November 2013

Application to Alberta Utilities Commission for an Amendment to the HR Milner Expansion Project 520 MW Natural Gas Fired Power Plant

ABBREVIATIONS

Abbreviation	Term
ACCS	Alberta Culture and Community Spirit
AENV	Alberta Environment
AESO	Alberta Electric System Operator
AIES	Alberta Interconnected Electric System
AUC	Alberta Utilities Commission
AWN	Aseniwuche Winewak Nation
°C	degrees Celsius
CCGT	combined-cycle gas turbine
CEMS	Continuous Emission Monitoring System
CO	carbon monoxide
CO_2	carbon dioxide
dBA	A-weighted sound level expressed in decibels
DFO	Department of Fisheries and Oceans
EIA	Environmental Impact Assessment
EPEA	Alberta Environment Protection and Enhancement Act
ESRD	Alberta Environment and Sustainable Resource Development
EUB	Alberta Energy and Utilities Board
FAQs	Frequently Asked Questions
GCML	Grande Cache Metis Local #1994
GHG	greenhouse gas
GJ/h	gigajoule per hour
GWh	gigawatt hour
ha	hectare
HEE	Hydro and Electric Energy Act
HFP	HFP Acoustical Consultants Corporation
HgA	mercury absolute
HHV	high heating value
HP	high pressure
HRIA	Historical Resources Impact Assessment
HRSG	heat recovery steam generator
IDP	Inter-municipal Development Plan
kg/h	kilogram per hour
kJ/h	kilojoules per hour
kJ/kWh	kilojoules per kilowatt hour
km	kilometre
km^2	square kilometres
kPa	kilopascal
kV	kilovolt
kWh	kilowatt-hour
l/s	litres per second
l/s/ha	litres per second per hectare

LAA	Local Assessment Area
L_{eq}	energy equivalent sound
m	metre
m/s	metres per second
m^2	square metres
m^3	cubic metre
m^3/h	cubic metres per hour
m^3/y	cubic metres per year
M1	HR Milner Generating Station
M2	HR Milner Expansion Project
MAXIM	Maxim Power Corp.
MBD	Mixed Bed Demineralizer
MD	Municipal District
MLA	Member of the Legislative Assembly
mm	millimetre
MP	Member of Parliament
MPa	megapascal
MVA	megavolt ampere
MW	megawatt
MWh	megawatt hour
NG	natural gas
NGO	non-governmental association
NIA	Noise Impact Assessment
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
PM	particulate matter
ppm	parts per million
PWMP	process water management pond
Q	quarter year
RAA	Regional Assessment Area
RO	reverse osmosis
ROW	right of way
rpm	revolutions per minute
SCR	Selective Catalytic Reduction
SO_2	sulphur dioxide
SMP	Stormwater Management Plan
TDS	total dissolved solids
TSS	total suspended solids
t/y	tonnes per year
UPRP	Upper Peace Regional Plan
V	volt
Westhoff	Westhoff Engineering Resources Inc.

1. INTRODUCTION

1.1 Project Description

Maxim Power Corp. (MAXIM) currently owns and operates the HR Milner Generating Station (M1), a 150 MW single unit coal-fired power generation facility. M1 and the majority of its associated infrastructure are situated on land owned by MAXIM, known as the Milner Site. The Milner Site is located approximately 20 km north of the town of Grande Cache, Alberta in the north half of Section 10 and south half of Section 15, in Township 58, Range 8, West of the 6th Meridian. It is located adjacent to Highway 40 and the Smoky River. The Milner Site is approximately 30 ha. M1 takes up approximately 12 ha of the Milner Site. M1 operates under Alberta Energy and Utilities Board (EUB) Approval No. U2004-014 (dated January 23, 2004) and is connected to the Alberta Interconnected Electric System (AIES) under EUB Connection Order No. U2003-015 (dated January 23, 2004). M1 operates under Alberta Environment and Sustainable Resource Development (ESRD) Approval 9814-02, as amended. M1 is comprised of the following:

- Pulverized coal-fired boiler system
- High pressure steam system
- Steam turbine
- Water treatment system
- Coal receipt
- Coal storage and handling facilities
- Ash management systems
- Electrical substation
- Ancillary components to support these major systems

In 2008, MAXIM proposed to build a second power plant to operate along with M1 on the Milner Site, called the HR Milner Expansion Project (M2). The goals of the M2 Project are to increase electrical generating capacity in Alberta and provide long-term economic benefits to the local and regional area.

In January 2009, MAXIM submitted an application to the Alberta Utility Commission (AUC) and an Environmental Impact Assessment (EIA) to Alberta Environment (AENV) to build and operate a 500 MW coal-fired power plant. This plant, known as M2, was approved by the AUC (Approval No U2011-255 dated August 10, 2011) and ESRD (Approval No. 9814-02-03 dated May 18, 2012). MAXIM currently has the approvals and licences to construct and operate M2.

New federal greenhouse gas (GHG) emissions legislation was introduced in September 2012 that requires stringent performance standards for coal-fired generators. The standards are fixed at 420 tonnes of carbon dioxide per gigawatt hour (CO_2/GWh) to be met by new coal-fired generators by July 1, 2015. Given the new standards and MAXIM's commitment to reduce the environmental effects of their operations, MAXIM altered the plans for the M2 Project. Rather than building the 500 MW coal-fired power plant, MAXIM is planning to build and operate a natural gas fired plant with lower GHG emissions. The current low price in natural gas makes this a financially feasible option. This application seeks an amendment to the licence based on the proposed change in scope to construct and operate a 520 MW natural gas fired plant instead of a 500 MW coal burning plant.

A major benefit in the proposed amendment to burn natural gas as the fuel source is that CO_2 emissions are reduced by approximately 49% compared to the coal burning plant. The natural gas fired M2 plant will produce 1,539,000 t/y of CO_2 as compared to the previous coal-fired M2 balance of 3,033,000 t/y. In addition, there will no longer be a risk of increased contamination from fugitive dust from M2 because there is no coal processing plant or stock pile.

The proposed 520 MW natural gas electric generating station and ancillary facilities is still called M2. It will take up approximately 5 ha on the Milner Site. The amendment to the M2 Project will not change the facility's physical footprint. It will be built on the existing Milner Site, which is land designated for industrial use under the Municipal District (MD) of Greenview No 16 / Town of Grande Cache *Grande Cache Inter-Municipal*

Development Plan (IDP) (July 2002). No expansion of the Milner Site is required and there are no new restrictions on land use adjacent to the facility.

MAXIM plans to build M2 in two phases with the construction of two 260 MW combined-cycle gas turbine (CCGT) power plants. Natural gas will be supplied to the Milner Site via an expansion of the existing natural gas pipeline currently supplying M1. Each phase will consist of the construction of the following:

- Gas turbine generator
- Heat recovery steam generator
- Steam turbine generator
- Ancillary systems to support these major systems

The first phase will also include the construction of a water treatment plant, a cooling tower and an electrical substation, all of which will be used by both plants.

As previously mentioned, the M2 Project will be constructed and operate within the existing boundaries of the Milner Site. The Project Site includes the following:

- Existing M1 facilities
- Internal paved, gravel and dirt roads located within the Milner Site boundaries
- Area for the proposed M2 facilities
- A wetland area located within the existing Milner Site boundaries
- Proposed water intake structure located off the Milner Site on adjacent Crown lands
- A temporary storage area required during construction of M2 that is located off the Milner Site on adjacent Crown lands.

As part of the construction phase of M2, there will also be 9.16 ha of temporary surface area disturbance required. It will be comprised of:

- On-site short term equipment laydown and other construction facilities such as offices and lunch rooms (1.64 ha)
- Offsite temporary storage area adjacent to the south side of the Project Site on Crown land (1.40 ha)
- Offsite area located near Sheep Creek (6.12 ha) for long term equipment storage on Crown Land

When the construction phases of M2 are completed these temporary areas will be returned to their pre-use condition.

The table below highlights the changes to the Project being applied for in this amendment application:

Category	**Approved Application**	**Amendment Application**
Gross Power Output	500 MW	520 MW
Projected Facility Life	40 years	40 years
Heat Rate, HHV (efficiency)	9,460 kJ/kWh (38%)	7,064 kJ/kWh (51%)
Estimated Manpower for Operations	62 workers	15 – 20 workers
Estimated Manpower for Construction	450 – 680 workers	150 – 200 workers
Operations Water Intake	279 l/s	135 l/s
Waste Water Discharge	67 l/s, 5,789 m3/day	40 l/s, 3,456 m3/day
Natural Gas / Coal Consumption	~3 GJ/h NG / 178 t/h coal	3600 GJ/h NG / 0 t/h coal (2 CCGT units)

2.1 APPLICATION REQUIREMENTS:

2.2 Information Requirements

(PP1) Identify the sections of the HEE Act under which the application is made.

This application for the approval to construct and operate the proposed M2 Project is made pursuant to Section 11 of the *Hydro and Electric Energy Act* (RSA 2000, c. H-16).

Connection applications for power plant, substations, and transmission lines will be made pursuant to section 18 of the *Hydro and Electric Energy Act.*

(PP2) Identify any other acts that may affect the project.

Other Acts potentially affecting the Project are:

- *Alberta Land Stewardship Act* (Statutes of Alberta 2009, Chapter A-26.8)
- *Electric Utilities Act* (SA 2003, c. E-5.1)
- *Environmental Protection and Enhancement Act* (RSA 2000 c. E-12)
- *Fisheries Act* (RSC. 1985, c. F-14)
- *Highways Development and Protection Act (*Statues of Alberta 2004, H-8.5)
- *Historical Resources Act* (RSA 2000, c. H-9)
- *Municipal Government Act* (RSA 2000, c. M-26)
- *Navigable Waters Protection Act* (RSC. 1985, c. N-22)
- *Pipeline Act* (AR 91/2005)
- *Public Lands Act* (RSA 2000, c. P-40)
- *Water Act* (RSA 2000, c. W-3)
- *Canadian Environmental Assessment Act 2012*

(PP3) State the approvals that are being applied for from the Commission, and provide a draft of the approval being requested.

MAXIM is applying to the AUC pursuant to Section 11 of the *Hydro and Electric Energy Act*. MAXIM is applying for an amendment to the already existing Approval No U2011-255.

(PP4) Provide a list of existing approvals for facilities directly affected by this project, if any.

M2 has the following approvals:

- EPEA Approval No. 9814-02-03, amendment to the existing approval (9814-02-00), dated May 18, 2012, for the HR Milner Expansion Project.
- AUC Approval No. U2011 – 255 to construct and operate a 500 MW coal-fired power plant, dated August 10, 2011.
- EIA report was submitted to AENV on January 30, 2009 and was accepted as complete on January 12, 2010.
- Water Intake (Smoky River, Grande Cache), DFO file 07-HCAA-CA1-03477, dated January 26, 2011. Letter from the Department of Fisheries and Oceans (DFO) stating the M2 proposal has been assessed and evaluated as not having impacts on fish and fish habitat as long as additional mitigation measures are applied.
- Alberta Culture and Community Spirit (ACCS), Letter of Historic Resource clearance in regards to traditional land use sites, dated August 13, 2010. In 2009, during the approvals process for the proposed HR Milner Expansion Project, MAXIM conducted a Historic Resources Impact Assessment (HRIA) on the Project Site to account for potential new surface disturbance. The HRIA was submitted to ACCS for their review. ACCS reviewed the HRIA and had no concerns with the Project. The physical footprint for the M2 natural gas

fired power plant remains the same as the approved coal-fired power plant. Therefore, another HRIA was not required.

M1 has the following approvals:

- EPEA Approval 9814-02-00, dated March 9, 2007, for the construction, operation and reclamation of HR Milner Thermal Electric Power Plant (and subsequent amendments 01-04).
- EPEA Approval No. 9814-02-01, amendment to the existing approval (9814-02-00 HR Milner Thermal Power Generating Plant), dated June 3, 2009, for the installation of a Selective Non-Catalytic Reduction (SNCR) system.
- EPEA Approval No. 9814-02-02, amendment to the existing approval (9814-02-00), dated December 22, 2011, for an extended deadline for dispersion air modeling.
- EPEA Approval No. 9814-02-04, amendment to the existing approval (9814-02-00), dated May 22, 2013, for the construction of a coal beneficiation plant.
- Ash Disposal under Sections 4.4.10 to 4.4.15 of EPEA Approval No. 9814-02-01 (an amendment is currently with ESRD).
- Water Act Licence No. 6496 authorizing diversion of water from the Smoky River for use by the facilities:
  - Amendment 00037203-00-02 authorizing licence transfer from ATCO Power to Alberta Power (2000) Ltd., dated December 12, 2000.
  - Amendment 00037203-00-03 authorizing licence transfer from Alberta Power (2000) Ltd. To Milner Power Inc. dated March 1, 2004.
  - Amendment 0037203-00-05 authorizing a change in the Gross Diversion for Licence No. 00037203-00-00 issued on January 19, 1984.
- EUB Approval U2004-014 for the operation of M1, dated January 29, 2004.
- EUB Connection Approval U22003-015, dated January 23, 2004.
- Canadian Nuclear Safety Commission, Nuclear Substance and Radiation Devices Licence number 13573-1-16.0, dated February 1, 2011.

(PP9) Confirm that an application to ESRD has been made, if applicable, and list all other government departments and agencies from which approval is required.

Concurrent with this application to the AUC, an application for an amendment to the approval for M2 is being made to ESRD pursuant to the Alberta *Environmental Protection and Enhancement Act* (*EPEA*) and the Alberta *Water Act*. Other government departments and agencies besides the AUC and ESRD from which approvals are required are listed in Table 1.

Table 1: Other Regulatory Agencies Requiring Approval

Government Department/Agency	Applicable Legislation
Alberta Electric System Operator	*Electric Utilities Act*
MD of Greenview	*Municipal Government Act*
Alberta Environment and Sustainable Resource Development	*Public Lands Act*
Alberta Transportation	*Highways Development and Protection Act Pipeline Act*

(PP10) Confirm that a *Historic Resources Act* clearance is being applied for. If a historical and/or archaeological impact assessment is required, submit a summary describing any historical or archaeological sites and parks affected by the proposal.

During the approvals process for the proposed M2 Project in 2009, MAXIM conducted an Historic Resources Impact Assessment (HRIA) on the Project Site to account for potential new surface disturbance. The HRIA was submitted to Alberta Culture and Community Spirit (ACCS) who granted *Historic Resources Act* clearance for the Project Site on September 25, 2008 and for the temporary storage site near Sheep Creek on August 13, 2010. In a letter dated November 20, 2009 ACCS stated that an HRIA for palaeontological resources was not required. Copies of these clearance letters are provided in Appendix B.

(PP11) Provide the ISO assigned asset identification code, if available.

AESO has not issued an asset identification code as of the date this application is submitted.

(PP12) Provide the legal description of the proposed power plant site (Legal Subdivision [LSD], Section, Township, Range, Meridian) and connection point, if applicable.

M2 will occupy the following land:

- Plan 3618 RS, Portion of the North Half of Section 10 and the South Half of Section 15, both in Township 58, Range 8, West of the 6th Meridian (12.99 ha) Milner plant excepting thereout Plan 0024924 Power Substation (0.765 ha).
- Plan 8622136 in the South Half of Section 15, Township 58, Range 8, West of the 6th Meridian (0.810 ha) Milner Silo.
- Plan 2567TR in the South West Quarter of Section 14, and South East Quarter of Section 15 both in Township 58, Range 8, West of the 6th Meridian (16.774 ha) wetland area.
- New Water Intake Site: Located in Northeast Quarter of Section 10, Township 58, Range 8, West of the 6th Meridian (approximately 0.30 ha). Exact size and location will be finalized during the construction phase of M2.

Associated with the operation of M1, ESRD has issued the following instruments for the occupation and use of provincial Crown Lands:

- Air Monitoring Station: EZE7800082 in the Southwest Quarter of Section 14 and East Half of Section 15, Township 58, Range 8, West of the 6th Meridian (0.423 ha) September 8, 1978.
- Water Intake Site: LOC3526 in the Northeast Quarter of Section 10, Township 58, Range 8, West of the 6th Meridian 350'x470' (app. 1.528 ha) August 20, 1969.

- Conveyor Structure: LOC 010091, Plan 20856 TL in the South Half of Section 15, Township 58, Range 8, West of the 6th Meridian (0.363 ha) February 7, 2001.
- Scale House: MLL 000102 in the Northwest quarter of Section 10, Township 58, Range 8, West of the 6th Meridian (0.102 ha) February 8, 2001.
- Flood Creek Ash and Solid Inert Waste Disposal Site: MLL 000058 in the Northwest quarter of Section 7, Township 58, Range 7, West of the 6th Meridian (approx. 6.600 ha) August 16, 2000.
- Access Road to the HR Milner Plant: LOC 001712, in the Northwest Quarter of Section 10, Southwest Quarter of Section 15 Township 58, Range 8, West of the 6th Meridian (2.75 ha) November 2, 2000.
- Coal Stockpile Site: MLL 020048 in the South Half of Section 15, Township 58, Range 8, West of the 6th Meridian (±2.473 ha) June 13, 2002 to June 13, 2027.
- Temporary Onsite Storage Area: Located in Northeast Quarter of Section 10, Township 58, Range 8, West of the 6th Meridian (approximately 1.64 ha). Exact size and location will be finalized during the construction phase of the M2 Project. This area will be returned to its pre-use condition following completion of the M2 Project.
- The connection point to the AIES is proposed to be a new 240 kV substation to be constructed adjacent to the existing M1 facility.

(PP13) For wind power plant applications, provide the longitude and latitude coordinates for the centre of each structure supporting a wind-powered generator.

Not applicable.

(PP14) Describe the number of generating units and the total capacity (kilovolt-ampere (kVA), or megavolt-ampere (MVA) for the project.

M2 will consist of two identical 260 MW CCGT power plants that will produce a combined total of 520 MW, which is equivalent to 578 MVA. The plants will be comprised of new components as described below.

The major components of M2 are two industrial gas turbines, each of which drives an electric generator. The exhaust from each gas turbine is passed through a heat recovery boiler, which raises steam to drive two steam turbine-generators, one for each gas turbine. This method of generating electricity is highly efficient.

Each gas turbine is made up of three major components: an air compressor, a fuel combustor and a power turbine. Combustion air is drawn into the air compressor where it is compressed, mixed with natural gas and then burned. High-pressure hot gases are produced and expanded through the power turbine, where the gas is converted to shaft energy. The shaft energy drives an electrical generator to produce electricity. Some of the shaft energy is also used to drive the air compressor.

Exhaust gases exit the gas turbine and pass through a heat recovery boiler. The steam generated in the heat recovery boiler flows to a steam turbine where it is converted to shaft energy, to produce more electricity. Steam exhausted from the steam turbine enters a condenser where it is converted back to water and pumped at high pressure back to the heat recovery boiler as part of a closed-loop cycle. The cooling water used in the condenser is circulated in a closed loop system using an evaporative cooling tower. The exhaust gases, having passed through the heat recovery boilers, are sent into the atmosphere via stacks.

(PP15) Describe the existing environmental and land-use conditions on the project site, and discuss potential siting and land-use issues. Also, describe the regional setting of the development, such as regional land-use plans (i.e., Lower Athabasca Regional Plan). If applicable, include maps showing important environmental features and sensitive areas on or near the project site.

Existing Environmental and Land-Use Conditions

The Project Site is located approximately 20 km north of the Town of Grande Cache in the north half of Section 10 and south half of Section 15 of Township 58, Range 8, West of the 6th Meridian. The Project Site is bound by Highway 40 along its west/northwestern boundary and the Smoky River along its south/southeastern boundary. It is presently reached by a private access road directly off Highway 40. The Grande Cache Coal Company processing plant is adjacent to the southwest and the HR Milner 740S Substation is located on the southwest side of the Project Site.

The land on the Milner Site is designated for industrial use under the MD of Greenview No 16 / Town of Grande Cache IDP. The Milner Site is currently home to M1, a 150 MW single unit coal-fired power generation facility. The Milner Site is approximately 30 ha in total.

M1 takes up approximately 12 ha of the Milner Site. M1 includes a pulverized coal-fired boiler system; high pressure steam system; steam turbine; water treatment system; coal receipt; coal storage and handling facilities; ash management systems; electrical substation; and ancillary components to support these major systems.

The Project Site includes:

- Existing M1 facilities located within the Milner Site boundaries
- The area for M2 and internal paved, gravel and dirt roads that are located within the Milner Site boundaries
- Wetland area located within the Milner Site boundaries
- Proposed water intake structure will be located off the Milner Site on adjacent Crown lands
- Temporary storage area required during construction of the M2 Project that is located on the Milner Site and on adjacent Crown lands

After construction, the new 520 MW CCGT M2 Project and ancillary facilities will take up approximately 5 ha of the Milner Site.

There are no potential siting land-use issues. The proposed M2 Project will be constructed entirely within the Milner Site. It will not go beyond the present boundaries and no new land will be acquired for the power plant expansion. The site is already zoned for industrial use, so there are no land issues on the site at this time. A Decommissioning and Land Reclamation Plan will be executed at the end of the Project life, as outlined in the EPEA Approval 9814-02-03.

Regional Setting

This Project is within the Upper Peace Regional Plan. The Plan has not been initiated under Alberta's Land-use Framework process.

Regionally, the Project Site is located in the southern portion of the MD of Greenview No. 16. The main urban areas in the MD of Greenview are the towns of Grande Cache, Fox Creek and Valleyview. Highways 40 and 43 run through the MD of Greenview.

Biophysically, the Project Site is located in the Rocky Mountain Natural Region of Alberta. In this Region, the major valleys parallel the mountain ranges and are oriented from southeast to northwest. At various points the ranges have been cleft by drainage systems allowing the exit of waters from these valleys. Major river systems leaving the eastern slopes of the Rocky Mountains in Alberta flow in an easterly direction. Many of Alberta's largest rivers are found within this region, where they drain into the Saskatchewan and Mackenzie River systems.

The Rocky Mountain Natural Region is characterized by rugged topography and strong elevation gradient, with the widest range in elevation of any natural region in Alberta, ranging from 825 m to

3,600 m. This strong elevation gradient results in rapid changes in aspect, slope, substrate and climate. There are three sub-regions within the Rocky Mountain Natural Region - the Montane, Subalpine and Alpine - differentiated by changes in environmental conditions due to changes in altitude and aspect. The Project Site is located within the Montane Sub-region.

The Montane Sub-region occupies several discontinuous regions on lower slopes and valleys of the Rocky Mountains. The Montane is characterized by open forests and grasslands. Characteristic of the Rocky Mountain Natural Region, the growing season is short, but because of the moderating influence of Chinook winds during the winter months, the Montane Subregion has the warmest winters of any forested subregion in Alberta.

The most important environmental feature near the M2 Project is the Willmore Wilderness Park, located several kilometres outside Grande Cache on both the east and southwest sides of the town. This 4,600 km^2 park is adjacent to the Jasper National Park, with four access points that enter Willmore from the Grande Cache area. These sites include the Sulphur Gates, Cowlick Creek, Berland River and Rock Lake. No motorized vehicles are allowed in Willmore Wilderness Park. There is hiking, horseback riding and mountain biking. The trails in the Willmore Wilderness Park consist of historical routes used by the outfitters and fur trappers dating back to the early 1800s.

(PP16) At a level of detail commensurate with the size and type of potential impact(s) of the project, describe how the project is predicted to adversely affect the environment (such as soils, terrain, vegetation, wetlands, wildlife and wildlife habitat, fish and fish habitat, groundwater, surface water, air quality, land use, and visual aesthetics. Describe how the environmental effects of the project will be mitigated and any monitoring proposed to evaluate the efficacy of the mitigation.

In 2009, MAXIM conducted the required environmental studies to support the M2 Project application. An EIA for the original coal-fired M2 Project was filed with ESRD on January 30, 2009 (Jacques Whitford AXYS Ltd. 2009, Proposed HR Milner Expansion Project Environmental Impact Assessment Report). Its findings were also reported in MAXIM's January 2009 AUC application. The EIA was accepted as complete on January 12, 2010.

In the spring of 2013, MAXIM consulted with ESRD to determine which studies need to be updated for the current M2 amendment applications to ESRD and the AUC. ESRD determined that the air quality assessment, noise assessment and storm water management plan need to be updated to take into consideration the new configuration of the natural gas fired plant. ESRD deemed that all the other previous environmental studies (2009) still meet the requirements because the Project's physical footprint has not changed. Therefore, no other studies were carried out.

a. Air

An updated air quality assessment (see Appendix C) of the effects of the nitrogen oxides (NO_X and NO_2), sulphur dioxide (SO_2), fine particulate matter ($PM_{2.5}$), carbon monoxide (CO) and ammonia (NH_3) emissions from the natural gas fired M2 Project was conducted. This air quality assessment evaluated the emissions from M2 in combination with regional sources. Ambient air concentrations of these substances as measured at the Beaverlodge and Henry Pirker stations were evaluated. The measurements show that baseline concentrations are largely within regulatory limits, and measured exceedances of $PM_{2.5}$ are outliers, with the 90^{th} percentile measurements falling below the regulatory objective.

Potential effects on ambient air quality associated with operation of M2 were evaluated using the CALPUFF dispersion model and the assessment was completed in accordance with the ESRD Air Quality Model Guideline.

The predicted concentrations for NO_2, SO_2, $PM_{2.5}$, CO and NH_3 associated with emissions from M2 for all relevant averaging periods are below the Alberta ambient air quality objectives. In combination with existing and approved facilities in the region, modelling indicates exceedances of the 24-hour SO_2 and $PM_{2.5}$ objectives, as well as the 1-hour $PM_{2.5}$ guideline. These results are consistent with past assessments in the area. SO_2 predictions are likely conservative as

monitoring data has not shown exceedances of the objective. $PM_{2.5}$ values are strongly influenced by fugitive emission sources associated with Grande Cache Coal Company's coal mining operations and the coal haul road. There is little difference between Base Case and Application Case results, indicating that M2 does not exert a strong influence on regional air quality.

b. Hydrology

ESRD did not require a new hydrology assessment for this amendment application.

MAXIM is providing relevant updated information for this amendment application. The natural gas fired M2 facility will require less water per day than the previously proposed coal-fired M2 facility. On a daily average, the proposed natural gas fired M2 facility will consume approximately about 50% less water when compared to the coal facility - approximately 135 l/s vs. 279 l/s. The actual amount required is dependent on temperature and M2 will typically use less water in the winter and more water in the summer. There are two main uses for water in the natural gas fired M2 Project: (1) to generate steam to drive the steam turbine and (2) to cool equipment. Water consumed is primarily used as replacement water for losses incurred in these systems. MAXIM will recycle water to the maximum extent possible to reduce water consumption.

In the study performed for the 2009 application, alterations in the flow regime of the Smoky River due to water extraction for the Project were expected to be at most 0.3% of the annual flow, therefore imperceptible. The effect of the Project on flow regimes was assessed as having a low consequence. The proposed natural gas fired M2 Project will use even less water, so the effect of the Project on flow regimes remains imperceptible and of low consequence.

The existing M1 facility draws water from the Smoky River under a license from ESRD. MAXIM's existing water license volume is sufficient to handle the requirements of the current M1 facility and the natural gas fired M2 Project. The water licence for M1 allows for the annual extraction of 12.3 million cubic metres of water from the Smoky River. The volume that MAXIM draws from the Smoky River changes with demand and weather/season. The total net amounts drawn from the Smoky River leaves approximately 30 to 40% remaining in MAXIM's water license (approximately 60% - 70% of the withdrawal amount is used annually).

An existing water intake structure and pipeline diverts water from the Smoky River to the Milner Site. A new water intake system will be built to supply the needs of the natural gas fired M2 Project.

Surface erosion and sedimentation of the Smoky River as a result of the Project will be controlled by measures outlined in the Stormwater Management Plan (see Appendix D). Increased sediment loading of the Smoky River is expected to be not measureable and the environmental consequence of sediment loading on water users is assessed as low.

Overall, effects of the Project on hydrology are predicted to be not significant.

c. Surface Water Quality

The assessment of the effects of the Project on surface water quality has not changed since the 2009 EIA assessment. Section 4.4 of the air quality assessment (Appendix C) found that the Project emissions have minimal effect on potential acid input. The project effects on surface water quality are assessed as not significant.

d. Storm Water Management Plan

MAXIM retained Westhoff Engineering Resources Inc. (Westhoff) to revise the Stormwater Management Plan (SMP) in August 2013. See Appendix D for the detailed SMP.

The objectives of the SMP are to:

- Develop stormwater management strategies and identify infrastructure requirements to handle surface runoff for ultimate conditions of development at the Site (excluding MAXIM's proposed Coal Beneficiation Facility, for which a separate plan was prepared in 2012).

- Minimize effects on the adjacent environment with respect to water quantity and quality.
- Comply with regulatory requirements for industrial runoff management.

The proposed drainage system for the Plant Site consists of the following (see diagrams in Appendix D):

- Construction of a stormwater management pond (Pond 1) to reduce peak discharges during extreme rainfall and snowfall events and to improve water quality by settling and retaining suspended particles typically found in stormwater runoff.
- Construction of a control structure designed to have the following characteristics:
  - No immediate releases into the natural wetland are allowed for storm events with a return period equal to or less than 10 years. This is provided by a sluice gate that will normally be closed. Releases are allowed only after water quality analyses are complete on the collected runoff. Rates of release are controlled by an orifice located on the lower portion of the control structure (Orifice 1).
  - Water quality sampling and testing is proposed to be completed when water level at the pond is 10 cm above the invert elevation of Orifice 1.
  - Controlled releases to permissible rates for storm events with return periods between 10 and 100 years, provided by an orifice located on the upper portion of the control structure (Orifice 2). Maximum permissible release rate is 7.5 l/s/ha for the 1:100 year storm event.
  - An operational procedure for the control structure will be in place to provide guidance in achieving compliance with monitoring and other ESRD requirements.
  - A pipe and outfall will be constructed from the control structure to the natural wetland.
  - Internal drainage swales, roadside ditches and culverts to convey stormwater runoff towards Pond 1.

Based on modeling, the proposed design for Pond 1 is 16,500 m^3 which is greater than the required 15,744 m^3. This can handle a 1:100 year storm event. Models also indicated that the annual removal efficiency of the stormwater storage facility is well over 90% for TSS particles that are between 20 and 75 microns or greater. This implies that the pond has sufficient capacity to remove TSS particles equal or greater than 75 microns at 85%, complying with the current regulatory requirements by ESRD.

Based on the design and analysis, the following conclusions have been made regarding the planned drainage system:

- Volumes of runoff generated by a 10 year, 24-hour storm and smaller storm events will be fully contained in the proposed stormwater ponds and before any release to the natural wetland. For these events, the proposed control structure allows for controlled releases after water is sampled and analyzed for compliance with surface water quality guidelines.
- Discharge rates to the wetland will be reduced to permissible release rates at the control structure.
- A procedure will be implemented to operate the control structure of the storm pond to comply with specific EPEA requirements for industrial sites.
- Ditches, swales and culverts are proposed as the main internal conveyance systems to collect and transport runoff from the plant site to the proposed stormwater pond.
- A removal rate of greater than 85% of 75 microns (TSS particles) is achievable.
- An intercept/diversion system along the north-west to east boundary of the expansion site is proposed to prevent runoff from the external areas entering the site.

e. Groundwater

The assessment of the effects of the Project on groundwater has not changed since the 2009 EIA assessment.

The effects of the Project on groundwater resources will be mitigated through the following: restriction of excavations to less than 4 m depth; provision of secondary containment for chemical storage; and maintenance of holding tanks and water lines. With the incorporation of proposed Project mitigation measures, the changes to groundwater quantity are expected to be imperceptible, since dewatering during construction is not expected and groundwater will not be used in operation. Changes to groundwater quality are expected to be within the Canadian Drinking Water Quality Guidelines.

Overall, effects of the Project on groundwater are predicted to be not significant. The continuation of the existing groundwater monitoring plans in place for the Milner Site will allow for verification of the assessment and the identification of any variances from the expected effects on the groundwater resource. The details of the monitoring program will be determined in consultation with ESRD regulators.

f. Industrial Wastewater

The effects of the Project on industrial water have improved since the 2009 EIA assessment. The Water Balance Diagram shows that total waste water production is approximately 1,322,000 m^3/yr. Approximately 40 l/s will be returned to the river, which is equivalent to1,262,000 m^3/yr. There will be an evaporation loss from the ponds of approximately 2 l/s or 56,918 m^3/yr.

Industrial wastewater from M1 is currently discharged into two PWMPs. Sources of wastewater from M1 are the cooling tower and boiler blowdown; neutralized water treatment regeneration effluent; the ash system; and various plant sumps. Water that meets surface water quality guidelines is discharged from the PWMPs into a natural marsh area. This on-site wetland serves to further purify the water before it naturally drains to the Smoky River. Discharge from the PWMPs is controlled using a manual release structure that will facilitate isolation of an individual pond should it be required. This industrial wastewater management system has operated acceptably to date for M1.

The existing PWMPs system will continue to serve M2. M2's average annual industrial wastewater production is expected to be 1.32 million m^3 with 1.26 million m^3 returned as clean water to the Smoky River with the difference lost to evaporation. Major sources of industrial wastewater for M2 will be:

- Cooling tower blowdown that is not recycled for other uses
- Raw water filtration system backwash
- Neutralized water treatment plant effluent water
- Domestic water drains (grey water from sinks, showers and other domestic drains - no sanitary sewage is included)

For further details refer to the Plant Water Balance for M2 in Appendix E.

The existing system for Industrial Wastewater is expected to be capable of handling M2's requirements because the CCGT M2 plant design eliminates plant systems such as ash and coal handling systems, resulting in a cleaner operating facility. The effect to the environment due to the addition of M2 is expected to be negligible.

g. Vegetation and Wetlands

The assessment of the effects of the Project on vegetation and wetlands has not changed since the 2009 EIA assessment. As stated above for surface water quality, the air quality assessment (Appendix C) found that the Project emissions have minimal effect on potential acid input. The project effects on vegetation and wetlands are assessed as not significant.

h. Wildlife

The assessment of the effects of the Project on wildlife has not changed since the 2009 EIA assessment.

The majority of the Project Site is a brownfield site. Residual environmental effects associated with Project clearing consist of the loss of 0.03 ha of wetlands. The habitat that will be lost is of low quality and is not unique in the region.

With the incorporation of proposed Project mitigation measures, the effects of the Project on wildlife diversity and wildlife habitat are predicted to be not significant.

i. Aquatics

The assessment of the effects of the Project on aquatics has not changed since the 2009 EIA assessment.

Construction of the water intake will result in a small loss of fish habitat (approximately 80 m^2) within the Smoky River. The area of habitat disturbed is extremely minor in the context of the Smoky River. Compensation for the habitat loss will be negotiated with the Department of Fisheries and Oceans (DFO) prior to construction. Construction may also result in increased sedimentation in the Smoky River at the structure site. The implementation of standard in-stream construction procedures will result in non-substantive sedimentation.

Overall, effects of the Project on aquatics are predicted to be not significant.

j. Conservation and Reclamation

The Conservation and Reclamation plans have not changed since the 2009 Application because the Project footprint and the potential effects on the Milner Site in regard to surface land disturbances are the same, with the exception of the temporary storage area increasing from 1.4 ha to 9.16 ha. The following information was provided in MAXIM's application to the AUC in 2009 and is still valid for this Amendment Application.

The Project is designed to place nearly all permanent facilities on the disturbed portions of the Milner Site. The exception to this is approximately 0.30 ha of previously undisturbed land that will be disturbed permanently for the raw water intake system. New surface disturbances on the Project Site will be minimal (1.64 ha for the short term equipment laydown on the Milner Site; 1.40 ha for offsite temporary storage on Crown Land just south of the Project Site; and 6.12 ha on Crown Land for longer term equipment storage located near Sheep Creek). The new disturbance required for the temporary storage area is short-term in duration (except for the topsoil storage area) and it will be reclaimed once construction of the Project is completed.

The proposed temporary storage area will be cleared of vegetation and the topsoil removed will be salvaged and stockpiled within the Site for use during reclamation. Stripping of topsoil will use a single lift technique because topsoils are expected to be mainly uniform and no subsoil salvage is required due to the proposed use of the Project Site. Site grading will be kept to the minimum required and accepted industry standard soil handling measures will be followed. Topsoil will only be stockpiled (i.e. no subsoil salvage is required) on an upland (dry) location and appropriate measures will be implemented to minimize possible wind or water erosion and off-site sedimentation. The stockpile will have maximum 3:1 (horizontal:vertical) side slopes for safety and stability reasons. It will be located on the Project Site in an area of the temporary storage area not likely to experience heavy vehicular traffic, thereby reducing the potential for compaction, rutting, mixing or loss of the soil material.

Since the proposed life of the temporary storage area is relatively short (approximately 5.5 years), MAXIM intends to seed the stockpile with a fast growing annual cover crop to stabilize the surface and minimize the erosion potential. This crop should be reseeded annually until construction is finished and final reclamation of the site is undertaken.

Due to the moderately coarse texture of the mineral topsoils, there is a potential for erosion by wind and water while the cover crop is becoming established on the stockpiles. The following mitigation measures will help to minimize these impacts:

- spraying risk areas with water (short term or emergency measure)
- applying tackifying agents (short term)

- cover with slash (medium term)
- installing silt fences (short term to medium term) around the base of the stockpiles

In accordance with the Conservation and Reclamation Regulation (Alberta Regulation 115/93), the temporary storage area will be maintained in a manner conducive to returning it to “equivalent land capability” to the degree practical. Therefore, the temporary storage area will be able to support various land uses, after conservation and reclamation, similar to those that existed before development.

k. Historical Resources

During the approvals process for the proposed M2 Project in 2009, MAXIM conducted a Historic Resources Impact Assessment (HRIA) on the Project Site to account for potential new surface disturbance. The HRIA was submitted to Alberta Culture and Community Spirit (ACCS) who granted *Historic Resources Act* clearance for the Project Site on September 25, 2008 and for the temporary storage site near Sheep Creek on August 13, 2010. In a letter dated November 20, 2009 ACCS stated that an HRIA for palaeontological resources was not required. Copies of these clearance letters are provided in Appendix B.

(PP17) If the project site occurs within the plan boundaries of the Lower Athabasca Regional Plan (LARP):

i. Confirm that the proposed project is compliant with the LARP.

Not applicable.

(PP18) For projects in other regional land-use plan areas, created under the Alberta Land Stewardship Act, applicants should describe the land-use regional plan applicable to the project area and how the proposed project is compliant with the land-use planning detailed in the plan, following the steps described in PP17 i. to v., as applicable.

i. Confirm that the proposed project is compliant with the Upper Peace Regional Plan.

Not applicable, as the status of the UPRP as indicated on ESRD's website is reported as: "*Status: Not Started."*

ii. Confirm if the proposed project is in a conservation area or provincial recreation area established in the UPRP.

Not applicable because the UPRP has not yet established conservation or recreational areas.

iii. Provide submissions describing how the activity may be considered incidental to a previously approved activity.

Not applicable.

iv. If the project will release air or waste water emissions into the environment, use groundwater or surface water, or cause new surface or subsurface disturbance, summarize discussions held with AESRD regarding the project and its potential to exceed the triggers and limits of the air quality management framework, the surface water quality management framework, and the groundwater management framework of the UPRP. Discuss any actions or mitigation recommended by AESRD as a result of these discussions and describe how these actions or mitigation measures will be incorporated into the project.

The UPRP has not started, so this is not applicable. Please see Section PP16 above for information about environmental impacts.

v. If the project will clear vegetation, summarize discussions held with AESRD regarding the project and its potential to exceed the biodiversity targets detailed in the biophysical management framework for the UPRP. Any actions or mitigation measures recommended by AESRD and describe how these actions or mitigation measures will be incorporated into the project.

The UPRP has not started, so this is not applicable. See Section PP16 above for information about vegetation studies and remediation plans. The Project site is already a brownfield site. The only site with vegetation is the water intake structure. Little to no vegetation will be disturbed.

(PP26) If the power plant is to be located within an oil and gas facility, confirm the power plant will comply with the standards outlined in sections 8.090 and 8.170 of the Oil and Gas Conservation Regulations.

Not applicable.

(PP28) Provide details of the power generating equipment and associated facilities, such as make, model, and nominal capacity.

M2 will be made up of two identical 260 MW natural gas fired CCGT power plants. Each CCGT plant will be comprised of an industrial gas turbine generator, heat recovery steam generator, steam turbine generator and associated auxiliaries. Condenser cooling water for each CCGT plant will be provided from one common closed loop system utilizing an evaporative cooling tower. The efficiency (heat rate) of the CCGT plants will vary depending on ambient air temperature.

Major processing operations for M2 will include:

Fuel Delivery System

M2 will use natural gas as fuel for the industrial gas turbines. During times when both CCGT plants are out of service, natural gas will also be burned in auxiliary boilers to produce steam to satisfy equipment start-up and building heating needs. The natural gas supply for M2 will be delivered to the Milner Site by an expansion of the existing pipeline. MAXIM is presently in discussions with TransCanada Pipelines Limited to construct, operate and own the pipeline. TransCanada Pipelines Limited will carry out its own application process with relevant regulatory bodies for the pipeline portion of the M2 Project.

Gas compression may be required to bring the natural gas pressure up to the minimum allowed level for admission to the industrial gas turbines. A heating system will be required to ensure that natural gas temperatures are above allowable limits.

Gas Turbine-Generators

Each CCGT plant will have one packaged industrial gas turbine-generator. The data in this amendment was obtained from performance modelling based on a General Electric 7FA.04 (3-Series). A competitive bidding process will determine the actual make and model used during the initial stage of implementing the M2 Project.

The industrial gas turbine is made up of three major components: (i) an air compressor, (ii) a fuel combustor and (iii) a power turbine-generator. Combustion air is drawn into the air compressor where it is raised to high pressure, mixed with natural gas and then burned. High-pressure hot gases are produced and expanded through the power turbine, where thermal energy is converted to shaft energy. The shaft energy drives an electric generator to produce electricity. Some of the shaft energy is also used to drive the air compressor. Table 2 contains typical operating conditions for the gas turbine generator.

Table 2: Gas Turbine Generator Operating Conditions

Parameter	Operating Condition
Gross Electrical Power Output	170 MW
Exhaust Gas Exit Temperature	600 ºC
Exhaust Gas Mass Flow	1,510,000 kg/h

The gas turbine-generator system will be made up of the following major items:

- Inlet air system with filtering, heating and silencing components
- Gas turbine enclosure with ventilation and noise control components
- Fuel gas delivery and ignition
- Low NOx combustors
- Lubrication and control oil systems
- Control and monitoring systems
- Fire and gas detection with fire suppression systems

Heat Recovery Steam Generator (HRSG)

The exhaust gases from each gas turbine will be passed through a triple pressure heat recovery steam generator (HRSG) – one behind each gas turbine. HRSGs use the hot exhaust gases from the gas turbine to produce steam. Steam produced by each HRSG will be piped to a steam turbine-generator. Table 3 contains typical steam pressures and flows under normal operating conditions.

Table 3: Heat Recovery Steam Generator Operating Conditions

Parameter	Operating Condition
HP Steam Output Pressure	10.88 MPa
HP Steam Output Temperature	565 ºC
HP Steam Output Flow	174,000 kg/h

Gas turbine exhaust conditions are dependent on ambient air temperature. When the weather is very hot, steam generated by the HRSG may be insufficient to produce full-load output from the steam turbine-generator. To alleviate this situation, duct burners will be installed ahead of each HRSG and used, when necessary, to make up any steam production shortfall. The exhaust gases, having passed through the HRSG, are sent into the atmosphere via stacks. Each stack will be equipped with suitable access and platforms to the continuous emissions monitoring system (CEMS) and aircraft warning lights. Preliminary stack design data is shown in Table 4.

Table 4: Preliminary Stack Design Data

Parameter	Design Data
Height Above Grade	50 m
Flue Diameter	5.49 m
Flue Gas Exit Velocity	18.16 m/s

Selective Catalytic Reduction

Integral to the HRSG is a Selective Catalytic Reduction (SCR) System that is used to reduce the NOx emissions further in the flue gas. The SCR consists of a ceramic catalyst located in the flue gas stream. A gaseous reductant (namely aqueous ammonia) is injected into the flue gas stream, and reacts with the catalyst to reduce the NOx emissions. External to the HRSG is the aqueous ammonia storage tank, pumping system, a vaporizer, fan, air heater and mixing chamber.

Steam Turbine-Generator

The steam turbine for M2 will be designed to handle high, intermediate and low-pressure steam supplied from its associated HRSG. Each section will have a rotor fitted with turbine blades rotating within a casing that contains static blades. Steam expanding through the turbine blades is converted to shaft energy, which drives an electric generator. When producing electricity, steam turbine rotors will rotate at a constant rate of 3,600 rpm. The steam turbine-generator system will be made up of the following major items:

- High, intermediate and low-pressure turbine sections
- Steam admission and control system
- Gland steam sealing system
- Lubrication and control oil systems
- Control and monitoring systems
- Fire detection with fire suppression systems

Table 5 contains typical operating conditions for each steam turbine-generator.

Table 5: Steam Turbine-Generator Operating Conditions

Parameter	Operating Condition
Gross Electrical Power Output	90 MW
Exhaust Steam Pressure	26 mm HgA
Exhaust Steam Temperature	28 ºC

Steam exhausted from the low-pressure steam turbine will be passed over water-cooled tubes inside a condenser to convert it back to water. The resulting condensate will be collected in a tank (hotwell) at the base of the condenser. Over time the tube internals will become fouled with deposits and require cleaning to maintain condenser performance at optimum levels. The condenser will operate under vacuum and will include a de-aerator to remove dissolved gases, such as oxygen, in order to minimize metal corrosion with HRSG downstream feed water and steam raising piping.

Condensate and Boiler Feed Water Systems

Low-pressure pumps will be used to draw condensate from the condenser hotwell and supply the high-pressure pumps needed to return the condensate as feed water to the steam raising sections for the HRSGs.

Cooling and Heating Water Systems

Two independent cooling systems will be associated with M2: an open loop cooling system and a closed loop cooling system. The open loop cooling system will provide cooling water to the steam turbine-generator condensers. This system will consist of a cooling tower, circulating water pumps and piping systems that will convey the circulating water to and from the condenser. In the cooling tower the water will cascade over a fill-material as air is drawn through the fill by large fans. Cooled water will be collected in a large basin underneath the cooling tower and pumped to the condenser.

The cooling tower evaporates a portion of the water to support cooling which results in an increase of contaminants called total dissolved solids (TDS) in the remaining water. A percentage of the water in the cooling tower water basin will be blown down (discharged to the PWMPs) to keep the total TDS within acceptable limits.

Closed loop cooling systems will be used to provide cooling to key equipment where piping and components are prone to oxygen-related corrosion. Demineralized water from M2's water treatment plant will be used in these systems. The use of this higher quality water will ensure that critical equipment reliability is not jeopardized by the possibility of fouled coolers or corrosion related failures.

Losses from individual closed loop systems are anticipated to be small and may occur mainly through pump leakage. Makeup water for these systems will be supplied from the water treatment plant to the same quality as required for the HRSGs. No chemicals will be added to the water in the closed loop systems.

A heating system will be used to maintain the combustion air for the industrial gas turbines above the minimum inlet temperature limits. This system will utilize a 60/40 propylene glycol / water mix to avoid freeze-up situations.

Plant Electrical System

A 21 kV / 240 kV step-up transformer will be used to change each generator's output voltage to the substation voltage level. Electrical power required to operate M2's auxiliary equipment will be supplied via the substation using 240 kV / 4160 V station service transformers.

The existing diesel driven standby generator located in M1 will be connected to the 4160 V system to provide emergency power in conjunction with an uninterruptible power supply and

direct current battery system. These systems will provide M2 with a means of safe and orderly shutdown in the event that the electrical supply from the AIES is interrupted.

Plant Control System

M2 will be controlled using distributed control and programmable logic controller systems. These systems will allow M2's personnel to operate and monitor the plant equipment from the control room in a safe, efficient and reliable manner.

Substation and Interconnection

A new 240 kV substation comprised of buswork and breakers will be constructed on land adjacent to the Milner Site. M2 will also require a new 240 kV transmission line to be constructed. The configuration and alignment of this new line will be the subject of independent applications to be brought forward by the AESO and ATCO Electric, the transmission facility owner for this area.

Raw Water Supply and Filtration

MAXIM currently has a license to withdraw 10,000 acre-feet (12,334,800 m^3) annually from the Smoky River. Currently this diversion is currently accomplished by way of an intake structure immediately adjacent to the Milner Site. This system may not have sufficient capacity to service M2 and a new system was approved for the M2 Project.

Raw water withdrawn from the Smoky River for M2 will be strained to remove suspended solids and then pumped to the raw water storage tank.

M2 will use raw water for the following purposes:

- HRSG boiler feed water and condensate make-up
- Steam turbine condenser cooling including cooling tower make-up (open loop cooling system)
- Miscellaneous plant auxiliaries cooling (closed loop cooling systems)
- Miscellaneous uses including powerhouse washing

Water Treatment Plant

Water will be pumped from the raw water storage tank to M2's water treatment system to produce high quality water for the balance of plant operations. Ultra-pure feed water is required for the reliable, long-term operation of M2's HRSGs; steam turbines; associated piping and heater systems; and closed loop cooling systems. If impurities are not controlled they can deposit as scale inside the HRSG tubes and other pressure vessels. These deposits can lead to localized overheating and corrosion that ultimately result in early failure and extended maintenance outages.

In the first stage of water treatment, the raw water will undergo ultrafiltration to remove finer suspended particles before being directed into a reverse osmosis (RO) system. Water produced by the RO system will be collected in the RO treated water storage tank.

Water produced by the RO system will be further treated using Weak Acid Cation Exchange (a water softener) and Mixed Bed Demineralizer (MBD) units to meet the purity standard needed for HRSG operation. Demineralized water exiting the MBD units will be stored in a demineralized water storage tank. This tank will supply make-up to the steam generator feed water system and the closed cooling water systems.

Periodically, the resins used in the ion exchange and MBD systems will become exhausted and will be regenerated. Wastewater streams from this process together with ultrafiltration and RO membrane cleaning will be directed to a neutralization tank. Chemicals (sulphuric acid and sodium hydroxide) will be added to neutralize the pH of the water in this tank before it is discharged to the PWMPs.

Auxiliary Steam System

Two natural gas fired auxiliary boilers, one for each CCGT plant, will be used to provide M2 with fast start-up capability and building heating when both M1 and M2 are out of service. Table 6 contains typical auxiliary steam operating conditions.

Table 6: Auxiliary Steam Operating Conditions

Parameter	Operating Condition
Steam Pressure	1,035 kPa
Steam Temperature	186 °C
Flow (2 boilers)	45,400 kg/h

Fire Protection System

M2's fire protection system will provide water to fire hydrants and firewater sprinkler systems to protect major equipment and buildings. The system will conform to the Alberta Fire Code and National Fire Protection Association standards.

The source of fire water for M2 will be the large volume of water contained in the new cooling tower's water basin, as well as tying into the existing M1 fire water system.

General Service and Instrument Air Systems

A compressed air system will be installed for M2's Facilities. Ambient air will be drawn into the air compressors through intake air filters that remove dust particles. This system will supply air for both instrument and service requirements.

Instrument air will be used to supply all pneumatic instrumentation and controls, including actuators used for valves and other equipment. Instrument air must be clean and ultra-dry to avoid problems caused by moisture freezing in the air during inclement weather. Dryers will be used to remove moisture from the compressed air to a dew point of -40 ºC before it is discharged into the plant instrument air system.

Service air is clean compressed air used for purposes such as equipment cooling and to supply pneumatic tools used for maintenance purposes.

Environmental Control Systems

Burning natural gas as the fuel for M2 will result in reduced air emissions such as GHGs, sulphur dioxide (SO_2) and particulate matter (PM). The latest pre-combustion low-nitrogen oxide ($NO_{x)}$ technologies will be used for the gas turbine combustors, HRSG duct burners and auxiliary boiler burners to reduce NO_x production to minimum levels.

Two Selective Catalytic Reduction (SCR) systems, one for each HRSG, will be used to further reduce NO_x levels with minimal ammonia slip.

The stack for each CCGT plant will be equipped with a continuous emissions monitor system (CEMS) and manual stack sampling facilities in compliance with the CEMS Code (AEP 1998a).

Major control processes for M2 include:

Industrial Wastewater

Industrial wastewater produced from M1 is presently discharged into two existing PWMPs. Major sources of wastewater from the proposed M2 facilities are the cooling tower and HRSG blowdown; raw water filtration effluent; neutralized water treatment regeneration effluent; and domestic wash water (no sanitary sewage is included in this stream).

Water that meets surface water quality guidelines is discharged from these PWMPs into a natural marsh area on the Milner Site. Discharge from the PWMPs is controlled using a manual release structure that facilitates isolation of an individual pond should it be required. This industrial wastewater management system has operated acceptably to date for M1 and has sufficient capacity to handle the wastewater discharges from both the M1 and M2. Annual industrial

wastewater production for the M2 natural gas fired project is expected to be around 40% less than for the M2 coal-fired project.

Surface Water Runoff Control

Stormwater runoff from the Milner Site will be directed to on-site stormwater collection ponds. Under normal conditions, the stormwater stored in these ponds will be allowed to evaporate. However, if discharge from the stormwater management ponds is required, the water will be tested to ensure compliance with surface water quality guidelines prior to release into the on-site wetland. Before any release from these ponds, samples will be collected and sent for laboratory analysis. Discharge from the stormwater management ponds will be controlled using a manual release structure for storm events smaller than the 24-hour, 1-in-10 year storm. For bigger storms, the discharge will be controlled by an orifice installed in a control structure to reduce releases to pre-development release rates.

Sanitary Sewage

Sanitary sewage will continue to be collected on site in holding facilities and trucked to an approved off-site facility for disposal.

Drawings and Diagrams

The following drawings and diagrams are included in:

Appendix H: Engineering Drawings

- CCGT Plant 1 & 2 Preliminary Plot Plan107037-00103-00-ME-DPP-0001
- CCGT Plant 1 & 2 Single Line Diagram 107037-00103-00-EL-DSL-0001
- CCGT Plant 1 & 2 Simplified Process Flow Diagram 107037-00103-00-ME-PFD-0003
- CCGT Plant 1 & 2 Proposed Water Treatment Plant Process Flow Diagram 107037-00103-00-ME-PFD-0002

Appendix I: Mass Balance Diagram and Energy Balance Diagrams

- CCGT Plant 1 & 2 Mass Balance 107037-00103-00-ME-DSD-0001
- CCGT Plant 1 & 2 Energy Balance 107037-00103-00-ME-PFD-0001

(PP29) Present the estimated power plant heat rates, efficiency, and details of cooling system.

Table 7 presents the power plant capacities. Table 8 presents the open loop cooling system operating conditions.

Table 7: Proposed Facilities Capacity (from 2 identical CCGT Plants)

Capacity Items	Natural Gas Capacity Values	Coal Fired Capacity Values
Gross Power Output (Nominal)	520 MW	500 MW
Gross Energy Output	4,327,440 MWh (95% availability)	3,942,000 MWh (90% availability)
Heat Rate, HHV (efficiency)	7,064 kJ/kWh (51%)	9460 kJ/kWh (38%)
Natural Gas Consumption	3,600 GJ/h	3 GJ/h avg. (auxiliary fuel only)
Raw Water Intake	135 l/s	279 l/s

Table 8: Open Loop Cooling System Operating Conditions

Parameter	Natural Gas Operating Condition	Coal Burning Operating Condition
Flow rate	12,247m3/h (total 2 CCGT units)	38,400 m3/h
Condenser inlet temperature	14 ºC	17.5 ºC
Condenser outlet temperature	25 ºC	30.9 ºC
Heat dissipation rate	516 GJ/h	2,130 GJ/h

See Table 9 below and the Energy Balance Diagram in Appendix I for the changes in energy balance from the coal-fired M2 Project to the now proposed natural gas fired M2 Project.

Table 9: Energy Balance comparison

Parameter	Natural Gas fired M2	Coal-fired M2
Fuel Input	3,584,000MJ/h (2 CCGT units)	4,125,00 MJ/h
Electrical Output (Net)	1,826,400MJ/h (2 CCGT units)	1,629,700 MJ/h
Transformer and Station Service Losses	56,150MJ/h (2 CCGT units)	180,640 MJ/h
Other Losses	1,701,450MJ/h (2 CCGT units)	2,314,660 MJ/h

(PP30) State the fuel requirements of the power plant, including type, source, method of handling, transportation, and environmental effects.

The plant will use only natural gas for its fuel source. The natural gas will be transported to the site by pipeline, owned by TransCanada Pipelines Limited, who will take responsibility for all the regulatory requirements involved with the pipeline to the Milner Site and transporting natural gas. No Project-related environmental effects are anticipated for the supply of natural gas because this fuel will be delivered in a closed pipeline and not stored on site.

(PP31) State the projected annual electric energy production.

The projected annual electricity production is 2,733 GWh based on a 60% projected Operating Factor.

(PP35) Supply the expected in-service dates, and describe ramifications if the approval date cannot be met.

M2 is expected to have a commercial life of 40 years. Construction will start after all permits and approvals are acquired and financing is in place. Table 10 provides an outline of planned key dates associated with the construction of M2. The dates for the tasks listed in Table 10 will depend on factors such as when approvals are received and delivery times for major equipment at the time orders are placed.

Table 10: Construction and Operation Schedule for M2 Facilities

Project Milestone	Approved Project Date
Phase I: First 260 MW CCGT Plant	
Amendment Application Development	Q3 and Q4 2013
Stakeholder Engagement	Q3 2013 and ongoing
Submit Amendments to Alberta ESRD and AUC	Q4 2013
Obtain Regulatory Approval/MAXIM Notice To Proceed with Construction – Phase 1	Q3 2014
Commercial Operation – First 260 MW CCGT plant	Q1 2018
Phase II: Second 260 MW CCGT Plant	
Stakeholder Engagement	Ongoing
Construction – Phase II	Q4 2016
Commercial Operation – Second 260 MW CCGT plant	Q1 2020

(PP36) Indicate the plant's emission rates, in kilograms per megawatt-hour (kg/MWh) of nitrogen oxides (NOx), sulphur dioxide (SO2), and primary particulate matter, and state whether the emissions will comply with the current Alberta Source Emission Standards.

The plant's emission rates in kg/MWh for SO_2, NOx, and primary particulate matter are 0.0047, 0.042, and 0.0027, respectively. These values are estimated at facility maximum power output, at -42 degrees Celsius and with full turbine load and duct firing. The criterion for new large gas turbine plants is 0.3 kg/MWh. The gas fired M2 facility is much less than this limit.

(PP37) State whether the proposed plant will comply with the Alberta Ambient Air Quality Guidelines for ground-level concentrations of pollutants.

The predicted maximum ground concentrations for NO_2, SO_2, $PM_{2.5}$, CO, and NH_3 associated with emissions from M2 for all relevant averaging periods are below the Alberta ambient air quality objectives. In combination with existing and approved facilities in the region, modelling indicates exceedances of the 24-hour SO_2 and $PM_{2.5}$ objectives, as well as the 1-hour $PM_{2.5}$ guideline. These results are consistent with past assessments in the area. SO_2 predictions are likely conservative as monitoring data has not shown exceedances of the objective. $PM_{2.5}$ values are strongly influenced by fugitive emission sources associated with Grande Cache Coal Company's mining operations and the coal haul road. There is little difference between Base Case and Application Case results, indicating that M2 does not exert a strong influence on regional air quality. Therefore, the gas fired M2 facility will comply with AAAQO for ground-level concentrations of pollutants for NO_2, CO and SO_2. Table 11 shows the maximum predicted ground-level concentrations and the AAAQO thresholds for the gas fired M2 Project.

Table 11: Maximum Predicted Ground Level Concentrations for the Project Case

Substance	Averaging Period [d]	Maximum Predicted Concentration (µg/m³)	AAAQO [a] (µg/m³)	Percent of AAAQO %
Nitrogen Dioxide (NO_2)[b]	1-hour	50.2	300	17%
	24-hour	34.9	—	—
	Annual	7.9	45	17%
Nitrogen Dioxide (NOx)[c]	1-hour	55.7	—	—
	24-hour	35.6	—	—
	Annual	7.9	—	—
Nitrogen Dioxide (NO_2)[b]- Upset Conditions (No SCR)	1-hour	86.4	300	29%
Sulphur Dioxide (SO_2)	1-hour	6.3	450	1%
	24-hour	4.5	125	4%
	30-day	0.7	30	2%
	Annual	0.3	20	2%
Fine Particulate Matter ($PM_{2.5}$)[e]	1-hour	6.1	80	8%
	24-hour	4.0	30	13%
	Annual	0.9	—	—
Carbon Monoxide (CO)	1-hour	233.6	15,000	2%
	8-hour	193.1	6,000	3%
Ammonia (HN_3) - SCR slip	1-hour	21.2	1,400	2%

NOTES:

AAAQO: Alberta Ambient Air Quality Objectives and Guidelines. August, 2013.

NO_2 concentrations estimated from NOx concentrations using the Ozone Limiting Method

NO_2 concentrations assuming total conversion of NOx to NO_2

The maximum predicted 1-hr concentrations represent the maximum 9th highest 1-hr average concentration

Predicted $PM_{2.5}$ concentrations include secondary $PM_{2.5}$ formation

Results do not include consideration of background.

(PP41) For a municipality or a subsidiary of a municipality to hold an interest in a generating unit, documentation confirming compliance with section 95 of the EU Act is required.

Not applicable. No municipality or subsidiary of a municipality is participating in the Project.