Air Quality and Greenhouse Gas Technical Report

Completed in Support of the:

Napanee Generating Station Expansion

PREPARED FOR:

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Land Acknowledgement

Atura Power respectfully acknowledges that the land on which the Napanee Generating Station and any proposed future project(s) are in the traditional and treaty territory of the Mississauga Anishinaabeg. We believe that it is important to recognise the Mississauga Anishinaabeg for their care and teachings about the earth and our relations, and to honour those teachings through our interactions every day.

We also acknowledge the Chippewas of Georgina Island First Nation, the Chippewas of Mnjikaning (Rama) First Nation, and Beausoleil First Nation as signatories of the Williams Treaties, recognising the historical and ongoing connection to the lands within the traditional territories.

The Mohawks of the Bay of Quinte, whose treaty territory is in the neighbouring location of Tyendinaga, are recognised, along with the understanding that these lands have been home to many Indigenous peoples over the centuries, including the Huron-Wendat, Métis, and Haudenosaunee.

As a community, we have a shared responsibility for stewardship of the land on which we live and work.

Atura Power is committed to fostering positive and mutually beneficial relationships with Indigenous peoples and communities, in peace, respect, and friendship.

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Acronyms

$\mu g/m^3$ .... microgram(s) per cubic metre

µm .... micrometre(s)

AAQC .... Ambient Air Quality Criteria

ADMGO .... Air Dispersion Modelling Guideline for Ontario

BaP .... benzo(a)pyrene

BPIP .... building profile input program

CAAQS .... Canadian Ambient Air Quality Standards

CAS .... Chemical Abstracts Service

CCME .... Canadian Council of Ministers of the Environment

Cd .... cadmium

CEMP .... Construction Environmental Management Plan

CEMS .... Continuous Emissions Monitoring System

CEPEI .... Canadian Energy Partnership for Environmental Innovation

cm .... centimetre(s)

CO .... carbon monoxide

CO_2 .... carbon dioxide

CO_2e .... carbon dioxide equivalent

COPC .... constituent(s) of potential concern

ECA .... Environment Compliance Approval

ECCC .... Environment Canada and Climate Change

EPA .... *Environment Protection Act*

ERR .... Environmental Review Report

g/s .... gram(s) per second

GHG .... greenhouse gas(es)

HAP .... Hazardous Air Pollutant

km .... kilometre(s)

km/h .... kilometre(s) per hour

kV .... kilovolt(s)

m .... metre(s)

m/s .... metre(s) per second

MECP................ Ontario Ministry of the Environment, Conservation and Parks
mm.................... millimetre(s)
Mt...................... megatonne(s)
MW .... megawatt(s)
N_2O .... nitrous oxide
NGS .... Napanee Generating Station
NO .... Nitric Oxide
NO_2 .... nitrogen dioxide
NOx................... nitrogen oxides
NPRI .... National Pollutant Release Inventory
O. Reg................ Ontario Regulation
O_3...................... Ozone
OLM .... ozone limiting method
PAH................... polycyclic aromatic hydrocarbon
PM_{10} .... particulate matter less than 10 microns in diameter
$PM_{2.5}$ .... particulate matter less than 2.5 microns in diameter
POI………………point of impingement
ppb.................... part(s) per billion
PRIME............... Plume Rise Model Enhancements
SCR .... selective catalytic reduction
SO_2 .... sulphur dioxide
SPM .... suspended particulate matter
UTM .... Universal Transverse Mercator
U.S. EPA........... United States Environmental Protection Agency
VOC .... volatile organic compound(s)
WRF.................. Weather Research and Forecasting

1. Introduction

1.1 Project Overview

Portlands Energy Centre L.P. (Atura Power), a subsidiary of Ontario Power Generation (OPG), is proposing to expand the existing natural gas fuelled Napanee Generating Station (NGS) to increase its electricity generating capacity to support year-round electricity generation in Ontario. The proposed NGS Expansion (the project) will include adding a simple cycle combustion turbine generator unit with a nameplate capacity of 430 megawatts (MW) and gross output capacity of approximately 420 MW (at reference conditions with evaporative cooling system in service) and systems to support the new facility. Refer to Section 2 of the Environmental Review Report (ERR) for the full project description.

The project is located north of the Lake Ontario shoreline in the Town of Greater Napanee, Ont., west[1] of the existing NGS facility, within the existing OPG owned Lennox Generating Station (LGS) boundaries, as shown in **Figure 1**. Access to the project site is via an existing driveway to Highway 33 (Loyalist Parkway), located on the adjacent NGS property to the east. No expansion beyond the current NGS and LGS properties is required.

1. *For ease of reading and to reflect local conventions, cardinal directions in project documentation refer to the project as located directly west of the NGS, although in reality it is located southwest of the project site as shown on figures.*

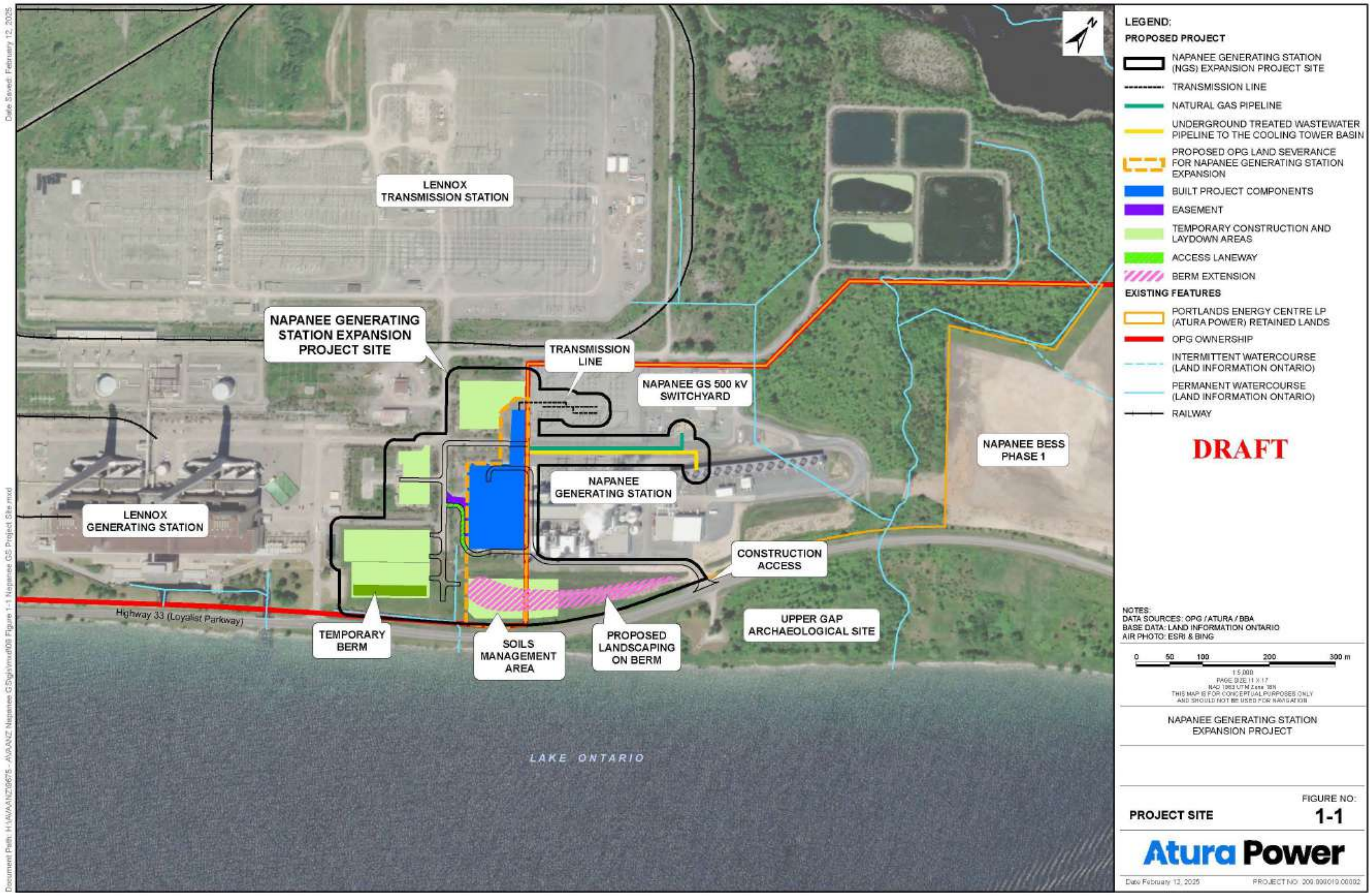


Figure 1: Map of Napanee Generating Station Expansion Project

1.2 Report Purpose

This technical report is supplementary to the discussion of air quality and climate change provided in the ERR for the project. The purpose of this report is to provide additional technical details on the assessment methodology, including air emissions calculations, an overview of the incremental and cumulative project assessment scenarios, dispersion modelling methods, and finally, the modelling results.

The purpose of the air quality assessment is to identify and, where possible, quantify the potential environmental impacts due to air emissions from project activities and their potential to disperse off-site and affect ambient air quality. The purpose of the greenhouse gas (GHG) assessment is to quantify the annual project GHG emissions, in units of carbon dioxide equivalent (CO_2e) per year, in order to inform the discussion on climate change.

1.3 Assessment Framework

The following sections establish the boundaries of the air quality and GHG assessments in terms of time and space and discuss technical limitations as well as how the project is expected to interact with the ambient atmospheric environment.

1.3.1 Spatial and Temporal Boundaries

The spatial boundaries of the air quality and GHG assessments are described in terms of study areas. The GHG assessment is limited to an evaluation of project emissions and therefore confined to the project site as defined in the ERR to include the collective location of all permanent and temporary project components (including the construction footprint) as illustrated in **Figure 1** above. The existing environment and assessment of effects of air quality extend outside of the project site to an area where potential effects of the project are likely to occur. The air quality study area is therefore defined by the air dispersion modelling domain as described in **Section 3.3.3.1**.

The temporal boundaries for the air quality and GHG assessments are consistent with the temporal boundaries defined in the ERR as follows:

- **Construction** – anticipated to start in Q3 of 2025 after all applicable assessments, permits, and approvals have been obtained to enable construction to begin. The construction phase may range from 18 to 30 months but is assumed to take 26 months to complete;
- **Operations and maintenance** – anticipated to start in 2028 with an expected operating life of 12 years; and
- **Decommissioning** – anticipated to start in 2040 at the end of the project's useful service life.

The assessment of air quality was evaluated based on short-term (e.g., 1-hour and 24-hour) as well as long-term (i.e., annual) average emission rates and air dispersion modelling scenarios. For each relevant averaging period, the maximum concentrations predicted by the CALPUFF model were compared to the applicable ambient air quality criteria discussed in **Section 1.4**. Air dispersion modelling requires meteorological data as an input, which is also timebound. A five-year site-specific meteorological dataset approved by the Ontario Ministry of the Environment, Conservation and Parks (MECP) was used to run the advanced CALPUFF air dispersion model (detailed modelling information is provided in **Section 3.3**). In addition to model predictions of maximum concentrations, total annual emissions were estimated for relevant years of project operation.

1.3.2 Technical Boundaries

The assessment of effects to the atmospheric environment are subject to several technical limitations. Technical limitations typically associated with air quality and GHG assessments pertain to the following:

- Quantification of source emission rates (i.e., grams/second of each contaminant emitted from each source), which requires detailed information about sources and operations and relies on a combination of manufacturer supplied data and published data and may not perfectly describe site-specific conditions.
- Configuration of the site layout and model source parameterisations (e.g., building layouts, source release heights, exhaust temperature, and flow, etc.).
- Use of past meteorology to describe potential future situations.
- General limitations inherent in all predictive models, which are based on algorithms developed either empirically or theoretically and may not perfectly describe real-world conditions.

A conservative assessment methodology has been applied to mitigate the impacts of the above limitations on the assessment results. Some of the measures taken to ensure a conservative assessment include:

- The modelled assessment scenarios consider all activities occurring concurrently at their individual maximum rates of production (see **Section 3.2**).
- The addition of conservative background concentrations to modelled results (see **Section 2.2.3**).
- The ozone limiting method (OLM), a methodology recognised as conservative, was used to convert nitrogen oxides (NOx) to NO_2 concentrations (see **Section 3.3.4**).

1.3.3 Project-Environment Interactions

1.3.3.1 Construction

The project has the potential to affect the local air quality during the construction phase. Emissions that are associated with construction activities are suspended particulate matter (SPM) and typical combustion emissions from construction equipment. As with any construction site, these emissions will be of relatively short duration and unlikely to have any long-lasting effect on the surrounding area. The use of well-maintained equipment will ensure that combustion emissions during the construction phase are kept to a minimum. The use of an electric fleet of construction equipment will be considered to the extent possible.

The construction phase will last less than three years (18 to 30 months) and will result in emissions primarily from heavy equipment use and other earthworks activities that generate fugitive dust (e.g., land clearing). To reduce the potential effects of dust emissions during the construction phase, the use of well-maintained construction equipment, effective dust suppression techniques (e.g., on-site watering, and limiting the speed of vehicles travelling on unpaved surfaces) in addition to adherence to the practices and procedures outlined in the document "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo Services Inc., 2005) will be followed. Construction activities will be conducted under a Construction Environmental Management Plan (CEMP) which will identify industry standard best practises to be implemented for the management of environmental concerns. Mitigation and management measures for the project outlined in the ERR and dictated by future permits and approvals will be incorporated into the CEMP.

1.3.3.2 Operations and Maintenance

Air emission sources for the project operations will consist of one natural gas-fuelled simple cycle combustion turbine generator with evaporative cooling, one dew point heater, and one emergency standby diesel generator which will supply power to allow for the safe shutdown of the NGS Expansion facilities in the event of an unplanned separation from the 500 kilovolt (kV) grid supply. Air emission sources for the existing NGS operations include two natural gas-fuelled combined cycle combustion turbine generators each equipped with evaporative coolers, duct burners, and a selective catalytic reduction (SCR) system, one auxiliary boiler, one dew point heater, a 14-cell parallel path wet-dry cooling tower, an emergency standby diesel generator which supplies power to the existing station to allow for the safe shutdown of the turbines in the event of an unplanned separation from the 500 kV grid supply, and a diesel engine to power the fire water pump in the event of an emergency.

The existing and proposed emergency standby diesel generators and diesel engine to power the fire water pump are intended for use in emergency situations only and periodically undergo testing. Air emissions from periodic testing of the emergency equipment are limited and will be addressed through permitting; therefore, emissions from emergency equipment are not included in the air quality assessment.

The principal air quality constituents released during the operation of the project combustion turbine generator and dew point heater include standard products of combustion consisting mainly of water, carbon dioxide (CO_2), NOx, and carbon monoxide (CO). Other constituents such as sulphur dioxide (SO_2), particulate matter (SPM, particulate matter less than 10 microns in diameter [PM_{10}] and particulate matter less than 2.5 microns in diameter [$PM_{2.5}$]), metals, polycyclic aromatic hydrocarbons (PAH) and volatile organic compounds (VOC) are emitted in trace amounts. The full list of constituents of potential concern (COPC) chosen for inclusion in the air quality assessment was based on those that were determined to be significant through a screening analysis (detailed in **Attachment A**), and includes the following:

- Nitrogen oxides (NOx), as nitrogen dioxide (NO_2),

- Carbon monoxide (CO),
- Suspended particulate matter (SPM),
- Particulate matter – inhalable fraction (PM_{10}),
- Particulate matter – fine fraction ($PM_{2.5}$),
- Sulphur dioxide (SO_2),
- Cadmium (Cd),
- Benzo(a)pyrene (BaP),
- Ethylene, and
- Propanal.

1.4 Air Quality Assessment Criteria

MECP and the Canadian Council of Ministers of the Environment (CCME) publish ambient air quality criteria (AAQC) and ambient air quality standards, respectively, which are applicable to the project. The MECP's AAQC have been established to be protective against adverse effects on health and/or the environment and are meant to be used to assess general or "ambient" air quality from all emission sources (Human Toxicology and Air Standards Section, Technical Assessment and Standards, 2020). As a result, the addition of a background concentration is required before comparing to an AAQC. Similarly, the Canadian Ambient Air Quality Standards (CAAQS) (Canadian Council of Ministers of the Environment, 2025) are health and environmental-based outdoor air quality objectives for pollutant concentrations in the air that have been developed to protect human health and the environment from air pollution. AAQCs and CAAQS are considered suitable criteria for provincial environmental assessments and air quality effects studies.

As noted above, the purpose of the air quality assessment is to evaluate the potential effects of the project on ambient air quality. As a result, model predicted concentrations will be added to the contribution of the existing NGS operations plus appropriate background concentrations and compared with applicable AAQC and CAAQS. **Table 1** summarises the air quality criteria applicable to the COPC identified for the project.

Table 1: Project Air Quality Criteria

COPC	Chemical Abstracts Service (CAS) Number	Averaging Period	MECP AAQC	CAAQS[1]	
			(microgram per cubic metre ($\mu g/m^3$))	(parts per billion (ppb))	($\mu g/m^3$)
NOx (as NO_2)	10102-44-0	1-Hour	400	42	80
		24-Hour	200	-	-
		Annual	-	12.0	23.0
CO	630-08-0	1-Hour	36,200	-	-
		8-Hour	15,700	-	-

COPC	Chemical Abstracts Service (CAS) Number	Averaging Period	MECP AAQC	CAAQS[1]	
			(microgram per cubic metre ($\mu g/m^3$))	(parts per billion (ppb))	($\mu g/m^3$)
SPM	-	24-Hour	120	-	-
		Annual	60	-	-
PM_{10}	-	24-Hour	50	-	-
$PM_{2.5}$	-	24-Hour	27[1]	-	27
		Annual	8.8[1]	-	8.8
SO_2	7446-09-5	10-Minute	178	-	-
		1-Hour	106	65	173
		Annual	10.6	4.0	10.6
Cd	7440-43-9	24-Hour	0.025	-	-
		Annual	0.01	-	-
BaP	50-32-8	24-Hour	0.00005	-	-
		Annual	0.00001	-	-
Ethylene	74-85-1	24-Hour	40	-	-
Propanal	123-38-6	10-Minute	10	-	-

Notes:
[1] NO_2 (1-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
NO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average concentrations
$PM_{2.5}$ (24-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual avg) statistical form: the 3-year average of the annual average of the daily 24-hour average concentrations
SO_2 (1-hour avg) statistical form: the 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
SO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average SO_2 concentrations

SPM is used throughout this report to describe all particulate matter with a diameter of less than 44 micrometres (μm) and, as described in **Section 2.2.3** of this report, emissions of SPM from the project are conservatively assumed to be equal to PM_{10} and $PM_{2.5}$.

1.4.1 Other Assessment Criteria

The project will require an amendment to the existing NGS Environmental Compliance Approval (ECA) Number A-500-1716089792 version 1.0 (issued June 9, 2022) to include the additional air and noise emission sources associated with the project. The ECA (Air and Noise) amendment will be supported by detailed air and noise technical assessments from all on-site sources included in the application and is subject to MECP review and approval.

1.4.1.1 Local Air Quality Standards (Air)

Ontario Regulation (O. Reg.) 419/05: Air Pollution - Local Air Quality (O. Reg. 419/05) under the Ontario *Environmental Protection Act* (EPA) works within the provincial air management framework by regulating air contaminants released into the air by various sources, including natural gas fuelled generating stations. MECP administers the EPA and is the key regulatory authority for establishing applicable emission limits, reviewing applications for approvals under the EPA, and for compliance. The project is subject to MECP approval for operational air emissions and will comply with O. Reg. 419/05. O. Reg. 419/05 includes three approaches for demonstrating compliance:

- Meeting a provincial air standard; or
- Requesting and meeting a site-specific standard; or
- Registering and meeting the requirements under a sector-based technical standard (not currently available for the electricity sector).

Atura Power is consulting with the MECP to identify the applicable compliance approach and associated approval(s) for the project.

The provincial air standards compliance approach involves an assessment of maximum concentration levels for various contaminants at a point of impingement (POI) (i.e., a point where airborne emissions from a facility contact the ground or a sensitive receptor). The values are then compared to MECP’s published list of air standards, guideline values, and screening levels (Ministry of the Environment, Conservation and Parks, 2021a). The MECP approvals process requires that an emissions summary and dispersion modelling report be completed and submitted with the ECA amendment application package for technical review. The documents “Guideline A-10: Procedure for Preparing an Emission Summary and Dispersion Modelling Report, Version 4.0” (Ministry of the Environment, Conservation and Parks, 2016a) and “Guideline A-11: Air Dispersion Modelling Guideline for Ontario, Version 3.0” (Ministry of the Environment, Conservation and Parks, 2016b), provide guidance for the air standards compliance approach with O. Reg. 419/05.

Through the process, preliminary emissions modelling has predicted that to demonstrate compliance with provincial air standards, Atura Power would be required to apply dispatch constraints (i.e., limitations of facility start-up operations) during specified and infrequent meteorological events. These dispatch constraints would affect Atura Power’s ability to provide power to the grid when dispatched by the IESO, and therefore Atura Power is considering an application for a site-specific standard under O. Reg. 419/05. This site-specific standard compliance option would allow Atura Power to moderate these anticipated facility dispatch constraints and better position the facility to respond and provide power to the grid when needed. Should this compliance approach be pursued, Atura Power will engage with the First Nations, Town of Greater Napanee, local residents and other interested parties to share information and receive feedback about this process.

1.4.1.2 In-Stack Limits (Air)

The document "Guideline A-5 Atmospheric Emissions from Stationary Combustion Turbines” (Ministry of the Environment, Conservation and Parks, 2021b) provides concentration-based in-stack limits for stationary combustion turbines for NOx and CO. The two existing NGS combustion turbines are subject to the original 1994 version of Guideline A-5, however, the new NGS Expansion combustion turbine will be subject to the current 2021 version.

The document “Guideline A-9: NOx Emissions from Boilers and Heaters” (Ministry of the Environment, Conservation and Parks, 2016c) provides NOx emission limits for new or modified fossil-fuel boilers and heaters which have a fuel energy input of greater than 10.5 GJ/hr (Ministry of the Environment, Conservation and Parks, 2016c), which is expected to apply to the natural gas dewpoint heater for the project.

1.4.2 Notification Criterion

Under Article V of the Ozone Annex to the Canada-U.S. Air Quality Agreement, Canada is obligated to notify the U.S. of any major modification to an existing facility in Canada within 100 kilometres (km) of the Canada-U.S. border which is expected to increase emissions by 40 tonnes or more per year of any one of the following constituents: SO_2, SPM, VOC, CO, and NOx (Environment and Climate Change Canada (ECCC), 2013). Notification is also required if the major modification will result in an increase of releases greater than one (1) tonne per year of any one Hazardous Air Pollutant (HAP). For the purposes of Notification, a HAP is any substance in the National Pollutant Release Inventory (NPRI) that is not categorised as a criteria air contaminant. The applicability of this notification criterion for the project is considered in **Section 3.2**.

2. Existing Conditions

The following sections provide the regional and local climate, meteorology and air quality context relevant to the project.

2.1 Climate and Meteorology

The area surrounding the project site has a humid continental climate like other parts of southern Ontario near the Great Lakes. The region is characterised by pronounced seasonal differences in weather and by a highly variable day-to-day weather pattern. Some periods in the summer can be characterised as a humid tropical climate (i.e., high temperature, high humidity, afternoon thunderstorms, etc.), while some periods in the winter can be characterised as a polar climate (i.e., very cold, clear, and dry) with precipitation occurring throughout the year. Due to its location on the north shore of Lake Ontario, the project site experiences moderate temperatures compared to inland areas, meaning cooler summers and milder winters. The lake effect can also bring occasional heavy snowfall and increased cloud cover in the winter.

Characterisation of the existing climate and meteorological conditions near the project site is important because these are the main forces driving the dispersion of emissions in the atmosphere. Wind direction and wind speed dictate the direction and distance from the source that emissions may travel. Near-surface temperature controls the buoyant component of turbulence (i.e., vertical motion) from the emission sources, while precipitation helps remove pollutants from the atmosphere.

The closest continuous meteorological station operated by ECCC is located approximately 21 km away from the project site at the Kingston Airport[2]. Additionally, data from the ECCC Kingston Climate Station[3] were incorporated into the composite climate elements presented in this assessment. The long-term historical meteorological data from these two stations were used to describe the average climatic conditions at the project site. The following sections provide summary description of this data.

2.1.1 Temperature

Climate normals for Kingston (1991-2020) (ECCC, 2024) are presented in **Table 2**. “Normals” is the term commonly used for values of climatic elements averaged over a fixed standard period of years (usually 30 years).

As shown in **Table 2**, the normal annual temperature is 7.3°C at the Kingston Airport, with a normal daily minimum temperature of –11.5°C in January and a normal daily maximum temperature of 25.4°C in July. Extreme temperatures range between –32.8°C in January to 33.7°C in July.

[2] *Climate ID 6104146; elevation:92.4 m*
[3] *Climate ID 6104142; elevation:93 m*

2.1.2 Precipitation

Table 3 provides precipitation normals and extremes in Kingston (1991-2020) for rainfall and snowfall. The Kingston area received and average of 959.6 millimetres (mm) of precipitation per year, 808.7 mm as rainfall and 157.1 centimetres (cm) as snowfall. The highest normal monthly rainfall was 93.7 mm in August. The extreme daily precipitation rate of 91.6 mm occurred in July and the extreme daily snow depth of 58 cm was recorded during February.

2.1.3 Wind Speed and Direction

Wind speed and direction climate normals and extremes are summarised in **Table 4**. The prevailing wind direction in the spring and summer (from March to September) was from the south, and from the west in the fall and winter (from October to February). The annual average wind speed was 14.8 kilometres per hour (km/h) (or 4.1 metres per second (m/s)), with the highest recorded wind speed of 78 km/h (or 21.7 m/s) occurring in September.

Figure 2 presents a comparison of a wind rose based on the CALMET meteorological dataset (see **Section 3.4.1.1**) extracted from the Kingston Airport (on the left) and a wind rose based on observed wind speeds recorded at the Kingston Climate station (on the right). The average wind speed based on the modelled data is 4.3 m/s whereas the observed average wind speed is 4.2 m/s.

Table 2: Kingston Temperature Normals (1991-2020)

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily Average (˚C)	-7.0	-6.4	-1.1	5.4	12.4	17.3	20.8	20.0	15.6	9.5	3.5	-2.2	7.3
Standard Deviation	2.9	3.2	2.6	1.1	1.3	0.9	1.4	1.1	1.2	1.5	1.8	2.2	0.9
Daily Maximum (˚C)	-2.6	-1.8	3.2	10.0	17.6	22.1	**25.4**	24.6	20.5	13.8	7.5	1.6	11.8
Daily Minimum (˚C)	**-11.5**	-10.9	-5.5	0.9	7.3	12.5	16.1	15.3	10.7	5.1	-0.6	-6.0	2.8
Maximum Daily Mean (˚C)	8.4	6.7	14.7	16.9	22.9	26.9	**28.2**	26.3	25.7	21.2	14.2	9.7	28.2
Minimum Daily Mean (˚C)	**-25.6**	-24.4	-16.7	-6.4	1.2	8.7	13.8	12.7	4.6	-1.7	-12.7	-23.4	-25.6
Extreme Maximum (˚C)	13.5	12.8	21.2	24.7	31.7	31.8	**33.7**	33.5	30.8	26.1	19.7	14.2	33.7
Extreme Minimum (˚C)	**-32.8**	-30.8	-23.7	-12.0	-4.0	2.6	7.5	6.7	-1.3	-7.5	-17.1	-28.3	-32.8

Note: **Bolded** values indicate the extreme for the year

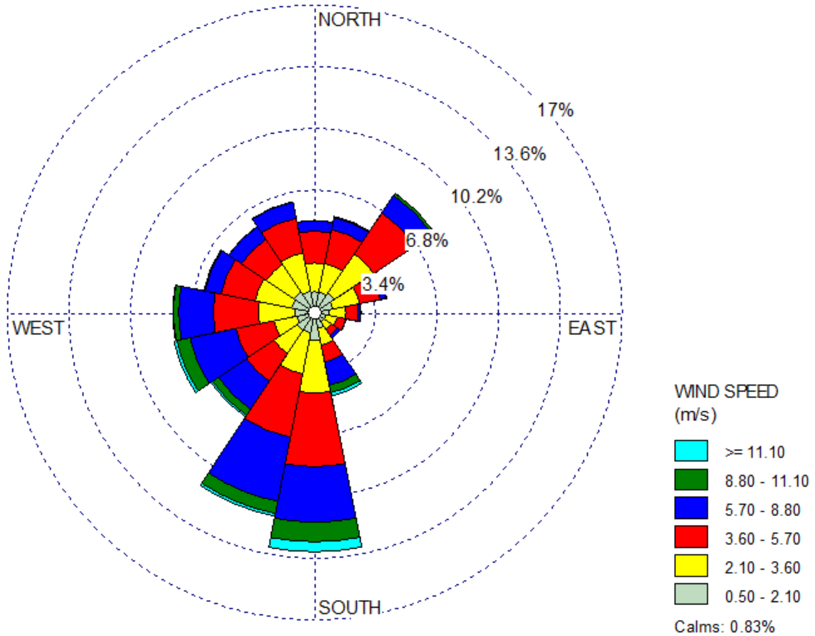
Table 3: Kingston Precipitation Normals (1991-2020)

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation [1,2]													
Rainfall (mm) [1]	29.2	29.0	41.3	77.5	76.9	72.0	64.0	93.7	89.7	91.0	92.4	52.2	808.7
Snowfall (cm) [1]	39.5	39.1	25.4	8.1	0.0	0.0	0.0	0.0	0.0	1.2	8.0	35.9	157.1
Precipitation (mm) [1]	65.2	65.1	69.2	87.1	76.9	72.0	64.0	93.7	89.7	92.4	100.3	84.1	959.6
Days with Rainfall ≥ 0.2 mm [1]	5.4	5.1	8.2	11.9	12.9	11.4	9.3	11.1	12.3	13.6	14.0	8.1	123.4
Days with Snowfall ≥ 0.2 cm [1]	13.2	11.1	7.3	2.6	0.0	0.0	0.0	0.0	0.0	0.4	4.3	11.5	50.4
Days with Precipitation ≥ 0.2 mm [1]	16.1	13.9	12.8	13.5	12.9	11.4	9.3	11.1	12.3	13.7	16.2	15.8	159.1
Extreme Daily Precipitation (mm) [2]	38.1	39.8	41.3	47.2	46.2	67.8	**91.6**	58.0	91.0	53.6	58.4	49.5	91.6
Extreme Snow Depth (cm) [2]	27.0	**58.0**	48.0	22.0	0.0	0.0	0.0	0.0	0.0	1.0	14.0	42.0	58.0

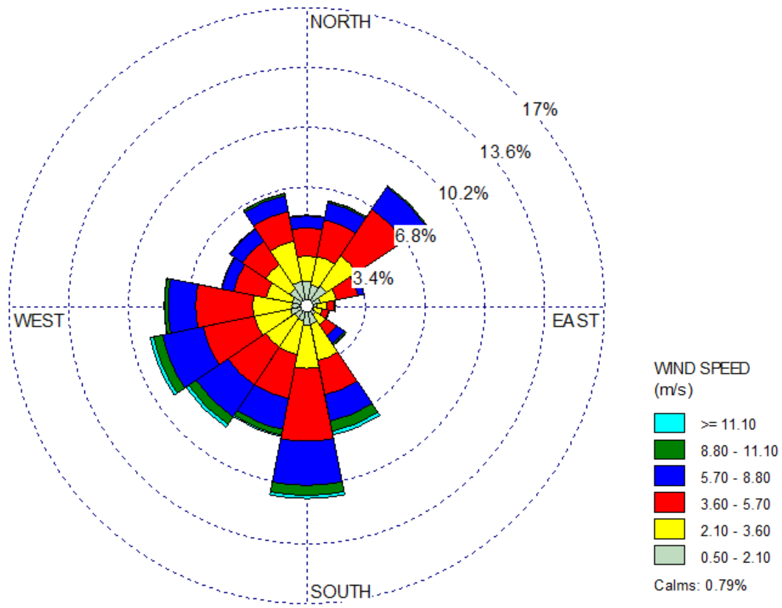
Notes:
Bolded values indicate the extreme for the year
[1]Climate Normals 1981-2010
[2]Climate Normals 1991-2020

Table 4: Kingston Wind Normals (1991-2020)

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Wind													
Wind Speed (km/h)	16.6	15.6	15.4	15.7	12.9	12.2	12.7	13.1	14	16	16.7	16.5	14.8
Most Frequent Wind Direction	W	W	S	S	S	S	S	S	S	W	W	W	S
Extreme Wind Speed (km/h)	67	69	74	59	57	46	70	54	**78**	61	71	65	78
Direction of Extreme Wind Speed	SW	W	SW	SW	SW	W	E	S	N	SW	SW	S	N
Extreme Gust Speed (km/h)	91	86	115	100	96	81	120	111	91	95	**130**	100	130
Direction of Extreme Gust Speed	SW	SW	SW	SW	N	N	W	NW	SW	W	SW	W	SW



CALMET Wind Rose at Kingston Airport, 2014-2018



Wind Rose at Kingston Climate Station (6104142), 2014-2018

Figure 2: Comparison of CALMET and Observed Kingston Wind Roses (2014-2018)

2.2 Existing Air Quality

The existing air quality at the project site is influenced by local industrial emission sources such as the existing NGS operations, LGS, the Lafarge cement plant at Bath, smaller industrial and commercial operations, farming activities, local traffic, local residences, and long-range (including cross-border) emissions generated upwind in urban and industrial areas.

As described in **Section 1.3.3**, the principal constituents from the project are combustion emissions of NOx and CO. Minor combustion emissions related to the project are SO_2, particulate matter, which is comprised of SPM, PM_{10} and $PM_{2.5}$, as well as PAHs, VOCs, and metals. Except for Cd, BaP, ethylene, and propanal, project emissions of PAHs, VOCs, and metals were determined to be insignificant through a screening analysis (detailed in **Attachment A**).

Representative background concentrations were used in the air quality assessment, where available. The incremental contribution attributed to the project was added to the contribution of the existing NGS operations plus appropriate background concentrations to establish total predicted ambient concentrations, which effectively estimates cumulative effects when the project is in operation. The potential cumulative effects of the project are presented in **Section 4.1.2.2**.

To define representative background concentrations for the air quality assessment, the selected background concentrations from the original NGS air quality assessment were considered and updated where appropriate. The original NGS air quality assessment included measured NO_2, CO, PM_{10}, $PM_{2.5}$, SO_2, and Ozone (O_3) concentrations from a continuous air monitoring station commissioned at the NGS site from February through October 2013 as summarised in **Section 2.2.1** below.

In addition, five years of historical air quality monitoring data from the closest representative ECCC station (Point Petre) was used to determine background PAH and VOC concentrations for the original NGS air quality assessment (SENES Consultants, 2014). At the time, the Point Petre station was selected over other MECP and ECCC stations as it was more representative of the NGS site, since it is located in a relatively pristine area on the shore of Lake Ontario, whereas the other nearby stations are generally located in urban areas such as Kingston and Belleville. As this data remains the most current and representative monitoring of background PAH and VOC concentrations for the project site, the selected background concentrations, where available, were applied in the project air quality assessment.

Current background NO_2, $PM_{2.5}$, and O_3 concentrations from the Kingston and Belleville MECP ambient monitoring stations are summarised in **Section 2.2.2** and were compared to the historical site-specific measurements to confirm or update the background concentrations for the purposes of the current air quality assessment.

2.2.1 Historical Site-specific Measurements

A continuous air monitoring station was set up at the NGS site to collect site-specific NO_2, CO, PM_{10}, $PM_{2.5}$, SO_2, and O_3 concentrations from February through October 2013, prior to construction and operation of the existing NGS. The air monitoring station sampled and collected air concentration data on NO_2, CO, PM_{10}, $PM_{2.5}$, SO_2, and O_3. A summary of the 1-hour average data collected between February 13 and October 31, 2013 is shown below in **Table 5**.

Table 5: Summary of Historic Project Site Air Monitoring (1-Hour Average)

	NO_2 (µg/m^3)	CO (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	O_3 (ppb)
Average	3.2	107.8	10.9	5.9	0.8	34
Max	54.5	432.1	86.0	73.0	32.0	80
Min	0.0	0.0	2.0	0.0	0.0	2
90th percentile	7.7	172.3	21.0	12.0	2.7	47
1-Hour MECP AAQC	400	36,200	-	-	106	-

As described in **Section 3.3.3.4**, the OLM, which requires the use of representative O_3, was used in the air quality assessment to calculate the maximum NO_2 concentrations. NO_2 is typically the most significant constituent emitted from natural gas-fuelled combustion sources. All hourly NO_2 measurements throughout the monitoring period were well below the MECP AAQC of 400 µg/m^3.

The measured concentrations were quite low and are reflective of the rural nature of the area. The air monitoring station would have also captured the influence of other neighbouring emissions sources such as the LGS and the Lafarge cement plant. When compared to the MECP 1-hour AAQC where applicable, the maximum measured concentrations were well below the applicable criteria.

2.2.2 MECP Ambient Monitoring Station Measurements

Current (2019-2023) ambient air quality levels available from MECP monitoring stations located in Belleville and Kingston were reviewed and compared to the historical site-specific measurements. The COPC data collected at these MECP monitoring stations is limited to NO_2, $PM_{2.5}$, and O_3. Historical (2010-2014) NO_2 background concentrations were also reviewed to determine the trend of ambient air quality in the region and support the use of the historical site-specific measurements for COPC which are not monitored at the MECP stations. The relevant MECP monitoring station data is summarised in **Table 6** below. The table also lists the historic project site air monitoring data for comparison.

Table 6: Summary of MECP Belleville and Kingston Monitoring Data

	NO_2 (µg/m^3)		$PM_{2.5}$ (µg/m^3)		O_3 (µg/m^3)	
	1-hour[1]	24-hour[1]	24-hour[1]	Annual[2]	1-hour[1]	24-hour[1]
Belleville (54012)						
Historic Data (2010-2014)	21.0	17.4	-	-	-	-
Current Data (2019-2023)	16.3	13.8	10.8	6.4	87.8	81.0
Kingston (52023)						
Historic Data (2010-2014)	15.3	13.5	-	-	-	-
Current Data (2019-2023)	14.5	13.2	10.3	6.1	85.8	81.8
Belleville (54012) and Kingston (52023)[3]						
Current Data (2019-2023)	15.3	13.6	10.5	6.2	87.8	81.3
NGS Monitoring						
Historic Data (2013)	7.7	5.9	9.0	5.9	47	-

Notes:
[1] 90th percentile
[2] Average
[3] Combined data from both monitoring stations

Examination of the historic and current NO_2 monitoring data from each MECP station indicates that the ambient levels of NO_2 have decreased since the historic site-specific measurements were conducted. It is therefore appropriate to use the historic site-specific measurement for COPC which are not measured at the MECP stations (i.e., CO and SO_2).

The historic and current data from the MECP stations compared to the historic site-specific monitoring is reflective of the rural nature of the project site. Although the current data from the MECP monitoring stations is likely overly conservative to characterise the project site, it was selected for use in the air quality assessment as insufficient historic data is available to determine 98th percentile concentrations of NO_2 and $PM_{2.5}$ as required for comparison to CAAQS.

2.2.3 Selected Background Concentrations

Representative background concentrations were established for each COPC and averaging period considered in the air quality assessment. Multiple background concentrations were determined for a single COPC and averaging period in instances where the statistical form required for comparison to MECP AAQC is different than that required for comparison to CAAQS. A summary of the representative background concentrations is presented in **Table 7**.

Table 7: Representative Background Concentrations Near the Project Site

COPC	CAS Number	Averaging Period	Representative Background Concentration	
			(µg/m³) for comparison to MECP AAQC[1]	(µg/m³) for comparison to CAAQS[2]
NOx (as NO_2) [3]	10102-44-0	1-Hour	15.3	62.7
		24-Hour	13.6	-
		Annual	-	7.3
O_3 [3,4]	10028-15-6	1-Hour	87.8	134.9
		24-Hour	81.3	-
		Annual	-	60.0
CO [5]	630-08-0	1-Hour	172.3	-
		8-Hour	169.5	-
SPM [6]	-	24-Hour	41.8	-
		Annual	24.9	-
PM_{10} [6]	-	24-Hour	20.9	-
$PM_{2.5}$ [3]	-	24-Hour	16.2	16.2
		Annual	6.0	6.0
SO_2 [5,7]	7446-09-5	1-Hour	2.7	32.0
		Annual	0.8	0.8
BaP [8]	50-32-8	24-Hour	0.00004	-
		Annual	0.00002	-

Notes:
[1] For comparison to MECP AAQC using the COPC specific statistical forms noted below
90th percentile statistical form for all COPC with 1-hour, 8-hour, and 24-hour averaging periods except for $PM_{2.5}$
Average statistical form for all COPC with annual averaging periods except for $PM_{2.5}$
See note 2 for $PM_{2.5}$ statistical forms
[2] For comparison to CAAQS using the COPC specific statistical forms noted below
NO_2 (1-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
NO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average concentrations
$PM_{2.5}$ (24-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual avg) statistical form: the 3-year average of the annual average of the daily 24-hour average concentrations
SO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average SO_2 concentrations
[3] Based on current (2019-2023) MECP monitoring data from Belleville (54012) and Kingston (52023) monitoring stations
[4] Background concentration applied for OLM
[5] Belleville and Kinston NO_2 have been trending down since 2014 therefore historic project site CO and SO_2 background measurements were considered
[6] SPM and PM_{10} were estimated by using the typical ratio seen in MOE monitoring sites (SPM:PM_{10}:$PM_{2.5}$ ratio of 4:2:1) (Environment Canada 2000, Brook et al 1997)
[7] Maximum 1-hour historic project site measurement applied to be conservative since 98th percentile cannot be determined
[8] Historic (2007-2011) Point Petre NAPS Station 64601 monitoring data remains the most current and representative

Nitrogen Oxides

NOx is present in the atmosphere as the sum of NO_2 and nitric oxide (NO). NOx emissions are primarily from high-temperature combustion processes such as the burning of fossil fuels. While the primary chemical parameter emitted from combustion processes is NO, it oxidises rapidly, in the presence of ozone (O_3), hydrocarbons and sunlight, to NO_2. NO_2 is a major contributor to the formation of acid rain.

The representative 1-hour and annual background NO_2 concentrations for the project site for comparison to the CAAQS are 62.7 µg/m^3 and 7.3 µg/m^3, respectively. These concentrations represent 78% and 32% of their respective CAAQS of 80.3 µg/m^3 and 23.0 µg/m^3. The representative 1-hour and 24-hour background NO_2 concentrations for comparison to the MECP AAQC are 15.3 µg/m^3 and 13.6 µg/m^3, respectively. These are insignificant in comparison to the corresponding MECP AAQCs for NOx (as total NO_2) of 400 µg/m^3 and 200 µg/m^3 for 1-hour and 24-hour averaging periods, respectively.

Ozone

Ground level ozone results from chemical reactions between VOCs and NOx in the presence of sunlight. Ozone is not a COPC for the project however representative background ozone levels are required to apply the OLM and calculate the maximum NO_2 concentrations from the predicted NOx concentrations.

Carbon Monoxide

CO is produced primarily through the incomplete combustion of fossil fuels. The representative 1-hour and 8-hour background CO concentrations for the project site for comparison to the MECP AAQC are 172.3 µg/m^3 and 169.5 µg/m^3, respectively. These are insignificant in comparison to the corresponding MECP AAQCs for CO of 36,200 µg/m^3 and 15,700 µg/m^3 for 1-hour and 8-hour averaging periods, respectively.

Particulate Matter

$PM_{2.5}$ is the fraction of SPM with aerodynamic diameters less than 2.5 µm. The MECP has adopted for their AAQC the 24-hour and annual CAAQS of 27 µg/m^3 and 8.8 µg/m^3, respectively. The representative 24-hour and annual background $PM_{2.5}$ concentrations for the project site are 16.2 µg/m^3 and 6.0 µg/m^3, respectively. These concentrations represent 60% and 68% of their respective CAAQS of 27.0 µg/m^3 and 8.8 µg/m^3.

PM_{10} is the fraction of SPM with aerodynamic diameters less than 10 µm. The representative 24-hour background PM_{10} concentration was estimated from the measured $PM_{2.5}$ concentration to be 20.9 µg/m^3, which is 42% of the MECP AAQC of 50 µg/m^3.

SPM is a measure of particulate matter, with aerodynamic diameters less than 44 µm, suspended in the air. The 24-hour and annual MECP AAQC for SPM is 120 µg/m^3 and 60 µg/m^3, respectively. The representative 24-hour and annual background SPM concentrations were estimated from the measured $PM_{2.5}$ concentrations to be 41.8 µg/m^3 and 24.9 µg/m^3, respectively, which are 35% and 41% the respective MECP AAQC.

Sulphur Dioxide

SO_2 is another combustion by-product that primarily occurs from the combustion of sulphur containing fossil fuels and is a major contributor to the formation of acid rain. The representative 1-hour and annual background SO_2 concentrations for the project site for comparison to the MECP AAQC are 2.7 µg/m^3 and 0.8 µg/m^3, respectively. These represent 3% and 8% of the corresponding MECP AAQCs for SO_2 of 106 µg/m^3 and 10.6 µg/m^3 for 1-hour and annual averaging periods, respectively.

Benzo(a)pyrene

BaP is a toxic air pollutant that is emitted from combustion sources as well as industrial processes. BaP is a PAH and is produced through incomplete combustion when organic materials are burned incompletely.

The representative 24-hour and annual background BaP concentrations for the project site for comparison to the MECP AAQC are 0.00004 µg/m^3 and 0.00002 µg/m^3, respectively. These represent 80% and 200% of the corresponding MECP AAQCs of 0.00005 µg/m^3 and 0.00001 µg/m^3, respectively.

3. Methodology

3.1 Atmospheric Emissions

3.1.1 COPC Emissions

Natural gas will be used to fuel the project combustion turbine generator and dew point heater. The combustion turbine generator is the most significant source of atmospheric emissions from the project. The natural gas supplied into the combustion turbine generator must be above a minimum pressure as defined by the combustion turbine generator manufacturer. If the gas delivered to the project site is below the minimum combustion turbine generator required pressure, electrically operated natural gas compressors will be run to raise the natural gas fuel to the required pressure. In addition to pressure, the temperature of the natural gas fuel must be above the dew point to prevent damage to the combustion turbine generator. Where the gas is required to be compressed, the compression process will generate the necessary heat to raise the temperature above the dew point. However, if the natural gas delivered to the project site does not need to be compressed and its temperature is below the dew point, then it must be heated to a temperature above the dew point by a natural gas fuelled dew point heater. The dew point heater may be required to run at any time throughout the year when the combustion turbine generator is operating.

As previously noted, the principal air quality constituents released during the operation of the project emission sources include standard products of combustion consisting mainly of water and CO_2 with lesser amounts of NOx and CO. Other constituents such as SO_2, particulate matter (SPM, PM_{10} and $PM_{2.5}$), metals, PAH and VOC are emitted in trace amounts.

For the project emission sources, emission rates of NOx, CO, and SPM for the combustion turbine generator were supplied by the manufacturer for startup, shutdown, and normal operations. The combustion turbine generator manufacturer has determined that typical operation of the combustion new turbine generator requires approximately 23 minutes for startup and 9 minutes for shutdown. SO_2 emissions from the project combustion turbine generator were estimated using the emission factor from the United States Environmental Protection Agency (U.S. EPA) AP-42 Chapter 3.2 - Natural Gas Engines. For the project dew point heater, emission factors were provided by the manufacturer for NOx, CO, SO_2, and SPM.

The project combustion turbine generator manufacturer provided an emission rate for PM_{10} but did not provide a breakdown of $PM_{2.5}$. Similarly, the project dew point heater manufacturer provided an emission rate for SPM but did not provide a breakdown of PM_{10} or $PM_{2.5}$. For the purposes of this assessment, it was conservatively assumed that all the particulate emitted from the significant on-site equipment is smaller than 2.5 microns (i.e., $PM_{2.5}$). This assumption represents an overestimate of $PM_{2.5}$ emissions and therefore a conservative assumption.

For the existing NGS emission sources, emission rates of NOx and CO for the combustion turbine generators were determined by analysing in-stack data from the continuous emission monitoring system (CEMS) for the 2021-2023 calendar years to identify the peak emission rates over a three-year period. The highest 1-hour emission rates recorded by the CEMS for the designated operating condition (i.e., startup, normal operation, and shutdown) were selected to represent the worst-case emissions. The CEMS data showed that peak CO emissions during startup/shutdown correspond to higher stack temperatures and flow rates. It was determined through modelling that CO emission rates that correspond with average or 'typical' startup/shutdown stack temperatures and flow rates, results in a higher predicted concentration, compared to peak CO emissions modelled with a higher stack temperature and flow rate. The 'typical' emission rates and stack conditions were therefore considered for the worst-case cumulative project scenario. SPM emission rates during startup, normal operation, and shutdown from the existing combustion turbine generators (inclusive of evaporative coolers and duct burners) are based on original equipment manufacturer specified emissions data. SO_2 emissions from the existing combustion turbine generators and duct burners were estimated using emission factors from U.S. EPA AP-42 Chapter 3.2 - Natural Gas Engines and Chapter 1.4 - Natural Gas Combustion, respectively.

Emission factors were provided by the original equipment manufacturer for the auxiliary boiler for CO, NOx, and SPM. SO_2 emission factors for the auxiliary boiler and CO, NOx, SPM and SO_2 emission factors for the existing dew point heater were estimated using emission factors from U.S. EPA AP-42 Chapter 1.4 - Natural Gas Combustion. The emissions of SPM released to the atmosphere from the wet portion of the cooling tower were estimated using ECCC guidance on particulate matter emissions from cooling towers.

Emission factors used to develop emission rates for metals, PAHs and VOCs from the various natural gas fuelled combustion equipment (existing and project related) were derived from the Canadian Energy Partnership for Environmental Innovation (CEPEI) 2022 Natural Gas Combustion Emissions Calculator (the Calculator) (Environment and Climate Change Canada, 2016). The Calculator is updated annually and was prepared to facilitate the calculation of air emissions from natural gas combustion for the natural gas industry and their customers in meeting the federal and provincial governments required reporting of annual releases for a range of substances. The Calculator includes only those constituents specific to the combustion of natural gas for select equipment types and was created to assist the natural gas customers, as well as the natural gas industry itself, develop accurate and consistent reporting of emissions to air related to natural gas use.

All applicable trace metals, PAHs and VOCs that were identified in the Calculator to be emitted from the various natural gas fuelled combustion equipment on-site were evaluated. However, with the exception cadmium, benzo(a)pyrene, ethylene, and propanal, all metals, PAHs and VOCs were determined to be insignificant through a screening analysis (detailed in **Attachment A**).

3.1.2 GHG Emissions

The combustion of any fossil fuel will result in the production of carbon dioxide (CO_2) which is the predominant GHG emitted from the existing NGS facility and the project. Small quantities of methane (CH_4) and nitrous oxide (N_2O) are also produced from fossil fuel combustion which have more significant global warming potential in comparison to CO_2.

Annual GHG emissions summarised in **Section 4.1.1** include projected emissions from existing NGS operations as well as projected emissions for the operations and maintenance phase of the project and are based on the verified 2023 GHG emissions and natural gas consumption for the existing NGS and the projected natural gas consumption for each calendar year up to and including the operations and maintenance phase of the project. As GHG emissions are linear to fuel consumption, the projected emissions in tonnes CO_2e are prorated from the verified 2023 emissions based on the projected natural gas consumption for existing NGS operations as well as the project.

3.1.3 Fugitive Releases

Fugitive emissions from the project were not assessed, as it was determined that there will be no significant fugitive emissions. The major source of fugitive particulate matter on industrial sites of this type is usually roads. The roads onsite will be paved or gravelled, well maintained, and vehicle movement will be minimal. Therefore, fugitive particulate emissions from the roads are considered negligible and were not included in this assessment.

The potential for fugitive chemical emissions is also low as the project will make use of the existing NGS chemical storage. The exception is CO_2 for firefighting purposes.

Natural gas is delivered to NGS via underground pipelines and as such there will be no storage of natural gas on site. All the natural gas used on-site will be odourised and thus any small leaks will be readily detected and repaired. During the normal operation of all existing NGS and project equipment all the natural gas is consumed. Continuous CO monitors detect any situations where the combustion process is non-ideal. During the startup of the combustion turbine generators, the pilots are always lit so there is no unburned natural gas. During the shutdown of the combustion turbine generators, there is a short section of pipe between the stop and control valves that vents a negligible amount of natural gas. The pilot lights are always on for all of the other natural gas combustion equipment so there is no unburned natural gas released during their startup or shutdown.

3.2 Assessment Scenarios

The project is expected to provide reliable capacity to Ontario's grid throughout the year and is designed to be dispatched independently from the existing NGS. The project may not be needed during lower electricity demand periods and therefore may be dormant for days at a time.

Based on similar simple cycle operations in Ontario, the project is expected to operate approximately 3% of the time on an annual basis, for an estimated 270 hours per year based on 60 starts per year at an average of 4 ½ hours per start. However, for the purposes of the ERR, a conservative operation scenario of 606 hours per year was considered based on the expected annual operations plus an additional two weeks of non-stop operation to support the Ontario electricity grid.

In order to assess the potential environmental effects from the project, eight different assessment scenarios were considered. Four of the scenarios consider project sources only (i.e., incremental project scenarios) and four of the scenarios consider project sources plus existing NGS sources and background air quality concentrations (i.e., cumulative project scenarios).

Combustion turbine generator emission rates vary by constituent and by operating mode and combustion turbine generator stack parameters (i.e., exhaust flow and temperature) vary by operating mode. The incremental and cumulative project scenarios were therefore designed to evaluate maximum worst-case (i.e., startup/shutdown) emissions as well as the highest emissions during normal operation, while considering the applicable stack parameters for each scenario. For example, 1-hour average CO emissions vary significantly for worst-case (i.e., startup/shutdown) and normal operation. Furthermore, modelling of project sources determined that the worst-case dispersion of the project combustion turbine generator stack occurs when the startup stack parameters are considered.

The following scenarios represent the cases used to develop the worst-case and normal operation incremental and cumulative project emission rates and applicable stack parameters. The worst-case and normal operation 1-hour incremental project scenarios are expected to occur 0.7% and 6.2% of the time, respectively, based on conservative estimates on an annual basis. For modelling purposes, however, the hourly emission rates for each project scenario were conservatively applied continuously in the modelling (i.e., 24 hours per day and 365 days per year) across 5 years of met data to determine worst-case concentrations.

Scenario 1 – Worst-Case 1-Hour Incremental Project Scenario

The worst-case 1-hour emission rates for the project would occur during an hour when the combustion turbine generator starts up and the dew point heater is operational under full load. The worst-case 1-hour incremental project scenario is defined as follows:

- Combustion turbine generator in startup for 23 minutes and full load for 37 minutes; and
- Dew point heater at full load.

Scenario 2 – Normal Operation 1-Hour Incremental Project Scenario

The normal operation 1-hour emission rates for the project would occur during an hour when the combustion turbine generator and dew point heater are operational under full load. The normal operation 1-hour incremental project scenario is defined as follows:

- Combustion turbine generator at full load; and
- Dew point heater at full load.

Scenario 3 – Worst-Case 24-Hour Incremental Project Scenario

The worst-case 24-hour emission rates for the project would occur during the potential two weeks of non-stop operation per year to support the Ontario electricity grid when the combustion turbine generator starts up and is operational under full load for the balance of the day and the dew point heater is conservatively assumed to operate continuously under full load. The worst-case 24-hour incremental project scenario is defined as follows:

- Combustion turbine generator in startup for 23 minutes and full load for 1,417 minutes; and
- Dew point heater at full load.

Scenario 4 – Worst-Case Annual Incremental Project Scenario

The worst-case annual emission rates for the project considers 606 hours of operation with 60 starts per year at an average of 4 1/2 hours per start plus an additional two weeks of non-stop operation to support the Ontario electricity grid. The normal operation annual incremental project scenario is defined as follows:

- Combustion turbine generator in startup for 23 hours, shutdown for 9 hours, and full load for 574 hours; and
- Dew point heater at full load for 606 hours.

Table 8 presents the project source emission rates used to develop the project scenarios studied.

Table 8: Project Source Emission Rates Used to Develop Incremental Project Scenarios

Constituent	CAS Number	Emission Rates (grams per second (g/s))			
		CTG-1C			DPH2
		Startup	Normal Operation	Shutdown	
NO_x	10102-44-0	28.3	28.1	28.9	0.0726
CO	630-08-0	855	11.4	612	0.0746
SPM[1]	-	0.986	0.869	0.680	0.00968
SO_2	7446-09-5	0.172	0.172	0.172	0.00141
Cd	7440-43-9	2.15E-05	2.15E-05	2.15E-05	2.17E-06
BaP	50-32-8	-	-	-	2.37E-09
Ethylene	74-85-1	1.50	1.50	1.50	0.00106
Propanal	123-38-6	0.0930	0.0930	0.0930	-

Notes:
CTG-1C = project combustion turbine generator
DPH2 = project dew point heater
[1] SPM = PM_{10} = $PM_{2.5}$

Since the project is within 100 km of the Canada-U.S. border (as noted in **Section 1.4.2**) the Canada-U.S. Air Quality Agreement requires notification if the project is expected to increase emissions by 40 tonnes or more per year of any one of the following constituents: SO_2, SPM, VOC, CO, and NOx (Environment and Climate Change Canada (ECCC), 2013). The maximum annual NOx and CO emissions are estimated to be greater than 40 tonnes per year and the project therefore requires notification.

Scenario 5 – Worst-Case 1-Hour Cumulative Project Scenario

The worst-case 1-hour cumulative project emissions would occur during an hour when the project combustion turbine generator starts up and the dew point heater is operational under full load. In addition, the two existing combustion turbine generators are also in startup and the existing auxiliary boiler and dew point heater are operational. The worst-case 1-hour cumulative project scenario is defined as follows:

Project emission sources:

- Combustion turbine generator in startup for 23 minutes and full load for 37 minutes; and
- Dew point heater at full load.

Existing NGS emission sources:

- Two combustion turbine generators in startup;
- Auxiliary boiler at full load; and
- Dew point heater at full load.

Scenario 6 – Normal Operation 1-Hour Cumulative Project Scenario

The normal operation 1-hour cumulative project emissions would occur during an hour when the project combustion turbine generator and dew point heater are operational under full load. In addition, the two existing combustion turbine generators are in normal operation and the and the existing auxiliary boiler and dew point heater are operational. The normal operation 1-hour cumulative project scenario is defined as follows:

Project emission sources:

- Combustion turbine generator at full load; and
- Dew point heater at full load.

Existing NGS emission sources:

- Two combustion turbine generators in normal operation;
- Auxiliary boiler at full load; and
- Dew point heater at full load.

Scenario 7 – Worst-Case 24-Hour Cumulative Project Scenario

The worst-case 24-hour cumulative project emissions would occur during the project's potential two weeks of non-stop operation per year to support the Ontario electricity grid when the combustion turbine generator starts up and is operational under full load for the balance of the day and the project dew point heater is conservatively assumed to operate continuously under full load. In addition, the two existing combustion turbine generators are in startup/shutdown for 9 hours and normal operation for 15 hours and the existing auxiliary boiler, dew point heater, and cooling tower[4] are operational. The worst-case 24-hour cumulative project scenario is defined as follows:

Project emission sources:

- Combustion turbine generator in startup for 23 minutes and full load for 1,417 minutes; and
- Dew point heater at full load.

Existing NGS emission sources:

- Two combustion turbine generators in startup for 9 hours and normal operation for 15 hours;
- Auxiliary boiler at full load;
- Dew point heater at full load; and
- Cooling tower at full load.

Scenario 8 – Worst-Case Annual Cumulative Project Scenario

The worst-case annual cumulative project emissions scenario considers 606 hours of operation for the project with 60 starts per year at an average of 4 1/2 hours per start plus an additional two weeks of non-stop operation to support the Ontario electricity grid. In addition, the two existing combustion turbine generators are in startup/shutdown for 9 hours per day and normal operation for 15 hours per day and the existing auxiliary boiler, dew point heater, and cooling tower are operational. The worst-case annual cumulative project scenario is defined as follows:

Project emission sources:

- Combustion turbine generator in startup for 23 hours, shutdown for 9 hours, and full load for 574 hours; and
- Dew point heater at full load for 606 hours.

Existing NGS emission sources:

- Two combustion turbine generators in startup for 9 hours per day and normal operation for 15 hours per day;
- Auxiliary boiler at full load;
- Dew point heater at full load; and
- Cooling tower at full load.

Table 9 presents the existing source emission rates used to develop the cumulative project scenarios studied.

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[4] *The cooling tower is not included in 1-hour cumulative scenarios as there is no 1-hour average criteria for the COPC emitted from this source.*

Table 9: Existing Source Emission Rates Used to Develop Cumulative Project Scenarios

Constituent	CAS Number	Emission Rates (g/s)						
		CTG-1A		CTG-1B		AUX	DPH1	CT
		Startup / Shutdown	Normal Operation	Startup / Shutdown	Normal Operation			
NOx	10102-44-0	18.8	15.5	18.8	15.5	0.437	0.0650	-
CO	630-08-0	800	77.3	800	77.3	0.485	0.109	-
SPM[1]	-	2.40	2.40	2.40	2.40	0.121	0.00247	0.362
SO_2	7446-09-5	0.174	0.174	0.174	0.174	0.00443	4.84E-04	-
Cd	7440-43-9	1.30E-04	1.30E-04	1.30E-04	1.30E-04	1.31E-05	1.43E-06	-
BaP	50-32-8	1.23E-07	1.23E-07	1.23E-07	1.23E-07	1.43E-08	1.56E-09	-
Ethylene	74-85-1	1.24	1.24	1.24	1.24	0.00639	6.98E-04	-
Propanal	123-38-6	0.0734	0.0734	0.0734	0.0734	-	-	-

Note:
CTG-1A and CTG-1B = existing combustion turbine generators
AUX = existing auxiliary boiler
DPH1 = existing dew point heater
CT = existing cooling tower
[1] SPM = PM_{10} = $PM_{2.5}$

3.3 Air Dispersion Modelling

Air dispersion modelling was completed using the CALMET/CALPUFF modelling system and following the MECP's Air Dispersion Modelling Guideline for Ontario (ADMGO) (Ontario Ministry of Environment, Conservation and Parks (MECP), 2017) to assess the effects of the NGS Expansion project. Specifically, CALMET version 6.5.0 (level 150223) and CALPUFF Version 7.21 (level 150618) were used.

CALMET is a meteorological model that produces hourly, three-dimensional gridded wind fields from available meteorological, terrain, and land use data. CALPUFF is a non-steady state puff dispersion model that utilises the CALMET wind fields and accounts for spatial changes in meteorology, variable surface conditions, and plume interactions with terrain and the water-land interface. CALPUFF is recommended in situations involving complex terrain and/or facilities near large bodies of water with very tall stacks and is a MECP recommended model in Ontario for use in such instances (Ontario Ministry of Environment, Conservation and Parks (MECP), 2017). All historical dispersion modelling for the existing NGS has been completed using the CALMET/CALPUFF modelling system, as approved by the MECP under sections 7(1) and 13(1) of O. Reg. 419/05.

3.3.1 Meteorology

At the request of the MECP and with permission provided by OPG, a CALMET meteorological data set developed for a five-year period (2014 to 2018) for the neighbouring LGS facility was used to run the CALPUFF dispersion model. The CALMET model was applied over a large modelling domain of 50 km in the east-west direction and 30 km in the south-north direction that includes the NGS property and surrounding area. CALMET was driven by the prognostic Weather Research and Forecasting (WRF) model outputs in M3D format and run with a horizontal resolution of 200 m. This fine resolution grid creates a more accurate representation of local wind patterns, temperature, and other meteorological variables that influence air dispersion.

3.3.2 Terrain and Land Use Data

Terrain and land-use data for the modelling domain were provided by the MECP in the form of seasonal geophysical data inputs required by CALMET. Terrain data used in modelling is shown in **Figure 3**, while **Figure 4** shows the land-use classifications over the modelling domain. At the direction of the MECP, terrain data were used to assign elevations to all modelled sources, buildings, and receptors.

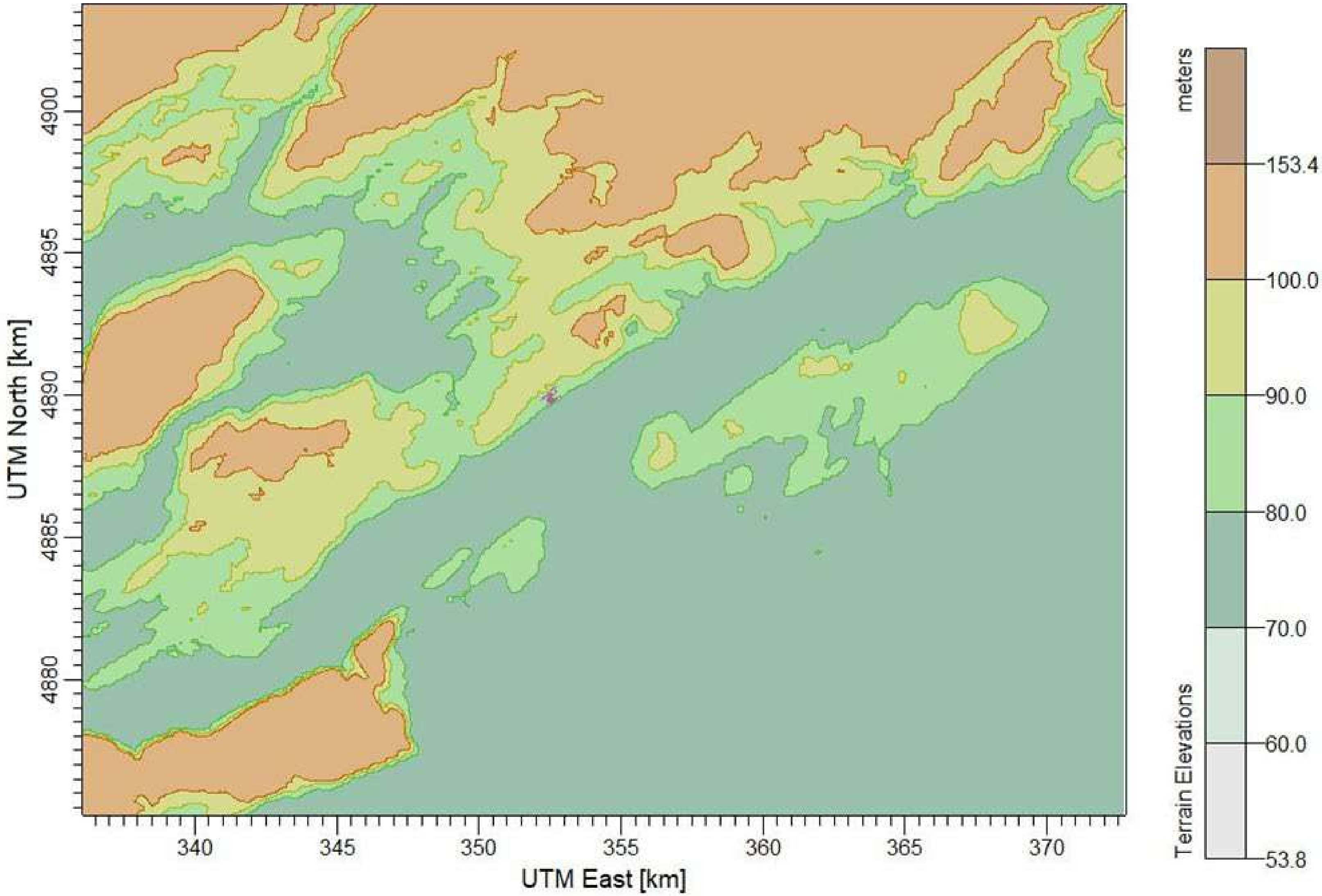

Figure 3: Terrain Data Used by CALMET

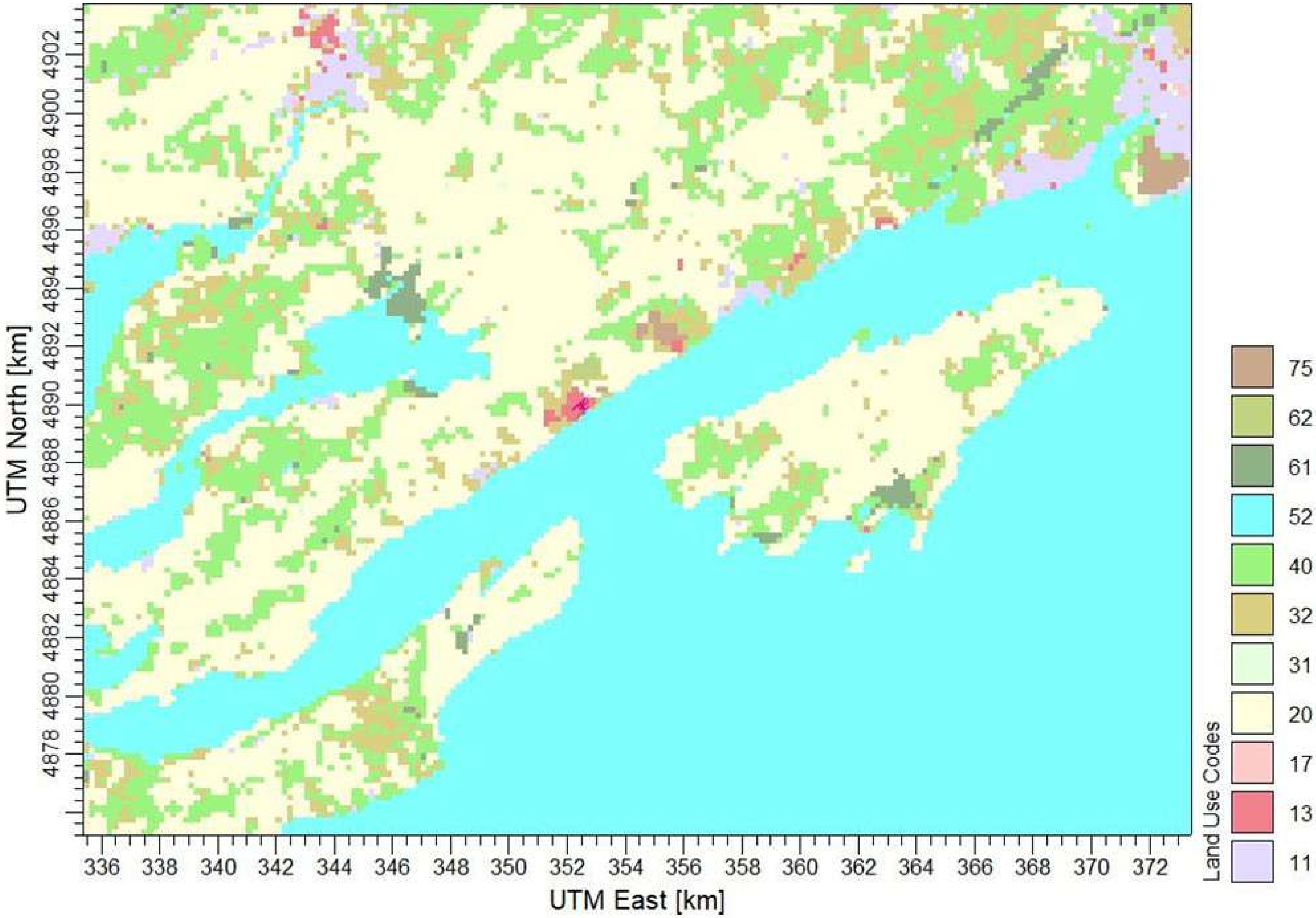

Figure 4: Land Use Data Used by CALMET

3.3.3 CALPUFF Setup

3.3.3.1 Modelling Domain and Grids

A nested receptor grid was created in accordance with Section 7.1 of the ADMGO and Section 14 of O. Reg. 419/05, as follows:

a) 20 m spacing, within an area of 200 m by 200 m from all modelled sources;
b) 50 m spacing, within an area surrounding the area described in (a) with a boundary at 300 m by 300 m outside the boundary of the area described in (a);
c) 100 m spacing, within an area surrounding the area described in (b) with a boundary at 800 m by 800 m outside the boundary of the area described in (a);
d) 200 m spacing, within an area surrounding the area described in (c) with a boundary at 1,800 m by 1,800 m outside the boundary of the area described in (a);
e) 500 m spacing, within an area surrounding the area described in (d) with a boundary at 4,800 m by 4,800 m outside the boundary of the area described in (a); and
f) 1,000 m spacing, within an area surrounding the area described in (e) for the remaining area of the model domain.

In addition to the nested grid receptors, receptors were placed every 10 m along the property boundary. Discrete sensitive receptors were also placed at the property boundaries of neighbouring homes, consistent with the acoustic assessment model. A total of four (4) sensitive receptors were included in the model (see **Table 10**) for a total of 4,609 receptor points in the model. The complete receptor grid is shown in **Figure 5**. As noted above, the terrain elevations for all receptors were assigned using the CALMET terrain data.

Table 10: Sensitive Receptors

Sensitive Receptor ID	Direction from Site	Universal Transverse Mercator (UTM) Coordinates	
		X (m)	Y (m)
Residential R1	South-West	351547.16	4888989.42
Residential R2	North-West	350366.86	4891509.92
Residential R3	East	353867.15	4890575.61
Residential R4	South-East	355582.28	4888849.30

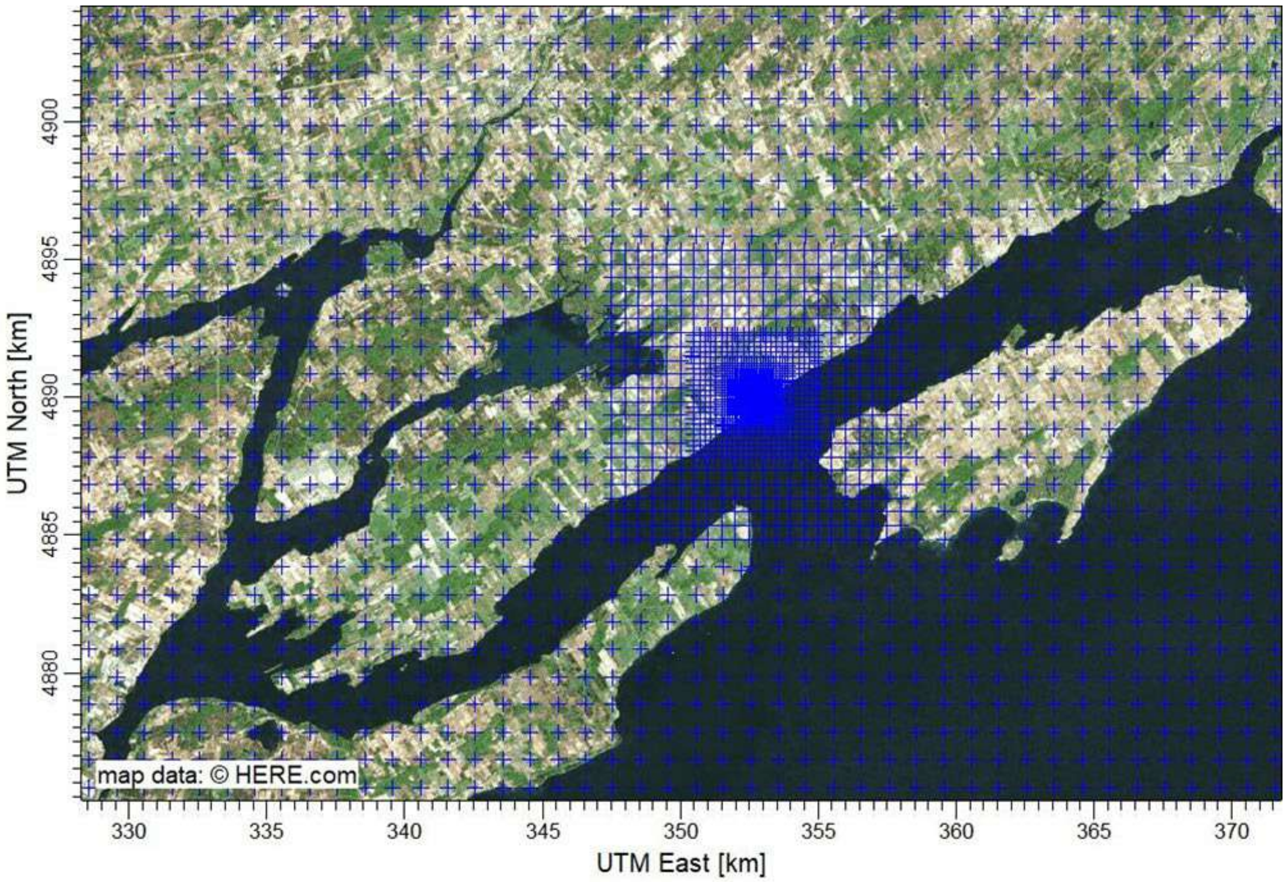

Figure 5: CALPUFF Air Dispersion Modelling Grid

3.3.3.2 Modelled Sources

All sources at the NGS and project site were modelled as point sources. The source layout for the existing NGS and the project is provided in **Figure 6**. As noted above, source elevations were assigned using the CALMET terrain data. **Table 11** lists the stack parameters for each modelled point source.

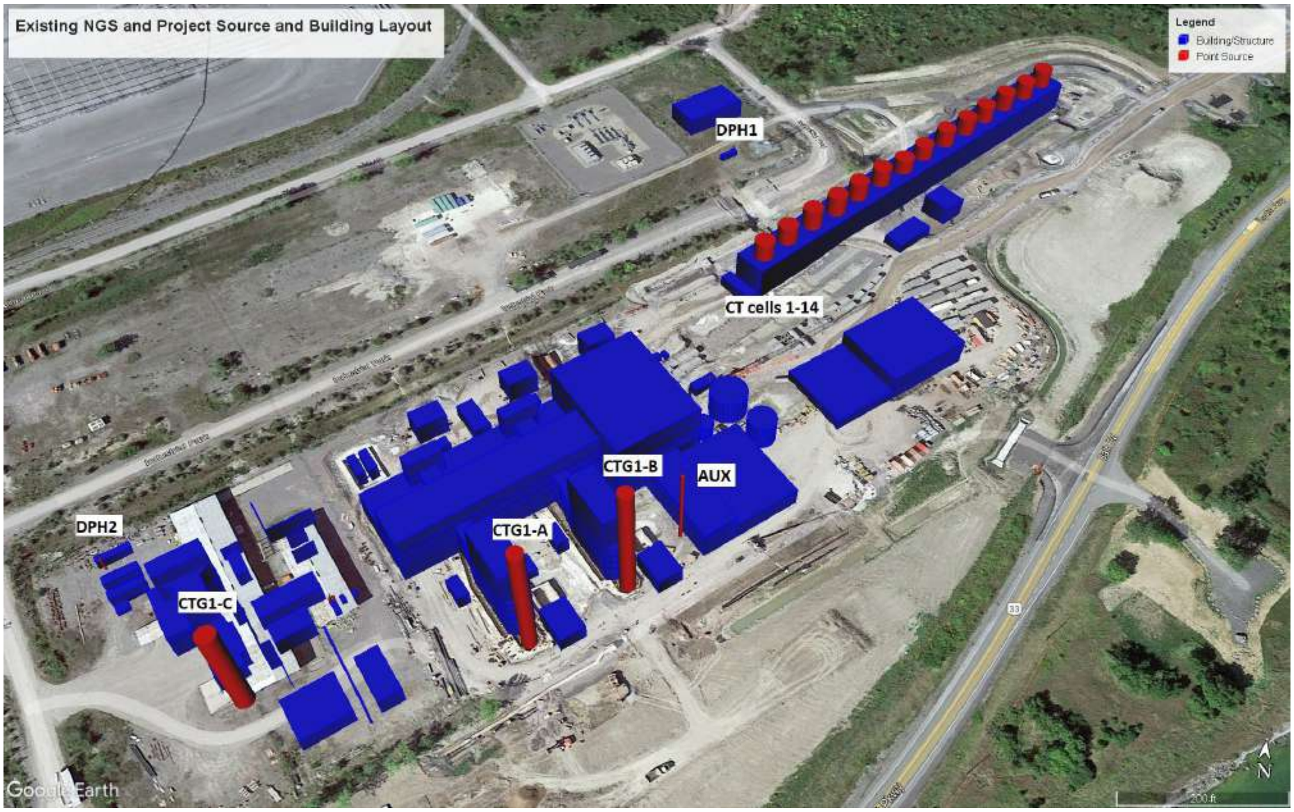

Figure 6: Source and Building Configuration Used for CALPUFF Modelling

Table 11: Modelled Source Parameters

Source Identifier	Source Description	Stack Parameters						
		Operating Condition	Stack Volumetric Flow Rate	Stack Exit Temperature	Stack Inner Diameter	Stack Height Above Grade	Source Coordinates	
			(m^3/s)	(°C)	(m)	(m)	UTM-x (m)	UTM-y (m)
CTG-1A	Main Turbine with evaporative cooler, duct burner and SCR	Startup/Shutdown	565	93.4	6.4	61.0	352668.4	4889878.5
		Normal	689	94.6				
CTG-1B	Main Turbine with evaporative cooler, duct burner and SCR	Startup/Shutdown	565	93.4	6.4	61.0	352702.7	4889905.3
		Normal	689	94.6				
CTG-1C	New simple cycle turbine, with evaporative cooler	Startup	318	418	7.47	47.2	352570.5	4889847.5
		Normal	2109	616				
		Shutdown	889	591				
AUX	Auxiliary boiler	Full load	40.9	148	1.7	40.0	352721.6	4889930.2
CT1	Cooling tower, cell 1	Full load	761	17.8	10.0	24.7	352751.7	4890080.4
CT2	Cooling tower, cell 2	Full load	761	17.8	10.0	24.7	352763.4	4890092.1
CT3	Cooling tower, cell 3	Full load	761	17.8	10.0	24.7	352775.1	4890103.6
CT4	Cooling tower, cell 4	Full load	761	17.8	10.0	24.7	352786.7	4890115.3
CT5	Cooling tower, cell 5	Full load	761	17.8	10.0	24.7	352798.4	4890127.0
CT6	Cooling tower, cell 6	Full load	761	17.8	10.0	24.7	352810.0	4890138.6
CT7	Cooling tower, cell 7	Full load	761	17.8	10.0	24.7	352821.6	4890150.2
CT8	Cooling tower, cell 8	Full load	761	17.8	10.0	24.7	352833.3	4890161.9
CT9	Cooling tower, cell 9	Full load	761	17.8	10.0	24.7	352844.8	4890173.6
CT10	Cooling tower, cell 10	Full load	761	17.8	10.0	24.7	352856.6	4890185.3
CT11	Cooling tower, cell 11	Full load	761	17.8	10.0	24.7	352868.1	4890196.8
CT12	Cooling tower, cell 12	Full load	761	17.8	10.0	24.7	352879.8	4890208.5
CT13	Cooling tower, cell 13	Full load	761	17.8	10.0	24.7	352891.5	4890220.0
CT14	Cooling tower, cell 14	Full load	761	17.8	10.0	24.7	352903.2	4890231.7
DPH1	Existing dew point heater	Full load	3.39	392	0.46	4.6	352735.7	4890168.9
DPH2	New dew point heater	Full load	2.56	177	0.86	7.5	352500.1	4889896.2

3.3.3.3 Building Downwash

The Plume Rise Model Enhancements (PRIME) algorithm was used in CALPUFF to simulate building wake and downwash effects on the dispersion of emissions from the modelled point sources. **Figure 6** shows the building layout of the existing NGS facility and the project that were used as inputs to the building profile input program (BPIP) that was used to generate the necessary PRIME parameters that form part of the CALPUFF model input file.

3.3.3.4 CALPUFF Settings and Switches

The key CALPUFF model settings and switches that were used in input groups 2 and 12 are summarised in **Table 12**. Where default options are not used, a rationale is provided.

Table 12: Key CALPUFF Model Options in Input Groups 1 and 12

Option	Parameter	Default	Selected	Comments
Vertical distribution used in the near field.	MGAUSS	1	1	Gaussian
Terrain adjustment method.	MCTADJ	3	3	Partial plume path adjustment.
Subgrid scale complex terrain module flag.	MCTSG	0	0	Not modelled
Near-field puffs modelled as elongated?	MSLUG	0	0	Slug model not used
Transitional Plume Rise modelled?	MTRANS	1	1	Transitional rise computed
Stack-tip downwash?	MTIP	1	1	Stack-tip downwash modelled
Method selected to compute plume rise for point sources not subject to downwash.	MRISE	1	1	Briggs plume rise
Method used to simulate building downwash?	MBDW	2	2	PRIME method
Vertical wind shear above stack top modelled in plume rise?	MSHEAR	0	1	Vertical wind shear modelled as recommended by the MECP.
Puff splitting allowed?	MSPLIT	0	1	Yes, puff splitting allowed. In long range transport, puff splitting may be necessary (Barclay & Scire, 2011) (British Columbia Ministry of Environment, 2015) (Lawrence, 2012).
Chemical Transformation Scheme.	MCHEM	1	0	No chemical transformation
Aqueous phase chemistry flag	MAQCHEM	0	0	Aqueous phase transformation not modelled. Used only if MCHEM = 6 or 7.

Option	Parameter	Default	Selected	Comments
Liquid Water Content flag	MLWC	1	1	MLWC = 1 is recommended if gridded cloud liquid water content data are available. Used only if MAQCHEM = 1.
Wet removal modelled?	MWET	1	0	Wet deposition not modelled
Dry deposition modelled?	MDRY	1	0	Dry deposition not modelled
Gravitational settling (plume tilt)?	MTILT	0	0	Plume tilt not modelled. Recommended for small combustion size particles less than 10 µm (Barclay & Scire, 2011) (British Columbia Ministry of Environment, 2015).
Methods used to compute the horizontal and vertical dispersion coefficients.	MDISP	3	2	Dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (u*, w*, L, etc.). Use of turbulence-based dispersion coefficients is recommended (Barclay & Scire, 2011) (British Columbia Ministry of Environment, 2015) (Lawrence, 2012).
Sigma measurements (σ_v/σ_θ, σ_w) from PROFILE.DAT used to compute σ_y, σ_z	MTURBVW	3	3	When measured sigmas are available, use observed σ_v/σ_θ, and σ_w from the PROFILE.DAT file to calculate σ_y and σ_z. Used only if MDISP =1 or 5.
Backup method to compute dispersion when measured turbulence data are missing.	MDISP2	3	3	Backup method is PG-based dispersion coefficients for RURAL areas when turbulence data are missing. Used only if MDISP=1 or 5.
Method used for Lagrangian time scale for σ_y	MTAULY	0	0	Lagrangian time scale (617.284 s). Only used when MDISP = 1 or 2.
Advective-Decay timescale for turbulence	MTAUADV	0	0	No turbulence advection
Method used to compute turbulence σv and σw profiles	MCTURB	1	1	Use standard CALPUFF subroutines
PG σy and σz adjusted for roughness?	MROUGH	0	0	No. Adjustment for surface roughness is not needed.
Partial plume penetration of elevated inversion?	MPARTL	1	1	Yes. Evaluate partial plume penetration into elevated inversions applied to point sources.
Partial plume penetration from buoyant area sources?	MPARTLBA	1	1	Yes. Model partial plume penetration into elevated inversions.

Option	Parameter	Default	Selected	Comments
Strength of temp inversion provided in PROFILE.DAT extended records?	MTINV	0	0	No. Computed from default gradients and upper air data.
Probability Distribution Function used for dispersion under convective conditions?	MPDF	0	1	Yes. Use if MDISP = 2 (turbulence-based dispersion coefficients).
Sub-grid TIBL module used for shoreline?	MSGTIBL	0	0	No. The sub-grid-scale TIBL option is not necessary for very fine resolution (Barclay & Scire, 2011). The CALMET grid resolution of 200 m is fine enough to resolve the land-water border sufficiently in the vicinity of the sources
Boundary conditions (concentration) modeled?	MBCON	0	0	No. Boundary conditions are not used.
Configure for FOG Model output?	MFOG	0	0	No. FOG model not run
Test options specified to see if they conform to regulatory values?	MREG	1	0	No checks are made. Not applicable to Ontario.
Minimum turbulence velocities, sigma v, and sigma w for each stability class over land and water	SVMIN SWMIN	σv =default σw = default	σv =default σw = default	Default values

3.3.4 Ozone Limiting Method

Emissions of NOx are comprised of NO and lesser amounts of NO_2. Over time, NO is converted to NO_2 through a series of chemical reactions in the atmosphere. Since the AAQC and CAAQS are based on NO_2, a conversion needs to be applied to the NOx predictions to estimate the NO_2 content, which is resolved using the OLM (Cole, 1979).

The OLM involves an initial comparison of the predicted NOx concentration and the ambient ozone concentration to determine which is the limiting factor to NO_2 formation. If the concentration of NOx is greater than the ozone concentration, then the formation of NO_2 is limited by the ambient ozone concentrations.

The following equation was used to calculate NO_2 levels based on modelled NOx concentrations:

NO_2 = ISR × NOx + the lesser of (O_3 or (ER - ISR) × NOx) + background NO_2

Where ISR refers to the in-stack ratio of NO_2 to NOx, and ER refers to the equilibrium ratio.

The OLM assumes that a portion of the NOx emissions are generated as NO_2. The remaining NOx emissions are assumed to be in the form of NO, which reacts with ambient levels of ozone to form additional NO_2.

The OLM method is recommended by the U.S. EPA (U.S. EPA, 2014) as one of Tier 3 methods of estimating concentrations of NO_2. An ISR of 0.50 was used in the assessment for all project sources which is the U.S. EPA recommended default when no source specific data are available (U.S. EPA, 2015). The choice of 0.5 for the ISR is conservative for most sources and is a reasonable default to insure model results do not underpredict potential source impacts. The background ozone levels used in the OLM calculations were summarised in **Table 7**.

3.3.5 Visible Plumes, Fogging, and Icing from Combustion Turbine Generator Stack

One of the major combustion products of natural gas is water. The water produced from the combustion of natural gas has the potential to result in a visible plume from the combustion turbine generator stack during the colder winter months and some other weather conditions. Observations at other natural gas-fired generating stations indicate that the plumes from the combustion turbine generator stack typically rise high into the air, are typically cloud-like, and meander with wind direction. However, due to the height of the stacks as well as the plume rise due to temperature and momentum, these plumes typically do not come down to ground level, and as such there are no concerns anticipated regarding icing and fogging on Highway 33 due to emissions from the combustion turbine generator stack. The project combustion turbine generator stack will not tie into the existing NGS cooling tower therefore there is no change to the cooling tower plume.

In addition, a yellowish plume will sometimes be visible during the early part of the startup phase. The yellow colour is caused by elevated NO_2 concentrations in the plume at this time. These elevated NO_2 emissions were included in the air dispersion model to assess the effect on local ground level concentrations.

4. Potential Effects, Mitigation Measures, Residual Net Effects

4.1 Potential Effects

4.1.1 Annual GHG Emissions

As described in **Section 3.1.2**, annual GHG emissions are prorated from the verified 2023 emissions based on the projected natural gas consumption for existing NGS operations as well as the project. The GHG assessment considers two scenarios: expected annual operations of 270 hours per year based on 60 starts at an average of 4 ½ hours per start, and worst-case operations of 606 hours per year based on expected annual operations plus an additional two weeks of non-stop operation to support the Ontario electricity grid. The estimated annual GHG emissions are shown in **Table 13** for existing NGS operations, the expected project scenario (i.e., 270 hours annual run time), and the worst-case project scenario (i.e., 606 hours annual run time). **Table 13** also shows the percent increase in emissions from the projected emissions for the existing NGS for each project scenario and calendar year. The maximum increase of CO_2e emissions due to the project is estimated to be 3.8% and 8.5% for the expected and worst-case project scenarios, respectively.

Section 7.10 of the ERR considers the anticipated GHG emissions from the project and evaluates the project's impacts on climate change as well as impacts of climate change on the project.

Table 13: Estimated Annual GHG Emissions

	2023[1]	2024	2025	2026	2027	2028	2029	2030	2031
Existing NGS									
Natural Gas Consumption (m^3)	590,061,762	746,877,947	688,665,644	755,350,516	816,478,911	828,696,837	782,657,157	775,263,478	726,136,578
CO_2e Emissions (Mt)	1.160	0.806	0.786	0.833	1.148	1.002	1.044	1.044	1.069
Project (NGS Expansion) – Expected Scenario (270 hours per year)									
Natural Gas Consumption (m^3)	-	-	-	-	-	27,408,767	27,408,767	27,408,767	27,408,767
CO_2e Emissions (Mt)	-	-	-	-	-	0.054	0.054	0.054	0.054
CO_2e % Increase	-	-	-	-	-	3.3%	3.5%	3.5%	3.8%
Project (NGS Expansion) – Worst-Case Scenario (606 hours per year)									
Natural Gas Consumption (m^3)	-	-	-	-	-	61,517,455	61,517,455	61,517,455	61,517,455
CO_2e Emissions (Mt)	-	-	-	-	-	0.121	0.121	0.121	0.121
CO_2e % Increase	-	-	-	-	-	7.4%	7.9%	7.9%	8.5%

Note:
[1] Existing NGS verified 2023 GHG Emissions Report

Estimated Annual GHG Emissions (continued)

	2032	2033	2034	2035	2036	2037	2038	2039	2040
Existing NGS									
Natural Gas Consumption (m^3)	859,322,345	875,596,119	828,678,488	778,817,697	857,925,053	882,078,856	864,601,547	738,188,708	806,085,797
CO_2e Emissions (Mt)	1.689	1.721	1.629	1.531	1.686	1.734	1.700	1.451	1.585
Project (NGS Expansion) – Expected Scenario (2704,150 hours per year)									
Natural Gas Consumption (m^3)	27,408,767	27,408,767	27,408,767	27,408,767	27,408,767	27,408,767	27,408,767	27,408,767	27,408,767
CO_2e Emissions (Mt)	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054
CO_2e % Increase	3.2%	3.1%	3.3%	3.5%	3.2%	3.1%	3.2%	3.7%	3.4%
Project (NGS Expansion) – Worst-Case Scenario (606 hours per year)									
Natural Gas Consumption (m^3)	61,517,455	61,517,455	61,517,455	61,517,455	61,517,455	61,517,455	61,517,455	61,517,455	61,517,455
CO_2e Emissions (Mt)	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121
CO_2e % Increase	7.2%	7.0%	7.4%	7.9%	7.2%	7.0%	7.1%	8.3%	7.6%

Note:
[1] Existing NGS verified 2023 GHG

4.1.2 Modelling Results

The CALPUFF air dispersion model was run for each of the assessment scenarios described in **Section 3.2** to determine the maximum predicted ground-level concentrations for each COPC and applicable averaging periods included in the assessment.

4.1.2.1 Incremental Project Scenarios

Table 14 summarises the maximum predicted incremental COPC concentrations from the worst-case incremental project scenarios (Scenarios 1, 3, and 4) as well as the normal operation incremental project scenarios (Scenario 2) in comparison to the MECP AAQC. Meteorological anomalies were eliminated per the ADMGO from the maximum predicted 1-hour NO_2 concentrations before comparing to the air quality criteria. The maximum predicted 1-hour average incremental concentrations of NO_2 and CO for the worst-case project scenario are 20% and 11% of the applicable criteria, respectively (Scenario 1) and the maximum predicted 24-hour average incremental concentration of NO_2 is 10% of the applicable criteria (Scenario 3). In comparison, the maximum predicted 1-hour average incremental concentrations of NO_2 and CO for the normal operation project scenario (Scenario 2) are 10% and 0.2% of the applicable criteria, respectively. Maximum predicted incremental concentrations for all other COPC and averaging periods are less than 10% of the applicable MECP criteria for all incremental project scenarios (Scenarios 1 to 4).

Table 15 summarises the maximum predicted incremental concentrations at the four sensitive receptors (see **Section 3.3.3.1**) for the COPC and averaging periods with maxima that are greater than 10% of the applicable criteria in **Table 14**. Specifically, maximum incremental concentrations of 1-hour NO_2 and CO and 24-hour NO_2 are presented for the worst-case project scenarios (Scenarios 1 and 3). At 5.2%, 1-hour NO_2 has the highest predicted incremental concentration at the sensitive receptors relative to its applicable criterion.

Similarly, contour plots for the COPC and averaging periods with maxima greater than 10% of the applicable criteria have been created. **Figure 7** and **Figure 8** show the maximum incremental concentrations of 1-hour NO_2 for the worst-case and normal operation scenario, respectively while the worst-case 24-hour NO_2 concentrations are presented in **Figure 9**. Finally, the worst-case 1-hour CO concentrations are presented in **Figure 10**. In general, the contour plots show that maxima presented in **Table 14** occur at or near the west or north property boundary of the project and within the lands occupied by LGS. Additionally, the figures show that concentrations drop off quickly with distance from the project site and are substantially lower at the sensitive receptors.

Table 16 summarises the maximum predicted incremental concentrations of NO_2, $PM_{2.5}$, and SO_2 from the project in comparison to the CAAQS. The maximum predicted 1-hour average incremental concentrations of NO_2 are 23% for both the worst-case and normal operation scenarios. The maximum predicted incremental concentrations for $PM_{2.5}$ and SO_2 for the worst-case scenarios are less than 10% of the CAAQS for all averaging periods. A contour plot of the maximum predicted incremental concentrations of 1-hour NO_2 in comparison to the CAAQS is presented in **Figure 11** for the worst-case scenario.

Table 14: Comparison of Maximum Predicted Incremental Concentrations to MECP AAQC

Constituent	CAS Number	Averaging Period	Scenario[1]	MECP AAQC[2]	Maximum Incremental Concentration[3,4]		UTM Coordinates of Maximum Location	
					Conc. (µg/m³)	% of Criteria	X (km)	Y (km)
Worst-Case Incremental Project Scenarios								
NO_2	10102-44-0	1-Hour	1	400	79.1	20%	352.433	4890.180
		24-Hour	3	200	19.6	10%	352.507	4889.877
CO	630-08-0	1-Hour	1	36,200	3865	11%	352.511	4889.953
		8-Hour	1	15,700	688	4.4%	352.505	4889.961
SPM	N/A	24-Hour	3	120	2.6	2.2%	352.507	4889.877
		Annual	4	60	0.02	0.04%	352.493	4889.939
PM_{10}	N/A	24-Hour	3	50	2.6	5.2%	352.507	4889.877
$PM_{2.5}$	N/A	24-Hour	3	27	2.1	7.6%	352.507	4889.877
		Annual	4	8.8	0.02	0.2%	352.493	4889.939
SO_2	7446-09-5	10-Minute	1	178	2.4	1.4%	352.498	4889.906
		1-Hour	1	106	1.5	1.4%	352.498	4889.906
		Annual	4	10.6	0.003	0.03%	352.493	4889.939
Cd	7440-43-9	24-Hour	3	0.025	0.001	2.3%	352.507	4889.877
		Annual	4	0.01	0.000005	0.05%	352.493	4889.939
BaP	50-32-8	24-Hour	3	0.00005	0.000001	1.3%	352.507	4889.877
		Annual	4	0.00001	0.00000001	0.05%	352.493	4889.939
Ethylene	74-85-1	24-Hour	3	40	0.3	0.8%	352.493	4890.220
Propanal	123-38-6	10-Minute	1	10	0.7	6.9%	352.511	4889.953
Normal Operation Incremental Project Scenarios								
NO_2	10102-44-0	1-Hour	2	400	40.4	10%	352.393	4890.180
CO	630-08-0	1-Hour	2	36,200	77.2	0.2%	352.498	4889.906
		8-Hour	2	15,700	23.2	0.1%	352.507	4889.877

Notes:
[1] Scenario 1: CTG-1C modelled assuming 23 minutes of startup and 37 minutes of normal operation plus DPH2 at full load over a one hour period.
Scenario 2: CTG-1C modelled assuming continuous normal operation plus DPH2 at full load over a one hour period.
Scenario 3: CTG-1C modelled assuming 23 minutes of startup and 1,417 minutes of normal operation plus DPH2 at full load over a twenty-four hour period.
Scenario 4: CTG-1C modelled assuming 23 hours of startup, 9 hours of shutdown, and 574 hours of normal operation plus DPH2 at full load for 606 hours over a one year period.
[2] Ontario's Ambient Air Quality Criteria (https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria)
[3] Meteorological anomalies were not removed with the exception of worst-case and normal 1-hour NO_2 modelling results
[4] $PM_{2.5}$ (24-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual avg) statistical form: the 3-year average of the annual average of the daily 24-hour average concentrations

Table 15: Comparison of Maximum Predicted Incremental Concentrations at Sensitive Receptors to MECP AAQC

Constituent	CAS Number	Averaging Period	Scenario[1]	MECP AAQC[2]	R1 Maximum Incremental Concentration[3]		R2 Maximum Incremental Concentration[3]		R3 Maximum Incremental Concentration[3]		R4 Maximum Incremental Concentration[3]	
					Conc. (µg/m³)	% of Criteria	Conc. (µg/m³)	% of Criteria	Conc. (µg/m³)	% of Criteria	Conc. (µg/m³)	% of Criteria
Worst-Case Incremental Project Scenarios												
NO_2	10102-44-0	1-Hour	1	400	20.7	5.2%	14.9	3.7%	19.5	4.9%	15.7	3.9%
		24-Hour	3	200	1.2	0.6%	1.8	0.9%	2.6	1.3%	0.5	0.2%
CO	630-08-0	1-Hour	1	36,200	629	1.7%	342	0.9%	589	1.6%	472	1.3%

Notes:
[1] Scenario 1: CTG-1C modelled assuming 23 minutes of startup and 37 minutes of normal operation plus DPH2 at full load over a one hour period.
Scenario 3: CTG-1C modelled assuming 23 minutes of startup and 1,417 minutes of normal operation plus DPH2 at full load over a twenty-four hour period.
[2] Ontario's Ambient Air Quality Criteria (https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria).
[3] Meteorological anomalies were not removed with the exception of 1-hour NO_2 modelling results.

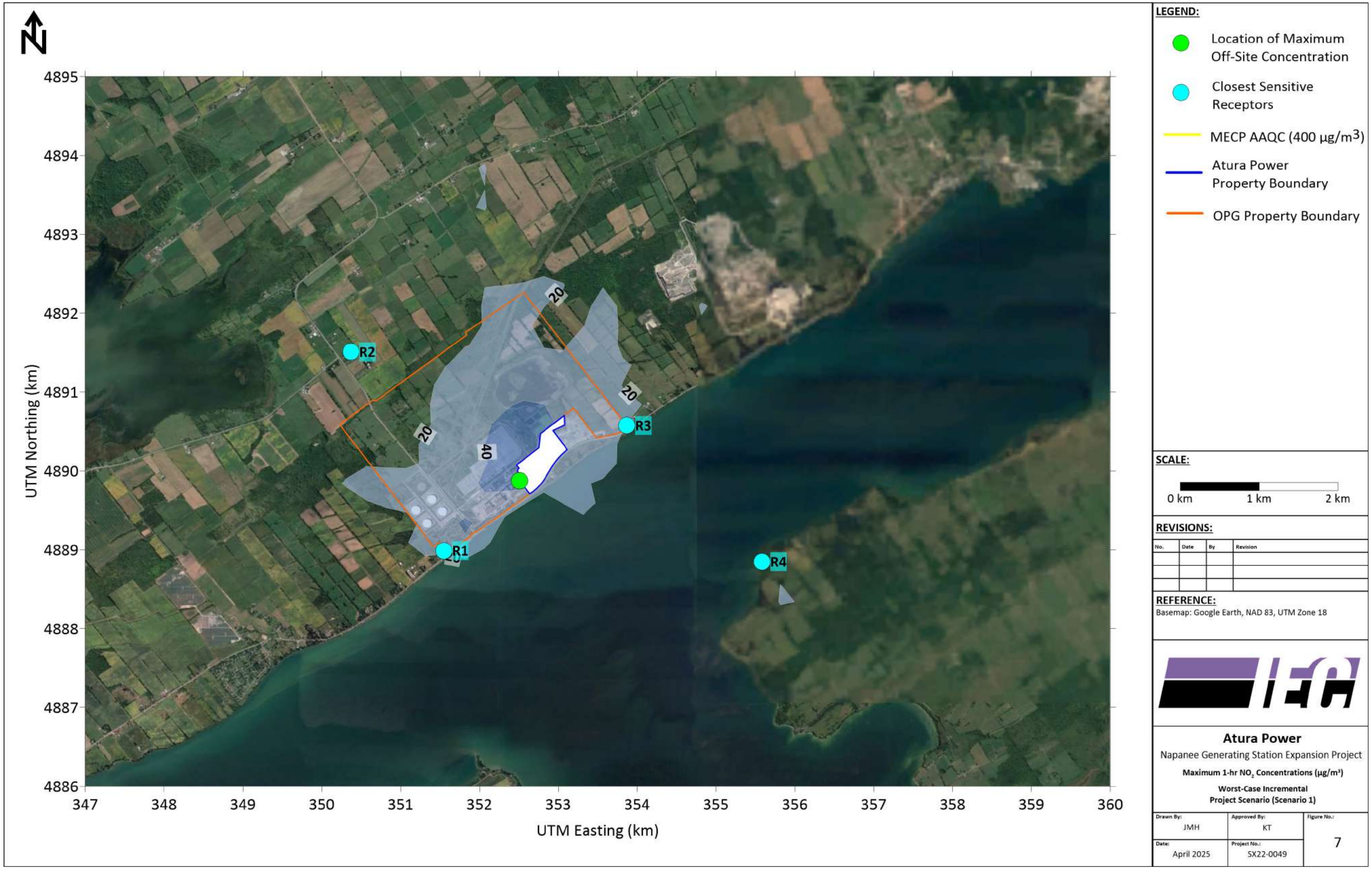

Figure 7: Maximum Worst-Case Incremental 1-Hour NO_2 Concentrations (AAQC)

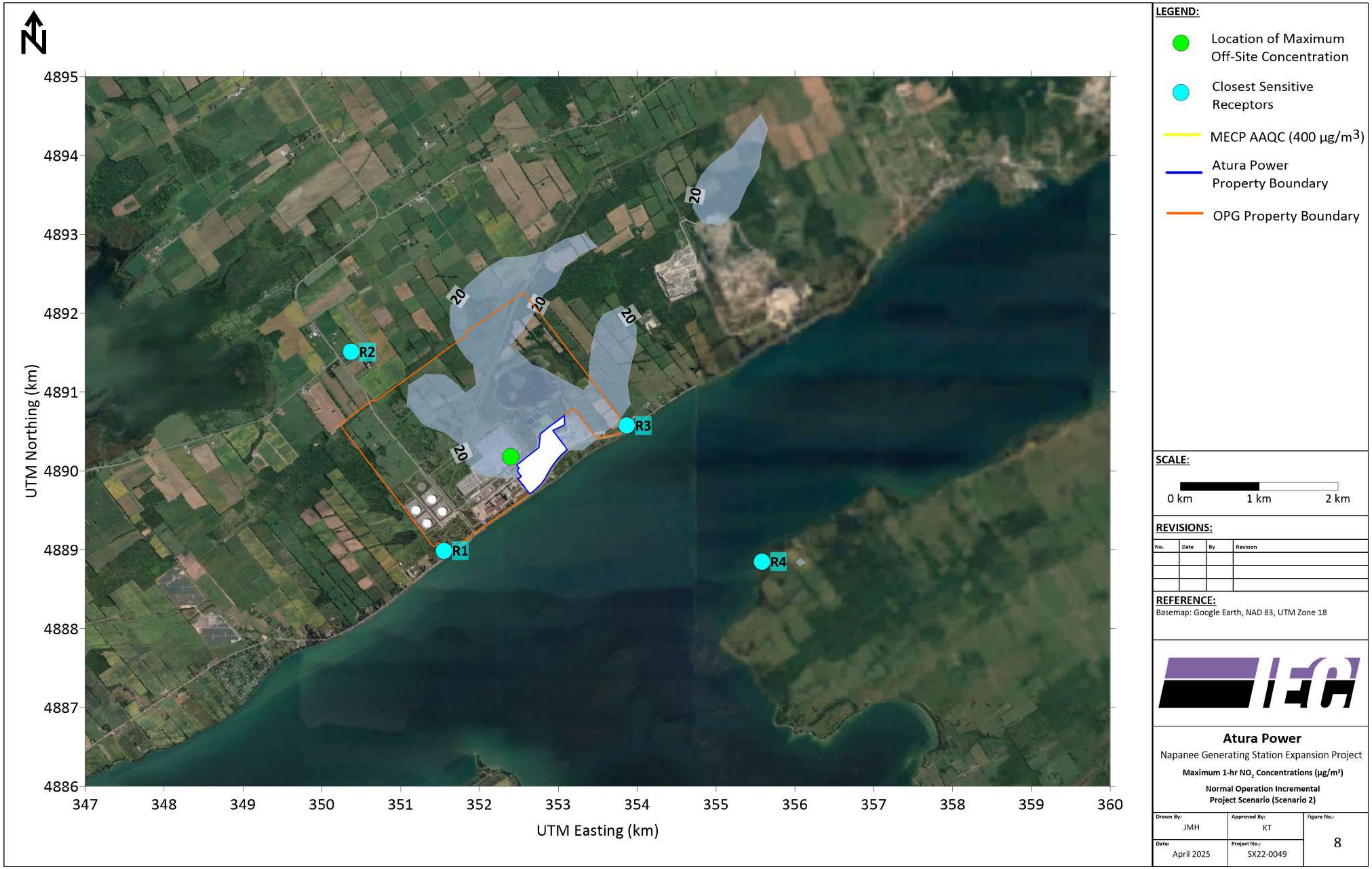

Figure 8: Maximum Normal Operation Incremental 1-Hour NO_2 Concentrations (AAQC)

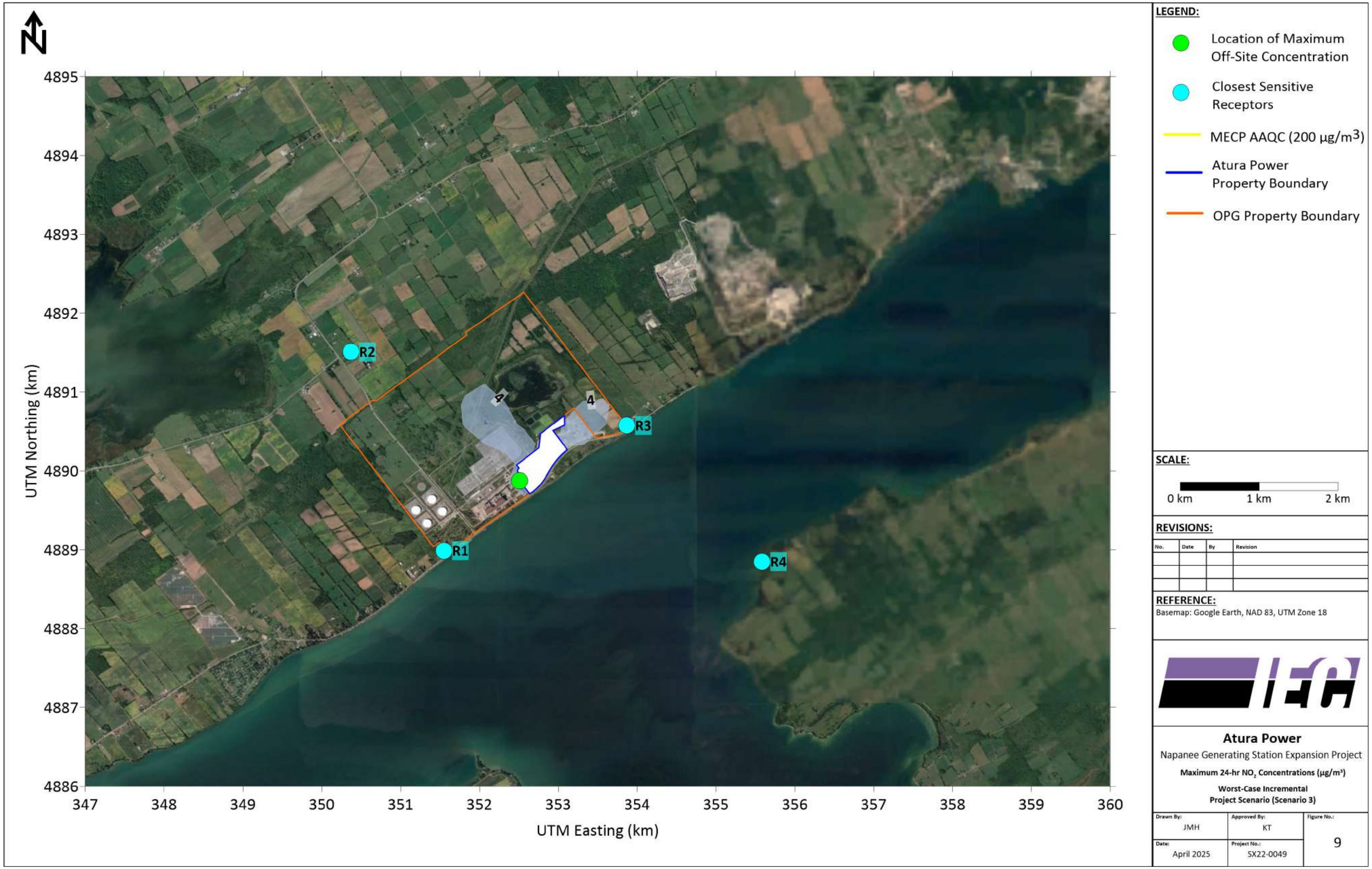

Figure 9: Maximum Worst-Case Incremental 24-Hour NO_2 Concentrations (AAQC)

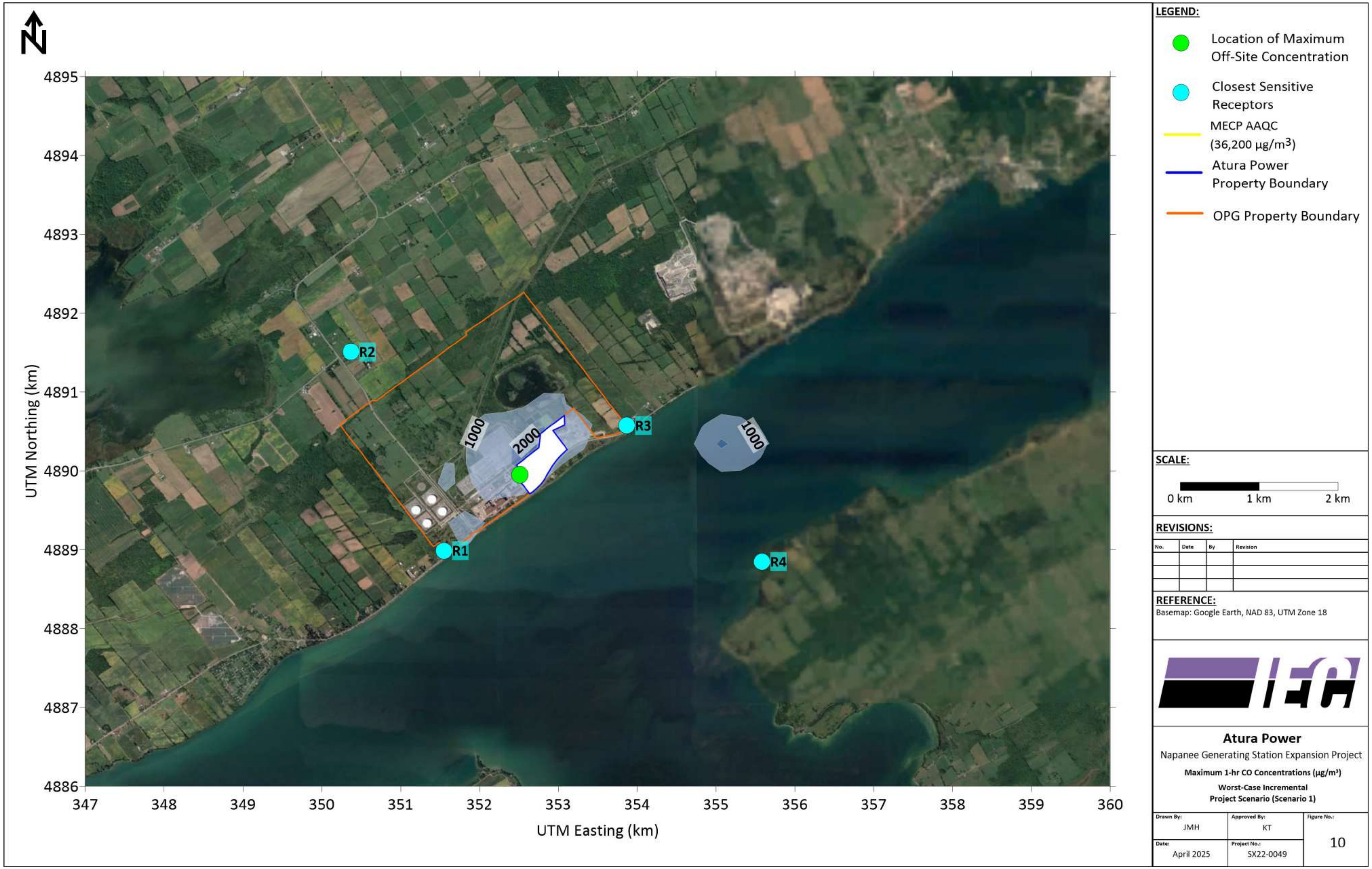

Figure 10: Maximum Worst-Case Incremental 1-Hour CO Concentrations (AAQC)

Table 16: Comparison of Maximum Predicted Incremental Concentrations to CAAQS

Constituent	CAS Number	Averaging Period	Scenario[1]	CAAQS[2]	Maximum Incremental Concentration[3]		UTM Coordinates of Maximum Location	
					Conc. ($\mu g/m^3$)	% of Criteria	X (km)	Y (km)
Worst-Case Incremental Project Scenarios								
NO_2	10102-44-0	1-Hour	1	80.3	18.6	23%	352.507	4889.877
		Annual	4	23.0	0.16	0.7%	352.493	4889.939
$PM_{2.5}$	N/A	24-Hour	3	27.0	2.1	7.6%	352.507	4889.877
		Annual	4	8.8	0.02	0.2%	352.493	4889.939
SO_2	7446-09-5	1-Hour	1	173	0.4	0.2%	352.507	4889.877
		Annual	4	10.6	0.003	0.03%	352.493	4889.939
Normal Operation Incremental Project Scenario								
NO_2	10102-44-0	1-Hour	2	80.3	18.6	23%	352.507	4889.877

Notes:
[1] Scenario 1: CTG-1C modelled assuming 23 minutes of startup and 37 minutes of normal operation plus DPH2 at full load over a one hour period.
Scenario 2: CTG-1C modelled assuming continuous normal operation plus DPH2 at full load over a one hour period.
Scenario 3: CTG-1C modelled assuming 23 minutes of startup and 1,417 minutes of normal operation plus DPH2 at full load over a twenty-four hour period.
Scenario 4: CTG-1C modelled assuming 23 hours of startup, 9 hours of shutdown, and 574 hours of normal operation plus DPH2 at full load for 606 hours over a one year period.
[2] Canadian Ambient Air Quality Standards (https://ccme.ca/en/air-quality-report#slide-7)
[3] NO_2 (1-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
NO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average concentrations
$PM_{2.5}$ (24-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual avg) statistical form: the 3-year average of the annual average of the daily 24-hour average concentrations
SO_2 (1-hour avg) statistical form: the 3-year average of the annual 99th percentile of the SO2 daily maximum 1-hour average concentrations
SO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average SO2 concentrations

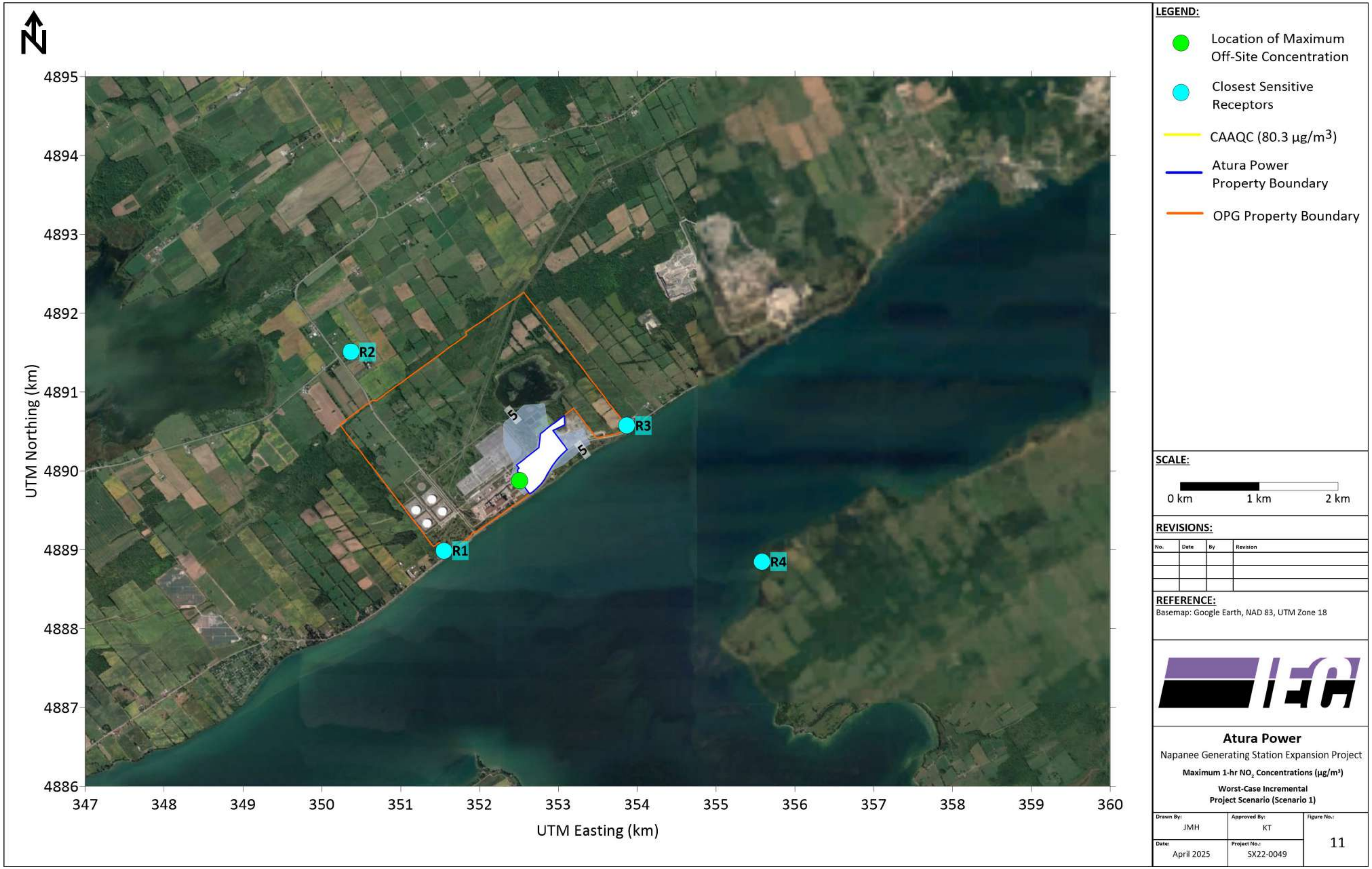

Figure 11: Maximum Worst-Case Incremental 1-Hour NO_2 Concentrations (CAAQS)

4.1.2.2 Cumulative Project Scenarios

For the assessment of cumulative air quality effects, it is necessary to add the incremental contribution attributed to the project to the contribution of the existing NGS operations plus appropriate background concentrations (see **Section 2.2.3)** to establish total predicted COPC concentrations.

Table 17 summarises the maximum predicted cumulative COPC concentrations from the worst-case cumulative project scenarios (Scenarios 5, 7, and 8) as well as the normal operation cumulative project scenarios (Scenario 6) in comparison to the MECP AAQC. Meteorological anomalies were eliminated per the ADMGO from the maximum predicted 1-hour NO_2 concentrations before comparing to the air quality criteria. The maximum predicted 1-hour average cumulative concentrations of NO_2 and CO are 55% and 92% of the applicable criteria, respectively (Scenario 5). In comparison, the maximum predicted 1-hour average cumulative concentrations of NO_2 and CO from the normal operation scenario (Scenario 6) are 42% and 4.3%, respectively. The significant decrease in the maximum predicted 1-hour CO concentration from the worst-case to normal operation scenario highlights the decreased emissions following startup when the natural gas combustion is more complete. The maximum predicted 24-hour average cumulative concentration of NO_2 and the maximum 8-hour average cumulative concentration of CO are 18% and 27% of the applicable criteria, respectively.

The BaP AAQC is very stringent, and in some instances the background concentrations are greater than this limit. This is the case for the NGS site where, as noted in **Section 2.2.3**, the 24-hour and annual background concentrations of BaP represent 80% and 200% respectively of the corresponding MECP AAQCs. The maximum predicted concentration of BaP without background (i.e., incremental contribution attributed to the project plus the contribution of the existing NGS operations) are well within the 24-hour and annual average criteria at 1.3% and 0.3%, respectively. The predicted exceedance of the annual AAQC is due to the fact that the existing background concentration in the region is already above the corresponding AAQC, while the incremental contribution attributed to the project in addition to the contribution of the existing NGS operations is negligible.

The maximum predicted cumulative SPM, PM_{10} and $PM_{2.5}$ concentrations for the worst-case scenarios (Scenarios 7 and 8) range from 40% (for 24-hour SPM) to 77% (for annual $PM_{2.5}$) of the applicable criteria. The maximum predicted 10-minute cumulative concentration of propanal for the worst-case scenario (Scenario 5) is 50% of the applicable criteria. The maximum predicted cumulative concentrations of SO_2, Cd, and ethylene for the worst-case scenarios (Scenarios 5, 7, and 8) are less than 10% of applicable criteria for all averaging periods.

Table 18 summarises the maximum predicted cumulative concentrations at the four sensitive receptors (see **Section 3.3.3.1**) for the COPC and averaging periods with maxima that are greater than 10% of the applicable criteria in **Table 17**. Specifically, maximum cumulative concentrations of 1-hour NO_2 and CO, and 24-hour NO_2 are presented for the worst-case scenarios (Scenarios 6 and 8). At 20%, 1-hour NO_2 has the highest predicted cumulative concentration at the sensitive receptors relative to its applicable criterion.

In addition to the tabular results, contour plots of the maximum predicted cumulative concentrations of 1-hour NO_2 for the worst-case scenario and the normal operation are also presented in **Figure 12** and **Figure 13**, respectively, while the worst-case 24-hour NO_2 and worst-case 1-hour CO concentrations are presented in **Figure 14** and **Figure 15**, respectively. The maximum predicted cumulative concentration plots also show that maxima presented in **Table 17** occur at the west and north property boundary. Concentrations drop off quickly with distance from the project site and are substantially lower at the sensitive receptors.

Table 19 summarises the maximum predicted cumulative COPC concentrations of NO_2, $PM_{2.5}$, and SO_2 in comparison to the CAAQS. The maximum predicted 1-hour average cumulative concentrations of NO_2 are 107% and 102% of the CAAQS for the worst-case and normal operation scenarios, respectively (Scenarios 5 and 6). The maximum predicted cumulative $PM_{2.5}$ and SO_2 concentrations for the worst-case scenarios (Scenarios 5, 7, and 8) range from 8.2% (for annual SO_2) to 77% (for annual $PM_{2.5}$) of the applicable CAAQS.

A contour plot of the maximum predicted cumulative concentrations of 1-hour NO_2 in comparison to the CAAQS is presented in **Figure 16** for the worst-case scenario (Scenario 5). The contour plot shows that the predicted exceedance of the 1-hour average NO_2 CAAQS extends beyond the east and north property boundary and outside of the LGS lands. However, as discussed in **Section 2.2.3**, the 1-hour background NO_2 concentration of 62.7 $\mu g/m^3$ in comparison to the CAAQS represents 78% of the applicable criterion. In comparison, the maximum predicted concentrations for NGS represent 29% and 24% of applicable criteria for the worst-case and normal operation scenarios, respectively. Also, as discussed in **Section 2.2.2**, the selected background concentrations from the MECP monitoring stations are likely overly conservative to characterise the project site.

It should also be noted that maximum predictions occur during worst-case meteorological conditions within the meteorological data set which must occur simultaneously with the worst-case scenario (i.e., existing NGS and project combustion turbine generators all in startup) for the maximum modelled concentrations to occur. This absolute maximum concentration occurs only at a single location only once in five years of meteorological data. For all other locations and at all other times, the concentration will be less.

Table 17: Comparison of Maximum Predicted Cumulative Concentrations to MECP AAQC

Contaminant	CAS Number	Averaging Period	Scenario[1]	MECP AAQC[2]	Maximum Cumulative Concentration[3,4]				UTM Coordinates of Maximum Location	
					Background Conc. (µg/m³)	NGS Conc. (µg/m³)	Total Conc. (µg/m³)	% of Criteria	X (km)	Y (km)
Worst-Case Cumulative Project Scenarios										
NO_2	10102-44-0	1-Hour	5	400	15.3	205	221	55%	352.393	4890.439
		24-Hour	7	200	13.6	22.5	36.2	18%	352.830	4890.516
CO	630-08-0	1-Hour	5	36200	172	32999	33171	92%	352.529	4889.930
		8-Hour	5	15700	170	4125	4294	27%	352.529	4889.930
SPM	N/A	24-Hour	7	120	41.8	5.7	47.6	40%	352.983	4890.145
		Annual	8	60	24.9	0.8	25.7	43%	352.967	4890.125
PM_{10}	N/A	24-Hour	7	50	20.9	5.7	26.6	53%	352.983	4890.145
$PM_{2.5}$	N/A	24-Hour	7	27	16.2	3.5	19.8	73%	352.971	4890.130
		Annual	8	8.8	6.0	0.8	6.8	77%	352.967	4890.125
SO_2	7446-09-5	10-Minute	5	178	4.5	11.8	16.3	9.1%	352.529	4889.930
		1-Hour	5	106.4	2.7	7.2	9.9	9.3%	352.529	4889.930
		Annual	8	10.6	0.8	0.01	0.8	7.7%	352.725	4890.273
Cd	7440-43-9	24-Hour	7	0.025	n/a	0.001	0.001	2.3%	352.507	4889.877
		Annual	8	0.01	n/a	0.00003	0.00003	0.3%	352.730	4890.277
BaP	50-32-8	24-Hour	7	0.00005	0.00004	0.000001	0.00004	81%	352.507	4889.877
		Annual	8	0.00001	0.00002	0.00000003	0.00002	200%	352.730	4890.277
Ethylene	74-85-1	24-Hour	7	40	n/a	1.6	1.6	4.1%	352.838	4890.522
Propanal	123-38-6	10-Minute	5	10	n/a	5.0	5.0	50%	352.529	4889.930
Normal Operation Cumulative Project Scenarios										
NO_2	10102-44-0	1-Hour	6	400	15.3	151	166	42%	352.718	4890.268
CO	630-08-0	1-Hour	6	36200	172	1395	1567	4.3%	352.752	4890.294
		8-Hour	6	15700	170	291	460	2.9%	352.846	4890.528

Contaminant	CAS Number	Averaging Period	Scenario[1]	MECP AAQC[2]	Maximum Cumulative Concentration[3,4]				UTM Coordinates of Maximum Location	
					Background Conc. (µg/m³)	NGS Conc. (µg/m³)	Total Conc. (µg/m³)	% of Criteria	X (km)	Y (km)

Notes:
[1] Scenario 5: Existing sources CTG-1A and CTG-1B modelled assuming continuous startup operation plus existing sources AUX and DPH at full load over a one hour period. Expansion source CTG-1C modelled assuming 23 minutes of startup and 37 minutes of normal operation plus expansion source DPH2 at full load over a one hour period.
Scenario 6: Existing sources CTG-1A and CTG-1B modelled assuming continuous normal operation plus existing sources AUX and DPH at full load over a one hour period. Expansion source CTG-1C modelled assuming continuous normal operation plus expansion source DPH2 at full load over a one hour period.
Scenario 7: Existing sources CTG-1A and CTG-1B modelled assuming 9 hours of startup/shutdown and 15 hours of normal operation plus existing sources AUX, DPH and CT1-CT14 at full load over a twenty-four hour period. Expansion source CTG-1C modelled assuming continuous normal operation plus DPH2 at full load over a twenty-four hour period.
Scenario 8: Existing sources CTG-1A and CTG-1B modelled assuming 9 hours per day of startup/shutdown and 15 hours per day of normal operation plus existing sources AUX, DPH and CT1-CT14 at full load over a one year period. Expansion source CTG-1C modelled assuming 23 hours of startup, 9 hours of shutdown, and 574 hours of normal operation plus expansion source DPH2 at full load for 606 hours over a one year period.
[2] Ontario's Ambient Air Quality Criteria (https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria)
[3] Meteorological anomalies were not removed with the exception of worst-case and normal 1-hour NO_2 modelling results
[4] $PM_{2.5}$ (24-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual avg) statistical form: the 3-year average of the annual average of the daily 24-hour average concentrations

Table 18: Comparison of Maximum Predicted Cumulative Concentrations at Sensitive Receptors to MECP AAQC

Constituent	CAS Number	Averaging Period	Scenario[1]	MECP AAQC[2]	R1 Maximum Incremental Concentration[3]		R2 Maximum Incremental Concentration[3]		R3 Maximum Incremental Concentration[3]		R4 Maximum Incremental Concentration[3]	
					Conc. (µg/m³)	% of Criteria	Conc. (µg/m³)	% of Criteria	Conc. (µg/m³)	% of Criteria	Conc. (µg/m³)	% of Criteria
Worst-Case Cumulative Project Scenarios												
NO_2	10102-44-0	1-Hour	5	400	68.2	17%	60.7	15%	71.2	18%	80.7	20%
		24-Hour	7	200	4.2	2.1%	5.1	2.6%	7.1	3.5%	3.8	1.9%
CO	630-08-0	1-Hour	5	36,200	2,620	7.2%	2,553	7.1%	4,127	11%	3,200	8.8%

Notes:

[1] Scenario 5: Existing sources CTG-1A and CTG-1B modelled assuming continuous startup operation plus existing sources AUX and DPH at full load over a one hour period. Expansion source CTG-1C modelled assuming 23 minutes of startup and 37 minutes of normal operation plus expansion source DPH2 at full load over a one hour period.
Scenario 7: Existing sources CTG-1A and CTG-1B modelled assuming 9 hours of startup/shutdown and 15 hours of normal operation plus existing sources AUX, DPH and CT1-CT14 at full load over a twenty-four hour period. Expansion source CTG-1C modelled assuming continuous normal operation plus DPH2 at full load over a twenty-four hour period.

[2] Ontario's Ambient Air Quality Criteria (https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria)

[3] Meteorological anomalies were not removed with the exception of 1-hour NO_2 modelling results

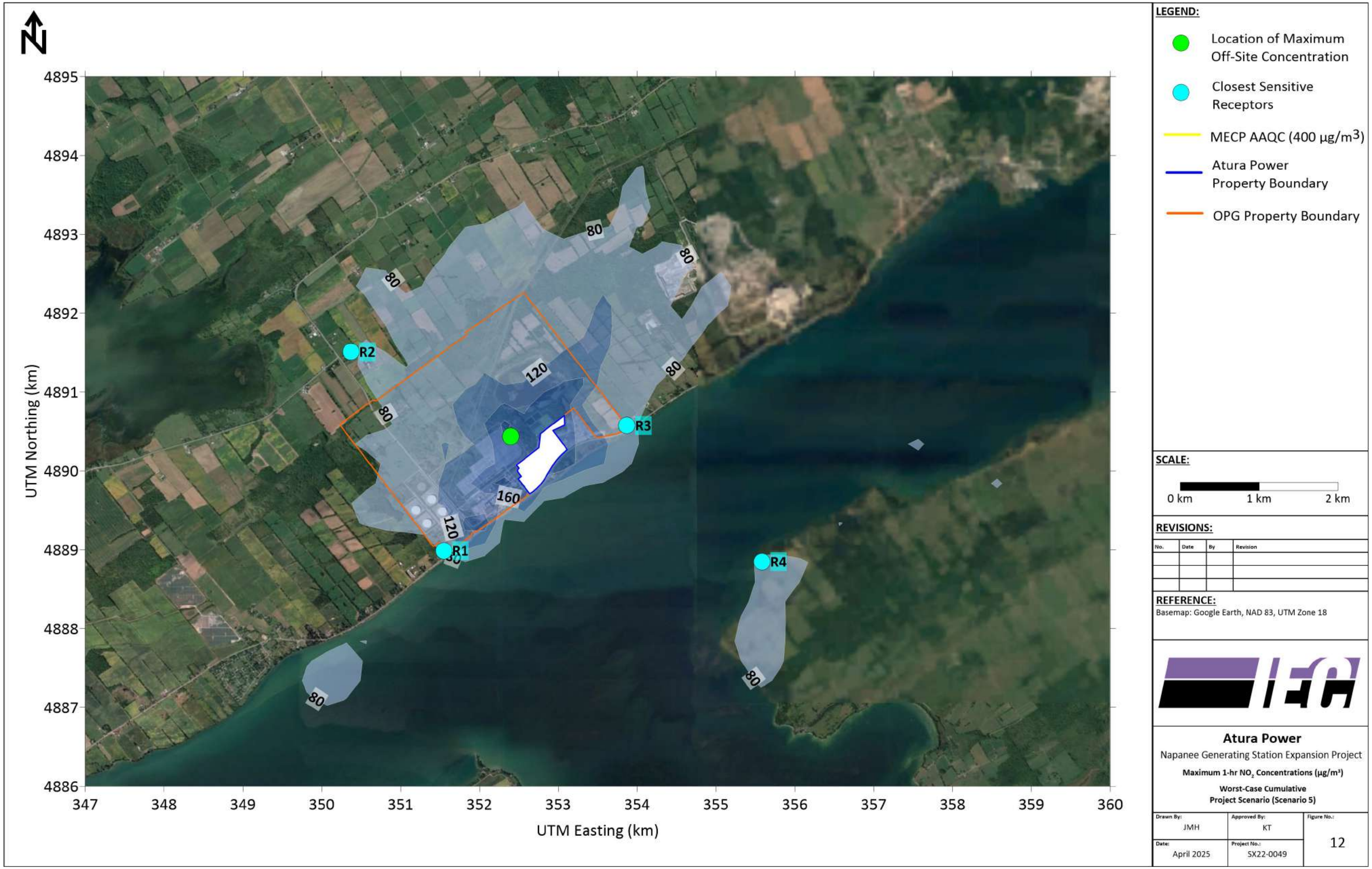

Figure 12: Maximum Worst-Case Cumulative 1-Hour NO_2 Concentrations (AAQC)

Figure 13: Maximum Normal Operation Cumulative 1-Hour NO_2 Concentrations (AAQC)

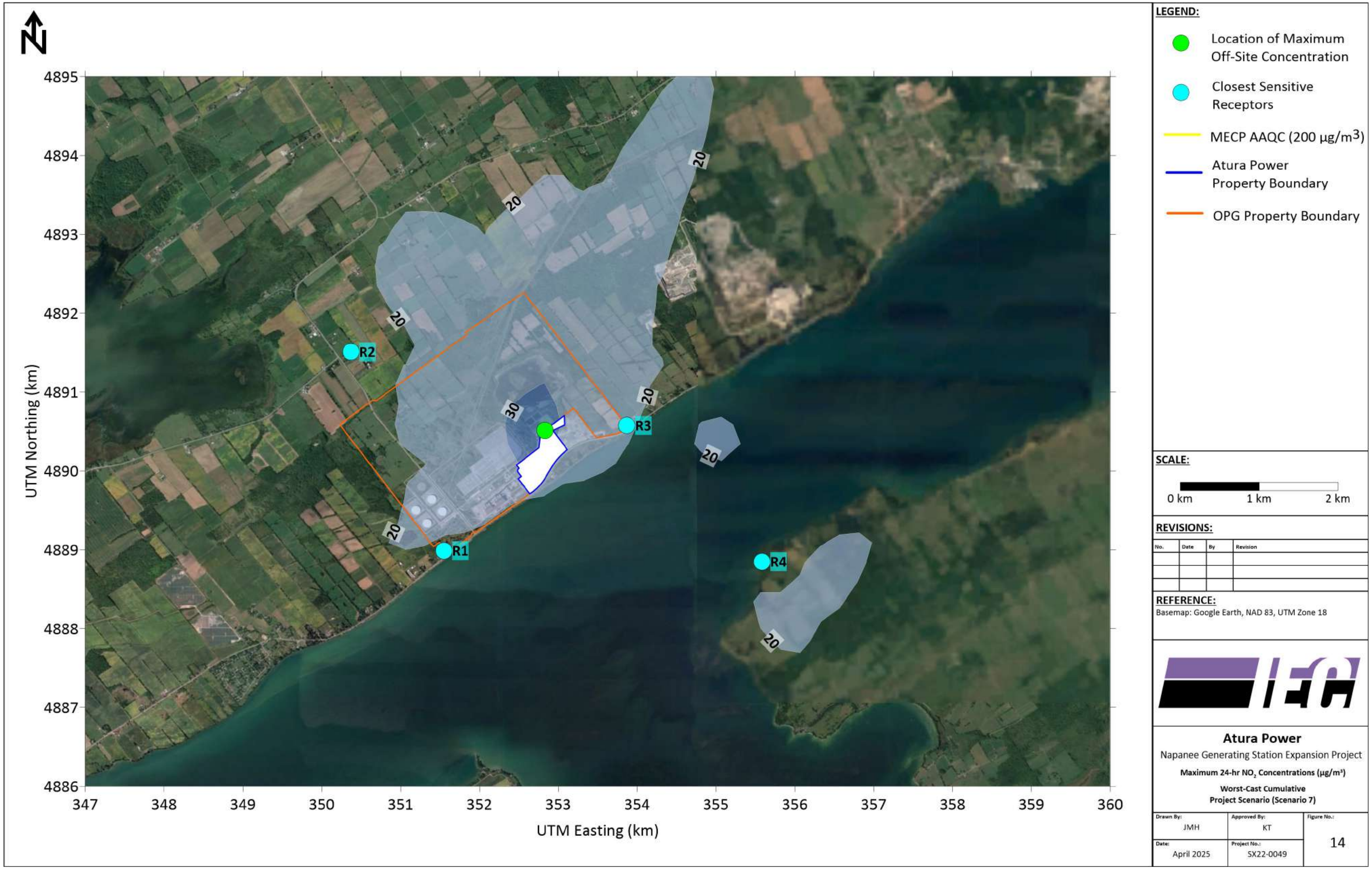

Figure 14: Maximum Worst-Case Cumulative 24-Hour NO_2 Concentrations (AAQC)

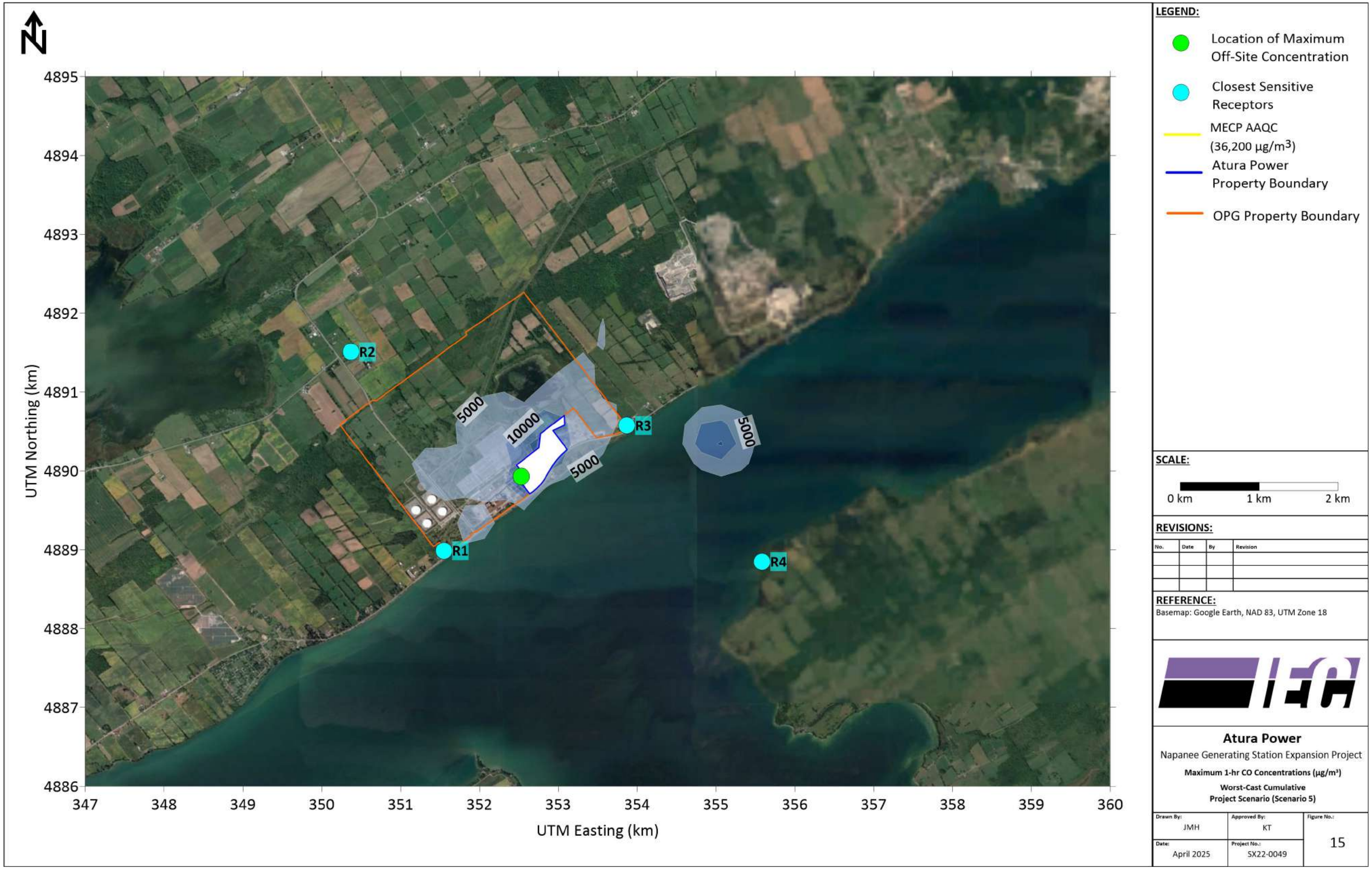

Figure 15: Maximum Worst-Case Cumulative 1-Hour CO Concentrations (AAQC)

Table 19: Comparison of Maximum Predicted Cumulative Concentrations to CAAQS

Constituent	CAS Number	Averaging Period	Scenario[1]	CAAQS[2] (µg/m³)	Maximum Cumulative Concentration[3]				UTM Coordinates of Maximum Location	
					Background Conc. (µg/m³)	NGS Conc. (µg/m³)	Total Conc. (µg/m³)	% of Criteria	X (km)	Y (km)
Maximum Cumulative Project Scenarios										
NO_2	10102-44-0	1-Hour	5	80	62.7	23.2	85.8	107%	352.693	4890.399
		Annual	8	23.0	7.3	1.6	8.9	39%	352.725	4890.273
$PM_{2.5}$	N/A	24-Hour	7	27	16.2	3.5	19.8	73%	352.971	4890.130
		Annual	8	8.8	6.0	0.8	6.8	77%	352.967	4890.125
SO_2	7446-09-5	1-Hour	5	173	32.0	2.6	34.6	20%	352.556	4890.143
		Annual	8	10.6	0.8	0.08	0.9	8.2%	352.725	4890.273
Normal Operation Cumulative Project Scenarios										
NO_2	10102-44-0	1-Hour	6	80	62.7	19.0	81.6	102%	352.507	4889.877

Notes:
[1] Scenario 5: Existing sources CTG-1A and CTG-1B modelled assuming continuous startup operation plus existing sources AUX and DPH at full load over a one hour period. Expansion source CTG-1C modelled assuming 23 minutes of startup and 37 minutes of normal operation plus expansion source DPH2 at full load over a one hour period.
Scenario 6: Existing sources CTG-1A and CTG-1B modelled assuming continuous normal operation plus existing sources AUX and DPH at full load over a one hour period. Expansion source CTG-1C modelled assuming continuous normal operation plus expansion source DPH2 at full load over a one hour period.
Scenario 7: Existing sources CTG-1A and CTG-1B modelled assuming 9 hours of startup/shutdown and 15 hours of normal operation plus existing sources AUX, DPH and CT1-CT14 at full load over a twenty-four hour period. Expansion source CTG-1C modelled assuming continuous normal operation plus DPH2 at full load over a twenty-four hour period.
Scenario 8: Existing sources CTG-1A and CTG-1B modelled assuming 9 hours per day of startup/shutdown and 15 hours per day of normal operation plus existing sources AUX, DPH and CT1-CT14 at full load over a one year period. Expansion source CTG-1C modelled assuming 23 hours of startup, 9 hours of shutdown, and 574 hours of normal operation plus expansion source DPH2 at full load for 606 hours over a one year period.
[2] Canadian Ambient Air Quality Standards (https://ccme.ca/en/air-quality-report#slide-7)
[3] NO_2 (1-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
NO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average concentrations
$PM_{2.5}$ (24-hour avg) statistical form: the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual avg) statistical form: the 3-year average of the annual average of the daily 24-hour average concentrations
SO_2 (1-hour avg) statistical form: the 3-year average of the annual 99th percentile of the SO2 daily maximum 1-hour average concentrations
SO_2 (annual avg) statistical form: the average over a single calendar year of all 1-hour average SO2 concentrations

Figure 16: Maximum Worst-Case Cumulative 1-Hour NO_2 Concentrations (CAAQS)

4.2 Mitigation Measures

To reduce the potential effects of dust emissions during the construction phase, the use of industry standard best practices will be implemented as identified in the CEMP. Measures may include use of well-maintained construction equipment, effective dust suppression techniques (e.g., on-site watering, and limiting the speed of vehicles travelling on unpaved surfaces) in addition to adherence to the practices and procedures outlined in the document "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo Services Inc., 2005). The use of an electric fleet of construction equipment will be considered to the extent possible.

The air quality assessment has determined that no mitigation is required for the operations and maintenance phase of the project. The maximum predicted cumulative project concentrations for the COPC did not exceed any applicable air quality criteria at any location except for annual BaP and 1-hour NO_2, which were above the applicable MECP AAQC and CAAQS, respectively. However, the maximum predicted concentration of BaP attributed to NGS is only 0.3% of the applicable MECP AAQC and the predicted exceedance is due to the fact that the existing baseline concentration in the region is already above the corresponding AAQC. The project contribution is therefore considered negligible, and no mitigation measures are required.

The maximum predicted cumulative concentration of 1-hour NO_2 is 107% of the CAAQS. The predicted exceedance of the 1-hour average NO_2 CAAQS extends beyond the east and north property boundary and outside of the LGS lands. However, as discussed in **Section 2.2.3**, the 1-hour background NO_2 concentration of 62.7 µg/m³ in comparison to the CAAQS represents 78% of the applicable criterion. Furthermore, as discussed in **Section 2.2.2**, the selected background concentrations from the MECP monitoring stations are likely overly conservative to characterise the project site. It should also be noted that CAAQS are intended to be used as indicators to help manage regional air quality and drive the improvement of air quality across Canada. CAAQS are established to work with regional air quality management systems (AQMS) to control and monitor air quality at the regional level but not intended to be directly applied to individual facilities (Canadian Council of Ministers of the Environment, 2025) or the compliance of individual facilities.

In accordance with MECP guidelines for end-of stack emission limits from stationary combustion turbines, emissions of NOx and CO from the project combustion turbine generator will be continuously monitored through the CEMS to verify compliance with applicable limits. No additional mitigation measures are anticipated.

4.3 Net Effects

During the operations phase, additional COPC emissions to existing conditions are expected but are considered to be in accordance with applicable MECP AAQC and CAAQS. Given that the project is also subject to MECP requirements and future approval, effects of air emissions are considered to be negligible.

5. Conclusion

An air quality assessment was completed that modelled the operations and maintenance phase of the project. Conservative emissions inventories were developed for existing NGS and project emission sources using emission rates supplied by the manufacturer where available or published emission factors and calculation methods. The predictive modelling was completed using the CALPUFF modelling system, a non-steady state puff dispersion model that utilises the CALMET wind fields to account for spatial changes in meteorology, variable surface conditions, and plume interactions with terrain and the water-land interface. The results of the modelling assessment were compared to applicable air quality criteria derived from provincial and federal criteria and standards.

In addition to examining the potential incremental project effects on ambient air quality, cumulative project effects were also considered, which examined the combined potential effects of the project with the existing NGS operations plus appropriate background concentrations to establish total predicted ambient levels.

For the incremental project scenarios, modelling predicts that all applicable air quality criteria are met. Modelling of the cumulative project scenarios showed that applicable air quality criteria are met for the majority of the COPC and averaging periods. However, in close proximity to the project site, short-term 1-hour concentrations of NO_2 are predicted to be above the CAAQS. The predicted exceedance of the 1-hour NO_2 CAAQS extends beyond the east and north property boundary and outside of the LGS lands. However, the background concentration represents 78% of the applicable criterion and is likely overly conservative to characterise the project site.

Due to the conservative assumptions that have been built into this air quality assessment, it is likely that actual COPC concentrations and exceedances will be less than what was predicted by the air dispersion model. While these conditions can occur, it would likely be rare, and they would not be continuous over many hours.

6. References

Barclay, J., & Scire, J. (2011). *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the "Approved Methods for the Modelling Assessments of Air Pollutants in NSW, Australia".* Sydney: NWS Office of Environment and Heritage.

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Attachment A

COPC Significance Screening Analysis

Atura Power

Attachment A: COPC Significance Screening Analysis

The principal air quality constituents released during the operation of the project combustion turbine generator and dew point heater were screened for negligibility using the following screening protocol listed in the MECP's Procedure for Preparing an Emission Summary and Dispersion Modelling Report (MECP, 2023).

- Identifying Significant Contaminants Using an Emission Threshold (Section 7.1.2)

Total constituent emissions from project emission sources and existing NGS emission sources were compared with emission thresholds that were calculated in accordance with Section 7.1.2 of the procedure document as follows:

Emission Threshold [g/s] = 0.5 * Air Quality Criteria [µg/m³] / Dispersion Factor [µg/m³ per g/s]

Dispersion factors were determined for each source and averaging period based on air dispersion modelling results (see **Section 3.3**). Using dispersion factors, a conservative estimate of the maximum concentration from project emission sources and existing NGS emission sources was determined by multiplying the source emission rate by the dispersion factor for each constituent and summing the results across all sources.

If a contaminant is less than 10% of the applicable air quality criteria using this conservative method, then no further assessment was performed for the air quality assessment.

Source	Dispersion Factors (µg/m³ per 1 g/s)			
	10-min[1]	1-hour	24-hour	Annual
CTG-1A	36.8	22.3	0.936	0.0271
CTG-1B	29.4	17.8	0.751	0.0262
CTG-1C	19.4	11.8	1.12	0.0430
AUX	52.9	32.0	6.29	0.572
DPH1	347	210	78.0	8.17
DPH2	1707	1034	270	28.9

Note:
[1] Converted averaging times are calculated in accordance with Table 7-1 of the MECP's Procedure for Preparing an Emission Summary and Dispersion Modelling Report