Brampton Transit

BUS MAINTENANCE & STORAGE FACILITY

Appendix G

Air Quality

March 18, 2021

Prepared for

BRAMPTON Flower City
brampton.ca

Prepared by

IBI GROUP

Report No. 92136

ORTECH
a Kontrol Energy Company

Report:

IBI Group
Brampton New Transit Maintenance Facility
Air Quality Environmental Assessment

Date: July 8, 2020



Report:

IBI Group
Brampton New Transit Maintenance Facility
Air Quality Environmental Assessment

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Report No.:	92136 17 pages, 4 Appendices	

Revision History

Version	Date	Summary Changes/Purpose of Revision
1	July 8, 2020	Draft Report

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EXECUTIVE SUMMARY

The City of Brampton has retained IBI Group to undertake the study and design of a new bus maintenance and storage facility (MSF) for use by Brampton Transit to be located at Highway 50 and Cadetta Road, in Brampton. In turn, IBI Group retained ORTECH Consulting Inc. (ORTECH) to prepare an Air Quality Assessment report in support of a facility Environmental Assessment for the proposed Brampton MSF. The Air Quality Assessment is an evaluation of the potential impacts this development might have on air quality in the area surrounding the proposed facility.

The purpose of the transit bus facility project is to increase maintenance and storage capacity for existing and new buses which are required to improve transit service across Brampton. The proposed facility will provide overnight inside storage facilities for up to 350 diesel buses and will have up to 24 maintenance bays. The proposed facility is forecasted for completion in 2024.

This air quality assessment studied potential impacts from the facility during construction and operation. Construction impacts will be minimized with the implementation of a best management practices plan. Air contaminant emissions during operations of the facility were estimated and impacts of the emissions were determined taking into account existing air quality for the significant contaminants.

Existing air quality in the Brampton Region is characterized by a provincial air quality monitoring station located in Brampton. The most recent ambient air quality data from that network is from 2018. The annual ambient air quality data available for the previous 5 years (2014, 2015, 2016, 2017, 2018) at the Brampton station are summarized in the report. Nitrogen dioxide concentrations in Brampton have been decreasing over the last 5 years and the Region has not experienced exceedances of the Ministry of the Environment, Conservation and Parks (MECP) guideline limits.

Emissions from the vehicles operations, vehicle maintenance, heating systems, and emergency generators, at the site are considered in the report. Nitrogen dioxide was determined to be the only significant contaminant that will be released from the site. The emission estimates were entered into the AERMOD dispersion model used to assess the effects of the new facility on air quality in the area surrounding the facility for the Environmental Assessment.

The maximum combined concentrations for each contaminant were determined to be below their respective guidelines. The report discusses the conservative nature of the emission estimates used in the modelling suggesting that typical levels will be much lower than predicted from modelling. It is anticipated that the surrounding community air quality will not be adversely impacted by the activities and emissions from the facility.

1. INTRODUCTION

The City of Brampton has retained IBI Group to undertake the study and design of a new bus maintenance and storage facility (MSF) for use by Brampton Transit to be located at Highway 50 and Cadetta Road, in Brampton. In turn, IBI Group retained ORTECH Consulting Inc. (ORTECH) to prepare an Air Quality Assessment report in support of a facility Environmental Assessment for the proposed Brampton MSF. The Air Quality Assessment is an evaluation of the potential impacts this development might have on air quality in the area surrounding the proposed facility.

1.1 Project and Facility Description

The purpose of the transit bus facility project is to increase maintenance and storage capacity for existing and new buses which are required to improve transit service across Brampton. The proposed facility will provide overnight inside storage facilities for up to 350 diesel buses and will have up to 24 maintenance bays. Buses returning daily will pass through the service lane for cleaning, fueling, and washing prior to being stored inside the building. Out of service vehicles will be housed in the maintenance bays while being serviced. The facility will also include administrative offices and staff parking. Potential site plans of the proposed building are provided in Appendix A. The proposed facility is forecasted for completion in 2024.

The proposed facility is located at the intersection of Highway 50 and Cadetta Road. The site currently consists of a satellite Public Works yard and agricultural land. Cumulatively, the property is approximately 40 acres. Figure 1 shows the proposed project site. The nearest sensitive receptors (residences) are located approximately 1 km south of the proposed site.

1.2 Scope of Environmental Assessment

This air quality assessment studied potential impacts from the facility during operation. Air contaminant emissions during operations of the facility were estimated and impacts of the emissions were determined taking into account existing air quality for the significant contaminants.

During construction new buildings will be constructed and the site will need to be paved. Construction sites will have air emissions associated with the site specific construction operations such as dust, particulate, and combustion contaminants. The emissions from construction activities will be from low level sources and will have a low potential for dispersion beyond the immediate areas surrounding the site. In addition, construction activities will be limited in duration. Thus, no detailed modelling of the impact of these activities was completed. Instead, a best practices plan will be prepared for construction activities at the site to reduce air emissions from the construction and demolition activities.

Figure 1: Project Site

2. CONTAMINANTS OF CONCERN

2.1 Emissions from Transit Bus Operations

The contaminants of interest from motor vehicles, including transit buses, have been determined by scientists and engineers with United States and Canadian government agencies such as the U.S. Environmental Protection Agency (EPA), the Ontario Ministry of the Environment, Conservation and Parks (MECP), Environment and Climate Change Canada (ECCC), Health Canada (HC), and the Ontario Ministry of Transportation (MTO). These contaminants are primarily emitted due to fuel combustion. The contaminants of interest from motor vehicles are categorized as Criteria Air Contaminants (CACs) and Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs) Metals and Dioxins and Furans.

These contaminants in Table 1 have been selected for this assessment due to their potential effect on human health or the environment and, based on ORTECH's experience, represent the contaminants that have the potential to exceed government criteria for a facility of this nature. VOCs, PAHs, metals and dioxins and furans from diesel transit bus exhaust were selected based on the EPA report "Air Toxic Emissions from On-road Vehicles in MOVES2014", dated December 2014.

In accordance with the MECP Air Contaminants Benchmarks (ACB) List, and the MECP Ambient Air Quality Criteria (AAQC) benzo[a]pyrene may be used as a surrogate for all polyaromatic hydrocarbons (PAHs). As Naphthalene has an ACB List limit and an AAQC guideline, this PAH contaminant was assessed and in addition to benzo[a]pyrene.

Dioxins and furans were assessed as a group, based on the total toxicity equivalent (TEQ) concentration contributed by all dioxin-like compounds in the emissions.

Table 1: Contaminants of Interest

Criteria Air Contaminants (CACs)	Volatile Organic Compounds (VOCs)	Polycyclic Aromatic Hydrocarbons (PAHs)	Metals
Nitrogen Dioxide (NO_2)	1,3-Butadiene	Naphthalene	Chromium VI
Carbon Monoxide (CO)	2,2,4-Trimethylpentane	Benzo(a)pyrene	Manganese
Particulate Matter ($PM_{2.5}$)	Acetaldehyde		Nickel
Particulate matter (PM_{10})	Acrolein		Mercury
	Benzene		Arsenic
	Ethyl Benzene		
	Formaldehyde		
	N-Hexane		
	Propionaldehyde		
	Toluene		
	Xylenes		

Note: Dioxins and furans assessed as a group

2.2 Emissions from Welding

Air emissions were also considered from welding in the body shop. Based on the EPA AP-42 Electrical Arc Welding document, contaminants of concern from welding are particulate matter, chromium, manganese, cobalt and nickel.

2.3 Emissions from Heating Equipment and Standby Generators

The main contaminants of concern associated with heating equipment due to the combustion of natural gas, is nitrogen oxides (NO_X), specifically nitrogen dioxide (NO_2) in relation to human health. Contaminants of natural gas combustion other than NO_X are generally negligible in accordance with the MECP "Guideline A-10: Procedure for Preparing and Emission Summary and Dispersion Modelling Report Version 4.1" dated March 2018 (Guideline A-10).

There will be two diesel standby generators at the site. The main contaminants of concern associated with diesel combustion are nitrogen dioxide, particulate matter, sulfur dioxide, and carbon monoxide.

2.4 Applicable Guidelines

In order to assess the impact of the project contaminant concentrations were calculated and compared to published guidelines. The applicable contaminant guidelines are:

- MECP Air Contaminants Benchmarks (ACB) List
- MECP Ambient Air Quality Criteria (AAQC)

The ACB List itemizes contaminants with corresponding benchmarks (standards, guidelines or screening levels), used by facilities to assess their contributions of a contaminant to air as predicted by air dispersion modelling. The benchmarks are based on a maximum ground-level concentration of a contaminant. For this assessment, the ACB List was used to assess negligibility and screen out contaminants prior to modelling. More details on this screening process are provided in Section 4.3 and Appendix C.

An AAQC is a desirable concentration of a contaminant in air, based on protection against adverse effects on health or the environment. The AAQC value for each contaminant and its applicable averaging period was used to assess the maximum predicted effect at off-site receptors derived from dispersion models, including the existing ambient concentrations for those contaminants. The AAQC values and averaging periods used in this assessment for the significant contaminants from the facility emission sources are presented in Table 2.

Table 2: Applicable AAQC Contaminant Guidelines

Contaminant	Averaging Period	AAQ Guideline ($\mu g/m^3$)	Limiting Effect
Nitrogen dioxide	1 hr	400	Health
	24 hr	200	Health

3. BACKGROUND (AMBIENT) CONDITIONS

3.1 Selection of Relevant Ambient Monitoring Stations

A review of MECP and National Air Pollution Surveillance (NAPS) ambient monitoring stations in Ontario was undertaken to identify the monitoring stations that are in relevant proximity to the study area and that would be representative of background contaminant concentrations in the study area. The MECP-operated Brampton station (NAPS ID #60428) was determined to be the most representative as they are located closest to the study area, in the same air shed, at a distance of 15 km.

3.2 Selection of Worst-Case Ambient Conditions

The most recent five years of ambient air quality monitoring data publically available from the selected station was summarized for the desired averaging periods. For the assessed contaminants data was available up to 2018. The highest maximum value over a 5-year period for each contaminant and averaging period was selected to represent ambient (or existing) concentrations in the study area. Using the maximum ambient concentration is a very conservative assumption because it represents an absolute worst-case scenario, which likely only occurred for one hour or one day over the five-year period. For this reason, it is often suggested that the 90th percentile background concentration be selected to represent a reasonable worst-case scenario. However, in order to build conservatism into the results, the maximum background concentration was selected.

Table 3 provides the average, 90th percentile and maximum concentration for each contaminant determined to be significant (see Section 4.3). The study area has consistently remained below the AAQC guideline for nitrogen dioxide.

Table 3: Brampton Monitoring Station Data for Significant Contaminants

Contaminant (Averaging Period)	Statistic	Ambient Monitoring Data ($\mu g/m^3$)						% of Guideline
		2014	2015	2016	2017	2018	Max. Year	
NO_2 (1 hr)	Maximum	134	122	104	102	106	134	33%
	90th Percentile	49	47	47	41	39	49	12%
	Mean	22	20	20	17	16	22	5%
NO_2 (24 hr)	Maximum	89	70	70	61	66	89	45%
	90th Percentile	41	42	41	34	32	42	21%
	Mean	21	20	20	17	16	21	11%

4. ASSESSMENT APPROACH

4.1 General Approach

In order to estimate the worst-case impacts resulting from contaminant emissions from the Brampton MSF the following were conducted:

- Contaminant emission rates were estimated based on U.S. EPA and MECP published values;
- Contaminant emission rates were assessed for negligibility; and
- Air dispersion modelling was conducted, including maximum background concentrations to provide conservative predictions of worst-case impacts.

4.2 Operating Conditions and Emission Rates

4.2.1 Bus Operations

Based on the bus operations of similar-sized bus garages, it is expected that up to 100 buses move in or out of the facility per 1 hour period. In a 24 hour period, it is assumed that up to 700 buses move in or out of the facility. This is a conservative assumption based on the maximum capacity of the proposed facility. Based on the operations of similar facilities, it was assumed that each vehicle moving in the time period (in and out of the facility) would drive for 0.2 km inside the building, and that each vehicle moving out of the facility would idle for 5 minutes. Emission rate estimates are based on these maximum operating conditions.

Idling emissions from inside the storage garage will be emitted through air handling unit exhaust fans. Based on similar bus garages, it is estimated that these fans will exhaust 2 m above the rooftop. It was assumed that the emissions from buses in the storage bay would be evenly mixed and emitted through the air handling units serving this area.

Vehicles may also idle in the maintenance bay while being worked on, and will be connected up to a bus fume exhaust hose system which exhaust on the rooftop. Based on the operations of similar facilities, it was assumed that one bus would be idling for up to 5 minutes through up to six bus fume exhaust hose systems.

Emissions from driving outside of the building, but still onsite, were also considered. Buses were modelled leaving and entering the facility. Based on the planned bus route, it was assumed that each vehicle moving in the time period (in and out of the facility) would drive for 0.65 km outside of the building.

The emission rate calculations for CACs and total VOCs from the bus operations have been estimated using emission factors from the "US EPA Average In-Use Emissions from Urban Buses and School Buses", dated October 2008. The emission factors for metals, dioxins and furans, and the toxic fractions of VOCs and PAHs were selected based on the EPA report "Air Toxic Emissions from On-road Vehicles in MOVES2014", dated December 2014. The emission factors used in the assessment for idling and moving buses are shown in Table 4. Details of the bus operation emission rate calculations are provided in Appendix B.

Table 4: Transit Bus Operations Emission Factors

Contaminant	CAS	Idling Emission Factor (g/s)	In-Use Emission Factor (g/km)	Source
Carbon monoxide	630-08-0	1.04E-02	2.10E+00	[1]
Nitrogen oxides	10102-44-0	1.70E-02	9.27E+00	[1]
$PM_{2.5}$	$PM_{2.5}$	2.97E-04	1.70E-02	[1]
PM_{10}	PM_{10}	3.23E-04	1.84E-01	[1]
Volatile organic compounds	VOC	7.50E-04	2.17E-01	[1]
Butadiene, 1,3-	106-99-0	6.00E-07	1.73E-04	[1], [2]
2,3,4-trimethylpentane	565-75-3	5.85E-06	1.69E-03	[1], [2]
Acetaldehyde	75-07-0	5.20E-05	1.50E-02	[1], [2]
Acrolein	107-02-8	7.49E-06	2.17E-03	[1], [2]
Benzene	71-43-2	9.68E-06	2.80E-03	[1], [2]
Ethyl Benzene	100-41-4	4.73E-06	1.37E-03	[1], [2]
Formaldehyde	50-00-0	1.63E-04	4.71E-02	[1], [2]
Hexane, n-	110-54-3	4.05E-06	1.17E-03	[1], [2]
Propionaldehyde	123-38-6	2.33E-06	6.72E-04	[1], [2]
Toluene	108-88-3	2.25E-05	6.50E-03	[1], [2]
Xylenes	1330-20-7	2.85E-05	8.24E-03	[1], [2]
Naphthalene	91-20-3	1.22E-05	3.53E-03	[1], [2]
Benzo(a)pyrene	50-32-8	4.39E-09	2.52E-07	[1], [2]
Chromium VI	18540-29-9	n/a	3.60E-09	[2]
Manganese	7439-96-5	n/a	3.42E-07	[2]
Nickel	7440-02-0	n/a	4.04E-07	[2]
Mercury	7439-97-6	n/a	6.83E-09	[2]
Arsenic	7440-38-2	n/a	1.43E-06	[2]
Dioxins and Furans	DF	n/a	1.79E-13	[2]

[1] US EPA Average In-Use Emissions from Urban Buses and School Buses, Table 2
[2] US EPA Air Toxic Emissions from On-road Vehicles in MOVES2014, Tables 62-65

4.2.2 Welding

Small carbon steel bus parts will be repaired at welding stations using an E70S carbon steel welding wire. A maximum consumption of 1 kg/day and 40 kg/year is conservatively assumed. Emissions from welding will be controlled with a fume extractor; however, emissions were conservatively estimated using uncontrolled emission factors. Uncontrolled emissions were estimated using AP-42 Section 12.19 emission factors for E70S welding wire for gas metal arc welding, or MIG welding. Details of the welding emission rate calculations are provided in Appendix B.

4.2.3 Heating Equipment and Diesel Generators

The facility will contain natural gas-fired make-up air units and water heaters. The facility will also have two diesel standby generators. The standby power generators will be used for standby power only with periodic testing. The emissions from the heaters and standby generators will be considered negligible in accordance with Guideline A-10.

4.3 Assessment of Negligibility

Many of the contaminants produced by the proposed facility will be emitted in small amounts. As such, a screening-out assessment of contaminants that are emitted in negligible amounts was conducted in accordance with MECP Guideline A-10. Emission rates for each contaminant were assessed against the emission threshold, using the urban dispersion factor at 20 m, the smallest separation distance provided in Guideline A-10. If the emission rate was less than the emission threshold, the contaminant was determined negligible and not assessed further. Contaminants that were not found to be negligible were modelled in AERMOD and assessed against their applicable guidelines for the applicable averaging periods. Details for the assessment of negligibility are shown in Appendix C.

4.4 Modelling Methods

The U.S. EPA's AERMOD dispersion model, based on the Gaussian plume equation, was used to predict air quality impacts from emissions at the Brampton MSF. The model inputs include background concentration, local building information, topography, sensitive receptor locations, meteorology, emission rates, and stack parameters. AERMOD uses this information to calculate hourly or 24 hour averages for the contaminants of interest at off-site receptor locations. Combined impacts were assessed for all emissions from the buses. Table 5 contains a summary of the inputs used.

The maximum ambient concentration value for each contaminant and averaging period was included in the model to represent background concentrations. It should be noted that this approach, combining the maximum values to the maximum ambient measurements is extremely conservative. It is not likely that the maximum facility concentration will occur at the same time as the maximum ambient concentration.

Table 5: AERMOD Model Input Summary Table

Parameter	Input
Source of Contaminant Emission Rates	Emission rate estimations are described in Section 4 of this report. Refer to Section 4 and Appendix B for details.
Source Parameters	Rooftop exhausts from the building were modelled as a volume source with the length of side of the conservatively based on the proposed site plan building with the smallest footprint. Outside driving emissions were modelled as a 1.3 km line source based on the proposed bus routes. Proposed site plans and bus routes are provided in Appendix A.
Meteorological Conditions	The MECP's regional meteorological data files processed with AERMET 19191 were downloaded from the Ministry's website.
Terrain Data	DEM data made available on the MECP's website was used.
Area of Modelling Coverage	Receptor grid determined in accordance with the MECP document "Air Dispersion Modelling Guideline for Ontario" (ADMGO), up to an extent of 5 km from the Facility. A default flagpole receptor height was set to 4 m to represent ambient conditions. No on-site receptors.
Averaging Periods	1 hr and 24 hr.
Urban/rural classification	Rural
Background concentration	Maximum background concentration for each applicable contaminant and averaging period, as described in Section 3 of this report.

5. AIR DISPERSION ASSESSMENT RESULTS

The maximum ambient concentration for each contaminant as a result of the proposed facility and current worst-case ambient concentrations are shown in Table 6. The results of the AERMOD modelling showed that the maximum concentration for each contaminant remained below its respective AAQC guideline. This maximum concentration is the highest concentration at any off-site receptor in the model. Contour plots showing the concentrations surrounding the facility for each contaminant and averaging period are provided in Appendix D. These contour plots show that the highest concentrations of the contaminants occur at, or next to the property line, and decrease with greater distance from the facility. Therefore, it is anticipated that the surrounding community air quality will not be adversely impacted by the activities and emissions from the facility.

Table 6: Air Quality Assessment Summary

Contaminant	Averaging Period (hours)	Current Maximum Ambient Concentration	Maximum Ambient Concentration with Proposed Facility (µg/m^3)	Guideline (µg/m^3)	Guideline Reference	Limiting Effect	Percent of Guideline (%)
Nitrogen dioxide	24	89	106	200	AAQC	Health	53%
Nitrogen dioxide	1	134	282	400	AAQC	Health	70%

6. CONCLUSIONS AND RECOMMENDATIONS

The potential effects of the proposed facility on local air quality have been assessed. The following conclusions and recommendations are a result of this assessment:

- Construction impacts will be minimized with the implementation of a best management practices plan.
- Nitrogen dioxide concentrations in Brampton have been decreasing over the last 5 years and the Region has not experienced exceedances of the Ministry of the Environment, Conservation and Parks (MECP) guideline limits.
- The maximum combined concentrations for each contaminant and averaging period were all below their respective guidelines. The report discusses the conservative nature of the emission estimates used in the modelling suggesting that typical surrounding community levels will be much lower than predicted from modelling.
- The maximum concentrations of the contaminants occur at, or next to the property line, and decrease with greater distance from the facility. Therefore, it is anticipated that the surrounding community air quality will not be adversely impacted by the activities and emissions from the facility.
- If any major changes are made to the facility design or operations as outlined in this report the modelling should be repeated to assess what changes might result.
- It is recommended that the design team plan the generator exhausts in accordance with O. Reg. 524/98 section 1.6.3 (i.e. vertical, uncapped stacks).
- Upon final selection of equipment and exhaust fans for the facility, the City of Brampton will need to register in the Environmental Activity and Sector Registry (EASR).

REFERENCES

Ministry of the Environment, C. a. (2017). Guideline A-11: Air Dispersion Modelling Guideline for Ontario.

Ministry of the Environment, Conservation and Parks. (2018). Guideline A-10: Procedure for Preparing and Emission Summary and Dispersion Modelling Report, Version 4.1.

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U.S. Environmental Protection Agency. (2014). Air Toxic Emissions from On-road Vehicles in MOVES2014.

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GLOSSARY

Abbreviations

AAQC	Ambient Air Quality Criteria
ACB	Air Contaminants Benchmarks
ADMGO	Air Dispersion Modelling Guideline for Ontario
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
CAC	Criteria Air Contaminant
CNG	Compressed Natural Gas
CO	Carbon Monoxide
EASR	Environmental Activity and Sector Registry
ECCC	Environment and Climate Change Canada
EPA	Environmental Protection Agency
HC	Health Canada
HSR	Brampton Transit
MECP	Ministry of the Environment, Conservation and Parks
MOVES	Motor Vehicle Emission Simulator
MSF	Maintenance and Storage Facility
MTO	Ministry of Transportation
NAPS	National Air Pollution Surveillance
NO2	Nitrogen Dioxide
NOx	Nitrogen Oxides
PM	Particulate Matter
PM10	Coarse Particulate matter
PM2.5	Fine Particulate Matter
TEQ	Toxic Equivalent
VOC	Volatile Organic Compound

Units

BTU	British thermal unit
g	grams
hp	horsepower
hr	hour
kJ	kilojoules
km	kilometers
L	liters
m	meters
min	minute
s	seconds
scf	standard cubic foot
µg	micrograms

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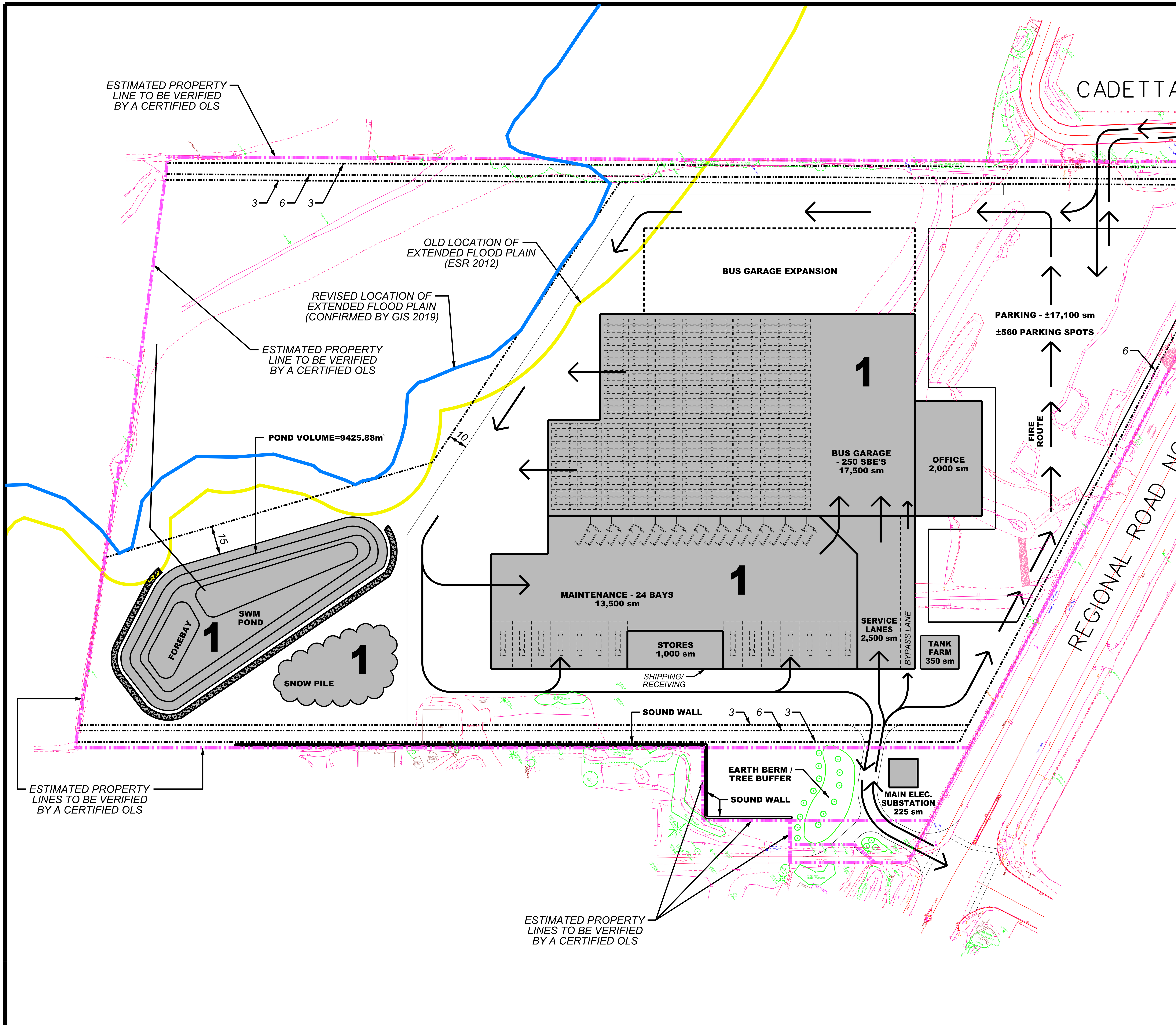
APPENDIX A

Proposed Site Plans
(14 Pages)



NO.	BY	DATE	REVISIONS	CHECKED

BRAMPTON Flower City
brampton.ca

Public Works & Engineering
Capital Works

PROJECT DWG. NO.

SITE PLAN
TRANSIT FACILITY
PHASE 1

SURVEYED BY: xxxxxx	DATE: SEPTEMBER 30, 2019	FILE NO. xxxxx
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DESIGNED BY: xxxxxx	CHECKED BY: xxxxxx	SHEET NO. x
SCALE: 1:500	DATE: 30 APR 03	

LAST UPDATED 23 JAN 17 -- PMZ

NEW LOCATION OF EXTENDED FLOOD PLAIN (ADDENDUM TO MESP 2018)
PROPOSED RE-ALIGNMENT OF RAINBOW CREEK (ADDENDUM TO MESP 2018)
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
CADETTA RD.
3
6
3
2
SNOW PILE
BUS GARAGE EXPANSION
PARKING - ±17,100 sm
±560 PARKING SPOTS
6
FIRE ROUTE
REGIONAL ROAD NO. 50
BUS GARAGE - 290 SBE'S 20,600 sm
OFFICE 2,000 sm
2
2
SWM POND
FOREBAY
2
MAINTENANCE - 36 BAYS 20,700 sm
SERVICE LANES 2,500 sm
BYPASS LANE
STORES 1,000 sm
TANK FARM 350 sm
SHIPPING/ RECEIVING
POND VOLUME=9425.88m³
SOUND WALL
3
6
3
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
EARTH BERM / TREE BUFFER
SOUND WALL
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO.
BY
DATE
REVISIONS
CHECKED
BRAMPTON Flower City
brampton.ca
Public Works & Engineering
Capital Works
PROJECT
DWG. NO.
SITE PLAN
TRANSIT FACILITY
PHASE 2
SURVEYED BY: xxxxxx
DATE: SEPTEMBER 30, 2019
FILE NO. xxxxx
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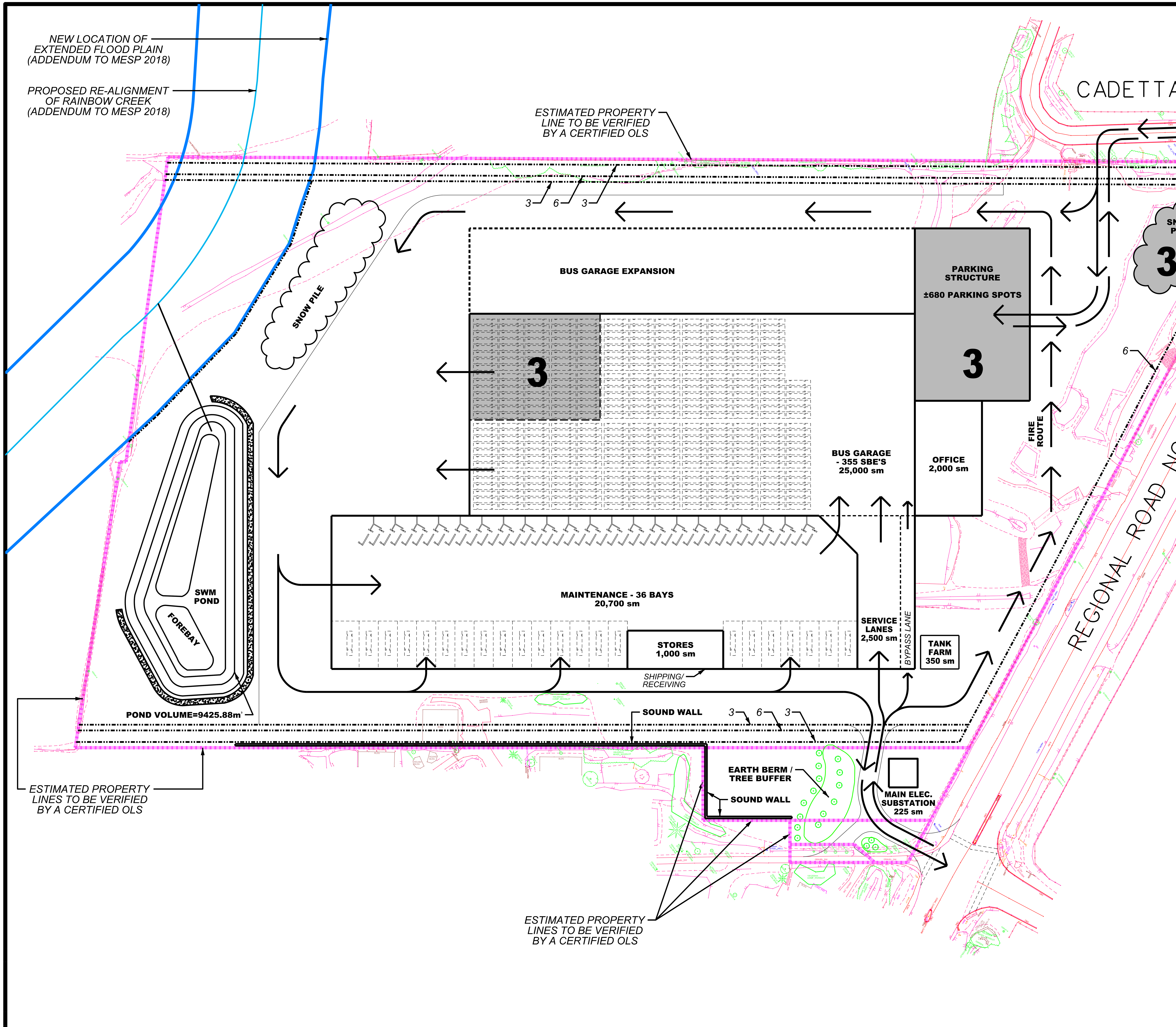
LAST UPDATED 23 JAN 17 -- PMZ



NO.	BY	DATE	REVISIONS	CHECKED

BRAMPTON Flower City
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Public Works & Engineering
Capital Works

PROJECT DWG. NO.

SITE PLAN
TRANSIT FACILITY
PHASE 3

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CADETTA RD.
3
6
3
SNOW PILE
SNOW PILE
BUS GARAGE EXPANSION FOR ELECTRICAL BUSES
4
PARKING STRUCTURE
±680 PARKING SPOTS
6
BUS GARAGE - 438 SBE'S 30,700 sm
OFFICE 2,000 sm
FIRE ROUTE
REGIONAL ROAD NO. 50
SWM POND
FOREBAY
POND VOLUME=9425.88m³
MAINTENANCE - 36 BAYS 20,700 sm
STORES 1,000 sm
SHIPPING/ RECEIVING
SERVICE LANES 2,500 sm
BYPASS LANE
TANK FARM 350 sm
SOUND WALL
3
6
3
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
EARTH BERM / TREE BUFFER
SOUND WALL
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO.
BY
DATE
REVISIONS
CHECKED
BRAMPTON Flower City
brampton.ca
Public Works & Engineering
Capital Works
PROJECT
DWG. NO.
SITE PLAN
TRANSIT FACILITY
PHASE 4
SURVEYED BY: xxxxxx
DATE: SEPTEMBER 30, 2019
FILE NO. xxxxx
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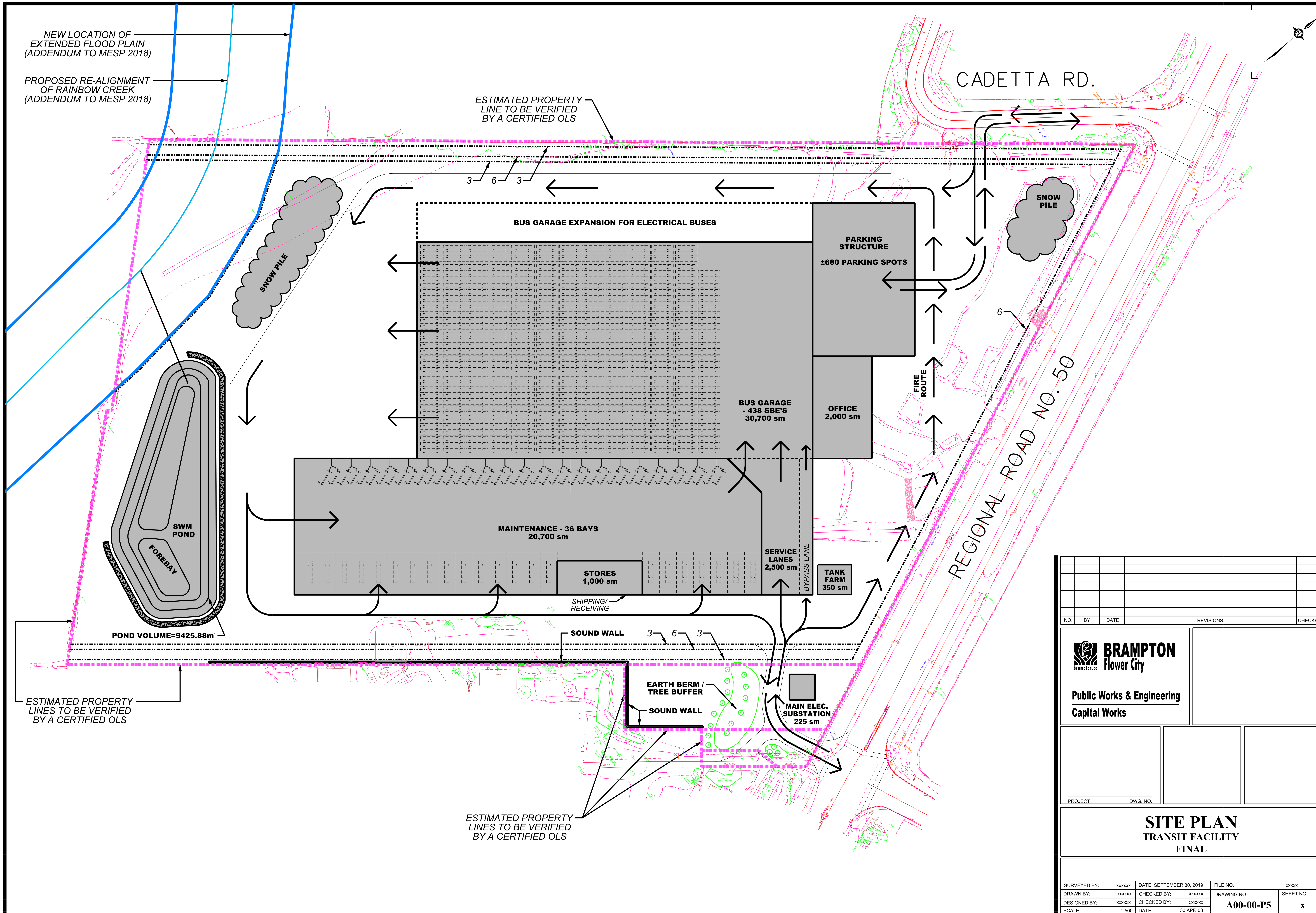
SHEET NO. x
DESIGNED BY: xxxxxx
CHECKED BY: xxxxxx
SCALE: 1:500
DATE: 30 APR 03
LAST UPDATED 23 JAN 17 -- PMZ



NEW LOCATION OF EXTENDED FLOOD PLAIN (ADDENDUM TO MESP 2018)
PROPOSED RE-ALIGNMENT OF RAINBOW CREEK (ADDENDUM TO MESP 2018)
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
CADETTA RD.
3
6
3
SNOW PILE
BUS GARAGE EXPANSION FOR ELECTRICAL BUSES
PARKING STRUCTURE
±680 PARKING SPOTS
SNOW PILE
6
FIRE ROUTE
REGIONAL ROAD NO. 50
BUS GARAGE - 438 SBE'S 30,700 sm
OFFICE 2,000 sm
SWM POND
FOREBAY
MAINTENANCE - 36 BAYS 20,700 sm
SERVICE LANES 2,500 sm
BYPASS LANE
TANK FARM 350 sm
STORES 1,000 sm
SHIPPING/ RECEIVING
POND VOLUME=9425.88m³
SOUND WALL
3
6
3
EARTH BERM / TREE BUFFER
SOUND WALL
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO.
BY
DATE
REVISIONS
CHECKED
BRAMPTON Flower City
brampton.ca
Public Works & Engineering
Capital Works
PROJECT
DWG. NO.
SITE PLAN
TRANSIT FACILITY
FINAL
SURVEYED BY: xxxxxx
DATE: SEPTEMBER 30, 2019
FILE NO. xxxxx
DRAWN BY: xxxxxx
CHECKED BY: xxxxxx
DRAWING NO. A00-00-P5
SHEET NO. x
DESIGNED BY: xxxxxx
CHECKED BY: xxxxxx
SCALE: 1:500
DATE: 30 APR 03
LAST UPDATED 23 JAN 17 -- PMZ

NEW LOCATION OF EXTENDED FLOOD PLAIN (ADDENDUM TO MESP 2018)
PROPOSED RE-ALIGNMENT OF RAINBOW CREEK (ADDENDUM TO MESP 2018)
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
CADETTA RD.
PARKING - ±8,500 sm
±270 PARKING SPOTS
BUS GARAGE EXPANSION
PARKING - ±15,800 sm
±500 PARKING SPOTS
FUTURE ENERGY STORAGE ± 6,000 sm
1
BUS GARAGE - 250 SBE'S 17,500 sm
FIRE ROUTE
REGIONAL ROAD NO. 50
SWM POND
SNOW PILE
MAINTENANCE EXPANSION
MAINTENANCE - 14 BAYS 8,150 sm
SERVICE LANES 2,500 sm
BYPASS LANE
OFFICE 2,000 sm
STORES - 1,225 sm
TANK FARM 360 sm
SHIPPING/RECEIVING
SOUND WALL
EARTH BERM / TREE BUFFER
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO. BY DATE REVISIONS CHECKED
BRAMPTON Flower City
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Capital Works
PROJECT DWG. NO.
SITE PLAN
TRANSIT FACILITY
PHASE 2
SURVEYED BY: xxxxxx
DRAWN BY: xxxxxx
DESIGNED BY: xxxxxx
SCALE: 1:500
DATE: SEPTEMBER 30, 2019
CHECKED BY: xxxxxx
CHECKED BY: xxxxxx
DATE: 30 APR 03
FILE NO. xxxxx
DRAWING NO. A00-00-19
SHEET NO. x
LAST UPDATED 23 JAN 17 -- PMZ

NEW LOCATION OF EXTENDED FLOOD PLAIN (ADDENDUM TO MESP 2018)
PROPOSED RE-ALIGNMENT OF RAINBOW CREEK (ADDENDUM TO MESP 2018)
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
CADETTA RD.
PARKING - ±8,500 sm
±270 PARKING SPOTS
3
6
3
BUS GARAGE EXPANSION FOR ELECTRICAL BUSES
2
10
10
FUTURE ENERGY STORAGE ± 6,000 sm
PARKING - ±15,800 sm
±500 PARKING SPOTS
6
FIRE ROUTE
REGIONAL ROAD NO. 50
BUS GARAGE - 438 SBE'S 30,700 sm
SWM POND
SNOW PILE
2
MAINTENANCE - 28 BAYS 16,150 sm
SERVICE LANES 2,500 sm
BYPASS LANE
OFFICE 2,000 sm
STORES - 1,225 sm
TANK FARM 360 sm
SHIPPING/RECEIVING
SOUND WALL
3
6
3
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
EARTH BERM / TREE BUFFER
SOUND WALL
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO.
BY
DATE
REVISIONS
CHECKED
BRAMPTON Flower City
brampton.ca
Public Works & Engineering
Capital Works
PROJECT
DWG. NO.
SITE PLAN
TRANSIT FACILITY
PHASE 2
SURVEYED BY: xxxxxx
DRAWN BY: xxxxxx
DESIGNED BY: xxxxxx
SCALE: 1:500
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CHECKED BY: xxxxxx
CHECKED BY: xxxxxx
DATE: 30 APR 03
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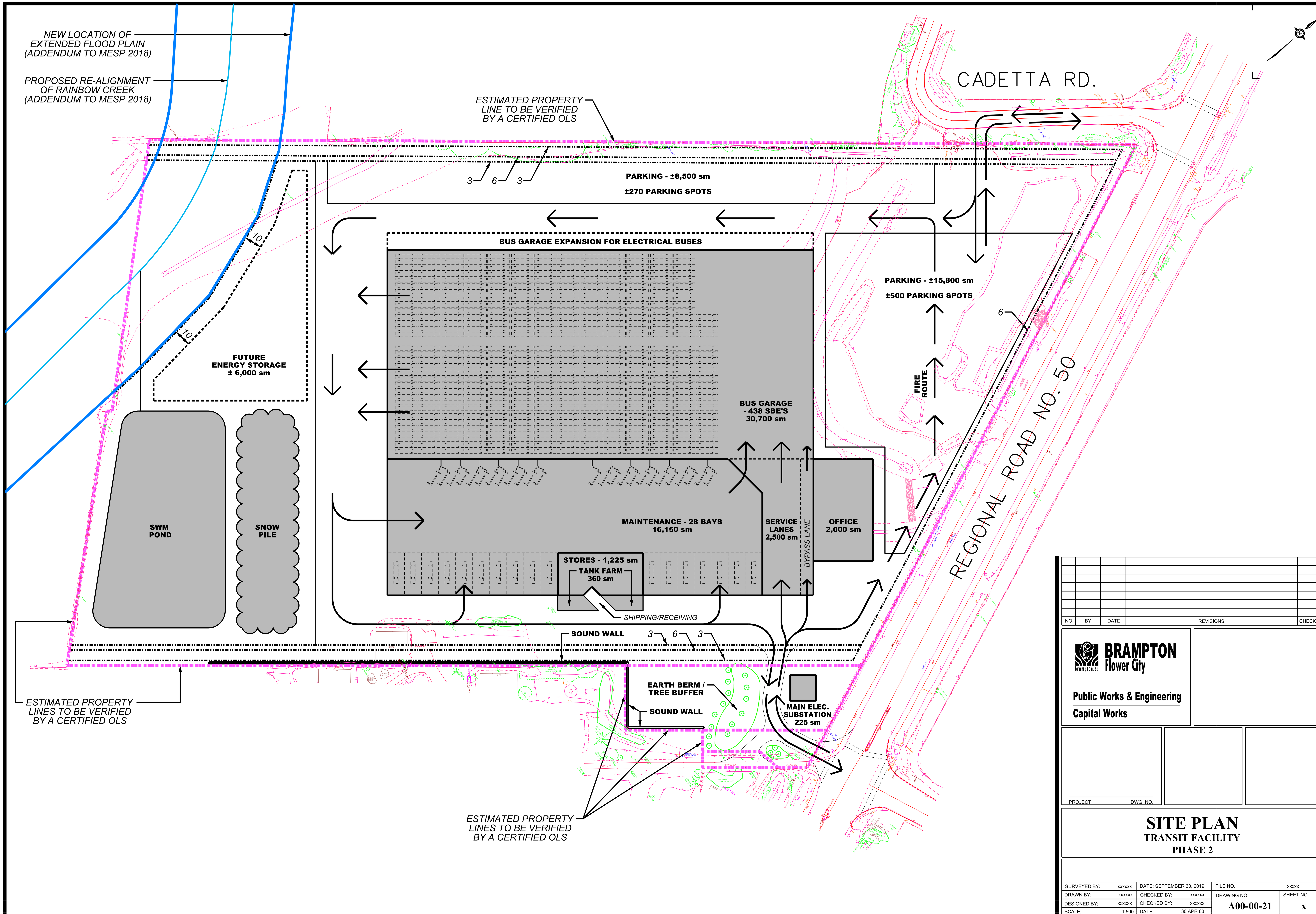

NO.	BY	DATE	REVISIONS	CHECKED

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Capital Works

PROJECT DWG. NO.

SITE PLAN
TRANSIT FACILITY
PHASE 2

SURVEYED BY: xxxxxx	DATE: SEPTEMBER 30, 2019	FILE NO. xxxxx
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DESIGNED BY: xxxxxx	CHECKED BY: xxxxxx	
SCALE: 1:500	DATE: 30 APR 03	

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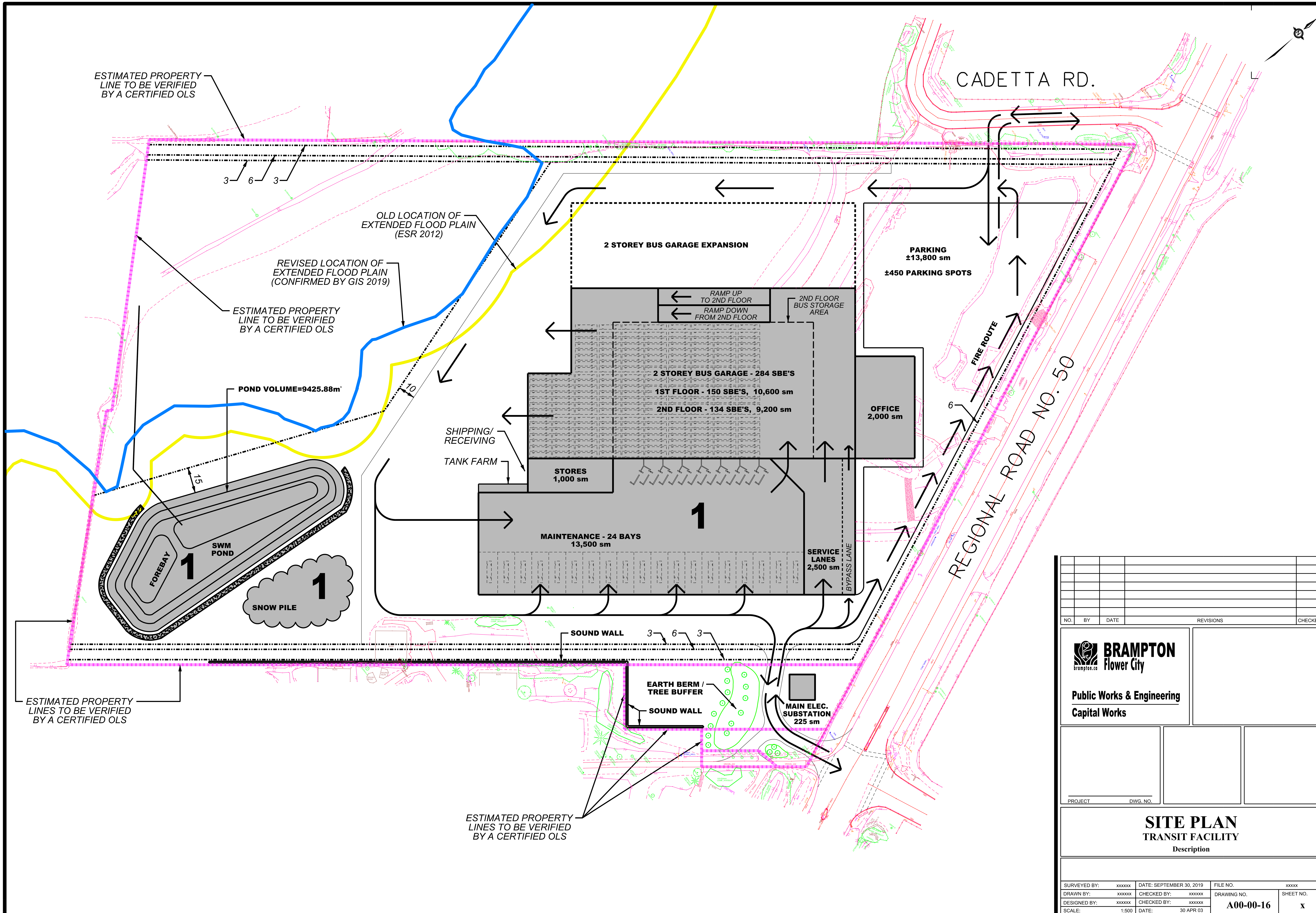
CADETTA RD.
REGIONAL ROAD NO. 50
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
OLD LOCATION OF EXTENDED FLOOD PLAIN (ESR 2012)
REVISED LOCATION OF EXTENDED FLOOD PLAIN (CONFIRMED BY GIS 2019)
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
POND VOLUME=9425.88m³
SWM POND
FOREBAY
SNOW PILE
2 STOREY BUS GARAGE EXPANSION
RAMP UP TO 2ND FLOOR
RAMP DOWN FROM 2ND FLOOR
2ND FLOOR BUS STORAGE AREA
2 STOREY BUS GARAGE - 284 SBE'S
1ST FLOOR - 150 SBE'S, 10,600 sm
2ND FLOOR - 134 SBE'S, 9,200 sm
OFFICE 2,000 sm
PARKING ±13,800 sm
±450 PARKING SPOTS
FIRE ROUTE
SHIPPING/ RECEIVING
TANK FARM
STORES 1,000 sm
MAINTENANCE - 24 BAYS 13,500 sm
SERVICE LANES 2,500 sm
BYPASS LANE
SOUND WALL
EARTH BERM / TREE BUFFER
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO. BY DATE REVISIONS CHECKED
BRAMPTON Flower City
Public Works & Engineering
Capital Works
PROJECT DWG. NO.
SITE PLAN
TRANSIT FACILITY
Description
SURVEYED BY: xxxxxx
DRAWN BY: xxxxxx
DESIGNED BY: xxxxxx
SCALE: 1:500
DATE: SEPTEMBER 30, 2019
CHECKED BY: xxxxxx
CHECKED BY: xxxxxx
DATE: 30 APR 03
FILE NO. xxxxx
DRAWING NO. A00-00-16
SHEET NO. x
LAST UPDATED 23 JAN 17 – PMZ


CADETTA RD.
REGIONAL ROAD NO. 50
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
OLD LOCATION OF EXTENDED FLOOD PLAIN (ESR 2012)
REVISED LOCATION OF EXTENDED FLOOD PLAIN (CONFIRMED BY GIS 2019)
ESTIMATED PROPERTY LINE TO BE VERIFIED BY A CERTIFIED OLS
POND VOLUME=9425.88m³
SWM POND
FOREBAY
SNOW PILE
PARKING STRUCTURE
±680 PARKING SPOTS
2ND FLOOR BUS STORAGE AREA
RAMP UP TO 2ND FLOOR
RAMP DOWN FROM 2ND FLOOR
2ND FLOOR BUS STORAGE AREA
2 STOREY BUS GARAGE - 438 SBE'S
BYPASS LANE AT 2ND FLOOR
1ST FLOOR - 234 SBE'S, 16,400 sm
2ND FLOOR - 204 SBE'S, 14,300 sm
OFFICE 2,000 sm
SHIPPING/ RECEIVING
TANK FARM
STORES 1,000 sm
MAINTENANCE - 28 BAYS 16,100 sm
SERVICE LANES 2,500 sm
BYPASS LANE
FIRE ROUTE
SOUND WALL
EARTH BERM / TREE BUFFER
SOUND WALL
MAIN ELEC. SUBSTATION 225 sm
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
ESTIMATED PROPERTY LINES TO BE VERIFIED BY A CERTIFIED OLS
NO. BY DATE REVISIONS CHECKED
BRAMPTON Flower City
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Capital Works
PROJECT DWG. NO.
SITE PLAN
TRANSIT FACILITY
Description
SURVEYED BY: xxxxxx
DATE: SEPTEMBER 30, 2019
FILE NO. xxxxx
DRAWN BY: xxxxxx
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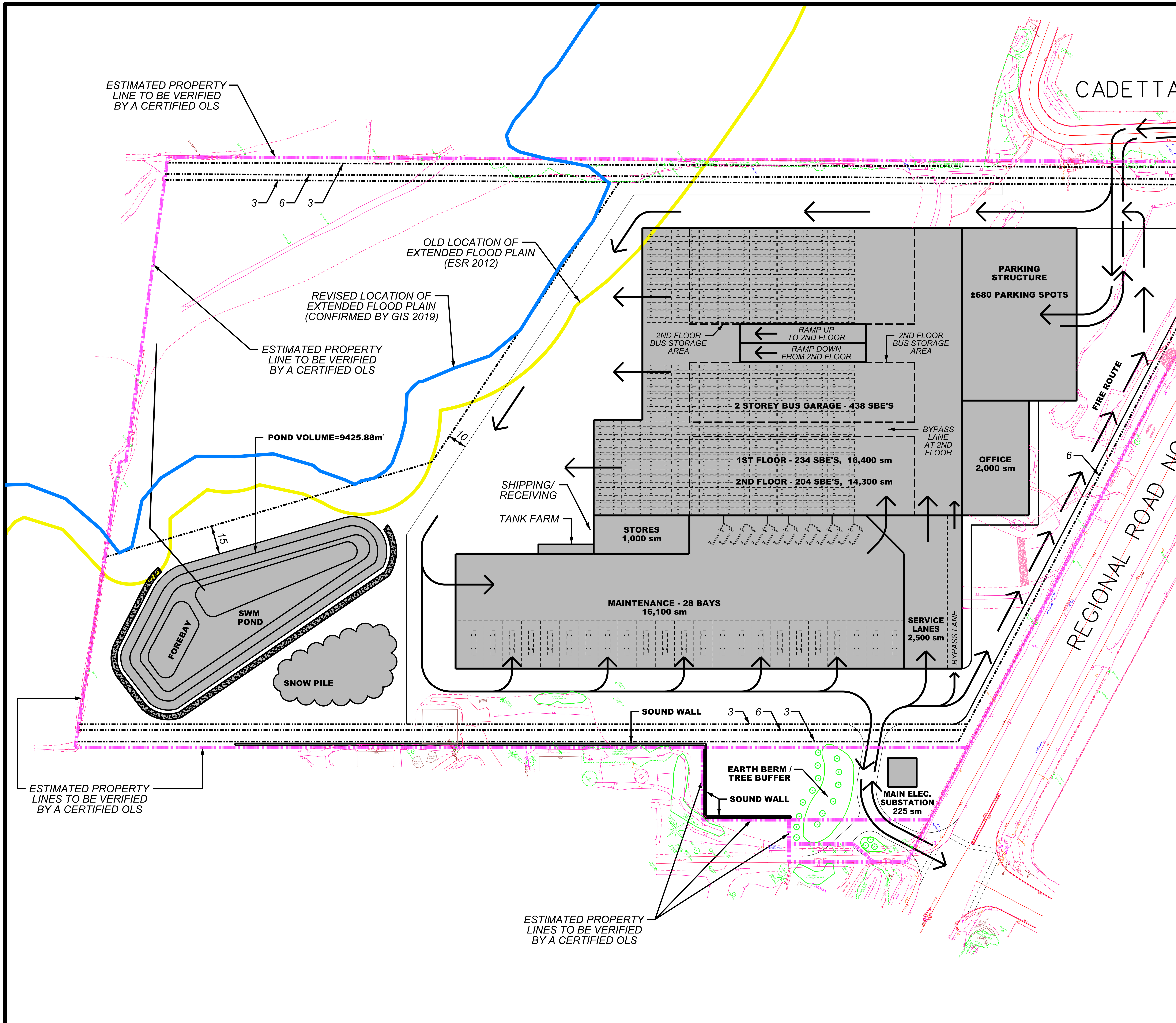

NO.	BY	DATE	REVISIONS	CHECKED

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PROJECT DWG. NO.

SITE PLAN
TRANSIT FACILITY
Description

SURVEYED BY: xxxxxx	DATE: SEPTEMBER 30, 2019	FILE NO. xxxxx
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DESIGNED BY: xxxxxx	CHECKED BY: xxxxxx	SHEET NO. x
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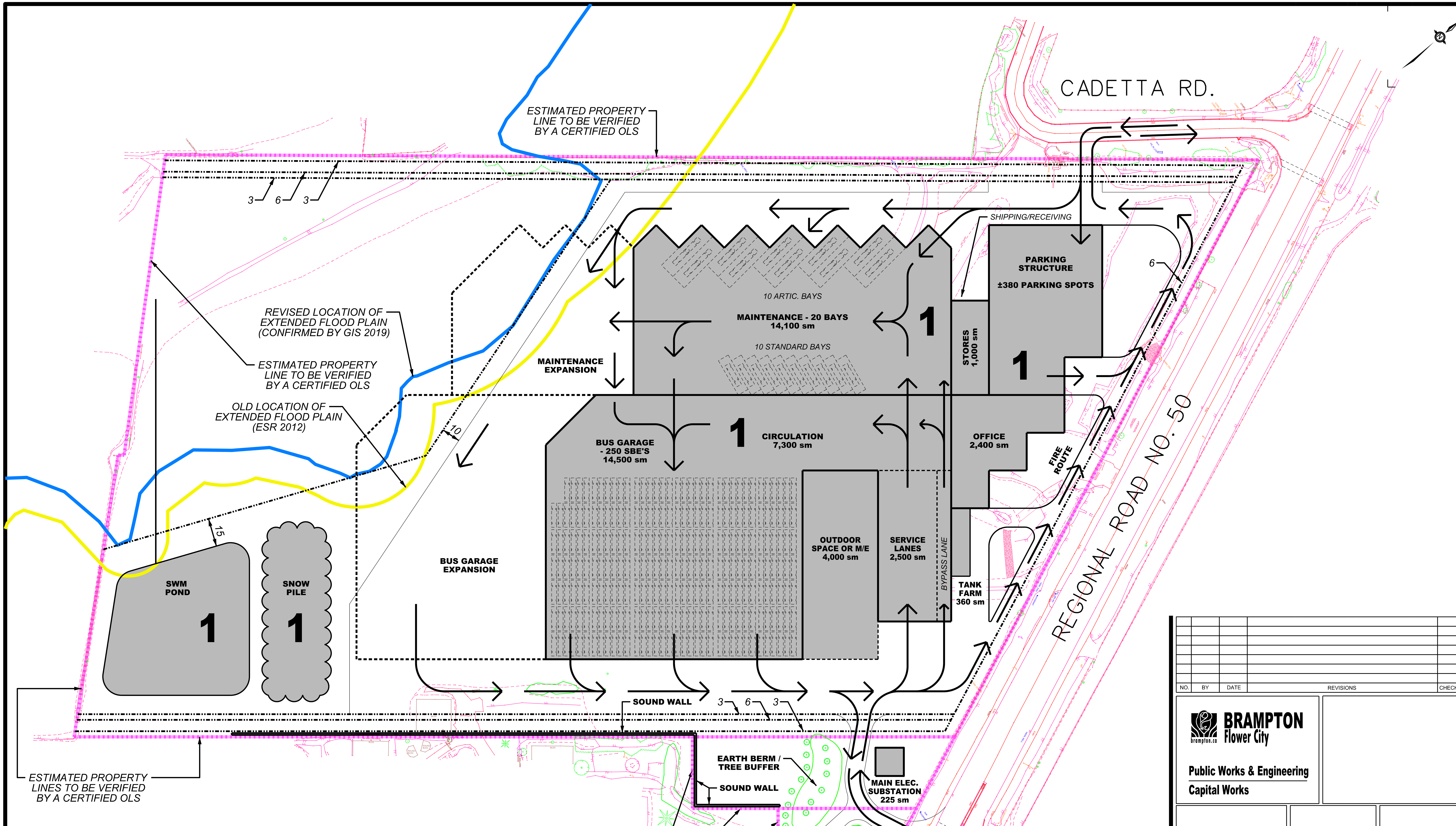

OPTION 4 - PHASE 1
SINGLE STOREY PLAN

10 ARTICULATED (60') MAINTENANCE BAYS
10 STANDARD (40') MAINTENANCE BAYS
250 SBE'S BUS STORAGE
380 CARS PARKING STRUCTURE

NO.	BY	DATE	REVISIONS	CHECKED

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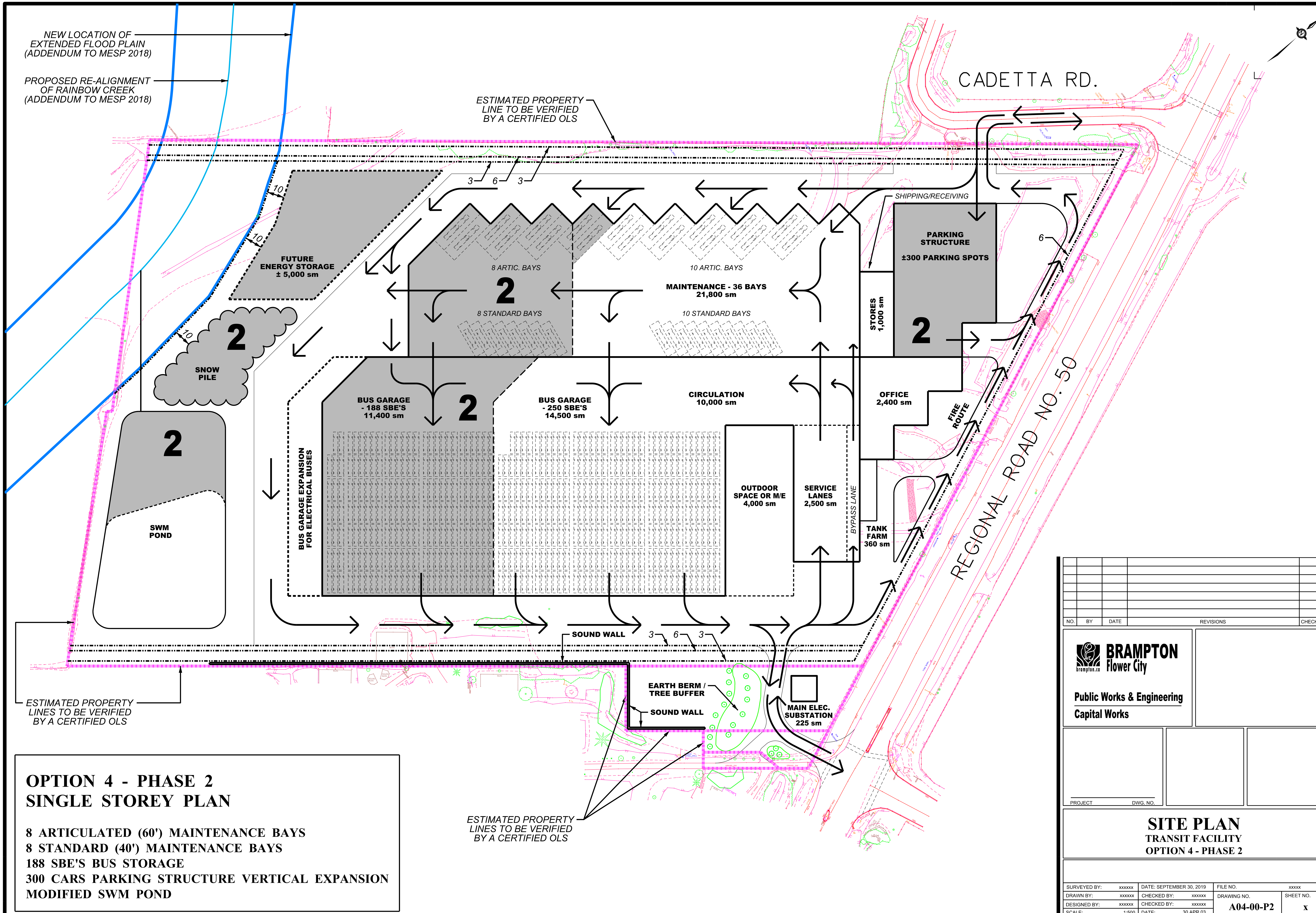
PROJECT | DWG. NO.

SITE PLAN
TRANSIT FACILITY
OPTION 4 - PHASE 1

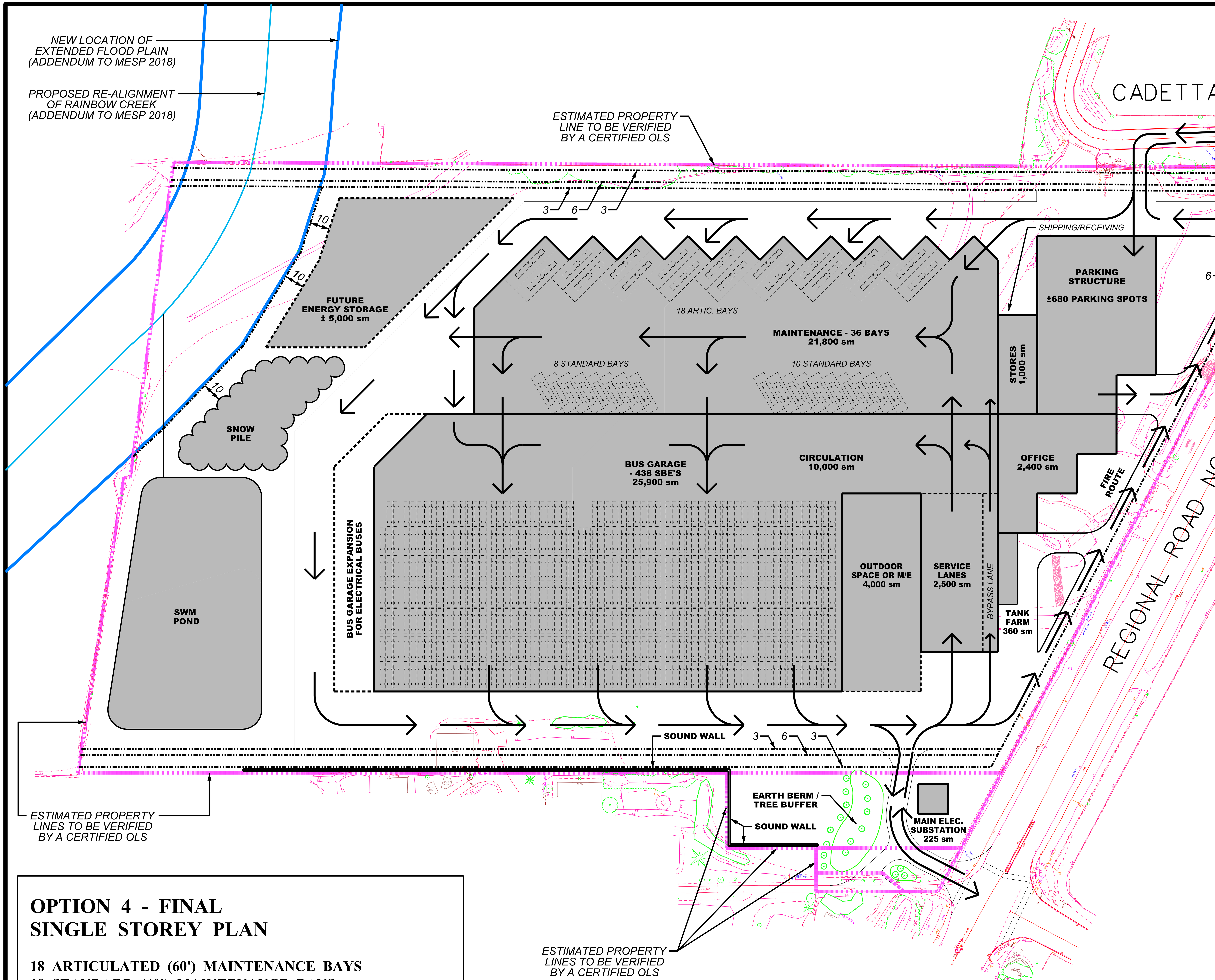
SURVEYED BY: xxxxxx	DATE: SEPTEMBER 30, 2019	FILE NO. xxxxx	
DRAWN BY: xxxxxx	CHECKED BY: xxxxxx	DRAWING NO. A04-00-P1	SHEET NO. x
DESIGNED BY: xxxxxx	CHECKED BY: xxxxxx		
SCALE: 1:500	DATE: 30 APR 03		

LAST UPDATED 23 JAN 17 – PMZ



OPTION 4 - PHASE 2
SINGLE STOREY PLAN

8 ARTICULATED (60') MAINTENANCE BAYS
8 STANDARD (40') MAINTENANCE BAYS
188 SBE'S BUS STORAGE
300 CARS PARKING STRUCTURE VERTICAL EXPANSION
MODIFIED SWM POND



OPTION 4 - FINAL
SINGLE STOREY PLAN

18 ARTICULATED (60') MAINTENANCE BAYS
18 STANDARD (40') MAINTENANCE BAYS
438 SBE'S BUS STORAGE
680 CARS PARKING STRUCTURE

NO.	BY	DATE	REVISIONS	CHECKED

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PROJECT
DWG. NO.

SITE PLAN
TRANSIT FACILITY
OPTION 4 - FINAL

SURVEYED BY: xxxxxx	DATE: SEPTEMBER 30, 2019	FILE NO. xxxxx	
DRAWN BY: xxxxxx	CHECKED BY: xxxxxx	DRAWING NO. A04-00-P3	SHEET NO. x
DESIGNED BY: xxxxxx	CHECKED BY: xxxxxx		
SCALE: 1:500	DATE: 30 APR 03		

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APPENDIX B

Emission Rate Calculations
(4 Pages)

Bus Emissions - Storage Garage

Notes:	1-hour maximum		24-hour maximum	
Max # of buses arriving and/or departing	100	buses per hour	700	buses
Distance travelled by each bus	0.2	km per bus	0.2	km per bus
Total Distance arriving/departing by buses	20	km in 1 hr	140	km in 24 hours
Idling time per bus	5	minutes	5	minutes
Max # of buses idling	100	buses per hour	350	buses
Total idling time of all buses	500	minutes, or	1750	minutes
	30,000	seconds	105,000	seconds

NOTE: Worst case scenario - 100 buses arriving/departing with each travelling 0.2 km inside facility in a 60-min period, with 100 bus idling for 5 minutes each in 60 minutes.
Emissions exhaust via the general ventilation of the garage.

					Urban Diesel Buses Emission Rates			1-hr Max Emissions			24-hr Max Emissions		
Contaminant	CAS	Fraction of VOC	Gaseous Phase (PAH/VOC)	Particulate Phase (PAH/OC2.5)	Idling (g/s)	In-Use (g/mi)	In-Use (g/km)	Idling Emissions (g/s)	Arriving/Departing Emissions (g/s)	Total Emission Rate (g/s)	Idling Emissions (g/s)	Arriving/Departing Emissions (g/s)	Total Emission Rate (g/s)
Carbon monoxide	630-08-0	-	-	-	1.04E-02	3.376	2.10E+00	8.66E-02	1.16E-02	9.83E-02	1.26E-02	3.40E-03	1.60E-02
Nitrogen oxides	10102-44-0	-	-	-	1.70E-02	14.93	9.27E+00	1.41E-01	5.15E-02	1.93E-01	2.06E-02	1.50E-02	3.57E-02
$PM_{2.5}$	SPM	-	-	-	2.97E-04	0.0274	1.70E-02	2.47E-03	9.45E-05	2.57E-03	3.61E-04	2.76E-05	3.88E-04
PM_{10}	SPM	-	-	-	3.23E-04	0.297	1.84E-01	2.69E-03	1.02E-03	3.71E-03	3.92E-04	2.99E-04	6.91E-04
Volatile organic compounds	VOC	-	-	-	7.50E-04	0.349	2.17E-01	6.25E-03	1.20E-03	7.45E-03	9.11E-04	3.51E-04	1.26E-03
Butadiene, 1,3-	106-99-0	0.0008	-	-	6.00E-07	0.0003	1.73E-04	5.00E-06	9.63E-07	5.96E-06	7.29E-07	2.81E-07	1.01E-06
2,3,4-trimethylpentane	565-75-3	0.0078	-	-	5.85E-06	0.0027	1.69E-03	4.88E-05	9.39E-06	5.81E-05	7.11E-06	2.74E-06	9.85E-06
Acetaldehyde	75-07-0	0.06934	-	-	5.20E-05	0.0242	1.50E-02	4.33E-04	8.35E-05	5.17E-04	6.32E-05	2.44E-05	8.76E-05
Acrolein	107-02-8	0.00999	-	-	7.49E-06	0.0035	2.17E-03	6.24E-05	1.20E-05	7.45E-05	9.11E-06	3.51E-06	1.26E-05
Benzene	71-43-2	0.01291	-	-	9.68E-06	0.0045	2.80E-03	8.07E-05	1.55E-05	9.62E-05	1.18E-05	4.53E-06	1.63E-05
Ethyl Benzene	100-41-4	0.0063	-	-	4.73E-06	0.0022	1.37E-03	3.94E-05	7.59E-06	4.70E-05	5.74E-06	2.21E-06	7.96E-06
Formaldehyde	50-00-0	0.21744	-	-	1.63E-04	0.0759	4.71E-02	1.36E-03	2.62E-04	1.62E-03	1.98E-04	7.64E-05	2.75E-04
Hexane, n- (n-Hexane and Hexane isomers onl	110-54-3	0.0054	-	-	4.05E-06	0.0019	1.17E-03	3.38E-05	6.50E-06	4.03E-05	4.92E-06	1.90E-06	6.82E-06
Propionaldehyde	123-38-6	0.0031	-	-	2.33E-06	0.0011	6.72E-04	1.94E-05	3.73E-06	2.31E-05	2.83E-06	1.09E-06	3.91E-06
Toluene	108-88-3	0.03	-	-	2.25E-05	0.0105	6.50E-03	1.88E-04	3.61E-05	2.24E-04	2.73E-05	1.05E-05	3.79E-05
Xylenes	1330-20-7	0.038	-	-	2.85E-05	0.0133	8.24E-03	2.38E-04	4.58E-05	2.83E-04	3.46E-05	1.33E-05	4.80E-05
Naphthalene	91-20-3	-	1.63E-02	0.0	1.22E-05	5.69E-03	3.53E-03	1.02E-04	1.96E-05	1.22E-04	1.49E-05	5.73E-06	2.06E-05
Benzo(a)pyrene [as a surrogate of total	50-32-8	-	0.0	1.48E-05	4.39E-09	4.06E-07	2.52E-07	3.66E-08	1.40E-09	3.80E-08	5.34E-09	4.08E-10	5.75E-09
Chromium Compounds (hexavalent forms)	18540-29-9	-	-	-	n/a	5.80E-09	3.60E-09	-	2.00E-11	2.00E-11	-	5.84E-12	5.84E-12
Manganese	7439-96-5	-	-	-	n/a	5.50E-07	3.42E-07	-	1.90E-09	1.90E-09	-	5.54E-10	5.54E-10
Nickel	7440-02-0	-	-	-	n/a	6.50E-07	4.04E-07	-	2.24E-09	2.24E-09	-	6.54E-10	6.54E-10
Mercury	7439-97-6	-	-	-	n/a	1.10E-08	6.83E-09	-	3.80E-11	3.80E-11	-	1.11E-11	1.11E-11
Arsenic	7440-38-2	-	-	-	n/a	2.30E-06	1.43E-06	-	7.94E-09	7.94E-09	-	2.31E-09	2.31E-09
Dioxin and Furans	DF	-	-	-	n/a	2.88E-13	1.79E-13	-	9.94E-16	9.94E-16	-	2.90E-16	2.90E-16

Bus Emissions - Maintenace Bays

	1-hour maximum		24-hour maximum	
Notes:				
Idling time per bus	5	minutes	5	minutes
Max # of buses idling	6	buses per hour	6	buses
Total idling time of all buses	30	minutes, or	30	minutes
	1,800	seconds	1,800	seconds

NOTE: worst case scenario 6 buses idling for 5 minutes each in 60 minutes.
Emissions exhaust via the general ventilation of the garage.

					Urban Diesel Buses Emission Rates			1-hr Max Emissions			24-hr Max Emissions		
Contaminant	CAS	Fraction of VOC	Gaseous Phase (PAH/VOC)	Particulate Phase (PAH/OC2.5)	Idling (g/s)	In-Use (g/mi)	In-Use (g/km)	Idling Emissions (g/s)	Arriving/Departing Emissions (g/s)	Total Emission Rate (g/s)	Idling Emissions (g/s)	Arriving/Departing Emissions (g/s)	Total Emission Rate (g/s)
Carbon monoxide	630-08-0	-	-	-	1.04E-02	3.376	2.10E+00	5.20E-03	-	5.20E-03	2.17E-04	-	2.17E-04
Nitrogen oxides	10102-44-0	-	-	-	1.70E-02	14.93	9.27E+00	8.49E-03	-	8.49E-03	3.54E-04	-	3.54E-04
$PM_{2.5}$	SPM	-	-	-	2.97E-04	0.0274	1.70E-02	1.48E-04	-	1.48E-04	6.19E-06	-	6.19E-06
PM_{10}	SPM	-	-	-	3.23E-04	0.297	1.84E-01	1.61E-04	-	1.61E-04	6.72E-06	-	6.72E-06
Volatile organic compounds	VOC	-	-	-	7.50E-04	0.349	2.17E-01	3.75E-04	-	3.75E-04	1.56E-05	-	1.56E-05
Butadiene, 1,3-	106-99-0	0.0008	-	-	6.00E-07	0.0003	1.73E-04	3.00E-07	-	3.00E-07	1.25E-08	-	1.25E-08
2,3,4-trimethylpentane	565-75-3	0.0078	-	-	5.85E-06	0.0027	1.69E-03	2.93E-06	-	2.93E-06	1.22E-07	-	1.22E-07
Acetaldehyde	75-07-0	0.06934	-	-	5.20E-05	0.0242	1.50E-02	2.60E-05	-	2.60E-05	1.08E-06	-	1.08E-06
Acrolein	107-02-8	0.00999	-	-	7.49E-06	0.0035	2.17E-03	3.75E-06	-	3.75E-06	1.56E-07	-	1.56E-07
Benzene	71-43-2	0.01291	-	-	9.68E-06	0.0045	2.80E-03	4.84E-06	-	4.84E-06	2.02E-07	-	2.02E-07
Ethyl Benzene	100-41-4	0.0063	-	-	4.73E-06	0.0022	1.37E-03	2.36E-06	-	2.36E-06	9.84E-08	-	9.84E-08
Formaldehyde	50-00-0	0.21744	-	-	1.63E-04	0.0759	4.71E-02	8.15E-05	-	8.15E-05	3.40E-06	-	3.40E-06
Hexane, n- (n-Hexane and Hexane isomers on	110-54-3	0.0054	-	-	4.05E-06	0.0019	1.17E-03	2.03E-06	-	2.03E-06	8.44E-08	-	8.44E-08
Propionaldehyde	123-38-6	0.0031	-	-	2.33E-06	0.0011	6.72E-04	1.16E-06	-	1.16E-06	4.84E-08	-	4.84E-08
Toluene	108-88-3	0.03	-	-	2.25E-05	0.0105	6.50E-03	1.13E-05	-	1.13E-05	4.69E-07	-	4.69E-07
Xylenes	1330-20-7	0.038	-	-	2.85E-05	0.0133	8.24E-03	1.43E-05	-	1.43E-05	5.94E-07	-	5.94E-07
Naphthalene	91-20-3	-	1.63E-02	0.0	1.22E-05	5.69E-03	3.53E-03	6.11E-06	-	6.11E-06	2.55E-07	-	2.55E-07
Benzo(a)pyrene [as a surrogate of total	50-32-8	-	0.0	1.48E-05	4.39E-09	4.06E-07	2.52E-07	2.20E-09	-	2.20E-09	9.16E-11	-	9.16E-11
Chromium Compounds (hexavalent forms)	18540-29-9	-	-	-	n/a	5.80E-09	3.60E-09	-	-	-	-	-	-
Manganese	7439-96-5	-	-	-	n/a	5.50E-07	3.42E-07	-	-	-	-	-	-
Nickel	7440-02-0	-	-	-	n/a	6.50E-07	4.04E-07	-	-	-	-	-	-
Mercury	7439-97-6	-	-	-	n/a	1.10E-08	6.83E-09	-	-	-	-	-	-
Arsenic	7440-38-2	-	-	-	n/a	2.30E-06	1.43E-06	-	-	-	-	-	-
Dioxin and Furans	DF	-	-	-	n/a	2.88E-13	1.79E-13	-	-	-	-	-	-

Bus Emissions - Roads

Notes:	1-hour maximum		24-hour maximum	
Max # of buses arriving and/or departing	100	buses per hour	700	buses
Distance travelled by each bus in 1 hr	0.65	km per bus	0.65	km per bus
Total Distance arriving/departing by buses	65	km in 1 hr	455	km in 24 hours

NOTE: Worst case scenario - 100 buses arriving/departing with each travelling 0.65 km on property in a 60-min period.

					Urban Diesel Buses Emission Rates			1-hr Max Emissions			24-hr Max Emissions		
Contaminant	CAS	Fraction of VOC	Gaseous Phase (PAH/VOC)	Particulate Phase (PAH/OC2.5)	Idling (g/s)	In-Use (g/mi)	In-Use (g/km)	Idling Emissions (g/s)	Arriving/Departing Emissions (g/s)	Total Emission Rate (g/s)	Idling Emissions (g/s)	Arriving/Departing Emissions (g/s)	Total Emission Rate (g/s)
Carbon monoxide	630-08-0	-	-	-	1.04E-02	3.376	2.10E+00	-	3.79E-02	3.79E-02	-	1.10E-02	1.10E-02
Nitrogen oxides	10102-44-0	-	-	-	1.70E-02	14.93	9.27E+00	-	1.67E-01	1.67E-01	-	4.88E-02	4.88E-02
$PM_{2.5}$	SPM	-	-	-	2.97E-04	0.0274	1.70E-02	-	3.07E-04	3.07E-04	-	8.96E-05	8.96E-05
PM_{10}	SPM	-	-	-	3.23E-04	0.297	1.84E-01	-	3.33E-03	3.33E-03	-	9.71E-04	9.71E-04
Volatile organic compounds	VOC	-	-	-	7.50E-04	0.349	2.17E-01	-	3.91E-03	3.91E-03	-	1.14E-03	1.14E-03
Butadiene, 1,3-	106-99-0	0.0008	-	-	6.00E-07	0.0003	1.73E-04	-	3.13E-06	3.13E-06	-	9.13E-07	9.13E-07
2,3,4-trimethylpentane	565-75-3	0.0078	-	-	5.85E-06	0.0027	1.69E-03	-	3.05E-05	3.05E-05	-	8.90E-06	8.90E-06
Acetaldehyde	75-07-0	0.06934	-	-	5.20E-05	0.0242	1.50E-02	-	2.71E-04	2.71E-04	-	7.92E-05	7.92E-05
Acrolein	107-02-8	0.00999	-	-	7.49E-06	0.0035	2.17E-03	-	3.91E-05	3.91E-05	-	1.14E-05	1.14E-05
Benzene	71-43-2	0.01291	-	-	9.68E-06	0.0045	2.80E-03	-	5.05E-05	5.05E-05	-	1.47E-05	1.47E-05
Ethyl Benzene	100-41-4	0.0063	-	-	4.73E-06	0.0022	1.37E-03	-	2.47E-05	2.47E-05	-	7.19E-06	7.19E-06
Formaldehyde	50-00-0	0.21744	-	-	1.63E-04	0.0759	4.71E-02	-	8.51E-04	8.51E-04	-	2.48E-04	2.48E-04
Hexane, n- (n-Hexane and Hexane isomers onl	110-54-3	0.0054	-	-	4.05E-06	0.0019	1.17E-03	-	2.11E-05	2.11E-05	-	6.16E-06	6.16E-06
Propionaldehyde	123-38-6	0.0031	-	-	2.33E-06	0.0011	6.72E-04	-	1.21E-05	1.21E-05	-	3.54E-06	3.54E-06
Toluene	108-88-3	0.03	-	-	2.25E-05	0.0105	6.50E-03	-	1.17E-04	1.17E-04	-	3.42E-05	3.42E-05
Xylenes	1330-20-7	0.038	-	-	2.85E-05	0.0133	8.24E-03	-	1.49E-04	1.49E-04	-	4.34E-05	4.34E-05
Naphthalene	91-20-3	-	1.63E-02	0.0	1.22E-05	5.69E-03	3.53E-03	-	6.38E-05	6.38E-05	-	1.86E-05	1.86E-05
Benzo(a)pyrene [as a surrogate of total	50-32-8	-	0.0	1.48E-05	4.39E-09	4.06E-07	2.52E-07	-	4.55E-09	4.55E-09	-	1.33E-09	1.33E-09
Chromium Compounds (hexavalent forms)	18540-29-9	-	-	-	n/a	5.80E-09	3.60E-09	-	6.50E-11	6.50E-11	-	1.90E-11	1.90E-11
Manganese	7439-96-5	-	-	-	n/a	5.50E-07	3.42E-07	-	6.17E-09	6.17E-09	-	1.80E-09	1.80E-09
Nickel	7440-02-0	-	-	-	n/a	6.50E-07	4.04E-07	-	7.29E-09	7.29E-09	-	2.13E-09	2.13E-09
Mercury	7439-97-6	-	-	-	n/a	1.10E-08	6.83E-09	-	1.23E-10	1.23E-10	-	3.60E-11	3.60E-11
Arsenic	7440-38-2	-	-	-	n/a	2.30E-06	1.43E-06	-	2.58E-08	2.58E-08	-	7.52E-09	7.52E-09
Dioxin and Furans	DF	-	-	-	n/a	2.88E-13	1.79E-13	-	3.23E-15	3.23E-15	-	9.42E-16	9.42E-16

Welding Emissions

Contaminant	CAS#	Emission Factor (g/kg)	Max Consumption	Emission Rate (g/s)
Particulate Matter	SPM	5.2	1 kg/day	6.02E-05
Total Chromium	7440-47-3	0.001	1 kg/day	1.16E-08
Manganese	7439-96-5	0.318	1 kg/day	3.68E-06
Cobalt	7440-48-4	0.001	1 kg/day	1.16E-08
Nickel	7440-02-0	0.001	40 kg/year	1.27E-09

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APPENDIX C

Emission Threshold Screening
(1 Page)

Emission Threshold Screening

Contaminant	CAS #	Facility Total Emission Rate (g/s)	Distance to Property Line (m)	Table B-1 Dispersion Factor (1-hour) (µg/m3 per g/s)	Averaging Period Converted Dispersion Factor (µg/m3 per g/s)	MECP POI Limit (µg/m^3)	MECP POI Limit Averaging Period (hrs)	MECP POI Limit Limiting Effect	MECP POI Limit Reference	Calculated Emission Threshold (g/s)	% of Emission Threshold (%)	Negligible?
Carbon monoxide	630-08-0	1.41E-01	<20	10000	12141.94884	6000	0.5	Health	B1	0.247	57.21%	Yes
Nitrogen oxides	10102-44-0	8.48E-02	<20	10000	4107.152724	200	24	Health	B1	0.024	348.47%	No
Nitrogen oxides	10102-44-0	3.69E-01	<20	10000	10000	400	1	Health	B1	0.020	1844.53%	No
Suspended particulate matter (< 44 µm diameter)	SPM	1.73E-03	<20	10000	4107.152724	120	24	Visibility	B1	0.015	11.84%	Yes
Butadiene, 1,3-	106-99-0	1.94E-06	<20	10000	787.2249505	2	8760	Health	B1	0.001	0.15%	Yes
2,3,4-trimethylpentane	565-75-3	1.89E-05	<20	10000	4107.152724	175	24	Health	B2	0.021	0.09%	Yes
Acetaldehyde	75-07-0	1.68E-04	<20	10000	4107.152724	500	24	Health	B1	0.061	0.28%	Yes
Acetaldehyde	75-07-0	8.14E-04	<20	10000	12141.94884	500	0.5	Health	B1	0.021	3.95%	Yes
Acrolein	107-02-8	2.42E-05	<20	10000	4107.152724	0.4	24	Health	B1	0.000	49.64%	Yes
Acrolein	107-02-8	1.17E-04	<20	10000	10000	4.5	1	Health	B1	0.000	52.14%	Yes
Benzene	71-43-2	3.12E-05	<20	10000	787.2249505	0.45	8760	Health	B1	0.000	10.93%	Yes
Ethyl benzene	100-41-4	7.40E-05	<20	10000	16515.14344	1900	0.17	Odour	B1	0.058	0.13%	Yes
Ethyl benzene	100-41-4	1.52E-05	<20	10000	4107.152724	1000	24	Health	B1	0.122	0.01%	Yes
Formaldehyde	50-00-0	5.26E-04	<20	10000	4107.152724	65	24	Health	B1	0.008	6.65%	Yes
Hexane, n- (n-Hexane and Hexane isomers only)	110-54-3	1.31E-05	<20	10000	4107.152724	7500	24	Health	B1	0.913	0.00%	Yes
Propionaldehyde	123-38-6	3.64E-05	<20	10000	16515.14344	10	0.17	Odour	B1	0.000	12.02%	Yes
Toluene	108-88-3	7.26E-05	<20	10000	4107.152724	2000	24	Odour	B1	0.243	0.03%	Yes
Xylenes	1330-20-7	4.46E-04	<20	10000	16515.14344	3000	0.17	Odour	B1	0.091	0.49%	Yes
Xylenes	1330-20-7	9.20E-05	<20	10000	4107.152724	730	24	Health	B2	0.089	0.10%	Yes
Naphthalene	91-20-3	3.94E-05	<20	10000	4107.152724	22.5	24	Health	B1	0.003	1.44%	Yes
Naphthalene	91-20-3	1.91E-04	<20	10000	16515.14344	50	0.17	Odour	B1	0.002	12.64%	Yes
Benzo(a)pyrene [as a surrogate of total Polycyclic Aromatic Hydrocarbons (PAHs)]	50-32-8	5.73E-09	<20	10000	787.2249505	0.00001	8760	Health	B1	6.35E-09	90.27%	Yes
Chromium Compounds (hexavalent forms)	18540-29-9	2.48E-11	<20	10000	787.2249505	0.00014	8760	Health	B1	8.89E-08	0.03%	Yes
Chromium Compounds (metallic, divalent and trivalent forms)	7440-47-3	1.16E-08	<20	10000	4107.152724	0.5	24	Health	B1	6.09E-05	0.02%	Yes
Cobalt	7440-48-4	1.16E-08	<20	10000	4107.152724	0.1	24	Health	B1	1.22E-05	0.10%	Yes
Manganese and Manganese Compounds	7439-96-5	3.68E-06	<20	10000	4107.152724	0.4	24	Health	B1	4.87E-05	7.56%	Yes
Nickel and Nickel Compounds	7440-02-0	4.05E-09	<20	10000	787.2249505	0.04	8760	Health	B1	2.54E-05	0.02%	Yes
Mercury (Hg)	7439-97-6	4.71E-11	<20	10000	4107.152724	2	24	Health	B1	2.43E-04	0.00%	Yes
Arsenic and compounds	7440-38-2	9.84E-09	<20	10000	4107.152724	0.3	24	Health	B1	3.65E-05	0.03%	Yes
Dioxins, Furans and Dioxin-like PCBs	DF	1.09E-15	<20	10000	4107.152724	1.00E-07	24	Health	B1	1.22E-11	0.01%	Yes

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APPENDIX D

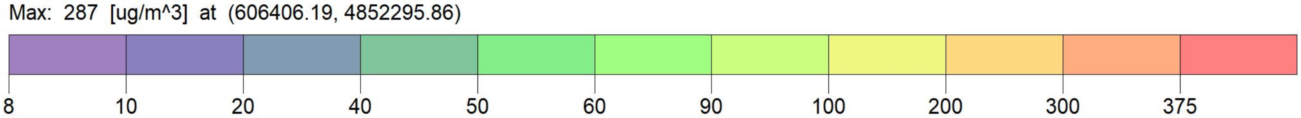
Contour Plots
(2 Pages)

PROJECT TITLE:

Brampton MSF Air Quality Environmental Assessment
Nitrogen Dioxide - 1 hr averaging period

PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

Max: 287 [ug/m^3] at (606406.19, 4852295.86)



COMMENTS:	SOURCES:	COMPANY NAME:	
	2	**ORTECH Consulting Inc.**	
	RECEPTORS: **3484**	MODELER: **Giulia Celli**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:16,794 (0 – 0.5 km)	
	MAX: **287 ug/m^3**	DATE: **2020-07-05**	PROJECT NO.: **92136**

PROJECT TITLE:

Brampton MSF Air Quality Environmental Assessment
Nitrogen Dioxide - 24 hr averaging period

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

Max: 107.4 [ug/m^3] at (606410.20, 4852286.91)

89.1 | 90.0 | 100.0 | 107.4

COMMENTS:	SOURCES:	COMPANY NAME:	
	2	**ORTECH Consulting Inc.**	
	RECEPTORS: **3484**	MODELER: **Giulia Celli**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:8,668 (0 — 0.3 km)	
	MAX: **107.4 ug/m^3**	DATE: **2020-07-05**	PROJECT NO.: **92136**