Summary Table of Water Quality Monitoring Data

January	pH	Suspended Solids (mg/L)	Ammonia (mg/L N)	Oil and Grease (mg/L)	Toxicity
01/14/01	8.20	0.00	0.00	0.00	N/A
01/21/02	7.70	32.50	0.26	0.00	N/A
01/13/03	8.00	5.40	0.00	0.00	N/A
01/28/04	8.00	2.50	0.00	0.00	N/A
01/12/05	7.60	17.00	0.63	0.00	N/A
01/06/06	7.65	4.00	1.70	0.00	N/A
01/23/07	7.72	26.00	0.41	0.00	N/A
01/10/08	7.85	33.00	0.16	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.20</b>	<b>33.00</b>	<b>1.70</b>	<b>0.00</b>	
<b>Average</b>	<b>7.84</b>	<b>15.05</b>	<b>0.40</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.21</b>	<b>13.89</b>	<b>0.57</b>	<b>0.00</b>	

February	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
02/22/01	7.90	5.50	0.00	0.00	N/A
02/20/02	7.80	5.50	1.29	0.00	N/A
02/10/03	7.80	5.50	0.97	0.00	N/A
02/18/04	7.70	6.60	0.00	0.00	N/A
02/08/06	7.56	3.00	1.10	0.00	N/A
02/20/07	7.89	3.00	0.00	0.00	N/A
<b>Min</b>	<b>7.56</b>	<b>3.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>6.60</b>	<b>1.29</b>	<b>0.00</b>	
<b>Average</b>	<b>7.78</b>	<b>4.85</b>	<b>0.56</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.13</b>	<b>1.49</b>	<b>0.62</b>	<b>0.00</b>	

March	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
03/22/01	7.70	20.00	0.62	0.00	N/A
03/13/02	7.70	5.00	0.28	0.00	N/A
03/18/03	8.00	5.50	0.25	0.00	N/A
03/25/04	7.90	3.60	2.80	0.00	N/A
03/10/05	7.21	35.00	0.30	0.00	N/A
03/13/06	7.90	3.00	1.10	0.00	N/A
03/14/07	7.65	77.00	0.08	0.00	N/A
<b>Min</b>	<b>7.21</b>	<b>3.00</b>	<b>0.08</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>77.00</b>	<b>2.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.72</b>	<b>21.30</b>	<b>0.78</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.26</b>	<b>27.25</b>	<b>0.95</b>	<b>0.00</b>	

April	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
04/19/01	7.70	13.00	0.45	0.00	N/A
04/17/02	7.90	0.00	0.71	0.00	N/A
04/15/03	7.90	4.00	1.30	0.00	N/A
04/26/04	8.00	2.10	0.00	0.00	N/A
04/13/05	7.65	18.00	0.28	0.00	N/A
04/19/06	8.06	36.00	0.25	0.00	N/A
04/16/07	8.00	2.00	0.00	0.00	N/A
04/24/07	8.00	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.65</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.06</b>	<b>36.00</b>	<b>1.30</b>	<b>0.00</b>	
<b>Average</b>	<b>7.90</b>	<b>9.39</b>	<b>0.37</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.15</b>	<b>12.58</b>	<b>0.45</b>	<b>0.00</b>	

May	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
05/12/99					Pass
05/10/00					Pass
05/23/01	7.70	6.00	0.56	0.00	Pass
05/06/02					Pass
05/07/02	7.80	0.00	0.47	0.00	N/A
05/13/03	8.00	4.00	0.76	0.00	Pass
05/04/04	7.40	3.80	0.00	0.00	N/A
05/25/04					Pass
05/05/05	7.97	110.00	0.41	0.00	N/A
05/24/05					Pass
05/10/06	8.12	4.00	0.00	0.00	N/A

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05/16/06					Pass
05/02/07	7.96	2.00	0.00	0.00	N/A
05/07/07	8.08	0.00	0.00	0.00	Pass
05/17/07	7.70	21.00	0.05	0.00	N/A
05/22/07					Pass
05/24/07	8.01	2.00	0.00	0.00	N/A
05/31/07	8.00	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.40</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.12</b>	<b>110.00</b>	<b>0.76</b>	<b>0.00</b>	
<b>Average</b>	<b>7.89</b>	<b>13.89</b>	<b>0.20</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.21</b>	<b>32.42</b>	<b>0.29</b>	<b>0.00</b>	
<b>June</b>	<b>pH</b>	<b>Suspended Solids</b>	<b>Ammonia</b>	<b>Oil and Grease</b>	<b>Toxicity</b>
06/27/01	8.10	0.00	0.00	0.00	N/A
06/19/02	8.00	7.50	0.00	0.00	N/A
06/18/03	8.00	3.50	0.07	0.00	N/A
06/21/04	7.80	2.70	0.90	0.00	N/A
06/21/05	7.94	2.00	0.12	0.00	N/A
06/06/06	7.93	6.00	0.09	0.00	N/A
06/28/07	7.90	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.80</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>7.50</b>	<b>0.90</b>	<b>0.00</b>	
<b>Average</b>	<b>7.95</b>	<b>3.10</b>	<b>0.17</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.09</b>	<b>2.84</b>	<b>0.33</b>	<b>0.00</b>	

<b>July</b>	<b>pH</b>	<b>Suspended Solids</b>	<b>Ammonia</b>	<b>Oil and Grease</b>	<b>Toxicity</b>
07/17/00	8.10	2.10	0.00	0.00	N/A
07/19/01	7.70	4.80	0.00	0.00	N/A
07/15/02	7.80	0.00	0.00	0.00	N/A
07/21/03	7.90	4.00	0.00	0.00	N/A
07/08/04	7.60	ND	0.11	0.00	N/A
07/11/05	7.92	5.00	0.34	0.00	N/A
07/25/06	8.00	3.00	0.00	0.00	N/A
07/24/07	8.01	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>5.00</b>	<b>0.34</b>	<b>0.00</b>	
<b>Average</b>	<b>7.88</b>	<b>2.70</b>	<b>0.06</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.17</b>	<b>2.10</b>	<b>0.12</b>	<b>0.00</b>	

<b>August</b>	<b>pH</b>	<b>Suspended Solids</b>	<b>Ammonia</b>	<b>Oil and Grease</b>	<b>Toxicity</b>
08/16/00	8.00	0.00	0.06	0.00	N/A
08/15/01	7.90	11.90	0.00	0.00	N/A
08/22/02	7.80	4.00	0.09	0.00	N/A
08/19/03	7.90	4.00	0.18	0.00	N/A
08/26/04	7.70	6.00	0.00	0.00	N/A
08/17/05	7.68	2.30	0.05	0.00	N/A
08/17/06	7.94	0.00	0.00	0.00	N/A
08/30/07	7.83	0.00	0.24	0.00	N/A
<b>Min</b>	<b>7.68</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>11.90</b>	<b>0.24</b>	<b>0.00</b>	
<b>Average</b>	<b>7.84</b>	<b>3.53</b>	<b>0.08</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.11</b>	<b>4.06</b>	<b>0.09</b>	<b>0.00</b>	

<b>September</b>	<b>pH</b>	<b>Suspended Solids</b>	<b>Ammonia</b>	<b>Oil and Grease</b>	<b>Toxicity</b>
09/26/00	7.80	0.00	0.00	0.00	N/A
09/17/01	7.90	2.50	0.00	0.00	N/A
09/11/02	7.70	3.50	0.00	0.00	N/A
09/16/03	7.70	2.50	0.19	0.00	N/A
09/06/05	8.04	2.00	1.70	0.00	N/A
09/19/06	7.99	2.00	0.00	0.00	N/A
09/24/07	8.08	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.70</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.08</b>	<b>3.50</b>	<b>1.70</b>	<b>0.00</b>	
<b>Average</b>	<b>7.89</b>	<b>1.79</b>	<b>0.27</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.16</b>	<b>1.32</b>	<b>0.63</b>	<b>0.00</b>	

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October	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
10/19/00	7.90	2.80	0.00	0.00	N/A
10/17/01	7.90	2.00	0.00	0.00	N/A
10/17/02	7.90	2.50	0.72	0.00	N/A
10/21/03	8.00	3.00	1.40	0.00	N/A
10/25/04	7.80	8.50	0.01	0.00	N/A
10/04/05	8.01	3.00	0.46	0.00	N/A
10/24/06	7.79	3.00	0.58	0.00	N/A
10/31/07	8.00	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.79</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.01</b>	<b>8.50</b>	<b>1.40</b>	<b>0.00</b>	
<b>Average</b>	<b>7.91</b>	<b>3.10</b>	<b>0.40</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.09</b>	<b>2.40</b>	<b>0.50</b>	<b>0.00</b>	

November	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
11/17/98					Pass
11/17/99					Pass
11/15/00					Pass
11/22/00	7.90	0.00	0.41	0.00	N/A
11/20/01	7.90	2.00	0.29	0.00	
11/30/01					Pass
11/06/02					Pass
11/21/02	7.90	2.50	0.40	0.00	N/A
11/19/03	8.00	3.50	0.00	0.00	Pass
11/10/04					Pass
11/24/04	7.80	15.80	0.28	0.00	N/A
11/21/05	7.61	4.00	0.00	0.00	N/A
11/23/05					Pass
11/20/06	8.02	0.00	0.00	0.00	N/A
11/21/07	8.03	6.00	0.00	0.00	N/A
11/30/07					Pass
<b>Min</b>	<b>7.61</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.03</b>	<b>15.80</b>	<b>0.41</b>	<b>0.00</b>	
<b>Average</b>	<b>7.90</b>	<b>4.23</b>	<b>0.17</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.14</b>	<b>5.09</b>	<b>0.19</b>	<b>0.00</b>	

December	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
12/14/00	7.80	7.00	0.28	0.00	N/A
12/19/01	7.80	8.50	0.19	0.00	N/A
12/19/02	7.90	6.00	0.38	0.00	N/A
12/15/03	7.60	2.50	0.60	0.00	N/A
12/12/05	7.64	11.00	0.47	0.00	N/A
12/12/06	7.69	26.00	0.69	0.00	N/A
12/18/07	7.93	4.00	0.00	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>2.50</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.93</b>	<b>26.00</b>	<b>0.69</b>	<b>0.00</b>	
<b>Average</b>	<b>7.77</b>	<b>9.29</b>	<b>0.37</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.13</b>	<b>7.88</b>	<b>0.24</b>	<b>0.00</b>	

**M150 - Miller's Creek Quarry - Summary Table of Water Quality Monitoring**

January	pH	Suspended Solids (mg/L)	Ammonia (mg/L N)	Oil and Grease (mg/L)	Toxicity
01/14/01	7.90	3.00	0.19	0.00	N/A
01/21/02	7.80	55.00	0.00	0.00	N/A
01/13/03	7.90	5.50	0.69	0.00	N/A
01/28/04	7.60	5.20	1.50	0.00	N/A
01/12/05	7.60	7.00	0.36	0.00	N/A
01/06/06	7.80	6.00	0.42	0.00	N/A
01/23/07	7.84	7.00	0.00	0.00	N/A
01/31/08	7.79	4.00	0.38	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>3.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>55.00</b>	<b>1.50</b>	<b>0.00</b>	
<b>Average</b>	<b>7.78</b>	<b>11.59</b>	<b>0.44</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.12</b>	<b>17.60</b>	<b>0.48</b>	<b>0.00</b>	

M140 - Bailey Quarry - Summary Table of Water Quality Monitoring Data

February	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
02/22/01	8.00	8.50	0.28	0.00	N/A
02/20/02	7.80	26.00	0.25	0.00	N/A
02/10/03	7.80	3.50	0.00	0.00	N/A
02/18/04	7.90	43.40	0.67	0.00	N/A
02/08/05	7.63	nd	nd	0.00	N/A
02/08/06	7.84	2.00	0.00	0.00	N/A
02/20/07	7.71	5.00	0.37	0.00	N/A
<b>Min</b>	<b>7.63</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>43.40</b>	<b>0.67</b>	<b>0.00</b>	
<b>Average</b>	<b>7.81</b>	<b>14.73</b>	<b>0.26</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.12</b>	<b>16.56</b>	<b>0.25</b>	<b>0.00</b>	

March	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
03/22/01	7.60	14.50	0.05	0.00	N/A
03/13/02	7.70	5.00	0.09	0.00	N/A
03/18/03	7.80	4.50	0.00	0.00	N/A
03/25/04	7.80	4.80	0.49	0.00	N/A
03/10/05	7.42	24.00	nd	0.00	N/A
03/13/06	7.88	48.00	0.44	0.00	N/A
03/14/07	7.70	23.00	24.00	0.00	N/A
<b>Min</b>	<b>7.42</b>	<b>4.50</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.88</b>	<b>48.00</b>	<b>24.00</b>	<b>0.00</b>	
<b>Average</b>	<b>7.70</b>	<b>17.69</b>	<b>4.18</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.15</b>	<b>15.80</b>	<b>9.71</b>	<b>0.00</b>	

April	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
04/19/01	6.30	11.50	0.07	0.00	N/A
04/17/02	7.80	0.00	0.41	0.00	N/A
04/15/03	8.00	4.00	0.00	0.00	N/A
04/26/04	7.80	nd	0.32	0.00	N/A
04/13/05	7.65	5.00	0.28	0.00	N/A
04/19/06	8.19	41.00	0.23	0.00	N/A
04/16/07	7.79	0.00	0.34	0.00	N/A
<b>Min</b>	<b>6.30</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.19</b>	<b>41.00</b>	<b>0.41</b>	<b>0.00</b>	
<b>Average</b>	<b>7.65</b>	<b>10.25</b>	<b>0.24</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.62</b>	<b>15.65</b>	<b>0.15</b>	<b>0.00</b>	

May	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
05/12/99					Pass
05/10/00					Pass
05/23/01	7.70	4.50	0.00	0.00	Pass
05/07/02	7.90	0.00	0.67	0.00	Pass
05/13/03	7.90	2.50	2.80	0.00	Pass
05/04/04	7.80	3.80	6.80	0.00	N/A
05/25/04					Pass
05/05/05	7.65	4.50	0.33	0.00	N/A
05/24/05					Pass
05/10/06	7.82	2.00	0.61	0.00	N/A
05/16/06					Pass
05/07/07	7.80	9.00	0.34	0.00	N/A
05/22/07					Pass
<b>Min</b>	<b>7.65</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>9.00</b>	<b>6.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.80</b>	<b>3.76</b>	<b>1.65</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.09</b>	<b>2.81</b>	<b>2.45</b>	<b>0.00</b>	

June	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
06/27/01	8.00	2.00	0.10	0.00	N/A
06/19/02	8.00	0.00	0.00	0.00	N/A
06/18/03	7.90	5.50	0.61	0.00	N/A
06/21/04	7.80	5.30	0.90	0.00	N/A
06/21/05	7.69	4.90	0.16	0.00	N/A
06/06/06	7.96	4.00	N/D	0.00	N/A

**M140 - Bailey Quarry - Summary Table of Water Quality Monitoring Data**

06/28/07	7.76	0.00	0.08	0.00	N/A
<b>Min</b>	<b>7.69</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>5.50</b>	<b>0.90</b>	<b>0.00</b>	
<b>Average</b>	<b>7.87</b>	<b>3.10</b>	<b>0.31</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.12</b>	<b>2.42</b>	<b>0.36</b>	<b>0.00</b>	

July	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
07/17/00	8.00	0.00	0.54	0.00	N/A
07/19/01	7.90	6.80	0.07	0.00	N/A
07/15/02	7.60	0.00	4.80	0.00	N/A
07/21/03	8.10	19.00	1.10	0.00	N/A
07/08/04	7.60	nd	0.08	0.00	N/A
07/11/05	7.83	5.00	0.34	0.00	N/A
07/25/06	7.99	0.00	0.36	0.00	N/A
07/24/07	7.89	0.00	0.24	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>0.00</b>	<b>0.07</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>19.00</b>	<b>4.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.86</b>	<b>5.13</b>	<b>0.94</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.18</b>	<b>7.40</b>	<b>1.59</b>	<b>0.00</b>	

August	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
08/16/00	7.90	2.70	0.14	0.00	N/A
08/15/01	7.90	0.00	0.33	0.00	N/A
08/22/02	7.50	3.50	1.10	0.00	N/A
08/19/03	8.10	7.00	0.00	0.00	N/A
08/28/04	7.60	3.60	0.58	0.00	N/A
08/21/04	7.80	5.90	1.10	0.00	N/A
08/17/05	7.52	4.20	1.80	0.00	N/A
08/17/06	7.95	0.00	0.23	0.00	N/A
08/30/07	7.80	2.00	0.25	0.00	N/A
<b>Min</b>	<b>7.50</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>7.00</b>	<b>1.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.77</b>	<b>3.46</b>	<b>0.73</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.23</b>	<b>2.68</b>	<b>0.63</b>	<b>0.00</b>	

September	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
09/26/00	7.60	2.70	0.30	0.00	N/A
09/17/01	7.80	6.80	0.06	0.00	N/A
09/19/02	8.00	4.00	0.07	0.00	N/A
09/16/03	7.70	2.50	0.19	0.00	N/A
09/21/04	7.80	5.90	1.10	0.00	N/A
09/06/05	7.92	2.00	0.51	0.00	N/A
09/19/06	7.76	2.00	0.00	0.00	N/A
09/24/07	7.74	4.00	0.13	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>6.80</b>	<b>1.10</b>	<b>0.00</b>	
<b>Average</b>	<b>7.79</b>	<b>3.74</b>	<b>0.30</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.12</b>	<b>1.81</b>	<b>0.36</b>	<b>0.00</b>	

October	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
10/19/00	7.90	1.40	3.06	0.00	N/A
10/17/01	7.90	5.00	0.12	0.00	N/A
10/16/02	7.90	2.50	0.72	0.00	N/A
10/21/03	7.90	7.50	1.20	0.00	N/A
10/25/04	7.80	6.00	0.28	0.00	n/a
10/04/05	7.75	4.00	0.29	0.00	N/A
10/24/06	7.94	0.00	0.00	0.00	N/A
10/31/07	7.75	3.00	0.21	0.00	N/A
<b>Min</b>	<b>7.75</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.94</b>	<b>7.50</b>	<b>3.06</b>	<b>0.00</b>	
<b>Average</b>	<b>7.86</b>	<b>3.68</b>	<b>0.74</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.08</b>	<b>2.46</b>	<b>1.02</b>	<b>0.00</b>	

**M140 - Bailey Quarry - Summary Table of Water Quality Monitoring Data**

November	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
11/17/98					Pass
11/17/99					Pass
11/15/00					Pass
11/22/00	7.90	0.00	0.00	0.00	N/A
11/20/01	7.90	0.00	1.08	0.00	Pass
11/30/01					Pass
11/06/02					Pass
11/21/02	8.00	3.00	0.00	0.00	N/A
11/19/03	7.80	4.00	0.63	0.00	Pass
11/10/04					Pass
11/24/04	7.80	0.00	0.28	0.00	N/A
11/21/05	7.73	3.00	0.78	0.00	N/A
11/23/05					Pass
11/20/06	7.83	0.00	0.25	35.00	Pass
11/21/07	7.79	3.00	0.31	0.00	N/A
11/30/07					Pass
<b>Min</b>	<b>7.73</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>4.00</b>	<b>1.08</b>	<b>35.00</b>	
<b>Average</b>	<b>7.84</b>	<b>1.63</b>	<b>0.42</b>	<b>5.00</b>	
<b>Standard Deviation</b>	<b>0.09</b>	<b>1.77</b>	<b>0.38</b>	<b>13.23</b>	

December	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
12/14/00	7.70	15.00	0.21	0.00	N/A
12/19/01	7.70	2.00	4.15	0.00	N/A
12/19/02	7.60	3.00	0.00	0.00	N/A
12/15/03	7.90	11.00	0.00	0.00	N/A
12/16/04	7.60	nd	0.32	0.00	N/A
12/12/05	7.84	6.00	0.00	0.00	N/A
12/12/06	7.64	4.00	0.45	0.00	N/A
12/18/07	7.68	3.00	0.42	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>15.00</b>	<b>4.15</b>	<b>0.00</b>	
<b>Average</b>	<b>7.71</b>	<b>6.29</b>	<b>0.69</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.11</b>	<b>4.89</b>	<b>1.41</b>	<b>0.00</b>	

B.3

POND DISCHARGE WATER QUALITY DATA

Miller's Creek Quarry - Statistics M150

January	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
01/14/01	7.90	3.00	0.19	0.00	N/A
01/21/02	7.80	55.00	0.00	0.00	N/A
01/13/03	7.90	5.50	0.69	0.00	N/A
01/28/04	7.60	5.20	1.50	0.00	N/A
01/12/05	7.60	7.00	0.36	0.00	N/A
01/06/06	7.80	6.00	0.42	0.00	N/A
01/23/07	7.84	7.00	0.00	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>3.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>55.00</b>	<b>1.50</b>	<b>0.00</b>	
<b>Average</b>	<b>7.78</b>	<b>12.67</b>	<b>0.45</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.127764665</b>	<b>18.71422937</b>	<b>0.523081529</b>	<b>0</b>	

February	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
02/22/01	8.00	8.50	0.28	0.00	N/A
02/20/02	7.80	26.00	0.25	0.00	N/A
02/10/03	7.80	3.50	0.00	0.00	N/A
02/18/04	7.90	43.40	0.67	0.00	N/A
02/08/05	7.63	nd	nd	0.00	N/A
02/08/06	7.84	2.00	0.00	0.00	N/A
02/20/07	7.71	5.00	0.37	0.00	N/A
<b>Min</b>	<b>7.63</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>43.40</b>	<b>0.67</b>	<b>0.00</b>	
<b>Average</b>	<b>7.81</b>	<b>14.73</b>	<b>0.26</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.12088956</b>	<b>16.55677102</b>	<b>0.25134969</b>	<b>0</b>	

March	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
03/22/01	7.60	14.50	0.05	0.00	N/A
03/13/02	7.70	5.00	0.09	0.00	N/A
03/18/03	7.80	4.50	0.00	0.00	N/A
03/25/04	7.80	4.80	0.49	0.00	N/A
03/10/05	7.42	24.00	nd	0.00	N/A
03/13/06	7.88	48.00	0.44	0.00	N/A
03/14/07	7.70	23.00	24.00	0.00	N/A
<b>Min</b>	<b>7.42</b>	<b>4.50</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.88</b>	<b>48.00</b>	<b>24.00</b>	<b>0.00</b>	
<b>Average</b>	<b>7.70</b>	<b>17.69</b>	<b>4.18</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.153188337</b>	<b>15.80110002</b>	<b>9.712810956</b>	<b>0</b>	

April	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
04/19/01	6.30	11.50	0.07	0.00	N/A
04/17/02	7.80	0.00	0.41	0.00	N/A
04/15/03	8.00	4.00	0.00	0.00	N/A
04/26/04	7.80	nd	0.32	0.00	N/A
04/13/05	7.65	5.00	0.28	0.00	N/A
04/19/06	8.19	41.00	0.23	0.00	N/A
04/16/07	7.79	0.00	0.34	0.00	N/A
<b>Min</b>	<b>6.30</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.19</b>	<b>41.00</b>	<b>0.41</b>	<b>0.00</b>	
<b>Average</b>	<b>7.65</b>	<b>10.25</b>	<b>0.24</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.619292992</b>	<b>15.64528683</b>	<b>0.149092493</b>	<b>0</b>	



Miller's Creek Quarry - Statistics M150

May	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
05/23/01	7.70	4.50	0.00	0.00	Pass
05/07/02	7.90	0.00	0.67	0.00	Pass
05/13/03	7.90	2.50	2.80	0.00	N/A
05/04/04	7.80	3.80	6.80	0.00	N/A
05/05/05	7.65	4.50	0.33	0.00	N/A
05/10/06	7.82	2.00	0.61	0.00	N/A
05/07/07	7.80	9.00	0.34	0.00	Pass
<b>Min</b>	<b>7.65</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>9.00</b>	<b>6.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.80</b>	<b>3.76</b>	<b>1.65</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.093782931</b>	<b>2.810016099</b>	<b>2.451802058</b>	<b>0</b>	

June	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
06/27/01	8.00	2.00	0.10	0.00	N/A
06/19/02	8.00	0.00	0.00	0.00	N/A
06/18/03	7.90	5.50	0.61	0.00	N/A
06/21/04	7.80	5.30	0.90	0.00	N/A
06/21/05	7.69	4.90	0.16	0.00	N/A
06/06/06	7.96	4.00	N/D	0.00	N/A
06/28/07	7.76	0.00	0.08	0.00	N/A
<b>Min</b>	<b>7.69</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>5.50</b>	<b>0.90</b>	<b>0.00</b>	
<b>Average</b>	<b>7.87</b>	<b>3.10</b>	<b>0.31</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.12392394</b>	<b>2.417988144</b>	<b>0.361575257</b>	<b>0</b>	

July	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
07/17/00	8.00	0.00	0.54	0.00	N/A
07/19/01	7.90	6.80	0.07	0.00	N/A
07/15/02	7.60	0.00	4.80	0.00	N/A
07/21/03	8.10	19.00	1.10	0.00	N/A
07/08/04	7.60	nd	0.08	0.00	N/A
07/11/05	7.83	5.00	0.34	0.00	N/A
07/25/06	7.99	0.00	0.36	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>0.00</b>	<b>0.07</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>19.00</b>	<b>4.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.86</b>	<b>5.13</b>	<b>1.04</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.19655364</b>	<b>7.404503134</b>	<b>1.693422851</b>	<b>0</b>	

August	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
08/16/00	7.90	2.70	0.14	0.00	N/A
08/15/01	7.90	0.00	0.33	0.00	N/A
08/22/02	7.50	3.50	1.10	0.00	N/A
08/19/03	8.10	7.00	0.00	0.00	N/A
08/28/04	7.60	3.60	0.58	0.00	N/A
08/21/04	7.80	5.90	1.10	0.00	N/A
08/17/05	7.52	4.20	1.80	0.00	N/A
08/17/06	7.95	0.00	0.23	0.00	N/A
<b>Min</b>	<b>7.50</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>7.00</b>	<b>1.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.77</b>	<b>3.46</b>	<b>0.73</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.232143223</b>	<b>2.676974127</b>	<b>0.630340044</b>	<b>0</b>	

Miller's Creek Quarry - Statistics M150

September	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
09/26/00	7.60	2.70	0.30	0.00	N/A
09/17/01	7.80	6.80	0.06	0.00	N/A
09/19/02	8.00	4.00	0.07	0.00	N/A
09/16/03	7.70	2.50	0.19	0.00	N/A
09/21/04	7.80	5.90	1.10	0.00	N/A
09/06/05	7.92	2.00	0.51	0.00	N/A
09/19/06	7.76	2.00	0.00	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>6.80</b>	<b>1.10</b>	<b>0.00</b>	
<b>Average</b>	<b>7.80</b>	<b>3.70</b>	<b>0.32</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.132880182</b>	<b>1.947648154</b>	<b>0.386066858</b>	<b>0</b>	

October	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
10/19/00	7.90	1.40	3.06	0.00	N/A
10/17/01	7.90	5.00	0.12	0.00	N/A
10/16/02	7.90	2.50	0.72	0.00	N/A
10/21/03	7.90	7.50	1.20	0.00	N/A
10/25/04	7.80	6.00	0.28	0.00	n/a
10/04/05	7.75	4.00	0.29	0.00	N/A
10/24/06	7.94	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.75</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.94</b>	<b>7.50</b>	<b>3.06</b>	<b>0.00</b>	
<b>Average</b>	<b>7.87</b>	<b>3.77</b>	<b>0.81</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.068068593</b>	<b>2.642419526</b>	<b>1.072862215</b>	<b>0</b>	

November	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
11/22/00	7.90	0.00	0.00	0.00	N/A
11/20/01	7.90	0.00	1.08	0.00	Pass
11/21/02	8.00	3.00	0.00	0.00	N/A
11/19/03	7.80	4.00	0.63	0.00	N/A
11/24/04	7.80	0.00	0.28	0.00	N/A
11/21/05	7.73	3.00	0.78	0.00	N/A
11/20/06	7.83	0.00	0.25	35.00	N/A
<b>Min</b>	<b>7.73</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>4.00</b>	<b>1.08</b>	<b>35.00</b>	
<b>Average</b>	<b>7.85</b>	<b>1.43</b>	<b>0.43</b>	<b>5.00</b>	
<b>Standard Deviation</b>	<b>0.088774728</b>	<b>1.812653934</b>	<b>0.410220614</b>	<b>13.2287566</b>	

December	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
12/14/00	7.70	15.00	0.21	0.00	N/A
12/19/01	7.70	2.00	4.15	0.00	N/A
12/19/02	7.60	3.00	0.00	0.00	N/A
12/15/03	7.90	11.00	0.00	0.00	N/A
12/16/04	7.60	nd	0.32	0.00	N/A
12/12/05	7.84	6.00	0.00	0.00	N/A
12/12/06	7.64	4.00	0.45	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>15.00</b>	<b>4.15</b>	<b>0.00</b>	
<b>Average</b>	<b>7.71</b>	<b>6.83</b>	<b>0.73</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.117108009</b>	<b>5.115336418</b>	<b>1.517231187</b>	<b>0</b>	

Baily Quarry - Statistics M140

January	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
01/14/01	8.20	0.00	0.00	0.00	N/A
01/21/02	7.70	32.50	0.26	0.00	N/A
01/13/03	8.00	5.40	0.00	0.00	N/A
01/28/04	8.00	2.50	0.00	0.00	N/A
01/12/05	7.60	17.00	0.63	0.00	N/A
01/06/06	7.65	4.00	1.70	0.00	N/A
01/23/07	7.72	26.00	0.41	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.20</b>	<b>32.50</b>	<b>1.70</b>	<b>0.00</b>	
<b>Average</b>	<b>7.84</b>	<b>12.49</b>	<b>0.43</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.226747185</b>	<b>12.78937431</b>	<b>0.6105852</b>	<b>0</b>	

February	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
02/22/01	7.90	5.50	0.00	0.00	N/A
02/20/02	7.80	5.50	1.29	0.00	N/A
02/10/03	7.80	5.50	0.97	0.00	N/A
02/18/04	7.70	6.60	0.00	0.00	N/A
02/08/06	7.56	3.00	1.10	0.00	N/A
02/20/07	7.89	3.00	0.00	0.00	N/A
<b>Min</b>	<b>7.56</b>	<b>3.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>6.60</b>	<b>1.29</b>	<b>0.00</b>	
<b>Average</b>	<b>7.78</b>	<b>4.85</b>	<b>0.56</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.128023435</b>	<b>1.494991639</b>	<b>0.62183599</b>	<b>0</b>	

March	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
03/22/01	7.70	20.00	0.62	0.00	N/A
03/13/02	7.70	5.00	0.28	0.00	N/A
03/18/03	8.00	5.50	0.25	0.00	N/A
03/25/04	7.90	3.60	2.80	0.00	N/A
03/10/05	7.21	35.00	0.30	0.00	N/A
03/13/06	7.90	3.00	1.10	0.00	N/A
03/14/07	7.65	77.00	0.08	0.00	N/A
<b>Min</b>	<b>7.21</b>	<b>3.00</b>	<b>0.08</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>77.00</b>	<b>2.80</b>	<b>0.00</b>	
<b>Average</b>	<b>7.72</b>	<b>21.30</b>	<b>0.78</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.26106923</b>	<b>27.25001529</b>	<b>0.95390176</b>	<b>0</b>	

April	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
04/19/01	7.70	13.00	0.45	0.00	N/A
04/17/02	7.90	0.00	0.71	0.00	N/A
04/15/03	7.90	4.00	1.30	0.00	N/A
04/26/04	8.00	2.10	0.00	0.00	N/A
04/13/05	7.65	18.00	0.28	0.00	N/A
04/19/06	8.06	36.00	0.25	0.00	N/A
04/16/07	8.00	2.00	0.00	0.00	N/A
04/24/07	8.00	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.65</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.06</b>	<b>36.00</b>	<b>1.30</b>	<b>0.00</b>	
<b>Average</b>	<b>7.90</b>	<b>9.39</b>	<b>0.37</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.150279502</b>	<b>12.58348549</b>	<b>0.45039467</b>	<b>0</b>	

Baily Quarry - Statistics M140

May	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
05/23/01	7.70	6.00	0.56	0.00	Pass
05/07/02	7.80	0.00	0.47	0.00	Pass
05/13/03	8.00	4.00	0.76	0.00	N/A
05/04/04	7.40	3.80	0.00	0.00	N/A
05/05/05	7.97	110.00	0.41	0.00	N/A
05/10/06	8.12	4.00	0.00	0.00	N/A
05/02/07	7.96	2.00	0.00	0.00	N/A
05/07/07	8.08	0.00	0.00	0.00	Pass
05/17/07	7.70	21.00	0.05	0.00	N/A
05/24/07	8.01	2.00	0.00	0.00	N/A
05/31/07	8.00	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.40</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.12</b>	<b>110.00</b>	<b>0.76</b>	<b>0.00</b>	
<b>Average</b>	<b>7.89</b>	<b>13.89</b>	<b>0.20</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.214259825</b>	<b>32.4174476</b>	<b>0.28678785</b>	<b>0</b>	
June	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
06/27/01	8.10	0.00	0.00	0.00	N/A
06/19/02	8.00	7.50	0.00	0.00	N/A
06/18/03	8.00	3.50	0.07	0.00	N/A
06/21/04	7.80	2.70	0.90	0.00	N/A
06/21/05	7.94	2.00	0.12	0.00	N/A
06/06/06	7.93	6.00	0.09	0.00	N/A
06/28/07	7.90	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.80</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>7.50</b>	<b>0.90</b>	<b>0.00</b>	
<b>Average</b>	<b>7.95</b>	<b>3.10</b>	<b>0.17</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.093935135</b>	<b>2.843706501</b>	<b>0.32621203</b>	<b>0</b>	

July	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
07/17/00	8.10	2.10	0.00	0.00	N/A
07/19/01	7.70	4.80	0.00	0.00	N/A
07/15/02	7.80	0.00	0.00	0.00	N/A
07/21/03	7.90	4.00	0.00	0.00	N/A
07/08/04	7.60	ND	0.11	0.00	N/A
07/11/05	7.92	5.00	0.34	0.00	N/A
07/25/06	8.00	3.00	0.00	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.10</b>	<b>5.00</b>	<b>0.34</b>	<b>0.00</b>	
<b>Average</b>	<b>7.86</b>	<b>3.15</b>	<b>0.06</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.172819752</b>	<b>1.892881401</b>	<b>0.12830395</b>	<b>0</b>	
August	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
08/16/00	8.00	0.00	0.06	0.00	N/A
08/15/01	7.90	11.90	0.00	0.00	N/A
08/22/02	7.80	4.00	0.09	0.00	N/A
08/19/03	7.90	4.00	0.18	0.00	N/A
08/26/04	7.70	6.00	0.00	0.00	N/A
08/17/05	7.68	2.30	0.05	0.00	N/A
08/17/06	7.94	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.68</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.00</b>	<b>11.90</b>	<b>0.18</b>	<b>0.00</b>	
<b>Average</b>	<b>7.85</b>	<b>4.03</b>	<b>0.05</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.122046049</b>	<b>4.108817464</b>	<b>0.06579188</b>	<b>0</b>	

Baily Quarry - Statistics M140

September	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
09/26/00	7.80	0.00	0.00	0.00	N/A
09/17/01	7.90	2.50	0.00	0.00	N/A
09/11/02	7.70	3.50	0.00	0.00	N/A
09/16/03	7.70	2.50	0.19	0.00	N/A
09/06/05	8.04	2.00	1.70	0.00	N/A
09/19/06	7.99	2.00	0.00	0.00	N/A
<b>Min</b>	<b>7.70</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.04</b>	<b>3.50</b>	<b>1.70</b>	<b>0.00</b>	
<b>Average</b>	<b>7.86</b>	<b>2.08</b>	<b>0.32</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.145292808</b>	<b>1.158303357</b>	<b>0.68275179</b>	<b>0</b>	

October	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
10/19/00	7.90	2.80	0.00	0.00	N/A
10/17/01	7.90	2.00	0.00	0.00	N/A
10/17/02	7.90	2.50	0.72	0.00	N/A
10/21/03	8.00	3.00	1.40	0.00	N/A
10/25/04	7.80	8.50	0.01	0.00	N/A
10/04/05	8.01	3.00	0.46	0.00	N/A
10/24/06	7.79	3.00	0.58	0.00	N/A
<b>Min</b>	<b>7.79</b>	<b>2.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.01</b>	<b>8.50</b>	<b>1.40</b>	<b>0.00</b>	
<b>Average</b>	<b>7.90</b>	<b>3.54</b>	<b>0.45</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.085829288</b>	<b>2.216496592</b>	<b>0.5153652</b>	<b>0</b>	

November	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
11/22/00	7.90	0.00	0.41	0.00	N/A
11/20/01	7.90	2.00	0.29	0.00	Pass
11/21/02	7.90	2.50	0.40	0.00	N/A
11/19/03	8.00	3.50	0.00	0.00	N/A
11/24/04	7.80	15.80	0.28	0.00	N/A
11/21/05	7.61	4.00	0.00	0.00	N/A
11/20/06	8.02	0.00	0.00	0.00	N/A
<b>Min</b>	<b>7.61</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Max</b>	<b>8.02</b>	<b>15.80</b>	<b>0.41</b>	<b>0.00</b>	
<b>Average</b>	<b>7.88</b>	<b>3.97</b>	<b>0.20</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.138064857</b>	<b>5.442644665</b>	<b>0.19085023</b>	<b>0</b>	

December	pH	Suspended Solids	Ammonia	Oil and Grease	Toxicity
12/14/00	7.80	7.00	0.28	0.00	N/A
12/19/01	7.80	8.50	0.19	0.00	N/A
12/19/02	7.90	6.00	0.38	0.00	N/A
12/15/03	7.60	2.50	0.60	0.00	N/A
12/12/05	7.64	11.00	0.47	0.00	N/A
12/12/06	7.69	26.00	0.69	0.00	N/A
<b>Min</b>	<b>7.60</b>	<b>2.50</b>	<b>0.19</b>	<b>0.00</b>	
<b>Max</b>	<b>7.90</b>	<b>26.00</b>	<b>0.69</b>	<b>0.00</b>	
<b>Average</b>	<b>7.74</b>	<b>10.17</b>	<b>0.44</b>	<b>0.00</b>	
<b>Standard Deviation</b>	<b>0.113915173</b>	<b>8.250252521</b>	<b>0.19002631</b>	<b>0</b>	

B.4

TYPICAL GROUND/SURFACE WATER SAMPLING PROTOCOL

## **SAMPLING WATER**

There are many different types of waters that can be sampled, requiring different sampling equipment, but most of the samples are treated similarly once they have been collected. In the case of groundwater, the drilling of a well and the contaminants that may be associated with the materials used in well construction are considered to be a part of the overall sampling equipment and are discussed in the subsection on groundwater. The types of water that may be most commonly sampled at contaminated sites include surface waters (rivers, lakes, artificial impoundments, runoff, etc.), groundwaters and springwaters, wastewaters (mine drainage, landfill leachate, industrial effluents, etc.), and ice. Other types of water that may be sampled infrequently, if at all, include saline waters, estuarine waters and brines, waters resulting from atmospheric precipitation and condensation (rain, snow, fog, and dew), process water, potable (drinking) waters, glacial melt waters, steam, water for subsurface injections, and water discharges including waterborne materials. The sampling of these latter water sources will not be addressed since most of them require special equipment that is not likely to be needed for the sources of water found at most contaminated sites.

### **Problems Unique to Sampling Water**

Waters are usually very heterogeneous, both spatially and temporally, making it difficult to obtain truly representative samples. Solids with specific gravities only slightly greater than that of water are usually inorganic. They will remain suspended in the flow, but will also form strata in smoothly flowing channels. Oils and solids lighter than water (usually organic) will float on, or near, the surface. Some liquids, such as halogenated organic compounds, are heavier than water and will sink to the bottom (4). The chemical composition of lakes and ponds may also vary significantly depending on the season. The composition of flowing waters, such as streams, depends on the flow and may also vary with the depth. Stratification within some bodies of water is common. In lakes shallower than about 5 m, wind action usually causes mixing, so neither chemical nor thermal stratification is likely for prolonged periods; however, both may occur in deeper lakes (28). Rapidly flowing shallow rivers usually show no chemical or thermal stratification, but deep rivers can exhibit chemical stratification with or without accompanying thermal stratification. Stratification may also commonly occur where two streams merge, such as the point where an effluent enters a river. Stratification is also a problem with ocean sampling; various species may be stratified at different depths. In addition, the composition of near shore waters usually differs greatly from waters far from shore. Estuarine sampling is even more complex because stratifications move up rivers unevenly.

Water sample contamination is always a problem, and it increases in importance as the analyte concentration levels decrease. To some extent, contamination sources may depend on the body of water being sampled. For instance, in groundwater monitoring, contamination from well construction materials can be significant and material blanks become very important. However, many potential contamination sources are common to all water samples.

Groundwater vulnerability to contamination is affected by water depth, recharge rate, soil composition, and topography (slope), as well as other parameters such as the volatility and

persistence of the analytes being determined. In planning groundwater sampling strategies, knowledge of the physical and chemical characteristics of the aquifer system is necessary (but almost never known). Groundwater presents special challenges for obtaining representative samples (4).

### **Reviewing Site Information and Reconnaissance**

Site information should be reviewed for sources of possible water contamination in a manner similar to that described above for soils and sediments. The more background information that can be found, the better the sampling and analysis programs can be planned. Also, as described in earlier sections, a preliminary site reconnaissance to inspect the potential locations where water samples will be taken will help significantly in planning the sampling efforts. Surprises can often be avoided and plans can be made to include any special sampling or safety equipment to overcome unusual physical barriers if an adequately planned site visit is made prior to the full sampling effort.

### **Representative Sampling Approaches**

The following general principles apply to the collection of representative water samples (14):

- Do not include large nonhomogeneous particles, such as leaves and detritus, in the sample.
- In flowing waters, place the sampling apparatus upstream to avoid contamination. Sampling from the upstream side of a bridge enables the collector to see whether any floating material is coming downstream and aids in preventing contamination of the sample.
- Collect a sufficient volume to permit replicate analyses and quality control testing. If not specified, the basic required volume is a summation of the volumes required for analysis of all the parameters of interest.

The collection of representative water samples requires the use of a variety of sampling equipment depending on the station, the medium to be sampled, and the analyte list. The choice of sampler type must be closely related to the analyte list in order to avoid sample contamination. In addition to being analyte and station specific, the sampling equipment must also provide suitable sample volumes and be suitable for use in a wide variety of environmental conditions (21). Special guidelines, discussed later, apply to obtaining representative samples from groundwaters, rivers, and streams. Additional special guidelines apply to sampling all types of surface waters under winter conditions.

### **Collecting Representative Water Samples from Rivers and Streams**

For water quality sampling sites located on a homogeneous reach of a river or stream, the collection of depth-integrated samples in a single vertical may be adequate. For small streams, a grab sample taken at the centroid of flow is usually adequate (14). When a single fixed intake



point is used, it should be located at about 60% of the stream depth in an area of maximum turbulence, and the intake velocity should be equal to or greater than the average water velocity (27).

For sampling site located on a nonhomogeneous reach of a river or stream, it is necessary to sample the channel cross section at the location at a specified number of points and depths. The number and type of samples taken will depend on the width, depth and discharge; the amount of suspended sediment being transported; and aquatic life present. Generally, the more points that are sampled along the cross section, the more representative the composite sample will be. Three to five vertical sampling points are usually sufficient, and fewer are necessary for narrow and shallow streams (14).

Some practical sampling considerations related to location and season of sampling surface waters are outlines below (14).

### ***Sampling Procedures from Bridges, Abutments, Boats, and Aircraft***

- Attach sufficient rope to permit the sampler to reach the required maximum depth. The other end of the rope should be secured to a permanent fixture on the bridge, boat, or aircraft.
- Ensure that all of the lines that are suspending the samplers remain in the vertical position to enable the accurate estimation of the depth of sample. Depending on the sampler used, weights may be added; the greater the stream velocity, the heavier the weight required.
- When sampling from a boat, sample from the upstream side; if sampling from a float aircraft, sample from the upstream and outer side of the pontoons to minimize the chance of contamination from engine oil leaks.
- When sampling, it is important that the sampling bottle not be permitted to touch the bottom of the river or lake to avoid contamination from stirred-up sediment; predetermine the water depth to prevent this.
- Rinse the sampler three or four times with the water to be sampled unless the bottle contains a preservative or is sterile.

### ***Sampling Procedures from Shores, Stream Banks, and Wharves***

- A sampling iron is often used when water samples are collected from shores, stream banks, and wharves.
- Insert an open, clean sampling bottle into the metal holder, ensuring that the ring clamp is securely locked in the holder frame by a key ring or suitable pin. Attach sufficient rope to the holder to permit sampling at the desired depths. Secure the other end of the rope to a permanent fixture on the bank, wharf, etc. Sampling weights should be added as required, as dictated by stream velocity.

- Throw the bottle with holder well out into the stream. In case of very shallow streams (approximately 0.5 m), the sampler should collect the sample by hand, wading out if necessary, facing upstream, and making sure not to contaminate the sample with sediment, debris, and other floating materials.
- Pull the bottle and holder in quickly to prevent the bottle from touching or becoming snagged on the bottom of the stream.
- Rinse the sampling bottle three or four times with the water collected above. It is important that the sample bottle be well rinsed with the water to be sampled before the sample is collected unless preservative has been added to the sample bottle prior to sampling or the bottle is sterile.

### **Collecting Representative Groundwater Samples**

In order to collect representative groundwater samples, temporal issues need to be considered such as the time of year sampling will be done, whether to sample before or after rainy seasons, etc., and other considerations, such as sampling after periods of high agricultural chemical usage. In constructing and using monitoring wells, alteration of the water being sampled must be minimized. Care must be taken during the drilling process not to cross-contaminate aquifers with loosened topsoil possibly laden with agricultural/industrial chemicals. Well construction and materials can profoundly influence the chemical composition of samples, so material blanks are important (4).

Purging wells before sample collection eliminates stagnant water. The method and rate of purging, time between purging and sampling, and sampling itself will depend on the diameter, depth and recharge rate of a well. Each well should be slug, pressure, or pump tested to determine the hydraulic conductivity of the formation and to estimate the extent and rate of purging prior to sampling (29). The standard purge volume obtains a stabilized concentration of the parameter of the interest. Purge volumes usually range from three to ten well volumes. Sometimes changes in pH, temperature, or conductance measurements can be monitored in consecutive samples to determine when a sample is representative, i.e., when surrogate values stop changing (4).

Select the material for well construction carefully. Cement used for polyvinyl chloride (PVC) pipe joints can leach into samples from wells; this can be prevented by using threaded pipes. Equipment for monitoring wells should be constructed of stainless steel or other inert materials (30, 31).

Sampling devices and sample containers are always likely sources of contamination. Carryover between samples from the sampling device must also be prevented. Contaminant leaching from sampling devices and containers is very complex and requires serious attention. Table 11 shows the types of contaminations caused by materials used in sampling devices and well construction monitoring. Tin and lead are also common contaminants to water transported through soldered

pipes. Water containing high calcium levels tends to extract lead preferentially, but tin is removed in small amounts for many years (28).

Sampling protocols often recommend that samples that analyze groundwater monitoring wells for metals be field-filtered under pressure before preservation and analysis. Samples collected for metals are usually acidified; acidification of unfiltered samples can lead to dissolution of minerals from suspended clays. Samples to be collected for organic compounds analyses, however, are never filtered (4).

As discussed above, blanks are used to assess contamination. Blank samples associated with groundwater samples should usually include equipment, field, and background blanks. Selections should be made by considering all likely sources of contamination for the specific situation.

Table 11: Potential Contaminants from Sampling Devices and Well Casings

Material	Contaminants prior to steam cleaning
Rigid PVC-threaded joints	Chloroform
Rigid PVC-cemented joints	Methyl ethyl ketone, toluene, acetone, methylene chloride, benzene, organic tin compounds, tetrahydrofuran, ethyl acetate, cyclohexanone, vinyl chloride
Flexible or rigid Teflon® tubing	None detectable
Flexible polypropylene tubing	None detectable
Flexible PVC plastics tubing	Phthalate esters and other plasticizers
Soldered pipes	Tin and lead
Stainless steel containers	Chromium, iron, nickel, and molybdenum
Glass containers	Boron and silicon

Analyte sorption is also a common problem. Polyvinyl chloride and plastics other than Teflon® tend to sorb organics and leach plasticizers and other chemicals used in their manufacture. In addition, some pesticides and halogenated compounds strongly adsorb to glass. When analyzing these substances in water samples, therefore, it is important not to pre-rinse the glass sample bottle with sample before collection. It is equally important at the laboratory to rinse the sample containers with portions of extraction solvent after the water sample has been quantitatively transferred into the extraction apparatus.

Tubing material used in automatic sampling devices is important; depletion of halocarbons from water depends more on the tube material than on the tubing diameter (surface area). However,

when a constant flow rate is used, losses are more likely to occur with and increase in tubing diameter. Thermoplastic materials (e.g., polypropylene) appear to sorb many organic analytes efficiently, so they should be avoided in sampling devices (28).

Polyvinyl chloride reportedly containing zinc, iron, antimony, and copper may leach these metals into water samples. Polyethylene has been reported to contain antimony, which may also leach into water (28). Flexible PVC and plastics other than Teflon® usually contain phthalate esters, which may also leach into water samples (30). Phthalate esters interfere with instrument sensitivity by masking other contaminants.

Sorption of metals at low concentrations on container walls depends on the metal species, concentration, pH, contact time, sample and container composition, and presence of dissolved organic carbon and complexing agents. Preserving metals samples with acid usually prevents this problem (28).

Variations in the permeability of an aquifer can affect the representativeness of groundwater samples. If the wells have varying recovery rates, varying concentrations of the analytes will result. Vertical gradients of flow between permeable strata within an aquifer can result in samples from multiple zones within one well (30).

APPENDIX C

DAILY STATIC GROUNDWATER LEVEL AVERAGES

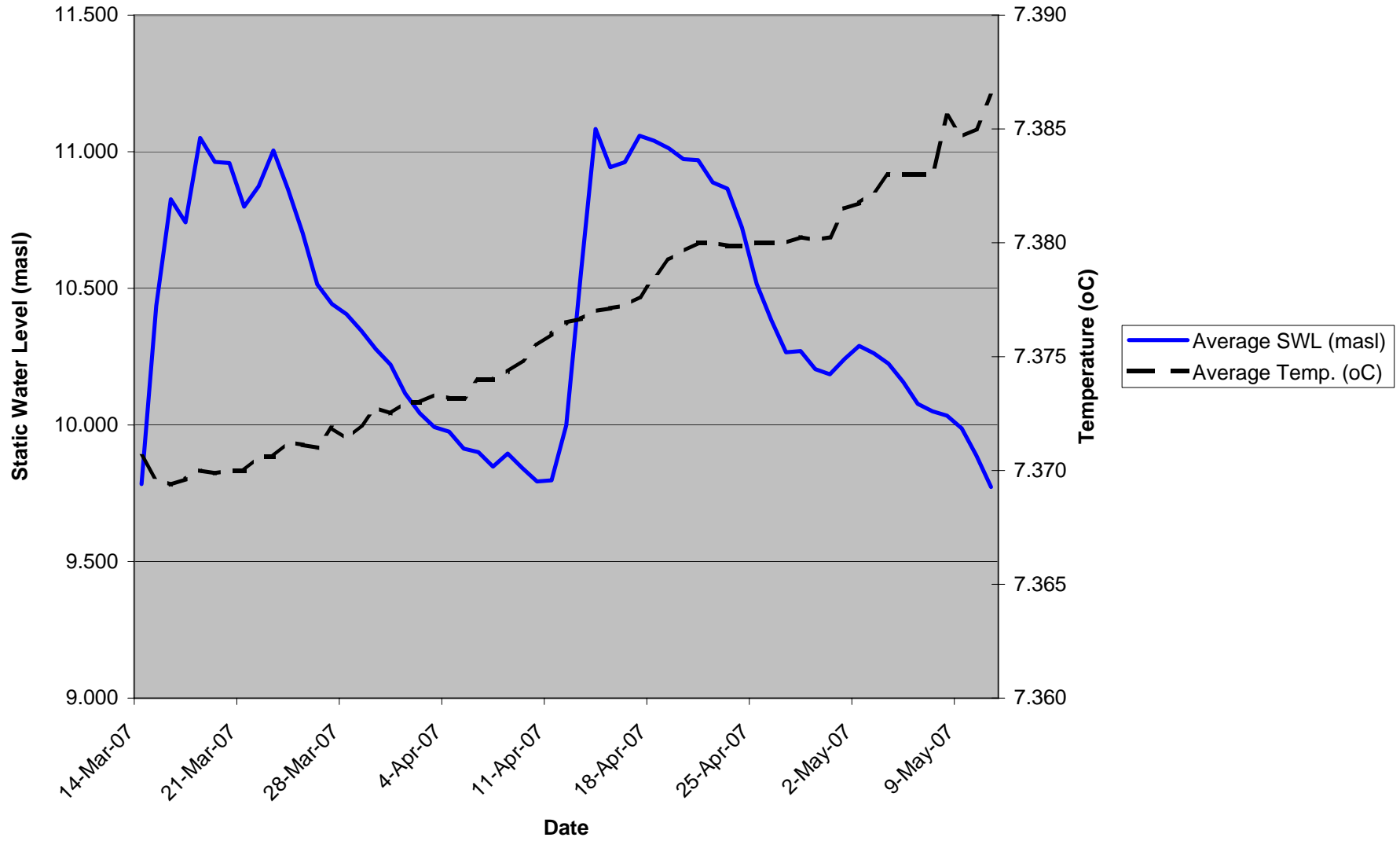
**MW-1d**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
14-Mar-07	-10.947	9.783	7.371
15-Mar-07	-10.294	10.436	7.370
16-Mar-07	-9.904	10.826	7.369
17-Mar-07	-9.989	10.741	7.370
18-Mar-07	-9.679	11.051	7.370
19-Mar-07	-9.767	10.963	7.370
20-Mar-07	-9.772	10.958	7.370
21-Mar-07	-9.931	10.799	7.370
22-Mar-07	-9.856	10.874	7.371
23-Mar-07	-9.725	11.005	7.371
24-Mar-07	-9.867	10.863	7.371
25-Mar-07	-10.028	10.702	7.371
26-Mar-07	-10.216	10.514	7.371
27-Mar-07	-10.287	10.443	7.372
28-Mar-07	-10.324	10.406	7.371
29-Mar-07	-10.385	10.345	7.372
30-Mar-07	-10.453	10.277	7.373
31-Mar-07	-10.509	10.221	7.373
1-Apr-07	-10.615	10.115	7.373
2-Apr-07	-10.687	10.043	7.373
3-Apr-07	-10.738	9.992	7.373
4-Apr-07	-10.755	9.975	7.373
5-Apr-07	-10.817	9.913	7.373
6-Apr-07	-10.830	9.900	7.374
7-Apr-07	-10.883	9.847	7.374
8-Apr-07	-10.834	9.896	7.374
9-Apr-07	-10.887	9.843	7.375
10-Apr-07	-10.937	9.793	7.376
11-Apr-07	-10.933	9.797	7.376
12-Apr-07	-10.731	9.999	7.377
13-Apr-07	-10.172	10.558	7.377
14-Apr-07	-9.647	11.083	7.377
15-Apr-07	-9.786	10.944	7.377
16-Apr-07	-9.768	10.962	7.377
17-Apr-07	-9.671	11.059	7.378
18-Apr-07	-9.690	11.040	7.379
19-Apr-07	-9.717	11.013	7.379
20-Apr-07	-9.757	10.973	7.380
21-Apr-07	-9.761	10.969	7.380
22-Apr-07	-9.842	10.888	7.380
23-Apr-07	-9.865	10.865	7.380
24-Apr-07	-10.008	10.722	7.380
25-Apr-07	-10.214	10.516	7.380
26-Apr-07	-10.346	10.384	7.380
27-Apr-07	-10.464	10.266	7.380
28-Apr-07	-10.460	10.270	7.380
29-Apr-07	-10.526	10.204	7.380
30-Apr-07	-10.545	10.185	7.380
1-May-07	-10.489	10.241	7.382
2-May-07	-10.441	10.289	7.382
3-May-07	-10.468	10.262	7.382

**MW-1d**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
4-May-07	-10.505	10.225	7.383
5-May-07	-10.572	10.158	7.383
6-May-07	-10.653	10.077	7.383
7-May-07	-10.680	10.050	7.383
8-May-07	-10.696	10.034	7.386
9-May-07	-10.743	9.987	7.385
10-May-07	-10.842	9.888	7.385
11-May-07	-10.957	9.773	7.386

MW-1d Daily Averages





**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
16-Aug-06	-4.039	60.361	7.969
17-Aug-06	-3.782	60.618	7.971
18-Aug-06	-3.572	60.828	7.973
19-Aug-06	-3.400	61.000	7.975
20-Aug-06	-3.288	61.112	7.977
21-Aug-06	-3.203	61.197	7.980
22-Aug-06	-3.148	61.252	7.982
23-Aug-06	-3.093	61.307	7.985
24-Aug-06	-3.060	61.340	7.988
25-Aug-06	-3.042	61.358	7.992
26-Aug-06	-3.037	61.363	7.995
27-Aug-06	-3.035	61.365	7.999
28-Aug-06	-3.023	61.377	8.002
29-Aug-06	-3.015	61.385	8.007
30-Aug-06	-3.025	61.375	8.011
31-Aug-06	-3.054	61.346	8.015
1-Sep-06	-3.089	61.311	8.020
2-Sep-06	-3.115	61.285	8.025
3-Sep-06	-3.120	61.280	8.029
4-Sep-06	-3.116	61.284	8.034
5-Sep-06	-3.131	61.269	8.040
6-Sep-06	-3.161	61.239	8.045
7-Sep-06	-3.195	61.205	8.051
8-Sep-06	-3.222	61.178	8.056
9-Sep-06	-3.244	61.156	8.062
10-Sep-06	-3.275	61.125	8.068
11-Sep-06	-3.316	61.084	8.074
12-Sep-06	-3.327	61.073	8.080
13-Sep-06	-3.332	61.068	8.086
14-Sep-06	-3.363	61.037	8.093
15-Sep-06	-3.390	61.010	8.099
16-Sep-06	-3.410	60.990	8.106
17-Sep-06	-3.429	60.971	8.113
18-Sep-06	-3.452	60.948	8.120
19-Sep-06	-3.481	60.919	8.126
20-Sep-06	-3.493	60.907	8.134
21-Sep-06	-3.529	60.871	8.141
22-Sep-06	-3.574	60.826	8.148
23-Sep-06	-3.594	60.806	8.155
24-Sep-06	-3.587	60.813	8.163
25-Sep-06	-3.603	60.797	8.170
26-Sep-06	-3.637	60.763	8.178
27-Sep-06	-3.673	60.727	8.186
28-Sep-06	-3.688	60.712	8.193
29-Sep-06	-3.695	60.705	8.201
30-Sep-06	-3.717	60.683	8.209
1-Oct-06	-3.746	60.654	8.217
2-Oct-06	-3.716	60.684	8.225
3-Oct-06	-3.645	60.755	8.233
4-Oct-06	-3.584	60.816	8.241
5-Oct-06	-3.520	60.880	8.249

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
6-Oct-06	-3.377	61.023	8.258
7-Oct-06	-3.236	61.164	8.267
8-Oct-06	-3.128	61.272	8.276
9-Oct-06	-3.068	61.332	8.285
10-Oct-06	-3.059	61.341	8.293
11-Oct-06	-3.086	61.314	8.302
12-Oct-06	-3.085	61.315	8.310
13-Oct-06	-3.061	61.339	8.319
14-Oct-06	-3.044	61.356	8.327
15-Oct-06	-2.974	61.426	8.336
16-Oct-06	-2.870	61.530	8.345
17-Oct-06	-2.782	61.618	8.355
18-Oct-06	-2.707	61.693	8.364
19-Oct-06	-2.629	61.771	8.373
20-Oct-06	-2.568	61.832	8.382
21-Oct-06	-2.496	61.904	8.391
22-Oct-06	-2.473	61.927	8.400
23-Oct-06	-2.448	61.952	8.410
24-Oct-06	-2.418	61.982	8.419
25-Oct-06	-2.418	61.982	8.428
26-Oct-06	-2.441	61.959	8.437
27-Oct-06	-2.452	61.948	8.446
28-Oct-06	-2.464	61.936	8.454
29-Oct-06	-2.408	61.992	8.463
30-Oct-06	-5.688	58.712	8.259
31-Oct-06	-9.003	55.397	8.493
1-Nov-06	-9.003	55.397	8.503
2-Nov-06	-9.005	55.395	8.514
3-Nov-06	-8.759	55.641	8.516
4-Nov-06	-8.068	56.332	8.522
5-Nov-06	-7.407	56.993	8.530
6-Nov-06	-6.785	57.615	8.538
7-Nov-06	-6.206	58.194	8.545
8-Nov-06	-5.642	58.758	8.553
9-Nov-06	-4.908	59.492	8.561
10-Nov-06	-4.143	60.257	8.570
11-Nov-06	-3.596	60.804	8.583
12-Nov-06	-3.157	61.243	8.597
13-Nov-06	-2.845	61.555	8.609
14-Nov-06	-2.612	61.788	8.619
15-Nov-06	-2.445	61.955	8.628
16-Nov-06	-2.349	62.051	8.637
17-Nov-06	-2.273	62.127	8.649
18-Nov-06	-2.217	62.183	8.659
19-Nov-06	-2.194	62.206	8.669
20-Nov-06	-2.186	62.214	8.678
21-Nov-06	-2.219	62.181	8.687
22-Nov-06	-2.241	62.159	8.695
23-Nov-06	-2.242	62.158	8.702
24-Nov-06	-2.204	62.196	8.709
25-Nov-06	-2.194	62.206	8.715

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
26-Nov-06	-2.176	62.224	8.722
27-Nov-06	-2.157	62.243	8.730
28-Nov-06	-2.161	62.239	8.736
29-Nov-06	-2.162	62.238	8.743
30-Nov-06	-2.134	62.266	8.749
1-Dec-06	-2.113	62.287	8.756
2-Dec-06	-2.084	62.316	8.762
3-Dec-06	-2.101	62.299	8.769
4-Dec-06	-2.098	62.302	8.776
5-Dec-06	-2.092	62.308	8.783
6-Dec-06	-2.121	62.279	8.789
7-Dec-06	-2.103	62.297	8.795
8-Dec-06	-2.060	62.340	8.801
9-Dec-06	-2.078	62.322	8.806
10-Dec-06	-2.080	62.320	8.812
11-Dec-06	-2.083	62.317	8.818
12-Dec-06	-2.098	62.302	8.824
13-Dec-06	-2.102	62.298	8.829
14-Dec-06	-2.076	62.324	8.834
15-Dec-06	-2.067	62.333	8.838
16-Dec-06	-2.050	62.350	8.843
17-Dec-06	-2.071	62.329	8.847
18-Dec-06	-2.076	62.324	8.852
19-Dec-06	-2.090	62.310	8.856
20-Dec-06	-2.115	62.285	8.860
21-Dec-06	-2.117	62.283	8.863
22-Dec-06	-2.144	62.256	8.866
23-Dec-06	-2.161	62.239	8.869
24-Dec-06	-2.119	62.281	8.871
25-Dec-06	-2.122	62.278	8.873
26-Dec-06	-2.102	62.298	8.875
27-Dec-06	-2.068	62.332	8.877
28-Dec-06	-2.095	62.305	8.881
29-Dec-06	-2.115	62.285	8.884
30-Dec-06	-2.127	62.273	8.887
31-Dec-06	-2.137	62.263	8.890
1-Jan-07	-2.170	62.230	8.892
2-Jan-07	-2.146	62.254	8.893
3-Jan-07	-2.153	62.247	8.895
4-Jan-07	-2.133	62.267	8.897
5-Jan-07	-2.107	62.293	8.899
6-Jan-07	-2.073	62.327	8.901
7-Jan-07	-2.059	62.341	8.903
8-Jan-07	-2.064	62.336	8.901
9-Jan-07	-2.027	62.373	8.898
10-Jan-07	-2.047	62.353	8.892
11-Jan-07	-2.084	62.316	8.886
12-Jan-07	-2.109	62.291	8.883
13-Jan-07	-2.114	62.286	8.882
14-Jan-07	-2.146	62.254	8.882
15-Jan-07	-2.164	62.236	8.883

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
16-Jan-07	-2.156	62.244	8.884
17-Jan-07	-2.201	62.199	8.885
18-Jan-07	-2.241	62.159	8.886
19-Jan-07	-2.211	62.189	8.887
20-Jan-07	-2.171	62.229	8.887
21-Jan-07	-2.216	62.184	8.878
22-Jan-07	-2.242	62.158	8.863
23-Jan-07	-2.250	62.150	8.853
24-Jan-07	-2.271	62.129	8.848
25-Jan-07	-2.293	62.107	8.846
26-Jan-07	-2.320	62.080	8.846
27-Jan-07	-2.362	62.038	8.846
28-Jan-07	-2.419	61.981	8.847
29-Jan-07	-2.466	61.934	8.848
30-Jan-07	-2.519	61.881	8.848
31-Jan-07	-2.571	61.829	8.849
1-Feb-07	-2.621	61.779	8.849
2-Feb-07	-2.654	61.746	8.849
3-Feb-07	-2.652	61.748	8.849
4-Feb-07	-2.687	61.713	8.849
5-Feb-07	-2.701	61.699	8.848
6-Feb-07	-2.712	61.688	8.848
7-Feb-07	-2.725	61.675	8.847
8-Feb-07	-2.735	61.665	8.846
9-Feb-07	-2.746	61.654	8.845
10-Feb-07	-2.776	61.624	8.844
11-Feb-07	-2.810	61.590	8.842
12-Feb-07	-2.828	61.572	8.840
13-Feb-07	-2.849	61.551	8.839
14-Feb-07	-2.873	61.527	8.836
15-Feb-07	-2.830	61.570	8.834
16-Feb-07	-2.817	61.583	8.832
17-Feb-07	-2.807	61.593	8.829
18-Feb-07	-2.822	61.578	8.826
19-Feb-07	-2.811	61.589	8.824
20-Feb-07	-2.829	61.571	8.821
21-Feb-07	-2.827	61.573	8.818
22-Feb-07	-2.831	61.569	8.814
23-Feb-07	-2.823	61.577	8.811
24-Feb-07	-2.816	61.584	8.808
25-Feb-07	-2.830	61.570	8.804
26-Feb-07	-2.841	61.559	8.800
27-Feb-07	-2.852	61.548	8.796
28-Feb-07	-2.862	61.538	8.792
1-Mar-07	-2.867	61.533	8.788
2-Mar-07	-2.875	61.525	8.784
3-Mar-07	-2.839	61.561	8.780
4-Mar-07	-2.797	61.603	8.775
5-Mar-07	-2.755	61.645	8.771
6-Mar-07	-2.713	61.687	8.766
7-Mar-07	-2.701	61.699	8.761

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
8-Mar-07	-2.670	61.730	8.756
9-Mar-07	-2.656	61.744	8.751
10-Mar-07	-2.656	61.744	8.746
11-Mar-07	-2.643	61.757	8.741
12-Mar-07	-3.759	60.641	8.729
13-Mar-07	-7.634	56.766	8.728
14-Mar-07	-6.838	57.562	8.724
15-Mar-07	-5.961	58.439	8.719
16-Mar-07	-5.007	59.393	8.714
17-Mar-07	-3.988	60.412	8.709
18-Mar-07	-3.335	61.065	8.704
19-Mar-07	-3.000	61.400	8.688
20-Mar-07	-2.785	61.615	8.658
21-Mar-07	-2.669	61.731	8.633
22-Mar-07	-2.570	61.830	8.617
23-Mar-07	-2.484	61.916	8.605
24-Mar-07	-2.471	61.929	8.595
25-Mar-07	-2.455	61.945	8.584
26-Mar-07	-2.440	61.960	8.572
27-Mar-07	-2.416	61.984	8.562
28-Mar-07	-2.400	62.000	8.553
29-Mar-07	-2.413	61.987	8.545
30-Mar-07	-2.427	61.973	8.538
31-Mar-07	-2.443	61.957	8.531
1-Apr-07	-2.468	61.932	8.523
2-Apr-07	-2.485	61.915	8.517
3-Apr-07	-2.494	61.906	8.510
4-Apr-07	-2.498	61.902	8.502
5-Apr-07	-2.487	61.913	8.496
6-Apr-07	-2.467	61.933	8.489
7-Apr-07	-2.460	61.940	8.482
8-Apr-07	-2.419	61.981	8.469
9-Apr-07	-2.422	61.978	8.413
10-Apr-07	-2.428	61.972	8.319
11-Apr-07	-2.422	61.978	8.333
12-Apr-07	-2.412	61.988	8.303
13-Apr-07	-2.375	62.025	8.281
14-Apr-07	-2.366	62.034	8.261
15-Apr-07	-2.392	62.008	8.236
16-Apr-07	-2.386	62.014	8.193
17-Apr-07	-2.363	62.037	8.169
18-Apr-07	-2.361	62.039	8.162
19-Apr-07	-2.369	62.031	8.149
20-Apr-07	-2.380	62.020	8.122
21-Apr-07	-2.387	62.013	8.108
22-Apr-07	-2.409	61.991	8.103
23-Apr-07	-2.414	61.986	8.064
24-Apr-07	-2.422	61.978	8.091
25-Apr-07	-2.471	61.929	8.088
26-Apr-07	-2.508	61.892	8.088
27-Apr-07	-2.548	61.852	8.084

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
28-Apr-07	-2.530	61.870	8.085
29-Apr-07	-2.488	61.912	8.084
30-Apr-07	-2.449	61.951	8.075
1-May-07	-2.416	61.984	8.070
2-May-07	-2.404	61.996	8.060
3-May-07	-2.399	62.001	8.049
4-May-07	-2.404	61.996	8.042
5-May-07	-2.418	61.982	8.012
6-May-07	-2.436	61.964	8.025
7-May-07	-2.439	61.961	8.024
8-May-07	-2.440	61.960	8.024
9-May-07	-2.464	61.936	7.968
10-May-07	-2.537	61.863	7.988
11-May-07	-2.648	61.752	7.982

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
16-Aug-06	-4.039	60.361	7.969
17-Aug-06	-3.782	60.618	7.971
18-Aug-06	-3.572	60.828	7.973
19-Aug-06	-3.400	61.000	7.975
20-Aug-06	-3.288	61.112	7.977
21-Aug-06	-3.203	61.197	7.980
22-Aug-06	-3.148	61.252	7.982
23-Aug-06	-3.093	61.307	7.985
24-Aug-06	-3.060	61.340	7.988
25-Aug-06	-3.042	61.358	7.992
26-Aug-06	-3.037	61.363	7.995
27-Aug-06	-3.035	61.365	7.999
28-Aug-06	-3.023	61.377	8.002
29-Aug-06	-3.015	61.385	8.007
30-Aug-06	-3.025	61.375	8.011
31-Aug-06	-3.054	61.346	8.015
1-Sep-06	-3.089	61.311	8.020
2-Sep-06	-3.115	61.285	8.025
3-Sep-06	-3.120	61.280	8.029
4-Sep-06	-3.116	61.284	8.034
5-Sep-06	-3.131	61.269	8.040
6-Sep-06	-3.161	61.239	8.045
7-Sep-06	-3.195	61.205	8.051
8-Sep-06	-3.222	61.178	8.056
9-Sep-06	-3.244	61.156	8.062
10-Sep-06	-3.275	61.125	8.068
11-Sep-06	-3.316	61.084	8.074
12-Sep-06	-3.327	61.073	8.080
13-Sep-06	-3.332	61.068	8.086
14-Sep-06	-3.363	61.037	8.093
15-Sep-06	-3.390	61.010	8.099
16-Sep-06	-3.410	60.990	8.106
17-Sep-06	-3.429	60.971	8.113
18-Sep-06	-3.452	60.948	8.120
19-Sep-06	-3.481	60.919	8.126
20-Sep-06	-3.493	60.907	8.134
21-Sep-06	-3.529	60.871	8.141
22-Sep-06	-3.574	60.826	8.148
23-Sep-06	-3.594	60.806	8.155
24-Sep-06	-3.587	60.813	8.163
25-Sep-06	-3.603	60.797	8.170
26-Sep-06	-3.637	60.763	8.178
27-Sep-06	-3.673	60.727	8.186
28-Sep-06	-3.688	60.712	8.193
29-Sep-06	-3.695	60.705	8.201
30-Sep-06	-3.717	60.683	8.209
1-Oct-06	-3.746	60.654	8.217
2-Oct-06	-3.716	60.684	8.225
3-Oct-06	-3.645	60.755	8.233
4-Oct-06	-3.584	60.816	8.241
5-Oct-06	-3.520	60.880	8.249

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
6-Oct-06	-3.377	61.023	8.258
7-Oct-06	-3.236	61.164	8.267
8-Oct-06	-3.128	61.272	8.276
9-Oct-06	-3.068	61.332	8.285
10-Oct-06	-3.059	61.341	8.293
11-Oct-06	-3.086	61.314	8.302
12-Oct-06	-3.085	61.315	8.310
13-Oct-06	-3.061	61.339	8.319
14-Oct-06	-3.044	61.356	8.327
15-Oct-06	-2.974	61.426	8.336
16-Oct-06	-2.870	61.530	8.345
17-Oct-06	-2.782	61.618	8.355
18-Oct-06	-2.707	61.693	8.364
19-Oct-06	-2.629	61.771	8.373
20-Oct-06	-2.568	61.832	8.382
21-Oct-06	-2.496	61.904	8.391
22-Oct-06	-2.473	61.927	8.400
23-Oct-06	-2.448	61.952	8.410
24-Oct-06	-2.418	61.982	8.419
25-Oct-06	-2.418	61.982	8.428
26-Oct-06	-2.441	61.959	8.437
27-Oct-06	-2.452	61.948	8.446
28-Oct-06	-2.464	61.936	8.454
29-Oct-06	-2.408	61.992	8.463
30-Oct-06	-5.688	58.712	8.259
31-Oct-06	-9.003	55.397	8.493
1-Nov-06	-9.003	55.397	8.503
2-Nov-06	-9.005	55.395	8.514
3-Nov-06	-8.759	55.641	8.516
4-Nov-06	-8.068	56.332	8.522
5-Nov-06	-7.407	56.993	8.530
6-Nov-06	-6.785	57.615	8.538
7-Nov-06	-6.206	58.194	8.545
8-Nov-06	-5.642	58.758	8.553
9-Nov-06	-4.908	59.492	8.561
10-Nov-06	-4.143	60.257	8.570
11-Nov-06	-3.596	60.804	8.583
12-Nov-06	-3.157	61.243	8.597
13-Nov-06	-2.845	61.555	8.609
14-Nov-06	-2.612	61.788	8.619
15-Nov-06	-2.445	61.955	8.628
16-Nov-06	-2.349	62.051	8.637
17-Nov-06	-2.273	62.127	8.649
18-Nov-06	-2.217	62.183	8.659
19-Nov-06	-2.194	62.206	8.669
20-Nov-06	-2.186	62.214	8.678
21-Nov-06	-2.219	62.181	8.687
22-Nov-06	-2.241	62.159	8.695
23-Nov-06	-2.242	62.158	8.702
24-Nov-06	-2.204	62.196	8.709
25-Nov-06	-2.194	62.206	8.715



**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
26-Nov-06	-2.176	62.224	8.722
27-Nov-06	-2.157	62.243	8.730
28-Nov-06	-2.161	62.239	8.736
29-Nov-06	-2.162	62.238	8.743
30-Nov-06	-2.134	62.266	8.749
1-Dec-06	-2.113	62.287	8.756
2-Dec-06	-2.084	62.316	8.762
3-Dec-06	-2.101	62.299	8.769
4-Dec-06	-2.098	62.302	8.776
5-Dec-06	-2.092	62.308	8.783
6-Dec-06	-2.121	62.279	8.789
7-Dec-06	-2.103	62.297	8.795
8-Dec-06	-2.060	62.340	8.801
9-Dec-06	-2.078	62.322	8.806
10-Dec-06	-2.080	62.320	8.812
11-Dec-06	-2.083	62.317	8.818
12-Dec-06	-2.098	62.302	8.824
13-Dec-06	-2.102	62.298	8.829
14-Dec-06	-2.076	62.324	8.834
15-Dec-06	-2.067	62.333	8.838
16-Dec-06	-2.050	62.350	8.843
17-Dec-06	-2.071	62.329	8.847
18-Dec-06	-2.076	62.324	8.852
19-Dec-06	-2.090	62.310	8.856
20-Dec-06	-2.115	62.285	8.860
21-Dec-06	-2.117	62.283	8.863
22-Dec-06	-2.144	62.256	8.866
23-Dec-06	-2.161	62.239	8.869
24-Dec-06	-2.119	62.281	8.871
25-Dec-06	-2.122	62.278	8.873
26-Dec-06	-2.102	62.298	8.875
27-Dec-06	-2.068	62.332	8.877
28-Dec-06	-2.095	62.305	8.881
29-Dec-06	-2.115	62.285	8.884
30-Dec-06	-2.127	62.273	8.887
31-Dec-06	-2.137	62.263	8.890
1-Jan-07	-2.170	62.230	8.892
2-Jan-07	-2.146	62.254	8.893
3-Jan-07	-2.153	62.247	8.895
4-Jan-07	-2.133	62.267	8.897
5-Jan-07	-2.107	62.293	8.899
6-Jan-07	-2.073	62.327	8.901
7-Jan-07	-2.059	62.341	8.903
8-Jan-07	-2.064	62.336	8.901
9-Jan-07	-2.027	62.373	8.898
10-Jan-07	-2.047	62.353	8.892
11-Jan-07	-2.084	62.316	8.886
12-Jan-07	-2.109	62.291	8.883
13-Jan-07	-2.114	62.286	8.882
14-Jan-07	-2.146	62.254	8.882
15-Jan-07	-2.164	62.236	8.883

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
16-Jan-07	-2.156	62.244	8.884
17-Jan-07	-2.201	62.199	8.885
18-Jan-07	-2.241	62.159	8.886
19-Jan-07	-2.211	62.189	8.887
20-Jan-07	-2.171	62.229	8.887
21-Jan-07	-2.216	62.184	8.878
22-Jan-07	-2.242	62.158	8.863
23-Jan-07	-2.250	62.150	8.853
24-Jan-07	-2.271	62.129	8.848
25-Jan-07	-2.293	62.107	8.846
26-Jan-07	-2.320	62.080	8.846
27-Jan-07	-2.362	62.038	8.846
28-Jan-07	-2.419	61.981	8.847
29-Jan-07	-2.466	61.934	8.848
30-Jan-07	-2.519	61.881	8.848
31-Jan-07	-2.571	61.829	8.849
1-Feb-07	-2.621	61.779	8.849
2-Feb-07	-2.654	61.746	8.849
3-Feb-07	-2.652	61.748	8.849
4-Feb-07	-2.687	61.713	8.849
5-Feb-07	-2.701	61.699	8.848
6-Feb-07	-2.712	61.688	8.848
7-Feb-07	-2.725	61.675	8.847
8-Feb-07	-2.735	61.665	8.846
9-Feb-07	-2.746	61.654	8.845
10-Feb-07	-2.776	61.624	8.844
11-Feb-07	-2.810	61.590	8.842
12-Feb-07	-2.828	61.572	8.840
13-Feb-07	-2.849	61.551	8.839
14-Feb-07	-2.873	61.527	8.836
15-Feb-07	-2.830	61.570	8.834
16-Feb-07	-2.817	61.583	8.832
17-Feb-07	-2.807	61.593	8.829
18-Feb-07	-2.822	61.578	8.826
19-Feb-07	-2.811	61.589	8.824
20-Feb-07	-2.829	61.571	8.821
21-Feb-07	-2.827	61.573	8.818
22-Feb-07	-2.831	61.569	8.814
23-Feb-07	-2.823	61.577	8.811
24-Feb-07	-2.816	61.584	8.808
25-Feb-07	-2.830	61.570	8.804
26-Feb-07	-2.841	61.559	8.800
27-Feb-07	-2.852	61.548	8.796
28-Feb-07	-2.862	61.538	8.792
1-Mar-07	-2.867	61.533	8.788
2-Mar-07	-2.875	61.525	8.784
3-Mar-07	-2.839	61.561	8.780
4-Mar-07	-2.797	61.603	8.775
5-Mar-07	-2.755	61.645	8.771
6-Mar-07	-2.713	61.687	8.766
7-Mar-07	-2.701	61.699	8.761

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
8-Mar-07	-2.670	61.730	8.756
9-Mar-07	-2.656	61.744	8.751
10-Mar-07	-2.656	61.744	8.746
11-Mar-07	-2.643	61.757	8.741
12-Mar-07	-3.759	60.641	8.729
13-Mar-07	-7.634	56.766	8.728
14-Mar-07	-6.838	57.562	8.724
15-Mar-07	-5.961	58.439	8.719
16-Mar-07	-5.007	59.393	8.714
17-Mar-07	-3.988	60.412	8.709
18-Mar-07	-3.335	61.065	8.704
19-Mar-07	-3.000	61.400	8.688
20-Mar-07	-2.785	61.615	8.658
21-Mar-07	-2.669	61.731	8.633
22-Mar-07	-2.570	61.830	8.617
23-Mar-07	-2.484	61.916	8.605
24-Mar-07	-2.471	61.929	8.595
25-Mar-07	-2.455	61.945	8.584
26-Mar-07	-2.440	61.960	8.572
27-Mar-07	-2.416	61.984	8.562
28-Mar-07	-2.400	62.000	8.553
29-Mar-07	-2.413	61.987	8.545
30-Mar-07	-2.427	61.973	8.538
31-Mar-07	-2.443	61.957	8.531
1-Apr-07	-2.468	61.932	8.523
2-Apr-07	-2.485	61.915	8.517
3-Apr-07	-2.494	61.906	8.510
4-Apr-07	-2.498	61.902	8.502
5-Apr-07	-2.487	61.913	8.496
6-Apr-07	-2.467	61.933	8.489
7-Apr-07	-2.460	61.940	8.482
8-Apr-07	-2.419	61.981	8.469
9-Apr-07	-2.422	61.978	8.413
10-Apr-07	-2.428	61.972	8.319
11-Apr-07	-2.422	61.978	8.333
12-Apr-07	-2.412	61.988	8.303
13-Apr-07	-2.375	62.025	8.281
14-Apr-07	-2.366	62.034	8.261
15-Apr-07	-2.392	62.008	8.236
16-Apr-07	-2.386	62.014	8.193
17-Apr-07	-2.363	62.037	8.169
18-Apr-07	-2.361	62.039	8.162
19-Apr-07	-2.369	62.031	8.149
20-Apr-07	-2.380	62.020	8.122
21-Apr-07	-2.387	62.013	8.108
22-Apr-07	-2.409	61.991	8.103
23-Apr-07	-2.414	61.986	8.064
24-Apr-07	-2.422	61.978	8.091
25-Apr-07	-2.471	61.929	8.088
26-Apr-07	-2.508	61.892	8.088
27-Apr-07	-2.548	61.852	8.084

**MW-2s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
28-Apr-07	-2.530	61.870	8.085
29-Apr-07	-2.488	61.912	8.084
30-Apr-07	-2.449	61.951	8.075
1-May-07	-2.416	61.984	8.070
2-May-07	-2.404	61.996	8.060
3-May-07	-2.399	62.001	8.049
4-May-07	-2.404	61.996	8.042
5-May-07	-2.418	61.982	8.012
6-May-07	-2.436	61.964	8.025
7-May-07	-2.439	61.961	8.024
8-May-07	-2.440	61.960	8.024
9-May-07	-2.464	61.936	7.968
10-May-07	-2.537	61.863	7.988
11-May-07	-2.648	61.752	7.982

**MW-3s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
16-Aug-06	-1.114	61.396	7.641
17-Aug-06	-1.097	61.413	7.675
18-Aug-06	-1.105	61.405	7.713
19-Aug-06	-1.171	61.339	7.750
20-Aug-06	-1.214	61.296	7.786
21-Aug-06	-1.277	61.233	7.823
22-Aug-06	-1.255	61.255	7.858
23-Aug-06	-1.268	61.242	7.893
24-Aug-06	-1.257	61.253	7.927
25-Aug-06	-1.242	61.268	7.962
26-Aug-06	-1.217	61.293	7.994
27-Aug-06	-1.205	61.305	8.028
28-Aug-06	-1.261	61.249	8.060
29-Aug-06	-1.335	61.175	8.092
30-Aug-06	-1.368	61.142	8.124
31-Aug-06	-1.340	61.170	8.155
1-Sep-06	-1.271	61.239	8.185
2-Sep-06	-1.224	61.286	8.216
3-Sep-06	-1.271	61.239	8.245
4-Sep-06	-1.380	61.130	8.275
5-Sep-06	-1.427	61.083	8.303
6-Sep-06	-1.432	61.078	8.332
7-Sep-06	-1.402	61.108	8.359
8-Sep-06	-1.404	61.106	8.386
9-Sep-06	-1.434	61.076	8.413
10-Sep-06	-1.418	61.092	8.438
11-Sep-06	-1.335	61.175	8.464
12-Sep-06	-1.390	61.120	8.489
13-Sep-06	-1.473	61.037	8.513
14-Sep-06	-1.449	61.061	8.536
15-Sep-06	-1.449	61.061	8.559
16-Sep-06	-1.487	61.023	8.582
17-Sep-06	-1.532	60.978	8.604
18-Sep-06	-1.559	60.951	8.626
19-Sep-06	-1.570	60.940	8.647
20-Sep-06	-1.661	60.849	8.667
21-Sep-06	-1.624	60.886	8.687
22-Sep-06	-1.535	60.975	8.707
23-Sep-06	-1.554	60.956	8.726
24-Sep-06	-1.668	60.842	8.745
25-Sep-06	-1.689	60.821	8.764
26-Sep-06	-1.631	60.879	8.782
27-Sep-06	-1.550	60.960	8.800
28-Sep-06	-1.567	60.943	8.817
29-Sep-06	-1.627	60.883	8.834
30-Sep-06	-1.581	60.929	8.851
1-Oct-06	-1.516	60.994	8.867
2-Oct-06	-1.510	61.000	8.885
3-Oct-06	-1.412	61.098	8.900

**MW-3s**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
4-Oct-06	-1.469	61.041	8.915
5-Oct-06	-1.345	61.165	8.932
6-Oct-06	-1.163	61.347	8.946
7-Oct-06	-1.201	61.309	8.960
8-Oct-06	-1.296	61.214	8.974
9-Oct-06	-1.381	61.129	8.988
10-Oct-06	-1.393	61.117	9.001
11-Oct-06	-1.347	61.163	9.014
12-Oct-06	-1.452	61.058	9.027
13-Oct-06	-1.509	61.001	9.038
14-Oct-06	-1.486	61.024	9.050
15-Oct-06	-1.298	61.212	9.063
16-Oct-06	-1.195	61.315	9.073
17-Oct-06	-1.191	61.319	9.083
18-Oct-06	-1.292	61.218	9.093
19-Oct-06	-1.357	61.153	9.102
20-Oct-06	-1.368	61.142	9.110
21-Oct-06	-1.455	61.055	9.118
22-Oct-06	-1.339	61.171	9.126
23-Oct-06	-1.334	61.176	9.133
24-Oct-06	-1.414	61.096	9.139
25-Oct-06	-1.453	61.057	9.145
26-Oct-06	-1.406	61.104	9.151
27-Oct-06	-1.339	61.171	9.156
28-Oct-06	-1.324	61.186	9.160
29-Oct-06	-1.256	61.254	9.167
30-Oct-06	-1.438	61.072	8.896
31-Oct-06	-0.988	61.522	9.189
1-Nov-06	-1.043	61.467	9.188
2-Nov-06	-1.082	61.428	9.190
3-Nov-06	-1.102	61.408	9.190
4-Nov-06	-1.054	61.456	9.191
5-Nov-06	-1.031	61.479	9.192
6-Nov-06	-1.041	61.469	9.192
7-Nov-06	-1.071	61.439	9.191
8-Nov-06	-1.138	61.372	9.190
9-Nov-06	-0.834	61.676	9.191
10-Nov-06	-0.260	62.250	9.190
11-Nov-06	-0.121	62.389	9.186
12-Nov-06	-0.115	62.395	9.182
13-Nov-06	-0.128	62.382	9.178
14-Nov-06	-0.229	62.281	9.174
15-Nov-06	-0.063	62.447	9.169
16-Nov-06	-0.039	62.471	9.164
17-Nov-06	-0.116	62.394	9.157
18-Nov-06	-0.179	62.331	9.150
19-Nov-06	-0.248	62.262	9.142
20-Nov-06	-0.308	62.202	9.134

**MW-3s**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
21-Nov-06	-0.218	62.292	9.126
22-Nov-06	-0.181	62.329	9.117
23-Nov-06	-0.225	62.285	9.109
24-Nov-06	-0.083	62.427	9.101
25-Nov-06	0.064	62.574	9.092
26-Nov-06	0.033	62.543	9.083
27-Nov-06	-0.006	62.504	9.075
28-Nov-06	0.054	62.564	9.067
29-Nov-06	0.069	62.579	9.059
30-Nov-06	-0.059	62.451	9.051
1-Dec-06	-0.120	62.390	9.043
2-Dec-06	-0.111	62.399	9.035
3-Dec-06	-0.012	62.498	9.027
4-Dec-06	-0.088	62.422	9.019
5-Dec-06	-0.104	62.406	9.010
6-Dec-06	0.015	62.525	9.001
7-Dec-06	-0.057	62.453	8.992
8-Dec-06	-0.172	62.338	8.983
9-Dec-06	-0.038	62.472	8.972
10-Dec-06	-0.039	62.471	8.961
11-Dec-06	0.010	62.520	8.950
12-Dec-06	0.098	62.608	8.938
13-Dec-06	0.059	62.569	8.926
14-Dec-06	-0.088	62.422	8.912
15-Dec-06	-0.120	62.390	8.898
16-Dec-06	-0.216	62.294	8.883
17-Dec-06	-0.135	62.375	8.868
18-Dec-06	-0.190	62.320	8.851
19-Dec-06	-0.240	62.270	8.833
20-Dec-06	-0.238	62.272	8.815
21-Dec-06	-0.370	62.140	8.797
22-Dec-06	-0.295	62.215	8.777
23-Dec-06	-0.340	62.170	8.757
24-Dec-06	-0.239	62.271	8.736
25-Dec-06	-0.121	62.389	8.715
26-Dec-06	-0.193	62.317	8.692
27-Dec-06	-0.262	62.248	8.670
28-Dec-06	-0.099	62.411	8.647
29-Dec-06	-0.064	62.446	8.624
30-Dec-06	-0.194	62.316	8.600
31-Dec-06	-0.325	62.185	8.576
1-Jan-07	-0.346	62.164	8.551
2-Jan-07	-0.284	62.226	8.526
3-Jan-07	-0.073	62.437	8.501
4-Jan-07	-0.108	62.402	8.475
5-Jan-07	-0.142	62.368	8.450
6-Jan-07	-0.164	62.346	8.423
7-Jan-07	-0.096	62.414	8.397

**MW-3s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
8-Jan-07	-0.053	62.457	8.370
9-Jan-07	-0.184	62.326	8.343
10-Jan-07	-0.138	62.372	8.316
11-Jan-07	-0.006	62.504	8.289
12-Jan-07	-0.004	62.506	8.261
13-Jan-07	-0.066	62.444	8.233
14-Jan-07	0.002	62.512	8.205
15-Jan-07	-0.057	62.453	8.177
16-Jan-07	-0.236	62.274	8.148
17-Jan-07	-0.073	62.437	8.120
18-Jan-07	0.030	62.540	8.091
19-Jan-07	-0.146	62.364	8.063
20-Jan-07	-0.190	62.320	8.034
21-Jan-07	-0.124	62.386	8.006
22-Jan-07	-0.116	62.394	7.977
23-Jan-07	-0.183	62.327	7.947
24-Jan-07	-0.263	62.247	7.917
25-Jan-07	-0.464	62.046	7.888
26-Jan-07	-0.601	61.909	7.859
27-Jan-07	-0.676	61.834	7.829
28-Jan-07	-0.686	61.824	7.800
29-Jan-07	-0.764	61.746	7.771
30-Jan-07	-0.767	61.743	7.742
31-Jan-07	-0.777	61.733	7.713
1-Feb-07	-0.786	61.724	7.684
2-Feb-07	-0.888	61.622	7.656
3-Feb-07	-1.070	61.440	7.627
4-Feb-07	-1.015	61.495	7.600
5-Feb-07	-1.056	61.454	7.571
6-Feb-07	-1.074	61.436	7.543
7-Feb-07	-1.096	61.414	7.515
8-Feb-07	-1.157	61.353	7.486
9-Feb-07	-1.209	61.301	7.458
10-Feb-07	-1.174	61.336	7.430
11-Feb-07	-1.129	61.381	7.402
12-Feb-07	-1.157	61.353	7.374
13-Feb-07	-1.149	61.361	7.346
14-Feb-07	-1.129	61.381	7.318
15-Feb-07	-1.363	61.147	7.291
16-Feb-07	-1.319	61.191	7.263
17-Feb-07	-1.285	61.225	7.236
18-Feb-07	-1.216	61.294	7.209
19-Feb-07	-1.275	61.235	7.181
20-Feb-07	-1.215	61.295	7.155
21-Feb-07	-1.238	61.272	7.127
22-Feb-07	-1.234	61.276	7.101
23-Feb-07	-1.272	61.238	7.074
24-Feb-07	-1.301	61.209	7.047



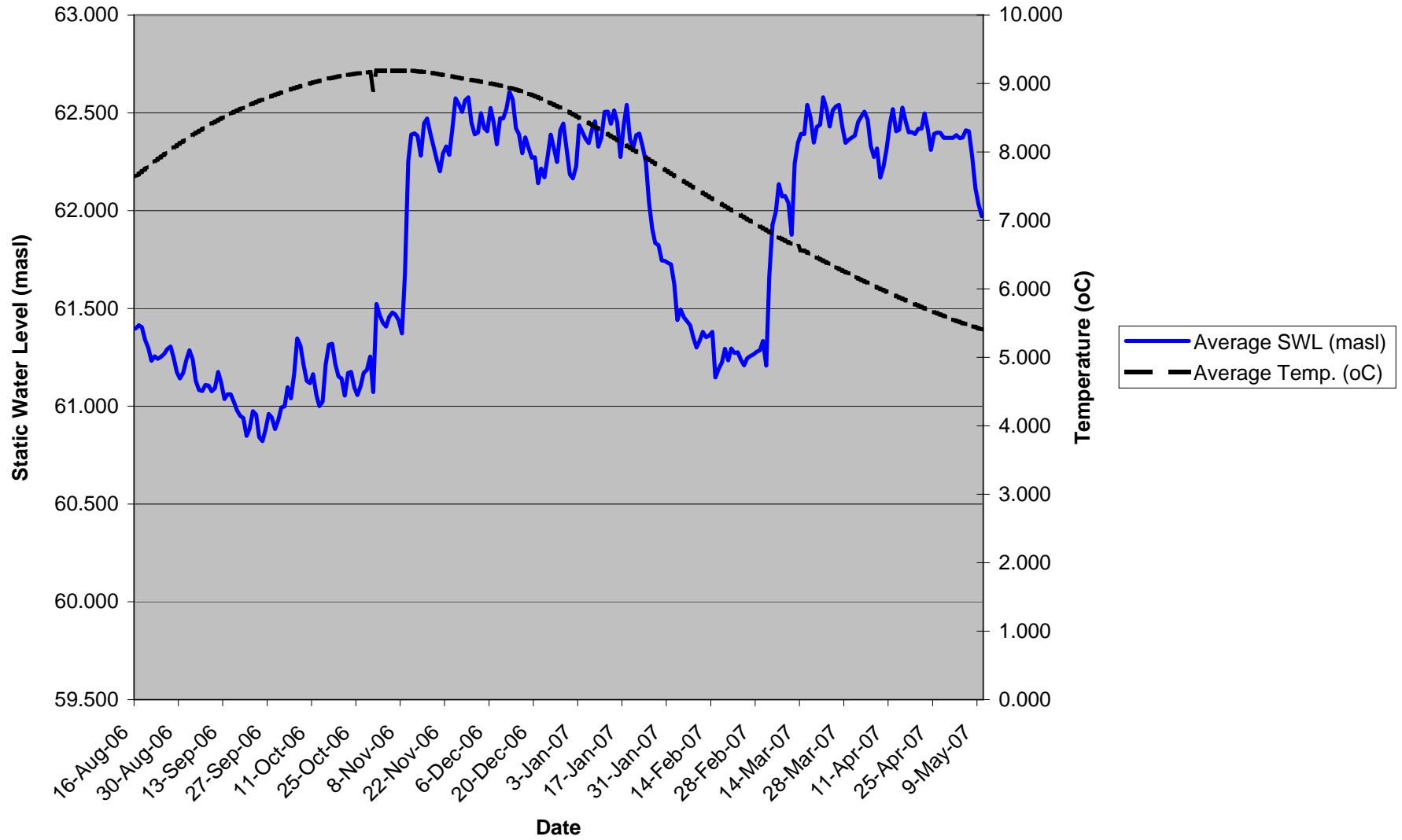
**MW-3s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
25-Feb-07	-1.266	61.244	7.020
26-Feb-07	-1.253	61.257	6.993
27-Feb-07	-1.244	61.266	6.967
28-Feb-07	-1.232	61.278	6.940
1-Mar-07	-1.224	61.286	6.914
2-Mar-07	-1.176	61.334	6.888
3-Mar-07	-1.302	61.208	6.861
4-Mar-07	-0.849	61.661	6.833
5-Mar-07	-0.582	61.928	6.806
6-Mar-07	-0.516	61.994	6.781
7-Mar-07	-0.375	62.135	6.755
8-Mar-07	-0.438	62.072	6.730
9-Mar-07	-0.435	62.075	6.704
10-Mar-07	-0.470	62.040	6.679
11-Mar-07	-0.633	61.877	6.653
12-Mar-07	-0.268	62.242	6.625
13-Mar-07	-0.162	62.348	6.630
14-Mar-07	-0.117	62.393	6.562
15-Mar-07	-0.119	62.391	6.557
16-Mar-07	0.031	62.541	6.533
17-Mar-07	-0.034	62.476	6.507
18-Mar-07	-0.162	62.348	6.484
19-Mar-07	-0.081	62.429	6.459
20-Mar-07	-0.071	62.439	6.435
21-Mar-07	0.070	62.580	6.411
22-Mar-07	0.013	62.523	6.387
23-Mar-07	-0.080	62.430	6.364
24-Mar-07	0.003	62.513	6.340
25-Mar-07	0.023	62.533	6.317
26-Mar-07	0.030	62.540	6.293
27-Mar-07	-0.080	62.430	6.270
28-Mar-07	-0.164	62.346	6.247
29-Mar-07	-0.148	62.362	6.224
30-Mar-07	-0.137	62.373	6.201
31-Mar-07	-0.126	62.384	6.178
1-Apr-07	-0.057	62.453	6.156
2-Apr-07	-0.029	62.481	6.133
3-Apr-07	-0.004	62.506	6.111
4-Apr-07	-0.045	62.465	6.088
5-Apr-07	-0.179	62.331	6.066
6-Apr-07	-0.235	62.275	6.044
7-Apr-07	-0.193	62.317	6.023
8-Apr-07	-0.341	62.169	6.001
9-Apr-07	-0.284	62.226	5.980
10-Apr-07	-0.194	62.316	5.959
11-Apr-07	-0.068	62.442	5.937
12-Apr-07	0.009	62.519	5.917
13-Apr-07	-0.104	62.406	5.896

**MW-3s**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
14-Apr-07	-0.096	62.414	5.875
15-Apr-07	0.017	62.527	5.855
16-Apr-07	-0.055	62.455	5.835
17-Apr-07	-0.109	62.401	5.815
18-Apr-07	-0.109	62.401	5.795
19-Apr-07	-0.119	62.391	5.775
20-Apr-07	-0.091	62.419	5.756
21-Apr-07	-0.091	62.419	5.736
22-Apr-07	-0.014	62.496	5.717
23-Apr-07	-0.095	62.415	5.698
24-Apr-07	-0.200	62.310	5.679
25-Apr-07	-0.117	62.393	5.660
26-Apr-07	-0.111	62.399	5.642
27-Apr-07	-0.112	62.398	5.624
28-Apr-07	-0.137	62.373	5.605
29-Apr-07	-0.138	62.372	5.588
30-Apr-07	-0.137	62.373	5.570
1-May-07	-0.138	62.372	5.552
2-May-07	-0.124	62.386	5.534
3-May-07	-0.139	62.371	5.517
4-May-07	-0.137	62.373	5.501
5-May-07	-0.099	62.411	5.485
6-May-07	-0.105	62.405	5.469
7-May-07	-0.233	62.277	5.454
8-May-07	-0.396	62.114	5.445
9-May-07	-0.476	62.034	5.423
10-May-07	-0.539	61.971	5.409
11-May-07	-2.020	60.490	9.761
12-May-07	-4.886	57.624	12.771
13-May-07	-4.824	57.686	12.277
14-May-07	-4.713	57.797	20.354
15-May-07	-4.389	58.121	19.377
16-May-07	-0.105	62.405	-0.105

### MW-3s Daily Averages



**MW-3d**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
16-Aug-06	-0.579	61.931	7.571
17-Aug-06	-0.553	61.957	7.571
18-Aug-06	-0.560	61.950	7.571
19-Aug-06	-0.623	61.887	7.571
20-Aug-06	-0.660	61.850	7.571
21-Aug-06	-0.725	61.785	7.571
22-Aug-06	-0.704	61.806	7.571
23-Aug-06	-0.716	61.794	7.571
24-Aug-06	-0.707	61.803	7.570
25-Aug-06	-0.695	61.815	7.570
26-Aug-06	-0.674	61.836	7.570
27-Aug-06	-0.669	61.841	7.570
28-Aug-06	-0.728	61.782	7.570
29-Aug-06	-0.800	61.710	7.570
30-Aug-06	-0.832	61.678	7.570
31-Aug-06	-0.806	61.704	7.570
1-Sep-06	-0.750	61.760	7.570
2-Sep-06	-0.716	61.794	7.570
3-Sep-06	-0.765	61.745	7.570
4-Sep-06	-0.872	61.638	7.570
5-Sep-06	-0.909	61.601	7.569
6-Sep-06	-0.916	61.594	7.569
7-Sep-06	-0.892	61.618	7.569
8-Sep-06	-0.902	61.608	7.569
9-Sep-06	-0.934	61.576	7.570
10-Sep-06	-0.923	61.587	7.569
11-Sep-06	-0.858	61.652	7.570
12-Sep-06	-0.916	61.594	7.570
13-Sep-06	-0.990	61.520	7.570
14-Sep-06	-0.971	61.539	7.570
15-Sep-06	-0.975	61.535	7.570
16-Sep-06	-1.013	61.497	7.570
17-Sep-06	-1.056	61.454	7.570
18-Sep-06	-1.083	61.427	7.569
19-Sep-06	-1.098	61.412	7.569
20-Sep-06	-1.182	61.328	7.570
21-Sep-06	-1.145	61.365	7.570
22-Sep-06	-1.074	61.436	7.571
23-Sep-06	-1.099	61.411	7.571
24-Sep-06	-1.210	61.300	7.571
25-Sep-06	-1.218	61.292	7.572
26-Sep-06	-1.170	61.340	7.572
27-Sep-06	-1.104	61.406	7.572
28-Sep-06	-1.124	61.386	7.572
29-Sep-06	-1.181	61.329	7.572
30-Sep-06	-1.136	61.374	7.572
1-Oct-06	-1.089	61.421	7.571
2-Oct-06	-1.206	61.304	7.571
3-Oct-06	-1.149	61.361	7.571

**MW-3d**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
4-Oct-06	-1.141	61.369	7.571
5-Oct-06	-1.146	61.364	7.571
6-Oct-06	-1.003	61.507	7.570
7-Oct-06	-0.988	61.522	7.570
8-Oct-06	-1.046	61.464	7.570
9-Oct-06	-1.103	61.407	7.571
10-Oct-06	-1.087	61.423	7.570
11-Oct-06	-1.032	61.478	7.570
12-Oct-06	-1.134	61.376	7.570
13-Oct-06	-1.164	61.346	7.570
14-Oct-06	-1.145	61.365	7.570
15-Oct-06	-1.129	61.381	7.570
16-Oct-06	-1.020	61.490	7.570
17-Oct-06	-0.985	61.525	7.570
18-Oct-06	-1.074	61.436	7.570
19-Oct-06	-1.121	61.389	7.570
20-Oct-06	-1.141	61.369	7.570
21-Oct-06	-1.231	61.279	7.570
22-Oct-06	-1.120	61.390	7.570
23-Oct-06	-1.123	61.387	7.570
24-Oct-06	-1.191	61.319	7.570
25-Oct-06	-1.195	61.315	7.570
26-Oct-06	-1.119	61.391	7.571
27-Oct-06	-1.043	61.467	7.571
28-Oct-06	-1.037	61.473	7.571
29-Oct-06	-1.222	61.288	7.571
31-Oct-06	-1.328	61.182	7.573
1-Nov-06	-1.250	61.260	7.575
2-Nov-06	-1.228	61.282	7.574
3-Nov-06	-1.192	61.318	7.573
4-Nov-06	-1.104	61.406	7.573
5-Nov-06	-1.059	61.451	7.573
6-Nov-06	-1.057	61.453	7.573
7-Nov-06	-1.072	61.438	7.573
8-Nov-06	-1.135	61.375	7.573
9-Nov-06	-1.264	61.246	7.573
10-Nov-06	-1.236	61.274	7.573
11-Nov-06	-1.080	61.430	7.572
12-Nov-06	-0.996	61.514	7.572
13-Nov-06	-0.928	61.582	7.572
14-Nov-06	-0.978	61.532	7.573
15-Nov-06	-0.980	61.530	7.573
16-Nov-06	-0.927	61.583	7.573
17-Nov-06	-0.968	61.542	7.573
18-Nov-06	-0.995	61.515	7.573
19-Nov-06	-0.984	61.526	7.573
20-Nov-06	-0.962	61.548	7.573
21-Nov-06	-0.831	61.679	7.574

**MW-3d**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
22-Nov-06	-0.770	61.740	7.574
23-Nov-06	-0.775	61.735	7.574
24-Nov-06	-0.871	61.639	7.574
25-Nov-06	-0.757	61.753	7.574
26-Nov-06	-0.749	61.761	7.574
27-Nov-06	-0.752	61.758	7.574
28-Nov-06	-0.679	61.831	7.573
29-Nov-06	-0.653	61.857	7.574
30-Nov-06	-0.744	61.766	7.574
1-Dec-06	-0.788	61.722	7.574
2-Dec-06	-0.832	61.678	7.574
3-Dec-06	-0.686	61.824	7.574
4-Dec-06	-0.731	61.779	7.575
5-Dec-06	-0.702	61.808	7.574
6-Dec-06	-0.585	61.925	7.575
7-Dec-06	-0.659	61.851	7.574
8-Dec-06	-0.764	61.746	7.575
9-Dec-06	-0.610	61.900	7.574
10-Dec-06	-0.603	61.907	7.575
11-Dec-06	-0.548	61.962	7.575
12-Dec-06	-0.452	62.058	7.575
13-Dec-06	-0.461	62.049	7.575
14-Dec-06	-0.586	61.924	7.575
15-Dec-06	-0.601	61.909	7.575
16-Dec-06	-0.664	61.846	7.575
17-Dec-06	-0.587	61.923	7.575
18-Dec-06	-0.601	61.909	7.575
19-Dec-06	-0.565	61.945	7.576
20-Dec-06	-0.497	62.013	7.576
21-Dec-06	-0.577	61.933	7.576
22-Dec-06	-0.493	62.017	7.576
23-Dec-06	-0.542	61.968	7.576
24-Dec-06	-0.692	61.818	7.576
25-Dec-06	-0.582	61.928	7.576
26-Dec-06	-0.647	61.863	7.576
27-Dec-06	-0.681	61.829	7.577
28-Dec-06	-0.526	61.984	7.576
29-Dec-06	-0.435	62.075	7.576
30-Dec-06	-0.422	62.088	7.576
31-Dec-06	-0.471	62.039	7.577
1-Jan-07	-0.452	62.058	7.577
2-Jan-07	-0.625	61.885	7.577
3-Jan-07	-0.482	62.028	7.577
4-Jan-07	-0.490	62.020	7.576
5-Jan-07	-0.513	61.997	7.577
6-Jan-07	-0.573	61.937	7.577
7-Jan-07	-0.510	62.000	7.577
8-Jan-07	-0.483	62.027	7.577

**MW-3d**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
9-Jan-07	-0.592	61.918	7.577
10-Jan-07	-0.519	61.991	7.577
11-Jan-07	-0.390	62.120	7.577
12-Jan-07	-0.390	62.120	7.577
13-Jan-07	-0.440	62.070	7.578
14-Jan-07	-0.372	62.138	7.577
15-Jan-07	-0.414	62.096	7.578
16-Jan-07	-0.550	61.960	7.578
17-Jan-07	-0.411	62.099	7.578
18-Jan-07	-0.314	62.196	7.578
19-Jan-07	-0.530	61.980	7.578
20-Jan-07	-0.663	61.847	7.578
21-Jan-07	-0.521	61.989	7.578
22-Jan-07	-0.477	62.033	7.578
23-Jan-07	-0.487	62.023	7.577
24-Jan-07	-0.478	62.032	7.577
25-Jan-07	-0.531	61.979	7.577
26-Jan-07	-0.591	61.919	7.577
27-Jan-07	-0.604	61.906	7.578
28-Jan-07	-0.576	61.934	7.578
29-Jan-07	-0.611	61.899	7.578
30-Jan-07	-0.574	61.936	7.578
31-Jan-07	-0.548	61.962	7.578
1-Feb-07	-0.516	61.994	7.578
2-Feb-07	-0.588	61.922	7.579
3-Feb-07	-0.717	61.793	7.579
4-Feb-07	-0.643	61.867	7.579
5-Feb-07	-0.680	61.830	7.579
6-Feb-07	-0.681	61.829	7.579
7-Feb-07	-0.696	61.814	7.579
8-Feb-07	-0.743	61.767	7.579
9-Feb-07	-0.777	61.733	7.579
10-Feb-07	-0.726	61.784	7.579
11-Feb-07	-0.677	61.833	7.580
12-Feb-07	-0.714	61.796	7.580
13-Feb-07	-0.690	61.820	7.580
14-Feb-07	-0.687	61.823	7.580
15-Feb-07	-0.947	61.563	7.580
16-Feb-07	-0.937	61.573	7.580
17-Feb-07	-0.911	61.599	7.579
18-Feb-07	-0.841	61.669	7.579
19-Feb-07	-0.904	61.606	7.580
20-Feb-07	-0.818	61.692	7.579
21-Feb-07	-0.852	61.658	7.580
22-Feb-07	-0.848	61.662	7.580
23-Feb-07	-0.900	61.610	7.580
24-Feb-07	-0.918	61.592	7.580
25-Feb-07	-0.869	61.641	7.580

**MW-3d**

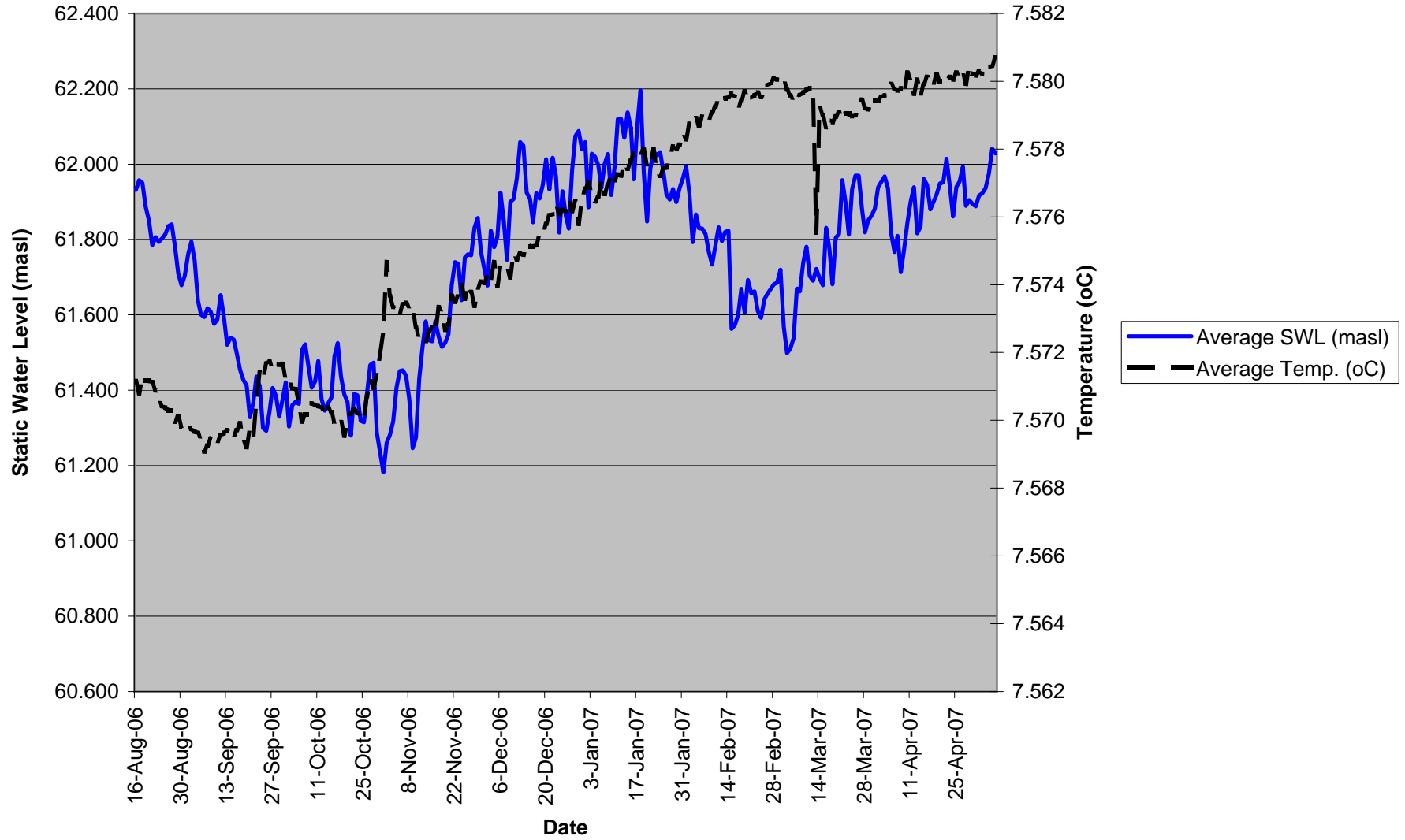
Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
26-Feb-07	-0.854	61.656	7.580
27-Feb-07	-0.841	61.669	7.580
28-Feb-07	-0.829	61.681	7.580
1-Mar-07	-0.824	61.686	7.580
2-Mar-07	-0.790	61.720	7.580
3-Mar-07	-0.941	61.569	7.580
4-Mar-07	-1.012	61.498	7.580
5-Mar-07	-1.000	61.510	7.580
6-Mar-07	-0.972	61.538	7.579
7-Mar-07	-0.840	61.670	7.579
8-Mar-07	-0.848	61.662	7.580
9-Mar-07	-0.772	61.738	7.580
10-Mar-07	-0.729	61.781	7.580
11-Mar-07	-0.807	61.703	7.580
12-Mar-07	-0.820	61.690	7.580
13-Mar-07	-0.788	61.722	7.576
14-Mar-07	-0.813	61.697	7.579
15-Mar-07	-0.831	61.679	7.579
16-Mar-07	-0.679	61.831	7.579
17-Mar-07	-0.735	61.775	7.579
18-Mar-07	-0.829	61.681	7.579
19-Mar-07	-0.705	61.805	7.579
20-Mar-07	-0.696	61.814	7.579
21-Mar-07	-0.552	61.958	7.579
22-Mar-07	-0.613	61.897	7.579
23-Mar-07	-0.697	61.813	7.579
24-Mar-07	-0.576	61.934	7.579
25-Mar-07	-0.540	61.970	7.579
26-Mar-07	-0.540	61.970	7.579
27-Mar-07	-0.629	61.881	7.579
28-Mar-07	-0.691	61.819	7.579
29-Mar-07	-0.659	61.851	7.579
30-Mar-07	-0.647	61.863	7.579
31-Mar-07	-0.628	61.882	7.579
1-Apr-07	-0.571	61.939	7.579
2-Apr-07	-0.556	61.954	7.580
3-Apr-07	-0.543	61.967	7.580
4-Apr-07	-0.574	61.936	7.580
5-Apr-07	-0.695	61.815	7.580
6-Apr-07	-0.743	61.767	7.580
7-Apr-07	-0.700	61.810	7.580
8-Apr-07	-0.797	61.713	7.580
9-Apr-07	-0.736	61.774	7.580
10-Apr-07	-0.665	61.845	7.580
11-Apr-07	-0.609	61.901	7.580
12-Apr-07	-0.571	61.939	7.580
13-Apr-07	-0.693	61.817	7.580
14-Apr-07	-0.676	61.834	7.580



**MW-3d**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
15-Apr-07	-0.549	61.961	7.580
16-Apr-07	-0.565	61.945	7.580
17-Apr-07	-0.630	61.880	7.580
18-Apr-07	-0.611	61.899	7.580
19-Apr-07	-0.590	61.920	7.580
20-Apr-07	-0.561	61.949	7.580
21-Apr-07	-0.558	61.952	7.580
22-Apr-07	-0.495	62.015	7.580
23-Apr-07	-0.567	61.943	7.580
24-Apr-07	-0.649	61.861	7.580
25-Apr-07	-0.571	61.939	7.580
26-Apr-07	-0.556	61.954	7.580
27-Apr-07	-0.517	61.993	7.580
28-Apr-07	-0.621	61.889	7.580
29-Apr-07	-0.605	61.905	7.580
30-Apr-07	-0.616	61.894	7.580
1-May-07	-0.622	61.888	7.580
2-May-07	-0.593	61.917	7.580
3-May-07	-0.587	61.923	7.580
4-May-07	-0.573	61.937	7.580
5-May-07	-0.535	61.975	7.580
6-May-07	-0.469	62.041	7.580
7-May-07	-0.481	62.029	7.581

### Mw-3d Daily Averages



**MW-4s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
2-Aug-06	-1.005	24.105	8.187
3-Aug-06	-0.860	24.250	8.158
4-Aug-06	-0.792	24.318	8.158
5-Aug-06	-0.666	24.444	8.118
6-Aug-06	-0.857	24.253	7.988
7-Aug-06	-1.010	24.100	7.984
8-Aug-06	-0.946	24.164	7.986
9-Aug-06	-1.078	24.032	7.989
10-Aug-06	-1.180	23.930	8.006
11-Aug-06	-1.191	23.919	8.028
12-Aug-06	-1.232	23.878	8.047
13-Aug-06	-1.294	23.816	8.076
14-Aug-06	-1.365	23.745	8.103
15-Aug-06	-1.414	23.696	8.124
16-Aug-06	-1.455	23.655	8.148
17-Aug-06	-1.498	23.612	8.171
18-Aug-06	-1.525	23.585	8.194
19-Aug-06	-1.538	23.572	8.218
20-Aug-06	-1.556	23.554	8.243
21-Aug-06	-1.457	23.653	8.269
22-Aug-06	-1.281	23.829	8.299
23-Aug-06	-1.419	23.691	8.331
24-Aug-06	-1.490	23.620	8.362
25-Aug-06	-1.541	23.569	8.392
26-Aug-06	-1.585	23.525	8.420
27-Aug-06	-1.615	23.495	8.446
28-Aug-06	-1.630	23.480	8.471
29-Aug-06	-1.638	23.472	8.497
30-Aug-06	-1.659	23.451	8.522
31-Aug-06	-1.686	23.424	8.547
1-Sep-06	-1.710	23.400	8.572
2-Sep-06	-1.727	23.383	8.596
3-Sep-06	-1.729	23.381	8.620
4-Sep-06	-1.718	23.392	8.644
5-Sep-06	-1.726	23.384	8.667
6-Sep-06	-1.734	23.376	8.691
7-Sep-06	-1.742	23.368	8.714
8-Sep-06	-1.748	23.362	8.737
9-Sep-06	-1.747	23.363	8.760
10-Sep-06	-1.744	23.366	8.782
11-Sep-06	-1.747	23.363	8.804
12-Sep-06	-1.738	23.372	8.825
13-Sep-06	-1.738	23.372	8.847
14-Sep-06	-1.761	23.349	8.867
15-Sep-06	-1.778	23.332	8.888
16-Sep-06	-1.783	23.327	8.908
17-Sep-06	-1.789	23.321	8.928
18-Sep-06	-1.798	23.312	8.947
19-Sep-06	-1.807	23.303	8.967

**MW-4s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
20-Sep-06	-1.797	23.313	8.985
21-Sep-06	-1.814	23.296	9.004
22-Sep-06	-1.832	23.278	9.022
23-Sep-06	-1.609	23.501	9.040
24-Sep-06	-1.432	23.678	9.063
25-Sep-06	-1.481	23.629	9.096
26-Sep-06	-1.694	23.416	9.124
27-Sep-06	-1.748	23.362	9.144
28-Sep-06	-1.762	23.348	9.160
29-Sep-06	-1.700	23.410	9.175
30-Sep-06	-1.559	23.551	9.192
1-Oct-06	-1.705	23.405	9.211
2-Oct-06	-0.506	24.604	9.236
3-Oct-06	-1.224	23.886	9.280
4-Oct-06	-1.463	23.647	9.314
5-Oct-06	-0.636	24.474	9.344
6-Oct-06	-1.114	23.996	9.373
7-Oct-06	-1.368	23.742	9.400
8-Oct-06	-1.461	23.649	9.414
9-Oct-06	-1.520	23.590	9.423
10-Oct-06	-1.567	23.543	9.429
11-Oct-06	-1.599	23.511	9.436
12-Oct-06	-1.389	23.721	9.443
13-Oct-06	-1.333	23.777	9.454
14-Oct-06	-1.130	23.980	9.468
15-Oct-06	-0.529	24.581	9.487
16-Oct-06	-1.101	24.009	9.512
17-Oct-06	-1.281	23.829	9.527
18-Oct-06	-0.957	24.153	9.537
19-Oct-06	-0.856	24.254	9.548
20-Oct-06	-1.068	24.042	9.559
21-Oct-06	-0.599	24.511	9.571
22-Oct-06	-1.044	24.066	9.581
23-Oct-06	-1.202	23.908	9.587
24-Oct-06	-1.267	23.843	9.588
25-Oct-06	-1.329	23.781	9.587
26-Oct-06	-1.162	23.948	9.586
27-Oct-06	-1.301	23.809	9.588
28-Oct-06	-1.366	23.744	9.587
29-Oct-06	-0.012	25.098	9.589
30-Oct-06	-0.104	25.006	9.596
31-Oct-06	-0.687	24.423	9.597
1-Nov-06	-0.929	24.181	9.595
2-Nov-06	-0.997	24.113	9.593
3-Nov-06	-0.938	24.172	9.590
4-Nov-06	-1.139	23.971	9.586
5-Nov-06	-1.225	23.885	9.581
6-Nov-06	-1.274	23.836	9.575

**MW-4s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
7-Nov-06	-1.148	23.962	9.568
8-Nov-06	-0.629	24.481	9.563
9-Nov-06	0.250	25.360	9.558
10-Nov-06	0.228	25.338	9.544
11-Nov-06	0.197	25.307	9.523
12-Nov-06	0.176	25.286	9.503
13-Nov-06	-0.014	25.096	9.482
14-Nov-06	-0.093	25.017	9.468
15-Nov-06	0.243	25.353	9.457
16-Nov-06	0.233	25.343	9.445
17-Nov-06	0.212	25.322	9.435
18-Nov-06	0.223	25.333	9.426
19-Nov-06	0.150	25.260	9.417
20-Nov-06	0.085	25.195	9.410
21-Nov-06	-0.096	25.014	9.401
22-Nov-06	-0.274	24.836	9.391
23-Nov-06	-0.355	24.755	9.380
24-Nov-06	0.245	25.355	9.327
25-Nov-06	0.240	25.350	9.329
26-Nov-06	0.164	25.274	9.234
27-Nov-06	0.132	25.242	9.147
28-Nov-06	-0.007	25.103	9.077
29-Nov-06	-0.112	24.998	8.990
30-Nov-06	-0.127	24.983	8.969
1-Dec-06	0.006	25.116	8.869
2-Dec-06	0.339	25.449	8.899
3-Dec-06	0.108	25.218	8.854
4-Dec-06	-0.133	24.977	8.813
5-Dec-06	-0.210	24.900	8.764
6-Dec-06	-0.301	24.809	8.979
7-Dec-06	-0.021	25.089	8.948
8-Dec-06	0.324	25.434	8.672
9-Dec-06	0.196	25.306	8.348
10-Dec-06	0.010	25.120	8.054
11-Dec-06	0.047	25.157	7.672
12-Dec-06	-0.272	24.838	7.906
13-Dec-06	-0.390	24.720	8.209
14-Dec-06	-0.074	25.036	8.192
15-Dec-06	-0.042	25.068	7.670
16-Dec-06	-0.116	24.994	7.660
17-Dec-06	-0.161	24.949	7.646
18-Dec-06	-0.180	24.930	7.626
19-Dec-06	-0.247	24.863	7.640
20-Dec-06	-0.377	24.733	8.168
21-Dec-06	-0.411	24.699	8.515
22-Dec-06	-0.440	24.670	8.554
23-Dec-06	-0.365	24.745	8.559
24-Dec-06	0.349	25.459	8.042

**MW-4s**

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
25-Dec-06	0.195	25.305	7.258
26-Dec-06	0.245	25.355	7.073
27-Dec-06	0.240	25.350	7.123
28-Dec-06	0.156	25.266	7.196
29-Dec-06	-0.200	24.910	7.188
30-Dec-06	-0.311	24.799	7.652
31-Dec-06	-0.309	24.801	7.661
1-Jan-07	-0.346	24.764	7.680
2-Jan-07	0.297	25.407	6.963
3-Jan-07	0.323	25.433	6.587
4-Jan-07	0.087	25.197	6.674
5-Jan-07	0.042	25.152	6.652
6-Jan-07	0.301	25.411	6.456
7-Jan-07	0.341	25.451	6.382
8-Jan-07	0.296	25.406	6.289
9-Jan-07	0.333	25.443	6.437
10-Jan-07	0.243	25.353	6.290
11-Jan-07	0.147	25.257	6.254
12-Jan-07	0.014	25.124	6.290
13-Jan-07	0.082	25.192	6.146
14-Jan-07	-0.011	25.099	6.232
15-Jan-07	-0.125	24.985	6.334
16-Jan-07	-0.108	25.002	6.440
17-Jan-07	-0.147	24.963	6.402
18-Jan-07	-0.177	24.933	6.350
19-Jan-07	0.015	25.125	6.412
20-Jan-07	0.415	25.525	6.029
21-Jan-07	0.252	25.362	5.860
22-Jan-07	-0.017	25.093	6.062
23-Jan-07	-0.149	24.961	6.386
24-Jan-07	-0.207	24.903	6.584
25-Jan-07	-0.209	24.901	6.635
26-Jan-07	-0.350	24.760	6.574
27-Jan-07	-0.635	24.475	6.520
28-Jan-07	-0.906	24.204	6.414
29-Jan-07	-1.067	24.043	6.457
30-Jan-07	-1.198	23.912	6.479
31-Jan-07	-1.259	23.851	6.612
1-Feb-07	-1.333	23.777	6.561
2-Feb-07	-1.377	23.733	6.974
3-Feb-07	-1.384	23.726	7.243
4-Feb-07	-1.435	23.675	7.260
5-Feb-07	-1.445	23.665	7.266
6-Feb-07	-1.465	23.645	7.268
7-Feb-07	-1.481	23.629	7.263
8-Feb-07	-1.492	23.618	7.255
9-Feb-07	-1.508	23.602	7.245
10-Feb-07	-1.539	23.571	7.232

**MW-4s**

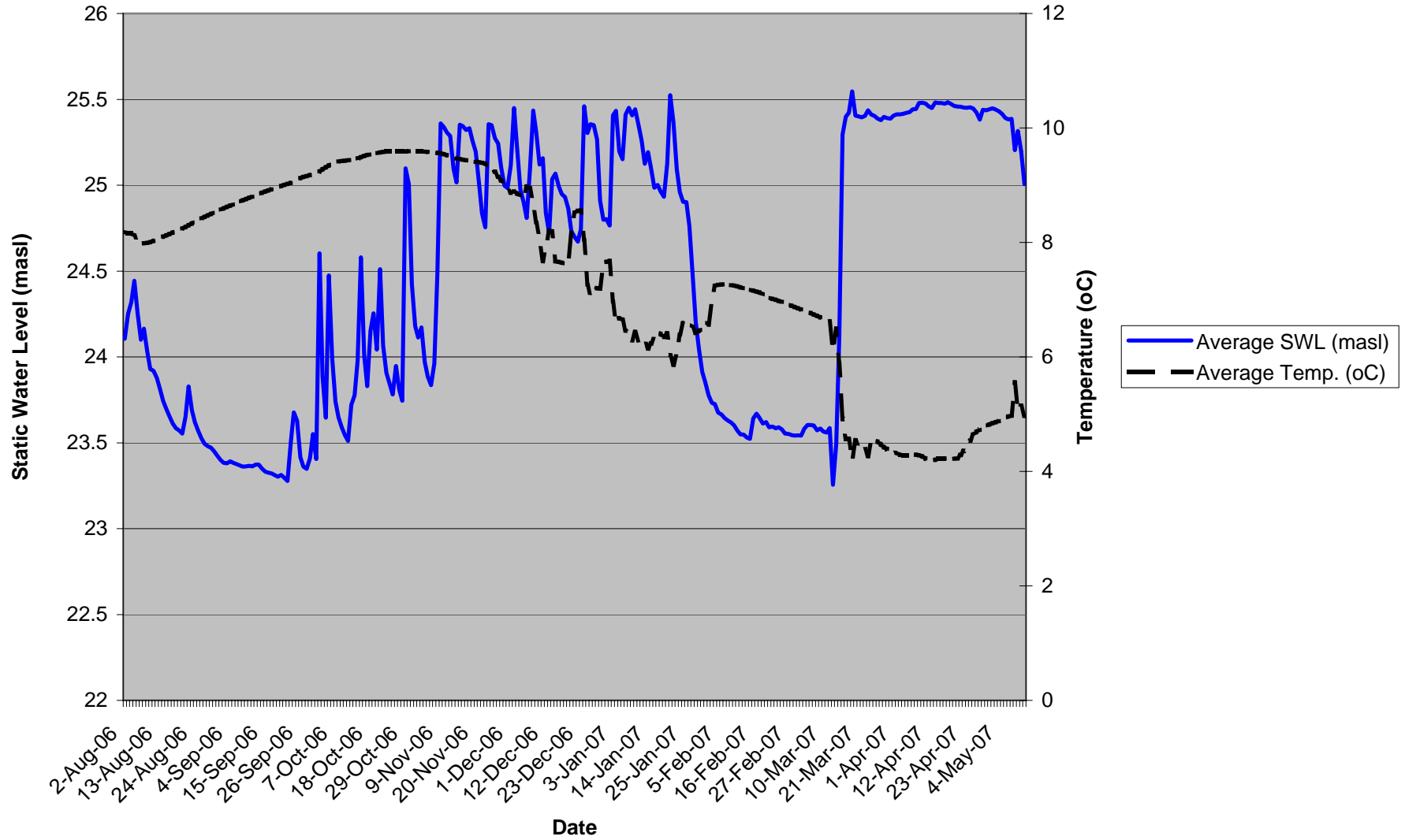
<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
11-Feb-07	-1.561	23.549	7.217
12-Feb-07	-1.562	23.548	7.199
13-Feb-07	-1.581	23.529	7.188
14-Feb-07	-1.588	23.522	7.174
15-Feb-07	-1.468	23.642	7.158
16-Feb-07	-1.441	23.669	7.143
17-Feb-07	-1.465	23.645	7.126
18-Feb-07	-1.497	23.613	7.092
19-Feb-07	-1.491	23.619	7.070
20-Feb-07	-1.520	23.590	7.034
21-Feb-07	-1.516	23.594	7.013
22-Feb-07	-1.526	23.584	6.999
23-Feb-07	-1.520	23.590	6.980
24-Feb-07	-1.534	23.576	6.960
25-Feb-07	-1.557	23.553	6.938
26-Feb-07	-1.558	23.552	6.916
27-Feb-07	-1.565	23.545	6.894
28-Feb-07	-1.569	23.541	6.873
1-Mar-07	-1.567	23.543	6.851
2-Mar-07	-1.568	23.542	6.829
3-Mar-07	-1.529	23.581	6.807
4-Mar-07	-1.506	23.604	6.785
5-Mar-07	-1.506	23.604	6.764
6-Mar-07	-1.509	23.601	6.741
7-Mar-07	-1.537	23.573	6.718
8-Mar-07	-1.527	23.583	6.692
9-Mar-07	-1.544	23.566	6.668
10-Mar-07	-1.551	23.559	6.644
11-Mar-07	-1.525	23.585	6.620
12-Mar-07	-1.854	23.256	6.106
13-Mar-07	-1.616	23.494	6.493
14-Mar-07	-0.996	24.114	5.897
15-Mar-07	0.185	25.295	4.910
16-Mar-07	0.289	25.399	4.560
17-Mar-07	0.312	25.422	4.574
18-Mar-07	0.436	25.546	4.187
19-Mar-07	0.295	25.405	4.543
20-Mar-07	0.290	25.400	4.453
21-Mar-07	0.285	25.395	4.397
22-Mar-07	0.294	25.404	4.387
23-Mar-07	0.326	25.436	4.264
24-Mar-07	0.301	25.411	4.553
25-Mar-07	0.294	25.404	4.550
26-Mar-07	0.277	25.387	4.522
27-Mar-07	0.269	25.379	4.472
28-Mar-07	0.287	25.397	4.421
29-Mar-07	0.281	25.391	4.392
30-Mar-07	0.277	25.387	4.395

**MW-4s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
31-Mar-07	0.296	25.406	4.383
1-Apr-07	0.303	25.413	4.328
2-Apr-07	0.303	25.413	4.284
3-Apr-07	0.305	25.415	4.281
4-Apr-07	0.311	25.421	4.284
5-Apr-07	0.316	25.426	4.273
6-Apr-07	0.333	25.443	4.276
7-Apr-07	0.333	25.443	4.294
8-Apr-07	0.369	25.479	4.283
9-Apr-07	0.370	25.480	4.263
10-Apr-07	0.365	25.475	4.225
11-Apr-07	0.350	25.460	4.189
12-Apr-07	0.339	25.449	4.187
13-Apr-07	0.372	25.482	4.204
14-Apr-07	0.369	25.479	4.221
15-Apr-07	0.368	25.478	4.221
16-Apr-07	0.365	25.475	4.228
17-Apr-07	0.373	25.483	4.228
18-Apr-07	0.363	25.473	4.235
19-Apr-07	0.352	25.462	4.221
20-Apr-07	0.348	25.458	4.230
21-Apr-07	0.346	25.456	4.286
22-Apr-07	0.343	25.453	4.358
23-Apr-07	0.341	25.451	4.421
24-Apr-07	0.344	25.454	4.537
25-Apr-07	0.336	25.446	4.637
26-Apr-07	0.314	25.424	4.690
27-Apr-07	0.271	25.381	4.731
28-Apr-07	0.328	25.438	4.763
29-Apr-07	0.327	25.437	4.796
30-Apr-07	0.331	25.441	4.821
1-May-07	0.338	25.448	4.841
2-May-07	0.331	25.441	4.858
3-May-07	0.321	25.431	4.880
4-May-07	0.306	25.416	4.908
5-May-07	0.282	25.392	4.935
6-May-07	0.273	25.383	4.960
7-May-07	0.276	25.386	4.974
8-May-07	0.094	25.204	5.553
9-May-07	0.205	25.315	5.051
10-May-07	0.087	25.197	5.144
11-May-07	-0.104	25.006	4.964



### MW-4s Daily Averages



**MW-5s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
2-Aug-06	0.768	38.092	9.670
3-Aug-06	0.778	38.082	9.497
4-Aug-06	0.791	38.069	9.762
5-Aug-06	0.804	38.056	9.905
6-Aug-06	0.808	38.052	10.046
7-Aug-06	0.809	38.051	10.142
8-Aug-06	0.813	38.047	10.212
9-Aug-06	0.819	38.041	10.273
10-Aug-06	0.826	38.034	10.362
11-Aug-06	0.834	38.026	10.456
12-Aug-06	0.841	38.019	10.513
13-Aug-06	0.848	38.012	10.556
14-Aug-06	0.857	38.003	10.598
15-Aug-06	0.866	37.994	10.644
16-Aug-06	0.864	37.996	10.686
17-Aug-06	0.852	38.008	10.724
18-Aug-06	0.844	38.016	10.762
19-Aug-06	0.839	38.021	10.802
20-Aug-06	0.836	38.024	10.839
21-Aug-06	0.835	38.025	10.871
22-Aug-06	0.831	38.029	10.902
23-Aug-06	0.829	38.031	10.930
24-Aug-06	0.824	38.036	10.957
25-Aug-06	0.823	38.037	10.984
26-Aug-06	0.822	38.038	11.008
27-Aug-06	0.822	38.038	11.033
28-Aug-06	0.818	38.042	11.057
29-Aug-06	0.817	38.043	11.080
30-Aug-06	0.816	38.044	11.103
31-Aug-06	0.814	38.046	11.124
1-Sep-06	0.809	38.051	11.145
2-Sep-06	0.807	38.053	11.164
3-Sep-06	0.810	38.050	11.183
4-Sep-06	0.809	38.051	11.199
5-Sep-06	0.808	38.052	11.213
6-Sep-06	0.818	38.042	11.226
7-Sep-06	0.825	38.035	11.238
8-Sep-06	0.828	38.032	11.249
9-Sep-06	0.833	38.027	11.259
10-Sep-06	0.834	38.026	11.267
11-Sep-06	0.838	38.022	11.274
12-Sep-06	0.864	37.996	11.282
13-Sep-06	0.870	37.990	11.288
14-Sep-06	0.893	37.967	11.279
15-Sep-06	0.925	37.935	11.275
16-Sep-06	0.924	37.936	11.281
17-Sep-06	0.929	37.931	11.286
18-Sep-06	0.934	37.926	11.291
19-Sep-06	0.933	37.927	11.295
20-Sep-06	0.942	37.918	11.298
21-Sep-06	0.941	37.919	11.298

**MW-5s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
22-Sep-06	0.940	37.920	11.299
23-Sep-06	0.941	37.919	11.300
24-Sep-06	0.941	37.919	11.300
25-Sep-06	0.942	37.918	11.300
26-Sep-06	0.941	37.919	11.301
27-Sep-06	0.937	37.923	11.303
28-Sep-06	0.935	37.925	11.304
29-Sep-06	0.938	37.922	11.306
30-Sep-06	0.937	37.923	11.307
1-Oct-06	0.935	37.925	11.307
2-Oct-06	0.936	37.924	11.307
3-Oct-06	0.936	37.924	11.307
4-Oct-06	0.940	37.920	11.304
5-Oct-06	0.944	37.916	11.301
6-Oct-06	0.945	37.915	11.297
7-Oct-06	0.943	37.917	11.292
8-Oct-06	0.944	37.916	11.285
9-Oct-06	0.944	37.916	11.277
10-Oct-06	0.948	37.912	11.268
11-Oct-06	0.948	37.912	11.260
12-Oct-06	0.952	37.908	11.250
13-Oct-06	0.952	37.908	11.239
14-Oct-06	0.948	37.912	11.228
15-Oct-06	0.946	37.914	11.216
16-Oct-06	0.942	37.918	11.201
17-Oct-06	0.940	37.920	11.171
18-Oct-06	0.942	37.918	11.164
19-Oct-06	0.941	37.919	11.149
20-Oct-06	0.940	37.920	11.132
21-Oct-06	0.939	37.921	11.115
22-Oct-06	0.937	37.923	11.097
23-Oct-06	0.937	37.923	11.045
24-Oct-06	0.937	37.923	11.018
25-Oct-06	0.935	37.925	10.970
26-Oct-06	0.933	37.927	10.884
27-Oct-06	0.931	37.929	10.820
28-Oct-06	0.930	37.930	10.733
29-Oct-06	0.933	37.927	10.782
30-Oct-06	0.932	37.928	10.683
31-Oct-06	0.932	37.928	10.639
1-Nov-06	0.933	37.927	10.641
2-Nov-06	0.932	37.928	10.633
3-Nov-06	0.931	37.929	10.554
4-Nov-06	0.928	37.932	10.454
5-Nov-06	0.922	37.938	10.394
6-Nov-06	0.917	37.943	10.308
7-Nov-06	0.912	37.948	10.280
8-Nov-06	0.915	37.945	10.282
9-Nov-06	0.925	37.935	10.316
10-Nov-06	0.935	37.925	10.321
11-Nov-06	0.935	37.925	10.244

MW-5s

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
12-Nov-06	0.931	37.929	10.218
13-Nov-06	0.925	37.935	10.237
14-Nov-06	0.923	37.937	10.216
15-Nov-06	0.924	37.936	10.214
16-Nov-06	0.923	37.937	10.210
17-Nov-06	0.926	37.934	10.219
18-Nov-06	0.932	37.928	10.227
19-Nov-06	0.933	37.927	10.153
20-Nov-06	0.935	37.925	10.085
21-Nov-06	0.931	37.929	10.000
22-Nov-06	0.924	37.936	9.901
23-Nov-06	0.922	37.938	9.867
24-Nov-06	0.924	37.936	9.871
25-Nov-06	0.924	37.936	9.802
26-Nov-06	0.924	37.936	9.745
27-Nov-06	0.923	37.937	9.756
28-Nov-06	0.922	37.938	9.693
29-Nov-06	0.920	37.940	9.601
30-Nov-06	0.921	37.939	9.642
1-Dec-06	0.921	37.939	9.664
2-Dec-06	0.925	37.935	9.635
3-Dec-06	0.923	37.937	9.523
4-Dec-06	0.924	37.936	9.408
5-Dec-06	0.923	37.937	9.373
6-Dec-06	0.921	37.939	9.323
7-Dec-06	0.922	37.938	9.321
8-Dec-06	0.925	37.935	9.333
9-Dec-06	0.923	37.937	9.214
10-Dec-06	0.922	37.938	9.199
11-Dec-06	0.919	37.941	9.129
12-Dec-06	0.916	37.944	9.099
13-Dec-06	0.909	37.951	9.085
14-Dec-06	0.909	37.951	9.117
15-Dec-06	0.913	37.947	9.141
16-Dec-06	0.915	37.945	9.129
17-Dec-06	0.914	37.946	9.059
18-Dec-06	0.915	37.945	9.041
19-Dec-06	0.913	37.947	8.950
20-Dec-06	0.912	37.948	8.933
21-Dec-06	0.912	37.948	8.844
22-Dec-06	0.912	37.948	8.801
23-Dec-06	0.912	37.948	8.736
24-Dec-06	0.915	37.945	8.703
25-Dec-06	0.916	37.944	8.625
26-Dec-06	0.916	37.944	8.598
27-Dec-06	0.917	37.943	8.478
28-Dec-06	0.916	37.944	8.473
29-Dec-06	0.912	37.948	8.432
30-Dec-06	0.911	37.949	8.419
31-Dec-06	0.907	37.953	8.378
1-Jan-07	0.905	37.955	8.376

MW-5s

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
2-Jan-07	0.900	37.960	8.535
3-Jan-07	0.903	37.957	8.360
4-Jan-07	0.902	37.958	8.326
5-Jan-07	0.902	37.958	8.365
6-Jan-07	0.897	37.963	8.495
7-Jan-07	0.890	37.970	8.584
8-Jan-07	0.892	37.968	8.550
9-Jan-07	0.890	37.970	8.554
10-Jan-07	0.891	37.969	8.495
11-Jan-07	0.889	37.971	8.457
12-Jan-07	0.889	37.971	8.409
13-Jan-07	0.890	37.970	8.393
14-Jan-07	0.894	37.966	8.336
15-Jan-07	0.895	37.965	8.272
16-Jan-07	0.894	37.966	8.231
17-Jan-07	0.895	37.965	8.179
18-Jan-07	0.898	37.962	8.189
19-Jan-07	0.901	37.959	8.148
20-Jan-07	0.904	37.956	8.149
21-Jan-07	0.911	37.949	7.951
22-Jan-07	0.927	37.933	7.547
23-Jan-07	0.931	37.929	7.476
24-Jan-07	0.936	37.924	7.401
25-Jan-07	0.937	37.923	7.366
26-Jan-07	0.934	37.926	7.295
27-Jan-07	0.940	37.920	7.253
28-Jan-07	0.934	37.926	7.190
29-Jan-07	0.923	37.937	7.186
30-Jan-07	0.915	37.945	7.177
31-Jan-07	0.907	37.953	7.081
1-Feb-07	0.898	37.962	7.067
2-Feb-07	0.893	37.967	7.022
3-Feb-07	0.890	37.970	7.012
4-Feb-07	0.887	37.973	6.998
5-Feb-07	0.885	37.975	6.924
6-Feb-07	0.885	37.975	6.907
7-Feb-07	0.884	37.976	6.913
8-Feb-07	0.880	37.980	6.875
9-Feb-07	0.879	37.981	6.798
10-Feb-07	0.878	37.982	6.755
11-Feb-07	0.876	37.984	6.754
12-Feb-07	0.873	37.987	6.669
13-Feb-07	0.876	37.984	6.629
14-Feb-07	0.887	37.973	6.661
15-Feb-07	0.881	37.979	6.680
16-Feb-07	0.876	37.984	6.644
17-Feb-07	0.874	37.986	6.525
18-Feb-07	0.871	37.989	6.578
19-Feb-07	0.867	37.993	6.552
20-Feb-07	0.861	37.999	6.516
21-Feb-07	0.859	38.001	6.440

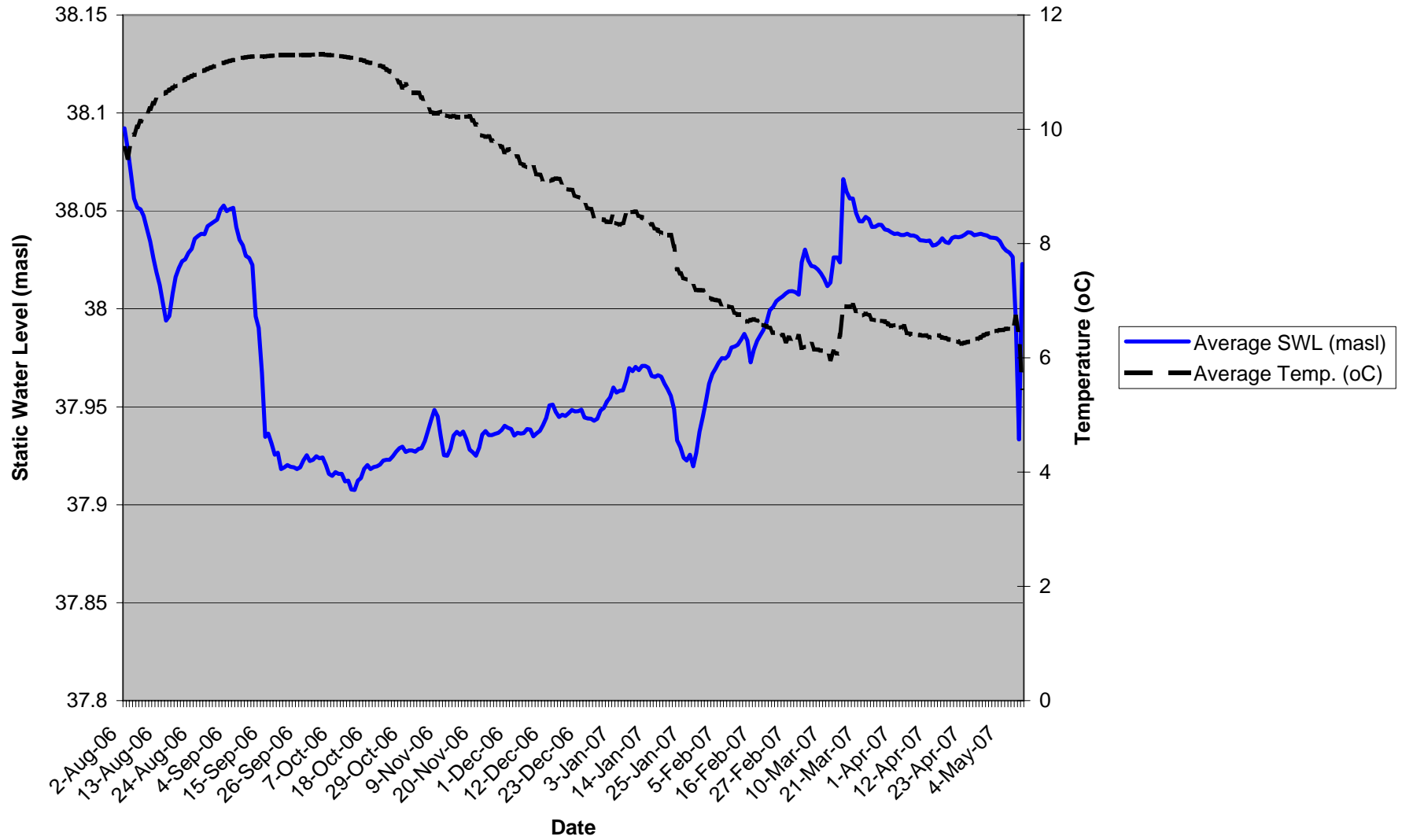
MW-5s

Date	Average SWL (btoc)	Average SWL (masl)	Average Temp. (°C)
22-Feb-07	0.856	38.004	6.446
23-Feb-07	0.855	38.005	6.471
24-Feb-07	0.854	38.006	6.399
25-Feb-07	0.852	38.008	6.291
26-Feb-07	0.851	38.009	6.348
27-Feb-07	0.851	38.009	6.291
28-Feb-07	0.852	38.008	6.253
1-Mar-07	0.853	38.007	6.377
2-Mar-07	0.836	38.024	6.173
3-Mar-07	0.830	38.030	6.196
4-Mar-07	0.835	38.025	6.206
5-Mar-07	0.838	38.022	6.245
6-Mar-07	0.839	38.021	6.149
7-Mar-07	0.840	38.020	6.144
8-Mar-07	0.842	38.018	6.126
9-Mar-07	0.845	38.015	6.121
10-Mar-07	0.848	38.012	6.129
11-Mar-07	0.847	38.013	5.971
12-Mar-07	0.834	38.026	6.112
13-Mar-07	0.834	38.026	6.071
14-Mar-07	0.836	38.024	6.398
15-Mar-07	0.794	38.066	6.872
16-Mar-07	0.800	38.060	6.904
17-Mar-07	0.804	38.056	6.895
18-Mar-07	0.804	38.056	6.923
19-Mar-07	0.811	38.049	6.822
20-Mar-07	0.815	38.045	6.822
21-Mar-07	0.815	38.045	6.733
22-Mar-07	0.813	38.047	6.778
23-Mar-07	0.814	38.046	6.741
24-Mar-07	0.818	38.042	6.678
25-Mar-07	0.818	38.042	6.653
26-Mar-07	0.817	38.043	6.674
27-Mar-07	0.817	38.043	6.649
28-Mar-07	0.819	38.041	6.639
29-Mar-07	0.820	38.040	6.595
30-Mar-07	0.821	38.039	6.556
31-Mar-07	0.822	38.038	6.572
1-Apr-07	0.822	38.038	6.510
2-Apr-07	0.822	38.038	6.528
3-Apr-07	0.822	38.038	6.555
4-Apr-07	0.822	38.038	6.438
5-Apr-07	0.823	38.037	6.417
6-Apr-07	0.823	38.037	6.421
7-Apr-07	0.823	38.037	6.424
8-Apr-07	0.825	38.035	6.396
9-Apr-07	0.825	38.035	6.388
10-Apr-07	0.825	38.035	6.397
11-Apr-07	0.825	38.035	6.352
12-Apr-07	0.828	38.032	6.399
13-Apr-07	0.827	38.033	6.382

**MW-5s**

<b>Date</b>	<b>Average SWL (btoc)</b>	<b>Average SWL (masl)</b>	<b>Average Temp. (°C)</b>
14-Apr-07	0.826	38.034	6.397
15-Apr-07	0.824	38.036	6.351
16-Apr-07	0.826	38.034	6.347
17-Apr-07	0.826	38.034	6.323
18-Apr-07	0.824	38.036	6.305
19-Apr-07	0.823	38.037	6.312
20-Apr-07	0.823	38.037	6.284
21-Apr-07	0.823	38.037	6.242
22-Apr-07	0.822	38.038	6.263
23-Apr-07	0.821	38.039	6.279
24-Apr-07	0.821	38.039	6.290
25-Apr-07	0.822	38.038	6.312
26-Apr-07	0.822	38.038	6.330
27-Apr-07	0.822	38.038	6.356
28-Apr-07	0.822	38.038	6.398
29-Apr-07	0.823	38.037	6.420
30-Apr-07	0.824	38.036	6.438
1-May-07	0.824	38.036	6.455
2-May-07	0.824	38.036	6.468
3-May-07	0.826	38.034	6.487
4-May-07	0.829	38.031	6.485
5-May-07	0.830	38.030	6.509
6-May-07	0.831	38.029	6.508
7-May-07	0.833	38.027	6.473
8-May-07	0.865	37.995	6.719
9-May-07	0.927	37.933	6.398
10-May-07	0.837	38.023	5.474

### MW-5s Daily Averages





APPENDIX D  
PROJECT SITE WETLAND REPORTS

# WETLAND 1 REPORT

## Wetland Delineation

Wetland 1 encompasses 4.22 ha and is predominately of mixedwood treed basin swamp with minor basin marsh components. This wetland is centered on 4986583 N, 414881 E (NAD 83). Wetland 1 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1: Geographical Boundaries of Wetland 1 (NAD 83)**

Boundary	Northing	Easting
North	4986793	415043
South	4986356	415021
East	4986576	414926
West	4986630	414781

During the Wetland 1 field surveys on May 31, June 11, and August 20, 2007, all species of plant, bird, mammal, reptile, and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

## Ecological Characterization

### Plants

Wetland 1 is predominantly spring-fed deciduous treed basin swamp. This wetland is bisected by a logging road which has a culvert to permit water flow under the road. Near the road on both sides are small patches of broad-leaved cattail (*Typha latifolia*), which quickly grades into treed swamp. In the treed swamp portion, the ground vegetation is dominated by sphagnum mosses, (*Sphagnum spp.*), cinnamon fern (*Osmunda cinnemonea*) water avens (*Geum rivale*), sensitive fern (*Onoclea sensibilis*), Eastern poison ivy (*Toxicodendron radicans*), interrupted fern (*Osmunda claytoniana*), and sedges (*Carex lurida*, *C. stricta*). Small yellow water-crowfoot (*Ranunculus gmelinii*) is abundant in small surface pools in this wetland.

Dominant shrubs in this wetland include specked alder (*Alnus incana*), Canada holly (*Ilex verticillata*), red maple (*Acer rubrum*), and trembling aspen (*Populus tremuloides*). Round-leaved dogwood (*Cornus rotundifolia*) is also present. The tree layer (>10 cm dbh) is dominated by red maple (*A. rubrum*), red spruce (*Picea rubens*), trembling aspen (*Populus tremuloides*) and yellow birch (*Betula alleghaniensis*). American elm (*Ulmus americana*) and Black ash saplings were also present in this wetland.

There is also a small basin marsh area near the western spring which is dominated by sedges (*C. lurida*, *C. stricta*), tall buttercup (*Ranunculus acris*) and meadow horsetails (*Equisetum arvense*). Sensitive fern is also present, as is some shining rose (*Rosa nitida*).

A small area near the spring approximately 20 by 15 m in size is dominated by sphagnum and greater bulrush (*Schoenoplectus tabermontanae*).

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 1. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 1 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 1.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 1.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervales	Possible	ACCDC
<i>juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs , swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 1.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervals, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

Thirteen sapling (2.5 - 10-cm dbh) and 5 seedling (<2.5-cm dbh) black ashes (*Fraxinus nigra*), a yellow-listed species, were the only listed plant species found within the wetland. The saplings are located throughout the wetland. Fundy Gypsum will work in cooperation with the Confederacy of Mainland Mi'kmaq (CMM) to monitor these individual black ashes.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 1 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Aythya collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps pf sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	High	Green
Sora	<i>Porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	High	Green
Willet	<i>Catoptrophorus semipalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>Bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	High	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	High	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some conifers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	Mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proocetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

White-throated Sparrow (*Zonotrichia albicans*), Magnolia Warbler (*Dendroica magnolia*), Black-capped Chickadee (*Poecile atricapilla*), Least Flycatcher (*Empidonax minimus*), Hairy Woodpecker (*Picoides villosus*) and Downy Woodpecker (*Picoides pubescens*) were all observed in this wetland during field surveys in summer 2007. Wetland 1 is not considered to be critical breeding habitat for significant numbers of any breeding bird species.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen avian species of concern reported within the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species are expected to be present in or to use Wetland 1 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

A litter of varying hare (*Lepus americana*) kits was observed in this wetland during the June 11, 2007 survey. Deer (*Odocoileus virginianus*) tracks were observed on the logging road bisecting the wetland on all three survey days.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR

yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

No reptiles or amphibians were observed during the wetland survey. Northern spring peepers (*Pseudacris crucifer*) were heard calling in this wetland on June 11, 2007. Green (*Rana clamitans*) and wood (*Rana sylvatica*) frogs were also observed in this wetland during later surveys. No reptiles were observed in this wetland during any surveys.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist and/or their known distribution in Nova Scotia does not include this area.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5: RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 1**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were identified on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no permanent surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 1 is fed by at least two springs which are apparent at the base of the slope along the northwestern edge of the basin containing this swamp. These springs supply water to a small intermittent stream which flows south for approximately 200 metres before flowing into a larger stream continued to flow towards the southeast. This stream is near the southern boundary of this wetland. After rainfall events, water may flow into this wetland across the logging road from Wetland 4, located to the east.

### **Hydrogeological Characterization**

As this wetland is spring-fed it plays a role in groundwater discharge. It may play a minor role in a groundwater recharge. It may play a small role in local erosion and flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in Miller's Creek Extension EARD).

### **Identifiable Impacts to Wetland**

Wetland 1 will be almost entirely removed by the mine quarry and placement of stockpiles. The small portion of Wetland 1 to be unaffected physically will be impacted by changes in surface water flow. There are no red-listed species at risk known to be present in this wetland. One species, black ash, has been found in this wetland. Eighteen black ash saplings were detected in this wetland on August 20, 2007. No fish species are present, as the wetland is a treed swamp and would not support breeding fish populations.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth. The logging road which passes through Wetland 1 has undoubtedly led to changes in drainage patterns since it was constructed, although it does have a culvert which permits water to flow from the northern to the southern portion of the wetland.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving



wetland alterations. She has also completed a Wetland Delineation and Classification course on the United States Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

## WETLAND 2 REPORT

### Wetland Delineation

Wetland 2 encompasses 0.12 ha, consists of deciduous treed basin swamp and is centered on 4986791 N, 415335 E (NAD 83). Wetland 2 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 2 (NAD 83)**

Boundary	Northing	Easting
North	4986798	415335
South	4986787	415333
East	4986781	415383
West	4986800	415283

During the Wetland 2 field surveys on May 31, June 11, and August 21, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 2 is a deciduous treed basin swamp. It is a long narrow shallow hummocky pool situated in a small valley between two small ridges. Dominant trees (>10 cm dbh) immediately surrounding this wetland include red maple (*A. rubrum*), red spruce (*Picea rubens*) and yellow birch (*Betula alleghaniensis*). Eastern hemlock (*Tsuga canadensis*) is also present. The shrub layer in this wetland is dominated by specked alder (*Alnus incana*), Canada holly (*Ilex verticillata*), red maple (*Acer rubrum*) and trembling aspen (*Populus tremuloides*). Sedges (*Carex lurida*, *C. pseudocyperus*), sensitive fern (*Onoclea sensibilis*), and interrupted fern (*Osmunda claytoniana*) dominate the ground vegetation around the perimeter, while wild calla (*Calla palustris*), hemlock water parsley (*Sium suave*) and Broad-Leaved Water-Plantain (*Alisma triviale*) occur in the shallow water. The sedge *Carex lurida* and the rush *Juncus effusus* also occur around the perimeter. The hummocks tend to be covered with Sphagnum mosses (*Sphagnum spp.*). Lesser duckweed (*Lemna minor*) covers a portion of the water's surface.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2005 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 2. These

are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 2 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 2.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 2.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

One sapling (2.5 - 10-cm dbh) black ash (*Fraxinus nigra*), a yellow-listed species, was the only listed plant species found within the wetland. The saplings are located roughly in the center of the wetland. Fundy Gypsum will work in cooperation with the Confederacy of Mainland Mi'kmaq (CMM) to monitor these individual black ashes.

## Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 2 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Athytha collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 2 on May 31, June 11, and August 21 2007, no bird species were observed within the wetland. Wetland 2 is not considered to be critical breeding habitat for any listed bird species, nor does it provide habitat for significant number of non-listed bird species.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

<b>NSDNR Status</b>	<b>Common Name</b>	<b>Binomial</b>	<b>Source of Record</b>	<b>Habitat Preference</b>	<b>Potential Presence on site</b>
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible

None of these four red-listed species or the thirteen yellow-listed bird species is expected to be present in or to use Wetland 2 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

No evidence of any mammal species was observed in Wetland 2 during any of the field surveys.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

Wood frogs (*Rana sylvatica*) were observed in this wetland during the field surveys. Northern spring peepers (*Pseudocaris crucifer crucifer*) and yellow-spotted salamanders (*Ambystoma laterale*) likely breed in this wetland. No reptiles were observed.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist or their known distribution does not include the project site.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat

for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 2**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were identified on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 2 has no observable inflow or outflow and probably receives its water from precipitation runoff, and there is no reason to suspect a groundwater supply.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in groundwater recharge. It does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the excavation of a gypsum quarry, as part of the planned expansion of gypsum mining operations in the area.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in Millers Creek Extension EARD).

### **Identifiable Impacts to Wetland**

Wetland 2 will be entirely removed by the mine project. Aside from a single black ash sapling, there are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first

approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetland functioning on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the United States Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.



## WETLAND 3 REPORT

### Wetland Delineation

Wetland 3 encompasses 0.03 ha, consists of isolated basin marsh and is centered on 4986921 N, 415385 E (NAD 83). Wetland 3 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 3 (NAD 83)**

Boundary	Northing	Easting
North	4986926	415385
South	4986914	415385
East	4986926	415402
West	4986924	415364

During the Wetland 3 field surveys on May 31, June 11, and August 21, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 3 is an isolated basin marsh located in a forested area. There is no tree layer in the wetland itself, but red maple (*Acer rubrum*), balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) occur around the perimeter. Graminoids such as little prickly sedge (*Carex echinata*) and soft rush (*Juncus effusus*) occur around the edges, as do sensitive fern (*Onoclea sensibilis*), narrow-leaved meadowsweet (*Spirea alba*), St. John's wort (*Triadenum virginicum*), and wild lily-of-the-valley (*Maianthemum canadense*). The open water portion is characterized by-moss covered floating deadwood, floating duckweed (*Lemna minor*) and submerged hemlock water-parsnip (*Sium suave*) around the edges. Wild calla (*Calla palustris*) and Bugleweed (*Lycopus americana*) also occur in this wetland.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 3. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a

government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 1 (Table 2).

None of these plants were observed in the wetland on the survey on May 31, 2007 and June 11, 2007, and August 14, 2007.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 3 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green -winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Aythya collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semipalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some conifers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 3 on May 31, June 11, and August 21 2007, no bird species were observed within the wetland. Wetland 3 is not considered to be critical breeding habitat for any breeding bird species.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

<b>NSDNR Status</b>	<b>Common Name</b>	<b>Binomial</b>	<b>Source of Record</b>	<b>Habitat Preference</b>	<b>Potential Presence on site</b>
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely



None of these four red-listed species or the thirteen yellow-listed bird species are expected to be present in or to use wetland 3 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 3 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

The only species of amphibian observed during field surveys on May 31, 2007 was a pair of mating green frogs (*Lithobates clamitans*). Spring peepers (*Pseudoeacaris crucifer*) and yellow-spotted salamanders (*Ambystoma laterale*) likely breed in this wetland. No evidence of reptiles was observed in or near Wetland 3.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence

on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 3**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravely, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna fuscillata</i>	Yellow	Bogs and swamp of bald Cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epithea princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were identified on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 3 has no inflow or outflow and probably receives its water from precipitation runoff; however insufficient evidence exists to determine if ground water sources exist.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in groundwater recharge. It does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction of a stockpile due to the expansion of gypsum mining operations in the general area.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit- the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in Miller's Creek Extension EARD).

### **Identifiable Impacts to Wetland**

Wetland 3 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

### **Past Impacts To The Wetland**

This wetland has likely been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

## **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

## **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

## **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and

fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

## WETLAND 4 REPORT

### Wetland Delineation

Wetland 4 encompasses 0.34 ha, consists of basin marsh and deciduous treed basin swamp and is centered on 4986428N, 415144 E (NAD 83). Wetland 4 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 4 (NAD 83)**

Boundary	Northing	Easting
North	4986447	415143
South	4986413	415150
East	4986447	415194
West	4986416	415416

During the Wetland 4 field surveys on June 11, and August 21, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 4 is comprised of a shallow water marsh and a deciduous treed basin swamp. The basin marsh is abundant with duckweed (*Lemna minor*), cat-tail (*Typha latifolia*), forget-me-not (*Myosotis laxa*) and sedges (*Carex* spp.). The treed swamp is dominated by sensitive fern (*Onoclea sensibilis*), field-horsetail (*Equisetum arvense*), red maple (*Acer rubrum*), trembling aspen (*Populus tremuloides*), red ash (*Fraxinus pennsylvanica*) and touch-me-not (*Impatiens capensis*).

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 4. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2)

with potential to occur in habitats present within and immediately surrounding wetland 4 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 4.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 4.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervaleas	Possible	ACCDC
<i>juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs , swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata var. gaspereaensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervaleas, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

None of these plants were observed in the wetland on the surveys on June 11 and August 20 2007.

### **Birds**

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of



the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 4 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Athytha collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 4 on June 11, 2007, a pair of eastern kingbirds (*Tyrannus tyrannus*) was noted within the wetland. Eastern kingbirds nest in open woodlands, clearings, rural roadsides, farms, orchards and edges of fields. Wetland 4 is not considered critical or suitable breeding habitat for eastern kingbirds; however may occur within the pairs breeding territory or any other breeding birds. Wetland 4 is not considered critical breeding habitat for other breeding birds.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

<b>NSDNR Status</b>	<b>Common Name</b>	<b>Binomial</b>	<b>Source of Record</b>	<b>Habitat Preference</b>	<b>Potential Presence on site</b>
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species are expected to be present in or to use wetland 4 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 4 field survey on June 11, 2007, evidence of a North American beaver (*Castor canadensis*) was observed. These observations include a small dam on the western edge. The beaver may, in part, be responsible for the high water level in wetland 4; however a skid trail with a wooden culvert also runs along the western edge of wetland 4 which may have supplemented the building of the dam. Evidence of white-tailed deer (*Odocoileus virginianus*) was also noted on the periphery of Wetland 4.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list; the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

The only species of amphibian observed during field surveys on June 11, 2007 were green frogs (*Lithobates clamitans*). No reptile evidence was observed in or near wetland 4.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.



## Odonates

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 4**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were observed on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 4 has an inflow stream from precipitation run-off but the outflow has been prevented by the presence of an American beaver dam. During the June 11, 2007 survey, precipitation level were high resulting in minor amounts of water draining over the crest of the beaver dam.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. It does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed by the placement of a mine stockpile.

### **Alternatives That Have Been Considered**

Stockpile outlines have already been adjusted to avoid larger wetlands in this area. (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 4 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL.

Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

### **References & Data Sources**

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## WETLAND 5 REPORT

### Wetland Delineation

Wetland 5 encompasses 0.12 ha, consists of an isolated basin marsh and is centered on 4987022 N, 413342 E (NAD 83). Wetland 5 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 5 (NAD 83)**

Boundary	Northing	Easting
North	4987033	413344
South	4987008	413339
East	4987030	413377
West	4987025	413314

During the Wetland 5 field surveys on June 13 and August 22, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 5 is an isolated basin marsh. It is an open shallow basin in a wooded area. There is no tree layer within this wetland. Red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), trembling aspen (*Populus tremuloides*) and red spruce (*Picea rubens*) trees are present around the perimeter of this wetland, which grades quickly into upland habitat. Some wetland vegetation on the fringe of the wetland included hemlock water-parasit (*Sium sauve*), fringed sedge (*Carex crinita*), shallow sedge (*Carex lurida*), small-fruit bulrush (*Carex microcarpus*) and sensitive fern (*Onoclea sensibilis*). Lesser duckweed (*Lemna minor*) occurs in open water portions of this wetland.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 5. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2004. As the Museum is a government department, not all of its species records are available to the non-governmental

ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 5 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 5.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 5.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervales	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervales, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

None of these plants were observed in the wetland or the immediate surrounding habitat on June 13 and August 22, 2007 field surveys.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of

the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 5 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Athytha collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 5 on June 13 and August 22, 2007, no bird species were observed within the wetland. Wetland 5 is not considered to be critical breeding habitat for breeding birds.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritima</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species listed in the ACCDC search or the NSM screening (Table 4) were observed during the wetland survey are expected to be present in or to use wetland 5 due to the lack of suitable habitat. Therefore wetland 5 is not critical habitat for any of these species.

### **Mammals**

During the Wetland 5 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

A red-spotted newt (*Notophthalmus viridescens viridescens*) was observed in the wetland during the August 22, 2007 field survey. Wood frogs (*Rana sylvatica*) and northern spring peepers (*Pseudocaris crucifer crucifer*) were also observed in the vicinity of the wetland. No reptiles were observed in the wetland.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 5**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of the above species were observed in the wetland during field surveys in 2007.



### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 5 has no inflow or outflow and probably receives its water from precipitation runoff.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. It does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 5 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will

consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

## WETLAND 6 REPORT

### Wetland Delineation

Wetland 6 encompasses 0.19 ha and consists of isolated basin marsh. This wetland is centered on 4986656 N, 414210 E (NAD 83). Geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 6 (NAD 83)**

Boundary	Northing	Easting
North	4986663	414209
South	4986641	414213
East	4986654	414253
West	4986639	414151

During the Wetland 6 field surveys on May 31, June 11 and August 21, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 6 is an isolated basin marsh. It is an open shallow basin in a wooded area. There is no tree layer within this wetland. A few red maple (*Acer rubrum*) saplings, some winterberry (*Ilex verticillata*) and speckled alder (*Alnus incana*) shrubs are present around the perimeter of this wetland, which grades quickly into upland habitat. Sedges such as hop sedge (*Carex lupulina*), little prickly sedge (*C. echinata*) and shallow sedge (*C. lurida*) are abundant around the perimeter of this wetland. Fallen trees are common. Broad-Leaved Water-Plantain (*Alisma triviale*) and hemlock water-parsnip (*Sium suave*) occur in the shallow waters of this marsh. Sensitive fern (*Onoclea sensibilis*), American bugleweed (*Lycopus americanus*), cinnamon fern (*Osmunda cinnamomea*), and touch-me-not (*Impatiens capensis*) also occur in this wetland.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 6. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia

Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated a one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 6 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 6.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 6.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

None of these plants were observed in the wetland or the immediate surrounding habitat on the May 22 2007, June 8 2007, or August 21 2007 field surveys.

## Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 6 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green -winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Aythya collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 6 on June 11, 2007, a northern waterthrush (*Seiurus noveboracensis*) was observed within the wetland. Wetland 6 is considered to be suitable breeding habitat for northern waterthrush, as this species breeds in uprooted tree stumps along wet habitats, but is not critical breeding habitat. The northern waterthrush is not listed as endangered or sensitive by the NSDNR.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

<b>NSDNR Status</b>	<b>Common Name</b>	<b>Binomial</b>	<b>Source of Record</b>	<b>Habitat Preference</b>	<b>Potential Presence on site</b>
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species are expected to be present in or to use Wetland 6 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 6 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

No reptiles or amphibians were observed during the wetland survey. A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 6**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravely, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cypress, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were observed on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 6 has no inflow or outflow and receives its water from precipitation and surface water runoff.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. Due to its very small size, it does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 6 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish habitat is present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth. An old logging road passes through this shallow wetland, and may have disrupted local surface water hydrology.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently



shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

# WETLAND 7 REPORT

## Wetland Delineation

Wetland 7 encompasses 0.17 ha and consists of 4 basin marshes connected by a treed swamp area with seasonal flooding. The wetland is centered on 4986870 N, 413244 E (NAD 83) with geographical boundaries listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 7 (NAD 83)**

Boundary	Northing	Easting
North	4986908	413227
South	4986836	413231
East	4986854	413267
West	4986843	413211

During the Wetland 7 field surveys on June 11 and August 20, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

## Ecological Characterization

### Plants

Wetland 7 is a complex of 4 basin marshes with a treed swamp component. Emergent cattails (*Typha latifolia*), duckweed (*Lemna minor*), Hemlock Water-Parsnip (*Sium suave*) and sedges (e.g. *Carex ludida*, *Carex echinata*, *Scirpus cyperinus*) characterize wetland 7. No trees >10 cm diameter at breast height (dbh) are growing within the marshes, however, several tree and shrub species including red maple (*Acer rubrum*), Canada Holly (*Ilex verticillata*), balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) dominate the treed swamp component. Other species found include sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), starflower (*Trientalis borealis*) and Spotted Jewel-Weed (*Impatiens capensis*).

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 7. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental

ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 7 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 7.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Alnus serrulata</i>	Brook-Side Alder	Yellow	Lakeshores	Possible	ACCDC
<i>Alopecurus aequalis</i>	Short-Awn Foxtail	Yellow	Muddy margins of rivers and shallow ponds, and gravel margins where competitor species are few	Possible	ACCDC
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Anemone virginiana var. alba</i>	River Anemone	Yellow	Intervals and streamsides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Arabis drummondii</i>	Drummond Rockcress	Yellow	Usually on dry slopes and talus, but occasionally in more fertile locations at lower elevations.	Possible	ACCDC
<i>Asplenium trichomanesramosum</i>	Green Spleenwort	Yellow	Shaded cliff along stream on basic rock/limestone	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Botrychium lanceolatum</i>	Triangle Grape-Fern	Yellow	Rich, wooded hillsides	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 7.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Botrychium simplex</i>	Least Grape-Fern	Yellow	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.	Possible	ACCDC NSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Cardamine parviflora</i>	Small-Flower Bitter-Cress	Yellow	Dry woods, shaded or exposed ledges, and in sandy soils	Possible	ACCDC
<i>Cardamine maxima</i>	Large toothwort	Red		Possible	ACCDC
<i>Carex livida var. radicaulis</i>	Livid Sedge	Red	Calcareous bogs and meadows.	Possible	ACCDC
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and intervale forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cryptogramma stelleri</i>	Fragile Rockbrake	Yellow	Shaded limestone cliffs, and shaded crevices in conglomerate cliff-face.	Possible	ACCDC NSM
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 7.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Dryopteris fragrans var. remotiuscula</i>	Fragrant Fern	Yellow	Dry, overhanging cliffs, and in cliff crevices along streams or near waterfalls.	Possible	ACCDC
<i>Elymus wiegandii</i>	Wiegand's Wild Rye	Red	Rich stream banks and meadows	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Floerkea proserpinacoides</i>	False Mermaid-Weed	Yellow	Deciduous ravine slopes, river margins, and intervalle forests.	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Isoetes acadiensis</i>	Acadian Quillwort	Yellow	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Lindernia dubia</i>	Yellow-Seed False-Pimpernel	Yellow	Wet areas and the muddy edges of streams. Drained Millponds and gravel pits	Possible	ACCDC
<i>Lophiola aurea</i>	Golden Crest	Red	Lakeshores, wet savannas, sphagnous swales	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 7.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Montia fontana</i>	Fountain Miner's-Lettuce	Yellow	Springy or seepy slopes, wet shores and brackish spots, coastal	Possible	ACCDC
<i>Dichanthelium xanthophysum</i>	Slender Dichanthelium	Red	Open thickets in dry, sandy or rocky soils.	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata var. gaspereaensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Sanicula odorata (syn. gregaria)</i>	Black Snake-Root	Red	Rich, alluvial woods and along intervals.	Possible?	ACCDC NSM
<i>Saxifraga paniculata ssp. neogaea</i>	White Mountain Saxifrage	Red	Pockets in cliffs, mossy hillsides, dripping cliffs, and limestone ledges	Possible	ACCDC
<i>Shepherdia canadensis</i>	Canada Buffalo-Berry	Yellow	Gypsum or talus slopes and along the coast within reach of salt spray.	Possible	ACCDC NSM
<i>Sphenopholis intermedia</i>	Slender Wedge Grass	Yellow	Calcareous ledges and shores	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 7.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervaleas, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

A single mature (14-cm dbh) black ash (*Fraxinus nigra*), a yellow-listed species, was the only listed plant species found within the wetland. The tree was located on the edge of one of the basin marshes in the treed swamp component. Fundy Gypsum will work in cooperation with the Confederacy of Mainland Mi'kmaq (CMM) to monitor this individual black ash.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 7 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green -winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Aythya collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proocetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 7 on May 29, 2007 and June 13, 2007, no bird species were observed within the wetland. Wetland 7 is not considered to be critical breeding habitat for breeding birds.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proecetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species are expected to be present in or to use wetland 7 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 7 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species and Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher

(*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### Reptiles and Amphibians

No amphibian or reptile evidence was observed in wetland 7. A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### Odonates

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 7**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes,	Possible



**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 7**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
			preferable those with little shore vegetation, and oxygenated ponds	
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cypress, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of the above species were observed in the wetland during field surveys in 2007.

### Hydrological Characterization

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 7 has no obvious inflow or outflow and probably receives its water from precipitation runoff.

### Hydrogeological Characterization

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. It does not play a significant role in erosion or flood control.

**Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

**Nature of the Proposed Alteration**

The wetland will be entirely removed.

**Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in EARD).

**Identifiable Impacts to Wetland**

Wetland 7 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

**Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

**Mitigation**

Fundy Gypsum will work with NSDNR, NSDEL and CMM to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

**Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

**Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site

assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

## **References & Data Sources**

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# WETLAND 8 REPORT

## Wetland Delineation

Wetland 8 encompasses 0.02 ha, consists of isolated basin marsh and is centered on 4986464 N, 412486 E (NAD 83). Wetland 8 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 8 (NAD 83)**

Boundary	Northing	Easting
North	4986470	412486
South	4986459	412485
East	4986465	412498
West	4986463	412473

During the Wetland 8 field survey on June 11 and August 20, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

## Ecological Characterization

### Plants

Wetland 8 is an isolated basin marsh. It is an open shallow basin in a regenerating clearcut area. There is no tree layer within this wetland. A few red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*) and gray birch (*Betula populifolia*) saplings with some speckled alder (*Alnus incana*) shrubs are present around the perimeter of this wetland, which grades quickly into upland habitat. Some wetland vegetation included Hemlock Water-Parsnip (*Sium sauve*), Little Prickly Sedge (*Carex echinata*), Fringed Sedge (*Carex crinita*), Small-Fruit Bulrush (*Carex microcarpus*) and Cinnamon Fern (*Osmunda cimmamonea*).

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 8. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the

general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 8 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 8.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Alnus serrulata</i>	Brook-Side Alder	Yellow	Lakeshores	Possible	ACCDC
<i>Alopecurus aequalis</i>	Short-Awn Foxtail	Yellow	Muddy margins of rivers and shallow ponds, and gravel margins where competitor species are few	Possible	ACCDC
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Anemone virginiana var. alba</i>	River Anemone	Yellow	Intervals and streamsides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Arabis drummondii</i>	Drummond Rockcress	Yellow	Usually on dry slopes and talus, but occasionally in more fertile locations at lower elevations.	Possible	ACCDC
<i>Asplenium trichomanesramosum</i>	Green Spleenwort	Yellow	Shaded cliff along stream on basic rock/limestone	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Botrychium lanceolatum</i>	Triangle Grape-Fern	Yellow	Rich, wooded hillsides	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 8.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Botrychium simplex</i>	Least Grape-Fern	Yellow	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.	Possible	ACCDC NSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Cardamine parviflora</i>	Small-Flower Bitter-Cress	Yellow	Dry woods, shaded or exposed ledges, and in sandy soils	Possible	ACCDC
<i>Cardamine maxima</i>	Large toothwort	Red		Possible	ACCDC
<i>Carex livida var. radicaulis</i>	Livid Sedge	Red	Calcareous bogs and meadows.	Possible	ACCDC
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cryptogramma stelleri</i>	Fragile Rockbrake	Yellow	Shaded limestone cliffs, and shaded crevices in conglomerate cliff-face.	Possible	ACCDC NSM
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 8.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Dryopteris fragrans var. remotiuscula</i>	Fragrant Fern	Yellow	Dry, overhanging cliffs, and in cliff crevices along streams or near waterfalls.	Possible	ACCDC
<i>Elymus wiegandii</i>	Wiegand's Wild Rye	Red	Rich stream banks and meadows	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Floerkea proserpinacoides</i>	False Mermaid-Weed	Yellow	Deciduous ravine slopes, river margins, and intervalle forests.	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Isoetes acadiensis</i>	Acadian Quillwort	Yellow	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.	Possible	ACCDC
<i>juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Lindernia dubia</i>	Yellow-Seed False-Pimpernel	Yellow	Wet areas and the muddy edges of streams. Drained Millponds and gravel pits	Possible	ACCDC
<i>Lophiola aurea</i>	Golden Crest	Red	Lakeshores, wet savannas, sphagnous swales	Possible	ACCDC



**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 8.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Montia fontana</i>	Fountain Miner's-Lettuce	Yellow	Springy or seepy slopes, wet shores and brackish spots, coastal	Possible	ACCDC
<i>Dichanthelium xanthophysum</i>	Slender Dichanthelium	Red	Open thickets in dry, sandy or rocky soils.	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs , swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata var. gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Sanicula odorata (syn. gregaria)</i>	Black Snake-Root	Red	Rich, alluvial woods and along intervals.	Possible?	ACCDC NSM
<i>Saxifraga paniculata ssp. neogaea</i>	White Mountain Saxifrage	Red	Pockets in cliffs, mossy hillsides, dripping cliffs, and limestone ledges	Possible	ACCDC
<i>Shepherdia canadensis</i>	Canada Buffalo-Berry	Yellow	Gypsum or talus slopes and along the coast within reach of salt spray.	Possible	ACCDC NSM
<i>Sphenopholis intermedia</i>	Slender Wedge Grass	Yellow	Calcareous ledges and shores	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 8.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

None of these plants were observed in the wetland on the survey on May 29, June 13 or August 20, 2007.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 8 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green -winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Aythya collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>Porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>Bartramia longicauda</i>	Probable	Open grassy areas	Low	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some conifers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 8 on May 29, 2007 and June 13, 2007, no bird species were observed within the wetland. Wetland 8 is not considered to be critical breeding habitat for breeding birds.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alea torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared	<i>Asio</i>	ACCDC	Breed in dyked wet	Unlikely



**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
	Owl	<i>flammeus</i>		meadows near coast in Nova Scotia	
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species are expected to be present in or to use Wetland 8 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 8 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

## Reptiles and Amphibians

No amphibian or reptile evidence was observed in wetland 8. A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

## Odonates

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 8**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna fuscillata</i>	Yellow	Bogs and swamp of bald Cypress, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped	<i>Somatochlora</i>	Yellow	Shady forest streams from trickles	Possible

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED ROM WITHIN 100 KM (ACCDC) OF WETLAND 8**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
Emerald	<i>tenebrosa</i>		to about 2 yards wide often partially dry and occasionally boggy or swampy.	
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of the above species were observed in the wetland during field surveys in 2007.

#### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 8 has no inflow or outflow and receives its water from precipitation runoff.

#### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. It does not play a significant role in erosion or flood control.

#### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

#### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 8 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

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## WETLAND 9 REPORT

### Wetland Delineation

Wetland 9 encompasses 0.09 ha, and consists of an isolated basin marsh with a treed swamp component. This wetland is centered on 4986807 N, 412821 E (NAD 83). Wetland 9's geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 9 (NAD 83)**

Boundary	Northing	Easting
North	4986830	412808
South	4986788	412817
East	4986806	412835
West	4986807	412800

During the Wetland 9 field surveys on May 29, June 13, and August 20, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 9 contain two wetland types. The isolated basin marsh contains a stand of broad-leaved cattails (*Typha latifolia*), and sedges (*Carex echinata*, *C. lupulina*, *C. lurida*), are abundant. Algal mats are plentiful on the water's surface. Hemlock water parsnip (*Sium suave*) occurs in the shallow water. In drier areas, ground vegetation includes sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), hay-scented fern (*Dennstaedtia punctilobula*), dwarf dogwood (*Cornus canadensis*) and field horsetail (*Equisetum arvense*). Wetland shrubs such as Canada holly (*Ilex verticillata*) and speckled alder (*Alnus incana*) also occur around the perimeter and grade into the treed swamp portion of this wetland. The treed swamp portion is dominated by red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and american elm (*Ulmus americana*). Ground vegetation includes *Sphagnum*, and many of the species found in the basin marsh portion.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 9. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in

the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2004. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 9 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 9.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC



**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 9.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

None of these plants were observed in the wetland or the immediate surrounding habitat on the May 22, June 8, or August 21 2007 field surveys.

## Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 9 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Aythya collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field surveys for Wetland 9 on May 22, June 8, or August 21 2007, no bird species were observed within the wetland. Wetland 9 is not considered to be critical breeding habitat for breeding birds.

A review of the ACCDC database of rare species records and the NSM screening revealed twenty at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 9.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species listed in the ACCDC search or the NSM screening (Table 4) were observed during the wetland survey are expected to be present in or to use wetland 9 due to the lack of suitable habitat. Therefore wetland 9 is not critical habitat for any of these species.

### **Mammals**

During the Wetland 9 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.



The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

Three species of amphibian were observed during field surveys May 22, June 8, or August 21 2007, including wood frogs (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*) and green frogs (*Rana clamitans melanota*). No evidence of reptiles was observed in or near wetland 9.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 9**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epithea princes</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were observed on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 9 has no inflow or outflow and likely receives its water from precipitation and surface water runoff.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. It does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 9 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish habitat is present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth. A rough logging road runs parallel to the eastern side of this wetland, and may have impacted this wetland. The outflow from this wetland runs across the road and has been damned by beaver activity, which has likely led to rising water levels in this wetland.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will

consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geol. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

# WETLAND 10 REPORT

## Wetland Delineation

Wetland 10 encompasses 0.72 ha and is predominately mixedwood treed basin swamp. It is centered on 4986382 N, 412497 E (NAD 83). Wetland 10 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 10 (NAD 83)**

Boundary	Northing	Easting
North	4986429	412494
South	4986346	412497
East	4986397	412585
West	4986373	412423

During the Wetland 10 field survey on May 29, June 13 and August 21 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

## Ecological Characterization

### Plants

Wetland 10 is predominantly a mixedwood treed basin swamp. The tree layer consists of red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), white ash (*Fraxinus americana*), and trembling aspen (*Populus tremuloides*). Black ash (*F. nigra*) also occurs in this wetland. Shrubs include speckled alder (*Alnus incana*), and Roundleaf Dogwood (*Cornus rugosa*). Ground vegetation is dominated by sphagnum mosses, cinnamon fern (*Osmunda cinnamomea*), purple avens (*Geum rivale*), water-pennywort (*Hydrocotyle americana*), with bristly water crpwfott (*Ranuncunculs gmelini*) in wetter areas. White bog orchid (*Platanthera dilatata*), spotted joe-pye weed (*Eupatorium maculatum*), Canada manna-grass (*Glyveria canadensis*), white turtlehead (*Chelone glabra*), and eastern helleborine (*Epipactis helleborine*) also occur in this wetland. Broad-leaved cattails (*Typha latifolia*) occur in a patch alongside the old logging road passing this wetland. A small open area of this swamp (15 x 15 m) is dominated by rushes (*Schoenoplectus tabermonatae*, *Juncus nodosus*) and sedges (*Carex lurida*), with a thick *Sphagnum* layer.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of uncommon to rare plant and animal species from the 1850s to the present. A review in 2007 for information on rare plants within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 13. These

are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2004. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding Wetland 10 (Table 2).

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 10.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Rare Vascular Plants Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 10.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC



Four sapling (2.5 - 10-cm dbh) black ashes (*Fraxinus nigra*), a yellow-listed species, were the only listed plant species found within the wetland. The saplings are located roughly in the center of the wetland. Fundy Gypsum will work in cooperation with the Confederacy of Mainland Mi'kmaq (CMM) to monitor these individual black ashes.

## Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 10 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Athytha collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 10 on May 29, June 13, and August 21, 2007, no bird species were observed to be breeding within the wetland. Wetland 10 is not considered to be critical breeding habitat for breeding birds.

A review of the ACCDC database of rare species records and the NSM screening revealed seventeen at-risk species reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the rare bird species, their provincial status and their habitat preferences is provided in Table 9.

**Table 4: Rare Bird Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Rare Birds Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

<b>NSDNR Status</b>	<b>Common Name</b>	<b>Binomial</b>	<b>Source of Record</b>	<b>Habitat Preference</b>	<b>Potential Presence on site</b>
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species listed in the ACCDC search or the NSM screening (Table 4) were observed during the wetland survey are expected to be present in or to use wetland 9 due to the lack of suitable habitat. Therefore Wetland 10 is not critical habitat for any of these species.

### **Mammals**

During the Wetland 10 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of rare or uncommon mammals on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

Three species of amphibian were observed during field surveys on May 29, June 13, and August 21 2007 including wood frogs (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*) and green frogs (*Rana clamitans melanota*). No evidence of reptiles was observed in or near wetland 10.

A review of the ACCDC database of rare species records revealed four currently at-risk herpetile species in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of rare or sensitive dragonflies and damselflies in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat



for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. RARE ODONATE HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF RARE ODONATES REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 10**

Common Name	Binomial	NS DNR Status	Habitat	Potential Presence on Site
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravely, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cypress, alder or cedar	Not Likely
Prince Baskettail	<i>Epithea princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of these species were observed on the site during wetland surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 10 is spring fed in the northern section of the wetland, where a small spring is evident at the base of the ridge surrounding this wetland. Two intermittent surface water inflows are present in the northeast and southwest sections during high level of precipitation and an outflow is present at the eastern section during high water.

### **Hydrogeological Characterization**

This wetland is a groundwater discharge wetland, as evidenced by the inflow of groundwater from a spring at the base of the surrounding ridge.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The majority of this wetland will be entirely removed, the remainder will be impacted by changes in water supply.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several rare species of plants to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 10 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. Additional plant and wetland surveys will be conducted in late summer of 2007. Additional mammal and herpetile observations will be noted concurrently.

No aquatic habitats or fish species are present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth. An old logging road passes this wetland and may have interfered with historical surface hydrology patterns.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation, significant long-term adverse impacts on wetlands on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

# WETLAND 11 REPORT

## Wetland Delineation

Wetland 11 encompasses 0.04 ha, consisted of an isolated basin marsh and is centered on 4986737 N, 412468 E (NAD 83). Wetland 11 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 11 (NAD 83)**

Boundary	Northing	Easting
North	4986742	412468
South	4986732	412468
East	4986740	412488
West	4986735	412445

During the Wetland 11 field survey on May 24, June 12 and August 20, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

## Ecological Characterization

### Plants

Wetland 11 is an isolated basin marsh. It is an open shallow basin in a regenerating clearcut area. There is no tree layer within this wetland. A few red maple (*Acer rubrum*), round-leaved dogwood (*Cornus rugosa*), balsam fir (*Abies balsamea*), trembling aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), large-toothed aspen (*Populus grandidentata*) and gray birch (*Betula populifolia*) saplings are present around the perimeter of this wetland, which grades gradually into upland habitat. Some other wetland vegetation in the wetland include broad-leaved cattails (*Typha latifolia*), American nannagrass (*Glyceria grandis*), black holly (*Ilex verticillata*), little prickly sedge (*Carex echinata*), shallow sedge (*Carex lurida*), hop sedge (*Carex lupulina*), cyperus-like sedge (*Carex pseudocyperus*), cinnamon fern (*Osmunda cinnamomea*) and sensitive fern (*Onoclea sensibilis*).

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of plant and animal species of concern from the 1850s to the present. A review in 2007 for information on plant species of concern within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding wetland 11. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia

Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 11 (Table 2).

**Table 2: Phenology and Habitat Preferences of Vascular Plant Species of Concern Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 11.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Vascular Plant Species of Concern Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 11.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata var. gaspereaensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

None of these plants were observed in the wetland or the immediate surrounding habitat during the May 24, June 12 or August 20, 2007 field surveys.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 11 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green -winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Athytha collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 11 on May 24, June 12 and August 20, 2007, the only bird species observed within the wetland was a common yellowthroat (*Geothlypis trichas*). The common yellowthroat breeds in marshy and brushy vegetation near water. Wetland 11 is suitable breeding habitat for common yellowthroats but it is not considered to be critical breeding habitat. The common yellowthroat is not listed as endangered or sensitive by the NSDNR.

A review of the ACCDC database of species of concern records and the NSM screening revealed seventeen species of concern reported in the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the bird species of concern, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Bird Species of Concern Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Bird Species of Concern Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

<b>NSDNR Status</b>	<b>Common Name</b>	<b>Binomial</b>	<b>Source of Record</b>	<b>Habitat Preference</b>	<b>Potential Presence on site</b>
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritima</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species is expected to be present in or to use Wetland 11 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 11 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of mammal species of concern and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of mammal species of concern on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

No reptiles or amphibians were observed during the wetland survey. A review of the ACCDC database of species of concern records revealed reports of four current herpetile species of concern in the region. Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be present within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed species of dragonfly and damselfly species of concern in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. ODONATE SPECIES OF CONCERN HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF ODONATE SPECIES OF CONCERN REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 11**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald Cyprus, alder or cedar	Not Likely
Prince Baskettail	<i>Epitheca princeps</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed species have the potential to be present on the project site, while three yellow-listed species have potential. None of the above species were observed in the wetland during field surveys in 2007.

**Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field



surveys. Wetland 11 has no inflow or outflow and probably receives its water from precipitation runoff.

### **Hydrogeological Characterization**

This wetland likely does not receive any groundwater inflow. It may play a minor role in a groundwater recharge. It does not play a significant role in erosion or flood control.

### **Reason for the Alteration**

The wetland in question will be removed due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

The wetland will be entirely removed.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several plant species of concern to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Wetland 11 will be entirely removed by the mine project. There are no species at risk or species of conservation concern known to be present in this wetland. No fish species are present.

### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

## **Summary**

In summary, assuming that appropriate wetland compensation is conducted, significant long-term adverse impacts on wetlands on the study site are not predicted.

## **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geol. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

### **References & Data Sources**

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## WETLAND 12 REPORT

### Wetland Delineation

Wetland 12 encompasses 1.53 ha, consists of mixedwood treed basin swamp and is centered on 4986261 N, 413494 E (NAD 83). Wetland 12 geographical boundaries are listed in Table 1. See Figure 1 for the location of this project within Nova Scotia and Figure 2 for the location of this wetland on the project site.

**Table 1. Geographical Boundaries of Wetland 12 (NAD 83)**

Boundary	Northing	Easting
North	4986323	413498
South	4986214	413500
East	4986242	413602
West	4986223	413386

During the Wetland 12 field survey on May 31, June 11 and August 22, 2007, all species of plant, bird, mammal, reptile and amphibian detected within the wetland were recorded. Evidence of wildlife species such as sightings, vocalizations, tracks, faeces, skeletal remains, and characteristic bite marks or dens were recorded.

### Ecological Characterization

#### Plants

Wetland 12 is predominantly mixedwood treed basin swamp. The wetland is dominated by red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), red spruce (*Picea rubens*) and yellow birch (*Betula alleghaniensis*) trees with some speckled alder (*Alnus incana*), beaked hazelnut (*Corylus cornuta*), black holly (*Ilex verticillata*) and wild raisin (*Viburnum nudum*) shrubs. Some other wetland vegetation included shallow sedge (*Carex lurida*), cyperus-like sedge (*Carex psuedocyperus*), Purple Avens (*Geum rivale*), sensitive fern (*Onoclea sensibilis*) and Cinnamon Fern (*Osmunda cimmamonea*). The wetland grades quickly on the northern side of the wetland and gradually on the southern side of the wetland.

The Atlantic Canada Conservation Data Centre (ACCDC) database consists of records of plant and animal species of concern from the 1850s to the present. A review in 2007 for information on plant species of concern within 100 km of the project site yielded a list of plants with habitat requirements similar to habitat present within and immediately surrounding Wetland 12. These are listed in Table 2. In addition, an environmental screening of all natural heritage resources in the area (within an approximate 10 km radius of the site) was compiled by the Nova Scotia Museum (NSM) in 2004, encompassing all their data from 1847 to 2007. As the Museum is a government department, not all of its species records are available to the non-governmental

ACCDC database. The NSM screening generated one additional species known from the general area or from similar habitats (the complete screening may be found in Appendix E.2) with potential to occur in habitats present within and immediately surrounding wetland 12 (Table 2).

**Table 2: Phenology and Habitat Preferences of Vascular Plant Species of Concern Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 12.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Anemone quinquefolia</i>	Wood Anemone	Yellow	Wooded riverbanks and shaded intervals.	Possible	ACCDC
<i>Anemone virginiana</i>	Virginia Anemone	Yellow	Intervals and stream sides. Calcareous and slaty ledges, shores and thickets.	Possible	ACCDC
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	Yellow	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores	Possible	ACCDCNSM
<i>Campanula aparinoides</i>	Marsh Bellflower	Yellow	Meadow, ditch, riverbank	Possible	ACCDC NSM
<i>Carex prairea</i>	Prairie Sedge	Red	Cattail swamp	Possible	ACCDC
<i>Carex tuckermanii</i>	Tuckerman Sedge	Red	Swale	Possible	ACCDC NSM
<i>Caulophyllum thalictroides</i>	Blue Cohosh	Red	Deciduous and interval forest	Possible	ACCDC NSM
<i>Clethra alnifolia</i>	Coast Pepper-Bush	Red	The shores of lake headwaters, swamps, damp thickets, and sandy woods	Possible	ACCDC
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	red	Boggy spots, damp mature woods, and fir or floodplain forests	Possible	ACCDC
<i>Conioselinum chinense</i>	Hemlock Parsley	Yellow	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast	Possible	ACCDC
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	Red	Alkaline swamps and bogs.	Possible	ACCDC NSM
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	Yellow	Quaking margins of ponds or lakes	Possible	ACCDC
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	Yellow	Low-lying ground, springy slopes and similar locations.	Possible	ACCDC
<i>Epilobium strictum</i>	Downy Willow-Herb	Yellow	Boggy areas and meadows	Possible	ACCDC

**Table 2: Phenology and Habitat Preferences of Vascular Plant Species of Concern Preferring Wetland Habitats and Reported within 100 km (ACCDC search) or 10 km (NSM screening) of Wetland 12.**

Scientific Name	Common Name	NS DNR Status	Preferred Habitat	Potential Presence on Site	Source of Record
<i>Fraxinus nigra</i>	Black Ash	Yellow	Low ground, damp woods and swamps.	Possible	ACCDC NSM
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	Yellow	Usually in wet or muddy places	Possible	ACCDC
<i>Impatiens pallida</i>	Pale Jewel-Weed	Yellow	Rich alluvial soils, damp thickets, and along intervalles	Possible	ACCDC
<i>Juncus marginatus</i>		Yellow	Clayey roadsides, damp fields, and brooksides	Possible	ACCDC
<i>Malaxis brachypoda</i>	White Adder's-Mouth	Red	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Possible	ACCDC
<i>Megalodonta beckii</i>	Beck Water-Marigold	Yellow	Shallow, quiet waters, slow-moving streams, and ponds	Possible	ACCDC
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	Yellow	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich alluvial soils	Possible	ACCDC NSM
<i>Rudbeckia laciniata</i> var. <i>gaspereauensis</i>	Cut-Leaved Coneflower	Yellow	Swales, the edges of swamps, or in gullies - in small colonies	Possible	ACCDC
<i>Salix sericea</i>	Silky Willow	Yellow	Low thickets and stream banks	Possible	ACCDC
<i>Stellaria longifolia</i>	Longleaf Stitchwort	Yellow	Damp or wet grassy places, in sandy or mucky soils	Possible	ACCDC
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	Red	Rich soils of river intervalles, or rich forest on limestone	Possible	ACCDC NSM
<i>Zizia aurea</i>	Common Alexanders	Yellow	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites	Possible	ACCDC

A population (40+ specimens) of ram's head lady slippers (*Cypripedium arietinum*) occurs on the north slope of the basin containing this wetland, within the proposed Conservation Area. Six sapling (2.5 - 10-cm dbh) black ashes (*Fraxinus nigra*), a yellow-listed species, were the only

listed plant species found within the wetland. The saplings are located roughly in the center of the wetland, and will not be removed by the Project. Fundy Gypsum will work in cooperation with the Confederacy of Mainland Mi'kmaq (CMM) to monitor these individuals.

### Birds

A desktop review of bird species known to breed in the area where the wetland is located was conducted using the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). A list of the status of each breeding bird species recorded from the 10 x 10 km atlas square containing Wetland 12 is provided in Table 3.

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

Common Name	Binomial	Breeding Status in Atlas Square <sup>1</sup>	Preferred Nesting Habitat <sup>1</sup>	Potential Presence on Site	NSDNR Status <sup>2</sup>
Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Confirmed	Fertile wetlands, impoundments	Moderate	Green
Wood Duck	<i>Anas spinosa</i>	Possible	Cavities near fertile wetlands/water	Moderate	Green
Green-winged Teal	<i>Anas crecca</i>	Probable	Forested areas, brackish marsh near coast	Moderate	Green
American Black Duck	<i>Anas rubripes</i>	Confirmed	on ground near water/wetland	High	Green
Blue-winged Teal	<i>Anas discors</i>	Confirmed	Open fertile marsh including estuary	Moderate	Green
American Wigeon	<i>Anas americana</i>	Confirmed	Marshes, estuaries	Moderate	Green
Ring-necked Duck	<i>Athytha collaris</i>	Confirmed	Lakes, ponds, and still waters, marsh, clumps of sedge, sweetgale or leatherleaf	Moderate	Green
Northern Harrier	<i>Circus cyaneus</i>	Probable	Open marshes, meadows	Low-Moderate	Green
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Possible	Conifer and mixed forests, spruce trees	High	Green
Northern Goshawk	<i>Accipiter gentilis</i>	Not within 10 km but within 20 km	Mature forest	Low-Moderate	Yellow
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Confirmed	Woodlands, forage in openings and cutovers	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
American Kestrel	<i>Falco sparverius</i>	Confirmed	Cavity nester	Moderate	Green
Gray Partridge	<i>Perid perdix</i>	Confirmed	Open lands, farmlands	Moderate	Introduced
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Confirmed	Farmland, suburban areas	Moderate	Introduced
Ruffed Grouse	<i>Bonasa umbellus</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Sora	<i>porzana carolina</i>	Probable	Fertile marshes	Moderate	Green
Common Moorhen	<i>Gallinula chloropus</i>	Probable	Fertile wetlands	Moderate	Green
Killdeer	<i>Charadrius vociferous</i>	Confirmed	clear-cuts, farmlands, gravel pits	HIGH	Green
Willet	<i>Catoptrophorus semilpalmatus</i>	Possible	fields and open areas near salt marshes	Moderate	Green
Spotted Sandpiper	<i>Actitis macularai</i>	Confirmed	Near watercourse, coast	Low	Green
Upland Sandpiper	<i>bartramia longicauda</i>	Probable	Open grassy areas	Low	Green
Common Snipe	<i>Gallinago gallinago</i>	Probable	Shallow marsh/bog with grasses/sedges low shrubs	HIGH	Green
Rock Pigeon	<i>Columba livia</i>	Confirmed	Associated with buildings, agriculture	Moderate	Introduced
Black-billed Cuckoo	<i>coccyzus erythrophthalmus</i>	Possible	Open woods, edges, nest in small trees/shrubs	Moderate	Green
Barred Owl	<i>Strix varia</i>	Confirmed	Cavities in hardwood or mixed forests	Moderate	Green
Long-Eared Owl	<i>Asio otus</i>	Not within 10 km but within 20 km	Woodlands	Low	Green
Short-eared Owl	<i>Asio flammeus</i>	Not within 10 km but within 20 km	Coastal marsh, open meadows	Low	Yellow (COSEWIC Special Concern)



**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Chimney Swift	<i>Chaetura pelagiaca</i>	Confirmed	Structures, hollow trees	Low	Yellow
Belted Kingfisher	<i>Ceryle alcyon</i>	Confirmed	Tree, cliff near water	Moderate	Green
Downy Woodpecker	<i>Picoides pubescens</i>	Confirmed	Hardwood, mixed forest	HIGH	Green
Hairy Woodpecker	<i>Picoides villosus</i>	Confirmed	Cavity, open woods	High	Green
Northern Flicker	<i>Colaptes auratus</i>	Confirmed	Open woods	High	Green
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Possible	Cavity in old large hardwoods	Moderate	Green
Olive-sided Flycatcher	<i>Contopus borealis</i>	Probable	Dense secondary growth	High	Yellow
Eastern Wood-pewee	<i>Contopus virens</i>	Probable	Hardwood and mixed forest	High	Green
Alder Flycatcher	<i>Empidonax alnprum</i>	Probable	Low in shrubbery	High	Green
Least Flycatcher	<i>Empidonax minimus</i>	Probable	Broad leafed woods	Low-Moderate	Green
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Confirmed	Open areas	Moderate	Green
Tree Swallow	<i>Tachycineta bicolor</i>	Confirmed	Cavities, nest boxes	Moderate	Green
Bank Swallow	<i>Riparia riparia</i>	Confirmed	Banks and cliffs	Moderate	Green
Cliff Swallow	<i>Hirundo pyrrhonata</i>	Confirmed	Cliffs, structures	Moderate	Green
Barn Swallow	<i>Hirundo rustica</i>	Confirmed	Buildings, caves, cliffs	Moderate	Yellow
Blue Jay	<i>Cyanocitta cristata</i>	Probable	Trees	High	Green
American Crow	<i>Corvus brachyrhynchos</i>	Confirmed	Trees	High	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Common Raven	<i>Corvus corax</i>	Confirmed	Large trees, cliffs, old buildings	High	Green
Black-capped Chickadee	<i>Poecile atricapilla</i>	Confirmed	Cavities in coniferous forests	High	Green
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Confirmed	Cavity in coniferous forest	High	Green
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Confirmed	Cavity in open woodlands, urban areas	Moderate	Green
Golden-crowned Kinglet	<i>Regulus satrapus</i>	Probable	Coniferous forests	Moderate	Green
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Probable	Conifers	High	Green
Eastern Bluebird	<i>Sialis sialis</i>	Not within 10 km but within 20 km	Woodpecker cavities	Low	Yellow
Veery	<i>Catharus fuscescens</i>	Probable	Broadleaf forest	Moderate	Green
Hermit Thrush	<i>Catharus guttatus</i>	Confirmed	Open woods	high	Green
Gray Catbird	<i>Dumetella carolinensis</i>	Confirmed	Hardwood forest	Moderate	Green
American Robin	<i>Turdus migratorius</i>	Confirmed	Wide range of habitats	High	Green
Northern Mockingbird	<i>Mimus polyglottos</i>	Confirmed	Urban areas	Low	Green
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Confirmed	Edge, open woods	Moderate	Green
European Starling	<i>Sturnus vulgaris</i>	Confirmed	Cavities, enclosed spaces	Moderate	Introduced
Red-eyed Vireo	<i>Sturnus vulgaris</i>	Confirmed	Forest	High	Green
Northern Parula	<i>Parula americana</i>	Probable	Bearded lichens in conifers	Moderate	Green
Yellow Warbler	<i>Dendroica petechia</i>	Confirmed	Shrubs, urban areas	Moderate	Green

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Probable	Low shrubs	Moderate	Green
Yellow-rumped Warbler	<i>Dendroica coronata</i>	Possible	Forest with some confers	Moderate	Green
Black-throated Green Warbler	<i>Dendroica virens</i>	Probable	mixed or coniferous forests	High	Green
Black-and- white Warbler	<i>Mniotilta varia</i>	Confirmed	Forests with some hardwoods	Moderate	Green
American Redstart	<i>Setophaga ruticilla</i>	Confirmed	Small trees	Moderate	Green
Ovenbird	<i>Seiurus aurocapillus</i>	Confirmed	On ground in mixedwoods	Moderate	Green
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Probable	Wet mixed woods near the ground	Moderate	Green
Common Yellowthroat	<i>Geothlypis trichas</i>	Confirmed	Brushy areas	Moderate	Green
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Probable	Coniferous forests	Low	Green
Evening Grosbeak	<i>Coccothraustes vespertinusq</i>	Probable	Coniferous forest, spruce trees	High	Green
Chipping Sparrow	<i>Spizella passerina</i>	Confirmed	Edge, open woods	Moderate	Green
Vesper Sparrow	<i>Proecetes gramineus</i>	Not within 10 km but within 20 km	Short grass, low shrubs	Low	Yellow
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Confirmed	Grasses, sedges	Moderate	Green
Song Sparrow	<i>Melospiza melodia</i>	Confirmed	Shrubs	Moderate	Green
White-throated Sparrow	<i>Zonotrichia albicollis</i>	Confirmed	On ground at forest edge	High	Green
Dark-eyed Junco	<i>Junco hyemalis</i>	Confirmed	Forest edge	High	Green
Bobolink	<i>Dolichonyx oryzivorus</i>	Confirmed	Lush meadows	Low	Yellow

**TABLE 3: BREEDING STATUS OF BIRDS WITHIN THE 10 x 10 Km ATLAS SQUARE ENCOMPASSING THE PROJECT SITE<sup>1</sup>**

<b>Common Name</b>	<b>Binomial</b>	<b>Breeding Status in Atlas Square<sup>1</sup></b>	<b>Preferred Nesting Habitat<sup>1</sup></b>	<b>Potential Presence on Site</b>	<b>NSDNR Status<sup>2</sup></b>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Confirmed	Marshes with cattails and shrubs	High	Green
Eastern Meadowlark	<i>Sturnella magna</i>	Not within 10 km but within 20 km	Grasslands	Low	Green
Common Grackle	<i>Quiscalus quiscula</i>	Confirmed	Open areas	Moderate	Green
Brown-headed Cowbird	<i>Molothrus ater</i>	Probable	Parasite farm areas	Low	Green
Baltimore Oriole	<i>Icterus galbula</i>	Confirmed	Open woods, scattered trees in farmlands	Low-Moderate	Green
Purple Finch	<i>Carpodacus purpureus</i>	Probable	Conifers	Moderate	Green
Pine Siskin	<i>Carduelis pinus</i>	Probable	Conifers	Low	Green
American Goldfinch	<i>Carduelis tristis</i>	Probable	Open areas	High	Green
House Sparrow	<i>Passer domesticus</i>	Confirmed	Settled areas, buildings	Low	Introduced

During the field survey for Wetland 12 on May 31, June 11 and August 22, 2007, no bird species were observed within the wetland. Wetland 12 is not considered to be critical breeding habitat for breeding birds.

A review of the ACCDC database of species of concern records and the NSM screening revealed seventeen avian species of concern reported within the region. Four red-listed and thirteen yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine's 1992 data, and the likelihood of their presence on site was determined based on comparison of known habitat preferences with habitats present within the wetland and in the immediate surrounding habitat. A summary of the bird species of concern, their provincial status and their habitat preferences is provided in Table 4.

**Table 4: Bird Species of Concern Habitat Modelling Exercise, Using ACCDC And NSM Lists Of Bird Species of Concern Reported From Within 100 Km (ACCDC) Or 10 Km (NSM) Of The Site**

NSDNR Status	Common Name	Binomial	Source of Record	Habitat Preference	Potential Presence on site
Red	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	ACCDC	Rocky cliffs	Unlikely
Red	Piping Plover	<i>Charadrius melodus</i>	ACCDC	Sandy Beaches	Unlikely
Red	Roseate Tern	<i>Sterna dougallii</i>	ACCDC	Coast	Unlikely
Red	Purple Martin	<i>Progne subis</i>	ACCDC	Breeds in colonies in nest boxes in Nova Scotia	Unlikely
Yellow	Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	ACCDC	Small clear lakes and ponds	Unlikely
Yellow	Northern Goshawk	<i>Accipiter gentilis</i>	ACCDC	Mature forest	Possible
Yellow	Purple Sandpiper	<i>Calidris maritime</i>	ACCDC	Not known to breed in Nova Scotia, subarctic	Unlikely
Yellow	Common Tern	<i>Sterna hirundo</i>	ACCDC	Coast	Unlikely
Yellow	Arctic Tern	<i>Sterna paradisaea</i>	ACCDC	Coast	Unlikely
Yellow	Razorbill	<i>Alca torda</i>	ACCDC	Coastal islands	Unlikely
Yellow	Atlantic Puffin	<i>Fratercula arctica</i>	ACCDC	Coastal islands	Unlikely
Yellow	Short-eared Owl	<i>Asio flammeus</i>	ACCDC	Breed in dyked wet meadows near coast in Nova Scotia	Unlikely
Yellow	Boreal Chickadee	<i>Poecile hudsonica</i>	ACCDC	Coniferous forest, nest in rotting trees and stumps	Unlikely
Yellow	Eastern Bluebird	<i>Sialia sialis</i>	ACCDC	Areas with scattered trees and short ground cover.	Unlikely
Yellow	Bobolink	<i>Dolichonyx oryzivorus</i>	ACCDC, NSM	Grasslands, lush meadows	Unlikely
Yellow	Rusty Blackbird	<i>Euphagus carolinus</i>	ACCDC	Spruce bogs, swamps and damp alder swales	Possible
Yellow	Vesper Sparrow	<i>Proocetes gramineus</i>	ACCDC	Short grass, pastures, low shrubs	Unlikely

None of these four red-listed species or the thirteen yellow-listed bird species is expected to be present in or to use Wetland 12 due to the lack of suitable habitat (Table 4). None of the birds listed in the ACCDC search or the NSM screening were observed during the wetland survey and the area is not critical habitat for any of these species.

### **Mammals**

During the Wetland 12 field surveys on May 31, June 8, and August 21 2007, no evidence of any mammal species was observed.

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of mammal species of concern and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Seven NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search including long-tailed or rock shrew (*Sorex dispar*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*Lasiurus cinereus*), southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennanti*), mainland moose (*Alces alces americana*) and Canada lynx (*Lynx lynx*). The Environmental Screening conducted by the NSM found four records of mammal species of concern on the Project site, two of which were not listed on the ACCDC list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). None of these species were observed or are expected to be present within the wetland, as suitable habitat does not exist and/or the species' known distribution does not include this area.

### **Reptiles and Amphibians**

No reptiles or amphibians were observed during the wetland survey.

A review of the ACCDC database of rare species records revealed four rare herpetile species reported from the region. Blanding's turtle (*Emyoidea blandingii*), wood turtle (*Glyptemys insculpta*), leatherback sea turtle (*Dermochelys coriacea*) and eastern ribbon snake (*Thamnophis sauritus septentrionalis*) were all reported from within 100 km of the site. None of these species were observed or are expected to be within the project site, as suitable habitat does not exist.

### **Odonates**

The ACCDC request noted eight red-listed and four yellow-listed dragonfly and damselfly species in the general area. Their habitat preferences and potential presence on site are summarized in Table 5. The complete ACCDC list of species reported is provided in Appendix E.1. There are no large streams, rivers, or lakes on the site that would provide habitat for species

requiring these habitats, so the potential species present are limited to those requiring small pools or slow moving streams or ponds.

**TABLE 5. ODONATE SPECIES OF CONCERN HABITAT MODELLING EXERCISE, USING ACCDC LISTS OF ODONATE SPECIES OF CONCERN REPORTED FROM WITHIN 100 KM (ACCDC) OF WETLAND 12**

<b>Common Name</b>	<b>Binomial</b>	<b>NS DNR Status</b>	<b>Habitat</b>	<b>Potential Presence on Site</b>
Dusky Clubtail	<i>Gomphus spicatus</i>	Yellow	Boggy or marshy ponds, lakes and slow streams, often sandy.	Possible
Brook Snaketail	<i>Ophiogomphus asperses</i>	Red	Clear streams in the open, with brushy banks and sandy, gravelly, or rocky riffles.	Not Likely
Maine Snaketail	<i>Ophiogomphus mainensis</i>	Red	Clear, moderately rapid rocky streams and rivers in forests, often where they drain lakes or swamps.	Not Likely
Lake Darner	<i>Aeshna eremita</i>	Red	Marshy lakes, ponds, deep fens, bogs and slow streams, especially sparsely vegetated or woodland lakes.	Possible
Springtime Darner	<i>Basiaeschna janata</i>	Red	Rivers and streams with a gentle current. Also forested lakes, preferable those with little shore vegetation, and oxygenated ponds	Possible
Harlequin Darner	<i>Gomphaeschna furcillata</i>	Yellow	Bogs and swamp of bald cypress, alder or cedar	Not Likely
Prince Baskettail	<i>Epithea princes</i>	Yellow	Permanent ponds, lakes and slow streams and rivers, with clear to muddy water	Possible
Clamp-Tipped Emerald	<i>Somatochlora tenebrosa</i>	Yellow	Shady forest streams from trickles to about 2 yards wide often partially dry and occasionally boggy or swampy.	Possible
Ebony Boghaunter	<i>Williamsonia fletcheri</i>	Red	Bog pools and fens in forest.	Not Likely
Emerald Spreadwing	<i>Lestes dryas</i>	Red	Prefer small ponds and places that may dry up in summer	Possible
Variable Dancer	<i>Argia fumipennis violacea</i>	Red	Common along streams, marshes and at marshy edges of ponds and lakes.	Possible
Taiga Bluet	<i>Coenagrion resolutum</i>	Red	Small ponds, roadside ditches, marshes, streams, anywhere with grassy or marshy borders. Prefer shaded habitats.	Possible

The results of the habitat modelling exercise indicate that five red listed odonate species have the potential to be present on the project site, while three yellow-listed species have potential. None of the above odonate species were observed in the wetland during field surveys in 2007.

### **Hydrological Characterization**

There is no surface connection between this wetland and any surface watercourses or lakes in the immediate area, based on 1:10,000 topographical mapping, air photography, and field surveys. Wetland 12 has no inflow or outflow and probably receives its water from precipitation runoff from the slope bounding the northern and eastern edges of the wetland. No evidence of a ground water source was observed.

### **Hydrogeological Characterization**

No evidence of a ground water source was observed. This wetland may play a small role in groundwater recharge.

### **Reason for the Alteration**

This wetland will be altered due to the construction and expansion of gypsum mining operations.

### **Nature of the Proposed Alteration**

Approximately one-half (0.75 ha) of this wetland will be removed due to the construction and expansion of gypsum mining operations. Removal of this portion should not affect water supply to the remaining portion, as the water supply should not be affected.

### **Alternatives That Have Been Considered**

There are no options for re-positioning of the open pit – the site of gypsum deposit is fixed in nature. The outline of the pit has already been adjusted to avoid impacting populations of several plant species of concern to the south of the proposed outline (See discussion in EARD).

### **Identifiable Impacts to Wetland**

Approximately fifty percent of Wetland 12, or 0.75 ha, will be removed by the mine project. The remainder is not expected to be impacted by changes in water supply. There are no species at risk or species of conservation concern known to be present in this wetland, although a population of a red-listed species, the ram's head lady slipper, is known to occur on the ridge bordering this wetland. The area containing this plant is being set aside as a Conservation Area (see EARD). No fish species are present.



### **Past Impacts To The Wetland**

This wetland has been impacted by forestry activities in the past. Forested areas around the wetland are in various stages of regrowth.

### **Mitigation**

Fundy Gypsum will work with NSDNR and NSDEL to develop the required mitigation measures including wetland compensation at a ratio agreed upon with NSDNR and NSDEL. Fundy Gypsum is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland that is to be altered. Fundy Gypsum is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded quarry pit has sufficiently shallow edges to support a marsh-type wetland. If this is not possible, the proponent will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

### **Summary**

In summary, assuming that appropriate wetland compensation, significant long-term adverse impacts on wetland functioning on the study site are not predicted.

### **Evaluation Expertise**

Conestoga-Rovers & Associates is a multi-disciplinary engineering, environmental consulting, construction, and information technology (IT) services firm. Since its inception in 1976, CRA has provided practical, innovative, and effective services in the areas of environmental site assessment, impact assessment, environmental remediation, regulatory compliance and permitting, risk assessment, hydrology, solid and hazardous waste management, air quality management, and municipal infrastructure planning and design. We are an established, reputable company with a strong history of solving engineering and environmental challenges in a responsive and cost-efficient manner.

The CRA Family of Companies employs more than 2,600 professional and support staff in over 70 offices located throughout North America, with additional offices in Brazil and England. Our headquarter office is located in Waterloo, Ontario, Canada.

Beth Cameron, B.Sc. M.Sc., is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. She has significant experience conducting surveys for flora and fauna, as well as wetland surveys, and has worked on federal and provincial environmental screenings involving wetland alterations. She has also completed a Wetland Delineation and Classification course on the US Army Corps of Engineers wetland delineation protocol and has also taken a course on identifying grasses, sedges, and rushes.

Jeffrey Balsdon, B.Sc., M.Sc. (Candidate), is a Terrestrial Ecologist with Conestoga-Rover & Associates' Halifax office. He has considerable experience conducting surveys for flora and fauna, as well as wetland surveys. He has also completed a course on identifying grasses, sedges, and rushes.

Susan Belford, B.Sc., M.Sc., is a Senior Project Manager with Conestoga-Rovers & Associates' Halifax office. She is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal regulations and processes.

Dave Strajt, M. Eng., is a Water Resources Engineer/Hydrologist with Conestoga-Rovers & Associates' Halifax office. He is very familiar with surface water processes as they relate to mining process.

Peter Oram, CESA, P.Geo. is a Geologist with Conestoga-Rovers & Associates' Halifax office. He has assisted with ten wetland alteration permits, providing hydrogeological advice. He is very familiar with wetland legislation, having worked on many environmental assessment projects involving provincial and federal legislative processes.

## APPENDIX E

E.1

ACCDC LIST OF RARE SPECIES RECORDED WITHIN 100 KM OF PROJECT SITE

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<u>Binomial</u>	<u>Common Name</u>	<u>S-Rank</u>	<u>Nearest Obs.</u>
<i>Adiantum pedatum</i>	Northern Maidenhair-Fern	S1	10.5Km+/-1
<i>Ageratina altissima</i>	White Snakeroot	S1	60.5Km+/-10
<i>Agrimonia gryposepala</i>	Tall Hairy Groovebur	S3?	14.2Km+/-1
<i>Allium schoenoprasum var. sibiricum</i>	Wild Chives	S2	74.3Km+/-10
<i>Allium tricoccum</i>	Small White Leek	S1	24.9Km+/-10
<i>Alnus serrulata</i>	Brook-Side Alder	S2	89.2Km+/-10
<i>Alopecurus aequalis</i>	Short-Awn Foxtail	S2S3	33.7Km+/-5
<i>Amelanchier fernaldii</i>	Fernald Serviceberry	S2?	71.4Km+/-10
<i>Amelanchier nantucketensis</i>	Nantucket Shadbush	S1	47.1Km+/-1
<i>Anemone canadensis</i>	Canada Anemone	S2	17.6Km+/-10
<i>Anemone quinquefolia</i>	Wood Anemone	S2	62.2Km+/-1
<i>Anemone quinquefolia var. quinquefolia</i>	Wood Anemone	S2	58.8Km+/-1
<i>Anemone virginiana</i>	Virginia Anemone	S1S2	14Km+/-0
<i>Anemone virginiana var. alba</i>	River Anemone	S1S2	74.3Km+/-10
<i>Anemone virginiana var. virginiana</i>	River Anemone	S2	13.5Km+/-10
<i>Antennaria parlinii</i>	a Pussytoes	S1	10Km+/-0.1
<i>Antennaria rosea ssp. arida</i>	a Rosy Pussy-Toes	S1	59.2Km+/-0.
<i>Arabis drummondii</i>	Drummond Rockcress	S2	30.8Km+/-1
<i>Arabis glabra</i>	Tower-Mustard	S1SE	49.8Km+/-0.
<i>Arabis hirsuta var. pycnocarpa</i>	Hairy Rock-Cress	S1S2	40Km+/-0.1
<i>Asclepias incarnata</i>	Swamp Milkweed	S3	11.9Km+/-10
<i>Asclepias incarnata ssp. pulchra</i>	Swamp Milkweed	S2S3	33.5Km+/-1
<i>Asplenium trichomanes</i>	Maidenhair Spleenwort	S2	16.4Km+/-0.
<i>Asplenium trichomanes-ramosum</i>	Green Spleenwort	S2	38.8Km+/-10
<i>Astragalus robbinsii</i>	Robbins Milkvetch	S1	59.2Km+/-0.
<i>Astragalus robbinsii var. minor</i>	Robbins' Milk-Vetch	S1	59.2Km+/-0.
<i>Atriplex acadiensis</i>	Maritime Saltbush	S1?	40.9Km+/-10
<i>Bartonia virginica</i>	Yellow Screwstem	S3	44.9Km+/-10
<i>Bidens connata</i>	Purple-Stem Swamp Beggar-Ticks	S3?	3.1Km+/-5
<i>Bidens hyperborea</i>	Estuary Beggar-Ticks	S1	86.9Km+/-0.
<i>Botrychium dissectum</i>	Cutleaf Grape-Fern	S3	41.6Km+/-0.
<i>Botrychium lanceolatum</i>	Triangle Grape-Fern	S2	28.1Km+/-0.
<i>Botrychium lanceolatum var. angustisegmentum</i>	Lance-Leaf Grape-Fern	S2	49.5Km+/-0.
<i>Botrychium lunaria</i>	Moonwort Grape-Fern	S1	73.2Km+/-1
<i>Botrychium simplex</i>	Least Grape-Fern	S2S3	24.6Km+/-1
<i>Calamagrostis stricta</i>	Slim-Stem Small-Reedgrass	S1S2	99Km+/-0.1

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Calamagrostis stricta ssp. stricta</i>	Northern Reedgrass	S1S2	90Km+/-1
<i>Calamagrostis stricta var. stricta</i>	Bentgrass	S1S2	59Km+/-10
<i>Campanula aparinoides</i>	Marsh Bellflower	S3?	14.3Km+/-1
<i>Cardamine maxima</i>	Large Toothwort	S1	73.1Km+/-0.
<i>Cardamine parviflora</i>	Small-Flower Bitter-Cress	S2	16.6Km+/-10
<i>Cardamine parviflora var. arenicola</i>	Small-Flower Bitter-Cress	S2	33Km+/-1
<i>Carex adusta</i>	Crowded Sedge	S2S3	58.2Km+/-5
<i>Carex argyrantha</i>	Hay Sedge	S3S4	41Km+/-50.1
<i>Carex atlantica ssp. capillacea</i>	Howe Sedge	S2	74.2Km+/-0.
<i>Carex atratiformis</i>	Black Sedge	S2	46.6Km+/-1
<i>Carex bebbii</i>	Bebb's Sedge	S1S2	5.6Km+/-5
<i>Carex bromoides</i>	Brome-Like Sedge	S3	10.9Km+/-10
<i>Carex capillaris</i>	Hair-Like Sedge	S2	59.2Km+/-0.
<i>Carex castanea</i>	Chestnut-Colored Sedge	S2	20.5Km+/-0
<i>Carex chordorrhiza</i>	Creeping Sedge	S1	98.3Km+/-0.
<i>Carex comosa</i>	Bristly Sedge	S2	3.7Km+/-10
<i>Carex cryptolepis</i>	Northeastern Sedge	S3?	84Km+/-0
<i>Carex eburnea</i>	Ebony Sedge	S3	52.4Km+/-0.
<i>Carex foenea</i>	Dry-Spike Sedge	S3?	26.3Km+/-1
<i>Carex garberi</i>	Elk Sedge	S1	94.4Km+/-0
<i>Carex granularis</i>	Meadow Sedge	S1	87.5Km+/-1
<i>Carex haydenii</i>	Cloud Sedge	S1	26.9Km+/-1
<i>Carex hirtifolia</i>	Pubescent Sedge	S2S3	56.1Km+/-0.
<i>Carex houghtoniana</i>	A Sedge	S2?	67Km+/-5
<i>Carex hystericina</i>	Porcupine Sedge	S1S2	27.6Km+/-0.
<i>Carex laxiflora var. laxiflora</i>	Loose-Flowered Sedge	S1	30.8Km+/-1
<i>Carex livida var. radicaulis</i>	Livid Sedge	S1	4.5Km+/-10
<i>Carex lupulina</i>	Hop Sedge	S3	13.6Km+/-0.
<i>Carex peckii</i>	White-Tinged Sedge	S2?	52.4Km+/-0.
<i>Carex pellita</i>	Woolly Sedge	S1	93.9Km+/-10
<i>Carex pennsylvanica</i>	Pennsylvania Sedge	S1S2	50Km+/-0.1
<i>Carex plantaginea</i>	Plantain-Leaved Sedge	S1	80.1Km+/-0.
<i>Carex prairea</i>	Prairie Sedge	S1	34.5Km+/-1
<i>Carex rosea</i>	Rosy Sedge	S3	13.6Km+/-1
<i>Carex swanii</i>	Swan Sedge	S2?	69.1Km+/-5
<i>Carex tenera</i>	Slender Sedge	S1S2	14.3Km+/-0.
<i>Carex tuckermanii</i>	Tuckerman Sedge	S1	13.2Km+/-0.
<i>Carex viridula ssp. oedocarpa</i>	A Sedge	S1S2	59.1Km+/-0.
<i>Caulophyllum thalictroides</i>	Blue Cohosh	S2	11.4Km+/-1
<i>Cephalanthus occidentalis</i>	Common Buttonbush	S2S3	89.2Km+/-10

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Ceratophyllum demersum</i>	Common Hornwort	S3?	83.8Km+/-0
<i>Clematis occidentalis</i>	Purple Clematis	S1	85Km+/-0.5
<i>Clethra alnifolia</i>	Coast Pepper-Bush	S1S2	65.5Km+/-0.
<i>Coeloglossum viride var. virescens</i>	Long-Bract Green Orchis	S2	20.6Km+/-1
<i>Conioselinum chinense</i>	Hemlock Parsley	S2S3	33.9Km+/-0.
<i>Conopholis americana</i>	Squaw-Root	S1S2	28Km+/-1
<i>Corallorhiza trifida</i>	Early Coralroot	S3	20Km+/-5
<i>Crassula aquatica</i>	Water Pigmy-Weed	S2	61.4Km+/-0.
<i>Crataegus robinsonii</i>	A Hawthorn	S1?	76.3Km+/-5
<i>Crataegus submollis</i>	A Hawthorn	S1?	16Km+/-10
<i>Cryptogramma stelleri</i>	Fragile Rockbrake	S1S2	4.8Km+/-0.1
<i>Cuscuta cephalanthi</i>	Button-Bush Dodder	S1	44Km+/-0.1
<i>Cuscuta pentagona</i>	Field Dodder	S1SE	20.4Km+/-1
<i>Cynoglossum virginianum</i>	Wild Comfrey	S1	31.9Km+/-0.
<i>Cynoglossum virginianum var. boreale</i>	Northern Wild Comfrey	S1	31.9Km+/-0.
<i>Cyperus dentatus</i>	Toothed Sedge	S3	72.1Km+/-0.
<i>Cypripedium arietinum</i>	Ram's-Head Lady's-Slipper	S1	10.7Km+/-5
<i>Cypripedium parviflorum</i>	Small Yellow Lady's-Slipper	S2S3	10.7Km+/-5
<i>Cypripedium parviflorum var. makasin</i>	Small Yellow Lady's-Slipper	S2	44.1Km+/-5
<i>Cypripedium parviflorum var. pubescens</i>	Large Yellow Lady's-Slipper	S2	26.7Km+/-5
<i>Cypripedium reginae</i>	Showy Lady's-Slipper	S2	11.6Km+/-5
<i>Cystopteris bulbifera</i>	Bulblet Fern	S3S4	3.6Km+/-1
<i>Cystopteris tenuis</i>	A Bladderfern	S3?	12.1Km+/-0.
<i>Decodon verticillatus</i>	Hairy Swamp Loosestrife	S2S3	90.5Km+/-10
<i>Desmodium canadense</i>	Showy Tick-Trefoil	S1	26.6Km+/-10
<i>Desmodium glutinosum</i>	Large Tick-Trefoil	S2	13.5Km+/-0
<i>Dichanthelium acuminatum var. lindheimeri</i>	Panic Grass	S1?	70Km+/-1
<i>Dichanthelium clandestinum</i>	Deer-Tongue Witchgrass	S3	18.7Km+/-10
<i>Dichanthelium linearifolium</i>	Slim-Leaf Witchgrass	S2?	27.9Km+/-10
<i>Dichanthelium xanthophyllum</i>	Slender Dichanthelium	S1	74.1Km+/-0
<i>Dirca palustris</i>	Eastern Leatherwood	S1	13.2Km+/-0.
<i>Draba arabisans</i>	Rock Whitlow-Grass	S2	30.8Km+/-1
<i>Draba glabella</i>	Rock Whitlow-Grass	S1	46.9Km+/-10
<i>Dryopteris fragrans var. remotiuscula</i>	Fragrant Fern	S2	42Km+/-10
<i>Eleocharis erythropoda</i>	Bald Spikerush	SH	73Km+/-1
<i>Eleocharis nitida</i>	Slender Spike-Rush	S3	18.7Km+/-1

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ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Eleocharis olivacea</i>	Capitate Spikerush	S2	85.6Km+/-0.
<i>Eleocharis olivacea var. olivacea</i>	Capitate Spikerush	S2	91.3Km+/-5
<i>Eleocharis ovata</i>	Ovate Spikerush	S2?	42.9Km+/-5
<i>Elodea canadensis</i>	Broad Waterweed	S3?	77.2Km+/-0
<i>Elymus hystrix</i>	Bottle-Brush Grass	S1	11.8Km+/-1
<i>Elymus hystrix var. bigeloviana</i>	Bottlebrush Grass	S1	11.1Km+/-0.
<i>Elymus wiegandii</i>	Wiegand's Wild Rye	S1	60Km+/-10
<i>Empetrum eamesii</i>	Rock Crowberry	S2S3	60Km+/-10
<i>Empetrum eamesii ssp. atropurpureum</i>	Purple Crowberry	S2S3	69.3Km+/-0.
<i>Empetrum eamesii ssp. eamesii</i>	Purple Crowberry	S2S3	69.3Km+/-0.
<i>Epilobium coloratum</i>	Purple-Leaf Willow-Herb	S2?	21.1Km+/-1
<i>Epilobium strictum</i>	Downy Willow-Herb	S3	16.6Km+/-1
<i>Equisetum palustre</i>	Marsh Horsetail	S1	30.4Km+/-5
<i>Equisetum pratense</i>	Meadow Horsetail	S2	11.1Km+/-0
<i>Equisetum scirpoides</i>	Dwarf Scouring Rush	S3S4	13.4Km+/-0.
<i>Equisetum variegatum</i>	Variegated Horsetail	S3	50.8Km+/-0.
<i>Erigeron hyssopifolius</i>	Daisy Fleabane	S2S3	11.9Km+/-10
<i>Erigeron philadelphicus</i>	Philadelphia Fleabane	S2	88.9Km+/-10
<i>Eriophorum chamissonis</i>	Russet Cotton-Grass	S3S4	98.1Km+/-0.
<i>Eriophorum gracile</i>	Slender Cotton-Grass	S2	18.2Km+/-1
<i>Eupatorium dubium</i>	Joe-Pye Thoroughwort	S2	99.1Km+/-10
<i>Euthamia caroliniana</i>	Grass-Leaved Goldenrod	S3	32Km+/-5
<i>Euthamia galetorum</i>	Narrow-Leaf Fragrant Golden-Rod	S3S4	31.5Km+/-10
<i>Festuca subverticillata</i>	Nodding Fescue	S1S2	18.7Km+/-10
<i>Floerkea proserpinacoides</i>	False Mermaid-Weed	S2S3	37.3Km+/-1
<i>Fraxinus nigra</i>	Black Ash	S3	12.1Km+/-0
<i>Fraxinus pennsylvanica</i>	Green Ash	S1	26.3Km+/-0.
<i>Galium boreale</i>	Northern Bedstraw	S2	24.9Km+/-10
<i>Geocaulon lividum</i>	Northern Comandra	S2S3	58.4Km+/-0.
<i>Geranium bicknellii</i>	Bicknell Northern Crane's- Bill	S3	77.2Km+/-0
GNAME	GCOMNAME	SRAN K	DISTKM
<i>Goodyera pubescens</i>	Downy Rattlesnake- Plantain	S1	11.7Km+/-0
<i>Goodyera repens</i>	Dwarf Rattlesnake-Plantain	S2S3	26.9Km+/-1
<i>Goodyera tessellata</i>	Checkered Rattlesnake- Plantain	S3	24.5Km+/-5
<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop	S1	69.6Km+/-10



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ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Hedeoma pulegioides</i>	American Pennyroyal	S2S3	20.1Km+/-0.
<i>Helianthemum canadense</i>	Canada Frostweed	S1	47.5Km+/-10
<i>Hepatica nobilis</i>	Round-Lobe Hepatica	S1	10Km+/-0.1
<i>Hepatica nobilis var. obtusa</i>	Round-Leaved Liverleaf	S1	20Km+/-5
<i>Hieracium kalmii</i>	Kalm's Hawkweed	S2?	42.4Km+/-5
<i>Hieracium kalmii var. fasciculatum</i>	Kalm's Hawkweed	S1?	67.8Km+/-5
<i>Hieracium kalmii var. kalmii</i>	Kalm's Hawkweed	S2?	42.6Km+/-10
<i>Hieracium paniculatum</i>	Panicled Hawkweed	S3	28.4Km+/-0.
<i>Hieracium robinsonii</i>	Robinson's Hawkweed	S2	76.3Km+/-1
<i>Hieracium umbellatum</i>	Umbellate Hawkweed	S2?	26.1Km+/-10
<i>Hudsonia ericoides</i>	Golden-Heather	S2	37.6Km+/-10
<i>Huperzia selago</i>	Fir Clubmoss	S1S3	37.2Km+/-1
<i>Hypericum dissimulatum</i>	Disguised St. John's-Wort	S2S3	46Km+/-0.5
<i>Hypericum majus</i>	Larger Canadian St. John's Wort	S1	41.7Km+/-1
<i>Impatiens pallida</i>	Pale Jewel-Weed	S2	33.1Km+/-10
<i>Iris prismatica</i>	Slender Blue Flag	S1	87.5Km+/-1
<i>Isoetes acadensis</i>	Acadian Quillwort	S3	20.2Km+/-10
<i>Isoetes lacustris</i>	Lake Quillwort	S3?	40.6Km+/-0.
<i>Isoetes prototypus</i>	Prototype Quillwort	S2	55.1Km+/-0
<i>Iva frutescens ssp. oraria</i>	Marsh Elder	S2SE	10.9Km+/-10
<i>Juncus dudleyi</i>	Dudley's Rush	S2?	50.5Km+/-1
<i>Juncus greenii</i>	Greene's Rush	S1S2	59.3Km+/-10
<i>Juncus marginatus</i>	Grassleaf Rush	S2S3	76.6Km+/-10
<i>Juncus nodosus</i>	Knotted Rush	S3S4	85.7Km+/-0
<i>Juncus secundus</i>	Secund Rush	S1	39.8Km+/-0.
<i>Juncus stygius ssp. americanus</i>	Moor Rush	S1	99Km+/-0.1
<i>Juncus subcaudatus</i>	Woods-Rush	S3	28.9Km+/-10
<i>Juncus subcaudatus var. planisepalus</i>	Woods-Rush	S3	90.2Km+/-0.
<i>Juncus vaseyi</i>	Vasey Rush	S1	98.9Km+/-10
<i>Lachnanthes caroliniana</i>	Carolina Redroot	S1	91Km+/-10
<i>Lactuca hirsuta var. sanguinea</i>	Hairy Wild Lettuce	S2	16.6Km+/-10
<i>Laportea canadensis</i>	Wood Nettle	S3	11.5Km+/-0.
<i>Lilaeopsis chinensis</i>	Eastern Lilaeopsis	S1	77.9Km+/-0.
<i>Lilium canadense</i>	Canada Lily	S2S3	10.7Km+/-0.
<i>Limosella australis</i>	Mudwort	S2S3	69.4Km+/-0.
<i>Lindernia dubia</i>	Yellow-Seed False-Pimpernel	S3S4	14.3Km+/-0
<i>Liparis loeselii</i>	Loesel's Twayblade	S3S4	20.7Km+/-5
<i>Listera australis</i>	Southern Twayblade	S1	23.2Km+/-0.

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Listera convallarioides</i>	Broad-Leaved Twayblade	S3	23.6Km+/-5
<i>Lobelia spicata</i>	Pale-Spiked Lobelia	S1S2SE	24.9Km+/-10
<i>Lophiola aurea</i>	Golden Crest	S2	83.4Km+/-10
<i>Luzula parviflora</i>	Small-Flowered Wood-Rush	S3	45.6Km+/-0
<i>Lycopodiella appressa</i>	Southern Bog Clubmoss	S3	43.3Km+/-5
<i>Lycopodium complanatum</i>	Trailing Clubmoss	S3?	16.2Km+/-0
<i>Lycopodium hickeyi</i>	Hickey's Clubmoss	S2?	24.6Km+/-1
<i>Lycopodium sabinifolium</i>	Ground-Fir	S3?	57.8Km+/-1
<i>Lycopodium sitchense</i>	Alaskan Clubmoss	S3?	20.4Km+/-1
<i>Lysimachia thyrsoflora</i>	Water Loosestrife	S3S4	76.6Km+/-0
<i>Malaxis brachypoda</i>	White Adder's-Mouth	S1	24.9Km+/-10
<i>Megalodonta beckii</i>	Beck Water-Marigold	S3	60.4Km+/-0.
<i>Milium effusum</i>	Tall Millet-Grass	S3	47.3Km+/-0
<i>Milium effusum var. cisatlanticum</i>	Tall Millet-Grass	S3	46.7Km+/-5
<i>Minuartia groenlandica</i>	Mountain Sandwort	S2	48.2Km+/-0.
<i>Montia fontana</i>	Fountain Miner's-Lettuce	S1	60.4Km+/-1
<i>Myriophyllum farwellii</i>	Farwell's Water-Milfoil	S2	38.3Km+/-1
<i>Myriophyllum humile</i>	Low Water-Milfoil	S3?	97.9Km+/-0
<i>Myriophyllum verticillatum</i>	Whorled Water-Milfoil	S2	25Km+/-10
<i>Najas gracillima</i>	Thread-Like Naiad	S1S2	18.5Km+/-0.
<i>Oenothera fruticosa</i>	Narrow-Leaved Sundrops	S2S3SE ?	20.4Km+/-1
<i>Oenothera fruticosa ssp. glauca</i>	Shrubby Sundrops	S2S3SE ?	11.9Km+/-10
<i>Ophioglossum pusillum</i>	Adder's Tongue	S2S3	30.9Km+/-0.
<i>Osmorhiza depauperata</i>	Blunt-Fruited Sweet-Cicely	S1	20.4Km+/-5
<i>Osmorhiza longistylis</i>	Smoother Sweet-Cicely	S2	18.7Km+/-5
<i>Oxytropis campestris var. johannensis</i>	St. John's Oxytrope	S1	59.2Km+/-0.
<i>Packera paupercula</i>	Balsam Groundsel	S3	12.1Km+/-0
<i>Panax trifolius</i>	Dwarf Ginseng	S3	26.2Km+/-0.
<i>Panicum philadelphicum</i>	Philadelphia Panic Grass	S2S3SE	14.3Km+/-0
<i>Panicum rigidulum var. pubescens</i>	Redtop Panic Grass	S2	91Km+/-10
<i>Pilea pumila</i>	Canada Clearweed	S1	14.2Km+/-0
<i>Piptatherum canadense</i>	Canada Mountain-Ricegrass	S2	20.2Km+/-0
<i>Piptatherum pungens</i>	Slender Mountain-Ricegrass	S2	96.8Km+/-1
<i>Plantago rugelii</i>	Black-Seed Plantain	S1SE	18.7Km+/-10
<i>Platanthera flava</i>	Southern Rein-Orchid	S2	73.9Km+/-0

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Platanthera flava var. flava</i>	Southern Rein Orchid	S2	18.7Km+/-10
<i>Platanthera flava var. herbiola</i>	Pale Green Orchid	S1S2	19.7Km+/-0.
<i>Platanthera grandiflora</i>	Large Purple-Fringe Orchis	S3	20Km+/-1
<i>Platanthera hookeri</i>	Hooker Orchis	S3	15.4Km+/-5
<i>Platanthera macrophylla</i>	Large Round-Leaved Orchid	S2	12.3Km+/-1
<i>Platanthera orbiculata</i>	Large Roundleaf Orchid	S3	44.9Km+/-1
<i>Poa glauca</i>	White Bluegrass	S2S3	13.9Km+/-1
<i>Poa glauca ssp. glauca</i>	White Bluegrass	S2S3	73Km+/-1
<i>Podostemum ceratophyllum</i>	Threadfoot	S1	70Km+/-0.1
<i>Polygala polygama</i>	Racemed Milkwort	S1SE	59.3Km+/-1
<i>Polygala sanguinea</i>	Field Milkwort	S2S3	37.5Km+/-10
<i>Polygonum achoreum</i>	Leathery Knotweed	S1?SE	98.9Km+/-10
<i>Polygonum arifolium</i>	Halberd-Leaf Tearthumb	S2	51.4Km+/-10
<i>Polygonum buxiforme</i>	Small's Knotweed	S2S3SE	20.7Km+/-1
<i>Polygonum pensyloanicum</i>	Pennsylvania Smartweed	S3	14.2Km+/-0
<i>Polygonum raii</i>	Pondshore Knotweed	S2S3SE	50.3Km+/-1
<i>Polygonum scandens</i>	Climbing False-Buckwheat	S2	17.6Km+/-10
<i>Polypodium appalachianum</i>	Appalachian Polypody	S3?	47Km+/-1
<i>Polystichum braunii</i>	Braun's Holly-Fern	S3S4	27.9Km+/-1
<i>Potamogeton confervoides</i>	Algae-Like Pondweed	S3S4	32.3Km+/-0.
<i>Potamogeton friesii</i>	Fries' Pondweed	S2	27.2Km+/-1
<i>Potamogeton obtusifolius</i>	Blunt-Leaf Pondweed	S2	84.1Km+/-0
<i>Potamogeton praelongus</i>	White-Stem Pondweed	S3?	29.2Km+/-1
<i>Potamogeton pulcher</i>	Spotted Pondweed	S1	76.1Km+/-10
<i>Potamogeton richardsonii</i>	Redhead Grass	S3?	25.9Km+/-5
<i>Potamogeton zosteriformis</i>	Flatstem Pondweed	S2S3	29Km+/-1
<i>Prenanthes nana</i>	Dwarf Rattlesnakeroot	S2?	73.5Km+/-1
<i>Primula laurentiana</i>	Bird's-Eye Primrose	S3	27.9Km+/-10
<i>Primula mistassinica</i>	Bird's-Eye Primrose	S2	74.3Km+/-10
<i>Proserpinaca palustris</i>	Marsh Mermaid-Weed	S3S4	92.9Km+/-0.
<i>Proserpinaca pectinata</i>	Comb-Leaved Mermaid-Weed	S3	63Km+/-10
<i>Puccinellia fasciculata</i>	Salt Marsh Goosegrass	S1SE	17.1Km+/-5
<i>Pyrola asarifolia</i>	Pink Wintergreen	S3	28.2Km+/-1
<i>Pyrola minor</i>	Lesser Wintergreen	S2	37.6Km+/-10
<i>Ranunculus flammula var. flammula</i>	Greater Creeping Spearwort	S2	26.1Km+/-0.
<i>Ranunculus gmelinii</i>	Small Yellow Water-Crowfoot	S3?	52.4Km+/-0.

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Ranunculus pensylvanicus</i>	Bristly Crowfoot	S1	77.4Km+/-0
<i>Ranunculus sceleratus</i>	Cursed Crowfoot	S1S2	65.7Km+/-1
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	S3	12.4Km+/-0.
<i>Rhexia virginica</i>	Virginia Meadow-Beauty	S3	55.2Km+/-10
<i>Ribes americanum</i>	Wild Black Currant	S1SE	3.8Km+/-1
<i>Rubus flagellaris</i>	Northern Dewberry	S1?	65.6Km+/-0.
<i>Rubus pensilvanicus</i>	Pennsylvania Blackberry	S3?	18.1Km+/-1
<i>Rudbeckia laciniata</i>	Cut-Leaved Coneflower	S2S3	93Km+/-0
<i>Rudbeckia laciniata var. gaspereaensis</i>	Cut-Leaved Coneflower	S2S3	16.6Km+/-10
<i>Rumex salicifolius</i>	Willow Dock	S2	20.2Km+/-1
<i>Rumex salicifolius var. mexicanus</i>	Willow Dock	S2	29.7Km+/-1
<i>Salix pedicellaris</i>	Bog Willow	S2	40.2Km+/-0.
<i>Salix petiolaris</i>	Meadow Willow	S3	25.1Km+/-0
<i>Salix sericea</i>	Silky Willow	S2	44.9Km+/-1
<i>Samolus valerandi ssp. parviflorus</i>	Water Pimpernel	S2	86.5Km+/-0.
<i>Sanguinaria canadensis</i>	Bloodroot	S3S4	10.2Km+/-1
<i>Sanicula odorata</i>	Black Snake-Root	S1	13.5Km+/-10
<i>Saxifraga paniculata</i>	White Mountain Saxifrage	S2	59.2Km+/-0.
<i>Saxifraga paniculata ssp. neogaea</i>	a White Mountain Saxifrage	S2	24.9Km+/-10
<i>Schizaea pusilla</i>	Curly-Grass Fern	S3	61.5Km+/-1
<i>Schoenoplectus robustus</i>	Saltmarsh Bulrush	S1?	99.7Km+/-5
<i>Scirpus longii</i>	Long's Bulrush	S2	89.8Km+/-0
<i>Scirpus pedicellatus</i>	Stalked Bulrush	S1	55.2Km+/-1
<i>Scrophularia lanceolata</i>	Hare Figwort	S1	59.4Km+/-1
<i>Senecio pseudoarnica</i>	Seabeach Groundsel	S2	74.3Km+/-10
<i>Shepherdia canadensis</i>	Canada Buffalo-Berry	S2	13.5Km+/-10
<i>Sisyrinchium angustifolium</i>	Pointed Blue-Eyed-Grass	S3S4	84.7Km+/-0.
<i>Sisyrinchium atlanticum</i>	Eastern Blue-Eyed-Grass	S3	98.6Km+/-1
<i>Sisyrinchium fuscatum</i>	Coastal-Plain Blue-Eyed-Grass	S1	72.3Km+/-0.
<i>Solidago hispida</i>	Hairy Goldenrod	S1?	60Km+/-10
<i>Solidago latissimifolia</i>	Elliott Goldenrod	S3	97.6Km+/-10
<i>Sparganium fluctuans</i>	Floating Bur-Reed	S3?	32Km+/-5
<i>Sparganium natans</i>	Small Bur-Reed	S3	18.7Km+/-5
<i>Sphenopholis intermedia</i>	Slender Wedge Grass	S3S4	12.4Km+/-0.
<i>Spiranthes casei var. casei</i>	Case's Ladies'-Tresses	S1	27.3Km+/-0.
<i>Spiranthes casei var. novaescotiae</i>	Case's Ladies'-Tresses	S2	74.5Km+/-0.
<i>Spiranthes lucida</i>	Shining Ladies'-Tresses	S2	12.1Km+/-0.
<i>Spiranthes ochroleuca</i>	Yellow Nodding Ladies'-Tresses	S2	26.6Km+/-10

APPENDIX E.1

ACCDC LIST OF RARE SPECIES LOCATED WITHIN 100 KM OF PROJECT SITE

<i>Spiranthes romanzoffiana</i>	Hooded Ladies'-Tresses	S3S4	20.4Km+/-0.
<i>Stellaria humifusa</i>	Creeping Sandwort	S2	40Km+/-1
<i>Stellaria longifolia</i>	Longleaf Stitchwort	S3	47.1Km+/-0
<i>Stuckenia filiformis ssp. alpina</i>	Northern Slender Pondweed	S2S3	57.1Km+/-0.
<i>Suaeda calceoliformis</i>	American Sea-Blite	S2S3	60Km+/-10
<i>Suaeda rolandii</i>	Roland's Sea-Blite	S1?	10.9Km+/-10
<i>Symphyotrichum boreale</i>	Boreal American-Aster	S2?	38.8Km+/-10
<i>Symphyotrichum ciliolatum</i>	Lindley's Aster	S2S3	48.5Km+/-1
<i>Symphyotrichum tradescantii</i>	Tradescant Aster	S3	72.7Km+/-0.
<i>Symphyotrichum undulatum</i>	Wavy-leaf American-Aster	S2	12.4Km+/-0.
<i>Symplocarpus foetidus</i>	Skunk Cabbage	S3	97.5Km+/-0.
<i>Teucrium canadense</i>	American Germander	S2S3	44Km+/-0.5
<i>Thuja occidentalis</i>	Northern White Cedar	S1S2	18.7Km+/-1
<i>Tiarella cordifolia</i>	Heart-Leaved Foam-Flower	S2	43.6Km+/-5
<i>Trillium erectum</i>	Ill-Scent Trillium	S3	20.3Km+/-1
<i>Trillium grandiflorum</i>	Large-Flower Trillium	S1SE	34.5Km+/-1
<i>Triosteum aurantiacum</i>	Coffee Tinker's-Weed	S2	11.8Km+/-0
<i>Trisetum spicatum</i>	Narrow False Oats	S3	33.1Km+/-5
<i>Utricularia gibba</i>	Humped Bladderwort	S2	73.5Km+/-10
<i>Utricularia radiata</i>	Small Swollen Bladderwort	S3	38.8Km+/-5
<i>Utricularia subulata</i>	Zigzag Bladderwort	S3	97.2Km+/-1
<i>Vaccinium boreale</i>	Northern Blueberry	S2	85Km+/-0.5
<i>Vaccinium caespitosum</i>	Dwarf Blueberry	S2	17.1Km+/-1
<i>Vaccinium ovalifolium</i>	Oval-Leaf Huckleberry	S1	66.6Km+/-10
<i>Vaccinium uliginosum</i>	Alpine Blueberry	S2	67.3Km+/-10
<i>Vallisneria americana</i>	Eel-Grass	S2	66.9Km+/-1
<i>Verbena hastata</i>	Blue Vervain	S3	13.1Km+/-10
<i>Viola canadensis</i>	Canada Violet	S1	83Km+/-10
<i>Viola nephrophylla</i>	Northern Bog Violet	S2	17.8Km+/-1
<i>Viola sagittata</i>	Arrow-Leaved Violet	S3S4	11.9Km+/-0
<i>Viola sagittata var. ovata</i>	Arrow-Leaved Violet	S3S4	60.3Km+/-0.
<i>Woodsia glabella</i>	Smooth Woodsia	S2	52Km+/-1
<i>Zizia aurea</i>	Common Alexanders	S1S2	92Km+/-10

E.2

NOVA SCOTIA MUSEUM RARE SPECIES SCREENING

**Heritage Division**

# Memorandum

1910-22 old. 4/11/04

TO: Allan Lines  
MGI Limited

FROM: Bob Ogilvie

RE: **Environmental Screening 04-08-16  
Avondale**

DATE: September 10, 2004

Further to your request of August 16, 2004, staff of the Heritage Division have reviewed their files for reference to the presence of known heritage resources in the study area. Please be aware that our information is not comprehensive, in that it is incomplete and of varying degrees of accuracy with respect to the precise location and condition of heritage resources.

### Archaeology

There are no recorded archaeological sites in the study area but several nearby. There is some potential for the presence of First Nations settlement sites, particularly adjacent to water courses, but the principal settlement focus would be closer to the Kennetcook and St. Croix rivers and outside of the study area.. The potential for Post-Contact Period archaeological sites is unknown but will be documented in historical documentation.

To ensure that there is no impact on archaeological remains, we would recommend that an archaeological assessment be undertaken. It would consist of the following components:

- a) background property search to determine past historic land use;
- b) an archaeological reconnaissance survey of the proposed development area to note any archaeological features present; and
- c) judgmental sub-surface testing of locations determined to have an elevated potential for Aboriginal archaeological sites.

### Natural Heritage

The nature of the development is not clear from the documents provided. Based on the large area outlined, there are more elements identified than may have been otherwise if the specific nature and scope of the development were more-clearly defined. The staff of the Nova Scotia Museum of Natural History have reviewed their records and make the following observations:

**Zoology**

The current open-pit mine at Poplar Grove/Mantua/Millers Creek was the location for several unique cave formations which have been removed during the mining operations (The Honeycombs, Millers Creek Cave). We note that such formations may exist within the Gypsum/(karst) matrix of the study area, and, as such would be deemed significant habitats/features. These include other cave features (stalagmites - rare in Nova Scotia), as well as rare and poorly-understood cave fauna. Due to the rarity of such features in Nova Scotia, any development that could impact on the such features, should be preceded by a comprehensive survey of the formations involved prior to development.

The surrounding tidal areas support extensive feeding by a number of migratory birds, so development that could impinge on these marsh/mudflat ecosystems would have to take that into account. Specific lists and numbers of birds in this category are not readily available, so a field survey (at the appropriate time of the year) would have to be undertaken.

Within the Avon Estuary there is a small population of the Anglewing Clam (*Barnea truncata*).

The Kennetcook River supports one of the few remaining populations of Sea-run Brook Trout (*Salvelinus fontinalis*) in the Province.

We have records of the following species of concern within the area (and habitat type), although we note that such gypsum/karst areas tend to support a higher variety of vulnerable species, mostly due to the nature of the substrates, as well as the limited availability of such ecosystems in the Province.

**Insects:**

Melanistic Tiger Beetles (*Cicendela* spp.)

Cave Cricket (*Ceuthophilus brevipes*)

**Breeding records of Birds (At the site or adjacent localities):**

- Northern Oriole (*Icterus galbula*) late May - June
- Eastern Meadowlark (*Sturnella magna*) - yellow-listed open woodland S, edge, fall
- Bobolink (*Dolichonyx oryzivorus*) - yellow-listed 3
- Possible Sharp-tailed Sparrow (*Ammodramus caudacutus*) - yellow-listed nest cover edge
- Eastern Kingbird (*Tyrannus tyrannus*) 3
- possible Common Moorhen (*Gallinula chloropus*) marsh, impoundment 3
- American Wigeon (*Anas americana*) marsh, agric impound 3
- Pied-billed Grebe (*Podilymbus podiceps*) fallow wetlands late July

**Mammals:**

Due to the possibility of caves within this area, specifically hibernation sites, we would note the presence of Little Brown bat (*Myotis lucifugus*) - yellow-listed

Northern long-eared bat (*Myotis septentrionalis*) - yellow-listed

Pipistrelle (*Pipistrellus subflavus*) - yellow-listed

As well, there has been a recent sighting of the Canada lynx (*Lynx lynx*) - Listed under the Nova Scotia Endangered Species Act.



*Botany*

This region of mainland Nova Scotia is one of the most significant for botanical resources, second only to southwestern Nova Scotia. Hants County hosts one of the highest densities of Red-listed species. For this reason, a complete botanical inventory should be conducted throughout the footprint of the proposed project, including new roads, during the growing season.

The presence/absence of the following vascular plant species-at-risk should be considered during a field inventory. These plants are known from areas of similar habitat within the proposed area or adjacent to it.

Red-listed species:

- Adiantum pedatum* ✓
- Carex tuckermanni* ✓
- Caulophyllum thalictroides* ✓
- Cynoglossum boreale* ✓
- Cypripedium arietinum* ✓
- C. reginae* ✓
- Dirca palustris* ✓
- Elymus hystrix* (= *Hystrix patula*) ✓
- Hepatica americana* ✓
- Sanicula gregaria*
- Triosteum aurantiacum*



Yellow-listed species:

- Bidens connata* ✓
- Botrychium simplex* ✓
- Campanula aparinoides* ✓
- Crataegus flabellata* ✓
- Cryptogramma stelleri* ✓
- Cypripedium calceolus* (2 varieties) ✓
- Dicanthelium (Panicum) linearifolium* ✓
- Fraxinus nigra* ✓
- Laportea canadensis* ✓
- Packera (Senecio) pauperculus*
- Polygonum scandens*
- Rhamnus alnifolia*
- Shepherdia canadensis*

*Ecological Reserves*

A review of our files show no known ecological reserves or candidate sites within the study area. Two sites are found nearby - St. Croix River, an IBP site featuring a hardwood forest on gypsum soils; and the Meander River, a small site with rare plants associated with the river intervale.

I have attached an invoice for the staff time spent reviewing our records and compiling this response. If you have any questions, please contact me at 424-6475.

APPENDIX E.3

BIRD SURVEY POST LOCATION DESCRIPTIONS (SURVEYOR: BERNARD FORSYTHE)

**Appendix E.3**  
**Bird Survey Post Location Descriptions (Surveyor: Bernard Forsythe)**

Station No.	Habitat Type	Site Description	Other Observations	GPS Coordinates (NAD 83 UTM)
B1	Wetland	Small beaver flooded area, cattail, sedge and rush around edge, depth >1 m, surrounded by shrubs, dirt access road along east edge; no obvious nesting areas	Time: 5:14 am; 20:53 Weather: clear; cloudy Temperature: 16°C; 18°C Wind speed/ Direction: light west; diminishing west Background Noise: distant highway	20 T 415286 4986668
B2	Coniferous forest; spruce, balsam fir and hemlocks	Near access road, mixedwood	Time: 5:30am Weather: clear Temperature: 16°C Wind speed/ Direction: light west; diminishing west Background Noise:	20 T 414841 4986796
B3	Wetland-Fish Brook Riparian Alders	Fish Brook headwater wetland; alder thicket	Time: 5:55am Weather: clear Temperature: 18°C Wind speed/ Direction: light, west Background Noise:	20 T 414729 4987132
B4	Sinkhole area	Off of Shaw Valley Trail, hemlock area	Time: 6:51am Weather: clear Temperature: 18°C Wind speed/ Direction: light, west Background Noise: some air traffic	20 T 414535 4986217
B5	Hemlock Brook	At trail crossing, shaded alders and mixedwood	Time: 7:21am Weather: clear Temperature: 20°C Wind speed/ Direction: light, west Background Noise: distant highway, some air traffic	20 T 414060 4986023
B6	Cut over area	West of Hemlock Brook	Time: 7:38am Weather: light cloud Temperature: 20°C Wind speed/ Direction: light, west Background Noise: highway	20 T 413870 4985850

**Appendix E.3**  
**Bird Survey Post Location Descriptions (Surveyor: Bernard Forsythe)**

Station No.	Habitat Type	Site Description	Other Observations	GPS Coordinates (NAD 83 UTM)
B7	Mixed wood area	South of Mine Pond, mixed balsam fir, trembling aspen	Time: 8:06am Weather: light cloud Temperature: 20°C Wind speed/ Direction: light, west Background Noise: highway, air traffic	20 T 413829 4986191
B8	Hardwood area	West of mine pond	Time: 8:42am Weather: light cloud Temperature: 22°C Wind speed/ Direction: light, west Background Noise:	20 T 413535 4986518
B9	Agricultural Field	Off Ferry Road, hayfield	Time: 10:35am Weather: clear Temperature: 22°C Wind speed/ Direction: moderate, west Background Noise: field equipment (tractor)	20 T 415405 4986077
B10	Wetland	Cattail marsh, alder thicket	Time: 10:22am Weather: clear Temperature: 16°C Wind speed/ Direction: light, west Background Noise: light highway	20 Y 416139 4987099
B11	Roadside	On-site dirt road	Time: 9:05am Weather: light cloud Temperature: 22°C Wind speed/ Direction: light, west Background Noise:	20 T 414128 4986325
B12	Roadside	On-site dirt road	Time: 9:17am Weather: light cloud Temperature: 22°C Wind speed/ Direction: light, west Background Noise:	20 T 414597 4986732

**Appendix E.3**  
**Bird Survey Post Location Descriptions (Surveyor: Bernard Forsythe)**

Station No.	Habitat Type	Site Description	Other Observations	GPS Coordinates (NAD 83 UTM)
B12b	Roadside	On-site dirt road	Time: 9:27am Weather: light cloud Temperature: 22°C Wind speed/ Direction: light, west Background Noise:	20 T 414646 4986769
B13	Field	Mowed hay	Time: 19:42pm Weather: clear Temperature: 20°C Wind speed/ Direction: strong, west Background Noise: local road traffic	20 T 416308 4987308
B14	Roadside	On-site dirt road	Time: 20:33pm Weather: clear Temperature: 20°C Wind speed/ Direction: strong, west Background Noise:	20 T 415845 4986610
B15	Roadside	On-site dirt road	Time: 21:17pm Weather: cloudy Temperature: 18°C Wind speed/ Direction: light, wes Background Noise:	20 T 414932 4986615
B16	Roadside	On-site dirt road	Time: 21:40pm Weather: cloudy Temperature: 18°C Wind speed/ Direction: light, west Background Noise:	20 T 415303 496405

## APPENDIX F

F.1

TABULATED METEOROLOGICAL DATA - KENTVILLE

Meteorological Data - Kentville  
 Station Name KENTVILLE CDA CS  
 Province NOVA SCOTIA  
 Latitude 45.07  
 Longitude -64.48  
 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/1/2007 0:00	2007	6	1	0:00	7.1	5.8	91	7	4
6/1/2007 1:00	2007	6	1	1:00	6.6	5.4	92	0	0
6/1/2007 2:00	2007	6	1	2:00	6.4	5.4	93	26	4
6/1/2007 3:00	2007	6	1	3:00	6.2	5.4	95	0	0
6/1/2007 4:00	2007	6	1	4:00	5.4	4.7	95	8	2
6/1/2007 5:00	2007	6	1	5:00	7.4	6.8	96	22	6
6/1/2007 6:00	2007	6	1	6:00	8.5	7.8	95	27	2
6/1/2007 7:00	2007	6	1	7:00	11.5	9.2	86	1	4
6/1/2007 8:00	2007	6	1	8:00	12.7	9.8	82	35	2
6/1/2007 9:00	2007	6	1	9:00	15.7	10.7	72	20	9
6/1/2007 10:00	2007	6	1	10:00	17.3	11.4	68	25	9
6/1/2007 11:00	2007	6	1	11:00	18.6	11.4	63	24	11
6/1/2007 12:00	2007	6	1	12:00	17.9	10.3	61	23	13
6/1/2007 13:00	2007	6	1	13:00	15.5	10.3	71	1	7
6/1/2007 14:00	2007	6	1	14:00	15.3	12.6	84	0	0
6/1/2007 15:00	2007	6	1	15:00	15.2	11.9	81	26	11
6/1/2007 16:00	2007	6	1	16:00	14.8	12.5	86	24	7
6/1/2007 17:00	2007	6	1	17:00	14.5	12.9	90	27	4
6/1/2007 18:00	2007	6	1	18:00	14.2	12.1	87	26	9
6/1/2007 19:00	2007	6	1	19:00	13.4	11.7	89	26	9
6/1/2007 20:00	2007	6	1	20:00	12.8	11.4	91	27	7
6/1/2007 21:00	2007	6	1	21:00	12.7	11.5	92	24	6
6/1/2007 22:00	2007	6	1	22:00	12.2	11.3	94	25	9
6/1/2007 23:00	2007	6	1	23:00	11.9	11.1	95	25	9
6/2/2007 0:00	2007	6	2	0:00	12.1	11.4	95	25	7
6/2/2007 1:00	2007	6	2	1:00	12.8	12.2	96	23	9
6/2/2007 2:00	2007	6	2	2:00	13.2	12.6	96	24	6
6/2/2007 3:00	2007	6	2	3:00	12.6	12	96	23	6
6/2/2007 4:00	2007	6	2	4:00	12.4	11.8	96	4	4
6/2/2007 5:00	2007	6	2	5:00	12.1	11.6	97	35	2
6/2/2007 6:00	2007	6	2	6:00	11.8	11.3	97	34	6
6/2/2007 7:00	2007	6	2	7:00	12.4	11.6	95	4	6
6/2/2007 8:00	2007	6	2	8:00	13.9	8.4	69	5	11
6/2/2007 9:00	2007	6	2	9:00	14.9	7.2	60	5	13
6/2/2007 10:00	2007	6	2	10:00	15.5	8	61	4	13
6/2/2007 11:00	2007	6	2	11:00	16.4	6.9	53	4	17
6/2/2007 12:00	2007	6	2	12:00	16.8	5.2	46	5	17
6/2/2007 13:00	2007	6	2	13:00	17.3	5.7	46	5	15
6/2/2007 14:00	2007	6	2	14:00	18.2	5.8	44	5	15
6/2/2007 15:00	2007	6	2	15:00	18.8	4.2	38	6	11
6/2/2007 16:00	2007	6	2	16:00	18.4	3.3	37	5	15
6/2/2007 17:00	2007	6	2	17:00	18.7	4.4	39	4	11
6/2/2007 18:00	2007	6	2	18:00	17.5	3.4	39	5	11
6/2/2007 19:00	2007	6	2	19:00	15	2.5	43	6	9
6/2/2007 20:00	2007	6	2	20:00	13.6	2.1	46	7	4
6/2/2007 21:00	2007	6	2	21:00	13.4	0.9	42	9	7
6/2/2007 22:00	2007	6	2	22:00	12.8	4	55	8	4
6/2/2007 23:00	2007	6	2	23:00	12.8	6.1	64	11	6
6/3/2007 0:00	2007	6	3	0:00	11.6	7.7	77	10	4
6/3/2007 1:00	2007	6	3	1:00	10	6.6	79	13	4
6/3/2007 2:00	2007	6	3	2:00	8.7	6.6	87	4	7
6/3/2007 3:00	2007	6	3	3:00	8	5.7	85	6	6
6/3/2007 4:00	2007	6	3	4:00	7.8	6.1	89	8	4
6/3/2007 5:00	2007	6	3	5:00	7.1	5.5	90	7	6
6/3/2007 6:00	2007	6	3	6:00	7.3	5.2	87	7	6
6/3/2007 7:00	2007	6	3	7:00	8.3	5.4	82	6	9
6/3/2007 8:00	2007	6	3	8:00	10.3	6.1	75	6	7
6/3/2007 9:00	2007	6	3	9:00	13.3	7.7	69	4	11
6/3/2007 10:00	2007	6	3	10:00	15	9	67	3	9
6/3/2007 11:00	2007	6	3	11:00	15.7	7.4	58	4	13



Meteorological Data - Kentville  
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 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/3/2007 12:00	2007	6	3	12:00	16.5	5.6	48	6	11
6/3/2007 13:00	2007	6	3	13:00	17.6	6.1	47	4	15
6/3/2007 14:00	2007	6	3	14:00	18.8	4.8	40	4	13
6/3/2007 15:00	2007	6	3	15:00	19.4	4.6	38	4	13
6/3/2007 16:00	2007	6	3	16:00	20	4.1	35	5	11
6/3/2007 17:00	2007	6	3	17:00	18.5	4.8	40	15	13
6/3/2007 18:00	2007	6	3	18:00	17.1	3.5	40	16	11
6/3/2007 19:00	2007	6	3	19:00	14.7	4.6	51	16	13
6/3/2007 20:00	2007	6	3	20:00	11.7	3.7	58	8	2
6/3/2007 21:00	2007	6	3	21:00	10.1	4.1	66	9	6
6/3/2007 22:00	2007	6	3	22:00	9	4.9	75	9	4
6/3/2007 23:00	2007	6	3	23:00	8	4.1	76	6	4
6/4/2007 0:00	2007	6	4	0:00	7.1	3.8	80	7	4
6/4/2007 1:00	2007	6	4	1:00	7.3	3.2	75	8	6
6/4/2007 2:00	2007	6	4	2:00	7.1	1.8	69	7	6
6/4/2007 3:00	2007	6	4	3:00	7.5	2.2	69	8	6
6/4/2007 4:00	2007	6	4	4:00	7.7	2.4	69	6	6
6/4/2007 7:00	2007	6	4	7:00	8.2	4.3	76	10	6
6/4/2007 8:00	2007	6	4	8:00	8	5.4	84	9	9
6/4/2007 9:00	2007	6	4	9:00	8.8	6.2	84	8	11
6/4/2007 10:00	2007	6	4	10:00	10.1	7.3	83	8	11
6/4/2007 11:00	2007	6	4	11:00	11.6	8.6	82	9	9
6/4/2007 12:00	2007	6	4	12:00	12.6	9.5	81	10	9
6/4/2007 13:00	2007	6	4	13:00	12.1	9.7	85	9	11
6/4/2007 14:00	2007	6	4	14:00	11.8	9.8	88	9	15
6/4/2007 15:00	2007	6	4	15:00	11.6	10.3	92	10	11
6/4/2007 16:00	2007	6	4	16:00	11.6	10.4	92	10	7
6/4/2007 17:00	2007	6	4	17:00	11.5	10.3	92	9	11
6/4/2007 18:00	2007	6	4	18:00	11.4	10.4	94	10	9
6/4/2007 19:00	2007	6	4	19:00	11.5	10.5	94	9	9
6/4/2007 20:00	2007	6	4	20:00	11.6	10.7	94	8	7
6/4/2007 21:00	2007	6	4	21:00	11.9	11.1	95	7	6
6/4/2007 22:00	2007	6	4	22:00	12.2	11.6	96	7	4
6/4/2007 23:00	2007	6	4	23:00	12.6	12.1	97	6	6
6/5/2007 0:00	2007	6	5	0:00	14.4	13.9	97	9	9
6/5/2007 1:00	2007	6	5	1:00	16.4	15.8	96	13	11
6/5/2007 2:00	2007	6	5	2:00	16.8	16	95	13	9
6/5/2007 3:00	2007	6	5	3:00	16.1	15.1	94	14	15
6/5/2007 4:00	2007	6	5	4:00	16.4	15.5	94	15	15
6/5/2007 5:00	2007	6	5	5:00	15.8	14.7	93	17	9
6/5/2007 6:00	2007	6	5	6:00	15.9	14.8	93	18	11
6/5/2007 7:00	2007	6	5	7:00	16.7	15.4	92	20	9
6/5/2007 8:00	2007	6	5	8:00	17.3	15.2	87	22	11
6/5/2007 9:00	2007	6	5	9:00	17.6	15.3	86	22	11
6/5/2007 10:00	2007	6	5	10:00	19.6	16	80	22	15
6/5/2007 11:00	2007	6	5	11:00	20.3	16.2	77	21	19
6/5/2007 12:00	2007	6	5	12:00	22.1	17.2	74	21	19
6/5/2007 13:00	2007	6	5	13:00	23	17.5	71	20	17
6/5/2007 14:00	2007	6	5	14:00	24.3	18.4	70	20	15
6/5/2007 15:00	2007	6	5	15:00	26	17.9	61	20	20
6/5/2007 16:00	2007	6	5	16:00	25.7	19.3	68	19	13
6/5/2007 17:00	2007	6	5	17:00	23.1	19	78	18	13
6/5/2007 18:00	2007	6	5	18:00	20.6	17.5	82	18	17
6/5/2007 19:00	2007	6	5	19:00	18.8	16.5	86	19	7
6/5/2007 20:00	2007	6	5	20:00	17.7	16.1	90	18	9
6/5/2007 21:00	2007	6	5	21:00	16.7	15.4	92	16	4
6/5/2007 22:00	2007	6	5	22:00	16.3	15	92	23	7
6/5/2007 23:00	2007	6	5	23:00	15.9	14.6	92	13	4
6/6/2007 0:00	2007	6	6	0:00	15.4	14	91	30	4
6/6/2007 1:00	2007	6	6	1:00	15.3	14.1	93	20	4

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/6/2007 2:00	2007	6	6	2:00	15.4	14.2	93	18	6
6/6/2007 3:00	2007	6	6	3:00	14.8	13.5	92	19	6
6/6/2007 4:00	2007	6	6	4:00	15	13.9	93	21	7
6/6/2007 5:00	2007	6	6	5:00	14.9	13.8	93	23	9
6/6/2007 6:00	2007	6	6	6:00	15.2	14	93	23	9
6/6/2007 7:00	2007	6	6	7:00	15.8	14.3	91	29	2
6/6/2007 8:00	2007	6	6	8:00	17.9	14.7	82	20	11
6/6/2007 9:00	2007	6	6	9:00	20.4	15.5	73	21	9
6/6/2007 10:00	2007	6	6	10:00	22.5	15.7	65	20	13
6/6/2007 11:00	2007	6	6	11:00	24.4	16.2	60	19	13
6/6/2007 12:00	2007	6	6	12:00	25.7	17.6	61	19	11
6/6/2007 13:00	2007	6	6	13:00	26.5	16.4	54	22	15
6/6/2007 14:00	2007	6	6	14:00	25	15.1	54	21	11
6/6/2007 15:00	2007	6	6	15:00	26.2	14.2	48	19	15
6/6/2007 16:00	2007	6	6	16:00	23.2	15.2	61	1	9
6/6/2007 17:00	2007	6	6	17:00	20.5	13.9	66	32	9
6/6/2007 18:00	2007	6	6	18:00	17.8	11.4	66	33	11
6/6/2007 19:00	2007	6	6	19:00	15.5	10.7	73	36	4
6/6/2007 20:00	2007	6	6	20:00	14.3	9.6	73	28	6
6/6/2007 21:00	2007	6	6	21:00	13.9	10.2	78	27	6
6/6/2007 22:00	2007	6	6	22:00	13.5	10.8	84	25	7
6/6/2007 23:00	2007	6	6	23:00	12.8	11.5	92	28	6
6/7/2007 0:00	2007	6	7	0:00	12.9	12	94	24	7
6/7/2007 1:00	2007	6	7	1:00	13	12.2	95	29	6
6/7/2007 2:00	2007	6	7	2:00	12.2	11.4	95	34	9
6/7/2007 3:00	2007	6	7	3:00	11.4	10	91	30	11
6/7/2007 4:00	2007	6	7	4:00	11	9.5	90	27	7
6/7/2007 5:00	2007	6	7	5:00	10.7	9.3	91	26	7
6/7/2007 6:00	2007	6	7	6:00	10.6	9.1	90	25	11
6/7/2007 7:00	2007	6	7	7:00	10.5	8.5	87	26	13
6/7/2007 8:00	2007	6	7	8:00	10.9	8.7	86	30	7
6/7/2007 9:00	2007	6	7	9:00	11.2	8.2	82	28	9
6/7/2007 10:00	2007	6	7	10:00	13.1	7.7	70	29	15
6/7/2007 11:00	2007	6	7	11:00	13.1	6.5	64	27	17
6/7/2007 12:00	2007	6	7	12:00	14.5	6.8	60	28	15
6/7/2007 13:00	2007	6	7	13:00	15.3	5.9	53	28	19
6/7/2007 14:00	2007	6	7	14:00	15.9	6.7	54	28	13
6/7/2007 15:00	2007	6	7	15:00	16.5	6.4	51	29	13
6/7/2007 16:00	2007	6	7	16:00	17.7	7.1	50	29	9
6/7/2007 17:00	2007	6	7	17:00	18.8	5.6	42	31	7
6/7/2007 18:00	2007	6	7	18:00	18.5	7	47	27	7
6/7/2007 19:00	2007	6	7	19:00	17.6	7.2	50	23	6
6/7/2007 20:00	2007	6	7	20:00	13.4	8.5	72	18	7
6/7/2007 21:00	2007	6	7	21:00	10.9	8.1	83	20	2
6/7/2007 22:00	2007	6	7	22:00	9.5	7.4	87	21	9
6/7/2007 23:00	2007	6	7	23:00	8.5	6.9	90	20	6
6/8/2007 0:00	2007	6	8	0:00	7.8	6.5	91	20	6
6/8/2007 1:00	2007	6	8	1:00	6.9	5.6	91	11	2
6/8/2007 2:00	2007	6	8	2:00	6.5	5.7	95	19	7
6/8/2007 3:00	2007	6	8	3:00	6.2	5.4	95	20	7
6/8/2007 4:00	2007	6	8	4:00	5.5	4.6	94	19	6
6/8/2007 5:00	2007	6	8	5:00	5.3	4.4	94	20	4
6/8/2007 6:00	2007	6	8	6:00	8.6	7.3	92	22	4
6/8/2007 7:00	2007	6	8	7:00	12.8	9.2	79	32	4
6/8/2007 8:00	2007	6	8	8:00	16.6	6.9	53	4	6
6/8/2007 9:00	2007	6	8	9:00	17.6	5.8	46	36	9
6/8/2007 10:00	2007	6	8	10:00	18.8	4.3	38	35	11
6/8/2007 11:00	2007	6	8	11:00	19	5.4	41	34	13
6/8/2007 12:00	2007	6	8	12:00	19.9	4.1	35	2	9
6/8/2007 13:00	2007	6	8	13:00	21	4.5	34	1	13

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/8/2007 14:00	2007	6	8	14:00	21.6	5.5	35	4	11
6/8/2007 15:00	2007	6	8	15:00	22	6.2	36	1	6
6/8/2007 16:00	2007	6	8	16:00	22.5	7.1	37	35	6
6/8/2007 17:00	2007	6	8	17:00	22.4	6.2	35	6	6
6/8/2007 18:00	2007	6	8	18:00	21.5	5.4	35	3	9
6/8/2007 19:00	2007	6	8	19:00	20.9	7.6	42	5	6
6/8/2007 20:00	2007	6	8	20:00	17.1	7.8	54	6	6
6/8/2007 21:00	2007	6	8	21:00	13.1	8.9	76	18	7
6/8/2007 22:00	2007	6	8	22:00	11.1	8.1	82	20	4
6/8/2007 23:00	2007	6	8	23:00	10	7.5	84	13	2
6/9/2007 0:00	2007	6	9	0:00	9.5	7.2	86	22	2
6/9/2007 1:00	2007	6	9	1:00	9.3	6.9	85	16	7
6/9/2007 2:00	2007	6	9	2:00	8.6	6.6	87	17	6
6/9/2007 3:00	2007	6	9	3:00	8.3	6.6	89	21	6
6/9/2007 4:00	2007	6	9	4:00	7.3	5.8	90	0	0
6/9/2007 5:00	2007	6	9	5:00	7.3	6.1	92	10	4
6/9/2007 6:00	2007	6	9	6:00	11.1	8.1	82	36	4
6/9/2007 7:00	2007	6	9	7:00	14.1	9.6	74	4	6
6/9/2007 8:00	2007	6	9	8:00	16.4	10.6	69	6	6
6/9/2007 9:00	2007	6	9	9:00	18.9	12.4	66	9	6
6/9/2007 10:00	2007	6	9	10:00	18.9	12.6	67	5	11
6/9/2007 11:00	2007	6	9	11:00	20.9	14.6	67	4	11
6/9/2007 12:00	2007	6	9	12:00	21.1	14.6	66	7	11
6/9/2007 13:00	2007	6	9	13:00	22.9	15.2	62	5	11
6/9/2007 14:00	2007	6	9	14:00	24.6	11.5	44	11	11
6/9/2007 15:00	2007	6	9	15:00	25.2	9.6	37	12	9
6/9/2007 16:00	2007	6	9	16:00	24.3	7.7	35	15	11
6/9/2007 17:00	2007	6	9	17:00	24.1	7.8	35	14	9
6/9/2007 18:00	2007	6	9	18:00	23.2	8.8	40	15	7
6/9/2007 19:00	2007	6	9	19:00	22.2	11	49	15	6
6/9/2007 20:00	2007	6	9	20:00	19.2	11.7	62	13	2
6/9/2007 21:00	2007	6	9	21:00	16.7	12.2	75	17	4
6/9/2007 22:00	2007	6	9	22:00	14.3	11.5	83	26	2
6/9/2007 23:00	2007	6	9	23:00	14.2	11.6	84	30	2
6/10/2007 0:00	2007	6	10	0:00	13.1	11.4	89	16	7
6/10/2007 1:00	2007	6	10	1:00	12	10.6	91	13	4
6/10/2007 2:00	2007	6	10	2:00	11.3	10.3	94	17	4
6/10/2007 3:00	2007	6	10	3:00	11.5	10.5	94	14	2
6/10/2007 4:00	2007	6	10	4:00	10.6	9.7	94	13	4
6/10/2007 5:00	2007	6	10	5:00	11.2	10.5	95	0	0
6/10/2007 6:00	2007	6	10	6:00	13.4	12.7	96	9	2
6/10/2007 7:00	2007	6	10	7:00	14.9	12.7	87	4	7
6/10/2007 8:00	2007	6	10	8:00	16.8	14	84	3	7
6/10/2007 9:00	2007	6	10	9:00	18.2	15.5	84	3	7
6/10/2007 10:00	2007	6	10	10:00	20.3	15.8	75	5	7
6/10/2007 11:00	2007	6	10	11:00	20.9	16.2	74	3	13
6/10/2007 12:00	2007	6	10	12:00	21.9	16.2	70	4	11
6/10/2007 13:00	2007	6	10	13:00	22.2	17.8	76	4	17
6/10/2007 14:00	2007	6	10	14:00	22	16.8	72	4	15
6/10/2007 15:00	2007	6	10	15:00	21.4	18.5	84	6	9
6/10/2007 16:00	2007	6	10	16:00	22.2	17.9	77	5	9
6/10/2007 17:00	2007	6	10	17:00	23	17.7	72	6	11
6/10/2007 18:00	2007	6	10	18:00	21.1	17.2	78	6	6
6/10/2007 19:00	2007	6	10	19:00	20.8	16.7	77	6	13
6/10/2007 20:00	2007	6	10	20:00	17.5	14.5	83	7	9
6/10/2007 21:00	2007	6	10	21:00	17.1	14.5	85	8	4
6/10/2007 22:00	2007	6	10	22:00	17.2	14.9	86	2	4
6/10/2007 23:00	2007	6	10	23:00	16.9	14.6	86	5	6
6/11/2007 0:00	2007	6	11	0:00	16.7	14.5	87	7	6
6/11/2007 1:00	2007	6	11	1:00	15.8	13.9	88	9	4

Meteorological Data - Kentville  
 Station Name KENTVILLE CDA CS  
 Province NOVA SCOTIA  
 Latitude 45.07  
 Longitude -64.48  
 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/11/2007 2:00	2007	6	11	2:00	17.1	15.4	90	6	6
6/11/2007 3:00	2007	6	11	3:00	17.3	15.3	88	6	7
6/11/2007 4:00	2007	6	11	4:00	16.8	15.1	90	6	6
6/11/2007 5:00	2007	6	11	5:00	16.6	15.5	93	6	7
6/11/2007 6:00	2007	6	11	6:00	16.5	15.7	95	6	9
6/11/2007 7:00	2007	6	11	7:00	15.9	15.1	95	5	9
6/11/2007 8:00	2007	6	11	8:00	15.9	15.1	95	5	6
6/11/2007 9:00	2007	6	11	9:00	16	15.2	95	6	9
6/11/2007 10:00	2007	6	11	10:00	15.3	14.5	95	8	7
6/11/2007 11:00	2007	6	11	11:00	15.3	14.6	96	6	9
6/11/2007 12:00	2007	6	11	12:00	16.8	16.1	96	5	11
6/11/2007 13:00	2007	6	11	13:00	17.4	16.1	92	4	15
6/11/2007 14:00	2007	6	11	14:00	16.6	15.8	95	5	7
6/11/2007 15:00	2007	6	11	15:00	17.2	16.6	96	2	11
6/11/2007 16:00	2007	6	11	16:00	17.1	16.5	96	8	6
6/11/2007 17:00	2007	6	11	17:00	16.3	15.6	96	9	7
6/11/2007 18:00	2007	6	11	18:00	15.9	15	94	10	7
6/11/2007 19:00	2007	6	11	19:00	15.2	14.3	94	9	6
6/11/2007 20:00	2007	6	11	20:00	14.6	13.6	94	8	6
6/11/2007 21:00	2007	6	11	21:00	14	13	94	7	6
6/11/2007 22:00	2007	6	11	22:00	13.6	12.7	94	10	7
6/11/2007 23:00	2007	6	11	23:00	13.9	13.1	95	8	4
6/12/2007 0:00	2007	6	12	0:00	13.8	13.1	96	7	4
6/12/2007 1:00	2007	6	12	1:00	13.9	13.3	96	7	6
6/12/2007 2:00	2007	6	12	2:00	13.8	13.2	96	8	4
6/12/2007 3:00	2007	6	12	3:00	13.9	13.2	96	10	2
6/12/2007 4:00	2007	6	12	4:00	13.8	13.2	96	5	4
6/12/2007 5:00	2007	6	12	5:00	13.8	13.2	96	6	6
6/12/2007 6:00	2007	6	12	6:00	13.5	12.8	96	8	6
6/12/2007 7:00	2007	6	12	7:00	13.8	13.1	96	8	4
6/12/2007 8:00	2007	6	12	8:00	14.6	13.7	94	7	7
6/12/2007 9:00	2007	6	12	9:00	15.1	13.9	93	8	4
6/12/2007 10:00	2007	6	12	10:00	15.6	14.3	92	5	6
6/12/2007 11:00	2007	6	12	11:00	16.2	14.7	91	6	9
6/12/2007 12:00	2007	6	12	12:00	15.7	14.2	91	7	6
6/12/2007 13:00	2007	6	12	13:00	15.7	14.6	93	5	9
6/12/2007 14:00	2007	6	12	14:00	15.8	14.8	94	6	9
6/12/2007 15:00	2007	6	12	15:00	14.9	14.1	95	4	7
6/12/2007 16:00	2007	6	12	16:00	15.2	14.1	93	4	9
6/12/2007 17:00	2007	6	12	17:00	14.9	13.6	92	3	11
6/12/2007 18:00	2007	6	12	18:00	14.1	12.9	92	4	7
6/12/2007 19:00	2007	6	12	19:00	13.9	12.5	91	5	9
6/12/2007 20:00	2007	6	12	20:00	13.1	11	87	5	13
6/12/2007 21:00	2007	6	12	21:00	12.4	10.4	88	5	7
6/12/2007 22:00	2007	6	12	22:00	11.9	10.2	89	6	7
6/12/2007 23:00	2007	6	12	23:00	11.9	10.2	89	5	7
6/13/2007 0:00	2007	6	13	0:00	11.5	8.8	83	7	9
6/13/2007 1:00	2007	6	13	1:00	10.7	8.2	85	8	9
6/13/2007 2:00	2007	6	13	2:00	10.4	8.1	86	7	7
6/13/2007 3:00	2007	6	13	3:00	10.4	7.6	83	5	11
6/13/2007 4:00	2007	6	13	4:00	10	7.6	85	8	6
6/13/2007 5:00	2007	6	13	5:00	9.4	7.5	88	6	7
6/13/2007 6:00	2007	6	13	6:00	9.9	8	88	6	7
6/13/2007 7:00	2007	6	13	7:00	10.3	8	86	5	11
6/13/2007 8:00	2007	6	13	8:00	11	8.6	85	4	11
6/13/2007 9:00	2007	6	13	9:00	11.4	8.6	83	4	11
6/13/2007 10:00	2007	6	13	10:00	13	8.9	76	4	17
6/13/2007 11:00	2007	6	13	11:00	13.4	9.4	77	4	15
6/13/2007 12:00	2007	6	13	12:00	14.1	9.8	75	5	13
6/13/2007 13:00	2007	6	13	13:00	15.5	10.1	70	4	17

Meteorological Data - Kentville  
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 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/13/2007 14:00	2007	6	13	14:00	15.4	10.1	71	4	17
6/13/2007 15:00	2007	6	13	15:00	15.5	10.2	71	5	15
6/13/2007 16:00	2007	6	13	16:00	15.4	10.4	72	4	15
6/13/2007 17:00	2007	6	13	17:00	14.8	10.1	73	5	11
6/13/2007 18:00	2007	6	13	18:00	14.7	9.8	72	5	9
6/13/2007 19:00	2007	6	13	19:00	14.1	10.1	77	4	9
6/13/2007 20:00	2007	6	13	20:00	13.7	10.3	80	7	6
6/13/2007 21:00	2007	6	13	21:00	13.3	10.4	83	5	4
6/13/2007 22:00	2007	6	13	22:00	12.6	10.2	85	5	7
6/13/2007 23:00	2007	6	13	23:00	12.1	9.6	85	5	7
6/14/2007 0:00	2007	6	14	0:00	11.8	9	83	5	9
6/14/2007 1:00	2007	6	14	1:00	11.4	8.8	84	6	7
6/14/2007 2:00	2007	6	14	2:00	10.8	9	89	8	7
6/14/2007 3:00	2007	6	14	3:00	10.1	7.3	83	7	9
6/14/2007 4:00	2007	6	14	4:00	9.6	6.7	82	7	11
6/14/2007 5:00	2007	6	14	5:00	9.4	6.6	83	8	9
6/14/2007 6:00	2007	6	14	6:00	9.2	7	86	6	9
6/14/2007 7:00	2007	6	14	7:00	9.5	7.8	89	6	7
6/14/2007 8:00	2007	6	14	8:00	9.5	8.5	93	5	7
6/14/2007 9:00	2007	6	14	9:00	10.1	9	93	6	7
6/14/2007 10:00	2007	6	14	10:00	10.9	9.5	91	5	7
6/14/2007 11:00	2007	6	14	11:00	11.7	9.3	85	5	11
6/14/2007 12:00	2007	6	14	12:00	12.3	9.4	82	4	11
6/14/2007 13:00	2007	6	14	13:00	13.4	9.1	75	6	9
6/14/2007 14:00	2007	6	14	14:00	14.4	9.2	71	5	9
6/14/2007 15:00	2007	6	14	15:00	16.2	10.8	70	7	7
6/14/2007 16:00	2007	6	14	16:00	17.1	10.6	66	4	15
6/14/2007 17:00	2007	6	14	17:00	17.3	11	66	3	11
6/14/2007 18:00	2007	6	14	18:00	17.1	10.8	66	6	7
6/14/2007 19:00	2007	6	14	19:00	16.2	11	71	5	7
6/14/2007 20:00	2007	6	14	20:00	14.3	10.5	78	6	6
6/14/2007 21:00	2007	6	14	21:00	11.7	9.9	89	8	4
6/14/2007 22:00	2007	6	14	22:00	9.9	8.8	93	8	2
6/14/2007 23:00	2007	6	14	23:00	9.2	8.3	94	11	2
6/15/2007 0:00	2007	6	15	0:00	8.2	7.4	95	15	2
6/15/2007 1:00	2007	6	15	1:00	8.2	7.3	94	16	2
6/15/2007 2:00	2007	6	15	2:00	6.9	6.1	95	16	2
6/15/2007 3:00	2007	6	15	3:00	6.5	5.9	96	17	4
6/15/2007 4:00	2007	6	15	4:00	5.7	5.1	96	15	2
6/15/2007 5:00	2007	6	15	5:00	5.8	5.3	97	12	2
6/15/2007 6:00	2007	6	15	6:00	7.6	7.1	97	0	0
6/15/2007 7:00	2007	6	15	7:00	8.2	7.6	96	6	6
6/15/2007 8:00	2007	6	15	8:00	10.3	9.2	93	36	6
6/15/2007 9:00	2007	6	15	9:00	12.4	9.8	84	2	9
6/15/2007 10:00	2007	6	15	10:00	13.9	10.4	79	4	9
6/15/2007 11:00	2007	6	15	11:00	14.5	11	79	4	11
6/15/2007 12:00	2007	6	15	12:00	15.7	11.6	77	5	7
6/15/2007 13:00	2007	6	15	13:00	17.6	12.7	73	3	7
6/15/2007 14:00	2007	6	15	14:00	20.4	13.7	65	4	11
6/15/2007 15:00	2007	6	15	15:00	22.1	13.1	57	3	11
6/15/2007 16:00	2007	6	15	16:00	22.7	13.9	58	5	11
6/15/2007 17:00	2007	6	15	17:00	21.5	12	55	8	11
6/15/2007 18:00	2007	6	15	18:00	21.4	12.5	57	5	7
6/15/2007 19:00	2007	6	15	19:00	20.8	13.2	62	6	6
6/15/2007 20:00	2007	6	15	20:00	19.1	14.1	73	14	4
6/15/2007 21:00	2007	6	15	21:00	17	13.6	80	20	4
6/15/2007 22:00	2007	6	15	22:00	16.7	13.4	81	16	6
6/16/2007 0:00	2007	6	16	0:00	15.7	13.3	86	9	2
6/16/2007 1:00	2007	6	16	1:00	15.3	13.4	88	9	6
6/16/2007 2:00	2007	6	16	2:00	15	13.2	89	9	4

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All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/16/2007 3:00	2007	6	16	3:00	14.6	13	90	6	4
6/16/2007 4:00	2007	6	16	4:00	14.3	12.9	91	5	6
6/16/2007 5:00	2007	6	16	5:00	13.8	12.8	94	6	6
6/16/2007 6:00	2007	6	16	6:00	13.7	12.9	95	5	6
6/16/2007 7:00	2007	6	16	7:00	14.5	13.5	94	4	7
6/16/2007 8:00	2007	6	16	8:00	15.1	13.3	89	8	7
6/16/2007 9:00	2007	6	16	9:00	16.7	14.5	87	6	7
6/16/2007 10:00	2007	6	16	10:00	18.6	15.6	83	6	7
6/16/2007 11:00	2007	6	16	11:00	19.9	16.3	80	6	11
6/16/2007 12:00	2007	6	16	12:00	20.5	16.2	76	6	7
6/16/2007 13:00	2007	6	16	13:00	20.7	16.8	78	9	2
6/16/2007 14:00	2007	6	16	14:00	23.1	18.2	74	15	7
6/16/2007 15:00	2007	6	16	15:00	23.8	17.6	68	14	9
6/16/2007 16:00	2007	6	16	16:00	24	17.4	67	15	9
6/16/2007 17:00	2007	6	16	17:00	23	17	69	15	11
6/16/2007 18:00	2007	6	16	18:00	21.4	16.9	76	14	6
6/16/2007 19:00	2007	6	16	19:00	19.5	16.2	81	16	7
6/16/2007 20:00	2007	6	16	20:00	17.9	15.6	86	16	9
6/16/2007 21:00	2007	6	16	21:00	17.2	15.5	90	23	6
6/16/2007 22:00	2007	6	16	22:00	16.2	14.6	90	22	7
6/16/2007 23:00	2007	6	16	23:00	15.2	13.7	91	21	9
6/17/2007 0:00	2007	6	17	0:00	14.6	13	90	22	6
6/17/2007 1:00	2007	6	17	1:00	14.7	13.1	90	27	6
6/17/2007 2:00	2007	6	17	2:00	14.7	13	90	16	2
6/17/2007 3:00	2007	6	17	3:00	14	12.6	91	20	6
6/17/2007 4:00	2007	6	17	4:00	13.8	12.6	92	15	2
6/17/2007 5:00	2007	6	17	5:00	13.2	12.3	94	4	4
6/17/2007 6:00	2007	6	17	6:00	12.8	12.1	96	7	2
6/17/2007 7:00	2007	6	17	7:00	14	13.4	96	4	2
6/17/2007 8:00	2007	6	17	8:00	15.2	14	93	32	4
6/17/2007 9:00	2007	6	17	9:00	16.5	14.5	88	23	6
6/17/2007 10:00	2007	6	17	10:00	19.6	15.7	78	22	7
6/17/2007 11:00	2007	6	17	11:00	21.6	15.8	70	19	9
6/17/2007 12:00	2007	6	17	12:00	23.9	16.3	62	22	11
6/17/2007 13:00	2007	6	17	13:00	22	16.5	71	4	7
6/17/2007 14:00	2007	6	17	14:00	21.3	16.1	72	6	7
6/17/2007 15:00	2007	6	17	15:00	25.9	14.5	49	21	11
6/17/2007 16:00	2007	6	17	16:00	24.2	14.3	54	21	13
6/17/2007 17:00	2007	6	17	17:00	24.2	15.4	58	22	7
6/17/2007 18:00	2007	6	17	18:00	21.6	15.3	67	2	6
6/17/2007 19:00	2007	6	17	19:00	19	14	73	5	6
6/17/2007 20:00	2007	6	17	20:00	17.1	13.4	79	34	4
6/17/2007 21:00	2007	6	17	21:00	15.1	11.4	79	32	9
6/17/2007 22:00	2007	6	17	22:00	13.7	11.9	89	6	4
6/17/2007 23:00	2007	6	17	23:00	13.5	12.2	92	26	2
6/18/2007 0:00	2007	6	18	0:00	13.8	12.8	94	32	7
6/18/2007 1:00	2007	6	18	1:00	13.3	12.4	94	25	11
6/18/2007 2:00	2007	6	18	2:00	12.7	11.9	95	24	9
6/18/2007 3:00	2007	6	18	3:00	13.1	12.4	96	26	6
6/18/2007 4:00	2007	6	18	4:00	13.4	12.7	96	23	9
6/18/2007 5:00	2007	6	18	5:00	14.1	13.4	96	25	4
6/18/2007 6:00	2007	6	18	6:00	15.2	13.9	92	31	7
6/18/2007 7:00	2007	6	18	7:00	16.1	13.9	87	31	11
6/18/2007 8:00	2007	6	18	8:00	14.8	12	83	34	15
6/18/2007 9:00	2007	6	18	9:00	14.7	11.4	81	33	19
6/18/2007 10:00	2007	6	18	10:00	14.1	11.5	84	34	15
6/18/2007 11:00	2007	6	18	11:00	14.5	11.6	83	33	13
6/18/2007 12:00	2007	6	18	12:00	15	11.2	78	35	15
6/18/2007 13:00	2007	6	18	13:00	15.6	11.2	75	35	13
6/18/2007 14:00	2007	6	18	14:00	17.5	11.9	70	1	15

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All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/18/2007 15:00	2007	6	18	15:00	18.6	12.1	66	36	15
6/18/2007 16:00	2007	6	18	16:00	19.4	12.3	63	2	11
6/18/2007 17:00	2007	6	18	17:00	19.8	12.1	61	4	11
6/18/2007 18:00	2007	6	18	18:00	18.6	10.2	58	35	17
6/18/2007 19:00	2007	6	18	19:00	15.6	10.9	74	5	11
6/18/2007 20:00	2007	6	18	20:00	13.2	9	76	4	11
6/18/2007 21:00	2007	6	18	21:00	12.3	8.2	76	1	6
6/18/2007 22:00	2007	6	18	22:00	10.1	7.8	86	29	4
6/18/2007 23:00	2007	6	18	23:00	10	7.8	86	27	2
6/19/2007 0:00	2007	6	19	0:00	10.7	7.6	81	31	7
6/19/2007 1:00	2007	6	19	1:00	10.8	7.6	81	33	7
6/19/2007 2:00	2007	6	19	2:00	11.2	8	81	32	7
6/19/2007 3:00	2007	6	19	3:00	11	8.2	83	34	11
6/19/2007 4:00	2007	6	19	4:00	10.8	8.5	86	35	11
6/19/2007 5:00	2007	6	19	5:00	10.7	8.6	87	34	9
6/19/2007 6:00	2007	6	19	6:00	10.9	8.8	87	3	4
6/19/2007 7:00	2007	6	19	7:00	11.7	9.2	85	33	9
6/19/2007 8:00	2007	6	19	8:00	11.3	8.7	84	32	13
6/19/2007 9:00	2007	6	19	9:00	12.3	9.1	81	35	17
6/19/2007 10:00	2007	6	19	10:00	14.1	9.6	74	36	17
6/19/2007 11:00	2007	6	19	11:00	15.8	10.6	71	34	11
6/19/2007 12:00	2007	6	19	12:00	17.7	11.4	67	35	19
6/19/2007 13:00	2007	6	19	13:00	19.2	9.7	54	35	17
6/19/2007 14:00	2007	6	19	14:00	20.2	8.4	47	35	17
6/19/2007 15:00	2007	6	19	15:00	19.7	7.1	44	34	19
6/19/2007 16:00	2007	6	19	16:00	18.9	6.8	45	35	17
6/19/2007 17:00	2007	6	19	17:00	18.5	7.7	49	35	13
6/19/2007 18:00	2007	6	19	18:00	17.4	5.7	46	34	11
6/19/2007 19:00	2007	6	19	19:00	16.6	4.8	46	35	9
6/19/2007 20:00	2007	6	19	20:00	14.1	6.1	59	29	2
6/19/2007 21:00	2007	6	19	21:00	10.4	6.6	77	23	2
6/19/2007 22:00	2007	6	19	22:00	9.4	6.8	84	11	4
6/19/2007 23:00	2007	6	19	23:00	8.7	7	89	20	4
6/20/2007 0:00	2007	6	20	0:00	7.6	6.3	91	27	2
6/20/2007 1:00	2007	6	20	1:00	7.6	6.5	93	17	4
6/20/2007 2:00	2007	6	20	2:00	6.9	5.7	92	19	6
6/20/2007 3:00	2007	6	20	3:00	6.6	5.6	93	22	11
6/20/2007 4:00	2007	6	20	4:00	6.2	4.8	91	10	2
6/20/2007 5:00	2007	6	20	5:00	5.7	4.8	94	19	4
6/20/2007 6:00	2007	6	20	6:00	8.3	7	92	24	2
6/20/2007 7:00	2007	6	20	7:00	11.7	8.5	81	36	2
6/20/2007 8:00	2007	6	20	8:00	14.5	10.3	76	2	6
6/20/2007 9:00	2007	6	20	9:00	16.9	10.7	67	3	6
6/20/2007 10:00	2007	6	20	10:00	19.7	12.2	62	27	2
6/20/2007 11:00	2007	6	20	11:00	21.8	11.5	52	5	6
6/20/2007 12:00	2007	6	20	12:00	22.9	11	47	5	6
6/20/2007 13:00	2007	6	20	13:00	23.1	12.4	51	4	13
6/20/2007 14:00	2007	6	20	14:00	23.1	11.5	48	5	13
6/20/2007 15:00	2007	6	20	15:00	23.6	9	39	6	9
6/20/2007 16:00	2007	6	20	16:00	23.3	7.8	37	3	7
6/20/2007 17:00	2007	6	20	17:00	22	8.5	42	3	7
6/20/2007 18:00	2007	6	20	18:00	22	9.5	45	21	7
6/20/2007 19:00	2007	6	20	19:00	21.4	11.1	52	21	4
6/20/2007 20:00	2007	6	20	20:00	19.5	10.7	57	21	6
6/20/2007 21:00	2007	6	20	21:00	17.8	10.1	61	24	6
6/20/2007 22:00	2007	6	20	22:00	16.2	7.9	58	23	6
6/20/2007 23:00	2007	6	20	23:00	16.1	11.2	73	30	4
6/21/2007 0:00	2007	6	21	0:00	15.9	12.2	79	26	4
6/21/2007 1:00	2007	6	21	1:00	14.8	12.5	86	19	4
6/21/2007 2:00	2007	6	21	2:00	14.4	12.5	88	20	4

Meteorological Data - Kentville  
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 Province NOVA SCOTIA  
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 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/21/2007 3:00	2007	6	21	3:00	13.8	12.3	91	36	6
6/21/2007 4:00	2007	6	21	4:00	13.2	12.2	94	35	2
6/21/2007 5:00	2007	6	21	5:00	13.2	12.3	94	1	4
6/21/2007 6:00	2007	6	21	6:00	12.7	12	96	35	4
6/21/2007 7:00	2007	6	21	7:00	13.1	12.4	96	33	2
6/21/2007 8:00	2007	6	21	8:00	13	12.3	96	2	4
6/21/2007 9:00	2007	6	21	9:00	13.5	12.5	94	28	6
6/21/2007 10:00	2007	6	21	10:00	15	13.8	93	28	6
6/21/2007 11:00	2007	6	21	11:00	15.5	13.9	90	28	7
6/21/2007 12:00	2007	6	21	12:00	17.7	14.8	83	31	7
6/21/2007 13:00	2007	6	21	13:00	17.2	14.6	85	32	11
6/21/2007 14:00	2007	6	21	14:00	17.6	14.6	83	33	6
6/21/2007 15:00	2007	6	21	15:00	16.8	14.6	87	28	7
6/21/2007 16:00	2007	6	21	16:00	17.3	15.1	87	30	4
6/21/2007 17:00	2007	6	21	17:00	17.8	15.2	85	32	4
6/21/2007 18:00	2007	6	21	18:00	17.3	14.8	85	28	9
6/21/2007 19:00	2007	6	21	19:00	17.8	14.9	83	28	6
6/21/2007 20:00	2007	6	21	20:00	16.9	14.5	86	31	6
6/21/2007 21:00	2007	6	21	21:00	15.9	14.2	90	27	6
6/21/2007 22:00	2007	6	21	22:00	15.4	14	91	0	0
6/21/2007 23:00	2007	6	21	23:00	15.4	14.1	92	30	4
6/22/2007 0:00	2007	6	22	0:00	15.1	13.8	92	23	2
6/22/2007 1:00	2007	6	22	1:00	14.5	13.6	94	17	2
6/22/2007 2:00	2007	6	22	2:00	14.3	13.6	96	21	6
6/22/2007 3:00	2007	6	22	3:00	13.9	13.1	95	22	2
6/22/2007 4:00	2007	6	22	4:00	12.8	12.1	96	24	4
6/22/2007 5:00	2007	6	22	5:00	12.3	11.7	96	0	0
6/22/2007 6:00	2007	6	22	6:00	12.7	12.1	96	18	6
6/22/2007 7:00	2007	6	22	7:00	13.8	13.2	96	0	0
6/22/2007 8:00	2007	6	22	8:00	15.3	13.9	91	16	2
6/22/2007 9:00	2007	6	22	9:00	17.3	14.2	82	2	4
6/22/2007 10:00	2007	6	22	10:00	17.3	14.2	82	5	6
6/22/2007 11:00	2007	6	22	11:00	20	15.3	74	3	7
6/22/2007 12:00	2007	6	22	12:00	14.6	12.5	87	17	6
6/22/2007 13:00	2007	6	22	13:00	14.6	13.3	92	2	4
6/22/2007 14:00	2007	6	22	14:00	16.7	14.9	89	5	6
6/22/2007 15:00	2007	6	22	15:00	15.8	12.1	79	22	7
6/22/2007 16:00	2007	6	22	16:00	14.6	12	84	26	7
6/22/2007 17:00	2007	6	22	17:00	16.1	13.4	84	23	4
6/22/2007 18:00	2007	6	22	18:00	17.9	12.5	71	28	4
6/22/2007 19:00	2007	6	22	19:00	16.9	14	83	18	2
6/22/2007 20:00	2007	6	22	20:00	14.3	13	92	10	4
6/22/2007 21:00	2007	6	22	21:00	14.3	13.2	93	30	6
6/22/2007 22:00	2007	6	22	22:00	13.6	12.1	91	23	4
6/22/2007 23:00	2007	6	22	23:00	12.4	11.3	93	26	2
6/23/2007 0:00	2007	6	23	0:00	11.4	10.7	95	24	6
6/23/2007 1:00	2007	6	23	1:00	10.8	10.1	95	23	4
6/23/2007 2:00	2007	6	23	2:00	10.8	10.2	96	20	2
6/23/2007 3:00	2007	6	23	3:00	11.1	10.5	96	0	0
6/23/2007 4:00	2007	6	23	4:00	12.4	11.8	96	24	4
6/23/2007 5:00	2007	6	23	5:00	12.7	12	96	25	7
6/23/2007 6:00	2007	6	23	6:00	13	12.3	96	25	7
6/23/2007 7:00	2007	6	23	7:00	13.1	12.2	94	25	11
6/23/2007 8:00	2007	6	23	8:00	13.1	12.1	94	25	7
6/23/2007 9:00	2007	6	23	9:00	13.1	11.9	92	25	9
6/23/2007 10:00	2007	6	23	10:00	13.3	12	92	25	13
6/23/2007 11:00	2007	6	23	11:00	14.9	12.3	84	26	13
6/23/2007 12:00	2007	6	23	12:00	15.6	12.4	81	27	13
6/23/2007 13:00	2007	6	23	13:00	16.8	12.6	76	27	11
6/23/2007 14:00	2007	6	23	14:00	17.2	12.9	76	29	13



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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/23/2007 15:00	2007	6	23	15:00	16.8	12.3	75	27	19
6/23/2007 16:00	2007	6	23	16:00	17.3	12.5	73	25	13
6/23/2007 17:00	2007	6	23	17:00	16.7	12	74	27	13
6/23/2007 18:00	2007	6	23	18:00	16.5	11.5	72	26	13
6/23/2007 19:00	2007	6	23	19:00	15	11.2	78	26	11
6/23/2007 20:00	2007	6	23	20:00	14	11	82	25	6
6/23/2007 21:00	2007	6	23	21:00	13.9	11	83	26	11
6/23/2007 22:00	2007	6	23	22:00	13.8	10.9	83	25	6
6/23/2007 23:00	2007	6	23	23:00	13.7	11.4	86	25	11
6/24/2007 0:00	2007	6	24	0:00	14	12	88	25	9
6/24/2007 1:00	2007	6	24	1:00	14.1	12.3	89	25	13
6/24/2007 2:00	2007	6	24	2:00	13.7	12.4	92	25	11
6/24/2007 3:00	2007	6	24	3:00	13.7	12.4	92	25	9
6/24/2007 4:00	2007	6	24	4:00	13.9	12.2	89	24	9
6/24/2007 5:00	2007	6	24	5:00	13.8	11.9	88	24	11
6/24/2007 6:00	2007	6	24	6:00	14	11.8	87	24	13
6/24/2007 7:00	2007	6	24	7:00	15	12.2	83	25	13
6/24/2007 8:00	2007	6	24	8:00	16	12.3	79	24	13
6/24/2007 9:00	2007	6	24	9:00	17.1	12.8	76	25	15
6/24/2007 10:00	2007	6	24	10:00	17.9	12.7	72	26	17
6/24/2007 11:00	2007	6	24	11:00	19	12.7	67	25	22
6/24/2007 12:00	2007	6	24	12:00	20.2	12.8	62	25	19
6/24/2007 13:00	2007	6	24	13:00	20.9	12.1	57	27	19
6/24/2007 14:00	2007	6	24	14:00	20.1	11.1	56	25	19
6/24/2007 15:00	2007	6	24	15:00	20.7	11.6	56	25	17
6/24/2007 16:00	2007	6	24	16:00	19.9	12.3	62	26	11
6/24/2007 17:00	2007	6	24	17:00	19.7	12.1	62	27	15
6/24/2007 18:00	2007	6	24	18:00	19.2	11.1	59	26	17
6/24/2007 19:00	2007	6	24	19:00	17.2	10.6	65	26	13
6/24/2007 20:00	2007	6	24	20:00	16.3	10.8	70	25	9
6/24/2007 21:00	2007	6	24	21:00	16.4	10.8	69	24	9
6/24/2007 22:00	2007	6	24	22:00	15.8	10.1	69	24	7
6/24/2007 23:00	2007	6	24	23:00	13	9.5	79	23	11
6/25/2007 0:00	2007	6	25	0:00	12.5	9.3	81	21	7
6/25/2007 1:00	2007	6	25	1:00	11.7	8.8	82	22	6
6/25/2007 2:00	2007	6	25	2:00	11.5	8.6	82	21	4
6/25/2007 3:00	2007	6	25	3:00	12.1	8.9	81	22	6
6/25/2007 4:00	2007	6	25	4:00	10.1	8.1	87	18	2
6/25/2007 5:00	2007	6	25	5:00	9.2	7.9	92	34	2
6/25/2007 6:00	2007	6	25	6:00	11.4	9.8	90	32	2
6/25/2007 7:00	2007	6	25	7:00	14.8	10.7	76	34	4
6/25/2007 8:00	2007	6	25	8:00	18.3	12.1	67	33	6
6/25/2007 9:00	2007	6	25	9:00	20.1	10.9	55	25	11
6/25/2007 10:00	2007	6	25	10:00	21.5	10.9	51	25	11
6/25/2007 11:00	2007	6	25	11:00	23.1	8.9	40	25	17
6/25/2007 12:00	2007	6	25	12:00	23.9	7.5	35	25	19
6/25/2007 13:00	2007	6	25	13:00	24.9	8.3	35	27	15
6/25/2007 14:00	2007	6	25	14:00	24.7	7.5	33	27	17
6/25/2007 15:00	2007	6	25	15:00	25.1	6.9	31	26	15
6/25/2007 16:00	2007	6	25	16:00	24.7	6.7	32	28	17
6/25/2007 17:00	2007	6	25	17:00	24.7	6.3	31	28	11
6/25/2007 18:00	2007	6	25	18:00	23.6	6.2	33	26	11
6/25/2007 19:00	2007	6	25	19:00	22.6	5.9	34	24	6
6/25/2007 20:00	2007	6	25	20:00	17.8	8.2	53	19	6
6/25/2007 21:00	2007	6	25	21:00	16.3	7.3	55	21	7
6/25/2007 22:00	2007	6	25	22:00	17.4	8.9	57	23	9
6/25/2007 23:00	2007	6	25	23:00	15.2	8.8	66	21	4
6/26/2007 0:00	2007	6	26	0:00	12.5	9.1	80	0	0
6/26/2007 1:00	2007	6	26	1:00	13.3	10.1	81	0	0
6/26/2007 2:00	2007	6	26	2:00	13.1	10	81	35	2

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/26/2007 3:00	2007	6	26	3:00	13.2	10.4	83	0	0
6/26/2007 4:00	2007	6	26	4:00	13.6	11.4	87	14	4
6/26/2007 5:00	2007	6	26	5:00	13.4	11.3	87	6	2
6/26/2007 6:00	2007	6	26	6:00	15.7	11.8	78	32	6
6/26/2007 7:00	2007	6	26	7:00	16.5	12.9	79	35	2
6/26/2007 8:00	2007	6	26	8:00	19.7	15.3	76	30	7
6/26/2007 9:00	2007	6	26	9:00	22.2	17.2	73	27	11
6/26/2007 10:00	2007	6	26	10:00	23.6	17	67	25	20
6/26/2007 11:00	2007	6	26	11:00	25.1	18.1	65	26	13
6/26/2007 12:00	2007	6	26	12:00	26.7	18.1	59	26	15
6/26/2007 13:00	2007	6	26	13:00	26.7	17.3	56	26	15
6/26/2007 14:00	2007	6	26	14:00	25.7	17.4	60	29	13
6/26/2007 15:00	2007	6	26	15:00	25	17.3	62	27	13
6/26/2007 16:00	2007	6	26	16:00	24.5	17.2	64	28	11
6/26/2007 17:00	2007	6	26	17:00	23.2	16.6	66	26	4
6/26/2007 18:00	2007	6	26	18:00	22.9	17.6	72	1	2
6/26/2007 19:00	2007	6	26	19:00	20.9	18.9	88	15	2
6/26/2007 20:00	2007	6	26	20:00	19.7	17.5	87	32	6
6/26/2007 21:00	2007	6	26	21:00	17.9	16.3	90	8	2
6/26/2007 22:00	2007	6	26	22:00	17.3	16.2	93	2	2
6/26/2007 23:00	2007	6	26	23:00	17.2	16.4	95	0	0
6/27/2007 0:00	2007	6	27	0:00	17.5	16.5	94	21	6
6/27/2007 1:00	2007	6	27	1:00	17.8	16.4	92	22	4
6/27/2007 2:00	2007	6	27	2:00	16.2	15.1	93	34	4
6/27/2007 3:00	2007	6	27	3:00	15.7	14.9	95	17	7
6/27/2007 4:00	2007	6	27	4:00	18.4	16.5	89	25	11
6/27/2007 5:00	2007	6	27	5:00	19.9	16.2	79	25	13
6/27/2007 6:00	2007	6	27	6:00	19.7	16.4	81	30	6
6/27/2007 7:00	2007	6	27	7:00	21.4	16.9	76	25	13
6/27/2007 8:00	2007	6	27	8:00	23.2	17.9	72	26	7
6/27/2007 9:00	2007	6	27	9:00	24.9	17.4	63	29	9
6/27/2007 10:00	2007	6	27	10:00	25.2	14.1	50	31	13
6/27/2007 11:00	2007	6	27	11:00	25.5	15.1	53	30	9
6/27/2007 12:00	2007	6	27	12:00	24.8	16.3	59	35	9
6/27/2007 13:00	2007	6	27	13:00	24.7	16.5	60	32	7
6/27/2007 14:00	2007	6	27	14:00	25	15.2	55	30	11
6/27/2007 15:00	2007	6	27	15:00	25.4	15.5	54	29	9
6/27/2007 16:00	2007	6	27	16:00	26.5	15.5	51	28	9
6/27/2007 17:00	2007	6	27	17:00	26.5	16	52	28	7
6/27/2007 18:00	2007	6	27	18:00	25.8	17	58	28	6
6/27/2007 19:00	2007	6	27	19:00	25.3	17.2	61	26	6
6/27/2007 20:00	2007	6	27	20:00	22.4	17.2	72	20	4
6/27/2007 21:00	2007	6	27	21:00	20.5	17.4	82	0	0
6/27/2007 22:00	2007	6	27	22:00	19.4	15.9	80	2	6
6/27/2007 23:00	2007	6	27	23:00	17.2	15.7	91	29	2
6/28/2007 0:00	2007	6	28	0:00	18	17.1	94	8	4
6/28/2007 1:00	2007	6	28	1:00	17.6	16.4	93	36	6
6/28/2007 2:00	2007	6	28	2:00	17	16.1	94	26	4
6/28/2007 3:00	2007	6	28	3:00	18.8	17.8	94	24	4
6/28/2007 4:00	2007	6	28	4:00	19.6	18.4	93	21	6
6/28/2007 5:00	2007	6	28	5:00	19.5	18.4	93	22	7
6/28/2007 6:00	2007	6	28	6:00	19.8	18.5	92	23	11
6/28/2007 7:00	2007	6	28	7:00	19.9	18.5	92	29	6
6/28/2007 8:00	2007	6	28	8:00	17.3	16.5	95	25	4
6/28/2007 9:00	2007	6	28	9:00	19.4	18.1	92	23	11
6/28/2007 10:00	2007	6	28	10:00	23.7	20.3	81	22	9
6/28/2007 11:00	2007	6	28	11:00	22.9	19.6	82	28	7
6/28/2007 12:00	2007	6	28	12:00	26	19.8	69	27	11
6/28/2007 13:00	2007	6	28	13:00	24.8	18.9	70	28	13
6/28/2007 14:00	2007	6	28	14:00	27.4	19.7	63	27	11

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
6/28/2007 15:00	2007	6	28	15:00	26.7	18	59	27	13
6/28/2007 16:00	2007	6	28	16:00	24.3	18.7	71	4	7
6/28/2007 17:00	2007	6	28	17:00	26.6	18.2	60	26	7
6/28/2007 18:00	2007	6	28	18:00	26.9	17.7	57	25	6
6/28/2007 19:00	2007	6	28	19:00	24.4	17.8	67	24	4
6/28/2007 20:00	2007	6	28	20:00	20.2	17.3	83	5	4
6/28/2007 21:00	2007	6	28	21:00	19.2	16.7	85	6	2
6/28/2007 22:00	2007	6	28	22:00	18.7	16.7	88	27	9
6/28/2007 23:00	2007	6	28	23:00	18.1	16.7	92	26	4
6/29/2007 0:00	2007	6	29	0:00	17.1	15.6	91	28	6
6/29/2007 1:00	2007	6	29	1:00	16.4	15.3	93	27	7
6/29/2007 2:00	2007	6	29	2:00	15.1	14.3	95	25	4
6/29/2007 3:00	2007	6	29	3:00	14.9	14.2	96	24	6
6/29/2007 4:00	2007	6	29	4:00	15.1	14.3	95	25	4
6/29/2007 5:00	2007	6	29	5:00	15.1	14.2	94	23	4
6/29/2007 6:00	2007	6	29	6:00	15.1	14	93	31	7
6/29/2007 7:00	2007	6	29	7:00	15	10.8	76	34	11
6/29/2007 8:00	2007	6	29	8:00	14.9	9.7	71	34	11
6/29/2007 9:00	2007	6	29	9:00	15.6	9.8	68	31	11
6/29/2007 10:00	2007	6	29	10:00	15.8	9.7	67	32	11
6/29/2007 11:00	2007	6	29	11:00	17.1	10.1	63	27	6
6/29/2007 12:00	2007	6	29	12:00	18.2	10.7	62	28	9
6/29/2007 13:00	2007	6	29	13:00	18	9.1	56	27	13
6/29/2007 14:00	2007	6	29	14:00	18.8	9.2	54	28	13
6/29/2007 15:00	2007	6	29	15:00	19	10.6	58	28	11
6/29/2007 16:00	2007	6	29	16:00	19	9.5	54	26	11
6/29/2007 17:00	2007	6	29	17:00	20	10.5	54	25	6
6/29/2007 18:00	2007	6	29	18:00	20.1	10.2	53	25	7
6/29/2007 19:00	2007	6	29	19:00	19.4	10.4	56	26	7
6/29/2007 20:00	2007	6	29	20:00	16.4	9.2	62	24	6
6/29/2007 21:00	2007	6	29	21:00	13.5	9	74	22	4
6/29/2007 22:00	2007	6	29	22:00	13.5	8	69	23	7
6/29/2007 23:00	2007	6	29	23:00	12.6	7.5	71	22	2
6/30/2007 0:00	2007	6	30	0:00	10.8	7.5	80	25	6
6/30/2007 1:00	2007	6	30	1:00	10	7.4	84	26	6
6/30/2007 2:00	2007	6	30	2:00	9	7.3	89	28	2
6/30/2007 3:00	2007	6	30	3:00	8.5	6.8	89	22	4
6/30/2007 4:00	2007	6	30	4:00	7.6	6.4	92	14	4
6/30/2007 5:00	2007	6	30	5:00	8.3	7.2	93	24	6
6/30/2007 6:00	2007	6	30	6:00	11.4	8.8	84	31	2
6/30/2007 7:00	2007	6	30	7:00	14.6	10.2	75	35	2
6/30/2007 8:00	2007	6	30	8:00	17.5	11.6	68	31	6
6/30/2007 9:00	2007	6	30	9:00	20.1	11	56	29	9
6/30/2007 10:00	2007	6	30	10:00	21.1	9.5	47	26	13
6/30/2007 11:00	2007	6	30	11:00	21.4	10.6	50	28	15
6/30/2007 12:00	2007	6	30	12:00	21.9	8.7	43	26	20
6/30/2007 13:00	2007	6	30	13:00	21.8	10.8	50	27	19
6/30/2007 14:00	2007	6	30	14:00	21.9	9.9	46	27	20
6/30/2007 15:00	2007	6	30	15:00	21.9	9.5	45	25	19
6/30/2007 16:00	2007	6	30	16:00	21.6	8.1	42	27	20
6/30/2007 17:00	2007	6	30	17:00	20.5	9	48	27	17
6/30/2007 18:00	2007	6	30	18:00	19.4	9.4	52	27	13
6/30/2007 19:00	2007	6	30	19:00	17.4	8.8	57	27	17
6/30/2007 20:00	2007	6	30	20:00	15.6	9.3	66	25	6
6/30/2007 21:00	2007	6	30	21:00	13.5	9.1	75	21	7
6/30/2007 22:00	2007	6	30	22:00	13.2	8.8	75	21	9
6/30/2007 23:00	2007	6	30	23:00	13	8.5	74	22	9
7/1/2007 0:00	2007	7	1	0:00	12.7	8.3	75	22	9
7/1/2007 1:00	2007	7	1	1:00	11.8	8.2	79	22	6
7/1/2007 2:00	2007	7	1	2:00	11.5	7.8	78	22	9

Meteorological Data - Kentville  
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 Province NOVA SCOTIA  
 Latitude 45.07  
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 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
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All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/1/2007 3:00	2007	7	1	3:00	10.9	7.4	79	21	9
7/1/2007 4:00	2007	7	1	4:00	9.7	6.8	82	24	2
7/1/2007 5:00	2007	7	1	5:00	7.8	6.3	90	23	2
7/1/2007 6:00	2007	7	1	6:00	11.9	8.3	79	26	2
7/1/2007 7:00	2007	7	1	7:00	14.9	8.9	67	26	9
7/1/2007 8:00	2007	7	1	8:00	15.1	8.9	66	25	11
7/1/2007 9:00	2007	7	1	9:00	16.8	9	60	28	11
7/1/2007 10:00	2007	7	1	10:00	18	8.8	55	27	13
7/1/2007 11:00	2007	7	1	11:00	19.3	7.8	47	26	17
7/1/2007 12:00	2007	7	1	12:00	20	7.4	44	27	17
7/1/2007 13:00	2007	7	1	13:00	20	7.2	43	29	15
7/1/2007 14:00	2007	7	1	14:00	20.4	7.3	43	27	17
7/1/2007 15:00	2007	7	1	15:00	20.7	6.7	40	26	13
7/1/2007 16:00	2007	7	1	16:00	20.2	7.3	43	27	15
7/1/2007 17:00	2007	7	1	17:00	19.4	7.3	45	27	17
7/1/2007 18:00	2007	7	1	18:00	18.9	7.3	47	26	13
7/1/2007 19:00	2007	7	1	19:00	17.8	7.6	51	26	13
7/1/2007 20:00	2007	7	1	20:00	15.5	7.1	57	23	6
7/1/2007 21:00	2007	7	1	21:00	14.9	7.3	60	28	7
7/1/2007 22:00	2007	7	1	22:00	12.7	7.7	72	27	11
7/1/2007 23:00	2007	7	1	23:00	11.7	7.9	77	22	11
7/2/2007 0:00	2007	7	2	0:00	11.5	8.2	80	22	9
7/2/2007 1:00	2007	7	2	1:00	10	7.7	86	24	2
7/2/2007 2:00	2007	7	2	2:00	9.7	7.7	87	22	6
7/2/2007 3:00	2007	7	2	3:00	8.8	7.1	89	0	0
7/2/2007 4:00	2007	7	2	4:00	9.3	8	92	20	6
7/2/2007 5:00	2007	7	2	5:00	9	7.2	88	30	4
7/2/2007 6:00	2007	7	2	6:00	11.9	9.8	87	23	9
7/2/2007 7:00	2007	7	2	7:00	13.9	10.4	79	25	6
7/2/2007 8:00	2007	7	2	8:00	15.4	11.1	76	30	7
7/2/2007 9:00	2007	7	2	9:00	17.6	11.2	66	35	7
7/2/2007 10:00	2007	7	2	10:00	18.3	11	62	2	7
7/2/2007 11:00	2007	7	2	11:00	19.2	11.2	60	34	9
7/2/2007 12:00	2007	7	2	12:00	20.3	9.9	51	31	11
7/2/2007 13:00	2007	7	2	13:00	20.6	9.3	48	35	11
7/2/2007 14:00	2007	7	2	14:00	20.3	9.6	50	33	15
7/2/2007 15:00	2007	7	2	15:00	20.1	10.3	53	32	13
7/2/2007 16:00	2007	7	2	16:00	19.1	9.9	55	35	17
7/2/2007 17:00	2007	7	2	17:00	18.3	11	62	32	11
7/2/2007 18:00	2007	7	2	18:00	17.6	9.5	59	34	9
7/2/2007 19:00	2007	7	2	19:00	15.7	10	69	2	9
7/2/2007 20:00	2007	7	2	20:00	14.8	10.2	74	6	4
7/2/2007 21:00	2007	7	2	21:00	12	9.7	86	18	4
7/2/2007 22:00	2007	7	2	22:00	10.7	9.1	90	21	6
7/2/2007 23:00	2007	7	2	23:00	9.8	8.4	91	19	6
7/3/2007 0:00	2007	7	3	0:00	9.7	8.5	92	18	4
7/3/2007 1:00	2007	7	3	1:00	9.3	8.3	93	18	6
7/3/2007 2:00	2007	7	3	2:00	8.6	7.6	93	20	4
7/3/2007 3:00	2007	7	3	3:00	8.3	7.5	95	21	6
7/3/2007 4:00	2007	7	3	4:00	7.5	6.7	95	19	2
7/3/2007 5:00	2007	7	3	5:00	7.5	6.8	95	20	4
7/3/2007 6:00	2007	7	3	6:00	9.9	9.2	95	0	0
7/3/2007 7:00	2007	7	3	7:00	13.4	10.5	83	36	2
7/3/2007 8:00	2007	7	3	8:00	15.1	10.1	72	5	6
7/3/2007 9:00	2007	7	3	9:00	16	9.3	64	5	4
7/3/2007 10:00	2007	7	3	10:00	17.2	8.4	56	8	6
7/3/2007 11:00	2007	7	3	11:00	18.4	7.7	50	4	7
7/3/2007 12:00	2007	7	3	12:00	18.2	8.1	52	4	9
7/3/2007 13:00	2007	7	3	13:00	19.2	7.8	48	3	6
7/3/2007 14:00	2007	7	3	14:00	20.3	7.7	44	28	6

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/3/2007 15:00	2007	7	3	15:00	21.6	7.9	41	1	6
7/3/2007 16:00	2007	7	3	16:00	21.2	7.5	41	36	11
7/3/2007 17:00	2007	7	3	17:00	20.8	5.8	38	34	9
7/3/2007 18:00	2007	7	3	18:00	18.2	8	51	32	13
7/3/2007 19:00	2007	7	3	19:00	15.5	7.9	61	29	6
7/3/2007 20:00	2007	7	3	20:00	14.2	8.9	70	24	6
7/3/2007 21:00	2007	7	3	21:00	13.5	8.5	72	23	6
7/3/2007 22:00	2007	7	3	22:00	12.3	7.8	74	21	6
7/3/2007 23:00	2007	7	3	23:00	11.8	7.5	75	20	4
7/4/2007 0:00	2007	7	4	0:00	11.1	7.7	80	19	7
7/4/2007 1:00	2007	7	4	1:00	10	7.4	84	24	6
7/4/2007 2:00	2007	7	4	2:00	9	7.4	90	23	6
7/4/2007 3:00	2007	7	4	3:00	8.5	6.9	90	22	2
7/4/2007 4:00	2007	7	4	4:00	8.2	7.1	93	20	4
7/4/2007 5:00	2007	7	4	5:00	8	7	93	23	6
7/4/2007 6:00	2007	7	4	6:00	11	9.3	89	22	6
7/4/2007 7:00	2007	7	4	7:00	13.6	10.2	80	33	4
7/4/2007 8:00	2007	7	4	8:00	17.1	12.1	72	3	6
7/4/2007 9:00	2007	7	4	9:00	19.3	12	63	28	7
7/4/2007 10:00	2007	7	4	10:00	21.5	11.6	53	30	9
7/4/2007 11:00	2007	7	4	11:00	22.7	10.9	47	27	11
7/4/2007 12:00	2007	7	4	12:00	23.8	10.4	43	26	11
7/4/2007 13:00	2007	7	4	13:00	24.9	9.9	39	26	11
7/4/2007 14:00	2007	7	4	14:00	21.6	12.7	57	7	9
7/4/2007 15:00	2007	7	4	15:00	22	12	53	12	6
7/4/2007 16:00	2007	7	4	16:00	21	12.3	58	11	6
7/4/2007 17:00	2007	7	4	17:00	20.1	13.4	65	14	6
7/4/2007 18:00	2007	7	4	18:00	21.4	13.9	62	17	6
7/4/2007 19:00	2007	7	4	19:00	20	13.4	66	16	6
7/4/2007 20:00	2007	7	4	20:00	17.4	13	75	21	2
7/4/2007 21:00	2007	7	4	21:00	16.8	10.2	65	21	6
7/4/2007 22:00	2007	7	4	22:00	14.2	10	76	24	4
7/4/2007 23:00	2007	7	4	23:00	13.7	9.3	75	25	4
7/5/2007 0:00	2007	7	5	0:00	12.5	8.4	76	30	4
7/5/2007 1:00	2007	7	5	1:00	12.9	8.8	76	26	6
7/5/2007 2:00	2007	7	5	2:00	14.3	9.6	73	27	6
7/5/2007 3:00	2007	7	5	3:00	13.7	9.8	77	27	6
7/5/2007 4:00	2007	7	5	4:00	13.8	10.3	79	20	6
7/5/2007 5:00	2007	7	5	5:00	13.6	11	84	21	6
7/5/2007 6:00	2007	7	5	6:00	13.6	11.1	85	22	6
7/5/2007 7:00	2007	7	5	7:00	14.4	11.3	82	19	9
7/5/2007 8:00	2007	7	5	8:00	14.9	10.5	75	17	11
7/5/2007 9:00	2007	7	5	9:00	15.2	10.6	74	18	7
7/5/2007 10:00	2007	7	5	10:00	15.6	12.4	81	14	6
7/5/2007 11:00	2007	7	5	11:00	15.6	13.1	85	16	7
7/5/2007 12:00	2007	7	5	12:00	16.1	11.9	76	15	11
7/5/2007 13:00	2007	7	5	13:00	16.9	12.6	76	16	13
7/5/2007 14:00	2007	7	5	14:00	17.9	13.7	76	17	19
7/5/2007 15:00	2007	7	5	15:00	16.3	13.7	85	16	19
7/5/2007 16:00	2007	7	5	16:00	16.2	13.4	83	16	22
7/5/2007 17:00	2007	7	5	17:00	16	13.8	87	18	13
7/5/2007 18:00	2007	7	5	18:00	16.3	14.3	88	18	11
7/5/2007 19:00	2007	7	5	19:00	16.7	14.9	89	19	7
7/5/2007 20:00	2007	7	5	20:00	17	15.2	89	20	4
7/5/2007 21:00	2007	7	5	21:00	17	15.4	90	21	6
7/5/2007 22:00	2007	7	5	22:00	17	15.4	90	22	9
7/5/2007 23:00	2007	7	5	23:00	16.8	15.1	90	22	11
7/6/2007 0:00	2007	7	6	0:00	16.8	15.2	90	23	6
7/6/2007 1:00	2007	7	6	1:00	16.9	15.3	90	22	9
7/6/2007 2:00	2007	7	6	2:00	17.1	15.5	90	23	11

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All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/6/2007 3:00	2007	7	6	3:00	16.9	15.6	92	25	6
7/6/2007 4:00	2007	7	6	4:00	16.7	15.5	93	10	2
7/6/2007 5:00	2007	7	6	5:00	16.8	15.6	93	18	4
7/6/2007 6:00	2007	7	6	6:00	15.8	14.5	92	8	6
7/6/2007 7:00	2007	7	6	7:00	15.1	14.3	95	5	4
7/6/2007 8:00	2007	7	6	8:00	15.2	14.5	96	7	4
7/6/2007 9:00	2007	7	6	9:00	15.9	15.1	95	2	2
7/6/2007 10:00	2007	7	6	10:00	16.6	15.8	95	2	6
7/6/2007 11:00	2007	7	6	11:00	16.8	15.8	94	1	4
7/6/2007 12:00	2007	7	6	12:00	18	16.5	91	6	4
7/6/2007 13:00	2007	7	6	13:00	19.1	17.2	89	7	2
7/6/2007 14:00	2007	7	6	14:00	19.5	17.4	88	7	4
7/6/2007 15:00	2007	7	6	15:00	20.2	17.9	87	8	2
7/6/2007 16:00	2007	7	6	16:00	20.1	17.8	87	6	6
7/6/2007 17:00	2007	7	6	17:00	18.6	16.9	90	9	6
7/6/2007 18:00	2007	7	6	18:00	18.3	17	92	3	2
7/6/2007 19:00	2007	7	6	19:00	18.7	17.4	92	32	4
7/6/2007 20:00	2007	7	6	20:00	18	16.8	93	16	4
7/6/2007 21:00	2007	7	6	21:00	17.7	16.7	94	19	4
7/6/2007 22:00	2007	7	6	22:00	17.6	16.7	94	34	7
7/6/2007 23:00	2007	7	6	23:00	17.5	16.6	94	29	2
7/7/2007 0:00	2007	7	7	0:00	17	16.2	95	30	6
7/7/2007 1:00	2007	7	7	1:00	16.5	15.9	96	26	4
7/7/2007 2:00	2007	7	7	2:00	16.5	15.9	96	25	7
7/7/2007 3:00	2007	7	7	3:00	16.5	15.8	96	26	6
7/7/2007 4:00	2007	7	7	4:00	15.7	15.1	96	27	6
7/7/2007 5:00	2007	7	7	5:00	15.4	14.9	97	26	4
7/7/2007 6:00	2007	7	7	6:00	15.2	14.7	97	26	7
7/7/2007 7:00	2007	7	7	7:00	15.2	14.5	96	24	7
7/7/2007 8:00	2007	7	7	8:00	15.8	14.8	94	24	9
7/7/2007 9:00	2007	7	7	9:00	17.5	15.4	87	25	11
7/7/2007 10:00	2007	7	7	10:00	19.7	16.2	80	26	13
7/7/2007 11:00	2007	7	7	11:00	21	15.1	69	25	17
7/7/2007 12:00	2007	7	7	12:00	21.9	14.7	64	27	15
7/7/2007 13:00	2007	7	7	13:00	20.6	14	66	26	15
7/7/2007 14:00	2007	7	7	14:00	21.5	14	62	25	19
7/7/2007 15:00	2007	7	7	15:00	21.7	11.7	53	27	24
7/7/2007 16:00	2007	7	7	16:00	21.6	10.8	50	25	24
7/7/2007 17:00	2007	7	7	17:00	21.4	10.4	49	25	19
7/7/2007 18:00	2007	7	7	18:00	21.1	10.4	50	26	15
7/7/2007 19:00	2007	7	7	19:00	20	9.4	50	25	11
7/7/2007 20:00	2007	7	7	20:00					
7/7/2007 21:00	2007	7	7	21:00	16.4	9.5	64	22	9
7/7/2007 22:00	2007	7	7	22:00	16.3	10.1	67	23	9
7/7/2007 23:00	2007	7	7	23:00	16.4	10.2	67	23	7
7/8/2007 0:00	2007	7	8	0:00	16.1	10	67	24	7
7/8/2007 1:00	2007	7	8	1:00	16.1	10.1	68	23	6
7/8/2007 2:00	2007	7	8	2:00	15.9	10.9	72	23	9
7/8/2007 3:00	2007	7	8	3:00	15.5	11.6	78	20	6
7/8/2007 4:00	2007	7	8	4:00	13.8	11.5	86	18	4
7/8/2007 5:00	2007	7	8	5:00	13.9	11.8	87	21	6
7/8/2007 6:00	2007	7	8	6:00	14.9	12.8	87	24	9
7/8/2007 7:00	2007	7	8	7:00	16	13.4	85	22	11
7/8/2007 8:00	2007	7	8	8:00	16.3	13.7	85	24	9
7/8/2007 9:00	2007	7	8	9:00	17.3	14	81	24	11
7/8/2007 10:00	2007	7	8	10:00	18.2	14.3	78	26	13
7/8/2007 11:00	2007	7	8	11:00	18.6	14	75	26	13
7/8/2007 12:00	2007	7	8	12:00	19	13.6	71	25	13
7/8/2007 13:00	2007	7	8	13:00	19.4	13.8	70	25	13
7/8/2007 14:00	2007	7	8	14:00	19.1	12.7	66	25	11

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/8/2007 15:00	2007	7	8	15:00	20	11.6	58	25	15
7/8/2007 16:00	2007	7	8	16:00	20.4	11.2	55	27	19
7/8/2007 17:00	2007	7	8	17:00	20.5	12.4	60	27	19
7/8/2007 18:00	2007	7	8	18:00	17.2	11.8	71	29	11
7/8/2007 19:00	2007	7	8	19:00	16.4	12.3	77	26	6
7/8/2007 20:00	2007	7	8	20:00	15.2	12.2	82	20	4
7/8/2007 21:00	2007	7	8	21:00	13.7	12.1	90	22	6
7/8/2007 22:00	2007	7	8	22:00	14.7	12.4	86	28	7
7/8/2007 23:00	2007	7	8	23:00	13	11.5	91	23	6
7/9/2007 0:00	2007	7	9	0:00	11.7	10.5	92	26	6
7/9/2007 1:00	2007	7	9	1:00	11.3	10	92	22	7
7/9/2007 2:00	2007	7	9	2:00	11.2	9.2	87	26	9
7/9/2007 3:00	2007	7	9	3:00	10.4	8.8	90	18	7
7/9/2007 4:00	2007	7	9	4:00	9.4	8.2	92	17	2
7/9/2007 5:00	2007	7	9	5:00	8.4	7.6	95	24	7
7/9/2007 6:00	2007	7	9	6:00	11.7	10.1	90	20	6
7/9/2007 7:00	2007	7	9	7:00	13	10.8	86	32	6
7/9/2007 8:00	2007	7	9	8:00	13.4	10.9	85	34	6
7/9/2007 9:00	2007	7	9	9:00	14.1	11	82	30	6
7/9/2007 10:00	2007	7	9	10:00	15.7	11.4	76	2	6
7/9/2007 11:00	2007	7	9	11:00	16.7	11.6	72	7	9
7/9/2007 12:00	2007	7	9	12:00	17.7	11.6	67	8	7
7/9/2007 13:00	2007	7	9	13:00	17.9	11.9	68	5	7
7/9/2007 14:00	2007	7	9	14:00	18.1	11.1	64	4	11
7/9/2007 15:00	2007	7	9	15:00	19.2	12.1	63	5	9
7/9/2007 16:00	2007	7	9	16:00	18.7	12.5	67	4	9
7/9/2007 17:00	2007	7	9	17:00	17.6	12.4	72	5	4
7/9/2007 18:00	2007	7	9	18:00	17	12.1	73	7	2
7/9/2007 19:00	2007	7	9	19:00	16.1	12.2	78	14	4
7/9/2007 20:00	2007	7	9	20:00	15.2	12.4	83	17	4
7/9/2007 21:00	2007	7	9	21:00	14.8	12.2	84	18	2
7/9/2007 22:00	2007	7	9	22:00	14.6	12	84	7	2
7/9/2007 23:00	2007	7	9	23:00	14.5	11.4	82	19	4
7/10/2007 0:00	2007	7	10	0:00	14	10.8	81	32	4
7/10/2007 1:00	2007	7	10	1:00	13.8	10.8	82	29	2
7/10/2007 2:00	2007	7	10	2:00	13.4	11.1	86	10	4
7/10/2007 3:00	2007	7	10	3:00	13.7	11	84	1	4
7/10/2007 4:00	2007	7	10	4:00	13.7	10.7	82	4	6
7/10/2007 5:00	2007	7	10	5:00	13.9	10.4	79	30	4
7/10/2007 6:00	2007	7	10	6:00	14.1	11	82	12	2
7/10/2007 7:00	2007	7	10	7:00	14.3	11.5	83	15	2
7/10/2007 8:00	2007	7	10	8:00	14.9	12.2	84	16	6
7/10/2007 9:00	2007	7	10	9:00	15.8	12.8	82	9	2
7/10/2007 10:00	2007	7	10	10:00	17.4	13.9	80	14	4
7/10/2007 11:00	2007	7	10	11:00	18.8	14.5	76	18	2
7/10/2007 12:00	2007	7	10	12:00	18.7	14.9	79	18	7
7/10/2007 13:00	2007	7	10	13:00	19.4	15.4	78	21	7
7/10/2007 14:00	2007	7	10	14:00	20.5	16.3	77	24	6
7/10/2007 15:00	2007	7	10	15:00	20.8	16.3	75	24	6
7/10/2007 16:00	2007	7	10	16:00	21.5	16.8	75	29	6
7/10/2007 17:00	2007	7	10	17:00	22.1	17.4	75	35	6
7/10/2007 18:00	2007	7	10	18:00	19.9	15.5	76	8	9
7/10/2007 19:00	2007	7	10	19:00	19.3	15.4	78	7	6
7/10/2007 20:00	2007	7	10	20:00	17.5	15.1	86	17	4
7/10/2007 21:00	2007	7	10	21:00	15.4	14.2	93	18	6
7/10/2007 22:00	2007	7	10	22:00	14.7	13.7	94	2	2
7/10/2007 23:00	2007	7	10	23:00	13.5	12.6	94	9	2
7/11/2007 0:00	2007	7	11	0:00	13.2	12.5	96	0	0
7/11/2007 1:00	2007	7	11	1:00	13.6	13	96	26	4
7/11/2007 2:00	2007	7	11	2:00	13.7	13.1	96	33	2

Meteorological Data - Kentville  
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 Province NOVA SCOTIA  
 Latitude 45.07  
 Longitude -64.48  
 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/11/2007 3:00	2007	7	11	3:00	14.2	13.5	96	14	2
7/11/2007 4:00	2007	7	11	4:00	14.4	13.5	94	0	0
7/11/2007 5:00	2007	7	11	5:00	14.6	13.8	95	7	2
7/11/2007 6:00	2007	7	11	6:00	15.4	14.5	94	4	6
7/11/2007 7:00	2007	7	11	7:00	17.1	15.7	91	3	4
7/11/2007 8:00	2007	7	11	8:00	19.2	16.5	84	14	6
7/11/2007 9:00	2007	7	11	9:00	20	16.5	80	21	7
7/11/2007 10:00	2007	7	11	10:00	21.3	17.7	80	20	6
7/11/2007 11:00	2007	7	11	11:00	22.6	18.4	77	17	6
7/11/2007 12:00	2007	7	11	12:00	23.9	18.7	73	18	9
7/11/2007 13:00	2007	7	11	13:00	24.5	19	71	17	13
7/11/2007 14:00	2007	7	11	14:00	25.6	19.6	69	18	13
7/11/2007 15:00	2007	7	11	15:00	26.9	20.2	67	19	11
7/11/2007 16:00	2007	7	11	16:00	26.2	20	69	20	17
7/11/2007 17:00	2007	7	11	17:00	25.6	19.7	70	19	11
7/11/2007 18:00	2007	7	11	18:00	24.1	19.7	76	19	15
7/11/2007 19:00	2007	7	11	19:00	22	19.1	84	18	13
7/11/2007 20:00	2007	7	11	20:00	21.3	19.2	88	18	11
7/11/2007 21:00	2007	7	11	21:00	20.9	19.3	91	19	13
7/11/2007 22:00	2007	7	11	22:00	20.7	19.2	91	17	11
7/11/2007 23:00	2007	7	11	23:00	20.6	19.1	91	18	11
7/12/2007 0:00	2007	7	12	0:00	20.8	19.3	91	18	9
7/12/2007 1:00	2007	7	12	1:00	20.5	19.1	92	17	11
7/12/2007 2:00	2007	7	12	2:00	19.8	18.4	92	17	11
7/12/2007 3:00	2007	7	12	3:00	19.8	18.5	92	16	11
7/12/2007 4:00	2007	7	12	4:00	19.9	18.5	92	16	7
7/12/2007 5:00	2007	7	12	5:00	20	18.5	91	15	11
7/12/2007 6:00	2007	7	12	6:00	19.9	18.5	92	15	13
7/12/2007 7:00	2007	7	12	7:00	19.9	18.7	93	16	15
7/12/2007 8:00	2007	7	12	8:00	19.8	18.6	93	17	11
7/12/2007 9:00	2007	7	12	9:00	20.9	19.4	91	19	11
7/12/2007 10:00	2007	7	12	10:00	22.3	20.3	88	18	11
7/12/2007 11:00	2007	7	12	11:00	23.6	20.2	81	19	15
7/12/2007 12:00	2007	7	12	12:00	24.7	21	80	20	13
7/12/2007 13:00	2007	7	12	13:00	25.1	21.2	79	22	11
7/12/2007 14:00	2007	7	12	14:00	25	21	78	20	7
7/12/2007 15:00	2007	7	12	15:00	25.5	21.9	81	21	4
7/12/2007 16:00	2007	7	12	16:00	20.6	18.5	88	7	7
7/12/2007 17:00	2007	7	12	17:00	20.2	18.4	89	34	6
7/12/2007 18:00	2007	7	12	18:00	19.5	18.6	95	34	2
7/12/2007 19:00	2007	7	12	19:00	19.4	18.6	95	27	2
7/12/2007 20:00	2007	7	12	20:00	19.2	18.5	96	20	2
7/12/2007 21:00	2007	7	12	21:00	19.4	18.7	96	29	2
7/12/2007 22:00	2007	7	12	22:00	19.3	18.6	96	26	6
7/12/2007 23:00	2007	7	12	23:00	19	18.4	96	26	9
7/13/2007 0:00	2007	7	13	0:00	18.4	17.8	96	27	7
7/13/2007 1:00	2007	7	13	1:00	17.2	16.6	96	25	9
7/13/2007 2:00	2007	7	13	2:00	17.1	16.6	97	24	7
7/13/2007 3:00	2007	7	13	3:00	16.6	16.1	97	23	4
7/13/2007 4:00	2007	7	13	4:00	16.4	15.9	97	27	6
7/13/2007 5:00	2007	7	13	5:00	16	15.5	97	24	11
7/13/2007 6:00	2007	7	13	6:00	16.8	16.2	96	24	6
7/13/2007 7:00	2007	7	13	7:00	18.4	17.2	93	29	4
7/13/2007 8:00	2007	7	13	8:00	20.5	18.1	86	28	6
7/13/2007 9:00	2007	7	13	9:00	22.6	18.6	78	29	6
7/13/2007 10:00	2007	7	13	10:00	24.2	17.9	68	28	11
7/13/2007 11:00	2007	7	13	11:00	25.4	15.2	53	25	13
7/13/2007 12:00	2007	7	13	12:00	25.9	15	51	25	17
7/13/2007 13:00	2007	7	13	13:00	25.9	11.2	40	24	19
7/13/2007 14:00	2007	7	13	14:00	25.9	9.7	36	24	20



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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/13/2007 15:00	2007	7	13	15:00	26.4	11.1	38	25	15
7/13/2007 16:00	2007	7	13	16:00	26.3	11.2	39	26	15
7/13/2007 17:00	2007	7	13	17:00	25.8	9.8	36	28	15
7/13/2007 18:00	2007	7	13	18:00	25.4	10.2	38	27	11
7/13/2007 19:00	2007	7	13	19:00	23.4	10.9	45	25	7
7/13/2007 20:00	2007	7	13	20:00	20.2	11.2	56	20	7
7/13/2007 21:00	2007	7	13	21:00	18.1	11.7	66	21	6
7/13/2007 22:00	2007	7	13	22:00	17.9	11.1	64	21	7
7/13/2007 23:00	2007	7	13	23:00	17	11.5	70	23	6
7/14/2007 0:00	2007	7	14	0:00	17.3	12.5	73	26	2
7/14/2007 1:00	2007	7	14	1:00	16.6	12.8	78	22	6
7/14/2007 2:00	2007	7	14	2:00	17.2	13	76	29	9
7/14/2007 3:00	2007	7	14	3:00	16.9	13.4	80	23	6
7/14/2007 4:00	2007	7	14	4:00	16.4	13.4	82	27	6
7/14/2007 5:00	2007	7	14	5:00	15.4	13.3	87	27	4
7/14/2007 6:00	2007	7	14	6:00	15.9	13.7	87	24	6
7/14/2007 7:00	2007	7	14	7:00	16.7	14.2	85	28	2
7/14/2007 8:00	2007	7	14	8:00	18.1	14.9	82	24	6
7/14/2007 9:00	2007	7	14	9:00	19.7	15.6	77	26	6
7/14/2007 10:00	2007	7	14	10:00	21.2	15.2	69	27	9
7/14/2007 11:00	2007	7	14	11:00	23.4	15.8	62	30	7
7/14/2007 12:00	2007	7	14	12:00	25.1	14.8	53	29	15
7/14/2007 13:00	2007	7	14	13:00	26.6	15.6	51	29	9
7/14/2007 14:00	2007	7	14	14:00	22.7	14.8	61	6	7
7/14/2007 15:00	2007	7	14	15:00	24	16.6	63	4	7
7/14/2007 16:00	2007	7	14	16:00	22	15.5	67	5	4
7/14/2007 17:00	2007	7	14	17:00	21	18	83	10	4
7/14/2007 18:00	2007	7	14	18:00	19.6	17.9	90	18	9
7/14/2007 19:00	2007	7	14	19:00	20.2	18.1	88	0	0
7/14/2007 20:00	2007	7	14	20:00	18.5	17.4	93	0	0
7/14/2007 21:00	2007	7	14	21:00	17.1	16.2	94	19	2
7/14/2007 22:00	2007	7	14	22:00	16	15.3	96	16	2
7/14/2007 23:00	2007	7	14	23:00	15.8	15.2	96	0	0
7/15/2007 0:00	2007	7	15	0:00	16.9	16.3	96	23	6
7/15/2007 1:00	2007	7	15	1:00	16.4	15.6	95	25	6
7/15/2007 2:00	2007	7	15	2:00	16	15	94	28	2
7/15/2007 3:00	2007	7	15	3:00	15.7	14.9	95	22	4
7/15/2007 4:00	2007	7	15	4:00	15	14.1	94	32	4
7/15/2007 5:00	2007	7	15	5:00	15.3	14.4	94	26	2
7/15/2007 6:00	2007	7	15	6:00	16.2	15	93	29	4
7/15/2007 7:00	2007	7	15	7:00	18	15.9	88	22	6
7/15/2007 8:00	2007	7	15	8:00	19.9	16.9	83	19	11
7/15/2007 9:00	2007	7	15	9:00	21.7	18.5	82	18	13
7/15/2007 10:00	2007	7	15	10:00	22.9	18.3	75	17	15
7/15/2007 11:00	2007	7	15	11:00	24.1	18.6	71	17	15
7/15/2007 12:00	2007	7	15	12:00	25.1	19.3	70	18	17
7/15/2007 13:00	2007	7	15	13:00	25.9	19	66	16	15
7/15/2007 14:00	2007	7	15	14:00	26.2	19.1	65	17	13
7/15/2007 15:00	2007	7	15	15:00	26.3	18.7	63	20	17
7/15/2007 16:00	2007	7	15	16:00	27	19.7	64	20	11
7/15/2007 17:00	2007	7	15	17:00	26.6	19.1	63	19	15
7/15/2007 18:00	2007	7	15	18:00	26.5	18.9	63	19	11
7/15/2007 19:00	2007	7	15	19:00	24.5	19.4	73	18	9
7/15/2007 20:00	2007	7	15	20:00					
7/15/2007 21:00	2007	7	15	21:00	22	19.3	85	19	7
7/15/2007 22:00	2007	7	15	22:00	20.9	18.9	88	19	9
7/15/2007 23:00	2007	7	15	23:00	20.5	18.5	88	20	9
7/16/2007 0:00	2007	7	16	0:00	20.2	17.8	86	22	7
7/16/2007 1:00	2007	7	16	1:00	20.3	17.9	86	22	11
7/16/2007 2:00	2007	7	16	2:00	20.2	18.2	88	21	11

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/16/2007 3:00	2007	7	16	3:00	20.6	18.6	88	24	7
7/16/2007 4:00	2007	7	16	4:00	20.4	18.8	91	20	6
7/16/2007 5:00	2007	7	16	5:00	20.4	19.1	92	22	6
7/16/2007 6:00	2007	7	16	6:00	20.8	19.2	91	22	6
7/16/2007 7:00	2007	7	16	7:00	21.3	18.9	86	22	7
7/16/2007 8:00	2007	7	16	8:00	22.3	18.9	81	24	11
7/16/2007 9:00	2007	7	16	9:00	22.9	18.9	78	26	9
7/16/2007 10:00	2007	7	16	10:00	23.9	19.2	75	28	11
7/16/2007 11:00	2007	7	16	11:00	24.8	19.7	73	27	15
7/16/2007 12:00	2007	7	16	12:00	26	19.3	67	27	13
7/16/2007 13:00	2007	7	16	13:00	26.7	17.1	56	27	17
7/16/2007 14:00	2007	7	16	14:00	27.1	16.2	51	27	11
7/16/2007 15:00	2007	7	16	15:00	27.7	15	46	26	15
7/16/2007 16:00	2007	7	16	16:00	27.9	13.8	42	27	13
7/16/2007 17:00	2007	7	16	17:00	26.8	12.2	40	27	13
7/16/2007 18:00	2007	7	16	18:00	25.8	11.1	40	27	13
7/16/2007 19:00	2007	7	16	19:00	24.6	11.6	44	26	9
7/16/2007 20:00	2007	7	16	20:00	20.9	13.1	61	20	6
7/16/2007 21:00	2007	7	16	21:00	18.3	12.1	67	21	6
7/16/2007 22:00	2007	7	16	22:00	17.9	11.4	66	20	6
7/16/2007 23:00	2007	7	16	23:00	17.5	12.2	71	21	6
7/17/2007 0:00	2007	7	17	0:00	15.8	12.3	80	22	4
7/17/2007 1:00	2007	7	17	1:00	16	12.2	78	20	6
7/17/2007 2:00	2007	7	17	2:00	16.1	12.1	77	18	6
7/17/2007 3:00	2007	7	17	3:00	13.7	11.4	86	24	4
7/17/2007 4:00	2007	7	17	4:00	13.1	11.4	89	0	0
7/17/2007 5:00	2007	7	17	5:00	12.4	11.3	93	16	2
7/17/2007 6:00	2007	7	17	6:00	14.2	12.7	91	0	0
7/17/2007 7:00	2007	7	17	7:00	17.8	14	78	0	0
7/17/2007 8:00	2007	7	17	8:00	20.3	14.6	70	28	7
7/17/2007 9:00	2007	7	17	9:00	22.5	14.7	61	27	9
7/17/2007 10:00	2007	7	17	10:00	24.4	15.6	58	25	9
7/17/2007 11:00	2007	7	17	11:00	25.9	15.3	52	27	13
7/17/2007 12:00	2007	7	17	12:00	27.3	13	41	27	13
7/17/2007 13:00	2007	7	17	13:00	27.7	10	33	27	15
7/17/2007 14:00	2007	7	17	14:00	27.7	9	31	27	20
7/17/2007 15:00	2007	7	17	15:00	28.1	9.8	32	28	15
7/17/2007 16:00	2007	7	17	16:00	27.8	10.5	34	27	17
7/17/2007 17:00	2007	7	17	17:00	27.5	10.6	35	28	11
7/17/2007 18:00	2007	7	17	18:00	26.8	11.4	38	27	9
7/17/2007 19:00	2007	7	17	19:00	24.9	10.7	41	25	11
7/17/2007 20:00	2007	7	17	20:00	21.4	12.5	57	20	6
7/17/2007 21:00	2007	7	17	21:00	18.4	13.2	72	23	4
7/17/2007 22:00	2007	7	17	22:00	17.4	12.7	74	24	7
7/17/2007 23:00	2007	7	17	23:00	16.2	12.8	80	24	6
7/18/2007 0:00	2007	7	18	0:00	15.8	12.4	80	22	4
7/18/2007 1:00	2007	7	18	1:00	15.4	12.3	82	21	2
7/18/2007 2:00	2007	7	18	2:00	14.7	11.9	83	27	2
7/18/2007 3:00	2007	7	18	3:00	13.5	11.7	89	30	4
7/18/2007 4:00	2007	7	18	4:00	13.1	11.5	90	2	2
7/18/2007 5:00	2007	7	18	5:00	12.9	11.7	92	23	2
7/18/2007 6:00	2007	7	18	6:00	14.2	12.6	90	0	0
7/18/2007 7:00	2007	7	18	7:00	15.8	13.7	87	30	2
7/18/2007 8:00	2007	7	18	8:00	19.1	15	77	34	4
7/18/2007 9:00	2007	7	18	9:00	22	16.7	72	1	4
7/18/2007 10:00	2007	7	18	10:00	25.7	14.6	50	23	7
7/18/2007 11:00	2007	7	18	11:00	27.7	12.3	38	19	9
7/18/2007 12:00	2007	7	18	12:00	27.9	17.6	54	3	9
7/18/2007 13:00	2007	7	18	13:00	27.2	15.5	49	8	6
7/18/2007 14:00	2007	7	18	14:00	24.1	16.4	62	9	7

Meteorological Data - Kentville  
 Station Name KENTVILLE CDA CS  
 Province NOVA SCOTIA  
 Latitude 45.07  
 Longitude -64.48  
 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/18/2007 15:00	2007	7	18	15:00	22.4	15	63	3	4
7/18/2007 16:00	2007	7	18	16:00	22.5	15.8	66	32	2
7/18/2007 17:00	2007	7	18	17:00	21.5	15.9	70	7	6
7/18/2007 18:00	2007	7	18	18:00	20.8	16	74	6	4
7/18/2007 19:00	2007	7	18	19:00	21.5	18.4	83	18	6
7/18/2007 20:00	2007	7	18	20:00	21	18.5	86	22	4
7/18/2007 21:00	2007	7	18	21:00	19.6	16.9	84	4	2
7/18/2007 22:00	2007	7	18	22:00	20.3	18.4	89	14	7
7/18/2007 23:00	2007	7	18	23:00	20.1	18.2	89	15	2
7/19/2007 0:00	2007	7	19	0:00	19.8	18.1	90	8	2
7/19/2007 1:00	2007	7	19	1:00	19.5	18.2	92	29	4
7/19/2007 2:00	2007	7	19	2:00	19.1	18	93	5	4
7/19/2007 3:00	2007	7	19	3:00	19	17.9	93	8	6
7/19/2007 4:00	2007	7	19	4:00	18.9	17.8	93	9	4
7/19/2007 5:00	2007	7	19	5:00	18.9	17.7	93	0	0
7/19/2007 6:00	2007	7	19	6:00	19	17.6	92	0	0
7/19/2007 7:00	2007	7	19	7:00	19.7	17.9	89	20	4
7/19/2007 8:00	2007	7	19	8:00	20.8	18.6	87	22	7
7/19/2007 9:00	2007	7	19	9:00	22.4	18.4	78	24	11
7/19/2007 10:00	2007	7	19	10:00	24.3	19	72	23	11
7/19/2007 11:00	2007	7	19	11:00	24	19.1	74	27	9
7/19/2007 12:00	2007	7	19	12:00	25.1	19.7	72	31	9
7/19/2007 13:00	2007	7	19	13:00	23.4	19.2	77	5	11
7/19/2007 14:00	2007	7	19	14:00	21.8	19.2	85	9	4
7/19/2007 15:00	2007	7	19	15:00	21.2	19.5	90	4	6
7/19/2007 16:00	2007	7	19	16:00	21.4	20.2	93	4	2
7/19/2007 17:00	2007	7	19	17:00	22.2	20.3	89	11	4
7/19/2007 18:00	2007	7	19	18:00	20.9	19.8	93	4	6
7/19/2007 19:00	2007	7	19	19:00	20.3	19.4	95	3	4
7/19/2007 20:00	2007	7	19	20:00	19.9	19.1	95	7	4
7/19/2007 21:00	2007	7	19	21:00	19.8	19.1	96	5	2
7/19/2007 22:00	2007	7	19	22:00	19.7	19	96	7	2
7/19/2007 23:00	2007	7	19	23:00	20.1	19.4	96	19	6
7/20/2007 0:00	2007	7	20	0:00	20.2	19.4	95	17	4
7/20/2007 1:00	2007	7	20	1:00	20.1	19.3	95	18	2
7/20/2007 2:00	2007	7	20	2:00	19.9	19.1	95	9	2
7/20/2007 3:00	2007	7	20	3:00	19.8	19.1	96	11	2
7/20/2007 4:00	2007	7	20	4:00	20	19.3	96	13	4
7/20/2007 5:00	2007	7	20	5:00	19.8	18.9	95	11	4
7/20/2007 6:00	2007	7	20	6:00	19.5	18.6	95	17	9
7/20/2007 7:00	2007	7	20	7:00	19.6	18.7	95	21	9
7/20/2007 8:00	2007	7	20	8:00	20.1	19.2	95	23	7
7/20/2007 9:00	2007	7	20	9:00	21.2	20.3	95	19	6
7/20/2007 10:00	2007	7	20	10:00	22.5	21	91	20	9
7/20/2007 11:00	2007	7	20	11:00	25.2	22.2	83	21	13
7/20/2007 12:00	2007	7	20	12:00	25.5	21.7	80	20	17
7/20/2007 13:00	2007	7	20	13:00	27.4	22.2	73	22	17
7/20/2007 14:00	2007	7	20	14:00	26.1	21.3	75	21	17
7/20/2007 15:00	2007	7	20	15:00	26.4	22	77	19	9
7/20/2007 16:00	2007	7	20	16:00	26.1	21.9	78	21	11
7/20/2007 17:00	2007	7	20	17:00	25.2	21.2	79	22	9
7/20/2007 18:00	2007	7	20	18:00	24.1	20.8	82	20	7
7/20/2007 19:00	2007	7	20	19:00	23.9	20.8	83	20	13
7/20/2007 20:00	2007	7	20	20:00	23.1	20.2	84	21	9
7/20/2007 21:00	2007	7	20	21:00	22.6	19.6	83	22	11
7/20/2007 22:00	2007	7	20	22:00	22.5	19.6	84	20	11
7/20/2007 23:00	2007	7	20	23:00	22	19.4	85	20	11
7/21/2007 0:00	2007	7	21	0:00	21.5	18.8	85	22	9
7/21/2007 1:00	2007	7	21	1:00	20.8	18.3	86	21	11
7/21/2007 2:00	2007	7	21	2:00	20.1	17.8	87	22	6

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All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/21/2007 3:00	2007	7	21	3:00	19.8	17.6	87	18	9
7/21/2007 4:00	2007	7	21	4:00	19.8	17.9	89	20	6
7/21/2007 5:00	2007	7	21	5:00	20	17.9	88	23	6
7/21/2007 6:00	2007	7	21	6:00	20	17.7	87	21	6
7/21/2007 7:00	2007	7	21	7:00	20.2	17.5	84	19	6
7/21/2007 8:00	2007	7	21	8:00	20.2	17.3	83	21	7
7/21/2007 9:00	2007	7	21	9:00	19.9	16.9	83	22	11
7/21/2007 10:00	2007	7	21	10:00	19.2	17.5	90	21	7
7/21/2007 11:00	2007	7	21	11:00	19.5	18.2	92	25	6
7/21/2007 12:00	2007	7	21	12:00	19.4	18.3	93	20	4
7/21/2007 13:00	2007	7	21	13:00	20.7	18.7	88	19	6
7/21/2007 14:00	2007	7	21	14:00	20.9	19	89	19	4
7/21/2007 15:00	2007	7	21	15:00	21.1	19.1	88	21	6
7/21/2007 16:00	2007	7	21	16:00	21.3	19.2	88	17	4
7/21/2007 17:00	2007	7	21	17:00	21.2	19.1	88	19	4
7/21/2007 18:00	2007	7	21	18:00	20.6	19.1	91	17	4
7/21/2007 19:00	2007	7	21	19:00	19.9	18.5	92	13	2
7/21/2007 20:00	2007	7	21	20:00					
7/21/2007 21:00	2007	7	21	21:00	18.9	18.1	95	25	2
7/21/2007 22:00	2007	7	21	22:00	18.5	17.7	95	20	2
7/21/2007 23:00	2007	7	21	23:00	18.2	17.5	96	24	4
7/22/2007 0:00	2007	7	22	0:00	18.1	17.5	96	19	6
7/22/2007 1:00	2007	7	22	1:00	18.1	17.4	96	29	4
7/22/2007 2:00	2007	7	22	2:00	17.5	16.7	95	20	4
7/22/2007 3:00	2007	7	22	3:00	16.5	15.8	96	28	4
7/22/2007 4:00	2007	7	22	4:00	15.7	15	96	27	4
7/22/2007 5:00	2007	7	22	5:00	15.8	15.1	96	23	4
7/22/2007 6:00	2007	7	22	6:00	16	15.3	96	27	4
7/22/2007 7:00	2007	7	22	7:00	16.5	15.9	96	30	6
7/22/2007 8:00	2007	7	22	8:00	17.3	16.4	94	35	7
7/22/2007 9:00	2007	7	22	9:00	18.8	16.4	86	1	9
7/22/2007 10:00	2007	7	22	10:00	21.6	16.6	73	2	9
7/22/2007 11:00	2007	7	22	11:00	22.8	15.6	64	5	9
7/22/2007 12:00	2007	7	22	12:00	23.1	14.9	60	5	9
7/22/2007 13:00	2007	7	22	13:00	24.1	15.4	58	4	7
7/22/2007 14:00	2007	7	22	14:00	24.9	15.1	54	9	7
7/22/2007 15:00	2007	7	22	15:00	25.9	15	51	3	7
7/22/2007 16:00	2007	7	22	16:00	24.9	12.2	45	2	13
7/22/2007 17:00	2007	7	22	17:00	24.1	10.9	43	1	7
7/22/2007 18:00	2007	7	22	18:00	23.6	14.2	56	7	4
7/22/2007 19:00	2007	7	22	19:00	22.1	14.6	62	7	4
7/22/2007 20:00	2007	7	22	20:00	19	15.1	78	14	2
7/22/2007 21:00	2007	7	22	21:00	17.2	14.9	86	20	6
7/22/2007 22:00	2007	7	22	22:00	16.4	13.4	82	27	2
7/22/2007 23:00	2007	7	22	23:00	15.4	12.9	85	21	6
7/23/2007 0:00	2007	7	23	0:00	14.4	12.1	86	21	2
7/23/2007 1:00	2007	7	23	1:00	13.4	11.8	90	0	0
7/23/2007 2:00	2007	7	23	2:00	13	11.8	92	18	2
7/23/2007 3:00	2007	7	23	3:00	12.7	11.8	94	18	2
7/23/2007 4:00	2007	7	23	4:00	12.7	11.9	95	20	6
7/23/2007 5:00	2007	7	23	5:00	12.2	11.4	95	17	4
7/23/2007 6:00	2007	7	23	6:00	13.2	12.4	95	18	2
7/23/2007 7:00	2007	7	23	7:00	18	14.4	79	0	0
7/23/2007 8:00	2007	7	23	8:00	19.3	15.4	78	2	4
7/23/2007 9:00	2007	7	23	9:00	21.5	17.4	77	4	6
7/23/2007 10:00	2007	7	23	10:00	22.5	17.4	73	7	7
7/23/2007 11:00	2007	7	23	11:00	23	17.5	71	4	7
7/23/2007 12:00	2007	7	23	12:00	24.8	16.9	61	6	7
7/23/2007 13:00	2007	7	23	13:00	25.5	10.9	40	16	7
7/23/2007 14:00	2007	7	23	14:00	26.5	11.7	40	15	7

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All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/23/2007 15:00	2007	7	23	15:00	27	11.7	39	16	7
7/23/2007 16:00	2007	7	23	16:00	25.4	11.8	43	19	7
7/23/2007 17:00	2007	7	23	17:00	24	13.1	51	19	6
7/23/2007 18:00	2007	7	23	18:00	22.8	14	58	17	7
7/23/2007 19:00	2007	7	23	19:00	22.2	14.3	61	19	4
7/23/2007 20:00	2007	7	23	20:00	20.9	15.3	70	21	6
7/23/2007 21:00	2007	7	23	21:00	19.8	16.1	79	18	6
7/23/2007 22:00	2007	7	23	22:00	19.6	17.2	86	21	6
7/23/2007 23:00	2007	7	23	23:00	19.3	17.3	88	22	4
7/24/2007 0:00	2007	7	24	0:00	19.1	17.4	90	21	7
7/24/2007 1:00	2007	7	24	1:00	18.9	17.5	92	22	6
7/24/2007 2:00	2007	7	24	2:00	18.8	17.5	92	25	4
7/24/2007 3:00	2007	7	24	3:00	19	17.6	92	32	2
7/24/2007 4:00	2007	7	24	4:00	18.8	17.5	92	24	4
7/24/2007 5:00	2007	7	24	5:00	18.5	17.5	94	27	4
7/24/2007 6:00	2007	7	24	6:00	19.3	18.4	95	23	2
7/24/2007 7:00	2007	7	24	7:00	20.3	19	92	0	0
7/24/2007 8:00	2007	7	24	8:00	22.3	20	87	29	4
7/24/2007 9:00	2007	7	24	9:00	23.6	20.6	83	20	6
7/24/2007 10:00	2007	7	24	10:00	24.6	21	80	29	6
7/24/2007 11:00	2007	7	24	11:00	25.4	21	77	30	6
7/24/2007 12:00	2007	7	24	12:00	26.3	21.1	73	31	6
7/24/2007 13:00	2007	7	24	13:00	25.8	21.3	76	31	9
7/24/2007 14:00	2007	7	24	14:00	26.7	21.2	72	33	9
7/24/2007 15:00	2007	7	24	15:00	27.7	21.2	68	27	9
7/24/2007 16:00	2007	7	24	16:00	27.8	21.4	68	25	11
7/24/2007 17:00	2007	7	24	17:00	26.7	20.8	70	28	13
7/24/2007 18:00	2007	7	24	18:00	25.8	20.1	71	26	15
7/24/2007 19:00	2007	7	24	19:00	24.4	19.4	74	26	9
7/24/2007 20:00	2007	7	24	20:00	22.4	19.2	82	24	6
7/24/2007 21:00	2007	7	24	21:00	20.4	18.5	89	23	4
7/24/2007 22:00	2007	7	24	22:00	19.4	18.2	93	29	4
7/24/2007 23:00	2007	7	24	23:00	19.3	18.1	93	29	6
7/25/2007 0:00	2007	7	25	0:00	18.7	17.8	95	27	7
7/25/2007 1:00	2007	7	25	1:00	17.7	16.5	93	25	6
7/25/2007 2:00	2007	7	25	2:00	17.1	15.5	90	24	13
7/25/2007 3:00	2007	7	25	3:00	16.2	14.8	91	25	6
7/25/2007 4:00	2007	7	25	4:00	16.2	15.1	93	26	7
7/25/2007 5:00	2007	7	25	5:00	16.5	15.3	93	23	6
7/25/2007 6:00	2007	7	25	6:00	16.6	15.3	92	22	6
7/25/2007 7:00	2007	7	25	7:00	18.4	16.1	86	25	4
7/25/2007 8:00	2007	7	25	8:00	18.7	16.4	86	28	9
7/25/2007 9:00	2007	7	25	9:00	20.5	17.3	82	26	11
7/25/2007 10:00	2007	7	25	10:00	22.8	17.9	74	25	13
7/25/2007 11:00	2007	7	25	11:00	25.1	19	69	27	11
7/25/2007 12:00	2007	7	25	12:00	26.7	19.4	64	28	6
7/25/2007 13:00	2007	7	25	13:00	26.8	19.8	66	28	11
7/25/2007 14:00	2007	7	25	14:00	27.8	19.4	60	29	11
7/25/2007 15:00	2007	7	25	15:00	28.9	19.4	57	31	11
7/25/2007 16:00	2007	7	25	16:00	29.1	19	55	28	11
7/25/2007 17:00	2007	7	25	17:00	28.8	18.7	54	27	9
7/25/2007 18:00	2007	7	25	18:00	27.7	18.9	59	27	13
7/25/2007 19:00	2007	7	25	19:00	26.5	19.1	64	25	7
7/25/2007 20:00	2007	7	25	20:00	23.7	18.2	71	24	6
7/25/2007 21:00	2007	7	25	21:00	21.8	18.2	80	19	4
7/25/2007 22:00	2007	7	25	22:00	22.1	17.1	73	24	4
7/25/2007 23:00	2007	7	25	23:00	21	16.8	77	23	4
7/26/2007 0:00	2007	7	26	0:00	20.1	16.9	82	20	2
7/26/2007 1:00	2007	7	26	1:00	20.5	17.1	81	24	9
7/26/2007 2:00	2007	7	26	2:00	21.7	17.7	78	25	9

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Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/26/2007 3:00	2007	7	26	3:00	21.6	17.5	78	25	9
7/26/2007 4:00	2007	7	26	4:00	21.4	17.2	77	26	9
7/26/2007 5:00	2007	7	26	5:00	21.1	16.7	76	24	7
7/26/2007 6:00	2007	7	26	6:00	21.5	17.1	76	25	9
7/26/2007 7:00	2007	7	26	7:00	23.3	18.2	73	26	11
7/26/2007 8:00	2007	7	26	8:00	25.1	19.3	70	25	11
7/26/2007 9:00	2007	7	26	9:00	26.9	19.2	63	26	11
7/26/2007 10:00	2007	7	26	10:00	28.6	18.4	54	27	11
7/26/2007 11:00	2007	7	26	11:00	30.1	17.9	48	27	17
7/26/2007 12:00	2007	7	26	12:00	31.1	16.9	43	28	17
7/26/2007 13:00	2007	7	26	13:00	31.2	15.1	38	27	19
7/26/2007 14:00	2007	7	26	14:00	31.6	15.2	37	26	15
7/26/2007 15:00	2007	7	26	15:00	31.4	13.6	34	25	17
7/26/2007 16:00	2007	7	26	16:00	31.2	13.6	34	26	13
7/26/2007 17:00	2007	7	26	17:00	30.4	15.7	41	26	17
7/26/2007 18:00	2007	7	26	18:00	29.4	18	50	26	13
7/26/2007 19:00	2007	7	26	19:00	28.1	18.8	57	25	11
7/26/2007 20:00	2007	7	26	20:00	25.9	17.7	61	23	11
7/26/2007 21:00	2007	7	26	21:00	24.6	16.7	61	23	11
7/26/2007 22:00	2007	7	26	22:00	23.3	16	64	24	7
7/26/2007 23:00	2007	7	26	23:00	21.7	15.8	69	24	4
7/27/2007 0:00	2007	7	27	0:00	22	15.9	68	24	7
7/27/2007 1:00	2007	7	27	1:00	21.7	16	70	25	6
7/27/2007 2:00	2007	7	27	2:00	21.6	16.3	72	26	7
7/27/2007 3:00	2007	7	27	3:00	21.2	16.6	75	25	9
7/27/2007 4:00	2007	7	27	4:00	21.1	16.8	76	25	11
7/27/2007 5:00	2007	7	27	5:00	20.9	17	78	25	7
7/27/2007 6:00	2007	7	27	6:00	21.7	17.4	77	25	9
7/27/2007 7:00	2007	7	27	7:00	23.1	18.1	73	25	9
7/27/2007 8:00	2007	7	27	8:00	24.8	18.9	70	26	11
7/27/2007 9:00	2007	7	27	9:00	27	19.5	64	25	9
7/27/2007 10:00	2007	7	27	10:00	28.4	19.6	59	26	13
7/27/2007 11:00	2007	7	27	11:00	29.7	18.1	50	26	13
7/27/2007 12:00	2007	7	27	12:00	31	17.9	46	28	13
7/27/2007 13:00	2007	7	27	13:00	31.6	16.7	41	29	17
7/27/2007 14:00	2007	7	27	14:00	32.1	16.1	38	28	15
7/27/2007 15:00	2007	7	27	15:00	32.3	16.2	38	27	11
7/27/2007 16:00	2007	7	27	16:00	32.2	15.7	37	28	13
7/27/2007 17:00	2007	7	27	17:00	31.6	15.8	39	26	11
7/27/2007 18:00	2007	7	27	18:00	30.1	17	45	27	13
7/27/2007 19:00	2007	7	27	19:00	28.6	16.9	49	26	6
7/27/2007 20:00	2007	7	27	20:00	25.7	17.5	61	25	7
7/27/2007 21:00	2007	7	27	21:00	24.7	17.3	63	22	7
7/27/2007 22:00	2007	7	27	22:00	23.4	17.8	71	24	11
7/27/2007 23:00	2007	7	27	23:00	22.4	17.6	74	23	6
7/28/2007 0:00	2007	7	28	0:00	21.5	17.8	79	24	6
7/28/2007 1:00	2007	7	28	1:00	21.3	18	81	23	6
7/28/2007 2:00	2007	7	28	2:00	20.7	17.8	83	22	7
7/28/2007 3:00	2007	7	28	3:00	18.6	17.1	91	25	6
7/28/2007 4:00	2007	7	28	4:00	17.7	16	90	23	2
7/28/2007 5:00	2007	7	28	5:00	17.1	15.9	93	0	0
7/28/2007 6:00	2007	7	28	6:00	18.3	17.3	94	19	4
7/28/2007 7:00	2007	7	28	7:00	19.5	17.9	90	29	2
7/28/2007 8:00	2007	7	28	8:00	21.8	19.2	85	32	2
7/28/2007 9:00	2007	7	28	9:00	24.8	20.3	76	27	11
7/28/2007 10:00	2007	7	28	10:00	27	20.8	69	26	17
7/28/2007 11:00	2007	7	28	11:00	28.3	21.3	66	27	11
7/28/2007 12:00	2007	7	28	12:00	26.5	20.5	70	5	11
7/28/2007 13:00	2007	7	28	13:00	26.5	21	72	4	9
7/28/2007 14:00	2007	7	28	14:00	29.4	21.4	62	3	11

Meteorological Data - Kentville

Station Name KENTVILLE CDA CS  
 Province NOVA SCOTIA  
 Latitude 45.07  
 Longitude -64.48  
 Elevation 48.7  
 Climate Identifier 8202810  
 WMO Identifier 71671  
 TC Identifier XKT

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

Date/Time	Year	Month	Day	Time	Temp (?C)	Dew Point Temp (?C)	Rel Hum (%)	Wind Dir (10's deg)	Wind Spd (km/h)
7/28/2007 15:00	2007	7	28	15:00	27.5	20.9	67	6	7
7/28/2007 16:00	2007	7	28	16:00	26.7	21.8	75	6	7
7/28/2007 17:00	2007	7	28	17:00	27	21.4	71	11	4
7/28/2007 18:00	2007	7	28	18:00	28.7	20.7	62	21	11
7/28/2007 19:00	2007	7	28	19:00	27.3	20.6	67	20	6
7/28/2007 20:00	2007	7	28	20:00	25.1	20.9	78	20	7
7/28/2007 21:00	2007	7	28	21:00	24.2	20.8	81	19	7
7/28/2007 22:00	2007	7	28	22:00	23.5	20.7	84	19	7
7/28/2007 23:00	2007	7	28	23:00	23.1	20.6	86	19	9
7/29/2007 0:00	2007	7	29	0:00	22.4	20.3	88	24	6
7/29/2007 1:00	2007	7	29	1:00	22.6	20.3	87	21	6
7/29/2007 2:00	2007	7	29	2:00	22.8	20.4	86	21	4
7/29/2007 3:00	2007	7	29	3:00	22.8	20.3	86	24	4
7/29/2007 4:00	2007	7	29	4:00	23.1	20.5	85	19	6
7/29/2007 5:00	2007	7	29	5:00	23	20.4	85	21	6
7/29/2007 6:00	2007	7	29	6:00	22.6	20.7	89	25	9
7/29/2007 7:00	2007	7	29	7:00	21.4	20.4	94	14	4
7/29/2007 8:00	2007	7	29	8:00	21.9	21	95	11	2
7/29/2007 9:00	2007	7	29	9:00	25.2	23.1	88	21	6
7/29/2007 10:00	2007	7	29	10:00	25.9	22.5	82	33	6
7/29/2007 11:00	2007	7	29	11:00	27.3	22.3	74	26	7
7/29/2007 12:00	2007	7	29	12:00	28.4	20.8	63	21	15
7/29/2007 13:00	2007	7	29	13:00	25.7	21.5	78	36	7
7/29/2007 14:00	2007	7	29	14:00	27.4	22.3	74	7	6
7/29/2007 15:00	2007	7	29	15:00	25.4	21.3	78	3	7
7/29/2007 16:00	2007	7	29	16:00	25.8	21.9	79	8	4
7/29/2007 17:00	2007	7	29	17:00	25.7	21.2	76	4	6
7/29/2007 18:00	2007	7	29	18:00	24.1	21.1	83	4	6
7/29/2007 19:00	2007	7	29	19:00	22.6	20.5	88	9	4
7/29/2007 20:00	2007	7	29	20:00	21.1	19.5	91	28	4
7/29/2007 21:00	2007	7	29	21:00	20.9	19.9	94	22	2
7/29/2007 22:00	2007	7	29	22:00	20.4	19.5	95	19	2
7/29/2007 23:00	2007	7	29	23:00	19.9	19.2	96	18	6

F.2

TABULATED METEOROLOGICAL DATA - HALIFAX INTERNATIONAL AIRPORT



Meteorological Data - Halifax Airport

Latitude: 44° 52' N Longitude: 63° 31' W Elevation: 145.40 m  
 Climate ID: 8202250 WMO ID: 71395 TC ID: YHZ

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)		-6	-5.6	-1.4	4	9.8	15	18.6	18.4	14.1	8.3	3.1	-2.8	6.3 A
Standard Deviation		1.7	2	1.6	1.2	1.3	1.1	1.1	0.9	1.2	1.2	1.4	2.2	0.7 A
Daily Maximum (°C)		-1.2	-1.1	3	8.4	15	20.3	23.6	23.3	18.8	12.7	6.9	1.4	11 A
Daily Minimum (°C)		-10.7	-10.2	-5.8	-0.5	4.5	9.6	13.5	13.5	9.3	3.8	-0.7	-7.1	1.6 A
Extreme Maximum (°C)		14.8	17.5	25.6	26.3	32.8	33.4	33.9	<b>35</b>	32.8	25.8	19.4	15	
Date (yyyy/dd)		1999/25	1994/20	1998/31	2004/30	1977/23	2001/27	1963/26+	<b>1995/01</b>	2002/10	1990/07	1961/05+	1953/06+	
Extreme Minimum (°C)		<b>-28.5</b>	-27.3	-22.4	-12.8	-4.4	0.6	6.1	4.4	-0.8	-6.7	-13.1	-23.3	
Date (yyyy/dd)		<b>1993/31+</b>	1993/07	1989/07	1995/05	1966/08	1975/10	1970/02	1965/30+	1989/28	1974/22	1978/27	1980/25	
Precipitation: Precipitation:														
Rainfall (mm)		100.6	69	96.4	96.1	106.2	98.3	102.2	92.7	103.6	126.4	133	114.5	1238.9 A
Snowfall (cm)		54.6	50.1	41.1	20.9	3.3	0	0	0	0	2.3	14.4	43.9	230.5 A
Precipitation (mm)		149.2	114.4	134.5	118.3	109.7	98.3	102.2	92.7	103.6	128.7	146	154.8	1452.2 A
Average Snow Depth (cm)		11	13	8	1	0	0	0	0	0	0	1	4	3 A
Median Snow Depth (cm)		9	12	6	0	0	0	0	0	0	0	0	2	2 A
Snow Depth at Month-end (cm)		10	13	2	0	0	0	0	0	0	0	1	10	3 A
Extreme Daily Rainfall (mm)		94.1	84.9	89.2	76.7	79.5	64	71.1	<b>218.2</b>	84.3	66.8	87.8	98.8	
Date (yyyy/dd)		1978/14	1996/17	1972/23	1962/08	2005/22	1972/10	1981/21	<b>1971/15</b>	2002/11	1967/10	2004/25	1975/10	
Extreme Daily Snowfall (cm)		43.7	<b>66</b>	28.6	28.4	26.9	0	0	0	0	38.6	28.2	47.5	
Date (yyyy/dd)		1961/04	<b>2004/19</b>	1984/09	1963/11+	1972/10	1953/01+	1953/01+	1953/01+	1953/01+	1974/20	1986/19	1970/24	
Extreme Daily Precipitation (mm)		100.1	84.9	90.2	76.7	79.5	64	71.1	<b>218.2</b>	84.3	66.8	87.8	98.8	
Date (yyyy/dd)		1978/14	1996/17	1972/23	1962/08	2005/22	1972/10	1981/21	<b>1971/15</b>	2002/11	1967/10	2004/25	1975/10	
Extreme Snow Depth (cm)		<b>94</b>	81	53	38	18	0	0	0	0	25	33	71	
Date (yyyy/dd)		<b>1971/24</b>	2004/23	1967/25+	1972/10	1972/11	1961/01+	1960/01+	1960/01+	1960/01+	1974/21	2004/15	1970/27	
Days with Maximum Temperature: Days with Maximum Temperature:														
<= 0 °C		17.4	16	8.7	0.5	0.03	0	0	0	0	0.03	2.5	11.9	57.1 A
> 0 °C		13.6	12.3	22.3	29.5	31	30	31	31	30	31	27.5	19.1	308.2 A
> 10 °C		1.2	0.63	2.2	10.5	25.7	29.6	31	31	29.8	22.3	8.6	2.9	195.5 A
> 20 °C		0	0	0	0.4	5	16.4	25.9	25.5	10.8	1.3	0	0	85.3 A
> 30 °C		0	0	0	0	0.2	0.5	0.76	0.7	0.07	0	0	0	2.2 A
> 35 °C		0	0	0	0	0	0	0	0	0	0	0	0	0 A
Days with Minimum Temperature: Days with Minimum Temperature:														
> 0 °C		1.5	1.3	2.9	11.9	28.2	30	31	31	29.9	25.5	11.5	3.4	208 A
<= 2 °C		30.5	27.8	30	24.5	7.8	0.2	0	0	0.37	11.7	22.7	29.3	185 A
<= 0 °C		29.5	27	28.1	18.1	2.8	0	0	0	0.07	5.5	18.5	27.6	157.3 A
< -2 °C		27.4	25.3	23	8.5	0.5	0	0	0	0	1.4	12.3	23.9	122.2 A
< -10 °C		16.5	14.5	6.5	0.03	0	0	0	0	0	0	0.68	9.9	48.1 A
< -20 °C		1.8	1.4	0.1	0	0	0	0	0	0	0	0	0.43	3.7 A
< -30 °C		0	0	0	0	0	0	0	0	0	0	0	0	0 A
Days with Rainfall: Days with Rainfall:														
>= 0.2 mm		8.8	6.4	9.3	11.7	13.7	12.9	12.1	10.4	10.9	12.3	12.8	10.5	131.9 A
>= 5 mm		4.9	3.1	4.7	5.6	6.2	5.5	5	4.5	5.1	6.2	6.7	5.3	62.7 A
>= 10 mm		3.4	2.3	3.2	3.3	3.3	3.2	3.4	2.8	3.4	3.9	4.6	3.6	40.6 A
>= 25 mm		1.3	0.9	1.2	0.77	0.83	0.9	0.97	0.83	1.4	1.5	1.4	1.3	13.3 A
Days With Snowfall: Days With Snowfall:														
>= 0.2 cm		14.3	12	10	6.2	0.73	0	0	0	0	0.4	4.2	12.4	60.2 A
>= 5 cm		3.6	2.9	3.1	1.4	0.23	0	0	0	0	0.1	0.83	2.6	14.8 A
>= 10 cm		1.4	1.4	1.4	0.37	0.1	0	0	0	0	0.07	0.38	1.1	6.2 A
>= 25 cm		0.1	0.27	0.1	0.07	0.03	0	0	0	0	0.03	0.03	0.13	0.76 A
Days with Precipitation: Days with Precipitation:														
>= 0.2 mm		19	15.2	15.7	14.9	14	12.9	12.1	10.4	10.9	12.4	15.4	18.3	171.2 A
>= 5 mm		7.8	5.5	7.1	7	6.4	5.5	5	4.5	5.1	6.3	7.3	7.8	75 A
>= 10 mm		4.9	3.9	4.7	4.1	3.4	3.2	3.4	2.8	3.4	4.1	5	4.9	47.7 A
>= 25 mm		1.6	1.3	1.4	0.93	0.97	0.9	0.97	0.83	1.4	1.6	1.5	1.6	15 A
Days with Snow Depth: Days with Snow Depth:														
>= 1 cm		22.1	22.1	19.2	5.5	0.37	0	0	0	0	0.27	3.6	14.2	87.3 A
>= 5 cm		16.4	17.7	13.7	3	0.27	0	0	0	0	0.23	1.9	9.2	62.4 A
>= 10		11.2	12.7	9.4	1.3	0.13	0	0	0	0	0.17	1.2	4.5	40.6 A
>= 20		5.6	7.8	4.6	0.28	0	0	0	0	0	0.07	0.34	1.7	20.3 A
Wind: Wind:														
Speed (km/h)		18.6	18.4	19	18.6	16.7	15.6	14.5	13.5	14.6	16.1	17.6	18.4	16.8 A
Most Frequent Direction		W	W	W	S	S	S	S	S	S	S	NW	W	S A

Meteorological Data - Halifax Airport

Latitude: 44° 52' N Longitude: 63° 31' W Elevation: 145.40 m  
 Climate ID: 8202250 WMO ID: 71395 TC ID: YHZ

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<b>Maximum Hourly Speed</b>	80	89	77	71	64	64	64	79	56	85	68	74	85	
<b>Date (yyyy/dd)</b>	1973/29	1969/10	1976/17	1975/04	1961/26	1973/17	1975/28	1982/26+	2003/29	1972/07	2005/22	1976/27		
<b>Direction of Maximum Hourly Speed</b>	S	E	S	E	S	N	SE	NW	S	SE	SE	E	E	
<b>Maximum Gust Speed</b>	117	127	126	115	92	97	130	89	93	109	111	132		
<b>Date (yyyy/dd)</b>	1978/09	1976/02	1976/17	1982/04	1961/28	1973/17	1975/28	1982/26	1979/07+	1972/07	1978/18	1976/26+		
<b>Direction of Maximum Gust</b>	SE	SW	SW	SE	SE	N	SE	NW	S	SE	S	SE	SE	
<b>Days with Winds &gt;= 52 km/hr</b>	2.9	1.7	1.9	1.2	0.3	0.2	0.2	0.1	0.4	0.6	1.6	2.2	13.4	A
<b>Days with Winds &gt;= 63 km/hr</b>	0.8	0.3	0.4	0.2	0	0	0.1	0	0	0.2	0.2	0.6	2.9	A
<b>Degree Days: Degree Days:</b>														
<b>Above 24 °C</b>	0	0	0	0	0	0.2	0.4	0.4	0	0	0	0	1	A
<b>Above 18 °C</b>	0	0	0	0	0.7	11.4	42.7	42.4	6.5	0.1	0	0	103.8	A
<b>Above 15 °C</b>	0	0	0	0.1	4.7	42.3	114.9	111	28.6	1.9	0.1	0	303.6	A
<b>Above 10 °C</b>	0.1	0	0.1	3.1	42.3	152.9	265.7	261.4	127.6	27.1	3.6	0.1	883.8	A
<b>Above 5 °C</b>	1.6	1.3	3.9	29.4	152.1	299.5	420.7	416.4	272.3	112.9	31.1	5.2	1746.3	A
<b>Above 0 °C</b>	15.8	13.2	38.4	124.3	302.7	449.4	575.7	571.4	422.3	257.3	110.2	33.1	2913.9	A
<b>Below 0 °C</b>	200.6	172.4	84.4	5.4	0.1	0	0	0	0	0.3	18.9	120.4	602.5	A
<b>Below 5 °C</b>	341.5	301.8	204.9	60.5	4.4	0.1	0	0	0	10.9	89.8	247.5	1261.3	A
<b>Below 10 °C</b>	494.9	441.9	356.1	184.3	49.6	3.5	0	0	5.2	80	212.3	397.3	2225.1	A
<b>Below 15 °C</b>	649.9	583.2	511	331.2	167	42.9	4.2	4.6	56.2	209.9	358.8	552.3	3471.2	A
<b>Below 18 °C</b>	742.9	668	604	421.1	256	102	25	29	124.1	301	448.7	645.3	4367.2	A
<b>Humidex: Humidex:</b>														
<b>Extreme Humidex</b>	18.4	18.3	27.7	26.2	36	40.2	42.4	41.9	39.6	30.5	25.4	18		
<b>Date (yyyy/dd)</b>	1999/25	1976/02	1998/31	2004/30	1977/23	2005/25	1977/21	1988/05	1961/11	2002/02	1982/05	1972/07		
<b>Days with Humidex &gt;= 30</b>	0	0	0	0	0.3	2.6	8.8	8.6	1.4	0	0	0	21.8	A
<b>Days with Humidex &gt;= 35</b>	0	0	0	0	0.1	0.5	1.3	1.4	0.1	0	0	0	3.3	A
<b>Days with Humidex &gt;= 40</b>	0	0	0	0	0	0	0	0.2	0	0	0	0	0.2	A
<b>Wind Chill: Wind Chill:</b>														
<b>Extreme Wind Chill</b>	-40.4	-41.1	-33.9	-24.4	-10.9	-5.6	3.7	0.7	-3.6	-10.1	-23.9	-35.6		
<b>Date (yyyy/dd)</b>	1982/18	1967/13	1989/07	1995/05	1972/11	1973/17	1965/08	1965/30	1980/29	1969/24+	1978/27	1980/25		
<b>Days with Wind Chill &lt; -20</b>	11.5	9.2	3.5	0	0	0	0	0	0	0	0.2	5.4	29.8	A
<b>Days with Wind Chill &lt; -30</b>	1.7	1	0.1	0	0	0	0	0	0	0	0	0.5	3.3	A
<b>Days with Wind Chill &lt; -40</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	A
<b>Humidity: Humidity:</b>														
<b>Average Vapour Pressure (kPa)</b>	0.4	0.4	0.5	0.6	0.9	1.3	1.6	1.6	1.3	0.9	0.7	0.5	0.9	A
<b>Average Relative Humidity - 0600LST</b>	83.2	82.1	83.8	86.5	87.5	88.1	89.6	90.7	91.2	89	86.8	84.5	86.9	A
<b>Average Relative Humidity - 1500LST</b>	74	69	67	64.2	62.3	61.8	62.6	62.8	64.6	66.9	73	75.9	67	A
<b>Pressure: Pressure:</b>														
<b>Average Station Pressure (kPa)</b>	99.5	99.5	99.5	99.5	99.7	99.7	99.7	99.9	99.9	99.9	99.7	99.6	99.7	A
<b>Average Sea Level Pressure (kPa)</b>	101.3	101.3	101.3	101.2	101.5	101.4	101.4	101.6	101.6	101.7	101.5	101.4	101.4	A
<b>Visibility (hours with): Visibility (hours with):</b>														
<b>&lt; 1 km</b>	41.3	37.3	55	57.8	77.9	69.7	76.6	60.7	30.3	30.1	33.5	34.7		A
<b>1 to 9 km</b>	159.6	129	146.6	145.7	117.9	117.3	133.4	139	114	110.5	127.5	150.5		A
<b>&gt; 9 km</b>	543.1	511.7	542.4	516.5	548.2	533	534	544.3	575.7	603.4	559	558.9		A
<b>Cloud Amount (hours with): Cloud Amount (hours with):</b>														
<b>0 to 2 tenths</b>	156.3	154.8	172	128.2	126	118.9	122.2	158.5	185.6	182.3	123	141		A
<b>3 to 7 tenths</b>	150.4	132.6	126.5	123.9	157.2	185.8	212.3	202.5	172.9	163.7	139.7	139.9		A
<b>8 to 10 tenths</b>	437.3	390.5	445.6	468	460.8	415.3	409.5	383	361.5	398	457.3	463.1		A

F.3

**SAMPLER FLOW CALCULATIONS AND CALCULATED FLOW RATES**

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">14-Jun-07</a>
Sampler S/N: <a href="#">GRAS W00-01</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	131	Corrected Pressure (mm Hg):	752
Daily Average Pressure (in Hg):	29.72	Temperature (deg K):	291
Daily Average Temperature (deg C):	18	Corrected Seasonal (mm Hg):	752
Seasonal Press. (in Hg):	29.72	Seasonal Temp. (deg K):	291
Seasonal Temp. (deg C):	18		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">GRAS W00-01</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA							
Plate or Test #	Manometer Reading			Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required		
	H2O (inches)	Qstd (m3/min)	Flow (CFM)				
1	<a href="#">3.53</a>	1.188	41.94	1.2%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">YES</td> <td style="width: 50%; text-align: center;">NO</td> </tr> </table>	YES	NO
YES	NO						
2	<a href="#">3.22</a>	1.144	40.41	0.3%			
3	<a href="#">3.24</a>	1.148	40.53	0.3%			
Avg.		1.160	40.96				

**Comments:**  
[Flow set to 40cfm](#)  
[Readings on manometer taken every 10minutes](#)

**Calculations**

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$   
 Qstd = standard flow rate  
 m = calibrator Qstd slope  
 b = calibrator Qstd intercept  
 Ta = actual temperature during calibration (deg K)  
 Pa = actual pressure during calibration (mm Hg)  
 Tstd = 293 deg K  
 Pstd = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <b>Fundy Gypsum, Windsor</b>	Date: <b>18-Jun-07</b>
Sampler S/N: <b>GRAS W00-01</b>	Tech: <b>J Mac Donald</b>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	131	Corrected Pressure (mm Hg):	742
Daily Average Pressure (in Hg):	29.36	Temperature (deg K):	293
Daily Average Temperature (deg C):	20	Corrected Seasonal (mm Hg):	742
Seasonal Press. (in Hg):	29.36	Seasonal Temp. (deg K):	293
Seasonal Temp. (deg C):	20		

CALIBRATION ORIFICE DATA			
Make: <b>Tisch Environmental</b>		Qstd Slope: <b>1.58493</b>	
Model:		Qstd Intercept: <b>-0.00610</b>	
Serial#: <b>GRAS W00-01</b>		Date Certified: <b>Nov 03/05</b>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	3.25	1.127	39.82	-0.1%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	3.61	1.198	42.31	1.4%					
3	3.27	1.141	40.28	0.2%					
Avg.		1.155	40.80						
<b>Comments:</b>									
Flow set to 40cfm									
Readings on manometer taken every 10minutes									

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <b>Fundy Gypsum, Windsor</b>	Date: <b>18-Jun-07</b>
Sampler S/N: <b>GRAS W00-02</b>	Tech: <b>J Mac Donald</b>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<b>131</b>	Corrected Pressure (mm Hg):	742
Daily Average Pressure (in Hg):	<b>29.36</b>	Temperature (deg K):	293
Daily Average Temperature (deg C):	<b>20</b>	Corrected Seasonal (mm Hg):	742
Seasonal Press. (in Hg):	<b>29.36</b>	Seasonal Temp. (deg K):	293
Seasonal Temp. (deg C):	<b>20</b>		

CALIBRATION ORIFICE DATA			
Make: <b>Tisch Environmental</b>		Qstd Slope: <b>1.58493</b>	
Model:		Qstd Intercept: <b>-0.00610</b>	
Serial#: <b>GRAS W00-02</b>		Date Certified: <b>Nov 03/05</b>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	<b>3.48</b>	1.167	41.20	0.7%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<b>3.38</b>	1.159	40.95	0.6%					
3	<b>3.46</b>	1.173	41.43	0.9%					
Avg.		1.166	41.19						
<b>Comments:</b>									
Flow set to 40cfm									
Readings on manometer taken every 10minutes									

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">14-Jun-07</a>
Sampler S/N: <a href="#">GRAS W00-03</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	752
Daily Average Pressure (in Hg):	<a href="#">29.72</a>	Temperature (deg K):	291
Daily Average Temperature (deg C):	<a href="#">18</a>	Corrected Seasonal (mm Hg):	752
Seasonal Press. (in Hg):	<a href="#">29.72</a>	Seasonal Temp. (deg K):	291
Seasonal Temp. (deg C):	<a href="#">18</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">GRAS W00-03</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	<a href="#">3.39</a>	1.164	41.11	0.7%	<table border="1" style="margin: auto;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<a href="#">3.49</a>	1.191	42.06	1.3%					
3	<a href="#">3.62</a>	1.213	42.83	1.7%					
Avg.		1.189	42.00						
<b>Comments:</b>									
<a href="#">Flow set to 40cfm</a>									
<a href="#">Readings on manometer taken every 10minutes</a>									

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(\text{H}_2\text{O}(\text{Pa}/\text{P}_{std})(\text{T}_{std}/\text{T}_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">18-Jun-07</a>
Sampler S/N: <a href="#">GRAS W00-03</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	131	Corrected Pressure (mm Hg):	742
Daily Average Pressure (in Hg):	29.36	Temperature (deg K):	293
Daily Average Temperature (deg C):	20	Corrected Seasonal (mm Hg):	742
Seasonal Press. (in Hg):	29.36	Seasonal Temp. (deg K):	293
Seasonal Temp. (deg C):	20		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">GRAS W00-03</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow (CFM)						
1	<a href="#">3.45</a>	1.162	41.02	0.6%	<table border="1" style="margin: auto;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<a href="#">3.53</a>	1.185	41.84	1.1%					
3	<a href="#">3.46</a>	1.173	41.43	0.9%					
Avg.		1.173	41.43						
<b>Comments:</b>									
<a href="#">Flow set to 40cfm</a>									
<a href="#">Readings on manometer taken every 10minutes</a>									

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(\text{H}_2\text{O}(\text{Pa}/\text{P}_{std})(\text{T}_{std}/\text{T}_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg



**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">14-Jun-07</a>
Sampler S/N: <a href="#">W02-01</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	752
Daily Average Pressure (in Hg):	<a href="#">29.72</a>	Temperature (deg K):	291
Daily Average Temperature (deg C):	<a href="#">18</a>	Corrected Seasonal (mm Hg):	752
Seasonal Press. (in Hg):	<a href="#">29.72</a>	Seasonal Temp. (deg K):	291
Seasonal Temp. (deg C):	<a href="#">18</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">W02-01</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA							
Plate or Test #	Manometer Reading			Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required		
	H2O (inches)	Qstd (m3/min)	Flow (CFM)				
1	<a href="#">3.24</a>	1.138	40.19	0.1%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: yellow; text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>	YES	NO
YES	NO						
2	<a href="#">3.36</a>	1.169	41.27	0.8%			
3	<a href="#">3.81</a>	1.244	43.94	2.3%			
4	<a href="#">3.63</a>	1.215	42.89	1.7%			
Avg.		1.191	42.07				

**Comments:**  
[Flow set to 40cfm](#)  
[Readings on manometer taken every 10minutes](#)

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">18-Jun-07</a>
Sampler S/N: <a href="#">W02-01</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	742
Daily Average Pressure (in Hg):	<a href="#">29.36</a>	Temperature (deg K):	293
Daily Average Temperature (deg C):	<a href="#">20</a>	Corrected Seasonal (mm Hg):	742
Seasonal Press. (in Hg):	<a href="#">29.36</a>	Seasonal Temp. (deg K):	293
Seasonal Temp. (deg C):	<a href="#">20</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">W02-01</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	<a href="#">3.17</a>	1.114	39.33	-0.4%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<a href="#">3.53</a>	1.185	41.84	1.1%					
3	<a href="#">3.20</a>	1.128	39.84	-0.1%					
Avg.		1.142	40.34						
<b>Comments:</b>									
<a href="#">Flow set to 40cfm</a>									
<a href="#">Readings on manometer taken every 10minutes</a>									

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">14-Jun-07</a>
Sampler S/N: <a href="#">W02-02</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	752
Daily Average Pressure (in Hg):	<a href="#">29.72</a>	Temperature (deg K):	291
Daily Average Temperature (deg C):	<a href="#">18</a>	Corrected Seasonal (mm Hg):	752
Seasonal Press. (in Hg):	<a href="#">29.72</a>	Seasonal Temp. (deg K):	291
Seasonal Temp. (deg C):	<a href="#">18</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">W02-02</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	<a href="#">3.29</a>	1.147	40.50	0.3%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<a href="#">2.97</a>	1.099	38.81	-0.8%					
3	<a href="#">3.11</a>	1.125	39.71	-0.2%					
Avg.		1.123	39.67						
<b>Comments:</b>									
<a href="#">Flow set to 40cfm</a>									
<a href="#">Readings on manometer taken every 10minutes</a>									

**Calculations**

$Q_{std} = 1/m[\text{sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum,Windsor</a>	Date: <a href="#">18-Jun-07</a>
Sampler S/N: <a href="#">W02-02</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	742
Daily Average Pressure (in Hg):	<a href="#">29.36</a>	Temperature (deg K):	293
Daily Average Temperature (deg C):	<a href="#">20</a>	Corrected Seasonal (mm Hg):	742
Seasonal Press. (in Hg):	<a href="#">29.36</a>	Seasonal Temp. (deg K):	293
Seasonal Temp. (deg C):	<a href="#">20</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">W02-02</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	<a href="#">3.22</a>	1.122	39.63	-0.2%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<a href="#">3.72</a>	1.216	42.95	1.8%					
3	<a href="#">3.04</a>	1.100	38.84	-0.7%					
Avg.		1.146	40.47						
<b>Comments:</b>									
<a href="#">Flow set to 40cfm</a>									
<a href="#">Readings on manometer taken every 10minutes</a>									

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum, Windsor</a>	Date: <a href="#">18-Jun-07</a>
Sampler S/N: <a href="#">W02-03</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	742
Daily Average Pressure (in Hg):	<a href="#">29.36</a>	Temperature (deg K):	293
Daily Average Temperature (deg C):	<a href="#">20</a>	Corrected Seasonal (mm Hg):	742
Seasonal Press. (in Hg):	<a href="#">29.36</a>	Seasonal Temp. (deg K):	293
Seasonal Temp. (deg C):	<a href="#">20</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">W02-03</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA							
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required	
	H2O (inches)	Qstd (m3/min)	Flow				
1	<a href="#">3.65</a>	1.195	42.19	1.3%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">YES</td> <td style="width: 50%; text-align: center;">NO</td> </tr> </table>	YES	NO
YES	NO						
2	<a href="#">3.55</a>	1.188	41.96	1.2%			
3	<a href="#">3.47</a>	1.175	41.49	0.9%			
Avg.		1.186	41.88				
<b>Comments:</b>							
<a href="#">Flow set to 40cfm</a>							
<a href="#">Readings on manometer taken every 10minutes</a>							

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <b>Fundy Gypsum, Windsor</b>	Date: <b>14-Jun-07</b>
Sampler S/N: <b>GRAS W00-02</b>	Tech: <b>J Mac Donald</b>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<b>131</b>	Corrected Pressure (mm Hg):	752
Daily Average Pressure (in Hg):	<b>29.72</b>	Temperature (deg K):	291
Daily Average Temperature (deg C):	<b>18</b>	Corrected Seasonal (mm Hg):	752
Seasonal Press. (in Hg):	<b>29.72</b>	Seasonal Temp. (deg K):	291
Seasonal Temp. (deg C):	<b>18</b>		

CALIBRATION ORIFICE DATA			
Make: <b>Tisch Environmental</b>		Qstd Slope: <b>1.58493</b>	
Model:		Qstd Intercept: <b>-0.00610</b>	
Serial#: <b>GRAS W00-02</b>		Date Certified: <b>Nov 03/05</b>	

CALIBRATION DATA									
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required			
	H2O (inches)	Qstd (m3/min)	Flow						
1	<b>3.48</b>	1.179	41.65	1.0%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO								
2	<b>3.27</b>	1.153	40.72	0.4%					
3	<b>3.32</b>	1.162	41.03	0.6%					
Avg.		1.165	41.13						
<b>Comments:</b>									
Flow set to 40cfm									
Readings on manometer taken every 10minutes									

**Calculations**

$Q_{std} = 1/m[\text{sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

**Conestoga-Rovers & Associates**  
**Ambient Air Monitoring Field Calibration Data**  
**Hivol TSP & PM10 Samplers**

SITE INFORMATION	
Location: <a href="#">Fundy Gypsum,Windsor</a>	Date: <a href="#">14-Jun-07</a>
Sampler S/N: <a href="#">W02-03</a>	Tech: <a href="#">J Mac Donald</a>

METEOROLOGICAL CONDITIONS			
Sampler Elevation (feet):	<a href="#">131</a>	Corrected Pressure (mm Hg):	752
Daily Average Pressure (in Hg):	<a href="#">29.72</a>	Temperature (deg K):	291
Daily Average Temperature (deg C):	<a href="#">18</a>	Corrected Seasonal (mm Hg):	752
Seasonal Press. (in Hg):	<a href="#">29.72</a>	Seasonal Temp. (deg K):	291
Seasonal Temp. (deg C):	<a href="#">18</a>		

CALIBRATION ORIFICE DATA			
Make: <a href="#">Tisch Environmental</a>		Qstd Slope: <a href="#">1.58493</a>	
Model:		Qstd Intercept: <a href="#">-0.00610</a>	
Serial#: <a href="#">W02-03</a>		Date Certified: <a href="#">Nov 03/05</a>	

CALIBRATION DATA										
Plate or Test #	Manometer Reading			Flow (CFM)	Percent Difference from 40CFM (MOE guideline)	Flow Adjustment Required				
	H2O (inches)	Qstd (m3/min)								
1	<a href="#">3.34</a>	1.155		40.80	0.5%	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;">NO</td> </tr> </table>			YES	NO
YES	NO									
2	<a href="#">3.33</a>	1.163		41.09	0.7%					
3	<a href="#">3.60</a>	1.210		42.72	1.6%					
Avg.		1.176		41.54						
<b>Comments:</b>										
<a href="#">Flow set to 40cfm</a>										
<a href="#">Readings on manometer taken every 10minutes</a>										

**Calculations**

$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$   
 $Q_{std}$  = standard flow rate  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 293 deg K  
 $P_{std}$  = 760 mm Hg

F.4

TOTAL SUSPENDED PARTICULATE AND  
FINE PARTICULATE MATTER LABORATORY RESULTS



Your Project #: 8206771  
Site: FUNDY GYPSUM AMBIENT MONITORING, MOOSE RIVER  
Your C.O.C. #: N/A

**Attention: Joyce MacDonald**

Conestoga-Rovers and Associates Ltd  
Dartmouth  
31 Gloster Crt  
Dartmouth , NS  
B3B 1X9

**Report Date: 2007/07/10**

This report supersedes all previous reports

**CERTIFICATE OF ANALYSIS**

**MAXXAM JOB #: A762540**

**Received: 2007/06/20, 12:58**

Sample Matrix: Air  
# Samples Received: 14

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Particulate Matter in Air Ø	14	N/A	2007/06/25	ATL SOP 00172	Based on EPAIO-2.1

(1) This test was performed by Sydney, NS (ESL)

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

ALAN STEWART,  
Email: alan.stewart.reports@maxxamanalytics.com  
Phone# (902) 420-0203

=====  
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.

Total cover pages: 1

Maxxam Job #: A762540  
Report Date: 2007/07/10

Conestoga-Rovers and Associates Ltd  
Client Project #: 8206771  
Project name: FUNDY GYPSUM AMBIENT MONITORING, M  
Sampler Initials:

### RESULTS OF ANALYSES OF AIR

Maxxam ID		T01210	T01217	T01218	T01219		
Sampling Date		2007/06/14	2007/06/14	2007/06/14	2007/06/18		
COC Number		N/A	N/A	N/A	N/A		
	<b>Units</b>	<b>LOCATION #1-TSP 10451</b>	<b>LOCATION #2-TSP 10452</b>	<b>LOCATION #3-TSP 10453</b>	<b>LOCATION #4-TSP 10454</b>	<b>RDL</b>	<b>QC Batch</b>

<b>INORGANICS</b>							
Particulate matter (< 10 um)	mg	19	11	13	12	0.5	1280575
Total Suspended Particulate	mg	19	11	13	12	0.5	1280575
N/A = Not Applicable RDL = Reportable Detection Limit QC Batch = Quality Control Batch							

Maxxam ID		T01220	T01221	T01222	T01231		
Sampling Date		2007/06/18	2007/06/18	2007/06/14	2007/06/14		
COC Number		N/A	N/A	N/A	N/A		
	<b>Units</b>	<b>LOCATION #5-TSP 10455</b>	<b>LOCATION #6-TSP 10456</b>	<b>LOCATION #1-PM10 Q0188492</b>	<b>LOCATION #2-PM10 Q0188491</b>	<b>RDL</b>	<b>QC Batch</b>

<b>INORGANICS</b>							
Particulate matter (< 10 um)	mg	13	15	3.6	2.0	0.5	1280575
Total Suspended Particulate	mg	13	15			0.5	1280575
N/A = Not Applicable RDL = Reportable Detection Limit QC Batch = Quality Control Batch							

Maxxam ID		T01232	T01233	T01238	T01239		
Sampling Date		2007/06/14	2007/06/18	2007/06/18	2007/06/18		
COC Number		N/A	N/A	N/A	N/A		
	<b>Units</b>	<b>LOCATION #3-PM10 Q0188490</b>	<b>LOCATION #4-PM10 Q0188489</b>	<b>LOCATION #5-PM10 Q0188488</b>	<b>LOCATION #6-PM10 Q0188487</b>	<b>RDL</b>	<b>QC Batch</b>

<b>INORGANICS</b>							
Particulate matter (< 10 um)	mg	5.6	3.3	5.0	4.1	0.5	1280575
N/A = Not Applicable RDL = Reportable Detection Limit QC Batch = Quality Control Batch							

Maxxam Job #: A762540  
Report Date: 2007/07/10

Conestoga-Rovers and Associates Ltd  
Client Project #: 8206771  
Project name: FUNDY GYPSUM AMBIENT MONITORING, M  
Sampler Initials:

**RESULTS OF ANALYSES OF AIR**

Maxxam ID		T01240	T01241		
Sampling Date					
COC Number		N/A	N/A		
	<b>Units</b>	<b>BLANK-TSP 10457</b>	<b>BLANK-PM10 Q0188476</b>	<b>RDL</b>	<b>QC Batch</b>

<b>INORGANICS</b>					
Particulate matter (< 10 um)	mg	<0.5	<0.5	0.5	1280575
Total Suspended Particulate	mg	<0.5		0.5	1280575

N/A = Not Applicable  
RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch

Maxxam Job #: A762540  
Report Date: 2007/07/10

Conestoga-Rovers and Associates Ltd  
Client Project #: 8206771  
Project name: FUNDY GYPSUM AMBIENT MONITORING, M  
Sampler Initials:

**GENERAL COMMENTS**

Report is reissued with change in results for PM10. Samples were rechecked and results have changed.

Sample T01210-01: The wrong side of the filter was used for sampling.

**Results relate only to the items tested.**

F.5

CALCULATED EMISSION RATES AND VEHICLE OPERATING HOURS

**Appendix F-F.5 Parameters Used for Emission Factor Calculations**

*Emission Factors Based on Tier 3 Equipment (2006-2010 model years)*

Except for 750hp as there is no Tier 3, so used Tier 2

Criteria	HC	CO	NOX	PM	BSFC	SPM adj
<b>EFSS</b>						
>175-300	0.1314	0.075	2.5	0.15	<b>0.367</b>	
>300-600	0.1669	0.8425	2.5	0.15	0.367	
>600-750	<b>0.1669</b>	<b>1.3272</b>	2.5	<b>0.15</b>	<b>0.367</b>	
>750	<b>0.1669</b>	<b>0.7642</b>	<b>4.1</b>	<b>0.1316</b>	<b>0.367</b>	
<b>TAF</b>						
CAT 777 100 Ton Haul Truck	1.05	1.53	1.04	1.47	1.01	0.0211569
Terex T100 100 ton Haul Truck	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT 992C Loader	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT 992G Loader	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT D9R Dozer	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT D9R Dozer	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT D8N Dozer	1.05	1.53	1.04	1.47	1.01	0.0211569
Hitachi Excavator EX1100	1.05	1.53	1.04	1.47	1.01	0.0211569
Hitachi EX300LC	1.05	1.53	1.04	1.47	1.01	0.0211569
Tamrock Pantera 1500 Drill	1	1	1	1	1	0.0209474
Ingersoll-Rand Drill	1	1	1	1	1	0.0209474
Champion Road Grader 780A*	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT 769C Water Truck	1.05	1.53	1.04	1.47	1.01	0.0211569
<b>Proposed</b>						
CAT 777D 100 Ton Haul Trucks	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT 992G Loader	1.05	1.53	1.04	1.47	1.01	0.0211569
CAT D9R Dozer	1.05	1.53	1.04	1.47	1.01	0.0211569
A	0.027	0.151	0.008	0.473		
DF (=1+A*B)	1.027	1.151	1.008	1.473	1	

EFadj = Efss\*TAF\*DF (g/hp-hr)

SPMadj = BSFC<sub>ss</sub>\*BSFCTAF\*453.6\*7\*soxcnv\*0.01\*(soxbas-soxdsl)

default values used in example in AP-42

soxbas	0.33
soxdsl	0.25
soxcnv	0.02247

SO2 emission factor

=BSFC\*453.6\*(1-soxcnv)-HC)\*0.001\*soxdsl\*2

APPENDIX G

LONG-TERM SOUND LEVEL MONITORING DATA

**NOISE DATA SET AND AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED**

Sampling Location	Sampling Date	Sampling Time	Average Leq Values dBA	Noise Measurement Criteria Leq dBA	Hourly Average Temperature °C	Hourly Average Wind Speed km/hr
1109 Belmont Road	June 29/07	15:32-15:59	43.2	Leq ≤65 dBA 0700-1900	19	11
		16:00-16:59	28.9		19	11
		17:00-17:59	42.8		20	6
		18:00-18:59	39.9		20.1	7
	June 29/07	19:00-19:59	34.5	Leq ≤60 dBA 1900-2300	19.4	7
		20:00-20:59	36.9		16.4	6
		21:00-21:59	36.5		13.5	4
		22:00-22:59	32.7		13.5	7
		23:00-23:59	28.9		12.6	2
	July 2/07	00:00-00:59	34.4	Leq ≤55 dBA 2300-0700	11.5	9
		01:00-01:59	29.0		10	2
		02:00-02:59	28.4		9.7	6
		03:00-03:59	27.2		8.8	0
		04:00-04:59	33.0		9.3	6
		05:00-05:59	38.2		9	4
		06:00-06:59	36.8		11.9	9
		07:00-07:59	36.2		13.9	6
		08:00-08:59	35.3		15.4	7
		09:00-09:59	36.7		17.6	7
	July 2/07	10:00-10:59	39.2	Leq ≤65 dBA 0700-1900	18.3	7
11:00-11:59		40.1	19.2		9	
12:00-12:59		41.5	20.3		11	
13:00-13:59		43.5	20.6		11	
14:00-14:59		43.2	20.3		15	
15:00-15:59		45.2	20.1		13	
16:00-16:59		46.7	19.1		17	
17:00-17:59		42.3	18.3		11	
18:00-18:59		39.2	17.6		9	
July 2/07		19:00-19:59	40.2		Leq ≤60 dBA 1900-2300	15.7
	20:00-20:59	34.2	14.8	4		
	21:00-21:59	33.5	12	4		
	22:00-22:59	30.9	10.7	6		
July 2/07 July 3/07	23:00-23:59	30.7	Leq ≤55 dBA 2300-0700	9.8	6	
	00:00-00:59	28.4		9.7	4	
	01:00-01:59	27.7		9.3	6	
	02:00-02:59	28.0		8.6	4	
	03:00-03:59	28.7		8.3	6	
	04:00-04:59	31.8		7.5	2	
	05:00-05:59	39.1		7.5	4	
	06:00-06:59	41.2		9.9	0	
July 2/07	07:00-07:59	37.6	Leq ≤65 dBA 0700-1900	13.4	2	
	08:00-08:59	37.1		15.1	6	
	09:00-09:59	39.0		16	4	
	10:00-10:59	38.7		17.2	6	
	11:00-11:59	40.0		18.4	7	
	12:00-12:59	41.2		18.2	9	
	13:00-13:59	40.6		19.2	6	
	14:00-14:59	40.1		20.3	6	
	15:00-15:59	39.9		21.6	6	
	16:00-16:12	37.3		21.2	11	
555 Ferry Road	July 6/07	16:13-16:59	40.3	Leq ≤60 dBA 1900-2300	20.1	6
		17:00-17:59	39.1		18.6	6
July 6/07	July 6/07	18:00-18:59	39.8	Leq ≤60 dBA 1900-2300	18.3	2
		19:00-19:59	39.7		18.7	4
		20:00-20:59	39.1		18	4
		21:00-21:59	41.1		17.7	4
		22:00-22:59	36.8		17.6	7
July 6/07 July 9/07	23:00-23:59	35.1	Leq ≤55 dBA 2300-0700	17.5	2	
	00:00-00:59	32.8		11.7	6	
	01:00-01:59	33.1		11.3	7	
	02:00-02:59	33.1		11.2	9	
	03:00-03:59	36.1		10.4	7	
	04:00-04:59	36.5		9.4	2	
	05:00-05:59	44.3		8.4	7	
	06:00-06:59	38.5		11.7	6	



**NOISE DATA SET AND AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED**

Sampling Location	Sampling Date	Sampling Time	Average Leq Values dBA	Noise Measurmnt Criteria Leq dBA	Hourly Average Temperature °C	Hourly Average Wind Speed km/hr
		07:00-07:59	43.3		13	6
		08:00-08:59	44.5		13.4	6
		09:00-09:59	42.5		14.1	6
		10:00-10:59	42.6		15.7	6
		11:00-11:59	42.1		16.7	9
		12:00-12:59	39.5		17.7	7
		13:00-13:59	40.9	Leq ≤65 dBA 0700-1900	17.9	7
		14:00-14:59	40.3		18.1	11
		15:00-15:59	40.4		19.2	9
		16:00-16:59	42.0		18.7	9
		17:00-17:59	41.1		17.6	4
		18:00-18:59	40.4		17	2
		19:00-19:59	39.9		16.1	4
		20:00-20:59	42.5		15.2	4
		21:00-21:59	37.4	Leq ≤60 dBA 1900-2300	14.8	2
		22:00-22:59	35.2		14.6	2
	July 9/07	23:00-23:59	35.1		14.5	4
	July 10/07	00:00-00:59	37.2		14	4
		01:00-01:59	36.4		13.8	2
		02:00-02:59	35.7		13.4	4
		03:00-03:59	34.7	Leq ≤55 dBA 2300-0700	13.7	4
		04:00-04:59	36.0		13.7	6
		05:00-05:59	43.0		13.9	4
		06:00-06:59	40.1		14.1	2
		07:00-07:59	39.4		14.3	2
		08:00-08:59	39.8		14.9	6
		09:00-09:59	39.3		15.8	2
		10:00-10:59	46.7		17.4	4
		11:00-11:59	41.7		18.8	2
		12:00-12:59	41.0		18.7	7
		13:00-13:59	43.1	Leq ≤65 dBA 0700-1900	19.4	7
		14:00-14:59	38.7		20.5	6
		15:00-15:59	40.5		20.8	6
		16:00-16:59	39.6		21.5	6
		17:00-17:59	38.3		22.1	6
		18:00-18:59	39.6		19.9	9
		19:00-19:59	42.0		19.3	6
		20:00-20:59	40.5		17.5	4
		21:00-21:59	36.1	Leq ≤60 dBA 1900-2300	15.4	6
		22:00-22:59	36.0		14.7	2
	July 10/07	23:00-23:59	37.2		13.5	2
	July 11/07	00:00-00:59	35.9		13.2	0
		01:00-01:59	38.2		13.6	4
		02:00-02:59	37.6		13.7	2
		03:00-03:59	36.6	Leq ≤55 dBA 2300-0700	14.2	2
		04:00-04:59	36.3		14.4	0
		05:00-05:59	44.0		14.6	2
		06:00-06:59	41.1		15.4	6
		07:00-07:59	40.8		17.1	4
		08:00-08:59	43.7		19.2	6
		09:00-09:59	43.6		20	7
		10:00-10:59	48.1		21.3	6
		11:00-11:59	49.1		22.6	6
		12:00-12:59	45.0		23.9	9
		13:00-13:59	43.8	Leq ≤65 dBA 0700-1900	24.5	13
		14:00-14:59	47.9		25.6	13
		15:00-15:59	50.7		26.9	11
		16:00-16:12	48.1		26.2	17

**NOISE DATA SET AND AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED**

Sampling Location	Sampling Date	Sampling Time	Average Leq Values dBA	Noise Measurement Criteria Leq dBA	Hourly Average Temperature °C	Hourly Average Wind Speed km/hr			
801 Avondale Road	July 17/07	10:20-10:59	47.7	Leq ≤65 dBA 0700-1900	24.4	9			
		11:00-11:59	46.2		25.9	13			
		12:00-12:59	40.1		27.3	13			
		13:00-13:59	45.3		27.7	15			
		14:00-14:59	47.1		27.7	20			
		15:00-15:59	46.4		28.1	15			
		16:13-16:59	46.8		27.8	17			
		17:00-17:59	40.0		27.5	11			
		18:00-18:59	42.5		26.8	9			
			19:00-19:59	44.2	Leq ≤60 dBA 1900-2300	24.9	11		
			20:00-20:59	42.4		21.4	6		
			21:00-21:59	39.4		18.4	4		
			22:00-22:59	35.2		17.4	7		
		July 17/07	23:00-23:59	31.0	Leq ≤55 dBA 2300-0700	16.2	6		
		July 18/07	00:00-00:59	29.1		15.8	4		
			01:00-01:59	30.1		15.4	2		
			02:00-02:59	28.6		14.7	2		
			03:00-03:59	30.3		13.5	4		
			04:00-04:59	30.7		13.1	2		
			05:00-05:59	37.8		12.9	2		
06:00-06:59			41.4	14.2		0			
				07:00-07:59		43.5	Leq ≤65 dBA 0700-1900	15.8	2
				08:00-08:59		40.8		19.1	4
	09:00-09:59	39.3		22	4				
	10:00-10:59	43.8		25.7	7				
	11:00-11:59	43.8		27.7	9				
	12:00-12:59	44.1		27.9	9				
	13:00-13:03	43.7		27.2	6				
	13:10-13:59	48.2		27.2	6				
	14:00-14:59	49.9		24.1	7				
	15:00-15:59	50.6		22.4	4				
		16:00-16:59	51.5	22.5	2				
		17:00-17:59	50.4	21.5	6				
		18:00-18:59	49.1	20.8	4				
				19:00-19:59	45.7	Leq ≤60 dBA 1900-2300	21.5	6	
				20:00-20:59	43.1		21	4	
21:00-21:59	43.8			19.6	2				
22:00-22:59	40.0			20.3	7				
	July 18/07	23:00-23:59	40.1	Leq ≤55 dBA 2300-0700	20.1	2			
	July 19/07	00:00-00:59	38.6		19.8	2			
		01:00-01:59	38.4		19.5	4			
		02:00-02:59	39.2		19.1	4			
		03:00-03:59	38.8		19	6			
		04:00-04:59	43.3		18.9	4			
		05:00-05:59	44.2		18.9	0			
		06:00-06:59	46.7		19	0			
					07:00-07:59	43.9	Leq ≤65 dBA 0700-1900	19.7	4
					08:00-08:59	43.3		20.8	7
09:00-09:59	42.7			22.4	11				
10:00-10:59	41.8			24.3	11				
11:00-11:59	42.9			24	9				
12:00-12:59	41.4			25.1	9				
13:00-13:59	41.6			23.4	11				
14:00-14:59	42.8			21.8	4				
15:00-15:59	43.6			21.2	6				
16:00-16:59	43.6			21.4	2				
		17:00-17:59	45.0	22.2	4				
		19:00-19:59	41.8	20.3	3				
36 Ferry Road	July 19/07	20:00-20:59	38.4	Leq ≤60 dBA 1900-2300	19.9	7			
		21:00-21:59	43.2		19.8	5			
		22:00-22:59	42.8		19.7	7			
	July 19/07	23:00-23:59	41.5	Leq ≤55 dBA 2300-0700	20.1	19			
	July 20/07	00:00-00:59	36.2		20.2	17			
		01:00-01:59	31.7		20.1	18			
		02:00-02:59	30.2		19.9	9			
		03:00-03:59	29.7		19.8	11			
		04:00-04:59	33.2		20	13			
		05:00-05:59	36.0		19.8	11			
		06:00-06:59	42.1		19.5	17			

**NOISE DATA SET AND AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED**

Sampling Location	Sampling Date	Sampling Time	Average Leq Values dBA	Noise Measuremnt Criteria Leq dBA	Hourly Average Temperature °C	Hourly Average Wind Speed km/hr
		07:00-07:59	40.5	Leq ≤65 dBA 0700-1900	19.6	21
		08:00-08:59	41.7		20.1	23
		09:00-09:59	45.6		21.2	19
		10:00-10:59	45.4		22.5	20
		11:00-11:59	44.4		25.2	21
		12:00-12:59	44.7		25.5	20
		13:00-13:59	45.1		27.4	22
		14:00-14:59	43.7		26.1	21
		15:00-15:59	42.8		26.4	19
		16:00-16:59	43.1		26.1	21
		17:00-17:59	42.6		25.2	22
		18:00-18:59	42.3		24.1	20
		19:00-19:59	42.9	Leq ≤60 dBA 1900-2300	23.9	20
		20:00-20:59	44.7		23.1	21
		21:00-21:59	46.9		22.6	22
		22:00-22:59	45.5		22.5	20
	July 20/07	23:00-23:59	40.8	Leq ≤55 dBA 2300-0700	22	20
	July 23/07	00:00-00:59	37.9		14.4	21
		01:00-01:59	34.8		13.4	0
		02:00-02:59	28.6		13	18
		03:00-03:59	28.8		12.7	18
		04:00-04:59	33.9		12.7	20
		05:00-05:59	35.8		12.2	17
		06:00-06:59	37.0		13.2	18
		07:00-07:59	40.9	Leq ≤65 dBA 0700-1900	18	0
		08:00-08:59	42.9		19.3	2
		09:00-09:32	43.8		21.5	4
		09:57-09:59	48.7		21.5	4
		10:00-10:59	35.5		22.5	7
		11:00-11:59	35.3		23	4
		12:00-12:59	40.2		24.8	6
		13:00-13:59	39.7		25.5	16
		14:00-14:59	39.6		26.5	15
		15:00-15:59	41.1		27	16
		16:00-16:59	46.5		25.4	19
		17:00-17:59	48.0		24	19
		18:00-18:59	39.6	22.8	17	
		19:00-19:59	40.4	Leq ≤60 dBA 1900-2300	22.2	19
		20:00-20:59	42.7		20.9	21
		21:00-21:59	35.6		19.8	18
		22:00-22:59	32.4		19.6	21
	July 23/07	23:00-23:59	33.1	Leq ≤55 dBA 2300-0700	19.3	22
	July 24/07	00:00-00:59	35.1		19.1	21
		01:00-01:59	29.8		18.9	22
		02:00-02:59	33.2		18.8	25
		03:00-03:59	32.5		19	32
		04:00-04:59	31.1		18.8	24
		05:00-05:59	37.9		18.5	27
		06:00-06:59	35.8		19.3	23
		07:00-07:59	36.9	Leq ≤65 dBA 0700-1900	20.3	0
		08:00-08:59	34.6		22.3	29
		09:00-09:59	44.8		23.6	20
		10:00-10:59	44.8		24.6	29
		11:00-11:59	39.0		25.4	30
		12:00-12:59	35.7		26.3	31
		13:00-13:59	38.6		25.8	31
		14:00-14:59	48.1		26.7	33
		15:00-15:59	43.2		27.7	27
		16:00-16:59	41.9		27.8	25
		17:00-17:59	40.9		26.7	28
		18:00-18:59	48.1		25.8	26
		19:00-19:59	50.9	Leq ≤60 dBA 1900-2300	24.4	26
		20:00-20:59	44.3		22.4	24
		21:00-21:59	34.7		20.4	23
		22:00-22:59	32.7		19.4	29

**NOISE DATA SET AND AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED**

Sampling Location	Sampling Date	Sampling Time	Average Leq Values dBA	Noise Measurement Criteria Leq dBA	Hourly Average Temperature °C	Hourly Average Wind Speed km/hr
	July 24/07	23:00-23:59	33.9		19.3	29
	July 25/07	00:00-00:59	32.7		18.7	27
		01:00-01:59	30.7		17.7	25
		02:00-02:59	30.6	Leq ≤55 dBA 2300-0700	17.1	24
		03:00-03:59	37.0		16.2	25
		04:00-04:59	29.9		16.2	26
		05:00-05:59	38.8		16.5	23
		06:00-06:59	37.2		16.6	22
		07:00-07:59	38.4	Leq ≤65 dBA 0700-1900	18.4	25
		08:00-08:59	38.3		18.7	28
80 Avondale Crossroads	July 25/07	09:08-09:59	36.2		20.5	11
		10:00-10:59	36.3		22.8	13
		11:00-11:59	35.1		25.1	11
		12:00-12:59	44.6		26.7	6
		13:00-13:59	39.3	Leq ≤65 dBA 0700-1900	26.8	11
		14:00-14:59	41.9		27.8	11
		15:00-15:59	42.9		28.9	11
		16:00-16:59	41.4		29.1	11
		17:00-17:59	41.1		28.8	9
		18:00-18:59	40.0		27.7	13
		19:00-19:59	37.3		26.5	7
		20:00-20:59	36.4	Leq ≤60 dBA 1900-2300	23.7	6
		21:00-21:59	35.4		21.8	4
		22:00-22:59	34.2		22.1	4
	July 25/07	23:00-23:59	32.3		21	4
	July 26/07	00:00-00:59	31.1		20.1	2
		01:00-01:59	30.5		20.5	9
		02:00-02:59	30.1	Leq ≤55 dBA 2300-0700	21.7	9
		03:00-03:59	30.3		21.6	9
		04:00-04:59	31.1		21.4	9
		05:00-05:59	37.6		21.1	7
		06:00-06:59	36.1		21.5	9
		07:00-07:59	38.2		23.3	11
		08:00-08:59	36.6		25.1	11
		09:00-09:59	44.7		26.9	11
		10:00-10:59	39.9		28.6	11
		11:00-11:59	46.2		30.1	17
		12:00-12:59	47.7	Leq ≤65 dBA 0700-1900	31.1	17
		13:00-13:59	50.0		31.2	19
		14:00-14:59	50.4		31.6	15
		15:00-15:59	47.0		31.4	17
		16:00-16:59	47.1		31.2	13
		17:00-17:59	45.1		30.4	17
		18:00-18:59	43.4		29.4	13
		19:00-19:59	40.9		28.1	11
		20:00-20:59	41.5	Leq ≤60 dBA 1900-2300	25.9	11
		21:00-21:59	39.4		24.6	11
		22:00-22:59	33.4		23.3	7
	July 26/07	23:00-23:59	32.3		21.7	4
	July 27/07	00:00-00:59	29.7		22	7
		01:00-01:59	31.7		21.7	6
		02:00-02:59	30.0	Leq ≤55 dBA 2300-0700	21.6	7
		03:00-03:59	29.9		21.2	9
		04:00-04:59	30.2		21.1	11
		05:00-05:59	37.7		20.9	7
		06:00-06:59	36.6		21.7	9
		07:00-07:59	37.5		23.1	9
		08:00-08:59	38.7		24.8	11
		09:00-09:59	39.4		27	9
		10:00-10:59	43.0		28.4	13
		11:00-11:59	41.0	Leq ≤65 dBA 0700-1900	29.7	13
		12:00-12:59	40.8		31	13
		13:00-13:59	44.6		31.6	17
		14:00-14:59	44.5		32.1	15
		15:00-15:59	47.4		32.3	11
		16:00-16:17	49.3		32.2	13