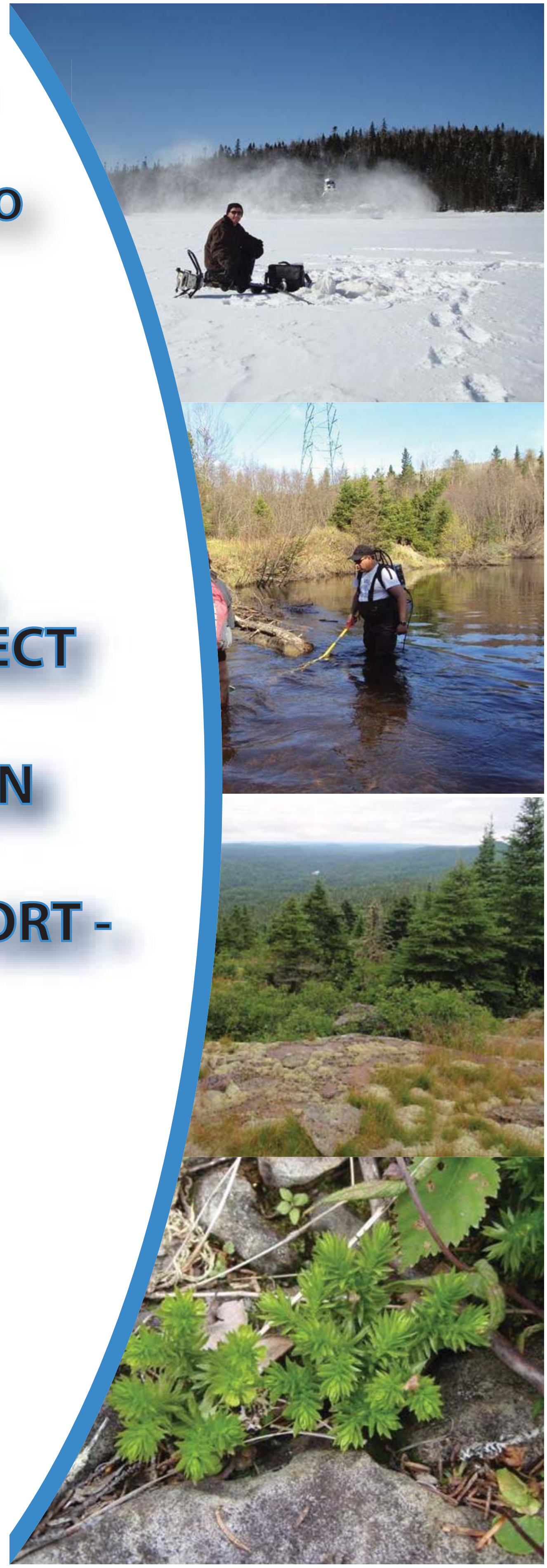
ENVIRONMENTAL ASSESSMENT FOR THE MARATHON PGM-Cu PROJECT AT MARATHON, ONTARIO



STILLWATER CANADA INC. MARATHON PGM-Cu PROJECT

SUPPORTING INFORMATION DOCUMENT No. 12 - BASELINE TECHNICAL REPORT - AIR - MARATHON PGM-Cu PROJECT

Prepared by:
TRUE GRIT CONSULTING LTD.
1127 Barton Street
Thunder Bay, ON
P7B 5N3

Stillwater Canada Inc.

Baseline Technical Report - Air

Marathon PGM-Cu Environmental Assessment

Marathon, Ontario

Prepared by:
True Grit Consulting Ltd.
1127 Barton Street
Thunder Bay, ON P7B 5N3
T: 807.626.5640 Ext. 227
F: 807.623.5690
Project Number: 11-317-13A
Contact: Paula Sdao, B.Eng.

July 5, 2012

Executive Summary

True Grit Consulting Ltd. (TGCL) was retained by Stillwater Canada Inc. (SCI) to assess baseline air quality for the Marathon copper/platinum group metals (PGM-Cu) mine project (the Project) in support of the Environmental Assessment process required to satisfy the Ontario Environmental Assessment Act and the Canadian Environmental Assessment Act.

SCI is proposing to construct a new 22,000 metric tonnes/day (MT/day) open pit PGM-Cu mine in Ontario. The proposed Project is located approximately 10 km north of the Town of Marathon, on the north side of the TransCanada Highway No. 17 (Highway 17). It lies partially within the municipal boundaries of the Town of Marathon and the unorganized townships of Pic, O'Neil and McCoy. The proposed Project site is in an undeveloped area characterized by dense vegetation, moderate to steep hilly terrain with a series of streams, ponds and small lakes. The Project property is bounded by the Pic River and Crown Land on the east; Crown Land, privately owned land, Hwy 17 and the Canadian Pacific Railway (CPR) tracks on the south and west; and Crown Land on the north.

TGCL evaluated baseline climate, meteorology and air quality at the proposed Marathon Project site. Topics that were reviewed included:

- Evaluation of Project, local and regional climate and meteorological data including temperature, relative humidity, wind speed, wind direction, precipitation, evaporation, solar radiation, and atmospheric pressure.
- Review of incidences of weather phenomena, including tornadoes, lightning, fog and other extreme weather phenomena such as ice storms, extreme rain or snow events or hail.
- Measurement of on-site dustfall, inhalable particulate matter (PM_{10}), sulphate, nitrate and metals.
- Supplemental weather measurements of temperature, wind speed, wind direction, atmospheric pressure and precipitation.
- Estimation of Project, local and regional baseline air quality for other criteria air contaminants (CACs) including nitrogen oxides (NO_x), sulphur oxides (as sulphur dioxide, SO_2), carbon monoxide (CO), total suspended particulate (TSP), respirable particulate matter $PM_{2.5}$.
- Presentation of baseline greenhouse gas emissions in Canada and Ontario.

The following sections describe the findings for the Marathon Project site.

Climate and Meteorology

Climate and meteorology at the Marathon Project site is typical of northwestern Ontario. Marathon experiences cooler summers and colder winters due perhaps to its proximity to Lake Superior compared to other more remote northern communities in northwestern Ontario. Project site climate is considered to be similar to local and regional climate in northwestern Ontario.

Mean annual temperatures at the project site are approximately 1.9°C, with extremes of 33.5°C and -43.0°C measured at the Marathon Environment Canada weather stations. Marathon temperatures tend to be cooler in the summer and colder in the winter than other nearby larger communities such as Sault Ste. Marie to the east and Thunder Bay to the west.

Levels of relative humidity (RH) vary from 20 to 100%, with an annual mean of about 75%. Lake evaporation data was not available for the Marathon area but is estimated to be on the order of 510 to 530 mm, based on available data from Atikokan, Ontario and available mapping.

The Marathon area receives approximately 826.5 mm of total precipitation annually, comprised of about 587.7 mm of rainfall and 238.1 mm of snowfall. Incidences of extreme snowfall (i.e. more than 10 cm in one day) have been reported along the north shore of Lake Superior since 1971 (approximately six to eight events).

The prevailing winds at the Project Site are typically from the northeast or the southwest. Summer winds tend to be dominated by southwesterly winds while winter winds are dominated by northeasterly winds. No differentiation was noted in the spring or fall. Mean wind speeds range from about 17 to 28 kilometres per hour (km/h), higher than what is typically measured across the region. Influences from Lake Superior or the extreme terrain on site may contribute to this result.

Air Quality

The Project site is located within a predominantly undeveloped area north of Highway 17, approximately 10 km north of Marathon, Ontario. With the exception of the Town of Marathon, Pic River First Nation and the Hemlo Gold Mine, located approximately 30 km east of the proposed site, most of the area is vegetated and undeveloped. As a result, air quality is expected to be good and unaffected by large industrial sources of atmospheric emissions.

Sources of airborne contaminants currently present on site include several permitted gravel pits and the Town of Marathon lagoons, in addition to ongoing exploration drilling being carried out by SCI. Regional influences on air quality include residential/commercial/institutional heating from the Town of Marathon, Pic River First Nation and nearby rural properties, fugitive emissions from traffic along Highway 17, fugitive emissions from airport traffic, and fugitive emissions from other nearby industrial sources, such as the Hemlo gold mine.

Between July and November 2011, TGCL measured ambient PM_{10} concentrations at three locations on the SCI property. In addition, dustfall was measured between August and October at up to five locations both on and off site. Metals, sulphate and nitrate were also analyzed in the dustfall samples. A summary of measured airborne contaminants on the Project site is provided below.

Summary of Measured Project Site Air Quality			
Contaminant	**Averaging Period**	**Marathon Project Site**	**MOE AAQC**
Measured Concentrations			
PM_{10} (ug/m^3)	24 h	12.8 – 14.6	50
Dustfall (g/m^2)	30 d	0.33 – 1.44	7
Metals in Dustfall[1] (ug/m^2/day)			
Ba	day	<8.31 to 27.1	n/a
Cr	day	<1.66 to 6.29	n/a
Co	day	<0.33 to 0.61	n/a
Cu	day	2.21 to 10.3	n/a
Pb	day	<0.83 to 3.2	n/a
Mn	day	<0.83 to 141	n/a
Ni	day	2.37 to 8.72	n/a
Sb	day	<0.33 to 1.17	n/a

Summary of Measured Project Site Air Quality			
Contaminant	**Averaging Period**	**Marathon Project Site**	**MOE AAQC**
Zn	day	<9.97 to 63.5	n/a
Note: 1. All other metals were below laboratory method detection limit.			
Nutrients in Dustfall (mg/m²/30d)			
Sulphate	30 d	79.1 to 161.4	n/a
Nitrate	30 d	8.5 to 27.18	n/a

Where MOE AAQC criteria exist, measured concentrations were well below criteria. Local influences on PM_{10} and dustfall include traffic on Highway 17, advanced exploration activities on the SCI property, aggregate extraction activities at several permitted gravel pits on the north side of Highway 17, and discharge of sewage to Town of Marathon sewage lagoons. Metals concentrations in dustfall for the Project site were either non-detectable or below estimated regional background concentrations except for copper, nickel and zinc which were higher than regional background concentrations. This may be due to fugitive dust emissions from nearby Highway 17 or on-site activities such as gravel pit extraction and travel on unpaved roads which occurred during the testing period. Levels of sulphate and nitrate deposition were also measured on site and, when converted to units of eq/ha/year, are less than the 50th percentile critical loads (CLs) for Ontario of 832 eq/ha/year but higher than the 5th percentile CL of 126 eq/ha/year. Calculated on-site values are considered conservative since the neutralizing potential of base cations was not taken into account. In addition, baseline concentrations of dustfall, metals, sulphate and nitrate may also be elevated relative to annual averages since data is based on testing that occurred between August and October 2011 and does not take into account periods when fugitive dust would be expected to be lower, such as the winter months when areas are covered with snow.

For all remaining contaminants of concern, concentrations were estimated based on published air quality data for the region (i.e. for Thunder Bay and Sault Ste. Marie). Estimated values are considered to be conservative for the Marathon Project site since both Thunder Bay and Sault Ste. Marie are communities much larger than Marathon and ambient contaminant concentrations would be expected to be higher in the larger centres.

Summary of Predicted Project Site Air Quality			
Contaminant	**Averaging Period**	**Marathon Project Site**	**MOE AAQC**
TSP (ug/m^3)	24 h	22 – 48	120
$PM_{2.5}$ (ug/m^3)	24 h	1 - 5	30
NO_x (ppb)	24 h	33.2	100
SO_2 (ppb)	24 h	3.25	100
CO (ppb)	24 h	0.83	30,000

Concentrations of all predicted concentrations were well below published MOE AAQC criteria.

Table of Contents

TABLES

FIGURES

APPENDICES

Acronyms and Abbreviations

C	Celsius
%	percent
$\mu g/m^3$	micrograms per cubic metre
AAQC	Ambient Air Quality Criteria
CACs	Criteria Air Contaminants
CEAA	Canadian Environmental Assessment Agency
CEPA	Canadian Environmental Protection Act
CH_4	methane
cm	centimetre
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPR	Canadian Pacific Railway
CWS	Canada Wide Standards
EA	Environmental Assessment
EcoMetrix	EcoMetrix Incorporated
EPA	Environmental Protection Act
GHGs	greenhouse gases
GWP	Global Warming Potential
H_2O	water
ha	hectare
JSL	Jurisdictional Screening Limits
KI	Key Indicator
km	kilometre
km/hr	Kilometre per hour
kT	kilotonnes
kT/y	kilotonnes per year
MBR1	MBR Phase 1 Pit
MBR2	MBR Phase 2 Pit
MBR3	MBR Phase 3 Pit
mm	millimetre
MMT	million tonnes
MOE	Ontario Ministry of the Environment
MPGM	Marathon PGM Corporation
MPMO	Major Projects Management Office
MT	metric tonnes
MT/yr	metric tonnes per year
NO	nitric oxide
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
N_2O	nitrous oxide
O_3	ozone
O.Reg	Ontario Regulation
ppb	parts per billion
PGMs	platinum group metals
PM	particulate matter
$PM_{2.5}$	respirable particulate matter with a diameter <2.5 microns
PM_{10}	inhalable particulate matter with a diameter <10 microns

POI	point of impingement
SCI	Stillwater Canada Inc.
SO, SnO, SO_4	sulphur oxides
SO_2	sulphur dioxide
SO_3	sulphur trioxide
SO_x	sulphur oxides (and also SO_4, S_nO)
SWC	Stillwater Mining Company
TGCL	True Grit Consulting Ltd.
TOR	Terms of Reference
TSP	total suspended particulate
UNFCCC or FCCC	United Nations Framework Convention on Climate Change
URT	Upper Risk Thresholds
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

1.0 Introduction

Stillwater Canada Inc. (SCI) proposes to develop a platinum group metals (PGMs), copper (Cu) and possibly iron (Fe) open-pit mine and milling operation near Marathon, Ontario. A Notice of Commencement (NoC) of an environmental assessment (EA) in relation to the proposed Marathon PGM-Cu Project (the "Project") was filed by the Canadian Environmental Assessment Agency (CEA Agency) under Section 5 of the Canadian Environmental Assessment Act on April 29, 2010 (updated July 19, 2010).

The EA was referred to an independent Review Panel by the Minister of the Environment on October 7, 2010. On March 23, 2011 SCI entered into a Voluntary Agreement (VA) with the Province of Ontario to have the Project subject to the Ontario Environmental Assessment Act (OEA Act). This agreement was the instrument that permitted provincial government to issue a Harmonization Order (HO) under Section 18(2) of the Canada-Ontario Agreement on Environmental Assessment Cooperation to Establish a Joint Review Panel for the Project between the Minister of the Environment, Canada and the Minister of the Environment, Ontario.

The HO was issued on March 25, 2011. The Terms of Reference (ToR) for the Project Environmental Impact Statement (EIS) and the agreement establishing the Joint Review Panel (JRP) were issued on August 8, 2011.

The following provides an overview of the proposed development including its location, surrounding land uses, the exploration history of the site and the primary features of the mining and milling facilities. The information provided below, in the Environmental Impact Statement Report and supporting technical studies is based on the conceptual mine design for the Project. The conceptual design provides planning level information for the environmental assessment process. Detailed design will commence following EA approval in concordance with the concepts presented herein.

1.1 Project Location

The Project is located approximately 10 km north of the Town of Marathon, Ontario (Figure 1). The town, with a population of 3,353 (2011 Census), is situated adjacent to the Trans-Canada Highway 17 (Hwy 17) on the northeast shore of Lake Superior, about 300 km east and 400 km northwest (by highway) of Thunder Bay and Sault Ste. Marie, respectively.

The centre of the Project footprint sits at approximately 48° 47' N latitude and 86° 19' W longitude. The Project site is in an area characterized by relatively dense vegetation, comprised largely of a birch and, to a lesser extent, spruce-dominated mixed wood forest. The terrain is moderate to steep, with frequent bedrock outcrops and prominent east to west oriented valleys. The climate of this area is typical of northern areas within the Canadian Shield, with long winters and short, warm summers.

Figure 1.1-1: Location of the Proposed Marathon PGM-Cu Project Site near Marathon, Ontario

1.2 Surrounding Land Uses

The Project site lies partially within the municipal boundaries of the Town of Marathon, as well as partially within the unorganized townships of Pic, O'Neil and McCoy. The primary zoning designation within the Project Site is 'rural'.

In the immediate vicinity of the Project there are several authorized aggregate sites, including SCI's licensed aggregate site located to the northeast of Hwy 17 along the existing site access road (Camp 19 Road).

The Marathon Municipal Airport (CYSP), which operates as a Registered Airport (Aerodrome class) under the Canadian Aviation Regulations (CARs; Subsection 302), is adjacent to, and south of the Project site. The airport occupies a land area of approximately 219 hectares and is accessed from Hwy 17.

Several First Nations and Métis peoples claim the Project site as falling within their traditional land use boundaries. Based on Aboriginal accounts, prior to the construction of the forestry road, the land and water uses associated with (or close to) the site would have typically been limited to the Pic River corridor, the Bamoos Lake-Hare Lake-Lake Superior corridor and the Lake Superior shoreline and near-shore area, rather than the interior of the Project site. Traditional land and water uses (or rights conferred by Treaty) that can be ascribed to the site could include:

- Hunting;
- Trapping;
- Fishing; and,
- Plant harvesting for food, cultural and medicinal uses.

Primary industries supporting the Town of Marathon, as well as the region, have historically been forestry, pulp and paper, mining and tourism. The Project site is located within the Big Pic Forest Management Area. The Big Pic Forest includes Crown land east and north of Lake Superior and is generally north, south and west of the community of Manitouwadge and includes the communities of Marathon, Caramat and Hillsport.

Until July 2010 the forest was managed under the authority of a Sustainable Forest License (SFL), which was held by Marathon Pulp Inc. This SFL was revoked, with the forest reverting to the Crown as a Crown Forest. Until recently, Marathon Pulp Inc. (MPI) operated a kraft pulp mill in Marathon on the shore of Peninsula Harbour. The mill announced its indefinite shut down (effective at the end of February 2009) on February 11, 2009, and as a result there has been a significant downturn in the local economy. A second mill operated in Terrace Bay was temporarily closed in December 2011.

The Hemlo Mining Camp is located 30 km to the southeast. There are currently two mines in production at the Camp (David Bell Mine, Williams Mine), which are estimated to be in operations until 2025.

1.3 Exploration History of the Site

Exploration for copper and nickel deposits on the Project site started in the 1920s and continued until the 1940s with the discovery of titaniferous magnetite and disseminated chalcopyrite occurrences. During the past four decades, the site has undergone several phases of exploration and economic evaluation, including geophysical surveys, prospecting, trenching, diamond drill programs, geological studies, resource estimates, metallurgical studies, mining studies, and economic analyses. These studies have successively enhanced the knowledge base of the deposit.

In 1963, Anaconda acquired the Marathon property and carried out systematic exploration work including diamond drilling of 36,531 m in 173 drill holes. This culminated in the discovery of a large copper-PGM deposit. Anaconda discontinued further work on the project in the early 1980s due to low metal prices at the time.

In 1985, Fleck purchased a 100% interest in the Marathon PGM-Cu Project with the objective of improving the project economics by focusing on the platinum group element (PGE) values of the deposit. The Fleck drilling totaled 3,615 m in 37 diamond drill holes. In 1986, H.A. Symons carried out a feasibility study for Fleck based on a 9,000 tonnes per day conventional flotation plant with marketing of copper concentrate and Kilborn Limited carried out a prefeasibility review for Fleck that included preliminary results from the Lakefield pilot plant tests (Kilborn Limited, 1987). The feasibility study indicated a low internal rate of return which was confirmed by Teck Corporation who concluded the project was uneconomic due to low metal prices at the time. On June 10, 1998, Fleck changed its name to PolyMet Mining Corp.

In 2000, Geomaque acquired certain rights to the Marathon PGM-Cu Project through an option agreement with Polymet. Geomaque and its consultants carried out a study of the economic potential of the Marathon PGM-Cu Project. The study included a review of the geology and drill hole database, interpretation of the mineralized zones, statistics and geostatistics, computerized block model, resource estimation, open pit design and optimization, metallurgy, process design, environmental aspects, capital and operating cost.

Marathon PGM Corp. acquired the Marathon PGM-Cu deposit from Polymet in December 2003. Marathon PGM Corp. funded programs of advanced exploration and diamond drilling on a continuous basis between June 2004 and 2009. Approximately 320 holes and 65,000 m were drilled from 2007 to 2009 to define and expand the resource and for condemnation holes outside of the pit area. A feasibility study was published in 2008 and updated in January 2010.

Stillwater Mining Company (SWC) and Marathon PGM entered into an agreement on September 7, 2010 pursuant to which SWC would acquire all of the outstanding shares of Marathon PGM. The acquisition agreement received ministerial approval under the Investment Canada Act on November 24, 2010 and the agreement closed on November 30, 2010. On December 31, 2010 Stillwater Mining Company formed a Canadian corporation, Stillwater Canada Inc. In March 2012, MC MINING LTD (MC) purchased 25% interest in Stillwater Canada Inc. who is the proponent of the Marathon PGM-Cu Project.

1.4 Project Overview

The Project is based on the development of an open pit mining and milling operation. The conceptual general layout of the components of the mine site, the transmission line corridor and access road is provided in Figure 1.4.2 below. One primary pit and a satellite pit complex to the south (currently envisaged to be comprised of four satellite pits) are proposed to be mined. Ore will be processed (crushed, ground, concentrated) at an on-site processing facility. Final concentrates containing copper and platinum group metals will be transported off-site via road and/or rail to a smelter and refinery for subsequent metal extraction and separation. The total mineral reserve (proven and probable) is estimated to be approximately 91.5 million tonnes. It is possible that an iron concentrate may also be produced, depending upon the results of further metallurgical testing and market conditions at that time.

During the operations phase of the Project, ore will be fed to the mill at an average rate of approximately 22,000 tonnes per day. The operating life of the mine is estimated to be approximately 11.5 years. The construction workforce will average approximately 400 people and will be required for between 18 and 24 months. During operations the work force will comprise an estimated 365 workers. The mine workforce will reside in local and surrounding communities, as well as in an Accommodations Complex that will be constructed in the Town of Marathon.

Approximately 288 million tonnes of mine rock[1] will be excavated. It is estimated that between eighty five to ninety percent of this material is non-acid generating (NAG) and will be permanently stored in a purposefully built Mine Rock Storage Area (MRSA) located east of the primary pit. The NAG or so-called Type 1 mine rock will also be used in the construction of access roads, dams and other site infrastructure as needed. Drainage from the MRSA will be collected, stored, treated and discharged as necessary to the Pic River. During mine operations, about 20 million tonnes of mine rock could have the potential to generate acid if left exposed for extended periods of time. This mine rock is referred to as Type 2 mine rock or potentially acid generating (PAG). The Type 2 mine rock will be managed on surface during mine operations in temporary stock piles with drainage directed into the open pits. This material will be relocated to the bottom of the primary and satellite pits and covered with water to prevent potential acid generation and covered with Type 1 materials.

[1] Mine rock is rock that has been excavated from active mining areas but does not have sufficient ore grades to process for mineral extraction.

Process solids[2] will be managed in the Process Solids Management Facility (PSMF), as well as in the satellite pit complex. The PSMF will be designed to hold approximately 61 million m^3 of material, and its creation will require the construction of dams. Two streams of process solids will be generated. An estimated 85 to 90% of the total amount of process solids produced will be non-acid generating, or so-called Type 1 process solids. The remaining ten to fifteen percent of the process solids could be potentially acid generating and referred to as Type 2 process solids. The Type 2 process solids will be stored below the water table in the PSMF or below water in the pits to mitigate potential acid generation and covered with Type 1materials. Water collected within the PSMF, as well as water collected around the mine site other than from the MRSA will be managed in the PSMF for eventual reclamation in the milling process. Excess water not needed in the mill will be discharged, following treatment as is necessary, to Hare Lake.

Access to the Project site is currently provided by the Camp 19 Road, opposite Peninsula Road at Hwy 17. The existing road runs east towards the Pic River before turning north along the river to the Project site (approximately 8 km). The existing road will be upgraded and utilized from its junction with Hwy 17 for approximately 2.0 km. At this point a new road running north will be constructed to the future plant site. The primary rationale for developing the new road is to move traffic away from the Pic River. The new section of road will link two sections of forest access roads located on the site.

Power to the Project site will be provided via a new 115 kV transmission line that will be constructed from a junction point on the Terrace Bay-Manitouwadge transmission line (M2W Line) located to the northwest of the primary pit. The new transmission line will run approximately 4.1 km to a substation at the mill site. The width of the transmission corridor will be approximately 30 m.

Disturbed areas of the Project footprint will be reclaimed in a progressive manner during all Project phases. Natural drainage patterns will be restored as much as possible. The ultimate goal of mine decommissioning will be to reclaim land within the Project footprint to permit future use by resident biota and as determined through consultation with the public, Aboriginal peoples and government. A certified Closure Plan for the Project will be prepared as required by Ontario Regulation (O.Reg.) 240/00 as amended by O.Reg.194/06 “Mine Development and Closure under Part VII of the Mining Act” and “Mine Rehabilitation Code of Ontario”.

Maps showing the existing features and topography of the site, as well as the proposed conceptual development of the site are provided in Figure 1.4.1 and 1.4.2.

[2] Process solids are solids generated during the ore milling process following extraction of the ore (minerals) from the host material.

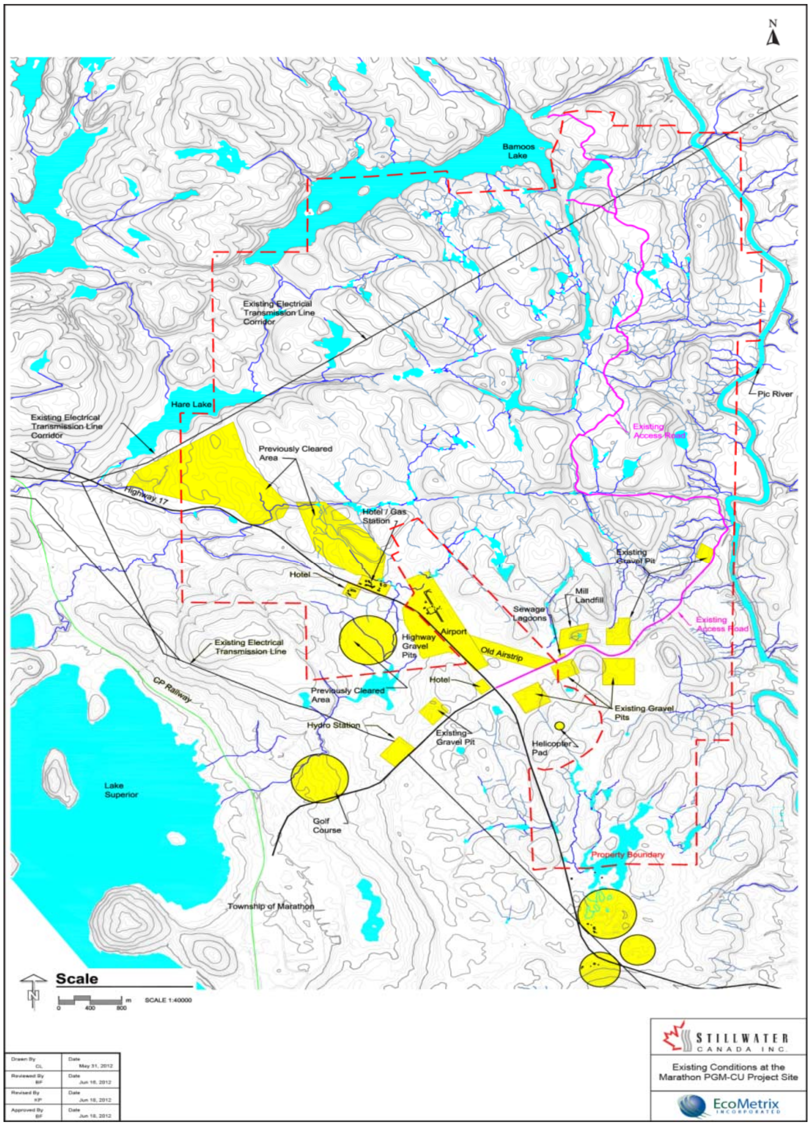


Figure 1.4-1: Existing Conditions at the Marathon PGM-Cu Project Site

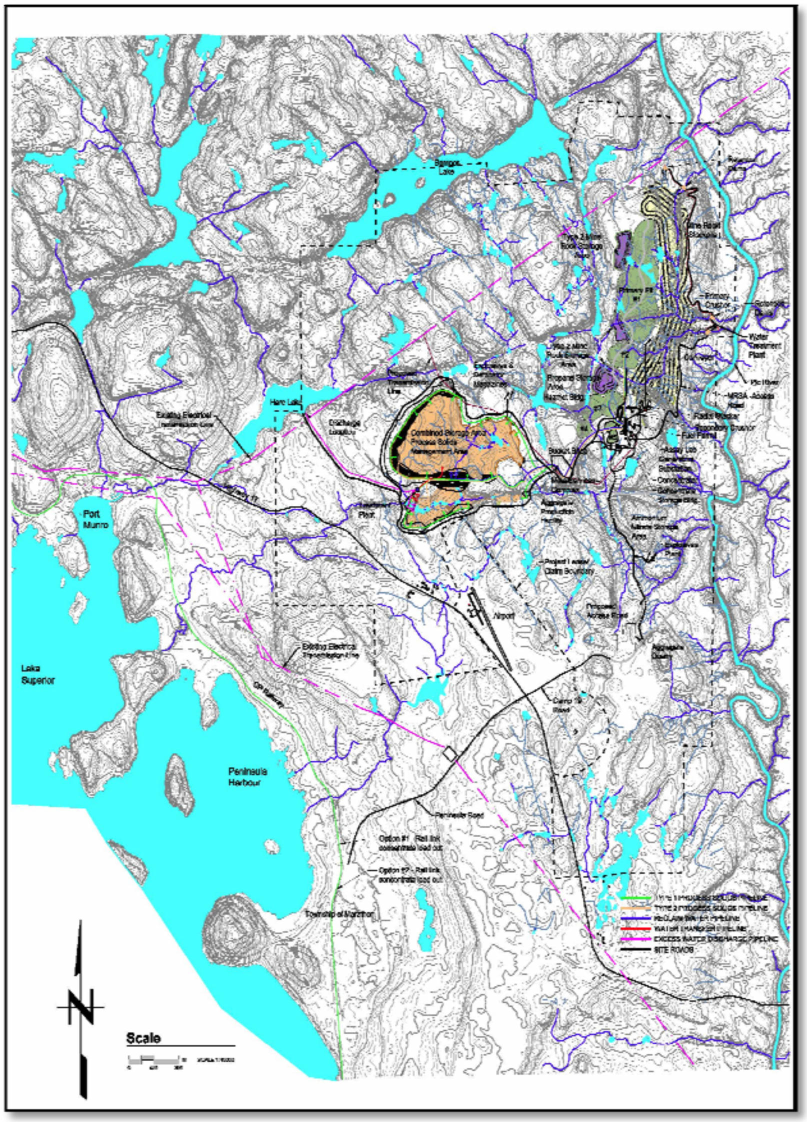


Figure 1.4-2: Marathon PGM-Cu Project Conceptual General Site Layout

2.0 Regulatory Setting

Baseline atmospheric conditions for the Project will be described in terms of three distinct categories: 1) climate and meteorology; 2) Criteria Air Contaminants (CACs); and, 3) greenhouse gases (GHGs). Establishment of the baseline atmospheric environment is important in terms of assessing the potential environmental impacts of the Project on the environment.

The following sections describe the regulatory setting relative to CACs and GHGs in the province of Ontario.

2.1 Assessment Criteria

2.1.1 Ontario Criteria

In the province of Ontario, the Ontario Ministry of Environment (MOE) has published the following point of impingement (POI) criteria:

- Ambient Air Quality Criteria (AAQC).
- Ontario Regulation 419/05 criteria.
- Jurisdictional Screening Limits (JSLs).
- Upper Risk Thresholds (URTs).

Ontario's AAQC criteria are desirable effect-based concentrations in air with variable averaging periods. The type of effect that a chemical may have varies but may be based on health, odour, vegetation, soiling, visibility, or corrosion, among others. The province of Ontario has established AAQC levels for 339 chemicals at values below which adverse health and/or environmental effects are not expected. AAQC concentrations are most commonly used in the environmental assessment process and are considered an appropriate reference criteria for evaluation.

Criteria published in O.Reg 419/05 *Air Pollution – Local Air Quality* made under the Environmental Protection Act (EPA) are typically applicable to proponents who emit contaminants to the environment from a process and are applied at a POI, most commonly a property boundary or, in the case of a mining property, the claim boundary. The exception is when a sensitive land use, such as a child care facility, health care facility or educational facility, exists on site. Certain activities are exempt from O.Reg. 419/05, such as combustion emissions from motor vehicles. As a result, O.Reg. 419/05 criteria are not considered to be appropriate for evaluation of all project related emissions from the Marathon PGM-Cu project since emissions from motor vehicles are being included in the assessment. However, they are a relevant reference criteria in terms of evaluating the permittability of the project.

Jurisdictional Screening Limits (JSLs) are screening criteria used in the province of Ontario to evaluate the significance of contaminant emissions for chemicals that do not have O.Reg. 419/05 or AAQC criteria. Similar to O.Reg. 419/05 criteria, JSL criteria are generally used for comparison at the property boundary. Modelled concentrations of chemicals that are below published JSLs are considered to be insignificant.

Upper Risk Thresholds (URTs) are maximum concentrations which are not to be exceeded anywhere off-property. Similar to JSL values, URTs are compared to modelled concentrations at the claim boundary.

A summary of applicable Ontario criteria is provided in Table 2.1.1-1.

Table 2.1.1-1: Summary of Ontario Criteria for CACs				
Contaminant	CAS#	Averaging Period (hours)	Criteria ($\mu g/m^3$)	
			O.Reg 419/05[a]	AAQC[b]
$PM_{2.5}$	n/a	24	--	30
			--	
PM_{10}	n/a	24	--	50
TSP	n/a	24	120	--
		Annual	--	60*
NO_x	10102-44-0	1	400	400
		24	200	200
SO_2	7446-09-5	1	690	690
		24	275	275
		Annual	--	55
CO	630-08-0	0.5	6,000	--
		1	--	36,200
		8	--	15,700
Dustfall	n/a	30 day	7 g/m^2	7 g/m^2
		Annual	--	4.6 g/m^2

Notes:
[a] Ontario MOE Air Quality (O.Reg 419/05)
[b] Ambient Air Quality Criteria (AAQC)
*Geometric mean

2.1.2 Canadian Criteria

Canadian air quality criteria are published in the National Ambient Air Quality Objectives (NAAQO) and the Canada Wide Standards (CWS). The federal criteria are denoted as Desirable, Acceptable and Tolerable, defined as follows (Health Canada, 1999):

The **Maximum Desirable Level** is the long-term goal for Air Quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and for the continuing development of control technology.

The **Maximum Acceptable Level** is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being.

The **Maximum Tolerable Level** is the maximum concentration beyond which appropriate action is required to protect the health of the general population.

In 1998, Health Canada published NAAQO criteria for PM_{10} and $PM_{2.5}$. These levels are referred to as Federal Reference Levels (FRLs). The applicable federal criteria are summarized in Table 2.1.2-1, below.

Table 2.1.2-1: Summary of Canadian Criteria for CACs					
Contaminant	CAS#	Averaging Period (hours)	POI Criteria ($\mu g/m^3$)		
			Maximum Desirable	Maximum Acceptable	Maximum Tolerable
$PM_{2.5}$	n/a	24	30[b]	--	--
			15[a]	--	--
PM_{10}	n/a	24	25[a]	--	--
TSP	n/a	24	--	120	400
		Annual	60*	70*	--
NO_x	10102-44-0	1	--	400	1000
		24	--	200	300
SO_2	7446-09-5	1	450	900	--
		24	150	300	800
		Annual	30	60	--
CO	630-08-0	1	15,000	35,000	--
		8	6,000	15,000	20,000

Notes:
[a] National Ambient Air Quality Objectives (NAAQO).
[b] Canada Wide Standards.
*Geometric mean

2.1.3 Greenhouse Gases (GHGs)

The Canadian Environmental Assessment Agency (CEAA) document *Incorporating Climate Change Considerations in Environmental Assessments: General Guidance for Practitioners* is the primary source of guidance for the incorporation of Climate Change considerations into an EA in Canada (CEAA, 2003).

Policy initiatives have been implemented to address GHG emissions. The *Kyoto Protocol* is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC) aimed at combating global warming. The UNFCCC is an international environmental treaty aimed at stabilizing atmospheric greenhouse gas concentrations to a level that would prevent dangerous anthropogenic interference with the climate system. The UNFCCC generated GHG targets that were related to 1990 emission levels, in accordance with Annex B of the Protocol. In December 2011, Canada formally withdrew from the Kyoto Protocol.

Under the authority of the Canadian Environmental Protection Act (CEPA), the Government of Canada has mandatory reporting requirements for facilities in Canada that emit 100 Kt or more of GHGs (in CO_2e terms) annually.

Ontario Regulation 452/09, (*Greenhouse Gas Emissions Reporting Regulation*, O.Reg 452/09) made under the Environmental Protection Act, requires that facilities subject to the regulation calculate and report GHG emissions annually if the minimum reporting threshold limit is exceeded.

3.0 Methodology

3.1 Site Setting

Evaluation of climate, meteorology and air quality was completed based on the regional setting, local setting and project setting, defined as follows:

Regional Setting	Northwestern Ontario, from Thunder Bay on the west to Sault Ste. Marie on the east, north to Highway 11
Local Setting	10 km from the Site Claim boundary, including the Town of Marathon and Pic River First Nation
Project Setting	Marathon PGM-Cu Claim Boundary

3.2 Climate and Meteorology

Canadian Climate Normal data spanning the years 1971 to 2000 was obtained from Environment Canada's web-based archive for the communities of Geraldton, Sault Ste. Marie, Sudbury and Thunder Bay. Climate normal data does not exist for Marathon. The data consisted of 30 year averages for temperature, precipitation and snow depth. Station data for climate normal data is summarized in Table 3.2-1.

Table 3.2-1:
Climate Normal Weather Stations

Station ID	Station Name	Elevation (m)	Latitude	Longitude
6044903	Manitouwadge	332.2	49°09'	85°48'
6048230	Terrace Bay	289.0	48°48'	87°06'
6068150	Sudbury A	347.5	46°37'	80°47'
6048261	Thunder Bay A	199.0	48°22'	89°19'

Local and regional climate and meteorological data for the period between 1996 and 2011 was obtained from Environment Canada's web site for the Town of Marathon, Marathon Airport, Pukaskwa Park and Hemlo Battle Mountain, as available. Data was comprised of temperature, relative humidity, wind speed, wind direction, snow on ground and atmospheric pressure. Data for the Marathon Airport station was only available for daytime hours (i.e. 8 a.m. until 5 p.m.). A summary of station location information is provided in Table 3.2-2, below.

Table 3.2-2:
Environment Canada Weather Stations

Station ID	Station Name	Elevation (m)	Latitude	Longitude
6044959	Marathon	189.0	48°43'	86°24'
6044962	Marathon 'A'	315.5	48°45'	86°20'
6046770	Pukaskwa National Park	192.0	48°36'	86°18'
6043452	Hemlo Battle Mountain	335.0	48°42'	85°53'

Evaporation data was obtained from available mapping published by the Hydrological Atlas of Canada. Map plate 17 depicting mean annual lake evaporation for the 10-year period spanning 1957 to 1966 was used to obtain data regarding the mean annual evaporation rate for the Marathon area.

Solar radiation data was obtained from the National Archive System of the Meteorological Service of Canada. Data from the nearest solar radiation station to the project site, Kapuskasing, Ontario, was referenced.

Local meteorological conditions were also measured between September and November 2011 in conjunction with PM_{10} and dustfall monitoring. A Davis Vantage Pro2 weather station was established on the Project site to provide hourly measurements of wind speed, wind direction, temperature, relative humidity and precipitation. The weather station was erected in accordance with the Environment Canada AES guideline entitled *MSC Guidelines for Co-operative Climatological Autostations, Version 3.*0, Meteorological Service of Canada, dated September 2004. The co-ordinates of the weather station were as follows:

Northing	N 48.8°
Easting	W 86.3°

Local data was compared to existing Environment Canada station data to assess data compatibility and to supplement data obtained from the Environment Canada Marathon Airport station.

3.3 Baseline Regional Ambient Air Quality

A literature search for available ambient air quality data for CACs for the Town of Marathon and other nearby municipalities was conducted. Neither Environment Canada nor the MOE operate ambient air monitoring stations in the vicinity of Marathon. The nearest stations are Sault Ste. Marie to the east and Thunder Bay to the west.

As a result, baseline regional ambient air quality data for criteria air contaminants (TSP, PM_{10}, $PM_{2.5}$, ozone, NO_x, SO_2 and CO) were obtained from available MOE Ontario air quality reports and raw data for Thunder Bay and Sault Ste. Marie, as available.

Annual geometric mean data was retrieved from the MOE reports or calculated, if not available. TSP data was only available for 1996.

3.4 Baseline Local Ambient Air Quality

Baseline concentrations of PM10, dustfall, metals and nutrients were measured at up to five locations on and around the Project site in 2011. In addition, Project site meteorology was measured for some of the sampling period in 2011. Sample locations are shown on Figure 3.4-1.

3.4.1 PM_{10}

Baseline concentrations of inhalable particulate matter (PM_{10}) were measured at three locations on the Project site using PQ100 portable PM_{10} air sampling equipment, as shown on Figure 3.4-1. Sampling was completed between June and November 2011 and was conducted in general accordance with methodology described in the MOE document *Operations Manual for Air Quality Monitoring in Ontario,* dated March 2008.

The PQ100 sampling equipment consisted of calibrated high volume particulate air samplers mounted on a tripod equipped with new, pre-weighed 47 mm Teflon filters. Each sampling station was operated by a dedicated wet cell battery. Sampling equipment was operated on a six-day sampling schedule where one 24-hour sample was collected every six days over the sampling period. Sample locations are shown in Table 3.4.1-1, below, and shown graphically on Figure 3.4-1.

Table 3.4.1-1:
PM_{10} Monitoring Station Locations

Station No.	1	2	3
Location	Pic River	North of May's Gifts	Hare Lake
Easting	551637	547152	545694
Northing	5402371	5401222	5403864

The PM_{10} sampling equipment was sited to meet the requirements of the MOE air quality monitoring manual. To the extent possible, sampling equipment was placed in locations where the distance between the nearest obstacle and the sampling equipment was at least twice the height of the obstacle. Placement of sampling equipment near unpaved roadways was avoided to the extent possible. Sampler inlets were placed at least 2.5 m above ground surface.

Prior to sampling, the sample flow rate was calibrated using either a Gilian Gilabrator or a Delta Cal primary calibrator and the flow rate recorded. Ambient temperature and pressure was also recorded. A new pre-weighed 47 mm Teflon filter was placed in the sample holder and the equipment was programmed to sample for the specified date.

Upon completion of sampling, filters were collected, placed in labelled petri dish containers, and shipped under Chain of Custody to Galson Laboratories, an ISO accredited laboratory, for analysis of particulate matter as PM_{10} by gravimetry.

3.4.2 Dustfall

Dustfall is a measure of total deposition of particulate, including wet deposition (material removed from the environment by precipitation) and dry deposition (material that settles naturally). Baseline dustfall was measured at five locations for the months of August, September and October 2011: four locations on or around the Project site (locations 1 through 4) and one within the Town of Marathon (location 5). Sampling locations were strategically selected to evaluate dustfall near identified sensitive receptors or areas that would be affected by dustfall once the Project site is developed. Site selection for the dustfall monitors was completed in general accordance with the MOE document *Operations Manual for Air Quality Monitoring in Ontario*, dated March 2008 and ASTM Method D1739-98 (2004). Monitoring sites were selected based on an analysis of prevailing meteorological conditions, proximity to existing dust-generating sources (i.e. Highway 17, Marathon airport, existing gravel pits) and suitability of sampling locations to meet siting criteria.

Each dustfall monitoring station consisted of a laboratory-supplied collection jar mounted onto a fabricated metal stand. The metal stand extended 2.0 metres above ground and had a mesh wind screen surrounding the sample jar. In addition, bird-deterring spikes were mounted on top of the wind screen to minimize the potential for birds to perch onto the stand and skew the results. A summary of dustfall stations is provided below in Table 3-4. Sampling locations are shown graphically on Figure 3.4-1.

Table 3.4.2-1: Dustfall Monitoring Station Locations					
Station No.	**1**	**2**	**3**	**4**	**5**
Location	Pic River	May's Gifts	Hare Lake	Airport	Field Office
Easting	0551643	0547147	0545694	0549180	0545863
Northing	5402374	5401216	5403873	5399815	5397092

Sample jars were deployed to the site at the beginning of each sampling month and left in place for the entire month (30 +/- 2 days). Following completion of sampling, jars were collected and transported under Chain of Custody to ALS Laboratory Group for analysis of total dustfall, total, soluble and insoluble anions and total metals.

3.5 Baseline Greenhouse Gas (GHG) Emissions

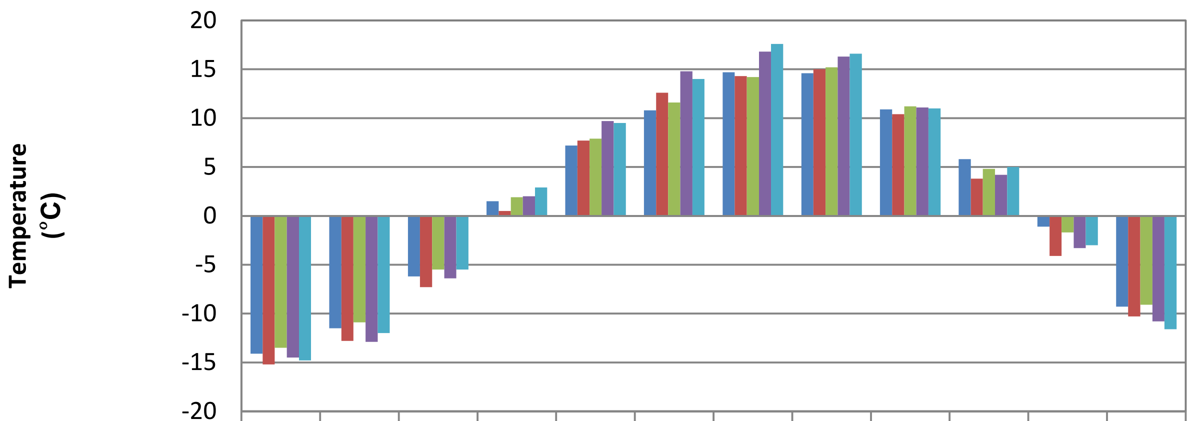
A literature search for annual provincial and federal GHG emission rates was completed. GHG emissions for Ontario and Canada were obtained from Environment Canada's *1990-2008 National Inventory Report.* Total GHG emissions are normally reported as carbon dioxide equivalents (CO_2e), calculated by multiplying the emission rate of each substance (CO_2, CH_4 and N_2O) by its global warming potential (GWP) relative to CO_2.

4.0 Climate and Meteorology

The Project area lies in the sub-arctic region. The climate of the Project area is typical of northern areas within the Canadian Shield, with long winters and short warm summers.

4.1 Temperature

Mean monthly temperatures for the four nearby meteorological stations (Marathon, Marathon Airport, Pukaskwa Park and Hemlo Battle Mountain) for all available data are shown below on Figure 4.1-1. Climate normal data for Thunder Bay are shown for comparison.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Marathon	-14.1	-11.5	-6.2	1.5	7.2	10.8	14.7	14.6	10.9	5.8	-1.1	-9.3
Marathon Airport	-15.2	-12.8	-7.3	0.5	7.7	12.6	14.3	15	10.4	3.8	-4.1	-10.3
Pukaskwa	-13.5	-10.9	-5.5	1.9	7.9	11.6	14.2	15.2	11.2	4.8	-1.7	-9.1
Hemlo	-14.5	-12.9	-6.4	2	9.7	14.8	16.8	16.3	11.1	4.2	-3.3	-10.8
Climate Normal	-14.8	-12	-5.5	2.9	9.5	14	17.6	16.6	11	5	-3	-11.6

Figure 4.1-1: Mean Monthly Temperatures for Marathon Airport

Temperatures for the Marathon area are characterized by warm summers and cold winters. Mean temperatures are relatively similar between the four stations in and around Marathon, with the coldest temperatures occurring during the winter months of December to February and the warmest temperatures occurring in the summer months of June to September. Mean temperatures measured at the Marathon airport appear to be relatively stable from year to year, with fluctuations of about ± 5°C per year and appear to be slightly colder in the winter and warmer in the summer than the Town of Marathon, likely due to lake effects.

Mean temperatures for the Marathon area are also similar to published climate normal data for the years 1971 to 2000 measured at the Thunder Bay airport, as shown on Figure 4.1-1 above, and are typical for locations along the north shore of Lake Superior.

Extreme maximum and minimum temperatures for the Marathon Airport for the years 1989 to 1999 are summarized on Figure 4.1-2, below.

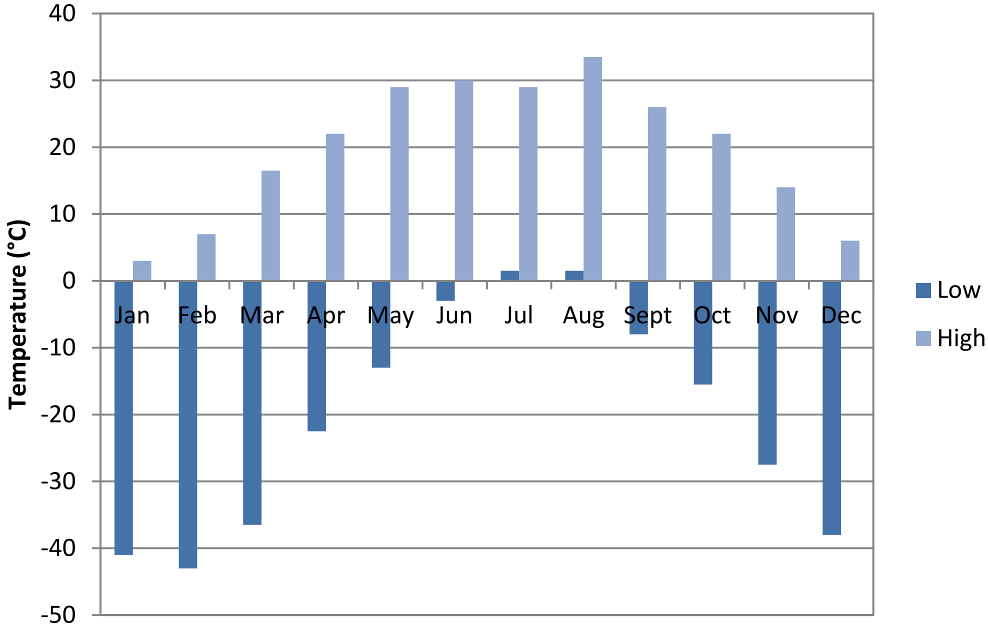


Figure 4.1-2: Maximum and Minimum Temperatures at Marathon Airport

Extreme minimum temperatures at the Marathon Airport ranged from -41°C to +1.5°C and maximum temperatures ranged from +3°C to +33.5°C. No trends were noted in minimum or maximum temperatures over the time period assessed.

4.2 Relative Humidity (RH)

Relative humidity is the gravimetric ratio of water vapour in a unit volume to the water vapour that would prevail under saturated conditions at a given temperature. Hourly relative humidity recorded at the Marathon Airport between 2008 and 2010 ranged from 20 to 100%. Average daily relative humidity ranged from 30 to 100%.

Average monthly levels of relative humidity for Thunder Bay, based on climate normal data, generally ranged from 49 to 93%, with the lowest values measured during the winter months.

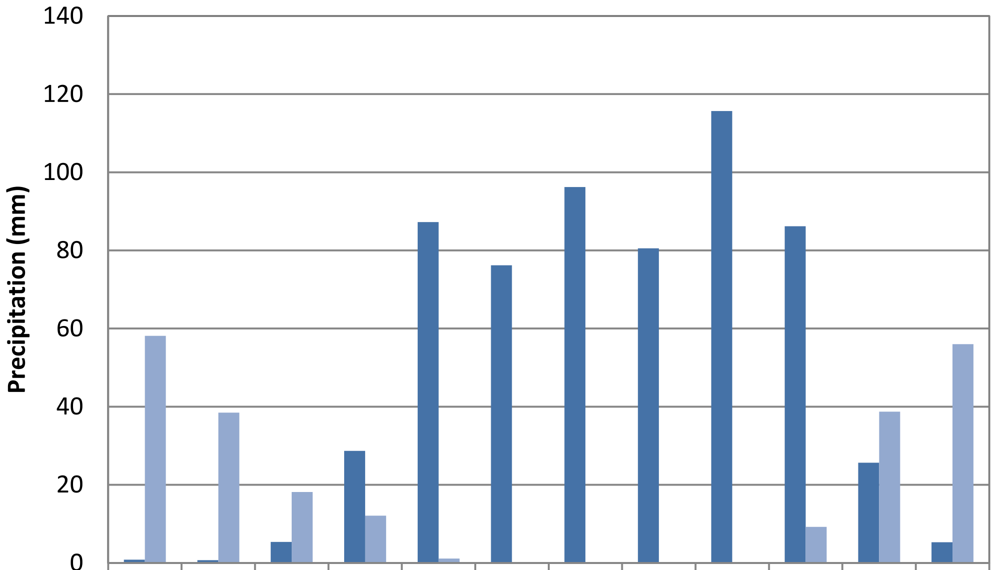
4.3 Evaporation

Based on the Hydrological Atlas of Canada, evaporation in the Marathon area is interpreted to be on the order of 510 mm. According to Environment Canada's Water Budget Values for the period 1959 to 1981, the mean annual evapotranspiration is approximately 488.2 mm (Golder, 2007).

An evaluation of Environment Canada lake evaporation data for Atikokan, Ontario between 1966 and 1988 shows a minimum value of -30 mm, a maximum of 3,910 mm and a 90th percentile value of 530 mm which compares well to the mapping value.

4.4 Precipitation

Monthly precipitation for the Marathon Airport for the period 1989 to 1999 is shown on Figure 4.4-1. Snowfall is shown as the quantity of rainfall and the water equivalent snowfall in units of millimetres.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rain	0.8	0.7	5.4	28.7	87.3	76.2	96.2	80.6	115.7	86.2	25.7	5.3
Snow	58.1	38.5	18.1	12.1	1.1	0.0	0.0	0.0	0.1	9.2	38.7	56.0

Figure 4.4-1: Mean Monthly Precipitation at Marathon Airport

The average annual total precipitation for the Marathon Airport is 840 mm (608 mm of rainfall and 232 cm of snowfall). Rainfall is typically heaviest between May and October, with a combined average of 327 mm representing 89% of the total annual rainfall. The maximum daily rainfall recorded at Marathon between 1988 and 1999 was 98 mm. Snowfall is heaviest between the months of November and February at 191 cm or 82% of the total.

Values for the Marathon Airport compare well to climate normal data spanning the years 1952 to 1983 for Marathon station, which reported an average annual total precipitation of 827 mm (587 mm of rainfall and 240 cm of snowfall).

4.5 Wind Speed and Direction

In general, the overall annual prevailing winds measured at the Marathon airport tend to be from the southwest and north-northeast.

The maximum daily wind gust recorded at the Marathon airport between 2008 and 2010 was 56 km/h, with a corresponding maximum mean daily wind speed of 44 km/h. The typical mean daily wind speed ranges from 17 to 28 km/h.

Figure 4.5-1 depicts predominant wind speeds and direction for all available data. Figures 4.5-2 to 4.5-5 show the seasonal wind roses for data obtained from 2007 to 2009 for the Marathon Airport. The prevailing winds are from the southwest and northeast, with calm winds occurring approximately 3.6% of the time. During the spring and fall, winds are predominantly from the southwest and northeast directions, consistent with the annual results. The only exceptions were during the summer months, when the winds are predominantly from the southwest and the winter months, when winds are predominantly from the northeast.

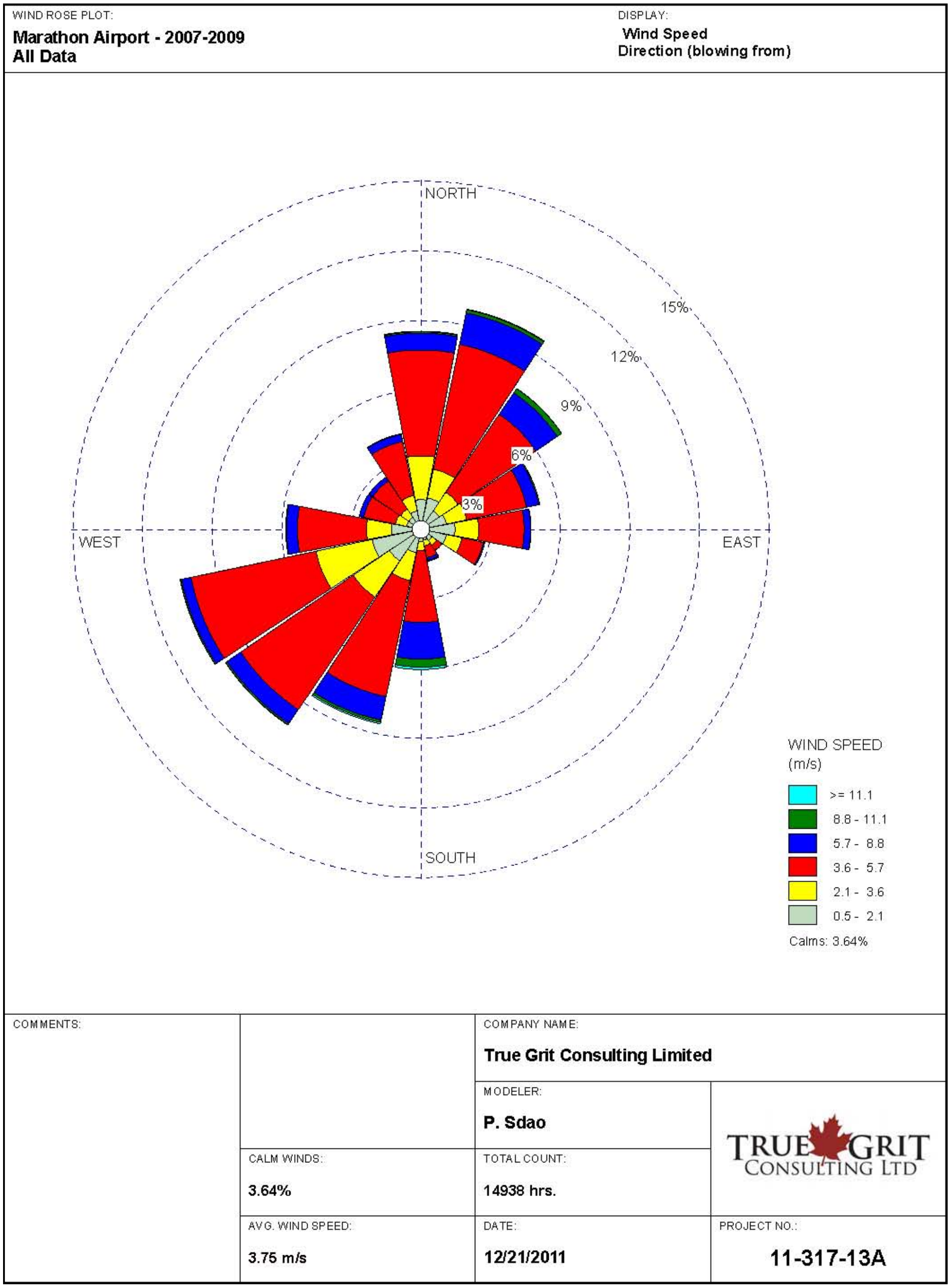


Figure 4.5-1: Wind Rose for Marathon Airport – 2007 to 2009

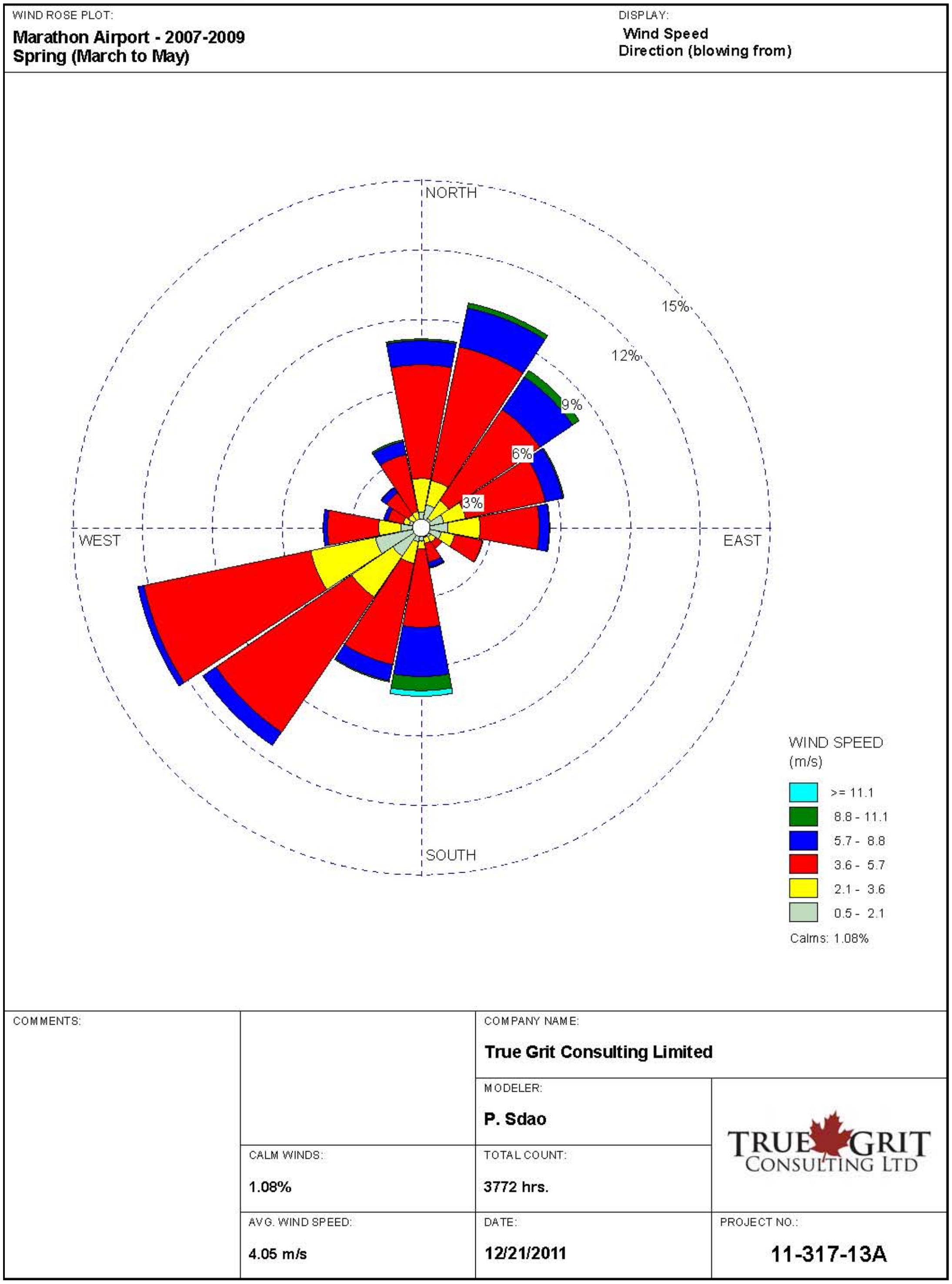


Figure 4.5-2: Seasonal Wind Rose for Marathon Airport – Spring

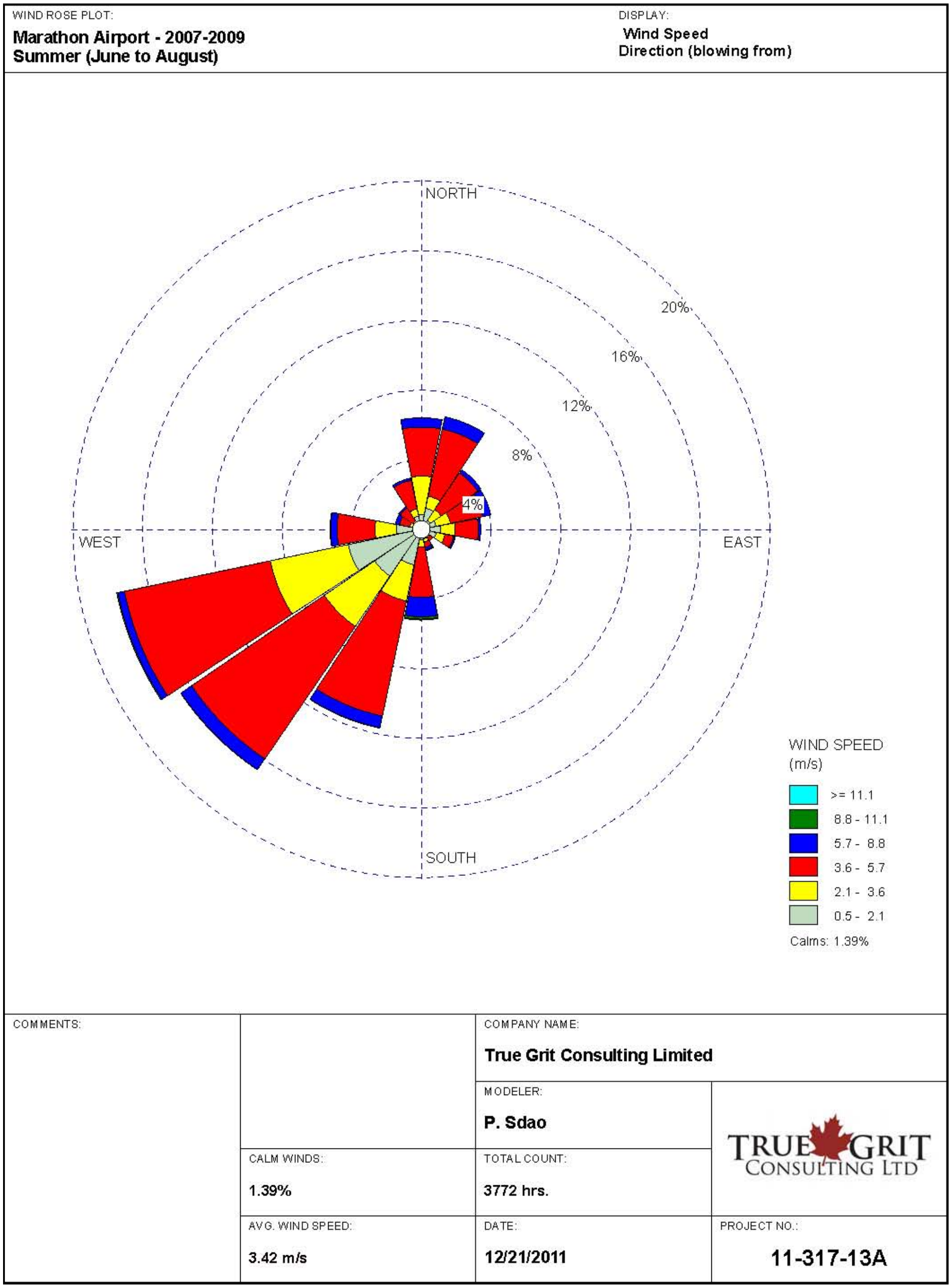


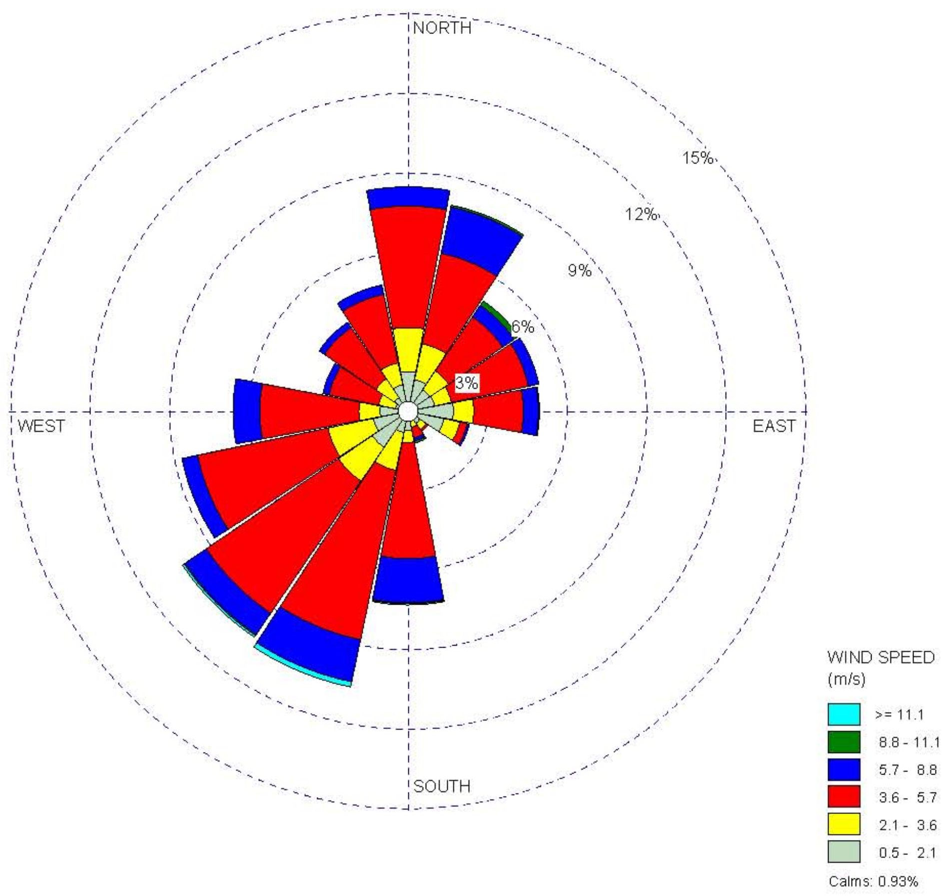
Figure 4.5-3: Seasonal Wind Rose for Marathon Airport – Summer

WIND ROSE PLOT:

Marathon Airport - 2007-2009
Fall (September to October)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:		COMPANY NAME: **True Grit Consulting Limited**	
		MODELER: **P. Sdao**	
	CALM WINDS: **0.93%**	TOTAL COUNT: **2471 hrs.**	
	AVG. WIND SPEED: **3.79 m/s**	DATE: **12/21/2011**	PROJECT NO.: **11-317-13A**

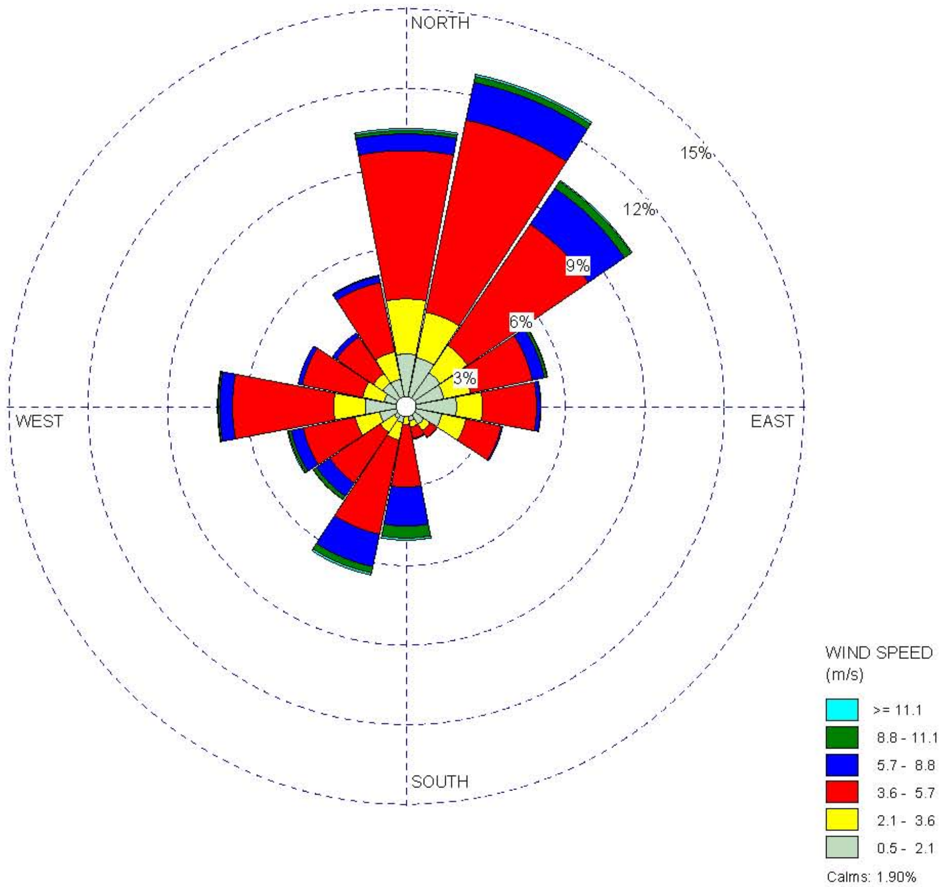
Figure 4.5-4: Seasonal Wind Rose for Marathon Airport - Fall

WIND ROSE PLOT:

Marathon Airport - 2007-2009
Winter (November to February)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:		COMPANY NAME: **True Grit Consulting Limited**	
		MODELER: **P. Sdao**	
	CALM WINDS: **1.90%**	TOTAL COUNT: **4912 hrs.**	
	AVG. WIND SPEED: **3.74 m/s**	DATE: **12/21/2011**	PROJECT NO.: **11-317-13A**

Figure 4.5-5: Seasonal Wind Rose for Marathon Airport - Winter

Winds were generally calm at the airport site about 8.5% of the time and the majority of wind speeds ranged from 4 to 20 km/h. Strong gusts above 20 km/h were measured approximately 10.3% of the time, as shown on Figure 4.5-6.

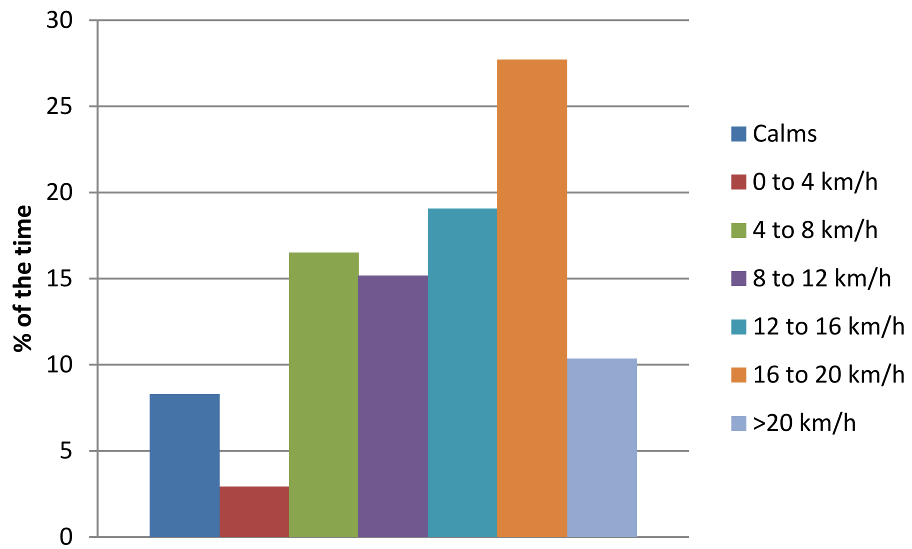


Figure 4.5-6: Summary of Wind Speeds at Marathon Airport (2007 to 2011)

Local Project site wind directions recorded between September and November 2011 correlated fairly well with Marathon Airport data, agreeing approximately 71% of the time. With the exception of calm periods, Project site wind speed was generally not consistent with Marathon Airport data, likely due to the elevation difference between the monitors (i.e. the Project site weather station was mounted 2.5 metres above ground while the Environment Canada weather station is located approximately 10 metres above ground). Wind speeds measured at the Environment Canada station were generally higher than those measured at the Pic River Project station site.

4.6 Atmospheric Pressure

Atmospheric pressure at the Marathon Airport generally ranges between 95 and 100 kPa, with an average pressure of 97.7 kPa. Measured pressures at Marathon Airport are similar to Climate Normal data for Thunder Bay, Sudbury and Sault Ste. Marie, which ranged from 97.3 to 99.2 kPa. Pressures tend to be lowest in the summer months (May through July) and highest in the fall (August through October).

4.7 Solar Radiation

Solar radiation is radiant energy emitted by the sun, particularly electromagnetic energy. About half of the radiation is in the visible short-wave part of the electromagnetic spectrum. The other half is mostly in the near-infrared part, with some in the ultraviolet part of the spectrum. A portion of the extraterrestrial solar radiation penetrates through the atmosphere to the earth's surface, while part of it is scattered and/or absorbed by gases, aerosol particles, cloud droplets and cloud crystals in the atmosphere.

Solar radiation is not measured at the Marathon airport. The nearest global solar radiation station to the project site is Kapuskasing, Ontario, located approximately 300 km northeast of the Marathon site. A review of the Kapuskasing data obtained from Environment Canada for the period 1962 to 1967 showed a maximum hourly global solar radiation value of 4.01 Megajoules per square metre (MJ/m^2) and a 90^{th}

percentile value of 1.92 MJ/m^2. The maximum daily global solar radiation for the station was 36 MJ/m^2 and the mean was 12.7 MJ/m^2.

Annual mean daily solar radiation values were obtained from the Energy, Mines and Resources Canada map *Canada Solar Radiation – Annual* (1984) and is approximately 12.8 MJ/m^2 for the Marathon area, similar to the cumulative daily solar radiation values obtained for the Kapuskasing station.

4.8 Weather Phenomena

Occurrences of weather phenomena, including extreme and rare meteorological phenomena, were reviewed from real-time data collected at the Marathon Airport and from published Environment Canada rare weather mapping.

4.8.1 Tornadoes

There are no reported occurrences of tornadoes in the Marathon area, based on Environment Canada mapping for the period 1979 to 2004.

4.8.2 Lightning

According to Environment Canada records for the period 1999 to 2008, approximately 10 to 15 incidents of cloud to ground lightning are reported per year in the Project area. The incidence of lightning near the Project site is typical of the northern Ontario and lower than the number of incidences observed in southern Ontario.

4.8.3 Fog

The average number of days per year that visibility is reduced to less than 1 km due to fog is approximately 30, based on Environment Canada mapping for the period 1971 to 1999. There were no incidents of fog resulting in a reduction of visibility to less than 1 km between 2007 and 2009, based on Marathon Airport data.

4.8.4 Other Extreme Weather Phenomena

Other extreme weather phenomena include ice storms, extreme rain or snow events, or hail.

Only one report of a potentially damaging hail occurrence was reported for the Marathon area between 1979 and 2009. Compared to southern Ontario where the range of incidences was from 1 to 50, the potential for damaging hail occurrences at the Project site is considered to be low.

The area is potentially susceptible to heavy snowfall events, with six to eight daily events of more than 10 cm of snowfall occurring between 1971 and 2000.

There were no reported damaging wind occurrences for the Marathon area between 1979 and 2009.

5.0 Baseline Air Quality

This section provides an overview of the baseline ambient air quality present both locally and regionally.

The closest MOE air monitoring station to the Project site is in Thunder Bay, approximately 300 km west of the subject property, and in Sault Ste. Marie, approximately 300 km east of the Project site. The Marathon Project site is located on the north side of Highway 11 in a remote area of northwestern Ontario, approximately 10 km north of the nearest community of Marathon. As a result, baseline ambient air quality is considered to be good and adequately represented by rural air quality. Data from more developed municipalities, such as Thunder Bay and Sault Ste. Marie, are

5.1 Particulate Matter (TSP, PM_{10} and $PM_{2.5}$)

Particulate matter is defined based on particle diameter, as follows:

- Total suspended particulate (TSP) matter includes particles of all sizes.
- Inhalable particulate matter (PM_{10}) includes all particles with an aerodynamic diameter <10 µm.
- Respirable particulate matter ($PM_{2.5}$) includes all particles with an aerodynamic diameter <2.5 µm.

In Ontario, TSP is defined as particulate matter with an aerodynamic diameter less than 44 µm. Human exposure to fine particulate matter over a short period of time can irritate the respiratory tract. Chronic exposure to airborne fine particulate can lead to more extensive health problems, such as asthma, lung disease, and cardiovascular problems (USEPA, 2006).

At a mine site, particulate matter also contains metals that may become airborne during mining activities. Metal deposition in the environment can affect soils, vegetation and water quality, all of which may in turn affect overall habitat quality for wildlife and aquatic life.

Particulate matter is generated at the Project site during various industrial processes including, but not limited to: site clearing and construction activities; motor vehicle exhaust; drilling; blasting; material loading and unloading; crushing and grinding; diesel generator combustion; propane heating equipment combustion; and fugitive emissions such as wind erosion of storage piles, wind erosion of the process solids management facility (PSMF), and dust re-entrainment from driving on unpaved roads.

Ambient concentrations of TSP are no longer measured in Ontario since the focus now is on respirable particulate matter as it has a greater impact on human health. TSP generally settles to the ground at limited distances from a source. The last regional testing of TSP was completed by the MOE in 1996 and this data was referenced. Concentrations of TSP in 1996 ranged from a low of 20.4 micrograms per cubic metre of air (ug/m^3) in Fort Frances to a high of 455 ug/m^3 in Hearst, recorded near a sawmill operation. The annual geometric mean for TSP in the province of Ontario between 1987 and 1996 ranged from about 35 to 48 ug/m^3 (MOE, 1996). Based on the location of the Marathon property relative to dust-generating sources and the undeveloped nature of the property, baseline ambient TSP concentrations are expected to be near the lower limits of the annual provincial mean range of 35 to 48 ug/m^3, well below MOE's AAQC 24-hour TSP criterion of 120 ug/m^3. A second estimate of Project site TSP concentrations was made using the following empirical equation relating PM_{10} to TSP concentrations developed based on monitoring of TSP and PM_{10} at 14 urban sites across Canada between 1986 and 1994 (WGAQOG, 1999): $PM_{10} = 10^{(0.826 \times \log TSP)}$. The range of TSP concentrations using this formula and measured PM_{10} concentrations at the Project site is 21.9 to 25.7 ug/m^3, lower than the Ontario annual mean range.

Measurements of on-site PM_{10} concentrations were made at three locations between July and October 2011. Results are summarized in Table 5.1-1, below.

Table 5.1-1: Summary of Measured PM_{10} Concentrations			
Sample Date	24-hr PM_{10} Concentration (ug/m^3)		
	Pic River	May's Gifts	Hare Lake
7/24/11	7.1	5.6	6.3
7/30/11	12.5	12.1	12.7
8/5/11	16.4	16.4	16.9
8/11/11	6.4	4.8	5.2
8/17/11	10.41	10.46	11.61
8/23/11	15.55	12.96	12.64
8/29/11	7.09	6.27	6.27
9/4/11	4.59	4.15	4.18
9/10/11	6.69	6.19	5.83
9/16/11	4.14	4.21	4.17
9/22/11	4.14	4.26	4.20
9/28/11	9.52	6.82	8.32
10/4/11	9.10	8.07	7.90
10/10/11	14.05	12.66	13.36
10/16/11	< 4.18	4.14	4.19
10/22/11	4.99	4.95	6.28
10/28/11	< 4.16	4.16	7.12
24 hr Average	**8.3**	**7.5**	**8.1**
90^{th} Percentile	**14.6**	**12.8**	**13.0**

Average 24-hr PM_{10} concentrations for the study period were fairly similar at all three stations, ranging from 7.5 ug/m^3 at May's Gifts to 8.3 ug/m^3 at the Pic River station. The 90^{th} percentile results ranged from 12.8 ug/m^3 at May's Gifts to 14.6 ug/m^3 at the Pic River station. Days when elevated PM_{10} concentrations were detected were consistent across all three sampling stations, suggesting a regional and not local source. For comparison, the annual composite geometric mean for the province of Ontario between 1991 and 1996 ranged from about 18 to 22 ug/m^3, with peak values of up to 164 ug/m^3 measured near industrial sources. All results for the Marathon Project site were below the Ontario averages and well below MOE's AAQC of 50 ug/m^3.

The 2009 annual mean $PM_{2.5}$ concentration for Thunder Bay was 3.8 ug/m^3, the fifth lowest among 40 MOE air monitoring stations across the province (MOE, 2009). The maximum 24 hour measurement in 2009 for Thunder Bay was 18 ug/m^3. In comparison, ambient $PM_{2.5}$ concentrations in rural areas of North America (WGAQOG, 1999) range from 1 to 5 ug/m^3. These results are considered representative of regional and local air quality. The baseline $PM_{2.5}$ concentrations at the Project site are expected to be between 1 and 5 ug/m^3, given the remote nature of the Marathon site and its significantly smaller population than Thunder Bay.

The ratio between $PM_{2.5}$ and PM_{10} varies between 0.1 and 0.8, depending on the source of the particulate. However, a recognized mean ratio $PM_{2.5}/PM_{10}$ of 0.54 has been used to estimate the relationship between the two particulate size fractions for ambient air quality (Lall et al, 2004). Based on this relationship and the measured Project site PM_{10} concentrations, the estimated $PM_{2.5}$ mean concentration ranges from about 4.0 to 4.5 ug/m^3, similar to the values measured in Thunder Bay. The estimated $PM_{2.5}$ site concentrations are considered to be conservative since the measured data spanned only the summer months and PM_{10} concentrations are expected to be lower during the winter months due to snow cover. The predicted Project $PM_{2.5}$ concentrations and the measured Thunder Bay concentrations are well below MOE's AAQC criterion of 30 ug/m^3.

5.2 Nitrogen Oxides (NO_x)

Nitrogen oxides (NO_x) are produced mainly from combustion processes and are made up of more than six different nitrogen oxide compounds. Nitric oxide (NO) and nitrogen dioxide (NO_2) are the predominant forms of NO_x found in air emissions and the most significant air pollutants. NO_2 is a red/brown gas that contributes to photochemical smog in the presence of sunlight and other volatile organic compounds (VOCs). NO is associated with many physiological and pathological processes in humans and animals. In the environment, NO can be oxidized to NO_2.

The levels of NO and NO_2 and the ratio of the two gases, together with the presence of hydrocarbons and sunlight, are the most important factors in the formation of ground-level ozone and other oxidants. In the atmosphere, further oxidation and combination with water forms nitric acid, a constituent of acid rain. Smog conditions that last days or weeks can be detrimental to human health, crop and vegetation growth and health.

The Project emissions of NO_x originate from combustion sources such as vehicle traffic, construction and mining equipment exhaust, blasting and diesel power generation.

Baseline NOx concentrations are considered to be representative of regional ambient air quality. Figure 5.2-1 depicts measured NOx concentrations at Thunder Bay between 2000 and 2010.

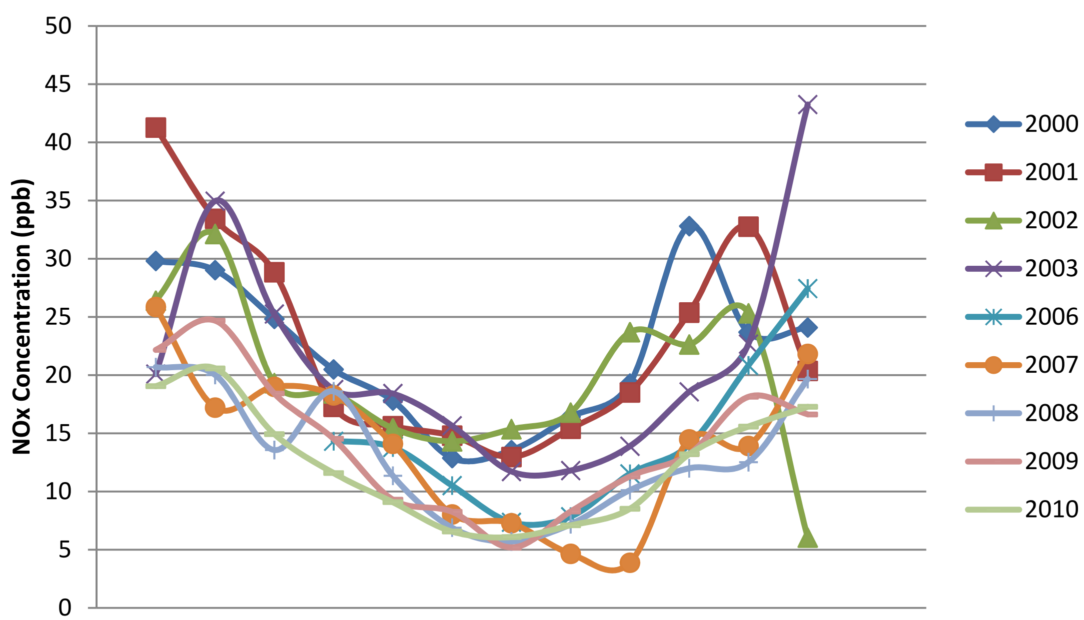


Figure 5.2-1: Regional NOx Concentrations

Average monthly concentrations of NOx ranged from 4.6 to 43 parts per billion (ppb). Concentrations are highest in the winter months, during heating season, and lowest in the summer. The 90th percentile NOx concentration averaged over 24 hours was 33.2 ppb. All concentrations are below MOE's AAQC 24-hour criterion of 100 ppb.

5.3 Carbon Monoxide (CO)

Carbon monoxide (CO) is a colourless, odourless gas. It is produced primarily as a product of incomplete combustion of fossil fuels, as well as from industrial processes and natural sources. Emissions of CO will be generated from the incomplete combustion of fuel from vehicles and heavy equipment, detonation of blasting compounds and diesel power generation.

The 90th percentile 24-hour average CO concentration at Thunder Bay was 0.83 ppb, based on data collected in 2002 and 2003. Regional CO concentrations are low and well below MOE's AAQC 24-hour criterion of 30,000 ppb.

5.4 Sulphur Oxides (SO_x)

Sulphur oxides (SO_x) are a group of chemicals comprised of sulphur monoxide (SO), sulphur dioxide (SO_2), sulphur trioxide (SO_3) as well as lower and higher order sulphur oxide compounds (i.e. S_nO, SO_4). Although SO_x is a complex mixture of sulphur oxide compounds, SO_2 is often used as the indicator compound to reflect SOx emissions as a whole.

Sulphur dioxide is a non-flammable, non-explosive colourless gas with a distinctive pungent sulphur odour. It is produced by the oxidation of sulphur in fuel during combustion. At high concentrations, it can have a negative effect on plant and animal health, particularly with respect to their respiratory systems. SO_2 is also a contributing factor to acid rain when it is oxidized in the environment and depleted from the atmosphere by precipitation to form sulphuric acid.

Project-related SO_2 emissions will be produced through the combustion of sulphur-containing fuels in on-site vehicles, heavy equipment and diesel power generating equipment. The use of low sulphur fuels throughout all phases of the Project will be encouraged to minimize SO_2 emissions.

The 90th percentile 24-hour average SO_2 concentration measured at Thunder Bay between 2000 and 2003 was 1.375 ppb, with a minimum measured value of 0 ppb and a maximum value of 12.5 ppb. These values are expectedly lower than values measured at Sault Ste. Marie (2001 to 2010), which had a 90th percentile 24-hour average of 3.25 ppb and a maximum value of 24.0 ppb. With the exception of the maximum value for Sault Ste. Marie, all results were well below the AAQC 24-hour criterion of 100 ppb and the annual criterion of 20 ppb.

5.5 Dustfall

Dustfall was measured at the Project site at five locations in August, September and October 2011. No measurements were made in August at Location #5 (Field Office). The laboratory Certificates of Analysis are attached in Appendix A. Results are presented in Table 5.5-1, below.

Table 5.5-1: 2011 Total Dustfall Results					
Sampling Date	Station ID				
	1	2	3	4	5
August	0.57	0.72	0.49	0.70	--
September	0.86	1.26	0.95	0.97	1.42
October	0.44	0.41	0.33	0.39	1.44
Mean	0.62	0.80	0.59	0.69	1.43

Notes: Results shown in $g/m^2/30d$.

All measured total dustfall concentrations were well below the MOE AAQC criterion of 7 g/m^2 for a 30 day averaging period. Converted to annual averaging periods, results ranged from 0.16 to 0.72 g/m^2, well below the MOE AAQC annual criterion of 4.6 g/m^2. As expected, dustfall concentrations were highest at Station 5 (Field Office), located in the Town of Marathon for both sampling events.

The percentage of soluble dustfall in the collected samples ranged from 1.81% to 17.9%, with a mean of 9.9%. This result suggests that approximately 90% of the deposition is a result of dry deposition due to particle settling.

5.5.1 Metals in Particulate

Metals in dustfall were measured in August, September and October 2011. There are no metals deposition criteria for comparison to the results. Results are summarized in Table 5.5.1-1.

Table 5.5.1-1: Summary of Metals in Dustfall			
Metal	Method Detection Limit (ug/m²/day)	Range of Results (ug/m²/day)	Regional Background (ug/m²/day)
Sb	0.332	BDL to 1.17	--
As	1.66	BDL	0.466
Ba	8.31	BDL to 27.1	--
Be	3.32	BDL	--
Cd	0.166	BDL	0.0822 to 0.465
Cr	1.66	BDL to 6.29	--
Co	0.332	BDL to 0.614	--
Cu	1.66	2.21 to 10.3	0.658 to 2.88
Pb	0.831	BDL to 3.2	1.07 to 3.3
Mn	0.831	BDL to 141	--
Ni	0.332	2.37 to 8.72	0.22 to 1.07
P	166	BDL to 209	--
Se	3.32	BDL	--
Ag	0.332	BDL	--
Tl	0.332	BDL	--
Zn	9.97	BDL to 63.5	3.8 to 14
Hg	0.0565	BDL to 0.33	--

Notes: BDL = below laboratory method detection limit.

Arsenic, beryllium, cadmium, selenium, silver and thallium were not detected in any of the dustfall samples collected. Measurable concentrations of antimony, barium, chromium, cobalt, copper, lead, manganese, nickel, phosphorus, zinc and mercury were detected in some of the collected samples.

Results were compared to estimated annual regional background total metal deposition compiled for the years 1989 to 1995 (Environment Canada/Health Canada, 1999). Background data for Geraldton, Ontario and the average of all 11 stations were referenced. For the metals with measurable concentrations, levels of copper, nickel and zinc were higher than regional background concentrations while concentrations of lead were similar to or lower than the background concentrations.

5.5.2 Nitrate and Sulphate

Nitrate and sulphate content in dustfall was measured on two occasions (September and October 2011) to determine the combined effects of wet and dry acidic deposition. Results are summarized in Table 5.5.2-1.

Table 5.5.2-1: Nitrate and Sulphate Deposition			
Station ID	**Description**	**September**	**October**
Nitrate			
1	Pic River	19.59	11.9
2	May's Gifts	21.48	8.5
3	Hare Lake	27.18	18.1
4	Former Airport	22.68	14.8
5	Field Office	17.22	19.0
Sulphate			
1	Pic River	110.1	115.0
2	May's Gifts	126.6	79.1
3	Hare Lake	161.4	105.3
4	Former Airport	129.0	84.2
5	Field Office	93.9	81.7

Notes: All results reported in $mg/m^2/30d$

Nitrate deposition ranged from 8.5 to 27.18 $mg/m^2/30d$ for the two sampling events. For all but the field office sample (Station 5), nitrate concentrations were lower in October than in September. Deposition levels were highest at the Hare Lake station in September but highest at the Field Office station in October.

Sulphate deposition at the Project site ranged from 79.1 to 161.4 $mg/m^2/30d$, with levels in October again generally lower than in September except for the Pic River Station (Station 1). Similar to the nitrate results, Hare Lake had the highest deposition values in September while the Pic River station was highest in October.

Results were converted to annual averaging periods and compared to estimated regional background concentrations (Health Canada/Environment Canada, 1999). The range of natural background sulphate deposition in the Algoma district (near Sudbury, Ontario) was reported as 3.6 to 5.6 kg/ha/year. Sulphate deposition considering all North American sources ranged from 13.9 to 22.9 kg/ha/year. Marathon Project site sulphate deposition results ranged from 9.6 to 19.6 kg/ha/year, higher than the predicted natural background deposition rates but within the range of deposition which included existing North American sources. This range is at the Eastern Canada Acid Rain Program target loading of 20 kg/ha/year. The results suggests that sulphate deposition at the project site is affected by existing sources of SO_2 emissions to the environment, which may originate locally, regionally or even internationally (i.e. transboundary).

An evaluation of critical loads (CLs) for Ontario was carried out. Critical loads outline the amount of acidifying deposition that the environment (aquatic and terrestrial) can receive without anticipated adverse effects. The 5th percentile CL for Ontario is 126 eq/ha/year and the 50th percentile value is 832 eq/ha/year (EC/MSC, 2000). The highest baseline acidifying deposition for the Project site was calculated to be 440 eq/ha/year but does not take into account any neutralization from base cations (which were not measured). As a result, the calculated value is overstated and the net acidifying deposition will be lower.

5.6 Greenhouse Gases (GHGs)

Baseline GHG emissions for Ontario and Canada for the years 1990 and 2004 to 2008 (Environment Canada, 2008) are presented in Table 5.6-1.

Table 5.6-1: National and Provincial Greenhouse Gas Emissions

Year	GHG (CO_2e) Emissions (kT/y)			
	Canadian Total	Mining	Ontario Total	
			Electricity Generation	Total from all Sectors
2008	734,000	23,900	34,000	190,000
2007	750,000	23,200	34,000	200,000
2006	718,000	16,800	27,500	192,000
2005	731,000	15,600	32,900	200,000
2004	741,000	14,900	30,100	199,000
1990	592,000	6,190	25,900	176,000

Canadian GHG emissions have been fairly stable since 2004; however, emissions from mining have increased by approximately 160%, increasing its share of the Canadian total from 1% to 3.3%. Ontario accounts for approximately 26% of all GHG emissions in Canada (EC, 2008). Road transportation and the residential/commercial/institutional sectors were the largest contributors to Ontario's total at 32% and 17%, respectively.

Baseline GHG emissions from the Project site are low since the Project site is located in an undeveloped area north of Highway 17. Local and regional GHG emissions are driven by emissions from vehicular traffic along Highway 17 and nearby municipal roads, from airport traffic at the Marathon airport, and from residential, commercial and institutional heating sources within the Town of Marathon, Pic River and surrounding communities.

6.0 Summary and Conclusions

6.1 Climate

Climate and meteorology in the Marathon Project site area is typical of northwestern Ontario. Marathon experiences cooler summers and warmer winters compared to other more remote northerly communities in northwestern Ontario due to its proximity to Lake Superior. Project site climate is considered to be similar to local and regional climate and details are summarized in Table 6.1-1, below.

Table 6.1-1: Summary of Project and Regional Climate

Parameter	Station		
	Marathon	Sault Ste. Marie	Thunder Bay
Temperature			
Mean Annual Temperature (°C)	1.9	5.2	2.5
Extreme Maximum Temperature (°C)	33.5	36.8	40.3
Extreme Minimum Temperature (°C)	-43.0	-38.9	-41.1
Relative Humidity			
Mean Annual Relative Humidity (%)	75.0	65.5 - 84.8	58.7 – 81.7
Evaporation			
Evaporation (mm)	510		
Precipitation			
Mean Annual Total Precipitation (mm)	826.5	888.7	711.6
Mean Annual Rainfall (mm)	587.7	634.3	559.0
Mean Annual Snowfall (cm)	238.1	302.9	187.6
Wind Speed and Direction			
Prevailing Wind Direction (Blowing From)	NE and SW	W	W
Mean Wind Speed (km/h)	17 to 28	13.3	11.7

Climate at the Marathon Project site is expected to be influenced by the proximity of Lake Superior near the southern property boundary.

The site does not experience a significant amount of adverse weather phenomena. Isolated events of hail, extreme rainfall or extreme snowfall are possible.

6.2 Air Quality

Baseline air quality at the Project site is good since the property is located in a relatively undeveloped, pristine area north of Highway 17. Sources of airborne contaminants currently present on site include several permitted gravel pits and the Town of Marathon wastewater lagoons, in addition to ongoing exploration drilling being carried out by SCI.

Regional influences on air quality include residential/commercial/institutional heating, fugitive emissions from Highway 17 traffic, fugitive emissions from airport traffic, and other nearby industrial sources, such as the Hemlo gold mine, located approximately 30 km east of the Project site.

Concentrations of CACs at the property were either confirmed to be low through measurement or were predicted to be low, based on regional air quality data sets obtained from the MOE. A summary of baseline measured and predicted CAC concentrations for the Project site is provided in Table 6.2-1.

Table 6.2-1: Summary of Measured and Predicted Project Site Air Quality			
Contaminant	**Averaging Period**	**Marathon Project Site**	**MOE AAQC**
Measured Air Quality Parameters			
PM_{10} (ug/m^3)	24 h	12.8 – 14.6	50
Dustfall (g/m^2)	30 d	0.33 – 1.44	7
Metals in Dustfall[1] (ug/m^2)			
Ba	day	<8.31 to 27.1	n/a
Cr	day	<1.66 to 6.29	n/a
Co	day	<0.332 to 0.614	n/a
Cu	day	<2.21 to 10.3	n/a
Pb	day	<0.831 to 3.2	n/a
Mn	day	<0.831 to 141	n/a
Ni	day	2.37 to 8.72	n/a
P	day	166 to 209	n/a
Sb	day	0.332 to 1.17	n/a
Zn	day	9.97 to 63.5	n/a
Hg	day	0.0565 to 0.33	n/a
Note: 1. All other metals were below laboratory method detection limits.			
Nutrients in Dustfall (mg/m^2/30d)			
Sulphate	30 d	79.1 to 161.4	n/a
Nitrate	30 d	8.5 to 27.18	n/a
Predicted Air Quality Parameters			
TSP (ug/m^3)	24 h	35 – 48	120
$PM_{2.5}$ (ug/m^3)	24 h	1 - 5	30
NO_x (ppb)	24 h	33.2	100
SO_2 (ppb)	24 h	3.25	100
CO (ppb)	24 h	0.83	30,000

Aside from the previously noted regional influences, baseline ambient air quality at the Project site is expected to reflect low regional background concentrations. For parameters with MOE AAQC criteria, baseline ambient air quality is measured or predicted to be well below applicable criteria. Measured concentrations are expected to be related to on-site activities (e.g. advanced exploration work, gravel pit operations, etc.), nearby industrial activities and traffic from the nearby Highway 17.

Baseline concentrations of metals and nutrients deposition were considered to reflect ambient concentrations at the Project site but were considered to be affected by on-site or nearby activities, such as fugitive dust generating activities or combustion. The baseline acidifying deposition was below Ontario CL values for the 50th percentile but above 5th percentile values, although the calculated deposition is conservative since it does not take into account any neutralizing potential of base cations that may be present.

Measurable concentrations of antimony, barium, chromium, cobalt, copper, lead, manganese, nickel, phosphorus, zinc and mercury were detected in some of the collected dustfall samples. Of these, concentrations of zinc, nickel and copper were generally higher than expected regional background concentrations. Given that on-site traffic on gravel-surfaced roads and operation within the permitted gravel pits on the southeast side of the site occurred throughout the testing period, these elevated concentrations are likely associated with these activities and naturally-occurring concentrations of these metals in soils and rock on site.

7.0 Closure

Respectfully submitted by:

True Grit Consulting Ltd.

Casey Ladouceur, B.Eng. EIT.
Jr. Air Quality Scientist, Air Services
cladoucer@tgcl.ca

Paula Sdao, B.Eng.
Principal/Manager, Air Services
psdao@tgcl.ca

CJL/PS:pn

8.0 References

Alberta Environment (AE), 2004. *Acid Deposition Assessment for Alberta*.

AE, 2006. *Dry Deposition Monitoring Methods in Alberta – Final Report.*

ASTM International, 2004. *ASTM Method D1739-98 (Reapproved 2004) Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter).*

Canada, Department of Fishers and the Environment, 1975. *Hydrological Atlas of Canada*.

CCME (Council of Ministers of the Environment), 2006. *Canada-Wide Standards for Particulate Matter PM) and Ozone: Five year report: 2000-2005*, November 2006.

Energy, Mines and Resources Canada, 1984. *Canada Solar Radiation – Annual.*

Environment Canada (EC). (1961-1990.). *National Climate Data and Information Archive: Climate Normals for Marathon Ontario.*

Environment Canada. (2006-2008). Reported Facility Greenhouse Gas Data.

Environment Canada (2007). Regulatory Framework for Air Emissions. Available at: http://www.ec.gc.ca/doc/media/m_124/report_eng.pdf

Environment Canada/Health Canada (1999). *Priority Substances List Assessment Report.*

EcoMetrix & True Grit Consulting Ltd. (February 2010). *Marathon PGM Corporation, Marathon Platinum Group Metals – Copper Project, Project Description.*

EcoMetrix & True Grit Consulting Ltd. (July 2010). Marathon PGM Corporation, Marathon Platinum Group Metals – Copper Project, July 2010 Addendum to The Project Description.

Health Canada (HC), 1998. *National Ambient Air Quality Objectives for Particulate Matter*.

Health Canada, 1999. *National Ambient Air Quality Objectives (NAAQOs)*.

Ontario Ministry of the Environment (MOE), 1996. *Air Quality in Ontario – 1996.*

MOE, 2008. *Ontario's Ambient Air Quality Criteria.*

MOE, 2009. *Air Quality in Ontario – 2009 Report.*

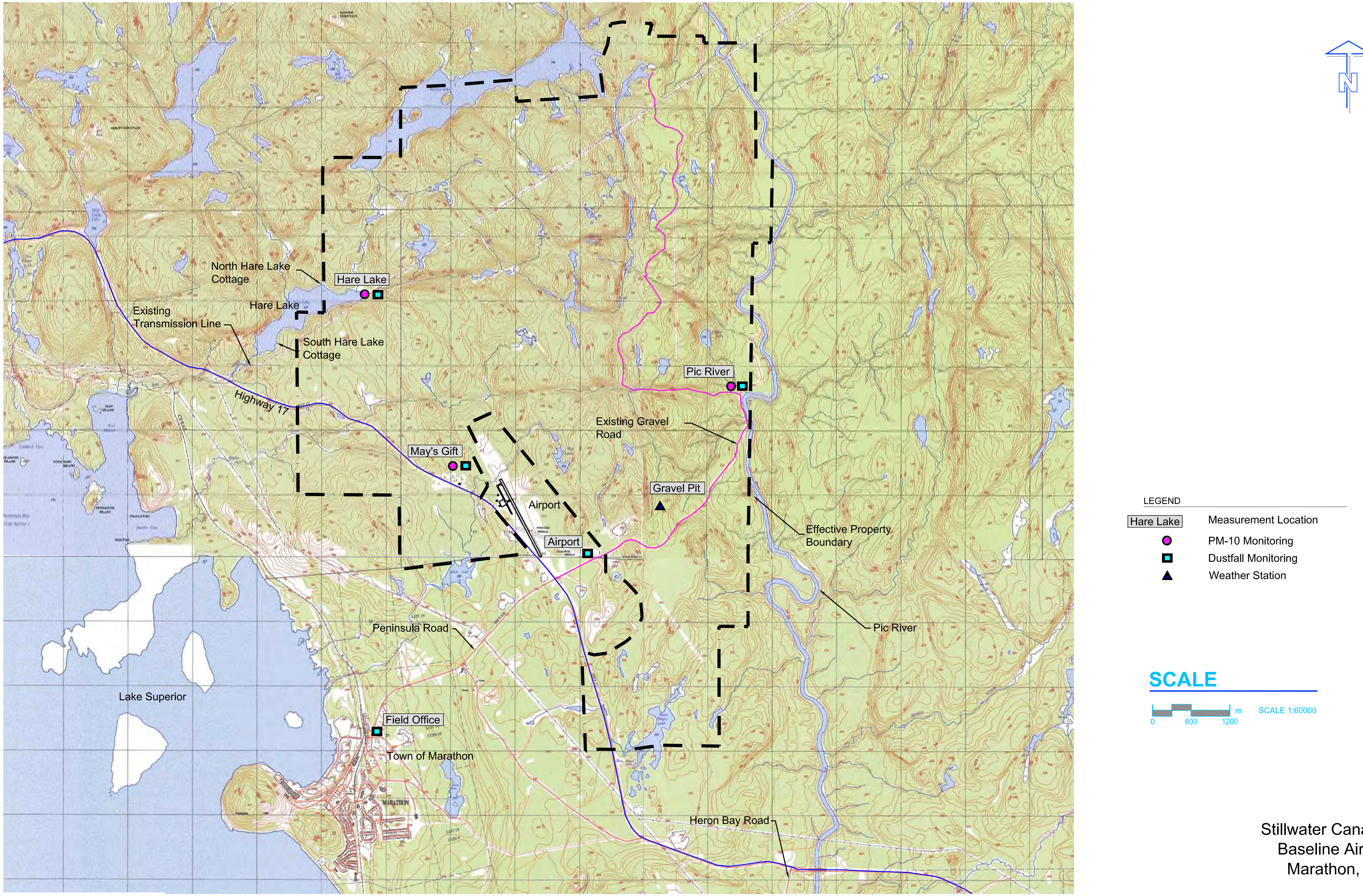
MOE, 2009. *Guideline for Greenhouse Gas Emissions Reporting. O.Reg 452/09*.

National Atlas of Canada. *Average Annual Potential Evapotranspiration.*

USEPA. *Appendix J to Part 50 – Reference Method for the Determination of Particulate Matter as* PM_{10} *in the Atmosphere.*

Working Group on Air Quality Objectives and Guidelines (WGAQOG), 1999. *National ambient air quality objectives for particulate matter. Part 1: science assessment document.*

Figures



File No. 11-317-13A

Stillwater Canada Inc.
Baseline Air Report
Marathon, Ontario

Background Air Sampling Location Plan

TRUE GRIT CONSULTING LTD

Designed By: MS
Approved By: PS
Date: December 22, 2011

Notes:

1) Datum: NAD 27 Projection : UTM Zone 16N
2) Base Map - OBM; MNR NAD 83 - (Images re-positioned to reflect NAD 27 Datum).

FIGURE 3.4-1

Appendix A:
Laboratory Certificates of Analysis

5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact:	Ron McLeod	**Client Name:**	True Grit Consulting Ltd.
ALS Project ID:	11392	**Client Address:**	1127 Barton St.
ALS WO#:	L1054017		Thunder Bay, ON, P7B 5N3
Date of Report	5-Jan-12		
Date of Sample Receipt	2-Sep-11	**Client Contact:**	Casey Ladouceur
		Client Project ID:	11-317-13A

COMMENTS:
Metals analysed via ICP-MS Method USEPA 6020A (MC 23-Sept-2011)
Sample Preparation via USEPA Method 29 (MB 19-Sept-2011)

***** Revised Report *****
This report supersedes all prior reports for the above-noted workorder and test. The report has been revised as follows:
As requested, the results have been expressed in mg/m2/day using client-supplied information.

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by: ____________________
Steve Kennedy
Laboratory Manager

ALS Environmental

Sample Analysis Summary Report

Sample Name		**PIC RIVER DUSTFALL**	**MAY'S GIFT DUSTFALL**	**HARE LAKE DUSTFALL**	**AIRPORT DUSTFALL**
ALS Sample ID		L1054017-1	L1054017-2	L1054017-3	L1054017-4
Matrix		DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
Analysis Type		Sample	Sample	Sample	Sample
Sampling Date		31-Aug-11	31-Aug-11	31-Aug-11	31-Aug-11
Date of Receipt		2-Sep-11	2-Sep-11	2-Sep-11	2-Sep-11
Multi-Metals via ICP-MS	**LOR**				
	mg/m2/day	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**
Front Half HF Fraction 1A					
Antimony	0.000332	<	<	<	0.000799
Arsenic	0.00166	<	<	<	<
Barium	0.00831	0.0101	0.0144	0.0126	0.0171
Beryllium	0.000332	<	<	<	<
Cadmium	0.000166	<	<	<	<
Chromium	0.00166	0.00254	0.00299	0.00390	0.00429
Cobalt	0.000332	0.000435	0.000454	0.000440	
Copper	0.00166	0.00656	0.00784	0.00580	0.00372
Lead	0.000831	0.00128	0.00106	0.000957	0.00155
Manganese	0.000831	0.0148	0.0246	0.0166	0.0173
Nickel	0.000332	0.00872	0.00671	0.00661	0.00580
Phosphorus	0.166	<	<	<	<
Selenium	0.00332	<	<	<	<
Silver	0.000332	<	<	<	<
Thallium	0.000332	<	<	<	<
Zinc	0.00997	0.0148	0.0635	0.0400	0.0400

ALS Environmental

Sample QC Summary Report

Sample Name		**LCB**	**LCS**	**LCS**	**LCSD**	**LCSD**
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a
Multi-Metals via ICP-MS	**LOR**					
	mg/m2/da	**mg/m2/day**	**ug**	**% Rec**	**ug**	**% Rec**
Front Half HF Fraction 1A						
Antimony	0.000332	0.00138	24.9	103	24.5	101
Arsenic	0.00166	<	125	104	122	101
Barium	0.00831	<	129	103	129	102
Beryllium	0.000332	<	122	102	116	96
Cadmium	0.000166	<	60.5	101	60.7	101
Chromium	0.00166	<	121	99	115	95
Cobalt	0.000332	<	116	96	113	94
Copper	0.00166	<	122	98	117	94
Lead	0.000831	<	130	108	125	103
Manganese	0.000831	<	127	99	122	94
Nickel	0.000332	<	118	92	115	89
Phosphorus	0.166	<	2920	95	2830	92
Selenium	0.00332	<	122	102	119	101
Silver	0.000332	<	61.7	103	61.4	102
Thallium	0.000332	<	126	105	121	101
Zinc	0.00997	<	242	97	237	95

ALS Environmental

Sample QC Summary Report

Sample Name		**PIC RIVER DUSTFALL**	**PIC RIVER DUSTFALL**	**PIC RIVER DUSTFALL**	**PIC RIVER DUSTFALL**	**PIC RIVER DUSTFALL**	**PIC RIVER DUSTFALL**
ALS Sample ID		L1054017-1	L1054017-1	MS	MS	MSD	MSD
Matrix		DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
Analysis Type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date		31-Aug-11	31-Aug-11	31-Aug-11	31-Aug-11	31-Aug-11	31-Aug-11
Date of Receipt		2-Sep-11	2-Sep-11	2-Sep-11	2-Sep-11	2-Sep-11	2-Sep-11
Multi-Metals via ICP-MS	**LOR**						
	mg/m2/day	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**% Rec**	**mg/m2/day**	**% Rec**
Front Half HF Fraction 1A							
Antimony	0.000332	<	<	0.0414	103	0.0407	101
Arsenic	0.00166	<	<	0.208	104	0.203	101
Barium	0.00831	0.0101	0.0102	0.214	103	0.214	102
Beryllium	0.000332	<	<	0.203	102	0.193	96
Cadmium	0.000166	<	<	0.101	101	0.101	101
Chromium	0.00166	0.00254	0.00264	0.201	99	0.191	95
Cobalt	0.000332	0.000435	0.000301	0.193	96	0.188	94
Copper	0.00166	0.00656	0.00658	0.203	98	0.194	94
Lead	0.000831	0.00128	0.00118	0.216	108	0.208	103
Manganese	0.000831	0.0148	0.0148	0.211	99	0.203	94
Nickel	0.000332	0.00872	0.00901	0.196	92	0.191	89
Phosphorus	0.166	<	<	4.85	95	4.70	92
Selenium	0.00332	<	<	0.203	102	0.198	101
Silver	0.000332	<	<	0.103	103	0.102	102
Thallium	0.000332	<	<	0.209	105	0.201	101
Zinc	0.00997	0.0148	0.0173	0.402	97	0.394	95

5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact:	Ron McLeod	**Client Name:**	True Grit Consulting Ltd.
ALS Project ID:	11392	**Client Address:**	1127 Barton St.
ALS WO#:	L1066763		Thunder Bay, ON, P7B 5N3
Date of Report	5-Jan-12		
Date of Sample Receipt	3-Oct-11	**Client Contact:**	Casey Ladouceur
		Client Project ID:	11-317-13A

COMMENTS:
Metals analysed via ICP-MS Method USEPA 6020A (MC 24-Oct-2011)
Sample Preparation via USEPA Method 29 (MB 18-Oct-2011)

Antimony was detected in the laboratory control blank. As a result, sample data may be biased high for this element.

***** Revised Report *****
This report supersedes all prior reports for the above-noted workorder and test. The report has been revised as follows:
As requested, the results have been expressed in mg/m2/day using client-supplied information.

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by: [signature]
Steve Kennedy
Laboratory Manager

ALS Environmental

Sample Analysis Summary Report

Sample Name		**PIC RIVER DUSTFALL**	**MAYS GIFTS DUSTFALL**	**HARE LAKE DUSTFALL**	**AIRPORT DUSTFALL**	**FIELD OFFICE DUSTFALL**
ALS Sample ID		L1066763-1	L1066763-2	L1066763-3	L1066763-4	L1066763-5
Matrix		DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
Analysis Type		Sample	Sample	Sample	Sample	Sample
Sampling Date		29-Sep-11	29-Sep-11	29-Sep-11	29-Sep-11	29-Sep-11
Date of Receipt		3-Oct-11	3-Oct-11	3-Oct-11	3-Oct-11	3-Oct-11
Multi-Metals via ICP-MS	**LOR**					
	mg/m2/day	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**
Front Half HF Fraction 1A						
Antimony	0.000377	0.0000870	0.00117	0.000678	0.000512	0.000473
Arsenic	0.00188	0.0000546	0.000377	0.000377	0.000108	0.000279
Barium	0.00942	0.00569	0.0198	0.0217	0.0182	0.0271
Beryllium	0.000377	<	<	<	<	<
Cadmium	0.000188	<	0.0000220	0.0000804	0.0000234	0.0000354
Chromium	0.00188	0.000631	0.00518	0.00345	0.00450	0.00629
Cobalt	0.000377	0.0000431	0.000203	0.000339	0.000183	0.000614
Copper	0.00188	0.00288	0.00482	0.00631	0.00505	0.00460
Lead	0.000942	0.000689	0.00247	0.00320	0.00203	0.00215
Manganese	0.000942	0.0277	0.0923	0.141	0.0633	0.0919
Nickel	0.000377	0.00237	0.00640	0.00655	0.00618	0.00731
Phosphorus	0.188	0.0183	0.172	0.209	0.115	0.139
Selenium	0.00377	<	<	<	<	<
Silver	0.000377	0.0000473	0.000178	0.000198	0.000220	0.000226
Thallium	0.000377	<	<	<	<	<
Zinc	0.0113	0.0158	0.0584	0.0580	0.0371	0.0307

ALS Environmental

Sample QC Summary Report

Sample Name		**LCB**	**LCS**	**LCS**	**LCSD**	**LCSD**
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a

Multi-Metals via ICP-MS	**LOR**					
	mg/m2/da	**mg/m2/day**	**ug**	**% Rec**	**ug**	**% Rec**
Front Half HF Fraction 1A						
Antimony	0.000377	0.00109	12.6	100	12.2	97
Arsenic	0.00188	<	64.2	107	63.7	106
Barium	0.00942	<	60.4	101	59.8	100
Beryllium	0.000377	<	59.2	99	60.1	100
Cadmium	0.000188	<	31.0	103	29.9	100
Chromium	0.00188	<	59.3	99	59.6	99
Cobalt	0.000377	<	60.7	101	59.8	100
Copper	0.00188	<	62.1	104	60.7	101
Lead	0.000942	<	59.9	100	60.1	100
Manganese	0.000942	<	59.0	98	59.2	99
Nickel	0.000377	<	60.2	101	59.3	99
Phosphorus	0.188	<	1340	90	1360	91
Selenium	0.00377	0.000200	63.5	106	62.9	105
Silver	0.000377	<	25.4	85	29.3	98
Thallium	0.000377	<	57.2	96	58.1	97
Zinc	0.0113	<	119	100	120	100

ALS Environmental

Sample QC Summary Report

Sample Name		PIC RIVER DUSTFALL	PIC RIVER DUSTFALL	PIC RIVER DUSTFALL	PIC RIVER DUSTFALL	PIC RIVER DUSTFALL	PIC RIVER DUSTFALL
ALS Sample ID		L1066763-1	L1066763-1	MS	MS	MSD	MSD
Matrix		DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
Analysis Type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date		29-Sep-11	29-Sep-11	29-Sep-11	29-Sep-11	29-Sep-11	29-Sep-11
Date of Receipt		3-Oct-11	3-Oct-11	3-Oct-11	3-Oct-11	3-Oct-11	3-Oct-11

Multi-Metals via ICP-MS	**LOR**						
	mg/m2/da	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**% Rec**	**mg/m2/day**	**% Rec**
Front Half HF Fraction 1A							
Antimony	0.000377	0.0000870	0.0000723	0.0467	103	0.0454	100
Arsenic	0.00188	0.0000546	0.0000369	0.245	108	0.237	105
Barium	0.00942	0.00569	0.00561	0.226	98	0.220	95
Beryllium	0.000377	<	<	0.232	103	0.226	100
Cadmium	0.000188	<	<	0.119	106	0.115	102
Chromium	0.00188	0.000631	0.000224	0.226	100	0.217	95
Cobalt	0.000377	0.0000431	0.0000196	0.228	100	0.222	98
Copper	0.00188	0.00288	0.00284	0.235	103	0.228	99
Lead	0.000942	0.000689	0.000648	0.230	101	0.220	97
Manganese	0.000942	0.0277	0.0294	0.252	99	0.245	96
Nickel	0.000377	0.00237	0.00230	0.232	102	0.222	97
Phosphorus	0.188	0.0183	0.0168	4.97	88	4.82	85
Selenium	0.00377	<	<	0.243	107	0.237	106
Silver	0.000377	0.0000473	0.0000612	0.120	106	0.119	106
Thallium	0.000377	<	<	0.215	95	0.209	92
Zinc	0.0113	0.0158	0.0179	0.476	102	0.461	99

5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact:	Ron McLeod	**Client Name:**	True Grit Consulting Ltd.
ALS Project ID:	11392	**Client Address:**	1127 Barton St.
ALS WO#:	L1080265		Thunder Bay, ON, P7B 5N3
Date of Report	5-Jan-12		
Date of Sample Receipt	2-Nov-11	**Client Contact:**	Casey Ladouceur
		Client Project ID:	11-317-13A

COMMENTS:
Metals analysed via ICP-MS Method USEPA 6020A (MC 23-Nov-2011)
Sample Preparation via USEPA Method 29 (MB 22-Nov-2011)

Antimony was detected in the laboratory control blank. As a result, sample results may be biased high for this element. However, Antimony was either not detected, or detected just at the LOR in the samples. Negative impact to overall data quality is expected to be minimal.

***** Revised Report *****
This report supersedes all prior reports for the above-noted workorder and test. The report has been revised as follows:
As requested, the results have been expressed in mg/m2/day using client-supplied information.

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by:

Steve Kennedy
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

ALS Environmental

Sample Analysis Summary Report

Sample Name		**PIC RIVER**	**MAY'S GIFTS**	**AIRPORT**	**HARE LAKE**	**FIELD OFFICE**	**BLANK**
ALS Sample ID		L1080265-1	L1080265-2	L1080265-3	L1080265-4	L1080265-5	L1080265-6
Matrix		DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
Analysis Type		Sample	Sample	Sample	Sample	Sample	Sample
Sampling Date		1-Nov-11	1-Nov-11	1-Nov-11	1-Nov-11	1-Nov-11	1-Nov-11
Date of Receipt		2-Nov-11	2-Nov-11	2-Nov-11	2-Nov-11	2-Nov-11	2-Nov-11

Multi-Metals via ICP-MS	**LOR mg/m2/da**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**
Front Half HF Fraction 1A							
Antimony	0.000332	0.000349	<	<	<	0.000334	0.000500
Arsenic	0.00166	<	<	<	<	<	<
Barium	0.00831	0.0143	0.00834	<	<	0.0271	<
Beryllium	0.000332	<	<	<	<	<	<
Cadmium	0.000166	<	<	<	<	<	<
Chromium	0.00166	0.00307	0.00304	0.00238	0.00140		0.00169
Cobalt	0.000332	<	<	<	<	<	<
Copper	0.00166	0.0103	0.00485	0.00550	0.00221	0.00578	<
Lead	0.000831	0.000942	<	0.000954	<	0.00196	<
Manganese	0.000831	0.00157	0.00854	0.0149	<	0.0249	<
Nickel	0.000332	0.00786	0.00631	0.00605	0.00562	0.00739	0.00560
Phosphorus	0.166	<	<	<	<	<	<
Selenium	0.00332	<	<	<	<	<	<
Silver	0.000332	<	<	<	<	<	<
Thallium	0.000332	<	<	<	<	<	<
Zinc	0.00997	0.0130	<	0.0124	<	0.0160	<

ALS Environmental

Sample QC Summary Report

Sample Name		**LCB**	**LCS**	**LCS**	**LCSD**	**LCSD**
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a
Multi-Metals via ICP-MS	**LOR**					
	mg/m2/da	**mg/m2/day**	**ug**	**% Rec**	**ug**	**% Rec**
Front Half HF Fraction 1A						
Antimony	0.000332	0.00166	12.1	93	11.7	89
Arsenic	0.00166	<	62.8	104	62.0	103
Barium	0.00831	<	58.5	98	57.9	97
Beryllium	0.000332	<	59.9	100	60.4	101
Cadmium	0.000166	<	29.8	99	29.1	97
Chromium	0.00166	<	58.7	98	58.5	97
Cobalt	0.000332	<	58.9	98	58.6	98
Copper	0.00166	<	60.0	100	60.1	100
Lead	0.000831	<	60.9	102	60.4	101
Manganese	0.000831	<	55.7	96	55.9	96
Nickel	0.000332	<	58.9	98	59.5	99
Phosphorus	0.166	<	1410	93	1380	92
Selenium	0.00332	<	62.9	104	62.0	102
Silver	0.000332	<	30.7	102	31.4	104
Thallium	0.000332	<	57.5	96	57.0	95
Zinc	0.00997	<	119	99	116	97

ALS Environmental

Sample QC Summary Report

Sample Name		PIC RIVER	PIC RIVER	PIC RIVER	PIC RIVER	PIC RIVER	PIC RIVER
ALS Sample ID		L1080265-1	L1080265-1	MS	MS	MSD	MSD
Matrix		DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
Analysis Type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date		1-Nov-11	1-Nov-11	1-Nov-11	1-Nov-11	1-Nov-11	1-Nov-11
Date of Receipt		2-Nov-11	2-Nov-11	2-Nov-11	2-Nov-11	2-Nov-11	2-Nov-11
Multi-Metals via ICP-MS	**LOR**						
	mg/m2/da	**mg/m2/day**	**mg/m2/day**	**mg/m2/day**	**% Rec**	**mg/m2/day**	**% Rec**
Front Half HF Fraction 1A							
Antimony	0.000332	0.000349	0.000389	0.0397	99	0.0387	96
Arsenic	0.00166	<	<	0.196	98	0.196	98
Barium	0.00831	0.0143	0.0143	0.203	94	0.198	92
Beryllium	0.000332	<	<	0.199	100	0.193	97
Cadmium	0.000166	<	<	0.0970	97	0.0954	96
Chromium	0.00166	0.00307	0.00279	0.189	94	0.191	94
Cobalt	0.000332	<	<	0.188	94	0.193	96
Copper	0.00166	0.0103	0.0103	0.203	97	0.203	97
Lead	0.000831	0.000942	0.000926	0.198	98	0.191	96
Manganese	0.000831	0.00157	0.00152	0.189	95	0.189	94
Nickel	0.000332	0.00786	0.00784	0.194	93	0.196	94
Phosphorus	0.166	<	<	4.65	92	4.65	92
Selenium	0.00332	<	<	0.188	95	0.189	96
Silver	0.000332	<	<	0.102	102	0.099	99
Thallium	0.000332	<	<	0.183	92	0.178	89
Zinc	0.00997	0.0130	0.0134	0.397	96	0.389	94