

- an increase in total suspended particulate (TSP) and PM₁₀ (particulate matter less than 10 µm in diameter) concentrations throughout the study area;
- approximately a 2% to 40% increase in TSP and PM₁₀ concentrations at sensitive receptor locations adjacent to the 407 Transitway; and,
- negligible changes in gaseous and particulate matter concentrations when station parking lot and passenger pick-up and drop-off (PPUDO) emissions are considered.

Recommended Mitigation

Mitigative measures to reduce the impact of road dust at nearby sensitive areas are recommended where possible. Barriers (i.e., trees/shrubs, or where planned for safety and/or noise issues solid barriers) located along the 407 Transitway at sensitive receptor locations will act as screens and reduce the particulate matter flowing horizontally from the roadway. When recommended mitigation measures are considered it is expected that particulate matter concentrations at sensitive receptor locations will be within MOE standards. As a result, it is recommended that mitigation measures be implemented for the following five residential/sensitive receptor locations:

- Residences on Hartley Court; north of the Transitway, west of the GO-Barrie rail line;
- Residences on Yellowwood Circle; north of Transitway, east of Dufferin Street;
- Residences on Sassafras Circle; Daniel Reaman Crescent and Lander Crescent; north of Transitway, east of Langstaff Road;
- Residences on Langstaff Road West; west of Transitway; and,
- St. Robert Catholic High School, south of Transitway, east of Leslie Street.

Mitigation through the planting of trees and shrubs has been considered and incorporated into the preliminary landscape design. Where trees and shrubs are planted it is recommended that a combination of species including coniferous trees is used such that there is control throughout the year.

In addition, particulate matter emission estimates may have been overly conservative. Recently (June 2010), the U.S. EPA published draft guidance with an updated methodology for estimating road dust emissions (U.S. EPA, 2010). The revised methodology appears to give significantly lower levels of emissions compared to the U.S. EPA 2006 methods used in this assessment. The draft section proposing the revised calculation methodology as well as supporting documentation can be found at <http://www.epa.gov/ttn/chief/ap42/ch13/index.html>.

If during the detailed design phase of the project the proposed U.S. EPA methods become standard practice, the above recommendations to reduce the impact of particulate matter to nearby sensitive areas should be revisited.

Table 2.6 Recent Ambient Air Quality for PM_{2.5}

Station ID	Station Location	Averaging Time	PM _{2.5} (µg/m ³)					
			AAQC	Year				
				2004	2005	2006	2007	2008
#34020	Toronto North	Annual Background		9.0	10.0	9.0	9.0	9.0
		24-hr Mean	-	7.7	9.4	7.6	7.8	7.2
		24-hr 90 th Percentile	-	17.2	23.7	16	16.4	14.4
		1-hr Maximum	-	69	65	52	60	54
		24-hr Maximum	30*	43	51	36	40	35
		No. of Times above proposed CSW	-	12	19	2	7	1
Average		24-hr 90 th Percentile	-	17.5				

ND = No Data

*Compliance is measured as the 98th percentile over three years, therefore 10 exceedances (1% of 365x3) of the 24-hr criteria is within compliance for three years or nominally 3 exceedances per year on average for the three most recent monitoring years.

Note: All values are calculated from hourly data available from the <http://www.airqualityontario.ca/> website.

Table 2.7 Recent Ambient Air Quality Monitoring for Nitrogen Oxides

Station ID	Station Location	Averaging Time	Nitrogen Oxides (µg/m ³)					
			AAQC*	Year				
				2004	2005	2006	2007	2008
#34020	Toronto North	24-hr Mean	-	53	57	52	47	46
		1-hr 90 th Percentile	-	115	119	111	100	96
		24-hr 90 th Percentile	-	102	99	95	87	84
		1-hr Maximum	400	642	803	482	657	476
		24-hr Maximum	200	260	300	253	188	210
		No. of Times above 1-hr AAQC*	-	18	26	11	9	9
		No. of Times above 24-hr AAQC*	-	2	5	3	0	1
Average		1-hr 90 th Percentile	-	108.2				
		24-hr 90 th Percentile	-	93.4				

* NO_x concentrations are compared to the NO₂ AAQC. MOE Air Quality Ontario Reports do not demonstrate any NO₂ exceedances from 2004-2008 at the Toronto North Station.

ND = No Data

Note: All values are calculated from hourly data available from the <http://www.airqualityontario.ca/> website.

screen adjacent to the Transitway is suggested, where possible, for mitigating impacts of TSP and PM₁₀. Specific areas where barriers are recommended are identified in Table 5.6. At all locations, the barrier should be at least 2 metres high and be planted or installed adjacent to the Transitway. As outlined in the table, it is also recommended that a barrier be created along the west property line of St. Robert Catholic High School because road dust can impact this location when winds blow from a northwest direction.

Mitigation through the planting of trees and shrubs has been considered and incorporated into the preliminary landscape design. Where trees and shrubs are planted it is recommended that a combination of species including coniferous trees is used such that there is control throughout the year.

In addition, particulate matter emission estimates may have been overly conservative. Recently (June 2010), the U.S. EPA published draft guidance with an updated methodology for estimating road dust emissions (U.S. EPA, 2010). The revised methodology appears to give significantly lower levels of emissions compared to the U.S. EPA 2006 methods used in this assessment. The draft section proposing the revised calculation methodology as well as supporting documentation can be found at <http://www.epa.gov/ttn/chief/ap42/ch13/index.html>.

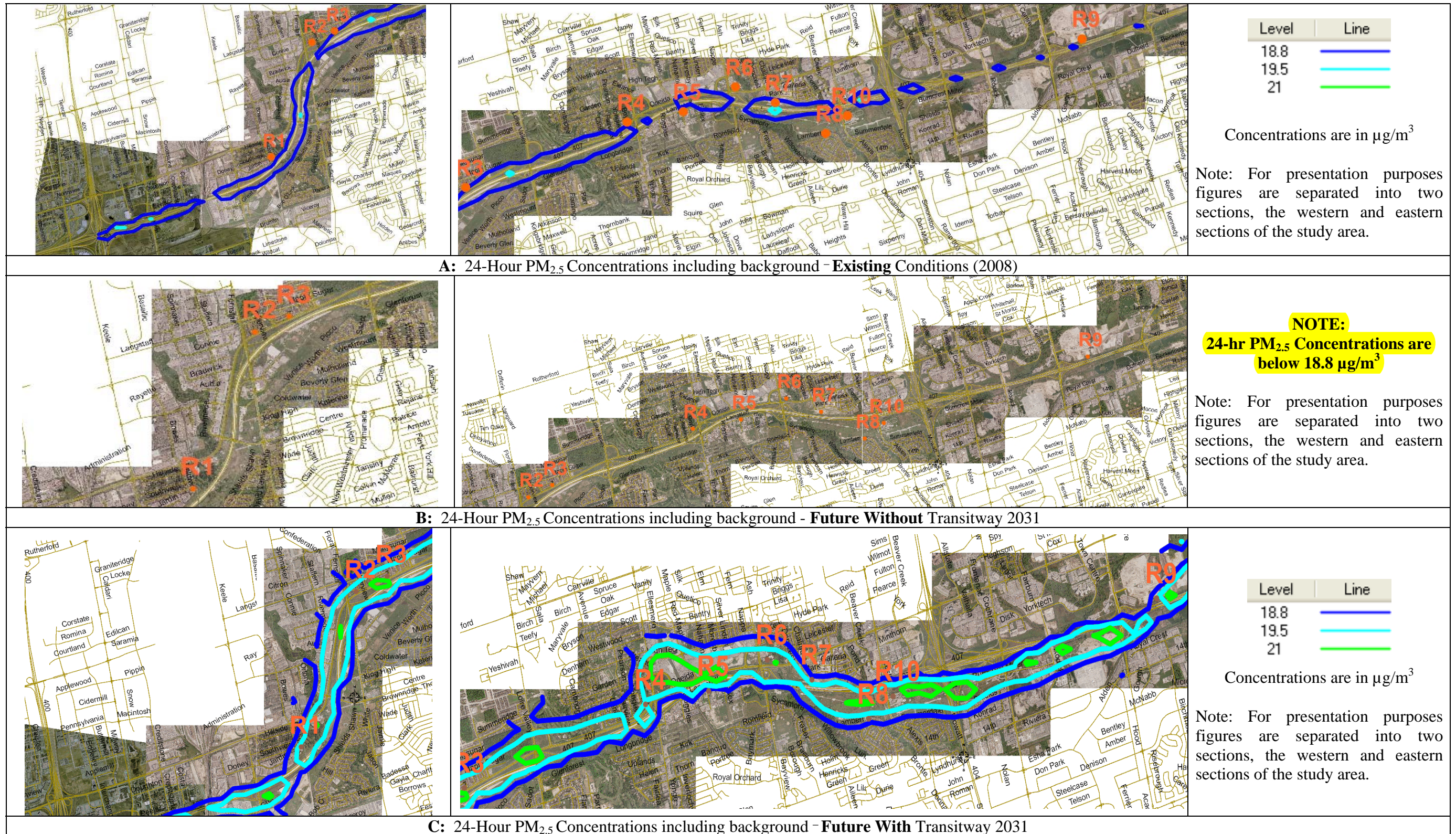
If during the detailed design phase of the project the proposed methods become standard practice, the recommendations outlined in Table 5.6 to reduce the impact of particulate matter to nearby sensitive areas should be revisited.

Table 5.6 Recommended Mitigation Options to Minimize Road Dust Impacts

Sensitive Area	Nearby Sensitive Receptor	Recommended Mitigation
Residences on Hartley Court; north of the Transitway, west of the GO Barrie Line	R1	Trees/shrubs or another barrier type for noise and/or safety purposes should be constructed on the north side of the Transitway, east of the GO Barrie rail line if feasible.
Residences on Yellowwood Circle; north of Transitway, east of Dufferin Street	R2	Trees/shrubs or another barrier type for noise and/or safety purposes should be constructed on the north side of the Transitway, beginning at Yellowwood Circle and ending at Thornhill Woods Drive if feasible.
Residences on Sassafras Circle; Daniel Reaman Cres. and Lander Cres., north of Transitway, east of Langstaff Road	R3	
Residences on Langstaff Road W; west of Transitway	R4	Since the Transitway is elevated in this area, it will not be possible to use a separate barrier as a mitigation option. Safety barriers constructed on the Transitway overpass at Yonge Street will block and retain some of the road dust at the base of the safety barrier.
Residence on Cedar Avenue, south of Transitway	R5	This area is not significantly impacted by the addition of the Transitway.
Apartment building, northeast corner of Bayview Avenue and Highway 7	R6	This section of the Transitway is below grade (approximately 8 m) and as a result, a retaining wall will be built on either side of the Transitway. This will act as a barrier and retain road dust at the base of the retaining wall.
Potential residential development, south of South Park Road	R7	This area is not significantly impacted by the addition of the Transitway.
Residences on Huntington Park Dr; south of Transitway	R8	This area is not significantly impacted by the addition of the Transitway.
Potential residential development north of Transitway, east of Warden Avenue	R9	If residences are ever constructed, trees/shrubs or another barrier type for noise and/or safety purposes will have to be constructed by the future builder on the north side of the Transitway from approximately the Markham Centre Tributary to the Stouffville Line where necessary.
St. Robert Catholic High School, south of Transitway, east of Leslie Street	R10	Trees/shrubs or another barrier type for noise and/or safety purposes should be constructed on the south side of the Transitway, just east of Leslie and extending approximately 500 m eastward. As well, it is recommended that trees be planted along the west property line of St. Robert Catholic High School. The trees and shrubs should form a visual boundary between the school and the Transitway.

Note: Where trees and shrubs are planted it is recommended that a combination of species including coniferous trees is used such that there is control throughout the year.

Figure 5.6 Maximum 24-hour PM_{2.5} Concentrations for Existing and Future Scenarios



- a slight increase in PM_{2.5} (particulate matter less than 2.5 µm in diameter) concentrations, particularly at receptors whose distance from a roadway (emission source) decreases with the addition of the Transitway;
- an increase in total suspended particulate (TSP) and PM₁₀ (particulate matter less than 10 µm in diameter) concentrations throughout the study area;
- approximately a 2% to 40% increase in TSP and PM₁₀ concentrations at sensitive receptor locations adjacent to the 407 Transitway; and,
- negligible changes in gaseous and particulate matter concentrations when station parking lot and passenger pick-up and drop-off (PPUDO) emissions are considered.

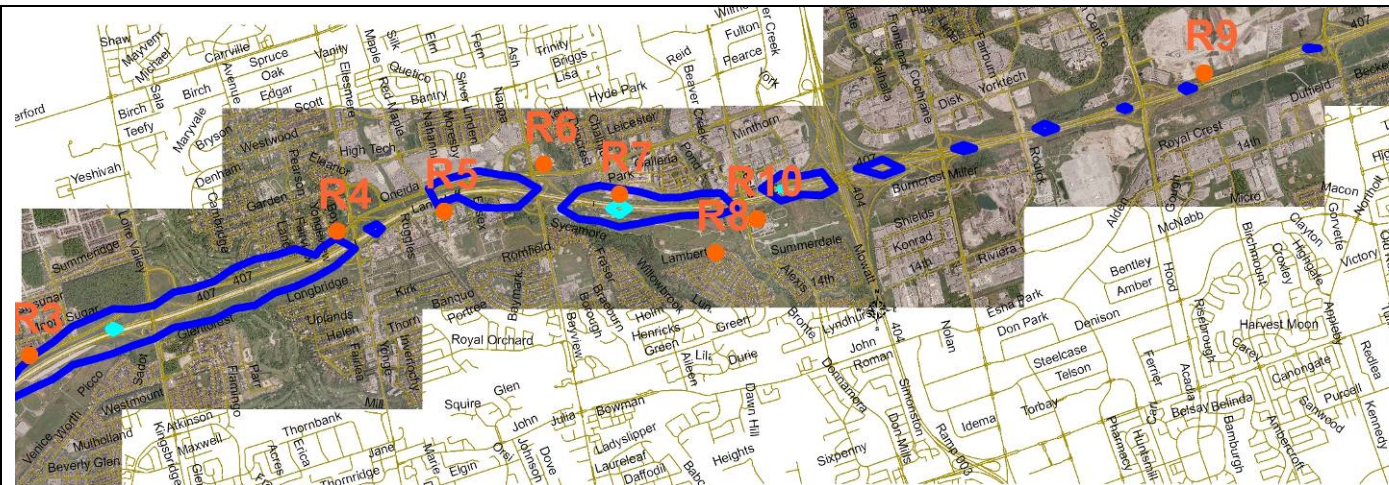
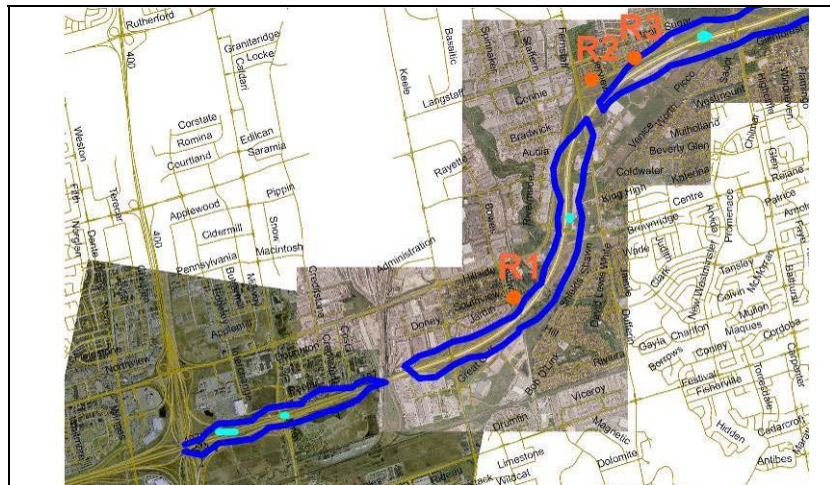
In all, the implementation of a 23 kilometre bus rapid transit system from Highway 400 to Kennedy Road in the municipalities of Vaughan, Richmond Hill and Markham, Ontario will result in increases in particulate matter (mainly TSP and PM₁₀) concentrations at sensitive receptor locations within the study area. The ambient air quality criterion for TSP is based on visibility, and the criterion for PM₁₀ is based on health effects. Therefore, the study shows that there will be an appreciable increase in one contaminant (PM₁₀) with health based standards. The recommended broad-based mitigation measures outlined below are proposed to reduce PM₁₀ impacts, and will also reduce TSP impacts.

6.2 BROAD-BASED MITIGATION PLAN

Mitigation measures are recommended to reduce future particulate based (TSP and PM₁₀) air quality impacts from the 407 Transitway which includes increased tree planting or constructing other solid barriers for noise and/or safety purposes adjacent to the Transitway which are at least 2 metres tall where possible. Trees/shrubs or solid barriers for noise and/or safety purposes located along the Transitway will act as screens and significantly reduce the particulate matter emission rate for material flowing horizontally from the roadways (Watson and Chow, 2000). In particular, it is recommended that trees be planted (or a solid barriers for noise and/or safety purposes be constructed) adjacent to the Transitway near St. Robert Catholic High School (receptor R10) and existing/planned residential areas with the exception of receptors R5, R6, R7, R8 and R9. Table 5.6 provided a summary of recommended mitigation options.

Mitigation through the planting of trees and shrubs has been considered and incorporated into the preliminary landscape design. Where trees and shrubs are planted it is recommended that a combination of species including coniferous trees is used such that there is control throughout the year.

In addition, particulate matter emission estimates may have been overly conservative. Recently (June 2010), the U.S. EPA published draft guidance with an updated methodology for estimating road dust emissions (U.S. EPA, 2010). The revised methodology appears to give significantly

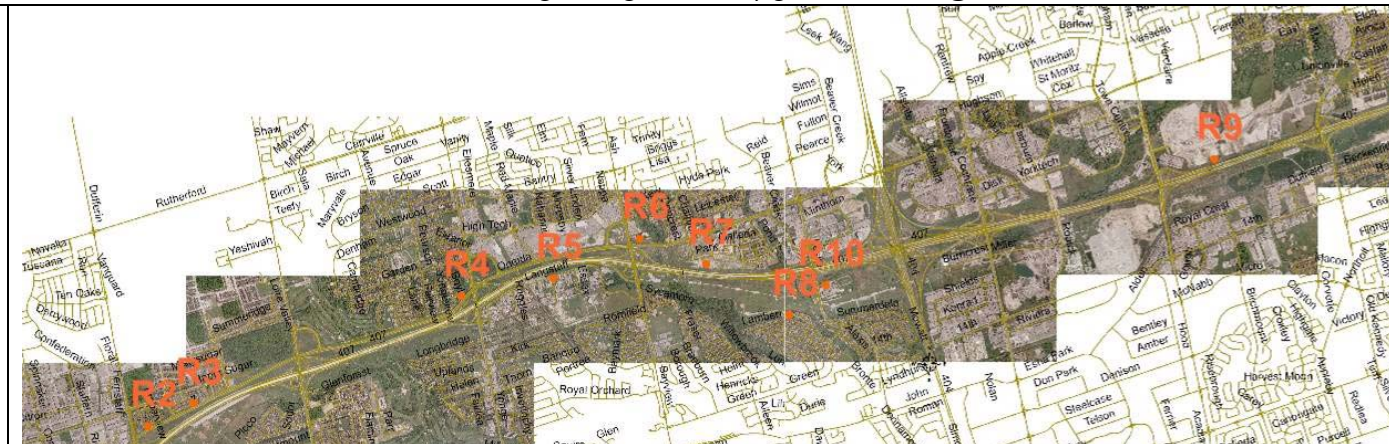


Level	Line
18.8	Blue line
19.5	Cyan line
21	Green line

Concentrations are in $\mu\text{g}/\text{m}^3$

Note: For presentation purposes figures are separated into two sections, the western and eastern sections of the study area.

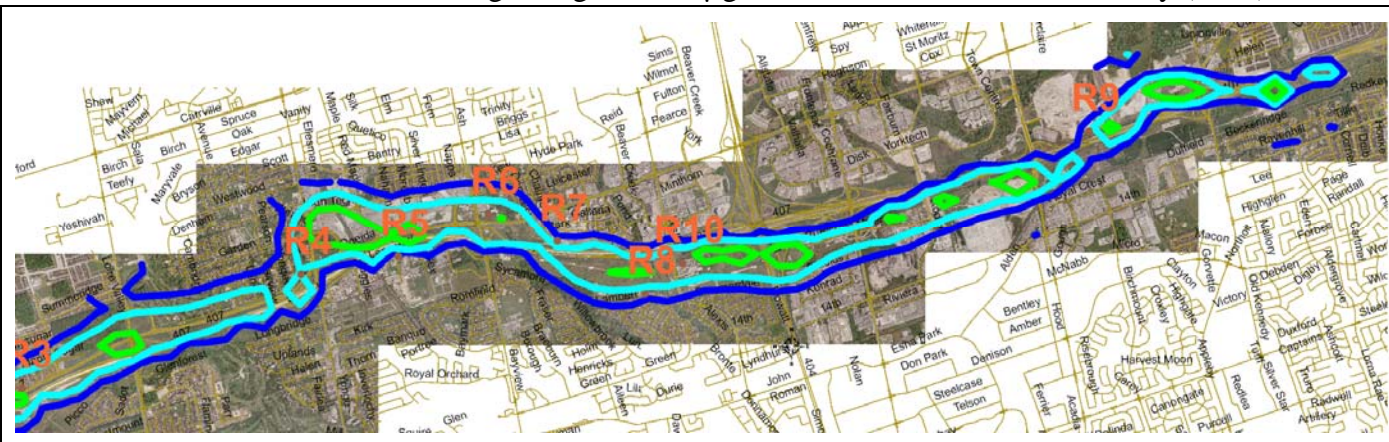
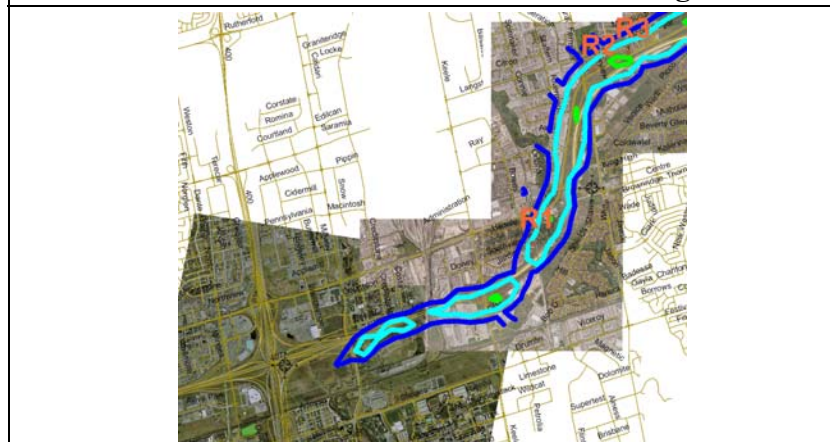
Figure A.24a 24-Hour $\text{PM}_{2.5}$ Concentrations including background in $\mu\text{g}/\text{m}^3$ - Existing Conditions (2008)



NOTE:
24-hr $\text{PM}_{2.5}$ Concentrations are below $18.8 \mu\text{g}/\text{m}^3$

Note: For presentation purposes figures are separated into two sections, the western and eastern sections of the study area.

Figure A.24b 24-Hour $\text{PM}_{2.5}$ Concentrations including background in $\mu\text{g}/\text{m}^3$ - Future Without Transitway (2031)



Level	Line
18.8	Blue line
19.5	Cyan line
21	Green line

Concentrations are in $\mu\text{g}/\text{m}^3$

Note: For presentation purposes figures are separated into two sections, the western and eastern sections of the study area.

Figure A.24c 24-Hour $\text{PM}_{2.5}$ Concentrations including background in $\mu\text{g}/\text{m}^3$ - Future With Transitway (2031)