TECHNICAL MEMORANDUM

DATE August 31, 2012 **PROJECT No.** 10-1151-0350

TO Cindy Toth, Director, Environmental Policy
Town of Oakville

CC EllisDon

FROM Golder Associates Ltd. **EMAIL** eklau@golder.com

NEW OAKVILLE HOSPITAL HPAQB RESPONSE TO TOWN OF OAKVILLE PEER REVIEW

Please find below the response to the Town of Oakville Peer Review letter received on August 3, 2012 regarding the New Oakville Hospital (NOH) Health Protection Air Quality By-law (HPAQB) application submitted on March 16, 2012.

This response is divided into two sections to address the comments provided in Appendix 1 and 2 of the Peer Review letter.

SECTION 1: RESPONSE TO PROVISION OF APPLICATION MATERIAL BY APPLICANT

1. *Application Item 3.4: Raw Materials, Products and Processes*

(vi) Provide the relationship between the average and maximum process rate(s) and operating conditions /hours of operation.

Some information provided in ss.2.4-2.7.5 of the Application report.

(vii) Provide information on the variability of production rates around the average.

No information was provided on variability of fuel consumption rates around the average.

Response:
(vi) It is assumed that the Peer Review is referring to the natural gas usage at the NOH. The NOH is not operational and there is no further information is available at this time. Detailed operational data may be made available once the NOH is fully functional.

(vii) See letter provided by Carillion Canada provided in Attachment 1.

2. *Application Item 3.5: Emission Sources and Processes*

(iii) Include a table with the identification/ID code, SCC codes and the annual average and maximum emissions of health-risk air pollutants for each source.

Provided (Table 4) — SCC codes not included.

Response:
SCC codes are provided below.

Emission Source	SCC Codes	SCC Code Definition	References
Emergency Generators	2-02-004-01	IC-Industrial-Large Bore Engine: Diesel	US EPA AP-42 3.4 Large Stationary Diesel And All Stationary Dual-fuel Engines and http://www.sbcapcd.org/eng/tech/scc.htm
Boilers	1-01-006-02	Ext.Comb. Boiler-Comm./Inst.-Natural Gas: 10-100 MMBTU/hr	US EPA AP-42 1.4 Natural Gas Combustion and http://www.sbcapcd.org/eng/tech/scc.htm
Cooling Towers	3-85-001-01, 3-85-001-20, 3-85-002-01	Induced Draft Cooling Towers	US EPA AP-42 Section 13.4 Wet Cooling Towers

3. *Application Item 4.2.1 Facility Emissions Estimate Requirements / Estimation Methods*

Summarise/tabulate (previously defined) emission scenarios and operating conditions that give rise to:

(i) average and worst-case annual emission rate

Provided for CALPUFF modelling but worst-case annual emission rates were not used in the same structure modelling analysis.

(ii) frequency with which emissions within 90% of the worst-case emissions levels may occur (as per s.3.2.1.2) and (iii) variability around the average emission rates.

Not provided.

Response:
(i) An evaluation of same structure contamination was carried out using the worst case emissions and the results and CALMET data analysis are provided in Attachment 2. See Section 1, Response 5 for a summary table of the results.

(ii) No further information is available at this time. Detailed operational data may be made available once the NOH is fully functional.

4. *Application Item 4.2.2 Meteorological Data Background Concentrations (ozone, NH3, FPM), Chemistry Model(s) Used Species Modelled, Grids, Special Receptors Identified*

Deviations from defaults must be fully explained.

Applicant used the non default value for the MSPLIT variable (set to 1) which deviates from the Town's (and US EPA's) default value of 0. See detailed review for discussion.

Response:
The CALPUFF modelling has been revised with the MSPLIT variable set to the default value of "0". Electronic copies of the relevant CALPUFF input and output files will be provided separately.

5. *Application Item 5. Mapping*

a) *Model numerical outputs must be provided in the form of Summary Values tables as described earlier.*

Summary Values Table was provided as Table 11. The table did not include the higher impact values found in the same-structure contamination study. Please update the Table.

Response:
An updated Table 11 is provided below which includes the same-structure contamination. The maximum cumulative concentration for same structure contamination was calculated using the sum of the average background FPM concentration and the facility-induced concentration. The average background value was calculated using the average of the background data provided by the Town of Oakville. The maximum background value was calculated using the maximum annual average of the data provided by the Town of Oakville.

Please see Section 2, Response 6 for a detailed reponse regarding the methodology used to completed the same-structure contamination assessment.

Assessment	**Average Emissions Concentration (µg/m³)**		**Maximal Emissions Concentration (µg/m³)**	
	MTFI	**MC**	**MTFI**	**MC**
CALPUFF Modelling	0.07	7.6	0.09	9.0
Same Structure Contamination	0.18	7.9	0.19	9.1

b) *For FPM, provide concentration contour maps of appropriate scale(s) showing concentration contours within the affected airshed (also identifying the boundaries of Oakville - coordinates will be supplied by the Town),* *Mapping of model output was not provided as it was indicated that impacts were below the Town's 0.2 pg m-3 (annual) threshold value.*

Response:
Contour maps for each emission scenario were provided in the original HPAQB application package. Updated contour plots are provided in Attachment 3.

6. *Health Risk Assessment*

After responding to all questions and verifications requested in this review the requirement for a health risk assessment should be re-evaluated.

Response:
Based on revised modelling results, the NOH facility does not significantly affect the existing airshed in Oakville or on site sensitive receptors as the facility-induced FPM concentrations are less than 0.2 micrograms per cubic metre annually, a criterion defined by the Oakville Health Protection Air Quality By-Law. As a result, a health risk assessment is not required.

SECTION 2: RESPONSE TO DETAILED TECHNICAL CRITIQUE OF APPLICATION FOR APPROVAL

1. *Application Item 3.3: Issue of Alternation of Building Shape:*

The Applicant did not use the full hospital building shape for dispersion modelling purposes but rather a highly simplified version. Use of a "simplified" shape requires analysis for the effect that the simplification had on the dispersion modelling results (e.g., a sensitivity analysis). The Applicant is requested to provide this.

Response:
Building wake effect is never accurate since all the downwash models are built on a simple set of building configurations as developed in wind tunnel experiments. Using a more complex building configuration does not necessary result in improved accuracy, nor does generating a more conservative concentration mean a model is more accurate.

Referring to Figure 4 of the report, the heights of the other structures and tiers (i.e., Block A is 24.9 m, Block C is 19.8 m, Block P is 17.9 m) are lower than the heights of the primary structures (Buildings 1, 2 and 3). BPIP files demonstrating no difference between using the simplified shape and more complex shape are provided in Attachment 4.

2. *Application Item 3.4(iii): Issue of Maximal Annual Gas Consumption:*

   The Applicant indicated that maximal annual gas consumption would be 125% of the average value based on an analysis by Enermodal Engineering. However, a description of that analysis, provided in Appendix D of the Application, does not explicitly mention this 125% factor. I recommend that verification of this factor be a condition of the permit to be issued.

Response:
See letter provided by Carillion Canada provided in Attachment 1.

3. *Application Item 3.4(iv): No Information Provided on Variability of Fuel Consumption:*

   No information was provided on the possible variability of fuel consumption (especially natural gas) around the average. The Applicant is requested to provide this information so as to provide Council perspective on the average emission rates, and therefore average impacts estimated.

Response:
See letter provided by Carillion Canada provided in Attachment 1.

4. *Application Item 3.5(i): No Evaluation of Lab Fume Hood Exhausts:*

   The Applicant indicated that no emissions of FPM or precursors were expected from the hospital lab fume hoods. While it is reasonable not to have information at this stage, I recommend that a re evaluation of these emissions be conducted, as a Condition of Approval, when the hospital is fully operating.

Response:
The laboratory fume hoods will be used to exhaust vapour from the evaporation of chemicals and liquids on heaters which would not be of any significance to the FPM or its precursors. No further work is required.

5. *Application Item 3.7(iii): Emission Rates Calculated:*

   (i) *The Applicant indicated that the emissions from the diesel fired generators should be based on the lower ("nominal") of the range of data provided by the manufacturer (in Appendix B of the Application report). This was justified based on the maintenance level expected for the generators; however, the manufacturer information provided does not mention maintenance level as a factor for the range of emission data provided. Please provide further justification/explanation.*

   (ii) *In Appendix C of the Application report the diesel generator's sulphur dioxide emissions are calculated based on an assumed 30% operating load and fuel input rate. However, examination of the manufacturer data indicates that the diesel fuel consumption rate at 30% operating load is 66 gallons per hour. This has an equivalent fuel weight usage of 469 pounds/hour or 9,043,980 BTU/hr energy equivalent. This is almost three times as much as the energy equivalent value used by the Applicant and would result in emissions almost three times as much. The calculations need to be explained or revisited. If, as a result of any recalculations prompted by this review, annual emissions for pre cursor compounds are found to be above major emitter limits, then it is mandatory that they be included in the impact analysis.*

   (iii) *For directly emitted particulate matter (PM) from the hospital's gas fired boilers, the Applicant used the US EPA emission factor of 7.6 pounds of PM emitted per million cubic feet of gas burnt. However, the manufacturer data provided in Appendix B of the Application report indicates an emission rate of 0.01 pounds of PM emitted per million BTU of gas burnt; this is equivalent to 10.2 pounds per million of cubic feet of gas, a value 1.3 times higher than used by the Applicant. Further clarification of this is required.*

Response:

i) The nominal emissions profile for the diesel engines were used for the modelling assessment as these are representative of a “nominal” engine as per the Caterpillar Application and Installation Guide provided in Appendix B of the report. The NOH emergency generators will be maintained according to Standard Operation Procedures which will be documented and available for review by 3rd parties such as the Ontario Ministry of the Environment. In addition, these diesel generators are considers as critical systems that must be operational if a power outage occurs and thus must be kept at optimum working order.

ii) Emergency diesel generator emissions using the US EPA emission factors have been revised using the manufacturer’s fuel consumption rating and are provided in Attachment 5. Updated emission summary tables are also provided in Attachment 5.

iii) Boiler emissions have been revised to use the manufacturer’s data where possible and are provided in Attachment 5. Updated emission summary tables are also provided in Attachment 5.

6. *Application Item 4.2.1(i): Same Structure Contamination Analysis Did Not Use Worst Case Emissions (as required) to Predict Worst Case Impacts:*

   This is required by the Town in order to provide Council with information on the upper limit of FPM impacts at receptors on the hospital.

Response:
Same structure contamination or self-contamination is estimated using building wake effect concentrations developed from wind tunnel measurements. They represent short-term episodic concentrations (i.e. 1-hr averages) that must be extrapolated to obtain annual averages. In Golder's professional opinion, using worst-case emissions with a short-term episodic hourly result to extrapolate to an annual average is an extreme extrapolation of results and may not accurately represent real world conditions.

However, to meet the requirements of the HPAQB, an evaluation of same structure contamination was carried out using the worst case emissions and the results are provided in Attachment 2. The results of the same-structure contamination assessment demonstrate that sensitive receptor concentrations of FPM do not exceed the 0.2 µg/m³ annual limit.

7. *Application Item 4.2.1(ii): No Estimate Provided of Frequency of Worst Case Emissions:*

   No Estimate Provided of Frequency of Worst Case Emissions:

   This is required by the Town in order to provide Council with information on the frequency with which worst case impacts can occur.

Response:
Worst-case emissions are based on the operations of the natural-gas fired boilers (steam and hot water) at the hospital. The equipment has not been procured and since the hospital is not yet in operation, the demand on the equipment is not available to estimate the frequency of worst-case emissions. It is expected that worst-case emissions would occur during the winter season when steam and hot water requirements may be greater.

8. *Application Item 4.2.2: Did Not Use Town Approved Dispersion Model:*

   The Applicant used a variant of the Town approved dispersion model CALPUFF. The CALPUFF dispersion model is a United States Environmental Protection Agency (US EPA) approved airborne pollutant dispersion model. The Town has adopted, as default, the US EPA approved version (v.5.8). However, the Applicant used an alternate version (v.6.263) because of problems they encountered using the approved version. Information is requested on attempts to modify their modelling scenario in order to use the approved version.

Response:
An error message (already supplied with the revised report) was encountered when first using V5.8. Proof of this error in the model code was also provided with the revised report. No attempts were made to modify the modelling scenario as changes to source parameters would not accurately represent the facility. Therefore, the alternate version (V6.263), in which the error has been corrected, was used for all modelling runs. It is our opinion that adjusting the inputs to fit the model does not suggest improved results but leads to other inaccuracies.

9. *Application Item 4.2.2: Did Not Use Town Approved Model Input Value (for variable MSPLIT):*

   In the dispersion modelling the variable MSPLIT controls the behaviour of the emitted pollutant cloud. The Town has adopted the US EPA default value of "0" for this variable. However, the Applicant used an alternate value ("1") on the basis that the default value caused a problem with their model calculations.

   We attempted to reproduce this problem by running The Applicant's input files with MSPLIT set back to the Town default of "0." The model used by the Applicant and supplied to us (v.6.263) did not function; however, the Applicant also supplied a slightly earlier version of the model (v.6.262) which did work. When running the supplied input files through v.6.262, and MSPLIT set back to the Town default of "0," we encountered no problems and so were not able to reproduce the problem.

Response:
The CALPUFF modelling has been revised with the MSPLIT variable set to the default value of "0". We believe the problem with MSPLIT can be attributed to using CALPUFF on a different complier as well as using a Linux version of the model. Electronic copies of the relevant CALPUFF input and output files will be provided separately.

10. *Application Item 4.2.2: Same Structure Analysis Did Not Reference an Averaging Period Conversion Factor Appropriate to Same Structure Contamination:*

    The Applicant used a conversion factor to convert hourly average concentrations to annualized concentrations. However, they used a conversion factor that may not be applicable to pollutant dispersion over a building structure; the applicant should review guidance provided by the American Society of Heating, Refrigeration and Air Conditioning Engineers. This same guidance is recommended by the MOE in their Air Dispersion Guideline for Ontario (March 2009) for same structure contamination.

Response:
As suggested in the above, the modelling of self-contamination is complex and Golder relied on wind tunnel results to generate hourly concentrations. The use of the conversion factor is acceptable as this method is also used to calculate the annual average in the US EPA SCREEN3 model (see Attachment 6).

11. Application Item 4.2.2: Same Structure Analysis Did Not Demonstrate Compliance with the Town FPM Threshold:

The Applicant used a method where impacts at same structure sensitive receptors were summed from all hospital emissions sources. However, using the example of Table 10 in the Application report, the sum of the impacts at the receptor "Entrances" equals 0.269 µg m 3 which is higher than the Town threshold of 0.2. Instead, the sum is presented as 0.182; please provide an explanation.

Response:
Updated tables for both the average and worst cases are provided below.

Average Case FPM Self-Contamination Modelling Results

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intake R5	Entrances R7	Terrace / Courtyard R8	Windo ws R12
Emergency Generators	A1	52	16456.7	0.005	0.003	0.003	0.002
	A2	52	16456.7	0.005	0.003	0.003	0.002
	A3	52	16456.7	0.005	0.003	0.003	0.002
	A4	52	16456.7	0.005	0.003	0.003	0.002
	A5	52	16456.7	0.005	0.003	0.003	0.002
	A6	52	16456.7	0.005	0.003	0.003	0.002
Boilers	B1	8760	1740.5	**0.035**	**0.013**	**0.031**	**0.028**
	B2	8760	1338.4	**0.027**	**0.010**	**0.024**	**0.022**
Cooling Towers	C1	5136	37.6	0.022	0.029	0.022	0.025
	C2	5136	37.6	0.022	0.029	0.022	0.025
	C3	5136	37.6	0.022	0.029	0.022	0.025
	C4	5136	37.6	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.178**	**0.158**	**0.161**	**0.163**

Worst Case FPM Self-Contamination Modelling Results

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intake R5	Entrances R7	Terrace / Courtyard R8	Windows R12
Emergency Generators	A1	52	16456.7	0.005	0.003	0.003	0.002
	A2	52	16456.7	0.005	0.003	0.003	0.002
	A3	52	16456.7	0.005	0.003	0.003	0.002
	A4	52	16456.7	0.005	0.003	0.003	0.002
	A5	52	16456.7	0.005	0.003	0.003	0.002

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intake R5	Entrances R7	Terrace / Courtyard R8	Windows R12
	A6	52	16456.7	0.005	0.003	0.003	0.002
Boilers	B1	8760	2175.6	**0.044**	**0.017**	**0.039**	**0.035**
	B2	8760	1673.0	**0.034**	**0.013**	**0.030**	**0.027**
Cooling Towers	C1	5136	37.6	0.022	0.029	0.022	0.025
	C2	5136	37.6	0.022	0.029	0.022	0.025
	C3	5136	37.6	0.022	0.029	0.022	0.025
	C4	5136	37.6	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.193**	**0.164**	**0.174**	**0.175**

12. *Application Item 5: Summary Value Table Incomplete:*

The Summary Value Table did not incorporate impact values from the same structure contamination modelling. Please include these in the Summary Value Table.

Response:
An updated table is provided in Section 2, Response 6.of this document.

JM/EKL/ADC/ng

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ATTACHMENT 1

Carillion Letter

10 August 2012

Re safety factor gas consumption

Dear Sir

Application item 3.4 (3) Maximal annual gas consumption.

Please find the explanation for 25% safety factor concerning the gas consumption for the New Oakville Hospital is a standard industry practice to allow for mitigation against possible design changes, an adjustment for over optimization of Energy Modeling and a further mitigation against processed loads i.e. Autoclaves which can vary enormously due to work loads and proportionally effect the gas consumption.

Application item 3.4 (4) Variability of Fuel consumption.

Variability of fuel consumption is not available at this present moment for the project as this will be achieved through M&V (Measurement & Verification) which is part of the project agreement schedule 15. The accreditation process will be achieved within six months after the scheduled substantial completion date.

We trust that this elucidates the questions.

Yours faithfully,

Mark Crabtree
General Facilities Manager
New Oakville Hospital

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ATTACHMENT 2

Same Structure Contamination Calculations

Sources A1 to A6

Diesel Generators

Self-Contamination Sample Calculation

PM Emission Rate	0.218	lb/hr	30% load
Operating Time	1	hr	
Exit P_{exit}	101.325	kPa	
Exit T_{exit}	848.12	°F	
	726.55	K	
Exit V_{exit}	8765.11	cfm	
	4.14	m³/s	
T0	293.15	K	
D =	1620	dilution factor	

$V0 = V_{exit}(T0/T_{exit})$

$$V0 = \frac{4.14\ m^3}{s} \cdot \frac{293.15\ K}{726.55\ K}$$

$$V0 = \frac{1.67\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.218\ lb}{hr} \cdot \frac{1\ hr}{3600\ s} \cdot \frac{453.59\ g}{lb} \cdot \frac{1\ hr}{1\ hr}$$

$$\text{PM Emission Rate} = \frac{0.027\ g}{s}$$

$$\text{PM C0} = \frac{0.027\ g}{s} \cdot \frac{1\ s}{1.67\ m^3} \cdot \frac{1000000\ \mu g}{g}$$

$$\text{PM C0} = \frac{16456.7\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$\text{C annual} = \frac{16457\ \mu g/m^3}{1620}$$

$$\text{C annual} = \frac{10.16\ \mu g}{m^3} \cdot 0.079$$

$$\text{C annual} = \frac{0.803\ \mu g}{m^3}$$

The above value assumes continuous operation for the entire year. In reality, the generator will operate 1 hour per week for testing.

$$\text{C adjusted} = \frac{0.803\ \mu g}{m^3} \cdot \frac{52\ hr}{8760\ hr}$$

$$\text{C adjusted} = \frac{0.005\ \mu g}{m^3}$$

Sources B1 to B2

Steam and Hot Water Boilers

Self-Contamination Sample Calculation - Average Case

Exit P_{exit}	101.325	kPa
Exit T_{exit}	221	°C
	494.15	K
Exit V_{exit}	10.30	m³/s
T0	293.15	K
D =	550	

$V0 = V_{exit}(T0/T_{exit})$

$$V0 = \frac{10.30\ m^3}{s} \cdot \frac{293.15\ K}{494.15\ K}$$

$$V0 = \frac{6.11\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.011\ g}{s}$$

$$\text{PM C0} = \frac{0.011\ g}{s} \cdot \frac{1\ s}{6.11\ m^3} \cdot \frac{1000000\ \mu g}{g}$$

$$\text{PM C0} = \frac{1740\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$\text{C annual} = \frac{1740\ \mu g/m^3}{550}$$

$$\text{C annual} = \frac{3.16\ \mu g}{m^3} \cdot 0.079$$

$$\text{C annual} = \frac{0.250\ \mu g}{m^3}$$

Sources B1 to B2

Steam and Hot Water Boilers

Self-Contamination Sample Calculation - Worst Case

Exit P_{exit}	101.325	kPa
Exit T_{exit}	221	°C
	494.15	K
Exit V_{exit}	10.30	m³/s
T0	293.15	K
D =	550	

$V0 = V_{exit}(T0/T_{exit})$

$$V0 = \frac{10.30\ m^3}{s} \cdot \frac{293.15\ K}{494.15\ K}$$

$$V0 = \frac{6.11\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.013\ g}{s}$$

$$\text{PM C0} = \frac{0.013\ g}{s} \cdot \frac{1\ s}{6.11\ m^3} \cdot \frac{1000000\ \mu g}{g}$$

$$\text{PM C0} = \frac{2175.58\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$\text{C annual} = \frac{2176\ \mu g/m^3}{550}$$

$$\text{C annual} = \frac{3.96\ \mu g}{m^3} \cdot 0.079$$

$$\text{C annual} = \frac{0.311\ \mu g}{m^3}$$

Sources C1 to C4

Cooling Towers

Self-Contamination Sample Calculation

Exit P_{exit}	101.325	kPa
Exit T_{exit}	20	°C
	298.15	K
Exit V_{exit}	120.70	m³/s
T0	293.15	K
D =	60	

$V0 = V_{exit}(T0/T_{exit})$

$$V0 = \frac{120.70\ m^3}{s} \times \frac{293.15\ K}{298.15\ K}$$

$$V0 = \frac{118.68\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.004\ g}{s}$$

$$\text{PM C0} = \frac{0.004\ g}{s} \times \frac{1\ s}{118.68\ m^3} \times \frac{1000000\ \mu g}{g}$$

$$\text{PM C0} = \frac{37.6\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$\text{C annual} = \frac{37.6\ \mu g/m^3}{60}$$

$$\text{C annual} = \frac{0.63\ \mu g}{m^3} \times 0.079$$

$$\text{C annual} = \frac{0.049\ \mu g}{m^3}$$

The above value assumes continuous operation for the entire year. In reality, the cooling tower will operate from March to September, inclusive (approximately 5136 hours per year).

$$\text{C adjusted} = \frac{0.049\ \mu g}{m^3} \times \frac{5136\ hr}{8760\ hr}$$

$$\text{C adjusted} = \frac{0.029\ \mu g}{m^3}$$

Self-Contamination Summary Average Case

Exhaust Stack Conditions

Emission Source	ID	FPM Emission Rate	Exhaust Temperature [K]	Exhaust Flow [m³/s]	Normalized Exhaust Flow [m³/s]	In-Stack Concentration [µg/m³]
Emergency Generators	A1- A6	0.027	726.55	4.1	1.67	16456.7
Boilers	B1	0.011	494.15	10.3	6.11	1740.5
	B2	0.011	461.15	12.5	7.95	1338.4
Cooling Towers	C1 -C4	0.004	298.15	120.7	118.68	37.6

Dilution Factors

Emission Source	ID	Receptor Location Dilution Factor			
		Air Intakes	Entrances	Terrace/Courtyard	Windows
Emergency Generators	A1- A6	1620	2500	2420	3400
Boilers	B1 - B2	750	1340	550	1790
Cooling Towers	C1 -C4	80	60	80	70

Conversion Factor 0.0787
1 hr to annual

Receptor FPM Concentrations

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intakes	Entrances	Terrace/Courtyard	Windows
Emergency Generators	A1	52	16456.7	0.005	0.003	0.003	0.002
	A2	52	16456.7	0.005	0.003	0.003	0.002
	A3	52	16456.7	0.005	0.003	0.003	0.002
	A4	52	16456.7	0.005	0.003	0.003	0.002
	A5	52	16456.7	0.005	0.003	0.003	0.002
	A6	52	16456.7	0.005	0.003	0.003	0.002
Boilers	B1	8760	1740.5	0.183	0.102	0.249	0.077
	B2	8760	1338.4	0.140	0.079	0.192	0.059
Cooling Towers	C1	5136	37.6	0.022	0.029	0.022	0.025
	C2	5136	37.6	0.022	0.029	0.022	0.025
	C3	5136	37.6	0.022	0.029	0.022	0.025
	C4	5136	37.6	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.439**	**0.315**	**0.547**	**0.248**

Wind Direction Adjustment Data

Emission Source	ID	Receptor Location Dilution Factor			
		Air Intake R5	Entrances R7	Terrace/Courtyard R8	Windows R12
Emergency Generators	A1- A6	-	-	-	-
Boilers	B1 - B2	19.34%	12.94%	12.42%	36.71%
Cooling Towers	C1 -C4	-	-	-	-

Average Case FPM Self-Contamination Modelling Results

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intake R5	Entrances R7	Terrace/Courtyard R8	Windows R12
Emergency Generators	A1	52	16456.7	0.005	0.003	0.003	0.002
	A2	52	16456.7	0.005	0.003	0.003	0.002
	A3	52	16456.7	0.005	0.003	0.003	0.002
	A4	52	16456.7	0.005	0.003	0.003	0.002
	A5	52	16456.7	0.005	0.003	0.003	0.002
	A6	52	16456.7	0.005	0.003	0.003	0.002
Boilers	B1	8760	1740.5	**0.035**	**0.013**	**0.031**	**0.028**
	B2	8760	1338.4	**0.027**	**0.010**	**0.024**	**0.022**
Cooling Towers	C1	5136	37.6	0.022	0.029	0.022	0.025
	C2	5136	37.6	0.022	0.029	0.022	0.025
	C3	5136	37.6	0.022	0.029	0.022	0.025
	C4	5136	37.6	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.178**	**0.158**	**0.161**	**0.163**

Self-Contamination Summary Worst Case

Exhaust Stack Conditions

Emission Source	ID	FPM Emission Rate	Exhaust Temperature [K]	Exhaust Flow [m³/s]	Normalized Exhaust Flow [m³/s]	In-Stack Concentration [µg/m³]
Emergency Generators	A1- A6	0.027	726.55	4.1	1.67	16456.7
Boilers	B1	0.013	494.15	10.3	6.11	2175.6
	B2	0.013	461.15	12.5	7.95	1673.0
Cooling Towers	C1 -C4	0.004	298.15	120.7	118.68	37.6

Dilution Factors

Emission Source	ID	Receptor Location Dilution Factor			
		Air Intake R5	Entrances R7	Terrace/Courtyard R8	Windows R12
Emergency Generators	A1- A6	1620	2500	2420	3400
Boilers	B1 - B2	750	1340	550	1790
Cooling Towers	C1 -C4	80	60	80	70

Conversion Factor 0.0787
1 hr to annual

Receptor FPM Concentrations

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intake R5	Entrances R7	Terrace/Courtyard R8	Windows R12
Emergency Generators	A1	52	16456.7	0.005	0.003	0.003	0.002
	A2	52	16456.7	0.005	0.003	0.003	0.002
	A3	52	16456.7	0.005	0.003	0.003	0.002
	A4	52	16456.7	0.005	0.003	0.003	0.002
	A5	52	16456.7	0.005	0.003	0.003	0.002
	A6	52	16456.7	0.005	0.003	0.003	0.002
Boilers	B1	8760	2175.6	0.228	0.128	0.311	0.096
	B2	8760	1673.0	0.176	0.098	0.239	0.074
Cooling Towers	C1	5136	37.6	0.022	0.029	0.022	0.025
	C2	5136	37.6	0.022	0.029	0.022	0.025
	C3	5136	37.6	0.022	0.029	0.022	0.025
	C4	5136	37.6	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.519**	**0.360**	**0.657**	**0.282**

Wind Direction Adjustment Data

Emission Source	ID	Receptor Location Dilution Factor			
		Air Intake R5	Entrances R7	Terrace/Courtyard R8	Windows R12
Emergency Generators	A1- A6	-	-	-	-
Boilers	B1 - B2	19.34%	12.94%	12.42%	36.71%
Cooling Towers	C1 -C4	-	-	-	-

Worst Case FPM Self-Contamination Modelling Results

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intake R5	Entrances R7	Terrace/Courtyard R8	Windows R12
Emergency Generators	A1	52	16456.7	0.005	0.003	0.003	0.002
	A2	52	16456.7	0.005	0.003	0.003	0.002
	A3	52	16456.7	0.005	0.003	0.003	0.002
	A4	52	16456.7	0.005	0.003	0.003	0.002
	A5	52	16456.7	0.005	0.003	0.003	0.002
	A6	52	16456.7	0.005	0.003	0.003	0.002
Boilers	B1	8760	2175.6	**0.044**	**0.017**	**0.039**	**0.035**
	B2	8760	1673.0	**0.034**	**0.013**	**0.030**	**0.027**
Cooling Towers	C1	5136	37.6	0.022	0.029	0.022	0.025
	C2	5136	37.6	0.022	0.029	0.022	0.025
	C3	5136	37.6	0.022	0.029	0.022	0.025
	C4	5136	37.6	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.193**	**0.164**	**0.174**	**0.175**

	N	NNE	NE	E	ESE	SE	S	SW	WSW	W	NW	WNW
Range	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315	315-345
Start	345	15	45	75	105	135	165	195	225	255	285	315
Count	2805	2451	4661	3999	1593	1211	1573	4091	7604	6592	4562	2634
Percentage	6.41%	5.60%	10.65%	9.14%	3.64%	2.77%	3.59%	9.35%	17.37%	15.06%	10.42%	6.02%

B1-B2 to R5
Re-entrainment directions
105° to 225°
120 °

ESE	3.64%
SE	2.77%
S	3.59%
SW	9.35%
TOTAL	19.34%

B1-B2 to R7
Re-entrainment directions
165° to 225°
60 °

S	3.59%
SW	9.35%
TOTAL	12.94%

B1-B2 to R8
Re-entrainment directions
315° to 15°
60 °

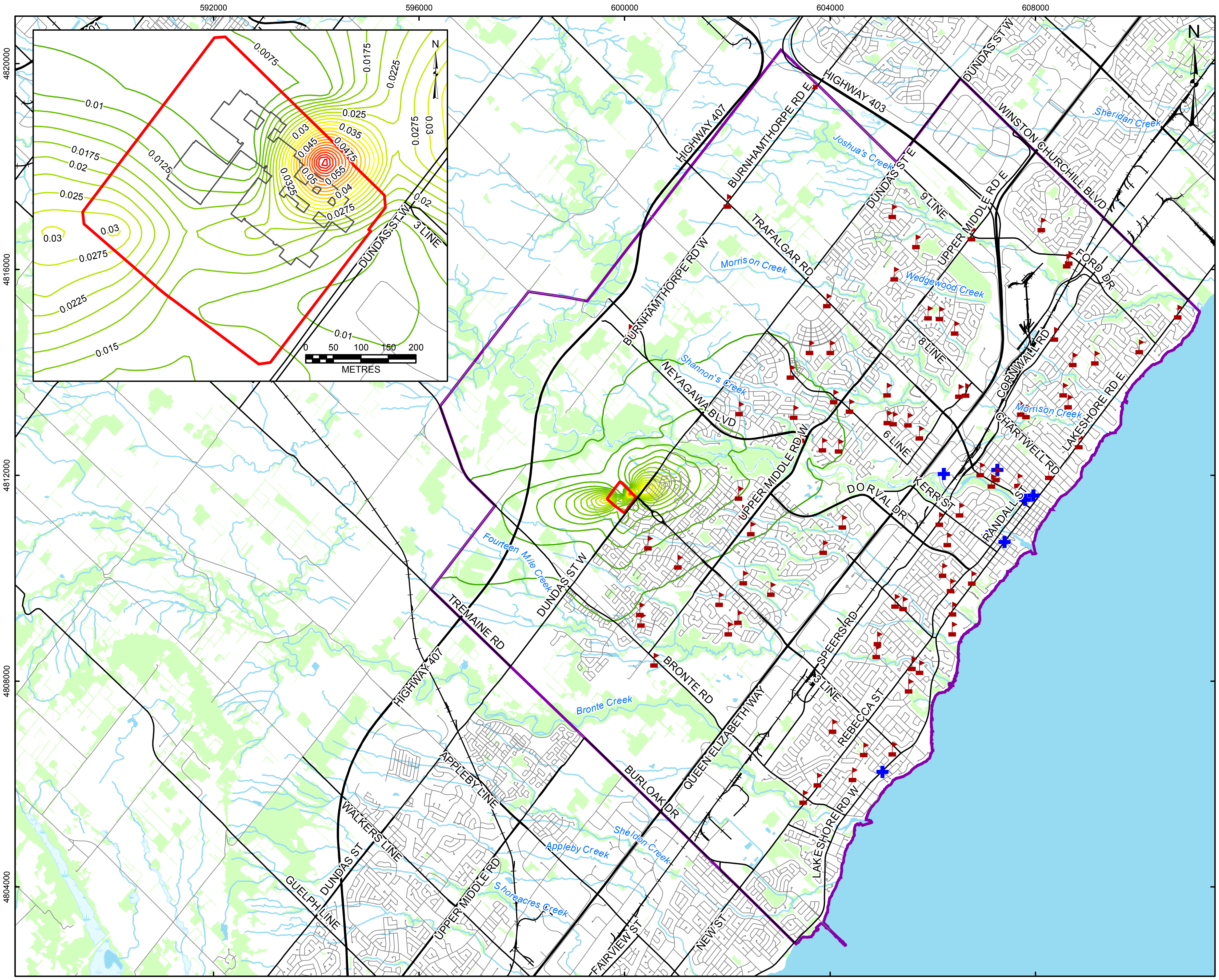
N	6.41%
WNW	6.02%
TOTAL	12.42%

B1-B2 to R12
Re-entrainment directions
105° to 255°
150 °

S	3.59%
SE	2.77%
SW	9.35%
ESE	3.64%
WSW	17.37%
TOTAL	36.71%

ATTACHMENT 3

Figures

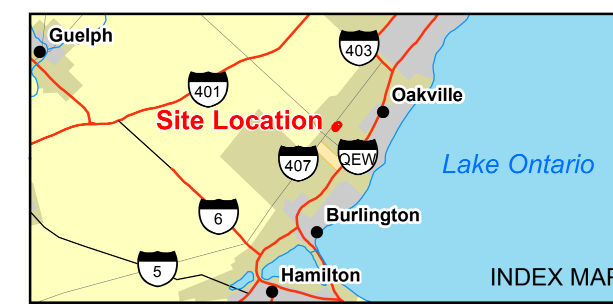


LEGEND

- Education
- Health Care
- Road
- Railways
- Watercourse
- Waterbody
- Wetland
- Wooded Area
- Property Boundary
- Town of Oakville

Concentration (µg/m³)

0.0025
0.005
0.0075
0.01
0.0125
0.015
0.0175
0.02
0.0225
0.025
0.0275
0.03
0.0325
0.035
0.0375
0.04
0.0425
0.045
0.0475
0.05
0.0525
0.055
0.0575
0.06
0.0625
0.065
0.0675



REFERENCE

Base Data - MNR LIO, obtained 2009
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2012
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

0 1,000 2,000 3,000 4,000
SCALE 1:75,000 METRES

PROJECT
OAKVILLE HOSPITAL
HPAQB APPLICATION

TITLE
FACILITY-INDUCED
FPM CONTOUR MAP (AVERAGE)

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0350			SCALE AS SHOWN	REV. 0.0
DESIGN	JO	16 Jan. 2012	**FIGURE: 6**	
GIS	JO	13 Aug. 2012		
CHECK	JM	13 Aug. 2012		
REVIEW	EKL	13 Aug. 2012		

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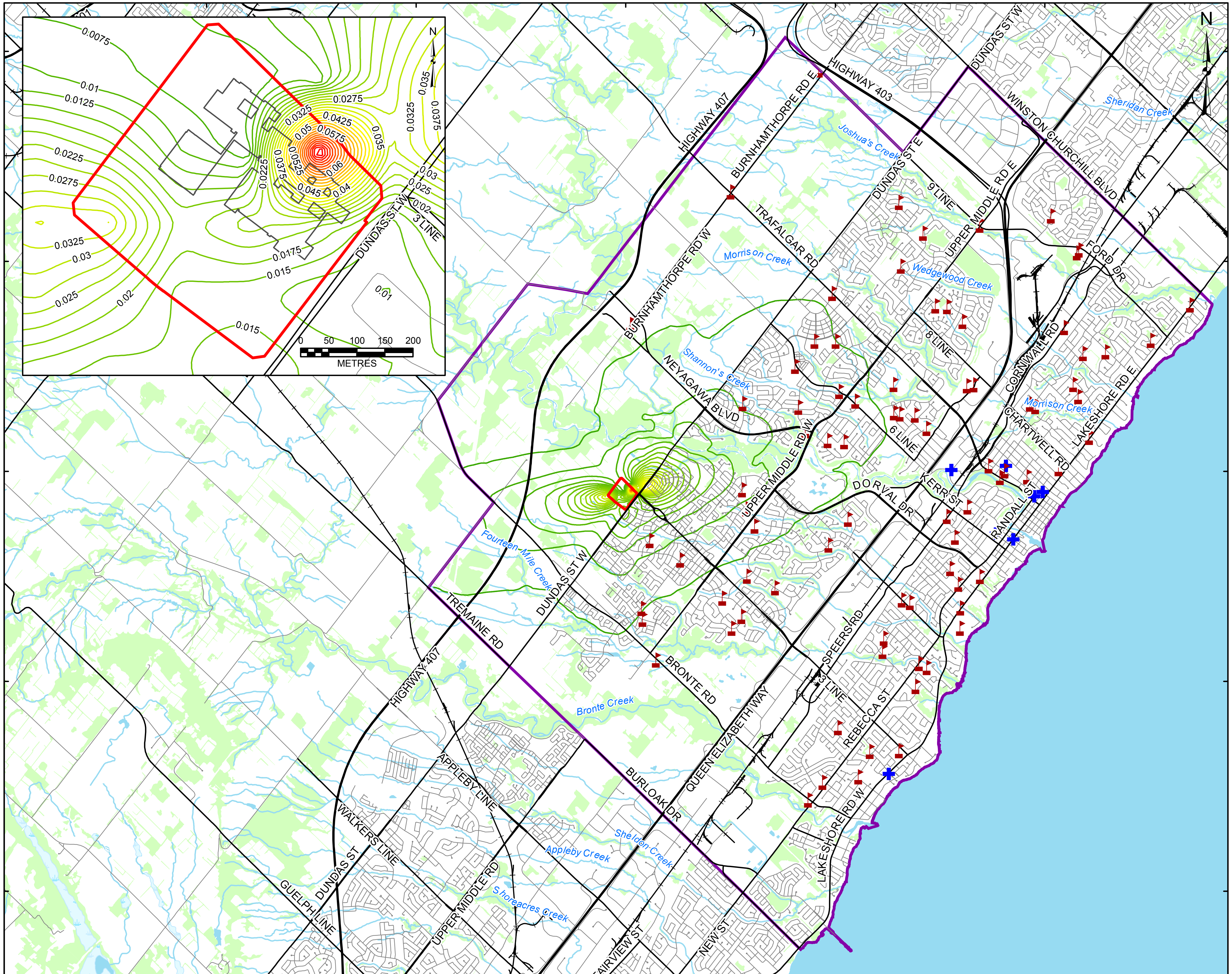
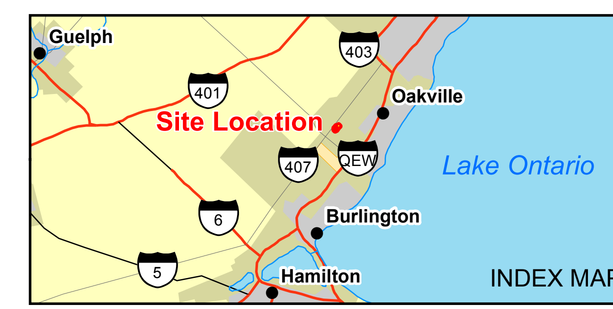


LEGEND

- Education
- Health Care
- Road
- Railways
- Watercourse
- Waterbody
- Wetland
- Wooded Area
- Property Boundary
- Town of Oakville

Concentration (µg/m³)

0.0025
0.005
0.0075
0.01
0.0125
0.015
0.0175
0.02
0.0225
0.025
0.0275
0.03
0.0325
0.035
0.0375
0.04
0.0425
0.045
0.0475
0.05
0.0525
0.055
0.0575
0.06
0.0625
0.065
0.0675
0.07
0.0725
0.075
0.0775
0.08



REFERENCE

Base Data - MNR LIO, obtained 2009
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2012
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

0 1,000 2,000 3,000 4,000
SCALE 1:75,000 METRES

PROJECT
OAKVILLE HOSPITAL
HPAQB APPLICATION

TITLE
FACILITY-INDUCED FPM CONTOUR MAP (WORSE)

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0350			SCALE AS SHOWN	REV. 0.0
DESIGN	JO	16 Jan. 2012		
GIS	JO	13 Aug. 2012	FIGURE: 7	
CHECK	JM	13 Aug. 2012		
REVIEW	EKL	13 Aug. 2012		

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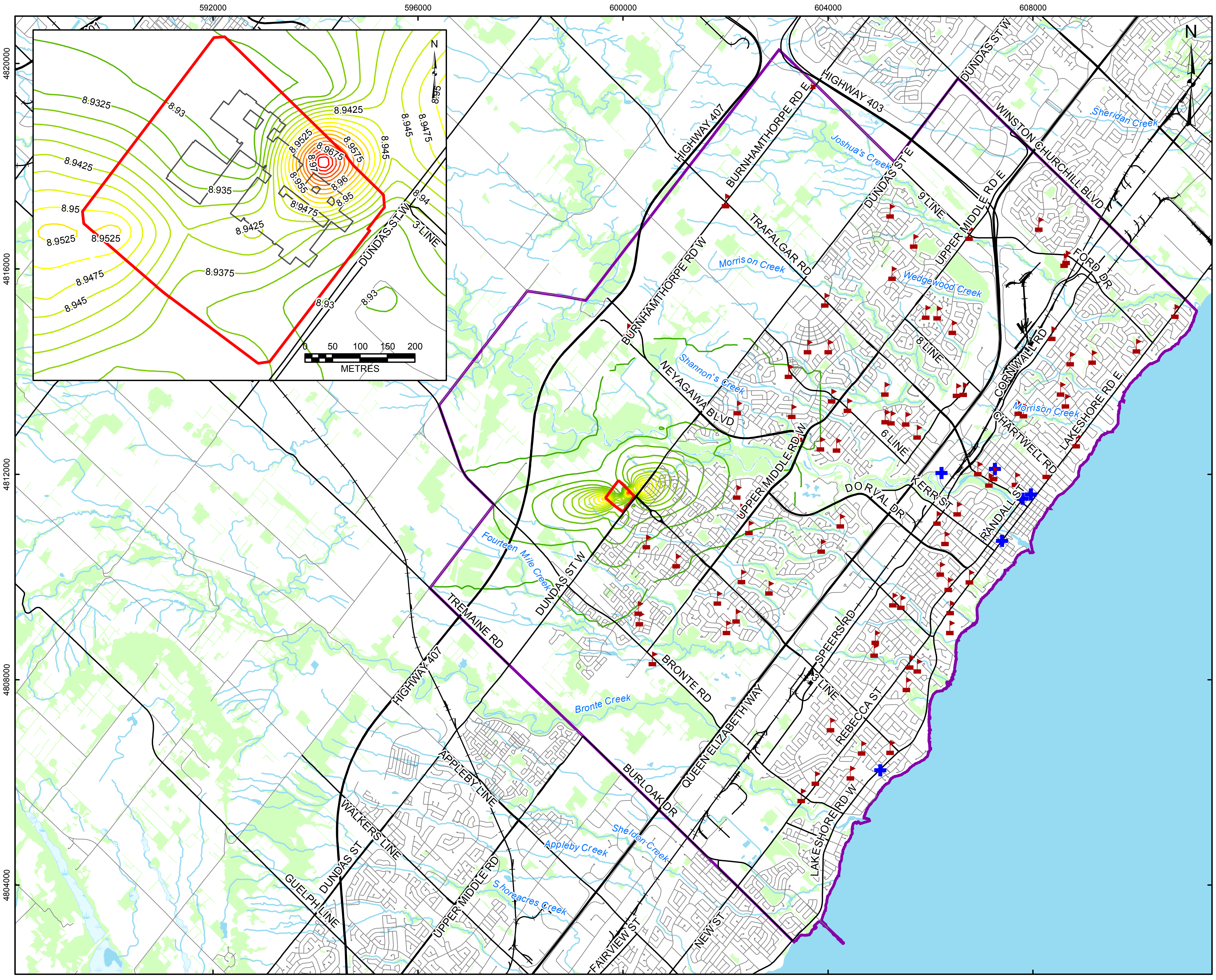
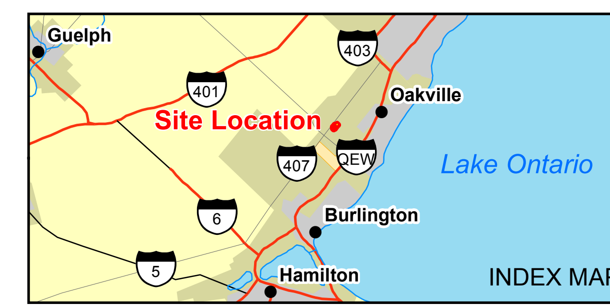


LEGEND

- Education
- Health Care
- Road
- Railways
- Watercourse
- Waterbody
- Wetland
- Wooded Area
- Property Boundary
- Town of Oakville

Concentration (µg/m³)

- 8.925
- 8.9275
- 8.93
- 8.9325
- 8.935
- 8.9375
- 8.94
- 8.9425
- 8.945
- 8.9475
- 8.95
- 8.9525
- 8.955
- 8.9575
- 8.96
- 8.9625
- 8.965
- 8.9675
- 8.97
- 8.9725
- 8.975



REFERENCE

Base Data - MNR LIO, obtained 2009
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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

0 1,000 2,000 3,000 4,000
SCALE 1:75,000 METRES

PROJECT
OAKVILLE HOSPITAL
HPAQB APPLICATION

TITLE
CUMULATIVE FPM CONTOUR MAP (AVERAGE)

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0350			SCALE AS SHOWN	REV. 0.0
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GIS	JO	13 Aug. 2012		
CHECK	JM	13 Aug. 2012		
REVIEW	EKL	13 Aug. 2012		

FIGURE: 8

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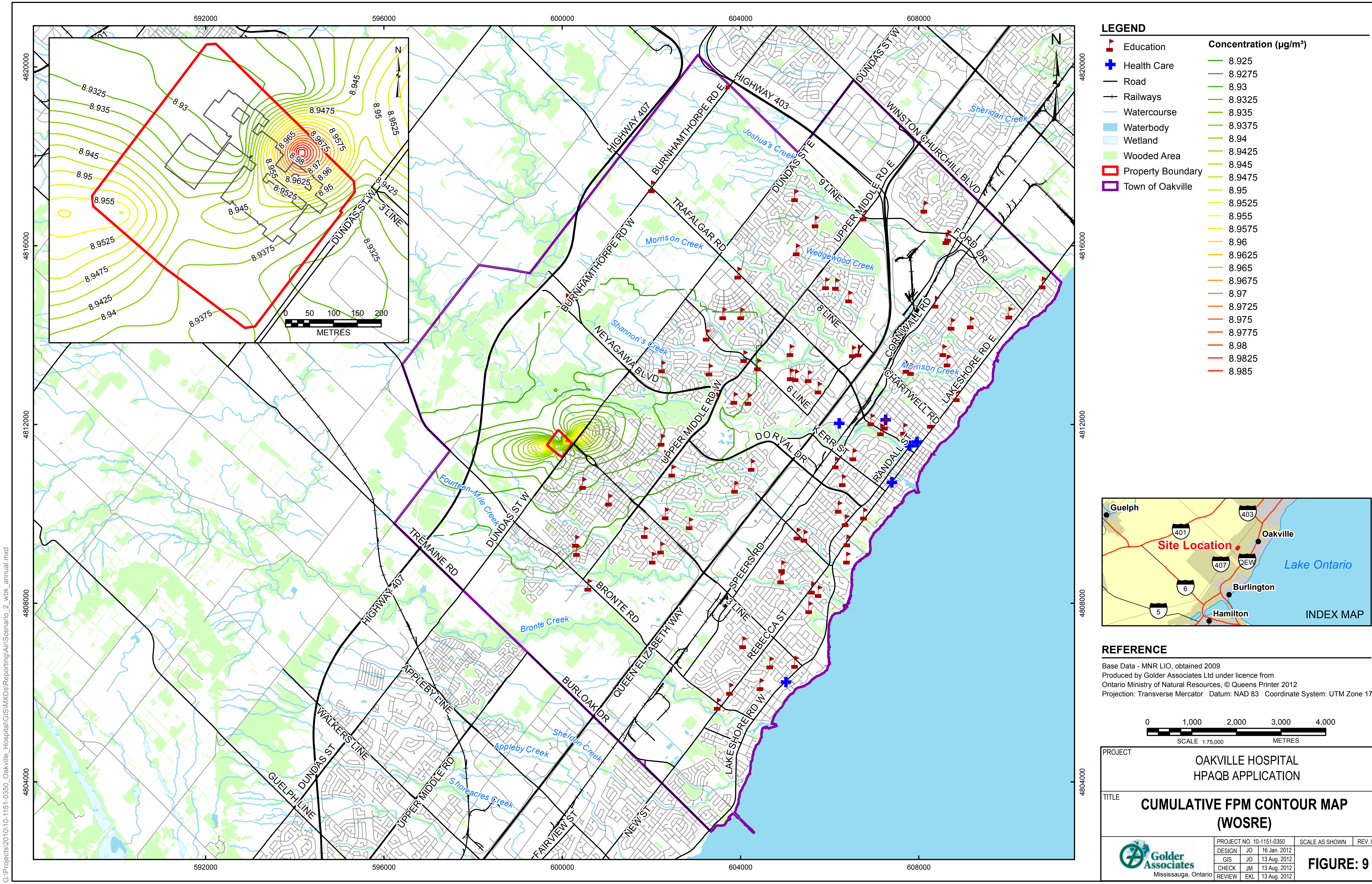

PROJECT
OAKVILLE HOSPITAL
HPAQB APPLICATION

TITLE
CUMULATIVE FPM CONTOUR MAP (WOSRE)

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0350			SCALE AS SHOWN	REV. 0.0
DESIGN	JO	16 Jan. 2012		
GIS	JO	13 Aug. 2012		
CHECK	JM	13 Aug. 2012		
REVIEW	EKL	13 Aug. 2012		

FIGURE: 9

ATTACHMENT 4

BPIP Files

```
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'UTMY' 0.00
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'BLD1' 1 160.00
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 600101.70 4811577.40
 600086.80 4811558.00
 600019.60 4811609.80
'BLD2' 1 160.00
4 45.1
 600101.60 4811577.20
 600125.20 4811559.30
 600110.40 4811540.20
 600086.80 4811558.00
'BLD3' 1 160.09
4 45.1
 599995.40 4811628.30
 600010.50 4811646.90
 600034.00 4811628.90
 600019.80 4811610.20
12
 'A1' 160.00 58.3 600050.6 4811607.5
 'A2' 160.00 58.3 600056.2 4811603.2
 'A3' 160.00 58.3 600061.3 4811599.3
 'A4' 160.00 58.3 600073.3 4811590.2
 'A5' 160.00 58.3 600078.8 4811586.1
 'A6' 160.00 58.3 600084.1 4811582.1
 'B1' 160.00 57.8 600021 4811615.3
 'B2' 160.00 57.8 600028.7 4811625.1
 'C1' 160.00 54.4 600095.4 4811562.2
 'C2' 160.00 54.4 600102.9 4811556.5
 'C3' 160.00 54.4 600104.4 4811555.2
 'C4' 160.00 54.4 600111.6 4811550
```

BREEZE BPIP

BPIP (Dated: 04274)

DATE : 7/22/2012
TIME : 19:47:27
BREEZE BPIP

============================
BPIP PROCESSING INFORMATION:
============================

The p flag has been set for preparing downwash related data for a model run utilizing the PRIME algorithm.

Inputs entered in METERS will be converted to meters using a conversion factor of 1.0000. Output will be in meters.

The UTMP variable is set to UTMY. The input is assumed to be in UTM coordinates. BPIP will move the UTM origin to the first pair of UTM coordinates read. The UTM coordinates of the new origin will be subtracted from all the other UTM coordinates entered to form this new local coordinate system.

Plant north is set to 0.00 degrees with respect to True North.

BREEZE BPIP

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	GEP** EQN1	Preliminary* GEP Stack Height Value
A1	58.30	0.00	135.70	135.70
A2	58.30	0.00	135.70	135.70
A3	58.30	0.00	135.70	135.70
A4	58.30	0.00	135.70	135.70
A5	58.30	0.00	135.70	135.70
A6	58.30	0.00	135.70	135.70
B1	57.80	0.00	135.70	135.70
B2	57.80	0.00	135.70	135.70
C1	54.40	0.00	135.70	135.70
C2	54.40	0.00	135.70	135.70
C3	54.40	0.00	135.70	135.70
C4	54.40	0.00	135.70	135.70

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.
** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 04274)

DATE : 7/22/2012
TIME : 19:47:27

BREEZE BPIP

BPIP output is in meters

SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDWID	A1	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A1	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A1	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDWID	A1	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A1	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A1	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDLEN	A1	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A1	66.07	75.23	82.10	86.48	88.23	146.91
SO	BUILDLEN	A1	85.79	88.06	87.65	84.58	78.94	70.90
SO	BUILDLEN	A1	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A1	66.07	75.23	82.10	86.48	88.23	146.91
SO	BUILDLEN	A1	85.79	88.06	87.65	84.58	78.94	70.90
SO	XBADJ	A1	-42.46	-34.13	-24.77	-18.16	-22.27	-25.70
SO	XBADJ	A1	-28.34	-30.13	-31.00	-30.93	-29.92	-58.20
SO	XBADJ	A1	-26.24	-26.87	-26.68	-25.68	-23.91	-21.40
SO	XBADJ	A1	-18.24	-14.53	-10.38	-9.79	-19.80	-29.20
SO	XBADJ	A1	-37.72	-45.10	-51.10	-55.55	-58.31	-88.71
SO	XBADJ	A1	-59.55	-61.19	-60.97	-58.90	-55.03	-49.50
SO	YBADJ	A1	-12.31	-14.20	-15.65	-16.65	-17.16	-17.14
SO	YBADJ	A1	-16.61	-15.56	-14.05	-12.11	-9.80	-7.16
SO	YBADJ	A1	-4.19	-1.24	1.75	4.69	7.48	10.05
SO	YBADJ	A1	12.31	14.20	15.65	16.65	17.16	17.14
SO	YBADJ	A1	16.61	15.56	14.05	12.11	9.80	7.16
SO	YBADJ	A1	4.19	1.24	-1.75	-4.69	-7.48	-10.05

SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDWID	A2	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A2	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A2	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDWID	A2	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A2	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A2	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDLEN	A2	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A2	66.07	75.23	82.10	86.48	88.23	146.91
SO	BUILDLEN	A2	85.79	88.06	87.65	84.58	78.94	70.90
SO	BUILDLEN	A2	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A2	66.07	75.23	82.10	86.48	88.23	146.91

```
SO BUILDLEN A2          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A2         -39.20  -32.01  -23.84  -18.47  -23.79  -28.40
SO XBADJ    A2         -32.14  -34.90  -36.60  -37.19  -36.65  -65.20
SO XBADJ    A2         -33.30  -33.76  -33.21  -31.64  -29.11  -25.70
SO XBADJ    A2         -21.51  -16.66  -11.31   -9.48  -18.27  -26.50
SO XBADJ    A2         -33.93  -40.33  -45.50  -49.29  -51.58  -81.71
SO XBADJ    A2         -52.49  -54.29  -54.44  -52.94  -49.83  -45.20
SO YBADJ    A2          -6.05   -7.47   -8.65   -9.60  -10.27  -10.62
SO YBADJ    A2         -10.65  -10.36   -9.75   -8.85   -7.67   -6.23
SO YBADJ    A2          -4.49   -2.76   -0.95    0.90    2.72    4.45
SO YBADJ    A2           6.05    7.47    8.65    9.60   10.27   10.62
SO YBADJ    A2          10.65   10.36    9.75    8.85    7.67    6.23
SO YBADJ    A2           4.49    2.76    0.95   -0.90   -2.72   -4.45

SO BUILDHGT A3          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A3          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A3          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A3          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A3          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A3          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A3          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A3          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A3          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A3          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A3          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A3          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A3          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A3          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A3          85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN A3          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A3          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A3          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A3         -36.24  -30.09  -23.02  -18.76  -25.19  -30.86
SO XBADJ    A3         -35.59  -39.24  -41.70  -42.89  -42.78  -71.57
SO XBADJ    A3         -39.71  -40.03  -39.13  -37.05  -33.84  -29.60
SO XBADJ    A3         -24.46  -18.58  -12.13   -9.19  -16.87  -24.04
SO XBADJ    A3         -30.47  -35.98  -40.40  -43.59  -45.45  -75.34
SO XBADJ    A3         -46.08  -48.03  -48.52  -47.53  -45.10  -41.30
SO YBADJ    A3          -0.35   -1.34   -2.29   -3.19   -4.00   -4.69
SO YBADJ    A3          -5.24   -5.63   -5.85   -5.89   -5.75   -5.40
SO YBADJ    A3          -4.78   -4.16   -3.41   -2.56   -1.63   -0.65
SO YBADJ    A3           0.35    1.34    2.29    3.19    4.00    4.69
SO YBADJ    A3           5.24    5.63    5.85    5.89    5.75    5.40
SO YBADJ    A3           4.78    4.16    3.41    2.56    1.63    0.65

SO BUILDHGT A4          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A4          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A4          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A4          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A4          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A4          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A4          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A4          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A4          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A4          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A4          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A4          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A4          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A4          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A4          85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN A4          60.71   48.67   35.15   27.95   42.07   54.90
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SO BUILDLEN A4          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A4          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A4         -29.37  -25.64  -21.14  -19.50  -28.54  -36.71
SO XBADJ    A4         -43.76  -49.48  -53.70  -56.29  -57.17  -86.51
SO XBADJ    A4         -54.75  -54.71  -53.02  -49.70  -44.88  -38.70
SO XBADJ    A4         -31.34  -23.03  -14.02   -8.45  -13.53  -18.20
SO XBADJ    A4         -22.31  -25.75  -28.40  -30.19  -31.07  -60.40
SO XBADJ    A4         -31.04  -33.34  -34.64  -34.88  -34.06  -32.20
SO YBADJ    A4          13.05   13.05   12.66   11.86   10.69    9.19
SO YBADJ    A4           7.41    5.41    3.25    0.99   -1.31   -3.52
SO YBADJ    A4          -5.53   -7.50   -9.26  -10.72  -11.87  -12.65
SO YBADJ    A4         -13.05  -13.05  -12.66  -11.86  -10.69   -9.19
SO YBADJ    A4          -7.41   -5.41   -3.25   -0.99    1.31    3.52
SO YBADJ    A4           5.53    7.50    9.26   10.72   11.87   12.65

SO BUILDHGT A5          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A5          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A5          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A5          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A5          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A5          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A5          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A5          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A5          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A5          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A5          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A5          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A5          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A5          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A5          85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN A5          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A5          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A5          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A5         -26.28  -23.67  -20.34  -19.90  -30.12  -39.42
SO XBADJ    A5         -47.52  -54.19  -59.20  -62.42  -63.74  -93.33
SO XBADJ    A5         -61.60  -61.39  -59.32  -55.44  -49.88  -42.80
SO XBADJ    A5         -34.42  -25.00  -14.82   -8.06  -11.95  -15.48
SO XBADJ    A5         -18.54  -21.04  -22.90  -24.06  -24.49  -53.58
SO XBADJ    A5         -24.19  -26.67  -28.34  -29.14  -29.06  -28.10
SO YBADJ    A5          19.18   19.62   19.47   18.70   17.36   15.49
SO YBADJ    A5          13.15   10.41    7.35    4.07    0.66   -2.72
SO YBADJ    A5          -5.92   -9.08  -11.97  -14.49  -16.57  -18.15
SO YBADJ    A5         -19.18  -19.62  -19.47  -18.70  -17.36  -15.49
SO YBADJ    A5         -13.15  -10.41   -7.35   -4.07   -0.66    2.72
SO YBADJ    A5           5.92    9.08   11.97   14.49   16.57   18.15

SO BUILDHGT A6          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A6          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A6          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A6          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A6          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A6          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A6          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A6          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A6          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A6          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A6          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A6          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A6          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A6          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A6          85.79   88.06   87.65   84.58   78.94   70.90
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SO BUILDLEN A6        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A6        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A6        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A6       -23.27  -21.72  -19.52  -20.24  -31.60  -42.01
SO XBADJ    A6       -51.14  -58.71  -64.50  -68.33  -70.08  -99.92
SO XBADJ    A6       -68.23  -67.86  -65.43  -61.01  -54.74  -46.80
SO XBADJ    A6       -37.44  -26.94  -15.63   -7.71  -10.46  -12.89
SO XBADJ    A6       -14.93  -16.52  -17.60  -18.15  -18.15  -46.99
SO XBADJ    A6       -17.56  -20.20  -22.22  -23.57  -24.20  -24.10
SO YBADJ    A6        25.09   25.97   26.06   25.34   23.83   21.60
SO YBADJ    A6        18.72   15.27   11.35    7.09    2.61   -1.91
SO YBADJ    A6        -6.26  -10.57  -14.56  -18.10  -21.10  -23.45
SO YBADJ    A6       -25.09  -25.97  -26.06  -25.34  -23.83  -21.60
SO YBADJ    A6       -18.72  -15.27  -11.35   -7.09   -2.61    1.91
SO YBADJ    A6         6.26   10.57   14.56   18.10   21.10   23.45

SO BUILDHGT B1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B1        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B1        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID B1        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B1        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B1        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID B1        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B1        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B1        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN B1        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B1        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN B1        85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN B1        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B1        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN B1        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    B1       -45.00  -31.34  -16.72   -5.11   -4.61   -3.96
SO XBADJ    B1        -3.20   -2.33   -1.40   -0.42    0.57  -28.67
SO XBADJ    B1         1.45   -1.87   -5.13   -8.23  -11.08  -13.60
SO XBADJ    B1       -15.70  -17.33  -18.43  -22.84  -37.46  -50.94
SO XBADJ    B1       -62.87  -72.89  -80.70  -86.06  -88.80 -118.24
SO XBADJ    B1       -87.24  -86.19  -82.52  -76.35  -67.86  -57.30
SO YBADJ    B1       -42.82  -44.68  -45.19  -44.34  -42.16  -38.70
SO YBADJ    B1       -34.06  -28.39  -21.85  -14.65   -7.01    0.89
SO YBADJ    B1         8.86   16.43   23.49   29.84   35.28   39.65
SO YBADJ    B1        42.82   44.68   45.19   44.34   42.16   38.70
SO YBADJ    B1        34.06   28.39   21.85   14.65    7.01   -0.89
SO YBADJ    B1        -8.86  -16.43  -23.49  -29.84  -35.28  -39.65

SO BUILDHGT B2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B2        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B2        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID B2        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B2        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B2        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID B2        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B2        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B2        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN B2        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B2        66.07   75.23   82.10   86.48   88.23  146.91
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SO BUILDLEN B2        85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN B2        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B2        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN B2        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    B2       -55.99  -43.18  -29.06  -17.57  -16.81  -15.53
SO XBADJ    B2       -13.78  -11.62   -9.10   -6.30   -3.32  -30.44
SO XBADJ    B2         1.85    0.69   -0.49   -1.66   -2.77   -3.80
SO XBADJ    B2        -4.71   -5.49   -6.09  -10.38  -25.26  -39.37
SO XBADJ    B2       -52.28  -63.61  -73.00  -80.17  -84.91 -116.47
SO XBADJ    B2       -87.64  -88.75  -87.16  -82.92  -76.17  -67.10
SO YBADJ    B2       -36.93  -40.80  -43.42  -44.74  -44.72  -43.33
SO YBADJ    B2       -40.63  -36.70  -31.65  -25.64  -18.85  -11.45
SO YBADJ    B2        -3.59    4.23   11.92   19.25   25.99   31.95
SO YBADJ    B2        36.93   40.80   43.42   44.74   44.72   43.33
SO YBADJ    B2        40.63   36.70   31.65   25.64   18.85   11.45
SO YBADJ    B2         3.59   -4.23  -11.92  -19.25  -25.99  -31.95

SO BUILDHGT C1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C1        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C1        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C1        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C1        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C1        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C1        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C1        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C1        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C1        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN C1        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C1        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C1        85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C1        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C1        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C1        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C1        -5.63   -6.89   -7.94  -12.26  -27.47  -41.84
SO XBADJ    C1       -54.95  -66.38  -75.80  -82.91  -87.51 -119.65
SO XBADJ    C1       -89.68  -90.37  -88.31  -83.57  -76.30  -66.70
SO XBADJ    C1       -55.08  -41.78  -27.21  -15.69  -14.60  -13.06
SO XBADJ    C1       -11.12   -8.84   -6.30   -3.56   -0.72  -27.26
SO XBADJ    C1         3.89    2.31    0.66   -1.01   -2.64   -4.20
SO YBADJ    C1        39.67   43.39   45.79   46.78   46.34   44.49
SO YBADJ    C1        41.28   36.83   31.25   24.72   17.45    9.67
SO YBADJ    C1         1.72   -6.44  -14.39  -21.91  -28.77  -34.75
SO YBADJ    C1       -39.67  -43.39  -45.79  -46.78  -46.34  -44.49
SO YBADJ    C1       -41.28  -36.83  -31.25  -24.72  -17.45   -9.67
SO YBADJ    C1        -1.72    6.44   14.39   21.91   28.77   34.75

SO BUILDHGT C2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C2        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C2        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C2        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C2        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C2        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C2        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C2        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C2        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C2        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN C2        60.71   48.67   35.15   27.95   42.07   54.90
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SO BUILDLEN C2         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C2         85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C2         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C2         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C2         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C2         -1.32   -4.10   -6.75  -12.71  -29.55  -45.49
SO XBADJ    C2        -60.05  -72.78  -83.30  -91.29  -96.51 -129.00
SO XBADJ    C2        -99.09  -99.56  -97.00  -91.50  -83.21  -72.40
SO XBADJ    C2        -59.39  -44.57  -28.40  -15.24  -12.51   -9.41
SO XBADJ    C2         -6.02   -2.45    1.20    4.81    8.28  -17.91
SO XBADJ    C2         13.30   11.50    9.35    6.92    4.27    1.50
SO YBADJ    C2         48.05   52.39   55.14   56.19   55.53   53.17
SO YBADJ    C2         49.21   43.74   36.95   29.03   20.24   10.86
SO YBADJ    C2          1.26   -8.52  -18.04  -27.01  -35.17  -42.25
SO YBADJ    C2        -48.05  -52.39  -55.14  -56.19  -55.53  -53.17
SO YBADJ    C2        -49.21  -43.74  -36.95  -29.03  -20.24  -10.86
SO YBADJ    C2         -1.26    8.52   18.04   27.01   35.17   42.25

SO BUILDHGT C3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C3         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C3         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C3         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C3         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C3         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C3         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C3         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C3         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN C3         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C3         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C3         85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C3         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C3         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C3         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C3         -0.30   -3.39   -6.38  -12.68  -29.86  -46.14
SO XBADJ    C3        -61.01  -74.03  -84.80  -92.99  -98.36 -130.95
SO XBADJ    C3       -101.07 -101.52  -98.88  -93.23  -84.75  -73.70
SO XBADJ    C3        -60.41  -45.28  -28.78  -15.27  -12.20   -8.76
SO XBADJ    C3         -5.06   -1.20    2.70    6.51   10.13  -15.96
SO XBADJ    C3         15.28   13.46   11.22    8.65    5.81    2.80
SO YBADJ    C3         49.75   54.25   57.09   58.18   57.49   55.05
SO YBADJ    C3         50.94   45.28   38.25   30.05   20.95   11.24
SO YBADJ    C3          1.29   -8.83  -18.69  -27.98  -36.42  -43.75
SO YBADJ    C3        -49.75  -54.25  -57.09  -58.18  -57.49  -55.05
SO YBADJ    C3        -50.94  -45.28  -38.25  -30.05  -20.95  -11.24
SO YBADJ    C3         -1.29    8.83   18.69   27.98   36.42   43.75

SO BUILDHGT C4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C4         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C4         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C4         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C4         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C4         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C4         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C4         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C4         27.95   42.07   54.90   66.07   75.23   82.10
```



```
SO BUILDLEN C4         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C4         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C4         85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C4         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C4         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C4         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C4          3.57   -0.96   -5.47  -13.33  -32.04  -49.77
SO XBADJ    C4        -66.00  -80.22  -92.00 -100.99 -106.90 -139.78
SO XBADJ    C4       -109.93 -110.13 -106.98 -100.58  -91.12  -78.90
SO XBADJ    C4        -64.28  -47.70  -29.68  -14.63  -10.03   -5.13
SO XBADJ    C4         -0.07    4.99    9.90   14.51   18.67   -7.13
SO XBADJ    C4         24.14   22.07   19.33   16.00   12.18    8.00
SO YBADJ    C4         57.75   62.79   65.92   67.04   66.10   63.15
SO YBADJ    C4         58.29   51.65   43.45   33.93   23.37   12.14
SO YBADJ    C4          0.65  -11.00  -22.32  -32.97  -42.60  -50.95
SO YBADJ    C4        -57.75  -62.79  -65.92  -67.04  -66.10  -63.15
SO YBADJ    C4        -58.29  -51.65  -43.45  -33.93  -23.37  -12.14
SO YBADJ    C4         -0.65   11.00   22.32   32.97   42.60   50.95
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'UTMY' 0.00
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'BLD1' 1 160.00
4 54.28
 600034.30 4811628.90
 600101.70 4811577.40
 600086.80 4811558.00
 600019.60 4811609.80
'BLD2' 1 160.00
4 45.1
 600101.60 4811577.20
 600125.20 4811559.30
 600110.40 4811540.20
 600086.80 4811558.00
'BLD3' 1 160.09
4 45.1
 599995.40 4811628.30
 600010.50 4811646.90
 600034.00 4811628.90
 600019.80 4811610.20
'BLDC' 1 160.09
24 19.8
 599984.60 4811615.20
 599934.40 4811549.40
 599954.00 4811535.40
 599959.20 4811543.70
 599962.30 4811540.60
 599959.70 4811538.50
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 600076.80 4811484.10
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 600113.60 4811537.00
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 600083.50 4811540.60
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 600076.80 4811566.50
 600066.40 4811552.00
 600021.40 4811587.70
 600031.70 4811600.20
 600007.90 4811616.70
 600000.70 4811604.80
'BLDA' 1 160.53
11 26.9
 599898.60 4811722.90
 599922.40 4811754.00
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 599952.50 4811774.20
 600036.40 4811710.00
 600024.50 4811695.50
 600016.20 4811703.20
 600001.20 4811685.10
 599992.90 4811676.30
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'BLDW1' 1 160.00
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4 37.8
 600086.60 4811623.50
 600070.60 4811602.80
 600133.80 4811554.10
 600148.80 4811574.30
'3N412003' 1 160.00
4 37.8
 600028.60 4811671.60
 600010.00 4811647.80
 600050.90 4811615.70
 600068.50 4811638.00
12
 'A1' 160.00 58.3 600050.6 4811607.5
 'A2' 160.00 58.3 600056.2 4811603.2
 'A3' 160.00 58.3 600061.3 4811599.3
 'A4' 160.00 58.3 600073.3 4811590.2
 'A5' 160.00 58.3 600078.8 4811586.1
 'A6' 160.00 58.3 600084.1 4811582.1
 'B1' 160.00 57.8 600021 4811615.3
 'B2' 160.00 57.8 600028.7 4811625.1
 'C1' 160.00 54.4 600095.4 4811562.2
 'C2' 160.00 54.4 600102.9 4811556.5
 'C3' 160.00 54.4 600104.4 4811555.2
 'C4' 160.00 54.4 600111.6 4811550
```

BREEZE BPIP

BPIP (Dated: 04274)

DATE : 8/ 9/2012
TIME : 13: 9:29
BREEZE BPIP

============================
BPIP PROCESSING INFORMATION:
============================

The p flag has been set for preparing downwash related data for a model run utilizing the PRIME algorithm.

Inputs entered in METERS   will be converted to meters using a conversion factor of   1.0000. Output will be in meters.

The UTMP variable is set to UTMY. The input is assumed to be in UTM coordinates. BPIP will move the UTM origin to the first pair of UTM coordinates read. The UTM coordinates of the new origin will be subtracted from all the other UTM coordinates entered to form this new local coordinate system.

Plant north is set to   0.00 degrees with respect to True North.

BREEZE BPIP

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	GEP** EQN1	Preliminary* GEP Stack Height Value
A1	58.30	0.00	135.70	135.70
A2	58.30	0.00	135.70	135.70
A3	58.30	0.00	135.70	135.70
A4	58.30	0.00	135.70	135.70
A5	58.30	0.00	135.70	135.70
A6	58.30	0.00	135.70	135.70
B1	57.80	0.00	135.70	135.70
B2	57.80	0.00	135.70	135.70
C1	54.40	0.00	135.70	135.70
C2	54.40	0.00	135.70	135.70
C3	54.40	0.00	135.70	135.70
C4	54.40	0.00	135.70	135.70

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.

** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 04274)

DATE : 8/ 9/2012
TIME : 13: 9:29

BREEZE BPIP

BPIP output is in meters

SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A1	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDWID	A1	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A1	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A1	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDWID	A1	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A1	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A1	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDLEN	A1	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A1	66.07	75.23	82.10	86.48	88.23	146.91
SO	BUILDLEN	A1	85.79	88.06	87.65	84.58	78.94	70.90
SO	BUILDLEN	A1	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A1	66.07	75.23	82.10	86.48	88.23	146.91
SO	BUILDLEN	A1	85.79	88.06	87.65	84.58	78.94	70.90
SO	XBADJ	A1	-42.46	-34.13	-24.77	-18.16	-22.27	-25.70
SO	XBADJ	A1	-28.34	-30.13	-31.00	-30.93	-29.92	-58.20
SO	XBADJ	A1	-26.24	-26.87	-26.68	-25.68	-23.91	-21.40
SO	XBADJ	A1	-18.24	-14.53	-10.38	-9.79	-19.80	-29.20
SO	XBADJ	A1	-37.72	-45.10	-51.10	-55.55	-58.31	-88.71
SO	XBADJ	A1	-59.55	-61.19	-60.97	-58.90	-55.03	-49.50
SO	YBADJ	A1	-12.31	-14.20	-15.65	-16.65	-17.16	-17.14
SO	YBADJ	A1	-16.61	-15.56	-14.05	-12.11	-9.80	-7.16
SO	YBADJ	A1	-4.19	-1.24	1.75	4.69	7.48	10.05
SO	YBADJ	A1	12.31	14.20	15.65	16.65	17.16	17.14
SO	YBADJ	A1	16.61	15.56	14.05	12.11	9.80	7.16
SO	YBADJ	A1	4.19	1.24	-1.75	-4.69	-7.48	-10.05

SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	45.10
SO	BUILDHGT	A2	54.28	54.28	54.28	54.28	54.28	54.28
SO	BUILDWID	A2	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A2	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A2	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDWID	A2	86.48	88.23	87.30	85.79	88.06	87.65
SO	BUILDWID	A2	84.58	78.94	70.90	60.71	48.67	42.45
SO	BUILDWID	A2	27.95	42.07	54.90	66.07	75.23	82.10
SO	BUILDLEN	A2	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A2	66.07	75.23	82.10	86.48	88.23	146.91
SO	BUILDLEN	A2	85.79	88.06	87.65	84.58	78.94	70.90
SO	BUILDLEN	A2	60.71	48.67	35.15	27.95	42.07	54.90
SO	BUILDLEN	A2	66.07	75.23	82.10	86.48	88.23	146.91

```
SO BUILDLEN A2         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A2        -39.20  -32.01  -23.84  -18.47  -23.79  -28.40
SO XBADJ    A2        -32.14  -34.90  -36.60  -37.19  -36.65  -65.20
SO XBADJ    A2        -33.30  -33.76  -33.21  -31.64  -29.11  -25.70
SO XBADJ    A2        -21.51  -16.66  -11.31   -9.48  -18.27  -26.50
SO XBADJ    A2        -33.93  -40.33  -45.50  -49.29  -51.58  -81.71
SO XBADJ    A2        -52.49  -54.29  -54.44  -52.94  -49.83  -45.20
SO YBADJ    A2         -6.05   -7.47   -8.65   -9.60  -10.27  -10.62
SO YBADJ    A2        -10.65  -10.36   -9.75   -8.85   -7.67   -6.23
SO YBADJ    A2         -4.49   -2.76   -0.95    0.90    2.72    4.45
SO YBADJ    A2          6.05    7.47    8.65    9.60   10.27   10.62
SO YBADJ    A2         10.65   10.36    9.75    8.85    7.67    6.23
SO YBADJ    A2          4.49    2.76    0.95   -0.90   -2.72   -4.45

SO BUILDHGT A3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A3         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A3         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A3         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A3         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A3         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A3         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A3         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A3         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A3         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A3         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A3         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A3         85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN A3         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A3         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A3         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A3        -36.24  -30.09  -23.02  -18.76  -25.19  -30.86
SO XBADJ    A3        -35.59  -39.24  -41.70  -42.89  -42.78  -71.57
SO XBADJ    A3        -39.71  -40.03  -39.13  -37.05  -33.84  -29.60
SO XBADJ    A3        -24.46  -18.58  -12.13   -9.19  -16.87  -24.04
SO XBADJ    A3        -30.47  -35.98  -40.40  -43.59  -45.45  -75.34
SO XBADJ    A3        -46.08  -48.03  -48.52  -47.53  -45.10  -41.30
SO YBADJ    A3         -0.35   -1.34   -2.29   -3.19   -4.00   -4.69
SO YBADJ    A3         -5.24   -5.63   -5.85   -5.89   -5.75   -5.40
SO YBADJ    A3         -4.78   -4.16   -3.41   -2.56   -1.63   -0.65
SO YBADJ    A3          0.35    1.34    2.29    3.19    4.00    4.69
SO YBADJ    A3          5.24    5.63    5.85    5.89    5.75    5.40
SO YBADJ    A3          4.78    4.16    3.41    2.56    1.63    0.65

SO BUILDHGT A4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A4         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A4         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A4         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A4         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A4         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A4         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A4         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A4         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A4         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A4         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A4         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A4         85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN A4         60.71   48.67   35.15   27.95   42.07   54.90
```



```
SO BUILDLEN A4         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A4         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A4        -29.37  -25.64  -21.14  -19.50  -28.54  -36.71
SO XBADJ    A4        -43.76  -49.48  -53.70  -56.29  -57.17  -86.51
SO XBADJ    A4        -54.75  -54.71  -53.02  -49.70  -44.88  -38.70
SO XBADJ    A4        -31.34  -23.03  -14.02   -8.45  -13.53  -18.20
SO XBADJ    A4        -22.31  -25.75  -28.40  -30.19  -31.07  -60.40
SO XBADJ    A4        -31.04  -33.34  -34.64  -34.88  -34.06  -32.20
SO YBADJ    A4         13.05   13.05   12.66   11.86   10.69    9.19
SO YBADJ    A4          7.41    5.41    3.25    0.99   -1.31   -3.52
SO YBADJ    A4         -5.53   -7.50   -9.26  -10.72  -11.87  -12.65
SO YBADJ    A4        -13.05  -13.05  -12.66  -11.86  -10.69   -9.19
SO YBADJ    A4         -7.41   -5.41   -3.25   -0.99    1.31    3.52
SO YBADJ    A4          5.53    7.50    9.26   10.72   11.87   12.65

SO BUILDHGT A5         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A5         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A5         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A5         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A5         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A5         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A5         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A5         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A5         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A5         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A5         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A5         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A5         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A5         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A5         85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN A5         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A5         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A5         85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A5        -26.28  -23.67  -20.34  -19.90  -30.12  -39.42
SO XBADJ    A5        -47.52  -54.19  -59.20  -62.42  -63.74  -93.33
SO XBADJ    A5        -61.60  -61.39  -59.32  -55.44  -49.88  -42.80
SO XBADJ    A5        -34.42  -25.00  -14.82   -8.06  -11.95  -15.48
SO XBADJ    A5        -18.54  -21.04  -22.90  -24.06  -24.49  -53.58
SO XBADJ    A5        -24.19  -26.67  -28.34  -29.14  -29.06  -28.10
SO YBADJ    A5         19.18   19.62   19.47   18.70   17.36   15.49
SO YBADJ    A5         13.15   10.41    7.35    4.07    0.66   -2.72
SO YBADJ    A5         -5.92   -9.08  -11.97  -14.49  -16.57  -18.15
SO YBADJ    A5        -19.18  -19.62  -19.47  -18.70  -17.36  -15.49
SO YBADJ    A5        -13.15  -10.41   -7.35   -4.07   -0.66    2.72
SO YBADJ    A5          5.92    9.08   11.97   14.49   16.57   18.15

SO BUILDHGT A6         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A6         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A6         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A6         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT A6         54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT A6         54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID A6         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A6         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A6         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID A6         86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID A6         84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID A6         27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN A6         60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A6         66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A6         85.79   88.06   87.65   84.58   78.94   70.90
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SO BUILDLEN A6          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN A6          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN A6          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    A6         -23.27  -21.72  -19.52  -20.24  -31.60  -42.01
SO XBADJ    A6         -51.14  -58.71  -64.50  -68.33  -70.08  -99.92
SO XBADJ    A6         -68.23  -67.86  -65.43  -61.01  -54.74  -46.80
SO XBADJ    A6         -37.44  -26.94  -15.63   -7.71  -10.46  -12.89
SO XBADJ    A6         -14.93  -16.52  -17.60  -18.15  -18.15  -46.99
SO XBADJ    A6         -17.56  -20.20  -22.22  -23.57  -24.20  -24.10
SO YBADJ    A6          25.09   25.97   26.06   25.34   23.83   21.60
SO YBADJ    A6          18.72   15.27   11.35    7.09    2.61   -1.91
SO YBADJ    A6          -6.26  -10.57  -14.56  -18.10  -21.10  -23.45
SO YBADJ    A6         -25.09  -25.97  -26.06  -25.34  -23.83  -21.60
SO YBADJ    A6         -18.72  -15.27  -11.35   -7.09   -2.61    1.91
SO YBADJ    A6           6.26   10.57   14.56   18.10   21.10   23.45

SO BUILDHGT B1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B1          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B1          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID B1          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B1          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B1          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID B1          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B1          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B1          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN B1          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B1          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN B1          85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN B1          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B1          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN B1          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    B1         -45.00  -31.34  -16.72   -5.11   -4.61   -3.96
SO XBADJ    B1          -3.20   -2.33   -1.40   -0.42    0.57  -28.67
SO XBADJ    B1           1.45   -1.87   -5.13   -8.23  -11.08  -13.60
SO XBADJ    B1         -15.70  -17.33  -18.43  -22.84  -37.46  -50.94
SO XBADJ    B1         -62.87  -72.89  -80.70  -86.06  -88.80 -118.24
SO XBADJ    B1         -87.24  -86.19  -82.52  -76.35  -67.86  -57.30
SO YBADJ    B1         -42.82  -44.68  -45.19  -44.34  -42.16  -38.70
SO YBADJ    B1         -34.06  -28.39  -21.85  -14.65   -7.01    0.89
SO YBADJ    B1           8.86   16.43   23.49   29.84   35.28   39.65
SO YBADJ    B1          42.82   44.68   45.19   44.34   42.16   38.70
SO YBADJ    B1          34.06   28.39   21.85   14.65    7.01   -0.89
SO YBADJ    B1          -8.86  -16.43  -23.49  -29.84  -35.28  -39.65

SO BUILDHGT B2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B2          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT B2          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT B2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID B2          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B2          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B2          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID B2          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID B2          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID B2          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN B2          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B2          66.07   75.23   82.10   86.48   88.23  146.91
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SO BUILDLEN B2          85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN B2          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN B2          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN B2          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    B2         -55.99  -43.18  -29.06  -17.57  -16.81  -15.53
SO XBADJ    B2         -13.78  -11.62   -9.10   -6.30   -3.32  -30.44
SO XBADJ    B2           1.85    0.69   -0.49   -1.66   -2.77   -3.80
SO XBADJ    B2          -4.71   -5.49   -6.09  -10.38  -25.26  -39.37
SO XBADJ    B2         -52.28  -63.61  -73.00  -80.17  -84.91 -116.47
SO XBADJ    B2         -87.64  -88.75  -87.16  -82.92  -76.17  -67.10
SO YBADJ    B2         -36.93  -40.80  -43.42  -44.74  -44.72  -43.33
SO YBADJ    B2         -40.63  -36.70  -31.65  -25.64  -18.85  -11.45
SO YBADJ    B2          -3.59    4.23   11.92   19.25   25.99   31.95
SO YBADJ    B2          36.93   40.80   43.42   44.74   44.72   43.33
SO YBADJ    B2          40.63   36.70   31.65   25.64   18.85   11.45
SO YBADJ    B2           3.59   -4.23  -11.92  -19.25  -25.99  -31.95

SO BUILDHGT C1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C1          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C1          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C1          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C1          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C1          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C1          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C1          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C1          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C1          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN C1          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C1          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C1          85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C1          60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C1          66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C1          85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C1          -5.63   -6.89   -7.94  -12.26  -27.47  -41.84
SO XBADJ    C1         -54.95  -66.38  -75.80  -82.91  -87.51 -119.65
SO XBADJ    C1         -89.68  -90.37  -88.31  -83.57  -76.30  -66.70
SO XBADJ    C1         -55.08  -41.78  -27.21  -15.69  -14.60  -13.06
SO XBADJ    C1         -11.12   -8.84   -6.30   -3.56   -0.72  -27.26
SO XBADJ    C1           3.89    2.31    0.66   -1.01   -2.64   -4.20
SO YBADJ    C1          39.67   43.39   45.79   46.78   46.34   44.49
SO YBADJ    C1          41.28   36.83   31.25   24.72   17.45    9.67
SO YBADJ    C1           1.72   -6.44  -14.39  -21.91  -28.77  -34.75
SO YBADJ    C1         -39.67  -43.39  -45.79  -46.78  -46.34  -44.49
SO YBADJ    C1         -41.28  -36.83  -31.25  -24.72  -17.45   -9.67
SO YBADJ    C1          -1.72    6.44   14.39   21.91   28.77   34.75

SO BUILDHGT C2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C2          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C2          54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C2          54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C2          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C2          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C2          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C2          86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C2          84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C2          27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN C2          60.71   48.67   35.15   27.95   42.07   54.90
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SO BUILDLEN C2        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C2        85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C2        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C2        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C2        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C2        -1.32   -4.10   -6.75  -12.71  -29.55  -45.49
SO XBADJ    C2       -60.05  -72.78  -83.30  -91.29  -96.51 -129.00
SO XBADJ    C2       -99.09  -99.56  -97.00  -91.50  -83.21  -72.40
SO XBADJ    C2       -59.39  -44.57  -28.40  -15.24  -12.51   -9.41
SO XBADJ    C2        -6.02   -2.45    1.20    4.81    8.28  -17.91
SO XBADJ    C2        13.30   11.50    9.35    6.92    4.27    1.50
SO YBADJ    C2        48.05   52.39   55.14   56.19   55.53   53.17
SO YBADJ    C2        49.21   43.74   36.95   29.03   20.24   10.86
SO YBADJ    C2         1.26   -8.52  -18.04  -27.01  -35.17  -42.25
SO YBADJ    C2       -48.05  -52.39  -55.14  -56.19  -55.53  -53.17
SO YBADJ    C2       -49.21  -43.74  -36.95  -29.03  -20.24  -10.86
SO YBADJ    C2        -1.26    8.52   18.04   27.01   35.17   42.25

SO BUILDHGT C3        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C3        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C3        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C3        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C3        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C3        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C3        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C3        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C3        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C3        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C3        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C3        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDLEN C3        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C3        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C3        85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C3        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C3        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C3        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C3        -0.30   -3.39   -6.38  -12.68  -29.86  -46.14
SO XBADJ    C3       -61.01  -74.03  -84.80  -92.99  -98.36 -130.95
SO XBADJ    C3      -101.07 -101.52  -98.88  -93.23  -84.75  -73.70
SO XBADJ    C3       -60.41  -45.28  -28.78  -15.27  -12.20   -8.76
SO XBADJ    C3        -5.06   -1.20    2.70    6.51   10.13  -15.96
SO XBADJ    C3        15.28   13.46   11.22    8.65    5.81    2.80
SO YBADJ    C3        49.75   54.25   57.09   58.18   57.49   55.05
SO YBADJ    C3        50.94   45.28   38.25   30.05   20.95   11.24
SO YBADJ    C3         1.29   -8.83  -18.69  -27.98  -36.42  -43.75
SO YBADJ    C3       -49.75  -54.25  -57.09  -58.18  -57.49  -55.05
SO YBADJ    C3       -50.94  -45.28  -38.25  -30.05  -20.95  -11.24
SO YBADJ    C3        -1.29    8.83   18.69   27.98   36.42   43.75

SO BUILDHGT C4        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C4        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C4        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C4        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDHGT C4        54.28   54.28   54.28   54.28   54.28   45.10
SO BUILDHGT C4        54.28   54.28   54.28   54.28   54.28   54.28
SO BUILDWID C4        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C4        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C4        27.95   42.07   54.90   66.07   75.23   82.10
SO BUILDWID C4        86.48   88.23   87.30   85.79   88.06   87.65
SO BUILDWID C4        84.58   78.94   70.90   60.71   48.67   42.45
SO BUILDWID C4        27.95   42.07   54.90   66.07   75.23   82.10
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SO BUILDLEN C4        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C4        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C4        85.79   88.06   87.65   84.58   78.94   70.90
SO BUILDLEN C4        60.71   48.67   35.15   27.95   42.07   54.90
SO BUILDLEN C4        66.07   75.23   82.10   86.48   88.23  146.91
SO BUILDLEN C4        85.79   88.06   87.65   84.58   78.94   70.90
SO XBADJ    C4         3.57   -0.96   -5.47  -13.33  -32.04  -49.77
SO XBADJ    C4       -66.00  -80.22  -92.00 -100.99 -106.90 -139.78
SO XBADJ    C4      -109.93 -110.13 -106.98 -100.58  -91.12  -78.90
SO XBADJ    C4       -64.28  -47.70  -29.68  -14.63  -10.03   -5.13
SO XBADJ    C4        -0.07    4.99    9.90   14.51   18.67   -7.13
SO XBADJ    C4        24.14   22.07   19.33   16.00   12.18    8.00
SO YBADJ    C4        57.75   62.79   65.92   67.04   66.10   63.15
SO YBADJ    C4        58.29   51.65   43.45   33.93   23.37   12.14
SO YBADJ    C4         0.65  -11.00  -22.32  -32.97  -42.60  -50.95
SO YBADJ    C4       -57.75  -62.79  -65.92  -67.04  -66.10  -63.15
SO YBADJ    C4       -58.29  -51.65  -43.45  -33.93  -23.37  -12.14
SO YBADJ    C4        -0.65   11.00   22.32   32.97   42.60   50.95
```

ATTACHMENT 5

Emission Calculations

Sources A1 to A6

Diesel Generators

Source Description: Six Caterpillar diesel emergency generators each rated at 2,500 kW. Only one emergency generator will be tested at a time.

Operating Rate: The generators are tested on a weekly basis for a 1 hour period at 30% load.

52 hr/yr
6 units

Specifications:

750.0 kW at 30% load
66.18 gal/hr diesel fuel consumption at 30% load

Methodology: Emission Factor

Source: Conversion factors for diesel fuel obtained from U.S. EPA AP-42 Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines (dated 10/96)
Caterpillar manufacturer's specifications provided in Appendix C.

Sample Calculation:

$$\text{Nitrogen oxides} = \frac{7.822\ \text{lb}}{\text{hr}} \left| \frac{454\ \text{g}}{\text{lb}} \right| \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{Nitrogen oxides} = 9.86\text{E-01}\ \frac{\text{g}}{\text{s}}$$

$$\text{Sulphur dioxide} = \frac{66.18\ \text{gal}}{\text{hr}} \left| \frac{7.1\ \text{lb}}{\text{gal}} \right| \frac{19{,}300\ \text{BTU}}{\text{lb}} \left| \frac{0.505\ \text{lb}}{1000000\ \text{BTU}} \right| \frac{454\ \text{g}}{\text{lb}} \left| \frac{1\ \text{hr}}{3600\ \text{s}} \right.$$

$$\text{Sulphur dioxide} = 5.77\text{E-01}\ \frac{\text{g}}{\text{s}}$$

Emission Summary

Contaminant	CAS	Emission Factor [lb/hr]	Emission Factor [lb/MMBtu]	US EPA Emission Factor Rating	Hourly Emissions Per Generator [g/s]	Worst Case Annual Operations	Annual Emissions [kg/yr]
Nitrogen oxides	11104-93-1	7.822	-	-	9.86E-01	N/A	1.11E+03
Particulate matter	PM	0.218	-	-	2.75E-02	N/A	3.09E+01
Sulphur dioxide	7446-09-5	-	0.505	B	5.77E-01	N/A	6.48E+02
Benzene	71-43-2	-	7.76E-04	C	8.87E-04	N/A	9.96E-01
Toluene	108-88-3	-	2.81E-04	E	3.21E-04	N/A	3.61E-01
Xylene	1330-20-7	-	1.93E-04	E	2.21E-04	N/A	2.48E-01
Propylene	115-07-1	-	2.79E-03	E	3.19E-03	N/A	3.58E+00
Formaldehyde	50-00-0	-	7.89E-05	E	9.02E-05	N/A	1.01E-01
Acetaldehyde	75-07-0	-	2.52E-05	E	2.88E-05	N/A	3.23E-02
Acrolein	107-02-8	-	7.88E-06	E	9.00E-06	N/A	1.01E-02
Naphthalene	91-20-3	-	1.30E-04	E	1.49E-04	N/A	1.67E-01
TOTAL VOCs	**VOC**	**-**	**-**	**-**	**4.89E-03**	**-**	**5.50E+00**

Sources B1 and B2

Steam and Hot Water Boilers

Source Description: The Facility operates up to three steam boilers and five hot water boilers each rated at 16,740,000 BTU (500 HP). All boilers primarily operate on natural gas but No. 2 fuel oil may be used in the event of an emergency. Fuel oil is only used in emergency situations and will not be used during normal operation; therefore, fuel oil combustion emissions are not considered. All boilers are equipped with low NOx burners.

Operating Rate: Variable emissions were used as input data into CALPUFF. Emissions were calculated based on typical natural gas fuel consumption for each month. The maximum scenario is assumed to be a 25% increase in natural gas consumption.

Month	Fuel Consumption (MJ)	Fuel Consumption (ft^3)
JAN	22,537,069	20,942,176
FEB	20,419,888	18,974,823
MAR	17,458,768	16,223,254
APR	12,579,556	11,689,332
MAY	9,835,883	9,139,822
JUN	7,232,216	6,720,410
JUL	7,391,529	6,868,449
AUG	7,418,328	6,893,351
SEP	7,703,298	7,158,155
OCT	10,816,663	10,051,194
NOV	12,958,954	12,041,881
DEC	19,123,435	17,770,117
Total	**155,475,588**	**144,472,962**

$$\text{January Fuel Consumption} = 22{,}537{,}069\ \text{MJ} \times \frac{947.8171\ \text{BTU}}{1\ \text{MJ}} \times \frac{1\ ft^3}{1020\ \text{BTU}}$$

January Fuel Consumption = 20,942,176 ft^3

Annual facility-wide natural gas consumption 144,472,962 ft^3

Percentage cosumed in steam boilers 50%
Factor for Converting from Average to Maximal Scenario 125%

Methodology: Emission Factor

Source: Tables 1.4-1 and 1.4-2 in U.S. EPA AP-42 Section 1.4 Natural Gas Combustion (dated 7/98)
Manufacturer's specifications

Contaminant	CAS	Emission Factors: Manufacturer Guarantee	Emission Factors: US EPA [lb/1,000,000 ft^3]	US EPA Emission Factor Rating
Nitrogen oxides	11104-93-1	0.035	-	-
Particulate matter	N/A	0.01	-	-
Sulphur dioxide	7446-09-5	0.001	-	-
VOC	VOC	0.016	-	-
Toluene	108-88-3	-	3.40E-03	C

Sample Calculation:

Nitrogen oxides = (January; Average Case)

20,942,176	ft³	0.035	lb	1020	BTU	453.59	g	1	month	1	day	1	hr	50%
		1000000	BTU		ft³		lb	31	day	24	hr	3600	s	

= 6.33E-02 g/s

Nitrogen oxides = (January; Maximal Case)

6.33E-02	g	125%
	s	

= 7.91E-02 g/s

Toluene = (January; Average Case)

20,942,176	ft³	3.40E-03	lb	454	g	1	month	1	day	1	hr	50%
	yr	1,000,000	ft^3	1	lb	31	day	24	hr	3600	s	

Toluene = (January; Average Case) 6.03E-06 g/s

Toluene = (January; Maximal Case)

6.03E-06	g	125%
	s	

Toluene = (January; Maximal Case) 7.54E-06 g/s

Emission Summary:

Month	Day/Month	Average Operating Scenario Emissions [g/s]					Maximum Operating Scenario Emissions [g/s]				
		Nitrogen oxides	Particulate matter	Sulphur dioxide	VOC	Toluene	Nitrogen oxides	Particulate matter	Sulphur dioxide	VOC	Toluene
JAN	31	6.33E-02	1.81E-02	1.81E-03	2.89E-02	6.03E-06	7.91E-02	2.26E-02	2.26E-03	3.62E-02	7.54E-06
FEB	28	6.35E-02	1.81E-02	1.81E-03	2.90E-02	6.05E-06	7.94E-02	2.27E-02	2.27E-03	3.63E-02	7.56E-06
MAR	31	4.90E-02	1.40E-02	1.40E-03	2.24E-02	4.67E-06	6.13E-02	1.75E-02	1.75E-03	2.80E-02	5.84E-06
APR	30	3.65E-02	1.04E-02	1.04E-03	1.67E-02	3.48E-06	4.56E-02	1.30E-02	1.30E-03	2.09E-02	4.35E-06
MAY	31	2.76E-02	7.89E-03	7.89E-04	1.26E-02	2.63E-06	3.45E-02	9.87E-03	9.87E-04	1.58E-02	3.29E-06
JUN	30	2.10E-02	6.00E-03	6.00E-04	9.60E-03	2.00E-06	2.62E-02	7.50E-03	7.50E-04	1.20E-02	2.50E-06
JUL	31	2.08E-02	5.93E-03	5.93E-04	9.49E-03	1.98E-06	2.60E-02	7.42E-03	7.42E-04	1.19E-02	2.47E-06
AUG	31	2.08E-02	5.95E-03	5.95E-04	9.53E-03	1.98E-06	2.60E-02	7.44E-03	7.44E-04	1.19E-02	2.48E-06
SEP	30	2.24E-02	6.39E-03	6.39E-04	1.02E-02	2.13E-06	2.79E-02	7.99E-03	7.99E-04	1.28E-02	2.66E-06
OCT	31	3.04E-02	8.68E-03	8.68E-04	1.39E-02	2.89E-06	3.80E-02	1.09E-02	1.09E-03	1.74E-02	3.62E-06
NOV	30	3.76E-02	1.07E-02	1.07E-03	1.72E-02	3.58E-06	4.70E-02	1.34E-02	1.34E-03	2.15E-02	4.48E-06
DEC	31	5.37E-02	1.53E-02	1.53E-03	2.46E-02	5.12E-06	6.71E-02	1.92E-02	1.92E-03	3.07E-02	6.39E-06
Average Emission Rate* [g/s]		-	**1.06E-02**	-	-	-	-	**1.33E-02**	-	-	-
Annual Total for Both Exhausts [kg/yr]		**2339.5**	**668.4**	**66.8**	**1069.5**	**0.22**	**2924.3**	**835.5**	**83.6**	**1336.8**	**0.28**

* The average particulate matter value is used to assess self-contamination at the NOH.

Made by: EKL
Checked by: JM/KSA

Sources C1 to C5

Cooling Towers

Source Description: The Facility operates four single cell 1,300 ton Marley NC8411 cooling towers.

Operating Rate: Average and Maximal Scenarios: Four BAC cooling towers operating simultaneously. Assuming maximum flow rate of 2400 gpm (9085 L/min] and max recommended TDS concentration.

5136 hr/yr

Methodology: Emission Factor

Source: Manufacturer guarantee

Sample Emission Rate Calculation:

$$\text{Drift Emission Rate from Circulating Water [g/s]} = \frac{9{,}085\ \text{L}}{\text{min}} \left| \frac{590\ \text{mg}}{\text{L}} \right| 0.005\% \left| \frac{1\ \text{g}}{1000\ \text{mg}} \right| \frac{1\ \text{min}}{60\ \text{s}}$$

$$= 4.47\text{E-03}\ \frac{\text{g}}{\text{s}}$$

Emission Summary:

Source	Source ID	Description	Circulating Water Flow Rate [L/min]	TDS Concentration [mg/L]	Drift % of Circulating Water Capacity* [10^{-2} L drift/L water flow]	Particulate Matter Emission Rate [g/s]	Annual Emissions [kg/yr]
Cooling Tower 1	C1	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
Cooling Tower 2	C2	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
Cooling Tower 3	C3	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
Cooling Tower 4	C4	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
TOTAL	-	-	-	-	-	**1.79E-02**	**3.30E+02**

Report Table 3

Pollutant	Annual Emissions [kg]	
	Average	Maximal
FPM	1029.63	1196.73
VOC	1074.97	1342.34
NO_X	3446.44	4031.31
SO_2	714.96	731.67
NH_3	0.00	0.00
Toluene	0.58	0.64
Xylene	0.25	0.25

Report Table 4

Emission Source	Average Annual Emissions [kg]						
	FPM	VOC	NOX	SO2	NH3	Toluene	Xylene
Emergency Generators	30.85	5.50	1106.97	648.11	0.00	0.36	0.25
Boilers	668.42	1069.47	2339.47	66.84	0.00	0.22	0.00
Cooling Towers	330.36	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**1029.63**	**1074.97**	**3446.44**	**714.96**	**0.00**	**0.58**	**0.25**

Report Table 5

Emission Source	Maximum Annual Emissions [kg]						
	FPM	VOC	NOX	SO2	NH3	Toluene	Xylene
Emergency Generators	30.85	5.50	1106.97	648.11	0.00	0.36	0.25
Boilers	835.53	1336.84	2924.34	83.55	0.00	0.28	0.00
Cooling Towers	330.36	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**1196.73**	**1342.34**	**4031.31**	**731.67**	**0.00**	**0.64**	**0.25**

ATTACHMENT 6

SCREEN3 Guidance

Colorado Department of Public Health and Environment

SCREEN3 Stationary Source Modeling Guidance

January 1, 2002 (updated 12/28/05) Air Pollution Control Division / Technical Services Program

1. Introduction

Although the U.S. EPA's SCREEN3 air quality model may be used for several purposes, the guidance in this document is primarily intended to support screening-level air quality modeling analyses (compliance demonstrations) for Colorado and National Ambient Air Quality Standards (CAAQS and NAAQS). While this guidance is particularly intended for anyone conducting screening-level modeling for new minor sources or minor modifications, it could be applicable in some major source permitting situations. Permit applicants for new major sources or major modifications should refer to the *Colorado Modeling Guideline* and applicable regulations for additional modeling and/or analysis requirements.

For general modeling guidance and procedures, refer to the U.S. EPA's *Guideline on Air Quality Models* (Appendix W of 40 CFR Part 51) and the *Colorado Modeling Guideline*.

SCREEN3 (zip file) is the recommended tool to calculate screening-level impact estimates for stationary sources. For help using the model, refer to the SCREEN3 Model User's Guide (EPA-454/B-95-004) and the related U.S. EPA guidance document: "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised" (EPA-454/R-92-019); available at: http://www.epa.gov/scram001/guidance_permit.htm.

In addition to the documents cited above, the U.S. EPA modeling clearinghouse contains documents and memos that help clarify U.S. EPA's guidance. U.S. EPA also has useful tutorials for some models. Although the SCREEN tutorial (zip file) is for the older SCREEN2 model, it is still helpful.

This is only a guidance document. It has been published in accordance with §25-6.5-102, C.R.S. It does not have the force and effect of a rule and is not intended to supersede statutory/regulatory requirements or recommendations of the U.S. EPA. U.S. EPA models and guidance are available on the Internet at: http://www.epa.gov/scram001.

2. Model Applicability

SCREEN3 is a single source model. It is not a multi-source model. Nevertheless, the impacts from multiple SCREEN3 model runs can be summed to conservatively estimate the impact from several sources. Section 2.2 – Merged Parameters for Multiple Stacks – in the U.S. EPA screening procedures document provides a method for modeling several sources that emit the same pollutant from several stacks with similar parameters. Nevertheless, in some situations, the source configuration or setting may be too complex to model with a simple tool like SCREEN3. Thus, it is not always possible to model a source with SCREEN3. In some cases, a refined model like ISCST3 should be used.

3. Concentration Estimates from SCREEN3

In simple terrain areas, SCREEN3 calculates 1-hour concentration estimates. Before comparing the modeled impact to the modeling significance levels or ambient air quality standards, the 1-hour concentration estimates should be converted to the averaging period of each applicable standards. In complex terrain, the model provides 24-hour concentration values. For more about converting concentration values from one averaging period to another, see section 11.

4. General Procedures for Compliance Demonstrations with Ambient Air Quality Standards

If a modeling analysis is warranted (see section 2 of the *Colorado Modeling Guideline*), the Division usually recommends that a *significant impact analysis* be conducted to help determine the scope of the modeling analysis.

If the estimated impact from the new source or modification is above the modeling significance levels in ***Table 1***, a compliance demonstration with the Colorado and National Ambient Air Quality Standards (CAAQS and NAAQS) is triggered. If the impact is below, the impact is considered to be insignificant and further air quality analysis is not usually warranted (i.e., it is not necessary to add a background concentration or to determine if there are any nearby sources that should be accounted for in the analysis).

Table 1. Modeling significance levels to determine if a source will have a significant impact on ambient air quality standards.

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Carbon Monoxide (CO)	a	a	500μg/m^3	a	2,000μg/m^3
Nitrogen Dioxide (NO_2)	1 μg/m^3	a	a	a	a
Sulfur Dioxide (SO_2)	1 μg/m^3	5 μg/m^3	a	25 μg/m^3	a
Particulate Matter <10 μm (PM-10)	1 μg/m^3	5 μg/m^3	a	a	a
a A modeling significance level has not been defined for this averaging period.					

A compliance demonstration with standards is sometimes referred to as the *full impact analysis* or the *cumulative impact analysis*. A full or cumulative *air quality impact analysis* involves a more comprehensive assessment of air quality impacts. It is discussed in section 4 of the *Colorado Modeling Guideline*.

If the impact from the new source or modification is significant and a CAAQS and NAAQS modeling analysis is warranted, use the procedures in Section 4.1 of the *Colorado Modeling Guideline*. In addition, refer to section 4.5.6 in EPA's "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised" for additional recommendations about screening-level modeling in multi-source areas.

The overall impact estimate in a compliance demonstration should account for the source under review plus existing air pollution levels at the locations (receptors) where the source has a significant impact. This can be done in several ways. In general, the compliance demonstration for standards should include:

1) the estimated (i.e., modeled) impact for the new source or modification (see section 4.1.3 in the *Colorado Modeling Guideline*);

2) an estimate of existing air quality levels within the probably area of influence of the new source or modification; at a minimum, a monitored background concentration is used (see section 4.1.5 in the *Colorado Modeling Guideline*). In some cases, there may be existing refined modeling in the area or at the source under review. If so, the historic modeling results can sometimes be used to account for existing sources at the facility and/or nearby sources. In some cases, it is necessary to model additional sources, such as:

   (a) existing sources at the facility under review (see section 4.1.4 in the *Colorado Modeling Guideline*);

   (b) existing ***nearby*** and ***other background*** sources (see section 4.1.4 in the *Colorado Modeling Guideline*);

   (c) proposed nearby sources (this includes those which have received PSD permits but are not yet in operation and others that have submitted *complete* PSD applications to a reviewing agency, but have not yet been issued permits; it may also include any large new ***minor sources*** that have received permits, but are not yet in operation).

5. Emission Rates

For the source under review (and for nearby sources), the emission rates used in the CAAQS and NAAQS compliance demonstration modeling should be based on federally enforceable emission limits, design capacity, controlled potential-to-emit, or similar allowable emission rates. This is a federal requirement in Appendix W of 40 CFR Part 51. For a more detailed explanation, see secions 4.1.3 and 4.1.4 in the *Colorado Modeling Guideline*.

While the emission rates entered into SCREEN3 are in units of grams per second, the emission rate entered into the model may be varied depending on the averaging period of interest. The emission rate entered into SCREEN3 should represent the maximum allowable emission rate allowed under the permit for the applicable averaging period. If there are no short-term emission limits, the modeled emission rate should reflect the design capacity or controlled potential-to-emit.

The usual procedure is to model the allowable short-term emission rate to determine if the source will comply with short-term (≤ 24-hours) and long-term (annual) standards. If compliance is shown with both standards, the analysis is complete; however, if compliance is not shown with the long-term standard, for example, the gram per second emission rate in SCREEN3 may be changed to reflect the allowable long-term emission rate.

6. Receptors

For SCREEN3 modeling, the receptor grid should be designed to locate the maximum concentration (see section 2.4.5 in the "SCREEN3 Model User's Guide"). When appropriate, the APCD recommends using the "automated distance array option" so that the model's iteration routine can locate the maximum value. For example, place the first receptor distance at the nearest fence line distance from the source (e.g., 10 meters); place the second receptor distance at a sufficiently large distance to find the maximum (e.g., 10,000 meters).

It is usually recommended that the receptor height be set to 0 meters (e.g., ground-level). Flagpole receptors (e.g., receptors located above ground-level) should be considered only in situations where there may be exposure concerns above ground-level. For example, if there is reason to believe the plume will impact a nearby apartment balcony, it might be appropriate to use flagpole receptors.

For the compliance demonstration, only those receptors in ambient air (i.e., receptors at or beyond the fence line or other physical barrier that prevents access by the public) need to be considered.

Refer to the secton 6.3 of the *Colorado Modeling Guideline* for additional guidance on receptor networks.

7. Building Downwash

If a stack is within a buildings "area of influence" (e.g., a distance of five times the lesser of the building's height or maximum projected width), the stack might be influenced by the wake of the building. If so, it's necessary to obtain or estimate building dimensions (e.g., height, width, and length) to run SCREEN3. Sources subject to aerodynamic turbulence induced by nearby buildings and structures should use the building downwash options in SCREEN3. Refer to EPA's SCREEN2 tutorial for example modeling exercises for sources with building downwash. As discussed in section 9, it is not necessary to enter terrain elevations when the building downwash options are used in SCREEN3.

8. Selection of Meteorology

In general, follow the recommendations in the SCREEN3 Model User's Guide and use the "full meteorology" option. The exception to this is for sources that have or will have operating schedule restrictions. For example, if a sand and gravel plant only operates from 8am to 5pm and there are or will be permit conditions restricting operation to these hours, then SCREEN3 may be run by stability class. That is, run SCREEN3 with A, B, C, and D stability classes, but exclude those classes (E and F) that occur only at night.

9. Complex Terrain

Sources located in complex terrain (terrain above release height) should consider using the terrain options in SCREEN3 to estimate impacts on nearby elevated terrain; however, if it is expected that the maximum impact will be controlled by building downwash and not by nearby terrain, it may not be necessary to use the terrain options in SCREEN3.

Refer to EPA's SCREEN tutorial for example modeling exercises for sources in complex terrain. Terrain elevations near the source may be obtained from 7.5 minute USGS topographic maps in hardcopy form or as Digital Raster Graphics (DRG) images. Digital Elevation Model (DEM) data may also be used to determine elevations. Refer to the

Colorado Modeling Guideline for additional discussion regarding elevation data for receptors.

The complex terrain algorithms in SCREEN3 are for point sources, not area sources. Thus, it is not necessary to use the complex terrain options in SCREEN3 for area source modeling. In addition, the complex terrain algorithms in SCREEN3 are for elevated plumes. It should also be emphasized that SCREEN3 "will not consider building downwash effects in either the VALLEY or the simple terrain component of the complex terrain screening procedure, even if the building downwash option is selected." (ref: "SCREEN3 Model User's Guide"). Thus, if impact estimates are appropriate for both complex terrain and building downwash scenarios, two separate SCREEN3 runs must be performed; one for complex terrain and one for building downwash.

As stated in the SCREEN3 tutorial, SCREEN3 generates a message indicating the final stable plume height, the distance to final rise, and instructions on how to select complex terrain locations for modeling in order to identify the worst-case impacts. The worst impact will generally occur at the nearest location where the stable plume actually impacts on the terrain. This is found by locating the nearest location where the terrain elevation is at or above the final plume height. For terrain locations closer than the distance to final rise, the plume may impact on the terrain at a lower elevation.

10. Conversion of NO_x to NO_2

When modeling NOx emissions from combustion sources, the estimated NOx concentration may be multiplied by 0.75 to obtain the nitrogen dioxide (NO_2) concentration.[1] The other methods allowed under federal rules are generally intended for refined-level modeling, not screening-level modeling. Thus, if use of the 0.75 ratio is not sufficient to show compliance with standards, it is usually recommended that a refined-level model be used.

[1] Most of the NOx emissions from combustion sources are emitted in the form of nitric oxide (NO), not nitrogen dioxide (NO_2). While some of the NO is converted to NO_2 by thermal reactions caused by the relatively high temperatures during the combustion process, it is usually assumed that about 90% of the NOx is emitted to the atmosphere as NO where it can be transformed into NO_2. When the NO plume mixes with ambient air, atmospheric chemical reactions occur. For example, NO reacts with ozone (O_3) to form NO_2. This is usually the primary mechanism for converting NO to NO_2 in rural areas. In urban areas, other reactions such as those with hydrocarbon oxidation products (e.g., hydroperoxyl (HO_2) and alkyl peroxy (RO_2) free radicals) can be important. The U.S. EPA recommends using a national default NO_2:NOx ratio of 0.75 (as calculated using the Ambient Ratio Method (Chu, S. and Meyer, E. L. *Use of Ambient Ratios to Estimate Impact of NOx Sources on Annual NOx Concentration*. Air & Waster Management Association, June 1991)) to estimate how much of the estimated NOx concentration exists as NO_2 in ambient air. The Division has reviewed the ratio in Colorado and believes it provides a conservative estimation (overestimation) of actual NO_2 impacts from stationary sources of NOx in Colorado. Thus, it is reasonable to use in screening-level modeling analyses.

11. Multiplying Factors

The SCREEN3 model generates 1-hour concentration estimates (unless the complex terrain mode is being used, in which case it also generates a 24-hour estimate). Initially, the 1-hour average estimates may be compared directly to ambient air standards. If compliance is NOT shown for a given averaging period, the 1-hour averages may be converted to a longer averaging period using the guidance below.

POINT SOURCES AND FLARES

For "points" and "flares," use the U.S. EPA multiplying factors shown in Table 2 to convert 1-hour concentration estimates from SCREEN3 to other averaging periods.

Table 2. "POINT" source multiplying factors to convert 1-hour average concentration estimates from the SCREEN3 model to longer averaging periods.

Averaging Period	EPA Multiplying Factor for POINT Sources[a]
3 hours	0.9
8 hours	0.7
24 hours	0.4
annual	0.08

[a] "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised," EPA-454/R-92-019, page 4-16).

VOLUME SOURCES

EPA has not developed multiplying factors for "volume" sources. Follow the recommendations in the first paragraph under "AREA SOURCES."

AREA SOURCES

EPA has not developed multiplying factors for "area" sources. For fugitive sources modeled with the "area" source algorithm in SCREEN3, EPA guidance recommends that the maximum 1-hour concentration be conservatively assumed to apply to averaging periods out to 24-hours. In many cases, it's reasonable to assume that the compliance demonstration for the 24-hour NAAQS is protective of the annual NAAQS; but there may be situations where this assumption is not valid. Thus, professional judgement must be used to decide if this assumption is valid. If compliance with the annual PM standard is believed to be issue (e.g., if there is a high annual background concentration), then refined modeling (e.g., ISC3) may be necessary.

The APCD realizes that, in most cases, it is very conservative to assume that 1-hour average concentration estimates are the same as 24-hour estimates. This is particularly true for sources where mechanical turbulence is important (e.g., haul roads). Thus, the APCD has developed 24-hour and annual multiplying factors for "area" sources that operate only during daytime hours (e.g., 7am to 5pm). The APCD has not yet developed such factors for sources that operate 24-hours per day.

The Colorado multiplying factors in *Table 3* may be used provided that the criteria in the table's footnotes are met. These multiplying factors are based on ISCST3 runs using Denver Stapleton Airport and Pueblo Airport meteorological data.

Table 3 "AREA" source multiplying factors to convert 1-hour average concentration estimates from the SCREEN3 model to longer averaging periods.

Averaging Period	Colorado Multiplying Factor for AREA Sources[a]
24 hours	0.15
annual	0.03

a The "area" source must meet the following criteria for these factors to be valid:

1. Sources modeled as "area" sources must have a significant degree of mechanically generated turbulence (e.g., sand and gravel operations, haul roads).
2. The facility must operate only during the daytime (e.g., 7am to 5pm).
3. The factors are NOT intended for new sources or modifications subject to PSD rules.

12. Modeling Methodology for "Fugitive" Particulate Matter Sources

Professional judgement must be used on a case-by-case basis to decide which sources at a facility should be modeled as "area" sources. For example, if the facility consists of an elevated point source (e.g., 10 meter tall stack) for which stack parameters can be estimated, haul roads, wind erosion, and near-ground-level quarrying activities, it would be appropriate to run the SCREEN3 model twice. The first SCREEN3 run would model emissions from the elevated point source as a "point" source. The second run would model the "fugitive" sources as an "area" source using the procedure below. Initially the maximum impact from each run of SCREEN3 could be added to calculate the cumulative impact. If this fails to show compliance, the estimates from each run may be superimposed (i.e., add concentration estimates on a receptor-by-receptor basis).

The following screening procedure is ***applicable for modeling fugitive sources of particulate matter*** (e.g., near-ground-level sources at sand and gravel plants):

1. ***Model the maximum daily and annual emission rates.***[2] The controlled potential-to-emit (design capacity) should be modeled unless the applicant is willing to accept lower emission rates as permit conditions. The short-term emission rate should reflect activities that are allowed to occur during a maximum production day. If there are several different emission scenarios of concern and it's not obvious which would be controlling, it may be appropriate to perform several SCREEN3 runs that look at different operating scenarios

2. Using professional judgement***, determine the dimensions of one or more SCREEN3 area sources*** to represent the regions where emissions occur. In most cases, it is acceptable to use a single ***area*** source. For example, it may be reasonable to base the dimensions of the ***area*** source on the total disturbed area for a daily or annual period, as appropriate. The total disturbed area for annual NAAQS modeling may be larger than the area used for short-term NAAQS modeling when appropriate.

3. Divide the total emission rate (in units of grams per second) by the area (in units of m^2) of the "area source" to ***calculate the emission rate in units of grams per second per meter squared***.

[2] Use the maximum "daily" production rate for short-term NAAQS modeling (e.g., 24hr PM10 NAAQS), if available. Use the "annual" production rate for annual NAAQS modeling.

4. ***Assume a release height of 10 meters in SCREEN3***.[3] This release height is intended to account for mechanical turbulence, the presence of on-site berms or pits, and similar factors that influence the dispersion of particulate matter from "fugitive" sources.

5. ***Use the "full meteorology" option*** in SCREEN3.

6. ***Assume simple terrain***.

7. ***Use 100 meter or finer receptor spacing out to a distance of at least 1000 meters*** (i.e., make sure the maximum impact is included in the receptor network). It is recommended that the "automated distance array option" in SCREEN3 be used. [NOTE: Remember that the receptor distances in SCREEN3 are measured from the ***center*** of the rectangular area, not from the edge. This may be important in determining which receptors are located in "ambient air."]

8. ***Refer to the section on "MULTIPLYING FACTORS"*** for recommendations on how to convert 1-hour SCREEN3 estimates to the longer averaging times.

9. ***Add a suitable background concentration*** to account for "nearby" and "other" background sources. Be sure to also include the concentration estimates from any other runs of SCREEN3 that were performed for other sources at or near the facility.

10. ***If the cumulative impact fails to show compliance with ambient air standards, refinements to the SCREEN3 modeling may be possible***, for example:

    - If the facility operates only during the day, the modeling can be redone using PG Stability Classes A, B, C, D (i.e., separate runs of SCREEN3 using PG classes 1, 2, 3, and 4). That is, exclude stable conditions (E and F) that can only occur at night. This normally results in lower estimates. This is ONLY acceptable for sources that do not operate at night.
    - It may also be helpful to revisit the emission rate(s) used in SCREEN3 to make sure that the modeled emission rates reflect activities that could realistically occur during a maximum production day.

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[3] The use of a 10 meter release height for "area" sources is allowed without justification ONLY for SCREEN3 modeling using the procedure above. It is NOT a general recommendation for all SCREEN3 modeling or for refined (e.g., ISC3) modeling. That is, the APCD generally recommends that release heights should be determined and justified on a case-by-case basis. The 10 meter release height recommended in the procedure above was determined by comparing estimates from refined ISC3 runs (with variable release heights for haul roads and similar near-ground-level sources) to results from SCREEN3 runs at various release heights. The comparison found that use of a 10 meter release height in SCREEN3 estimated impacts similar to, but more conservative than ISC3 runs where release heights had been determined on a source-by-source basis (e.g., hauls roads were modeled as volume sources with a release height of 2 meters and a sigma-z of 3 meters).