2.3.2 PM_{10} and TSP

By conservatively assuming that all particulate in the exhaust streams is $PM_{2.5}$, the maximum PM_{10} and TSP model predictions due to the Project sources are numerically the same as the $PM_{2.5}$ predictions. No comparisons are made to the TSP AQOs since the model predictions are far lower than the TSP AQOs. Model predictions are shown for the maximum PM_{10} concentrations in **Table 2.13**. In this case, the AQO is a maximum level not to be exceeded in any year. The maximum model prediction for each year is indicated and any exceedances are identified in bold text. An exceedance of the PM_{10} AQO is predicted at the MPOI. However, this is due to the addition of a high background PM_{10} concentration (41.7 µg/m^3). Model predictions including background are plotted in **Figure 2.11**. The predicted concentrations quickly fall below the AQO within a short distance from the fenceline. Predictions with background are below the AQO at all sensitive receptor locations.

Table 2.13 Maximum predicted 24-hour PM_{10} concentrations, Phase 1 (AQO = 50 µg/m^3)

Receptor	Maximum 24-hour Prediction (µg/m^3)						
	2014	2015	2016	2017	2018	max	Model + background
MPOI	29.7	26.6	23.6	27.4	24.6	29.7	**71.4**
1	0.1	0.1	0.1	0.1	0.1	0.1	41.8
2	0.1	0.1	0.1	0.1	0.1	0.1	41.8
3	0.1	0.1	0.1	0.1	0.1	0.1	41.8
4	0.5	0.6	0.4	0.4	0.5	0.6	42.3
5	0.0	0.0	0.0	0.0	0.0	0.0	41.7
6	0.2	0.2	0.4	0.2	0.3	0.3	42.0
7	0.2	0.3	0.2	0.3	0.3	0.3	42.0
8	0.6	0.6	0.7	0.5	0.6	0.7	42.4

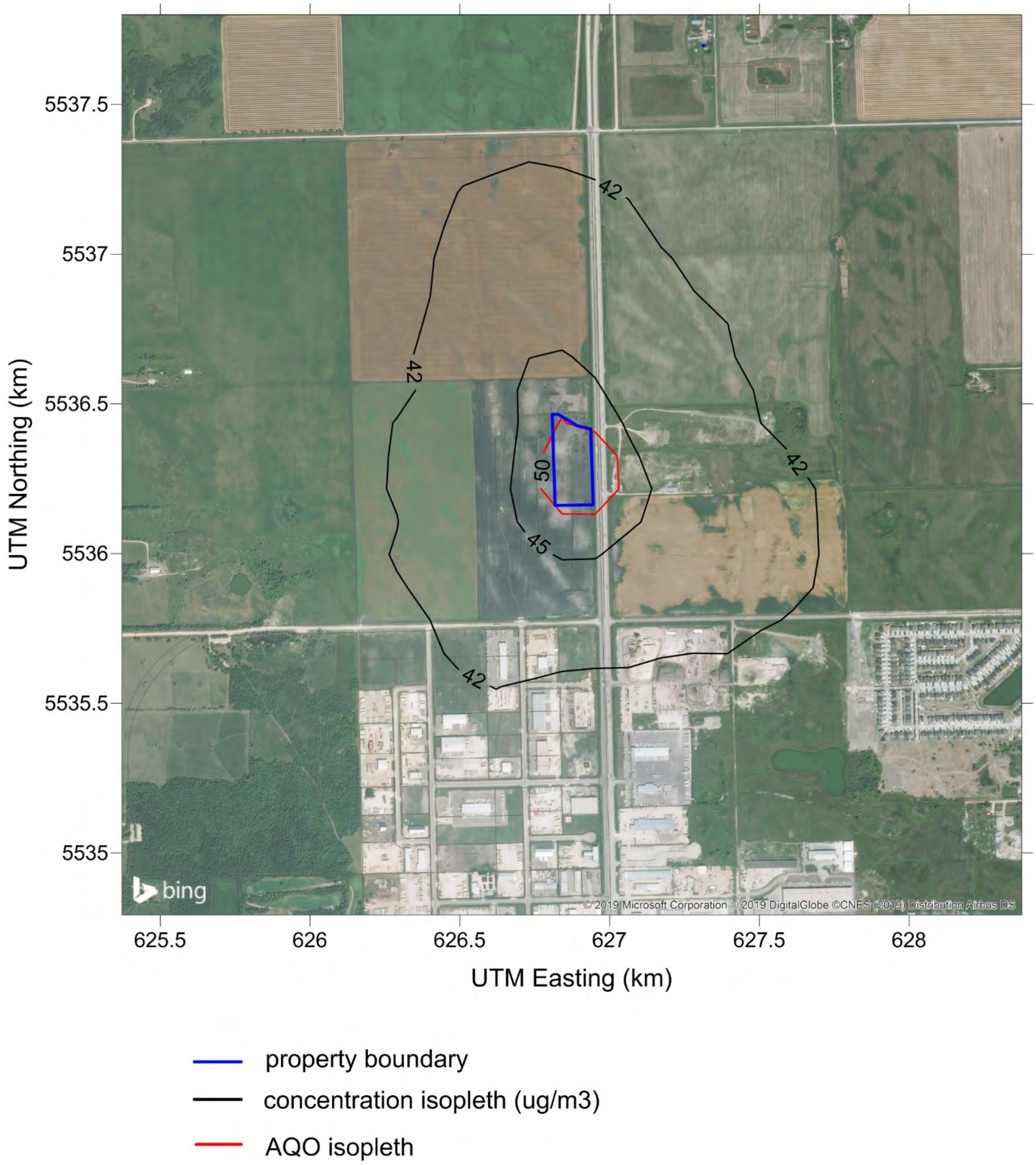


Figure 2.11 Maximum predicted 24-hour PM_{10} concentrations (2014 to 2018), Project sources with background (Phase 1)

2.3.3 NO_2

The maximum 1-hour, 24-hour and annual average NO_2 concentrations are shown in **Table 2.14,** assuming 100% conversion of NO_x to NO_2. The maximum predicted value that occurs in any year between 2014 and

2018 is shown. The predicted concentrations for each year are provided in Attachment II. There are no predicted exceedances of the provincial AQOs at any receptor location. The predictions at all sensitive receptors are compliant with the CAAQS.

Table 2.14 Maximum predicted NO_2 concentrations (100% conversion method), Phase 1 (AQOs = 400, 200 and 60 µg/m³ for 1-hour, 24-hour and annual averages, respectively)

Receptor	Project sources (µg/m³)			Project + background (µg/m³)		
	1-hour	24-hour	Annual	1-hour	24-hour	annual
MPOI	319.4	86.2	10.3	373.0	125.0	24.6
1	2.0	0.3	0.0	55.6	39.1	14.3
2	1.8	0.2	0.0	55.4	39.0	14.3
3	3.0	0.4	0.0	56.6	39.2	14.3
4	8.9	1.1	0.1	62.5	39.9	14.4
5	1.5	0.1	0.0	55.1	38.9	14.3
6	6.9	1.0	0.0	60.5	39.8	14.3
7	6.2	1.1	0.1	59.8	39.9	14.4
8	18.5	1.8	0.1	72.1	40.6	14.4

2.3.4 CO

The maximum predicted 1-hour and 8-hour CO concentrations over the modelling period are identified in **Table 2.15**. There are no predicted exceedances of the AQOs at any receptor location.

Table 2.15 Maximum predicted CO concentrations, Phase 1 (AQOs = 34,500 µg/m³ and 15,000 µg/m³ for 1-hour and 8-hour averages, respectively)

Receptor	Project sources (µg/m³)		Project + background (µg/m³)	
	1-hour	8-hour	1-hour	8-hour
MPOI	812.3	326.8	813.2	326.8
1	4.5	1.9	5.4	2.7
2	3.9	2.8	4.8	3.6
3	7.5	1.9	8.4	2.7
4	21.1	7.5	22.0	8.3
5	4.1	1.9	5.0	2.7
6	19.0	5.6	19.9	6.4
7	18.2	3.7	19.1	4.5
8	65.8	15.2	66.7	16.0

2.4 Dispersion Model Predictions: Phase 1 Water Vapour

2.4.1 Visible Plumes

The results of water vapour plume modelling are displayed in **Table 2.16**, **Figure 2.12** and **Figure 2.13**. These results are associated with daytime hours during the model period, after removing events occurring when the ambient relative humidity is greater than 98% (when natural background fog would be expected). If occurring, the longer plumes are more likely in the winter months. In total, plumes longer than 500 m are simulated to occur very infrequently (81 hours during the five-year simulation period). Similarly, plumes higher than 100 m are simulated to occur infrequently (58 hours during the five-year simulation period).

Table 2.16 Water vapour plume visible heights and lengths (daytime hours), 2014 to 2018

Range (m)	Hours per 5-year modelling period				
	Period	Winter	Fall	Spring	Summer
Plume height (hours during model period)					
<= 40	23,507	3,942	5,319	6,512	7,734
<= 50	914	355	174	285	100
<= 60	404	181	81	109	33
<= 70	278	136	53	71	18
<= 80	128	64	22	38	4
<= 90	81	44	12	22	3
<= 100	49	23	12	14	0
<= 110	32	21	5	6	0
<= 120	23	13	5	5	0
<= 130	15	8	3	4	0
<= 140	12	9	1	2	0
<= 150	2	1	1	0	0
<= 160	3	2	0	1	0
Plume length (hours during model period)					
<= 50	6,780	44	1,031	1,799	3,906
<= 100	16,578	3,483	4,289	4,884	3,922
<= 150	998	618	157	178	45
<= 200	487	290	96	95	6
<= 300	312	187	58	60	7
<= 500	212	121	45	44	2
<= 750	51	34	10	6	1
<= 1000	11	7	2	2	0
<= 1250	7	5	0	2	0
<= 1500	6	6	0	0	0
<= 1750	2	2	0	0	0
<= 2000	3	2	0	1	0
<= 2500	1	0	0	1	0

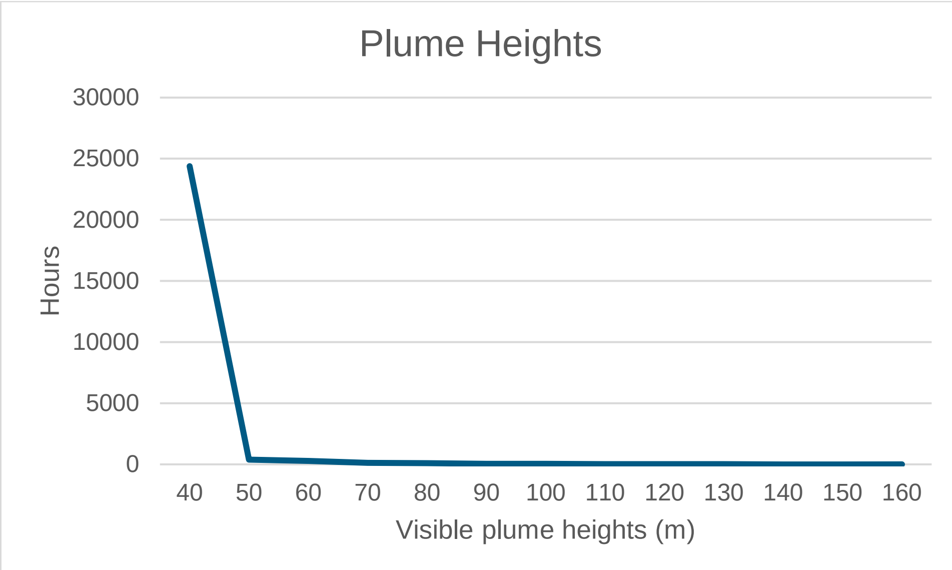


Figure 2.12 Estimated visible plume heights during Phase 1, 2014 to 2018

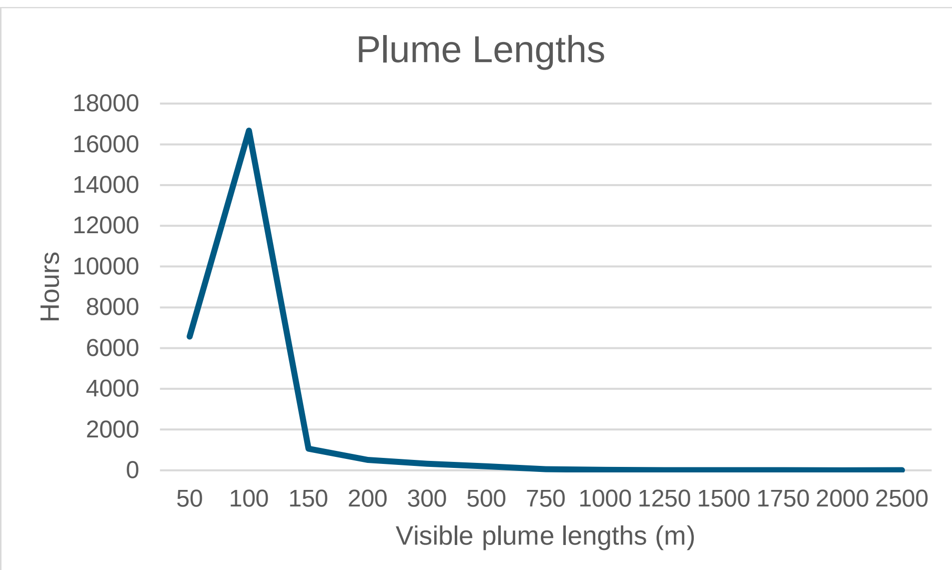


Figure 2.13 Estimated visible plume lengths during Phase 1, 2014 to 2018

The meteorological conditions during the longest 10 predicted plume lengths are identified in **Table 2.17.** These events are mostly associated with strong stability (Stability Class 6), low wind speed and low mixing height. These conditions restrict an emitted plume from climbing vertically or dispersing horizontally. A visible plume existing in these conditions would likely appear as a thin, long white line. However, two of the simulated extreme events occur during slightly stable and neutral conditions (Stability Class 5 and 4, respectively), with higher wind speeds. In all but one of the 10 maximum predicted plume lengths, the plume height is restricted to approximately 50 m.

Table 2.17 Meteorological conditions during the 10 longest predicted plumes, Phase 1

Date (DDMMYY)	Hour	Plume Height (m)	Plume Length (m)	Ambient Temp (ºK)	Mixing Height (m)	Stability Class	Wind Speed (m/s)	Wind Direction (degrees)	Ambient RH (%)
04/03/2014	7	53.4	2245	246	50	6	1.1	10	77
03/02/2014	24	49.4	1851	245	50	6	1.1	236.7	68
27/12/2015	9	53.1	1774	250	50	6	1.4	324	77
13/01/2016	8	52.8	1599	251	50	4	1.8	3	78
24/01/2016	8	55.3	1568	264	50	6	0.8	177	91
18/01/2018	8	53.9	1433	252	50	6	0.6	237	80
09/12/2015	8	106.8	1376	273	50	6	0.5	144	95
24/12/2015	17	56.2	1269	258	50	6	0.8	189	78
27/12/2015	8	46.1	1234	255	190	5	4.5	143	73
18/01/2016	8	42.0	1175	252	50	6	1.6	172	80

Notes: RH = relative humidity; stability class 6 = 'stable'; stability class 5 = 'slightly stable'; stability class 4 = 'neutral'

2.4.2 Surface Fogging and Icing

The CALPUFF FOG module is able to predict the occurrence of surface fogging and icing by simulating the dispersion of a moisture laden plume and evaluating whether or not a parcel of air at the surface is saturated. If the air parcel is saturated and the ambient temperature is above zero Celsius, fogging is predicted. If the ambient temperature is below zero, icing is predicted. As with visible plumes, hours with a background relative humidity greater than 98% were removed from the analysis.

The model receptors with at least one hour of predicted surface fog or ice at any hour of the day are identified in **Figure 2.14** and **Figure 2.15** respectively. Additional plots of model receptors with at least 10 hours of predicted fog or ice during the model period are provided in **Figure 2.16** and **Figure 2.17**. Only 3 receptors are predicted for 10 hours or more of fogging, and only right at the fenceline. Simulated icing for 10 or more hours is predicted at and near the property fenceline only, extending up to 130 m from the property.

For any one receptor location, fogging occurs up to 12 hours during the five-year period (0.03% of the time) and icing occurs up to 110 hours during the five-year period (0.25% of the time). The receptors with the maximum predicted frequency of fogging or icing are located at the northwest fenceline (fogging) and the southeast fenceline (icing).

The meteorological conditions associated with simulated surface fogging and icing are predominantly Stability Class 4 (and to a lesser degree 5), with wind speeds between 4 m/s and 8 m/s. These conditions are associated with building downwash. Building downwash brings an emitted plume to ground near the points of emission, which is why the model predictions are near the property boundary. The spread of affected receptors shown in the following figures relate to a predicted event at any time during the five-year simulation period. For any individual hour and predicted event, the affected receptors would be few.

A second simulation was completed in the model, turning the building downwash option 'off'. This simulation predicted no occurrences of fogging or icing, confirming that that action of turbulent downwash is responsible for the surface fogging and icing predictions.

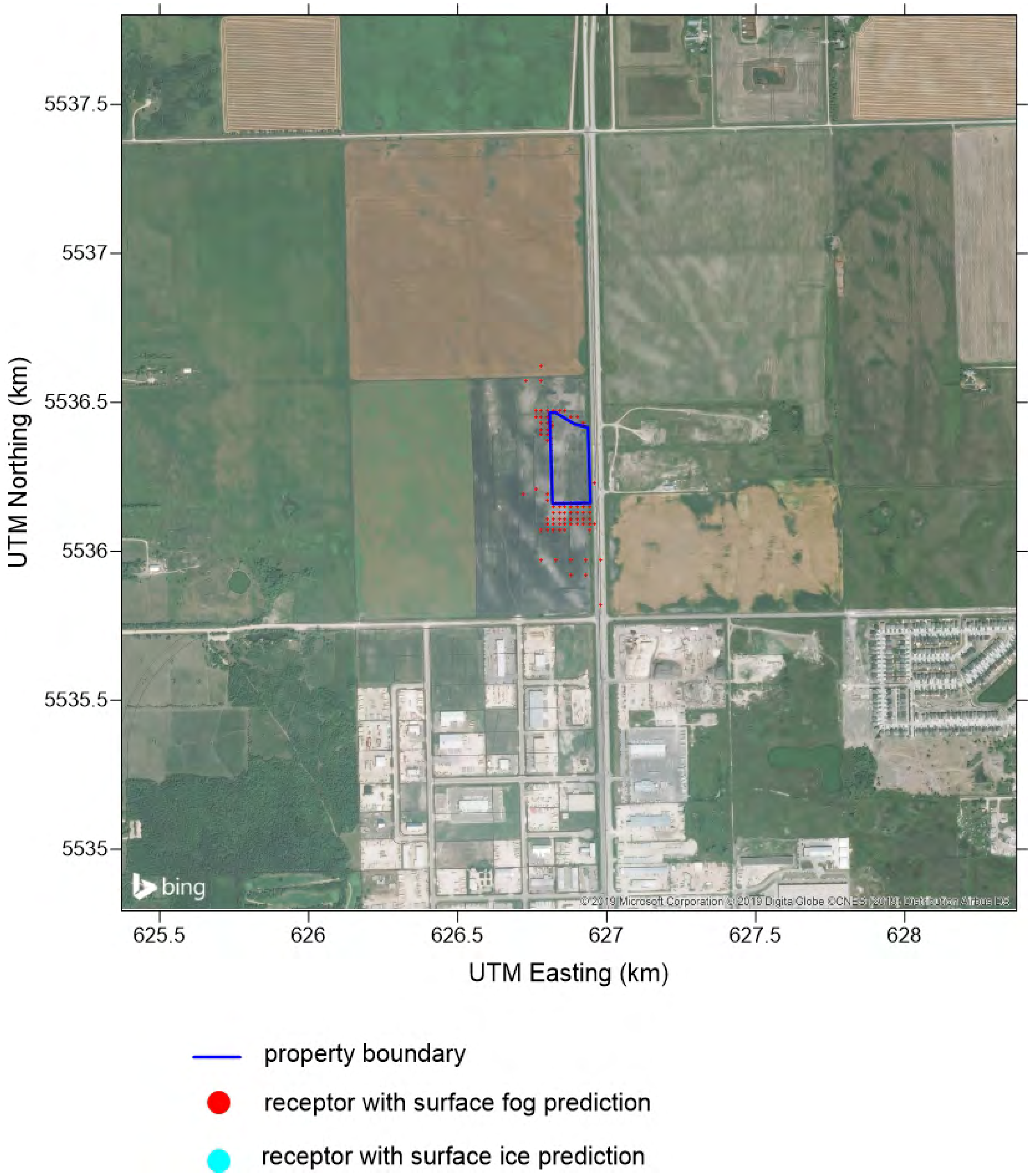


Figure 2.14 Phase 1 receptors with one or more hours of surface fog predictions, 2014 to 2018

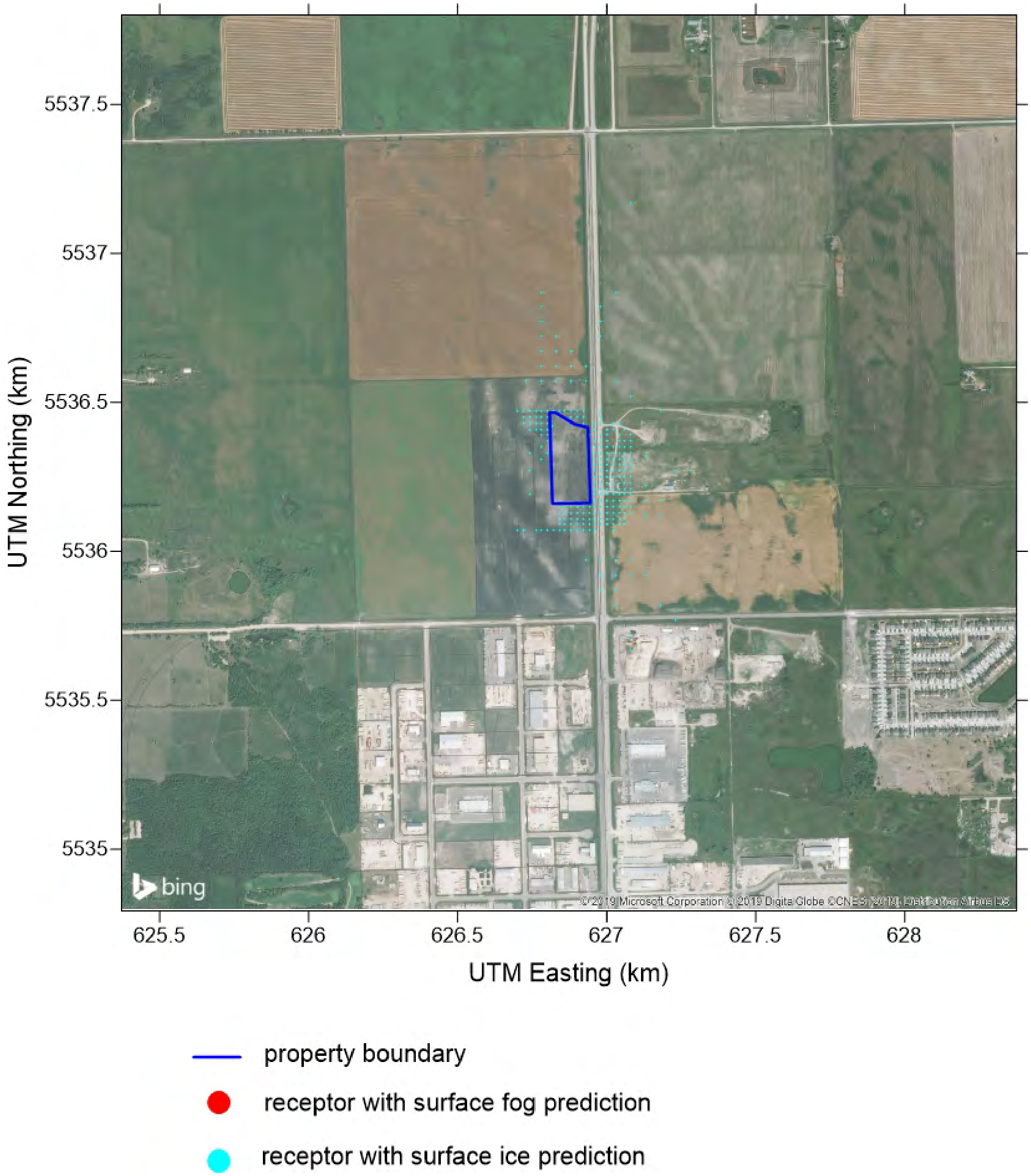


Figure 2.15 Phase 1 receptors with one or more hours of surface ice predictions, 2014 to 2018

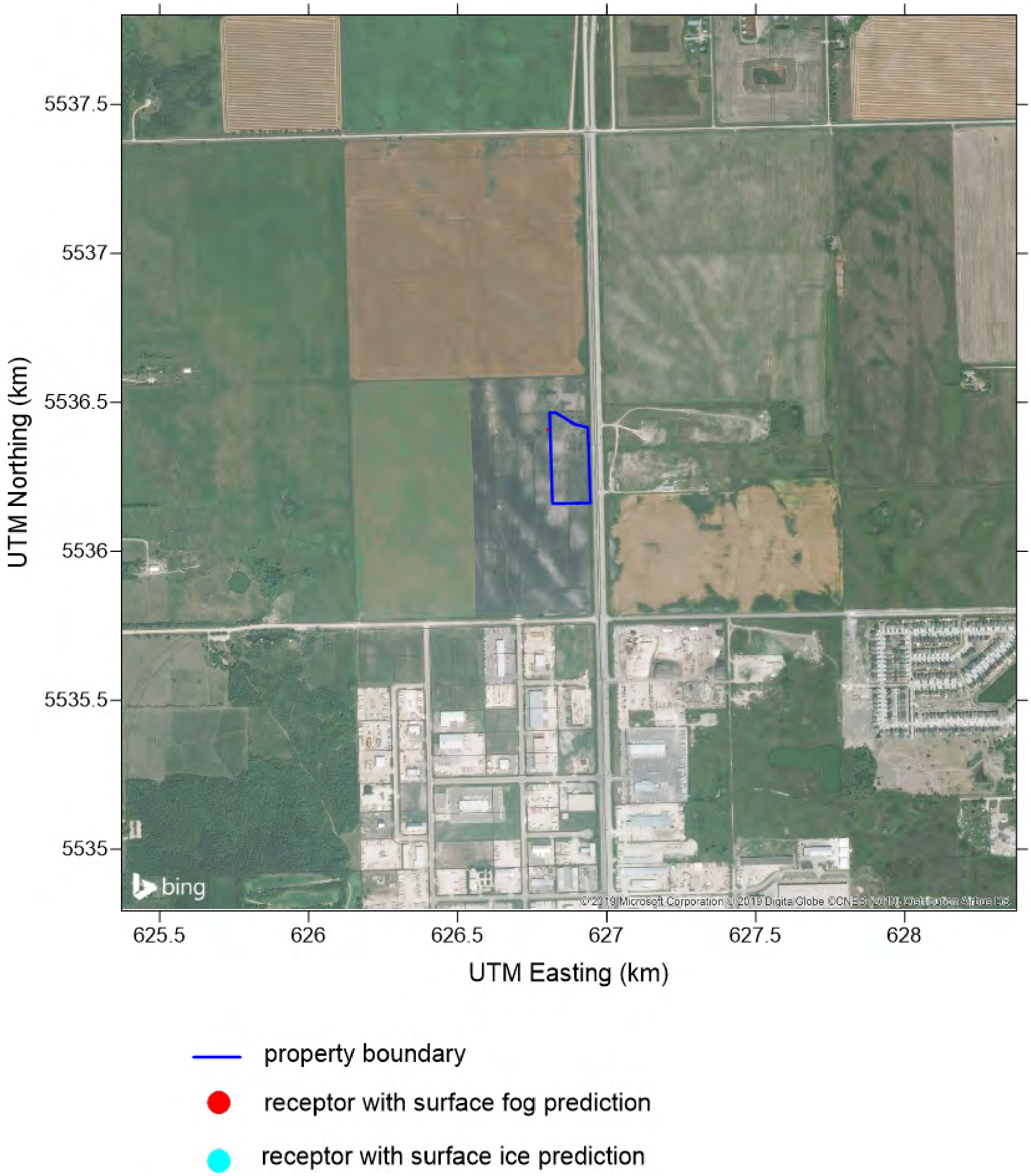


Figure 2.16 Phase 1 receptors with 10 or more hours of surface fog predictions, 2014 to 2018

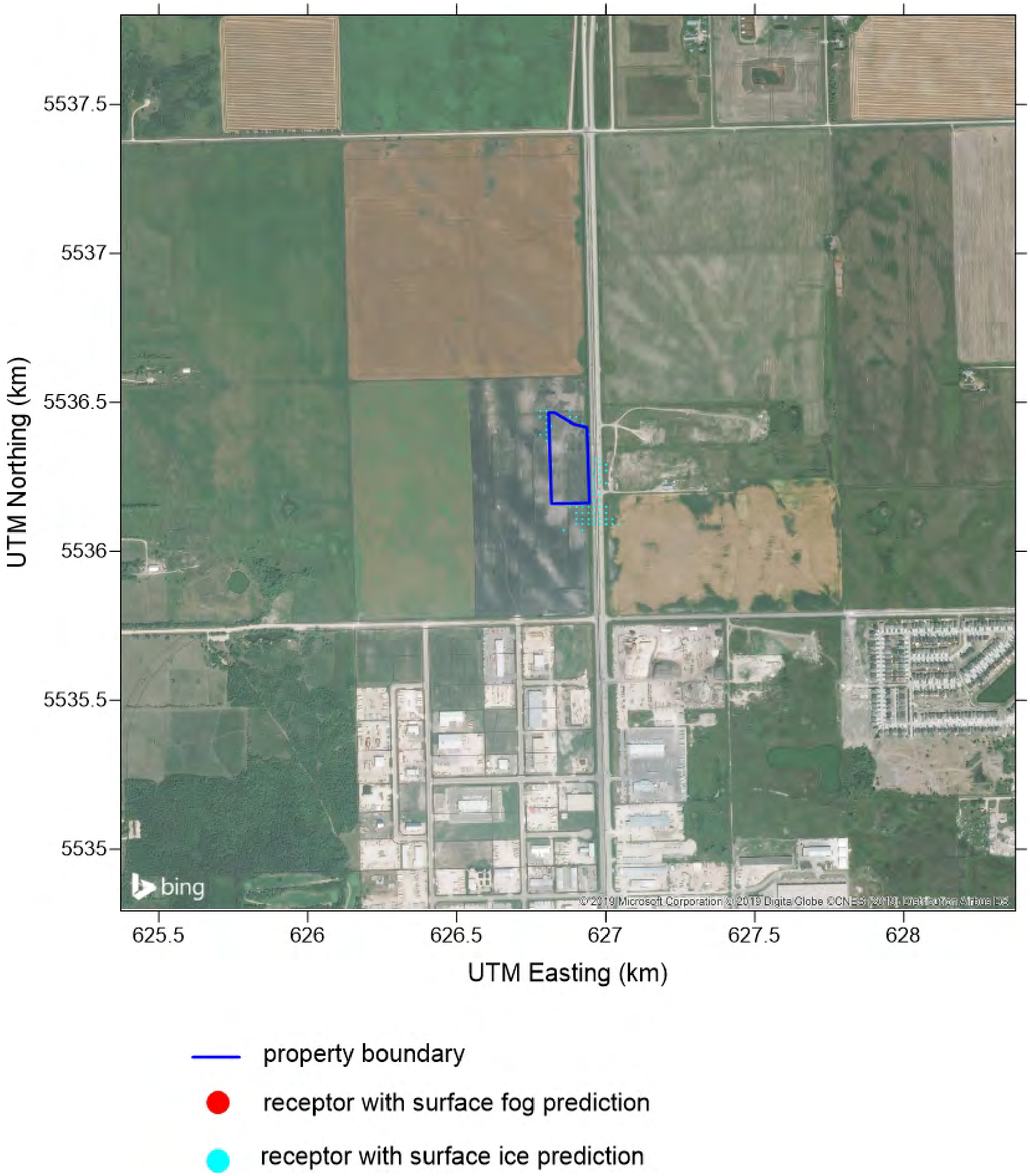


Figure 2.17 Phase 1 receptors with 10 or more hours of surface ice predictions, 2014 to 2018

2.5 Dispersion Model Predictions: Phase 2 CACs

2.5.1 $PM_{2.5}$

The maximum model predictions associated with the Phase 2 sources are displayed in **Table 2.18**. Model predictions for every simulated year are provided in Attachment II. Any prediction exceeding an AQO is displayed in bold.

Table 2.18 $PM_{2.5}$ maximum model predictions (24-hour AQO = 28; annual AQO = 10)

Receptor	Maximum 24-hour prediction (µg/m³)			Maximum annual prediction (µg/m³)		
	Model	Background	Model + background	Model	Background	Model + background
MPOI	**30.2**	18	**48.2**	7.8	6	**13.8**
1	0.2	18	18.2	0.0	6	6.0
2	0.1	18	18.1	0.0	6	6.0
3	0.2	18	18.2	0.0	6	6.0
4	0.7	18	18.7	0.2	6	6.2
5	0.1	18	18.1	0.0	6	6.0
6	0.5	18	18.5	0.1	6	6.1
7	0.4	18	18.4	0.1	6	6.1
8	1.0	18	19.0	0.2	6	6.2

Similar to the Phase 1 predictions, an exceedance of the 24-hour AQO and the annual average AQO is predicted at the maximum point of impingement (MPOI) when background concentrations are added to the Project contributions. However, an exceedance of the 24-hour AQO from the Project contributions alone is predicted in this case (30.2 µg/m³). As shown in **Figure 2.18**, the model exceedance from the Project contributions alone is not visible on the map, as the exceedance occurs right on the east fenceline and does not extend beyond the fenceline. When adding background, **Figure 2.19** shows that the 24-hour exceedance occurs at the east and west property fencelines, extending less than 100 m in distance.

The predicted annual average concentrations are shown in **Figure 2.20** and **Figure 2.21** for Project contributions and Project contributions with background, respectively. The model predictions are very low except right near the property fenceline. The model predictions at all sensitive receptor locations are compliant with the CAAQS.

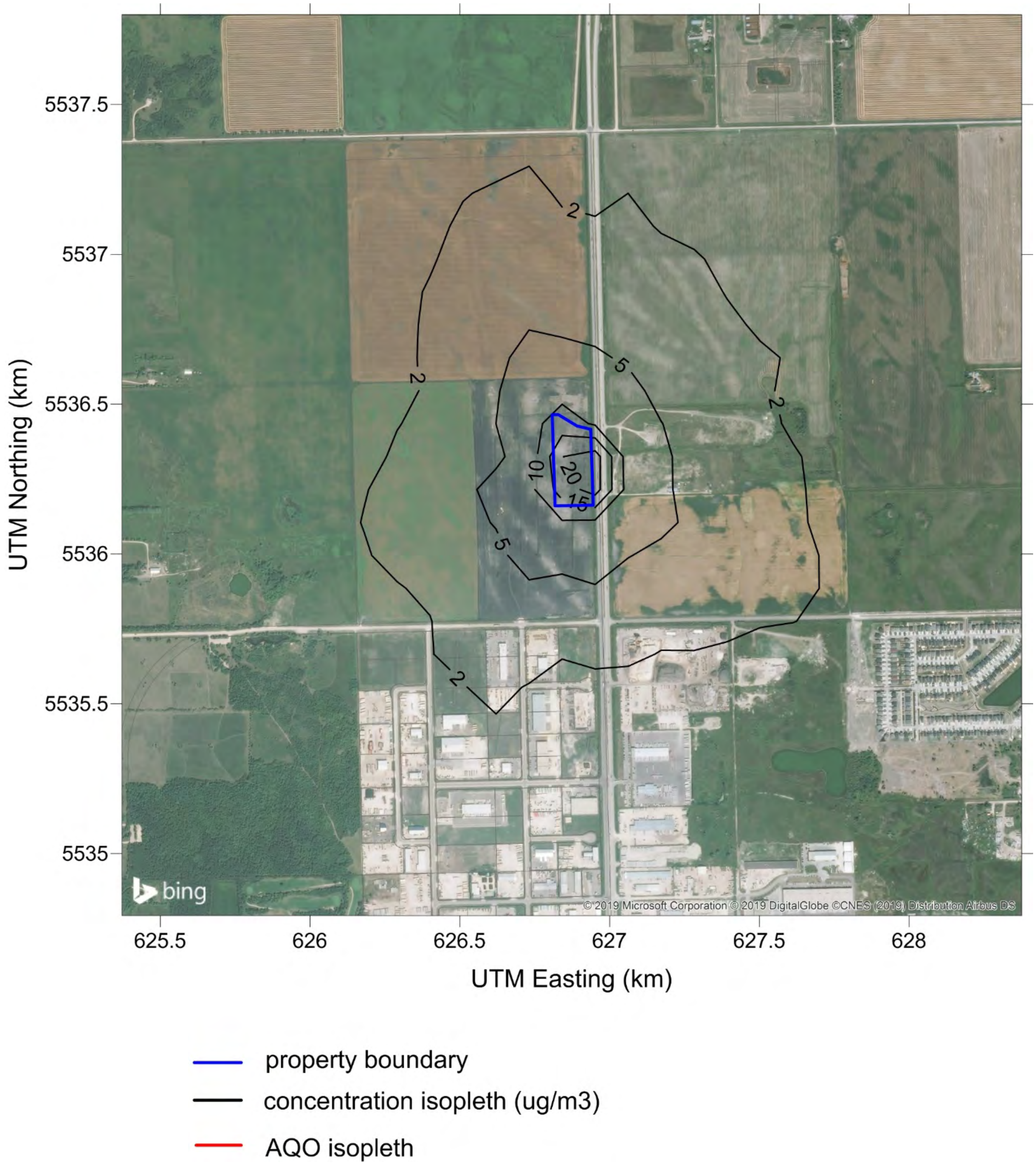


Figure 2.18 Phase 2 maximum 24-hour $PM_{2.5}$ predictions (average 98th percentile, 2016 to 2018), Project sources only

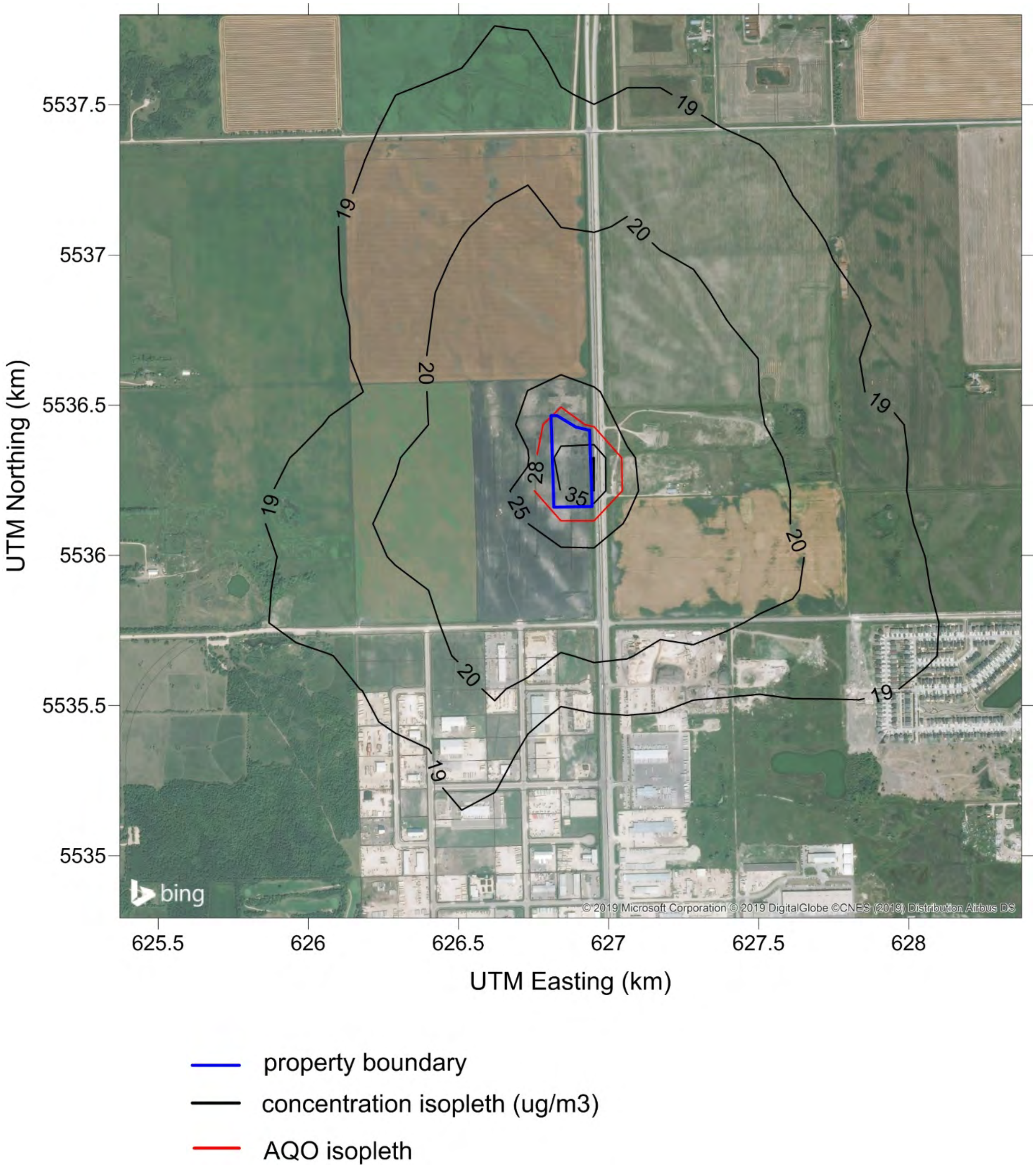


Figure 2.19 Phase 2 maximum predicted 24-hour $PM_{2.5}$ concentrations (average 98th percentile, 2016 to 2018), Project sources with background

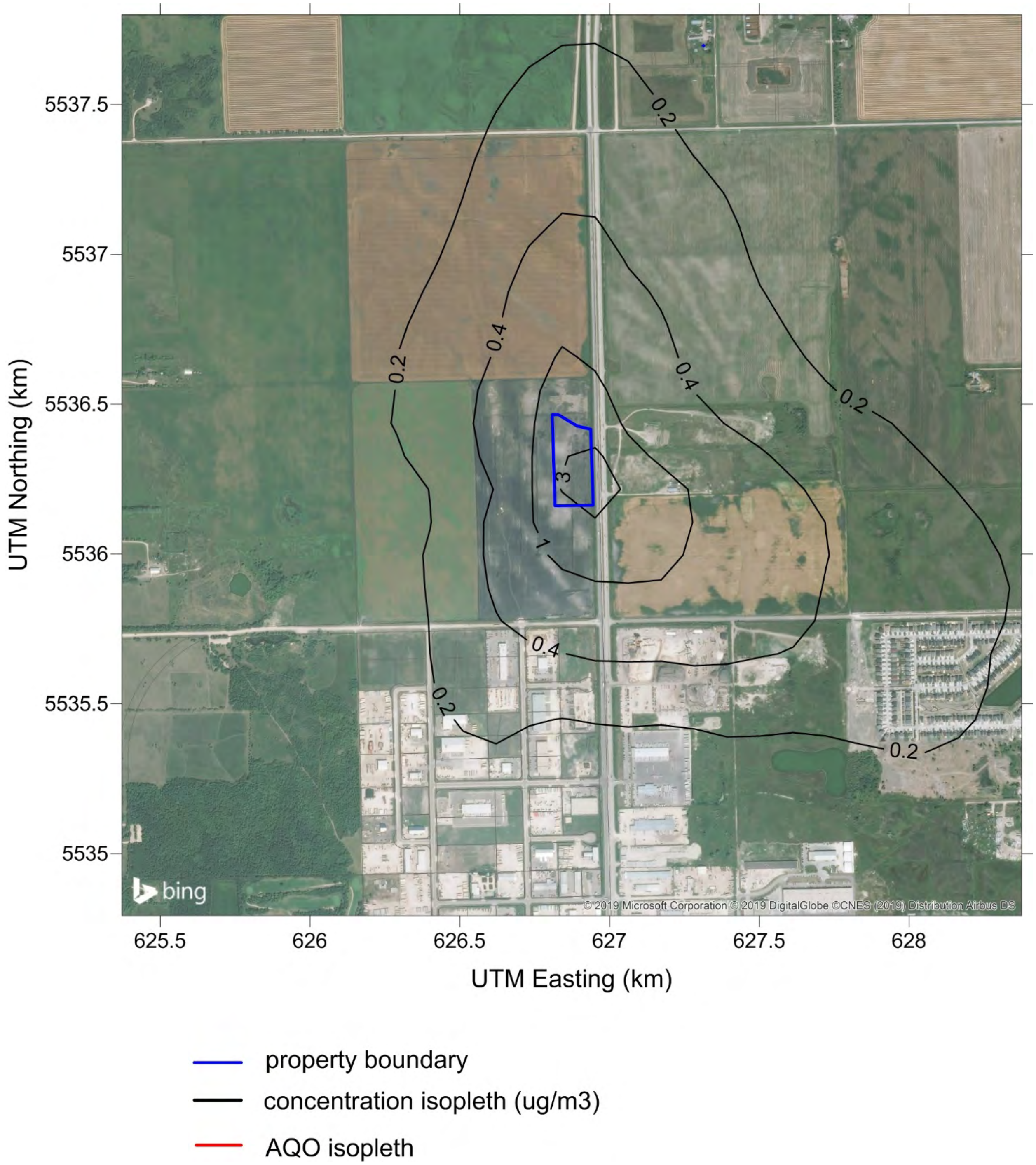


Figure 2.20 Maximum predicted annual average $PM_{2.5}$ concentrations (2014 to 2018), Project sources alone

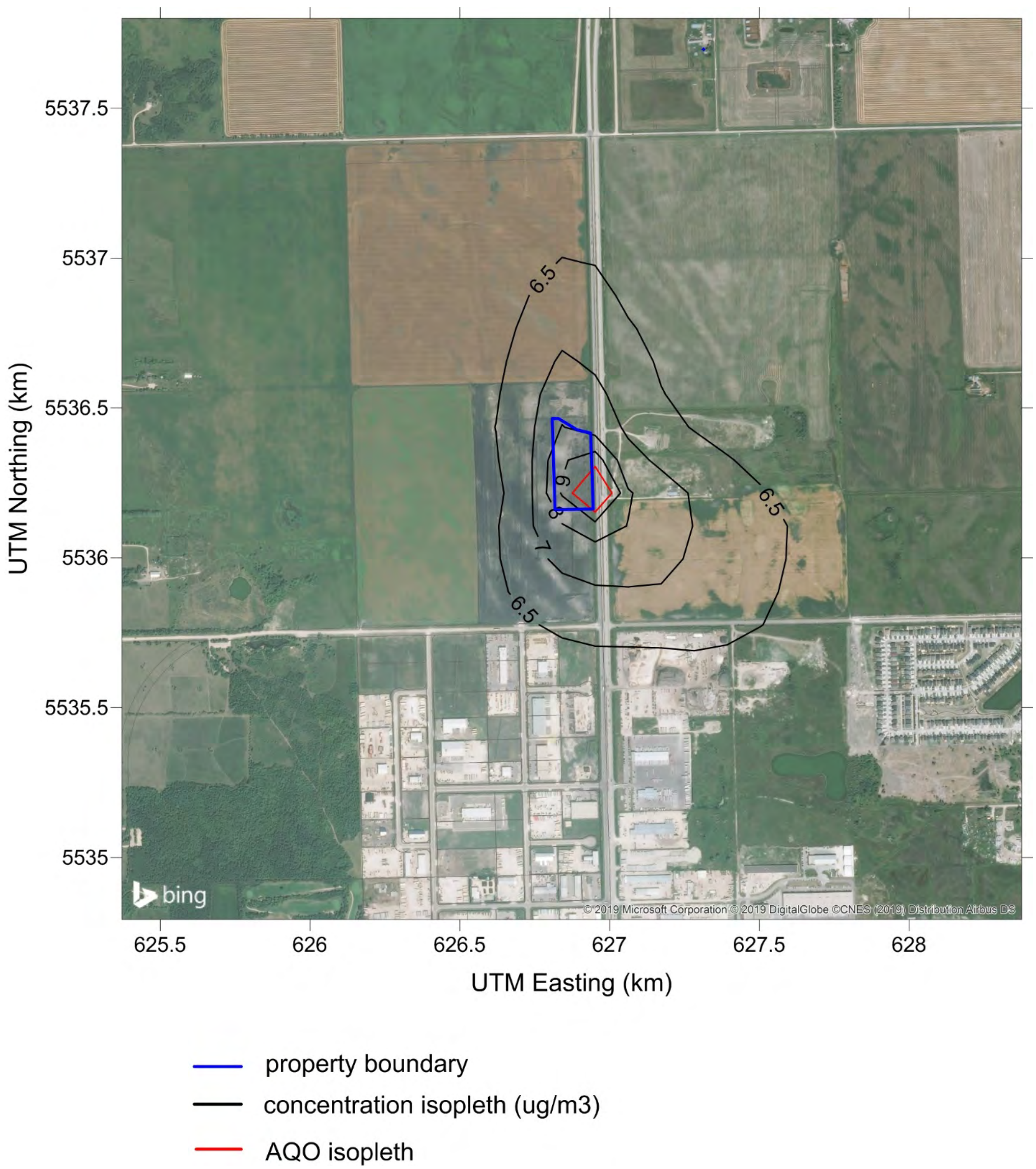


Figure 2.21 Maximum predicted annual average $PM_{2.5}$ concentrations (2014 to 2018), Project sources plus background

2.5.2 PM_{10} and TSP

The maximum model prediction of 24-hour PM_{10} for each simulated year is indicated in **Table 2.19**. An exceedance of the PM_{10} AQO (shown in bold) is predicted at the MPOI when background is added, similar to the Phase 1 case. Predicted concentrations at all sensitive receptors are below the 24-hour AQO when background is included. No comparisons are made to the TSP AQOs since the model predictions are far lower than the TSP AQOs).

Table 2.19 Maximum predicted 24-hour PM_{10} concentrations, Phase 2

Receptor	Maximum 24-hour prediction (µg/m^3)						
	2014	2015	2016	2017	2018	max	Max + bg
MPOI	31.6	27.2	27.5	28.9	34.2	34.2	**75.9**
1	0.2	0.1	0.2	0.1	0.2	0.2	41.9
2	0.2	0.1	0.1	0.1	0.1	0.2	41.9
3	0.2	0.2	0.2	0.2	0.2	0.2	41.9
4	0.8	0.7	0.7	0.7	0.7	0.8	42.5
5	0.1	0.1	0.1	0.1	0.1	0.1	41.8
6	0.3	0.4	0.7	0.3	0.5	0.7	42.4
7	0.4	0.4	0.4	0.4	0.4	0.4	42.1
8	1.0	0.9	1.2	0.8	1.0	1.2	42.9

2.5.3 NO_2

The maximum predicted 1-hour, 24-hour and annual average NO_2 concentrations for the Phase 2 emissions are shown in **Table 2.20**, assuming 100% conversion of NO_x to NO_2. The maximum predicted value that occurs in any year between 2014 and 2018 is shown. The predicted concentrations for each year are provided in Attachment II. As shown in bold text, an exceedance of the 1-hour AQO is predicted at the MPOI, from the Project emissions alone. There are no exceedances of the AQOs at any sensitive receptor, when including the background concentrations.

Table 2.20 Maximum predicted NO_2 concentrations, Phase 2 (AQOs = 400, 200 and 60 for 1-hour, 24-hour and annual averages, respectively) (100% Conversion Method)

Receptor	Project sources (µg/m³)			Project + background (µg/m³)		
	1-hour	24-hour	Annual	1-hour	24-hour	annual
MPOI	**458.2**	115.7	13.9	**511.8**	154.5	28.3
1	3.7	0.5	0.0	57.3	39.3	14.3
2	3.0	0.4	0.0	56.6	39.2	14.3
3	5.1	0.6	0.0	58.7	39.4	14.3
4	14.7	1.9	0.2	68.3	40.7	14.5
5	2.4	0.3	0.0	56.0	39.1	14.3
6	10.5	1.7	0.1	64.1	40.5	14.4
7	9.4	2.0	0.1	63.0	40.8	14.4
8	22.0	2.2	0.2	75.6	41.0	14.5

The maximum model predictions of NO_2 can be further treated to remove meteorological anomalies (Ontario Ministry of Environment, 2017) and to produce more refined estimates of the conversion of NO to NO_2 in the atmosphere. However, the U.S. EPA issued a guidance memorandum that recommended a national default NO_2/NO_x ratio of 0.80 for use determining the maximum hourly average (and 0.75 for the maximum annual average) (U.S. EPA, 2015). This ratio effectively reduces the maximum model prediction to 366.6 µg/m³ (and 420.2 µg/m³ with background). Since this default conversion rate is conservative and the model predictions remain far below the applicable AQOs at all sensitive receptors, no further refinement of the NO_2 predictions was done. No exceedances of the NO_2 AQOs are expected at any off site location. In addition, the model predictions at all sensitive receptor locations are compliant with the CAAQS.

2.5.4 CO

The maximum predicted 1-hour and 8-hour CO concentrations for the Phase 2 emissions are shown in **Table 2.21**. The maximum predicted value that occurs in any year between 2014 and 2018 is shown. The predicted concentrations for each year are provided in Attachment II. There are no exceedances of the AQOs at any receptor, when including the background concentrations.

Table 2.21 Maximum Predicted CO Concentrations, Phase 2 (AQOs = 34,500 and 15,000 for 1-hour and 8-hour averages respectively)

Receptor	Project Sources (µg/m³)		Project + Background (µg/m³)	
	1-hour	8-hour	1-hour	8-hour
MPOI	1017.2	409.7	1024.5	410.5
1	10.8	2.8	11.7	3.6
2	7.9	2.0	8.8	4.2
3	9.6	2.8	10.5	3.6
4	28.5	11.1	29.4	11.9
5	4.7	2.4	8.3	3.2
6	22.9	7.2	23.8	8.0
7	18.2	6.8	19.1	7.6
8	65.8	17.2	66.7	18.0

2.6 Dispersion Model Predictions: Phase 2 Water Vapour

2.6.1 Visible Plumes

The results of Phase 2 water vapour plume modelling are displayed in **Table 2.22**, **Figure 2.22** and **Figure 2.23**. These results are associated with daytime hours, after removing events occurring when the ambient relative humidity is greater than 98% (when natural background fog would be expected). The estimated visible plume heights and lengths are similar to those modelled for Phase 1, with extreme heights and lengths predicted more frequently. In the case of plume length, a prediction of almost 3,960 m occurs for one hour during the modelling period (compared to a maximum predicted length of almost 2,250 m in Phase 1).

In total, visible plumes longer than 500 m are simulated to occur infrequently (411 hours during the five-year simulation period). This compares to a 124-hour prediction for visible plumes longer than 500 m for Phase 1.

Table 2.22 Water vapour plume visible heights and lengths, Phase 2 (daytime hours)

Range (m)	Hours per 5-year modelling period				
	period	winter	fall	spring	summer
Plume height (hours during model period)					
30	22,342	3,438	5,102	6,274	7,528
40	1,499	662	257	368	212
50	623	243	137	171	72
60	406	162	100	113	31
70	219	114	38	54	13
80	133	75	19	32	7
90	53	26	10	14	3
100	42	25	7	7	3
110	35	14	9	9	3
120	24	7	5	11	1
130	25	12	2	9	2
140	15	8	2	5	0
150	11	9	0	2	0
160	6	3	0	3	0
170	0	0	0	0	0
Plume length (hours during model period)					
50	6,370	19	953	1,735	3,663
100	14,755	2,303	3,962	4,468	4,022
150	1,553	798	292	355	108
200	841	486	148	158	49
300	915	572	154	162	27
500	599	376	100	108	15
750	257	146	51	58	2
1,000	75	51	12	10	2
1250	32	19	10	3	0
1,500	16	8	3	5	0
1,750	11	5	2	4	0
2,000	2	2	0	0	0
2,500	10	9	0	1	0
3,000	4	3	0	1	0
3,500	2	2	0	0	0
4,000	2	0	0	2	0
4,500	0	0	0	0	0

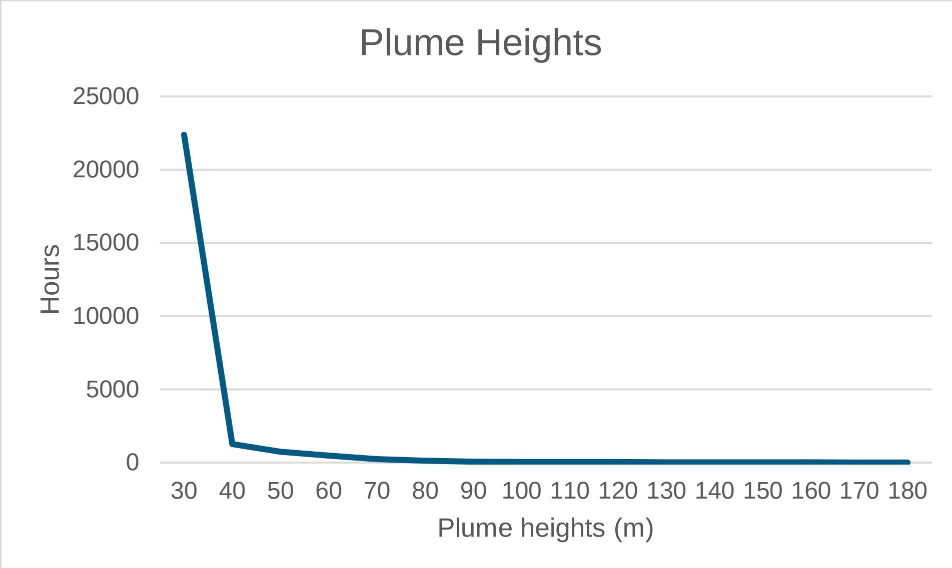


Figure 2.22 Visible plume heights for Phase 2

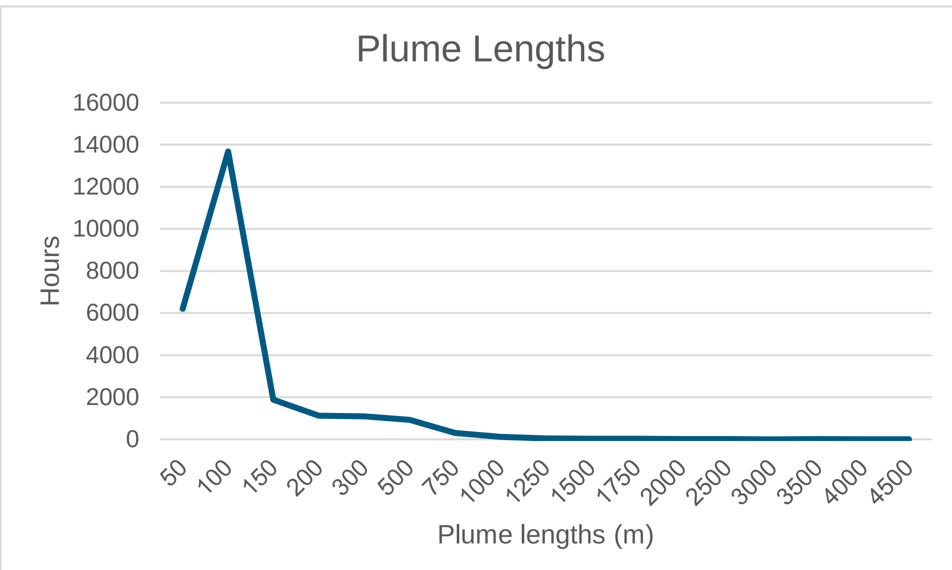


Figure 2.23 Visible plume lengths for Phase 2

2.6.2 Surface Fogging and Icing

The model receptors with at least one hour of predicted surface fog or ice for the Phase 2 water emissions are identified in **Figure 2.24** and **Figure 2.25** respectively. Additional plots of model receptors with at least 10 hours of predicted fog or ice are provided in **Figure 2.26** and **Figure 2.27**.

For any one receptor location, fogging occurs up to 43 hours during the five-year period (0.10% of the time) and icing occurs up to 447 hours during the five-year period (1.0% of the time). The location of the receptor with the most frequent fog and ice predictions is the same, on the southern property fenceline.

As with the Phase 1 predictions, the meteorological conditions associated with simulated surface fogging and icing are predominantly Stability Class 4 (and to a lesser degree 5), with wind speeds between 4 m/s and 8 m/s. These conditions are associated with building downwash.

A second simulation was completed in the model, turning the building downwash option 'off'. This simulation predicted a total of 3 hours of icing (zero hours of fogging) over the five year period.

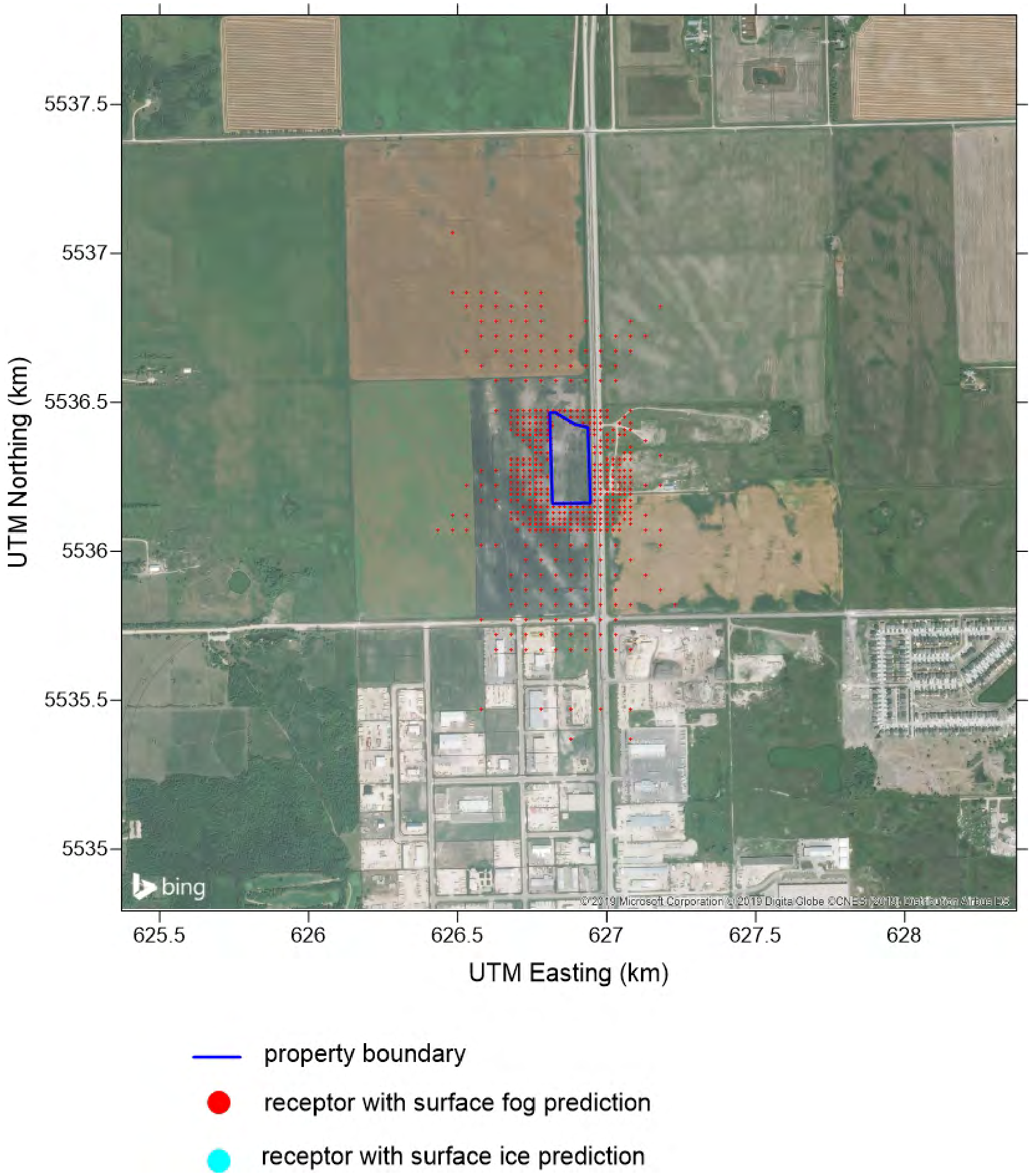


Figure 2.24 Phase 2 receptors with 1 or more hours of surface fog predictions, 2014 to 2018

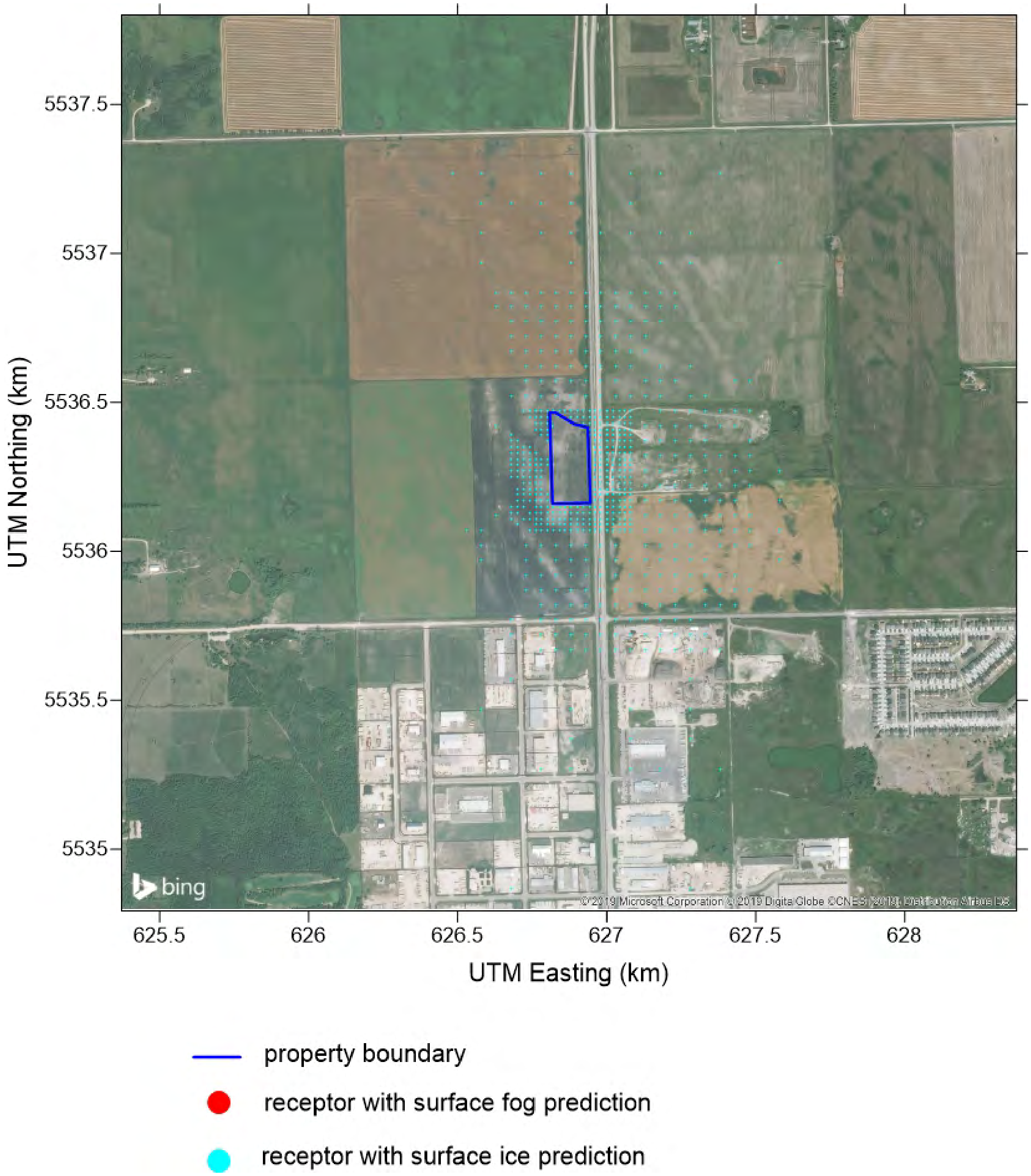


Figure 2.25 Phase 2 receptors with 1 or more hours of surface ice predictions, 2014 to 2018

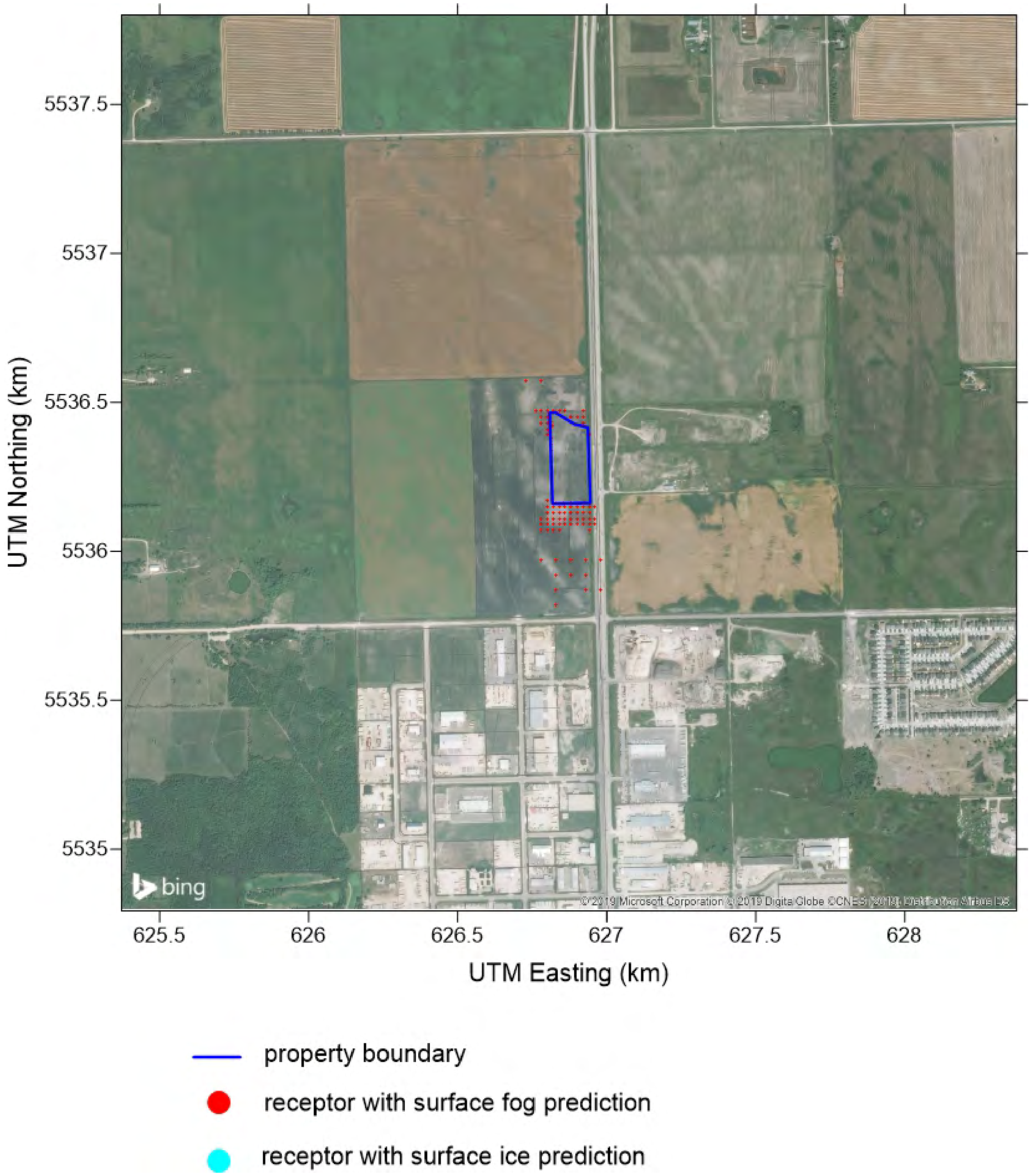


Figure 2.26 Phase 2 receptors with 10 or more hours of surface fog predictions, 2014 to 2018

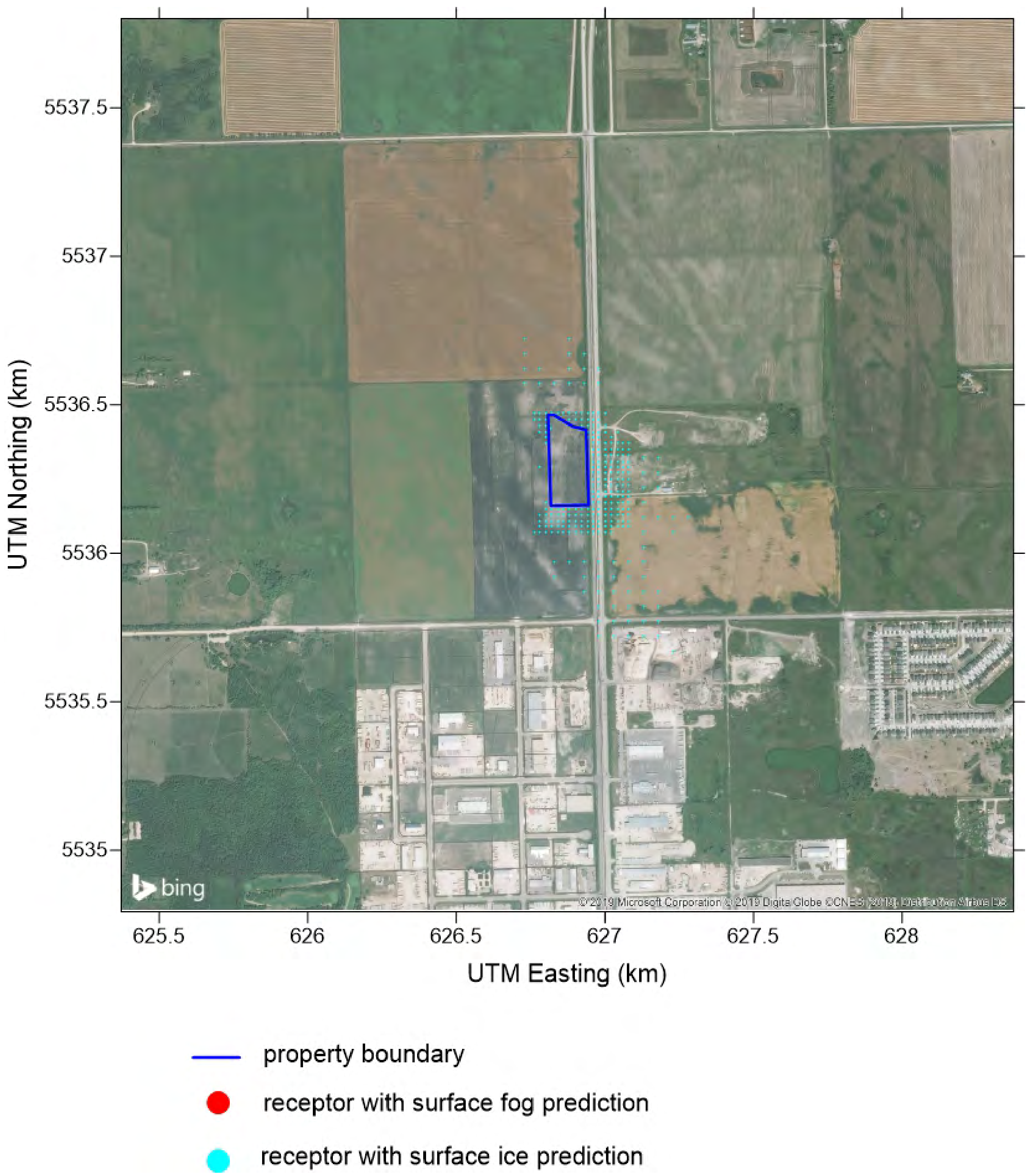


Figure 2.27 Phase 2 receptors with 10 or more hours of surface ice predictions, 2014 to 2018

2.8 Visible Plumes and YWG Flight Paths

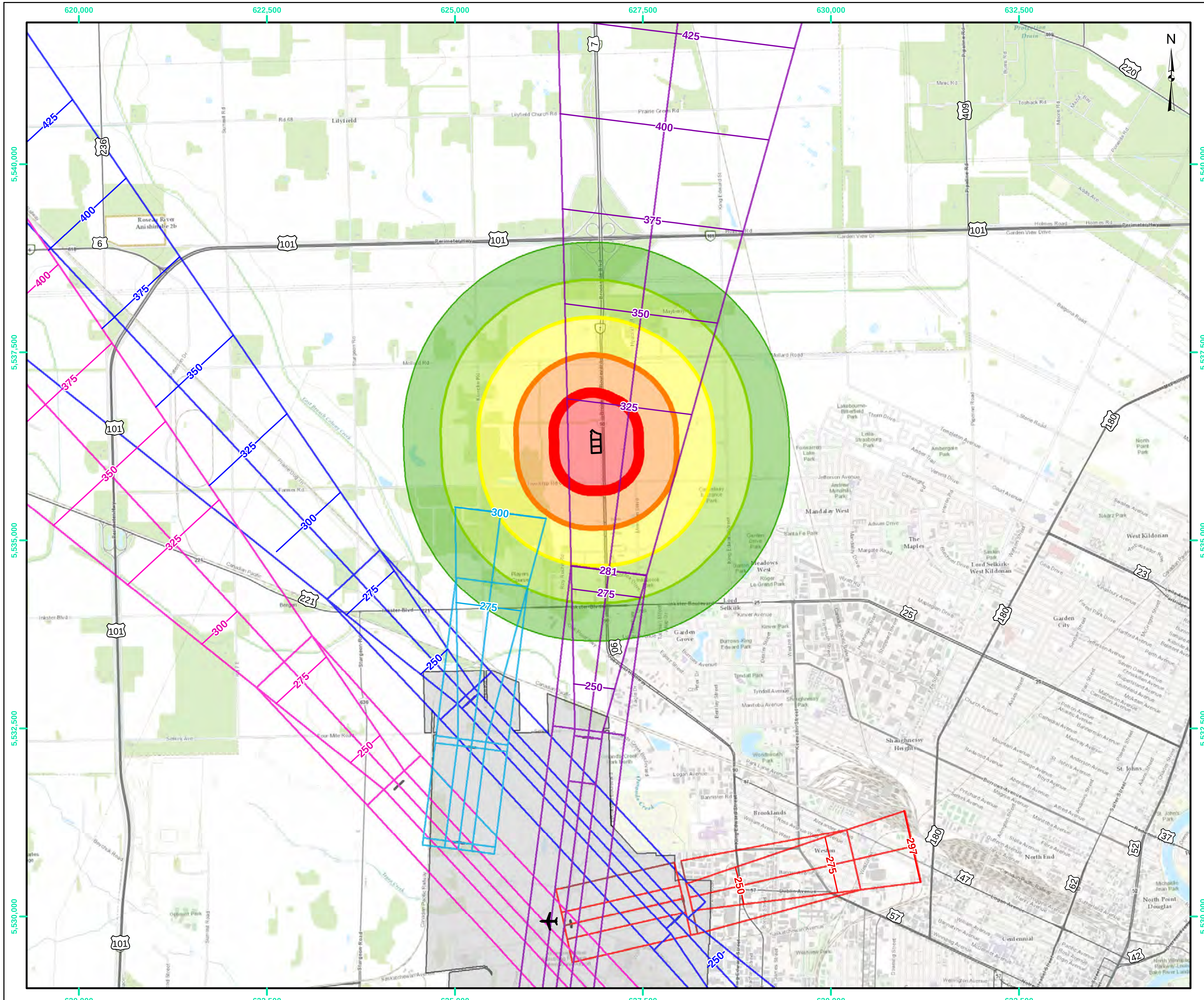
SNC-Lavalin acquired the Winnipeg International Airport (YWG) flight path data from Merit Foods so the assessment of visible water vapour plumes could be evaluated in terms of the nearby airport and associated air traffic. Merit Foods obtained the data from Barnes and Duncan, based on their proprietary flight path model. The flight path data include transit routes and aircraft elevations for the runways used at the airport.

2.8.1 Phase 1

Figure 2.28 shows the YWG flight paths with the modelled visible plume analysis for the Phase 1 facility emissions. One flight path (Runway 18L-36R) extends directly over the facility location and another flight path (Runway 18R) passes within a 500 m horizontal distance. However, based on the flight path data, the aircraft would be at least 260 m above the ground in these proximities, which is well above the extreme visible plume heights predicted (up to 157 m). For this reason, there is no expected visibility impact on arriving or departing flights due to the Phase 1 water vapour emissions.

2.8.2 Phase 2

Figure 2.29 shows the YWG flight paths with the modelled visible plume analysis for the Phase 2 facility emissions. In this case, three flight paths extend over the modelled horizontal extent of the visible plumes (Runways 18L-36R, 18R, and 13L-31R). At the greatest plume lengths predicted (3,000 m to 4,000 m), aircraft would be as low as approximately 230 m above the ground, which is much higher than the associated plume heights at these locations of 120 m or lower. At locations much closer to the facility the predicted plume heights are higher (as high as approximately 190 m on very infrequent occasions) although aircraft would be 300 m or higher in elevation at these locations.



LEGEND

- RUNWAY 07-25
- RUNWAY 18R
- RUNWAY 13L-31R
- RUNWAY 13R-31L
- RUNWAY 18L-36R
- STUDY PARCEL
- WINNIPEG RICHARDSON INTERNATIONAL AIRPORT

VISIBLE PLUME

HORIZONTAL DISTANCE, HOURS IN 5 YEAR PERIOD

- 0 - 500 METRES, 25,367 HOURS
- 500 - 1000 METRES, 62 HOURS
- 1000 - 1500 METRES, 13 HOURS
- 1500 - 2000 METRES, 5 HOURS
- 2000 - 2500 METRES, 1 HOUR

LABEL LEGEND

275 FLIGHT ELEVATION (m)

NOTES

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 14N.
2. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

DISCLAIMER

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DES	DRN	CHK	APP
00	2020 02 07	ISSUED FOR INFORMATION	LM	KVG	BM	LM

0 500 1,000 2,000 METRES

SCALE: 1:50,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
MERIT FUNCTIONAL FOODS	RM OF ROSSER

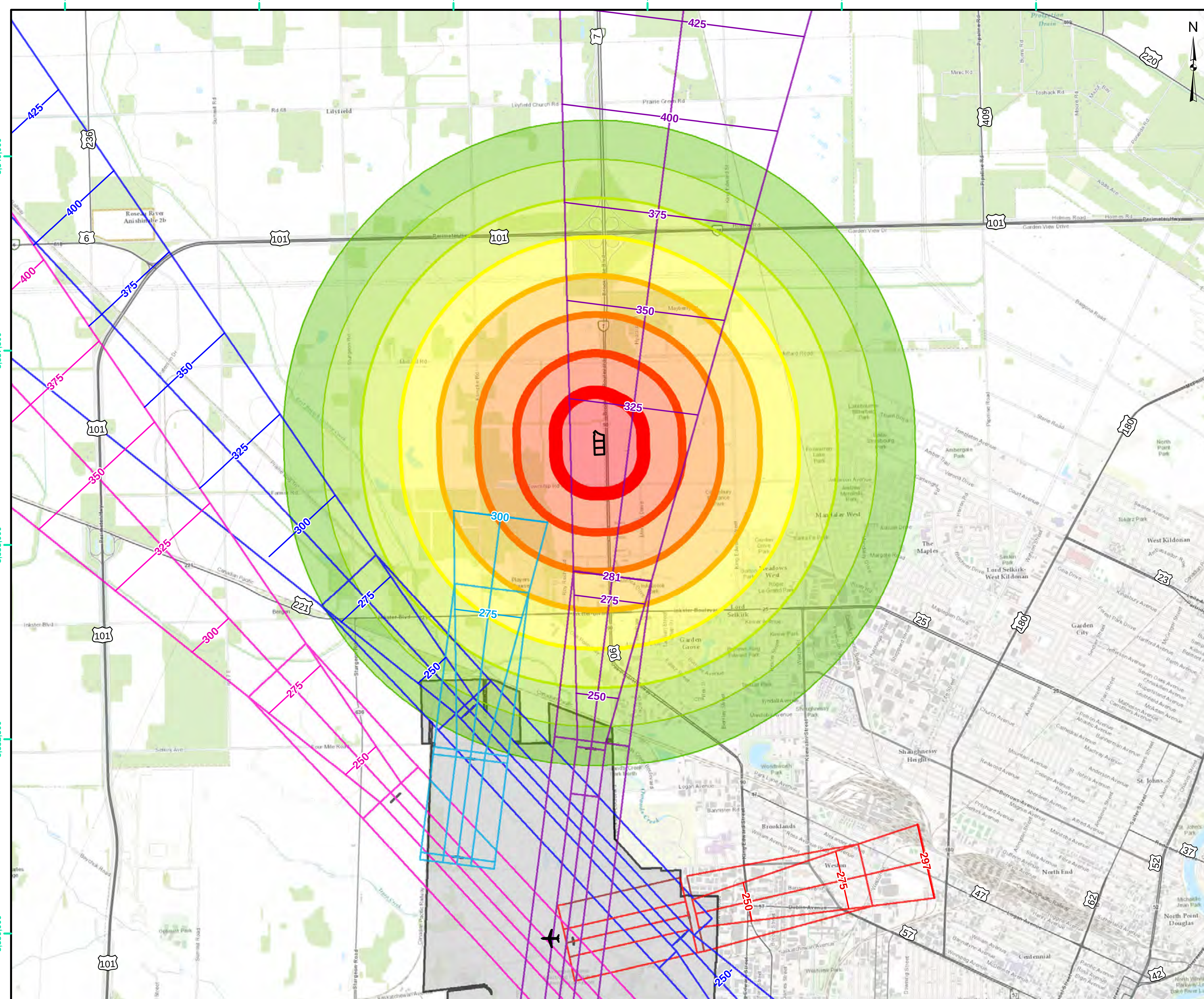
TITLE

VAPOUR PLUME MODEL, PHASE 1

DATE	2020 01 17	DWG No.	667646-0000-4GDD-0013	FIG No	2.28	REV	00

SIZE 11x17

Path: \\SLI1653\Projects QMS\Merit Functional Foods\667646_EA Proposal Merit Pea Canola Protein Proc. Plant\40_Execution\45_GIS_Dwgs\4.5.1 GIS\667646-0000-4GDD-0013 Air Phase 1 Plume.mxd



LEGEND

- RUNWAY 07-25
- RUNWAY 18R
- RUNWAY 13L-31R
- RUNWAY 13R-31L
- RUNWAY 18L-36R
- STUDY PARCEL
- WINNIPEG RICHARDSON INTERNATIONAL AIRPORT

VISIBLE PLUME

HORIZONTAL DISTANCE, HOURS IN 5 YEAR PERIOD

- 0 - 500 METRES, 25,033 HOURS
- 500 - 1000 METRES, 332 HOURS
- 1000 - 1500 METRES, 48 HOURS
- 1500 - 2000 METRES, 13 HOURS
- 2000 - 2500 METRES, 10 HOURS
- 2500 - 3000 METRES, 4 HOURS
- 3000 - 3500 METRES, 2 HOURS
- 3500 - 4000 METRES, 2 HOURS

LABEL LEGEND

275 FLIGHT ELEVATION (m)

NOTES

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 14N.
2. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

DISCLAIMER

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DES	DRN	CHK	APP
00	2020 02 07	ISSUED FOR INFORMATION	LM	KVG	BM	LM

0 500 1,000 2,000 METRES

SCALE: 1:50,000

SNC·LAVALIN

CLIENT	PROJECT LOCATION
MERIT FUNCTIONAL FOODS	RM OF ROSSER

TITLE

VAPOUR PLUME MODEL, PHASE 2

DATE	2020 01 17	DWG No.	667646-0000-4GDD-0014	FIG No.	2.29	REV	00

SIZE 11x17

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3 Conclusion

An air quality analysis was completed for Merit Foods, simulating the transport and dispersion of emissions from their facility, using an approved regulatory dispersion model (CALPUFF). The main source of air contaminants are the facility dryers, which will release limited amounts of suspended particulate matter (PM), following exhaust treatment in the facility cyclones and baghouses.

Dispersion modelling was completed using the expected maximum PM emission rates for the various sources. Emission estimates for NO_x and CO were also completed and used in the dispersion model. The maximum predicted ground-level ambient concentrations at various time averaging periods are shown in **Table 3.1**. These predictions are at the MPOI, which is at the facility fenceline in each case. Predicted exceedances of the AQOs are shown in bold.

In all cases, there are no exceedances of the AQOs at any sensitive receptor. Exceedances occur for PM, but only at or very near the facility fenceline. These relatively high model predictions are associated with building downwash, which may fold the plume over towards the ground during moderate to high wind speeds. It is recommended that $PM_{2.5}$ monitoring be conducted during the Phase 1 operations to validate the model. Further mitigation of the $PM_{2.5}$ emissions should be used if required.

An exceedance of the 1-hour NO_2 AQO was predicted for the Phase 2 emissions scenario, at the facility fenceline only. However, the model used a very conservative assumption that all NO emissions would immediately convert to NO_2, which would not be the case. For this reason, no exceedances of the NO_2 AQOs, at any location, are expected to occur in reality.

Table 3.1 Summary of air quality modelling results, Phase 1 and Phase 2

Air contaminant and averaging period	Maximum ground-level model prediction (µg/m^3) Phase 1		Maximum ground-level model prediction (µg/m^3) Phase 2		AQO
	Project contributions	Project + background	Project contributions	Project + background	
$PM_{2.5}$ 24-hour	26.6	**44.6**	**30.2**	**48.2**	28
$PM_{2.5}$ annual	6.3	**12.3**	7.8	**13.8**	10.0
PM_{10} 24-hour	29.7	**71.4**	34.2	**75.9**	50
NO_2 1-hour	319.4	373.0	**458.2**	**511.8**	400
NO_2 24-hour	86.2	125.0	115.7	154.5	200
NO_2 annual	10.3	24.6	13.9	28.2	40
CO 1-hour	812.3	813.2	1023.6	1024.5	34,500
CO 8-hour	326.0	326.8	409.7	410.5	15,000

The model predictions at all sensitive receptor locations included in the dispersion model are compliant with the CAAQS.

Additional dispersion modelling was conducted for the water vapour that will be released from the facility dryers. The water vapour has the potential for forming visible plumes in the air, as well as surface fogging or icing. The CALPUFF FOG model was used for this purpose, which simulates a plume of water vapour that disperses in the air with distance. The model predicts a visible plume, or surface ice or fog, depending on whether the air is determined to be saturated or not.

The results of the water vapour modelling are summarized below:

Phase 1:

- Visible plumes longer than 500 m are predicted to occur infrequently (81 hours over a five-year period). These plumes are predicted to extend as far as 2,250 m (1 hour over a five-year period). The extreme plume lengths are associated with low plume heights (approximately 50 m) during cold, calm conditions in the winter or fall. The visible plumes are not expected to impair visibility to aircraft using the Winnipeg International Airport.
- Surface fogging and icing is predicted to occur only very near the facility location, due to the action of building downwash. These events are infrequent, predicted to occur up to 12 hours over a five-year period (surface fogging) and up to 110 hours over a five-year period (surface icing). The locations of the maximum surface fogging or icing is right on the facility fenceline.

Phase 2:

- Visible plumes longer than 500 m are predicted to occur infrequently (411 hours over a five-year period) with the Phase 2 water emissions. These plumes are predicted to extend as far as 3,960 m (1 hour over a five-year period). The extreme plume lengths are associated with low plume heights (approximately 50 m) during cold, calm conditions in the winter or fall. The visible plume are not expected to impair visibility to aircraft using the Winnipeg International Airport.
- Surface fogging and icing is predicted to occur near the facility location, due to the action of building downwash. For the Phase 2 emissions, the areas over which surface fogging or icing are larger. Surface fogging is predicted to occur up to 43 hours over a five-year period and surface icing up to 447 hours over a five-year period. The locations of the maximum surface fogging or icing is right on the facility fenceline.

The extreme plume lengths from the modelling (up to 4.0 km in Phase 2) may be anomalous as they are predicted to occur very infrequently. While also very infrequent and limited spatially with the Phase 1 emissions, the potential surface fogging and icing is clearly associated with building downwash which is influenced by the current plan of short stacks on the dryers (5 feet high). The short stacks are expected to limit the potential problem of ice buildup on the dryer stacks (as communicated to SNC-Lavalin by Merit Foods). Use of higher stacks would reduce the likelihood of surface fogging and icing. Since the potential surface fogging and icing events with the current Phase 1 plans are rare and limited spatially to the adjacent Brookside Blvd., monitoring of this area is recommended during the Phase 1 operations. If the fogging and icing events are found to occur, higher stacks should be considered, particularly for the Phase 2 expansion.

More specifically, if the Phase 1 plans move ahead as expected, monitoring of the Brookside Blvd. for fogging or icing during cold ambient conditions (early morning hours, early evening hours) should be conducted, and mitigation measures to reduce surface fogging and icing should be implemented if required.

The great majority of time the visible plumes for both Phase 1 and Phase 2 emissions are predicted to be under 70 m in height and 500 m in length. Even the extreme plume heights and lengths infrequently predicted by the model, which may not occur in reality, do not intersect the flight paths in any cases.

4 References

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5 Closure

This Air Quality Assessment has been prepared by SNC-Lavalin Inc. on behalf of the Merit Functional Foods Corporation to support the Environment Act Proposal for the Project.

Submitted by:

SNC-Lavalin Inc.

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Manager, Impact Assessment and Community Engagement, Manitoba

Environment & Geoscience
Engineering, Design and Project Management

Attachment I

Meteorological Data Review

Meteorological Data Review

A review of the meteorological inputs was completed so that no problematic data would be used with CALPUFF that may affect its predictions.

Surface Data

A statistical summary of the Winnipeg International Airport station data for the years 2014 to 2018 is provided as **Table I.1**. The parameters follow the expected distribution patterns in all cases.

Additional data checks were completed on the hour by hour changes to the key parameters that influence model stability and associated model parameterizations, following checks that are completed with the Calpuff METSCAN processor. Plots of the average seasonal temperature profiles by year were also completed (**Figure I.1**). The following screening values were used to flag suspect data:

- Hourly temperature change > 5 ^{o}C
- Hourly RH change > 20
- Hourly surface pressure change > 4 mb

The diurnal temperature plots showed suspect temperatures for 2014 and 2015. These years were found to have bad temperature data and the hourly temperature data were replaced for these stations with hourly temperature data from a nearby station (Environment Canada Winnipeg A CS station).

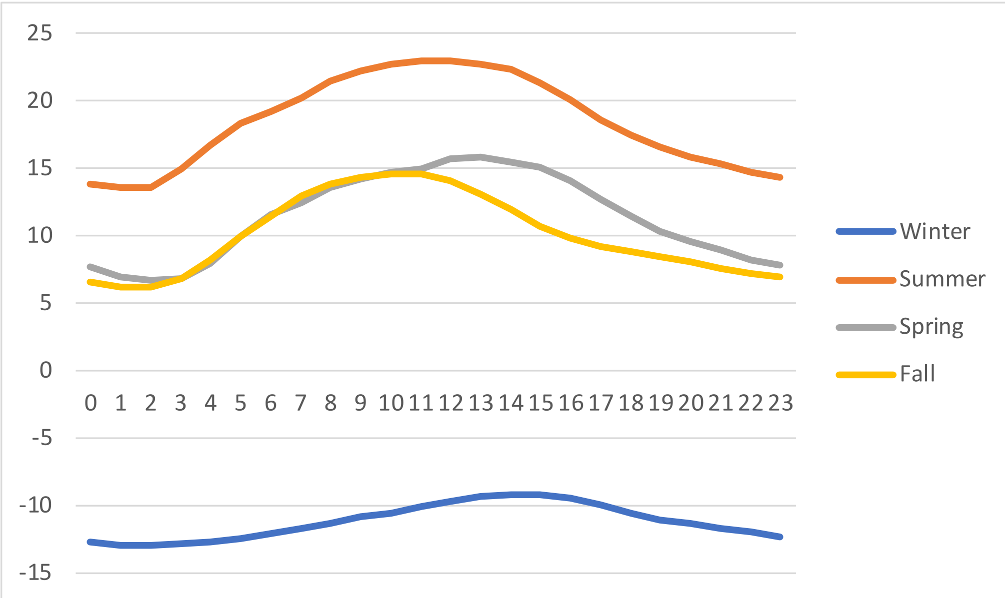
Any hour with an hourly delta greater than the values shown above were reviewed for reasonableness. The revised statistical distributions and ambient temperature plots for 2014 and 2015 are shown as **Table I.2** and **Figure I.2**.

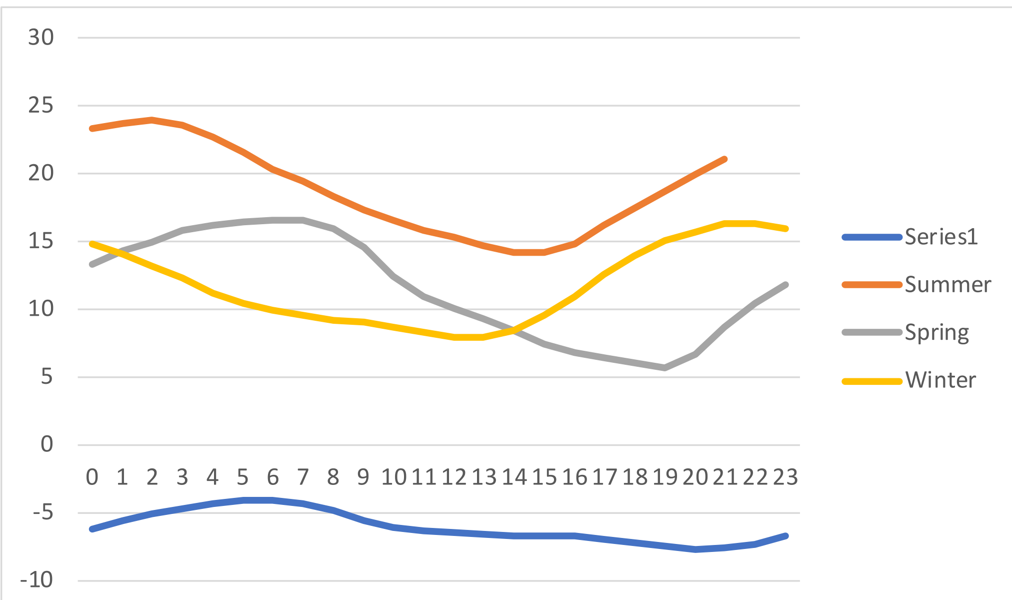
Table I.1 Statistical distribution of input surface meteorology (Winnipeg International Airport)

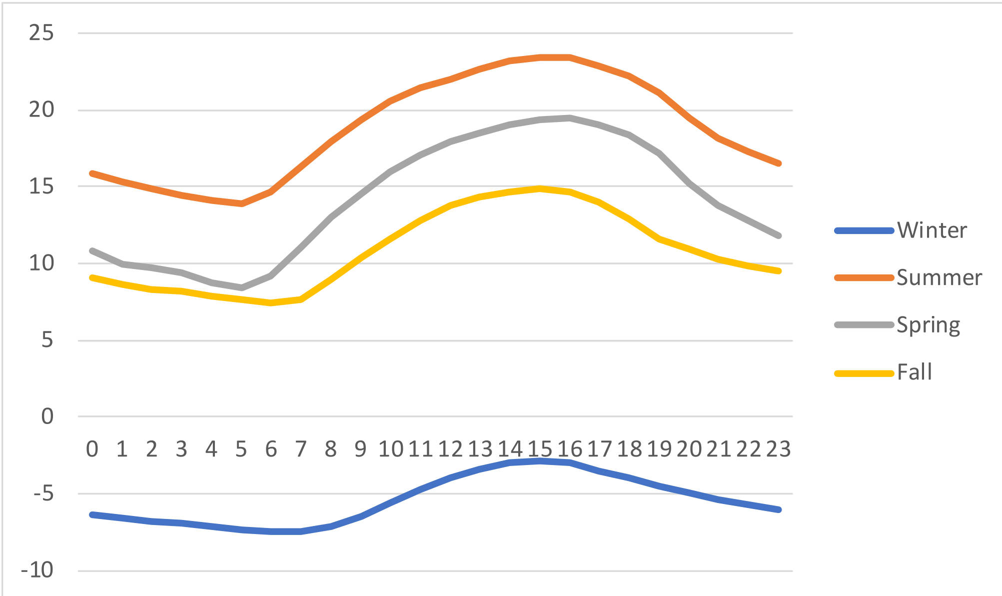
stat	2014				2015			
	P	T	WS	RH	P	T	WS	RH
max	1,014	33.0	18.9	99	1,017	34.0	20.0	100
99	1,007	27.5	13.1	98	1,009	28.6	13.3	98
95	1,002	24.0	10.8	95	1,001	24.6	10.3	96
90	998	20.8	9.2	93	998	22.1	8.9	93
75	992	14.9	6.9	85	992	16.4	6.4	86
50	986	3.6	5.0	75	986	6.1	4.7	75
25	980	-11.0	3.3	64	981	-5.2	3.1	61
10	975	-20.8	2.2	51	976	-16.5	2.2	45
min	956	-36.9	0.3	18	953	-33.9	0.3	13
stat	2016				2017			
	P	T	WS	RH	P	T	WS	RH
max	1,010	34.3	20.6	100	1,014	34.3	20.6	100
99	1,004	27.8	13.1	98	1,009	27.8	13.1	98
95	999	24.1	10.0	95	1,000	24.1	10.0	95
90	996	21.0	8.9	92	996	21.0	8.9	92
75	992	15.2	6.7	85	991	15.2	6.7	85
50	986	5.2	4.7	76	987	5.2	4.7	76
25	981	-6.3	3.1	62	981	-6.3	3.1	62
10	976	-15.7	1.9	44	975	-15.7	1.9	44
min	956	-34.7	0.0	15	951	-34.7	0.0	15
stat	2018							
	P	T	WS	RH				
max	1,017	37.2	16.4	100				
99	1,009	30.4	11.4	97				
95	1,002	25.8	9.2	94				
90	999	22.6	7.8	92				
75	993	16.0	6.1	85				
50	988	2.2	4.2	75				
25	982	-8.5	2.8	61				
10	978	-16.6	1.7	41				
min	963	-30.6	0.0	12				

Note: P=pressure in mb; T=temperature in ^{0}C; WS=wind speed in m/s; RH=relative humidity in %

Figure I.1 Diurnal temperature plots (2014 to 2018 in sequence)






25
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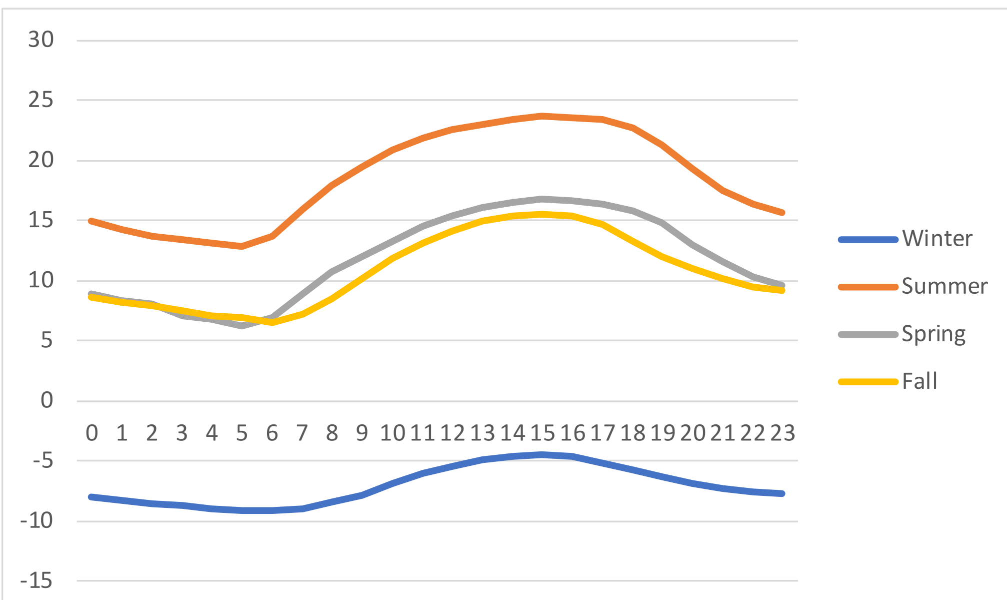
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Winter
Summer
Spring
Fall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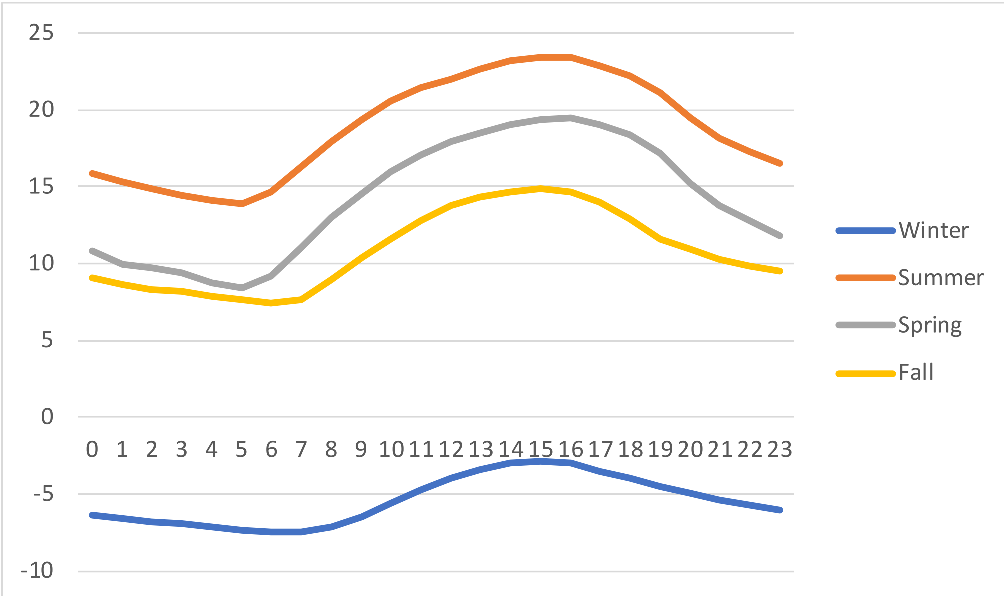
Winter
Summer
Spring
Fall


25
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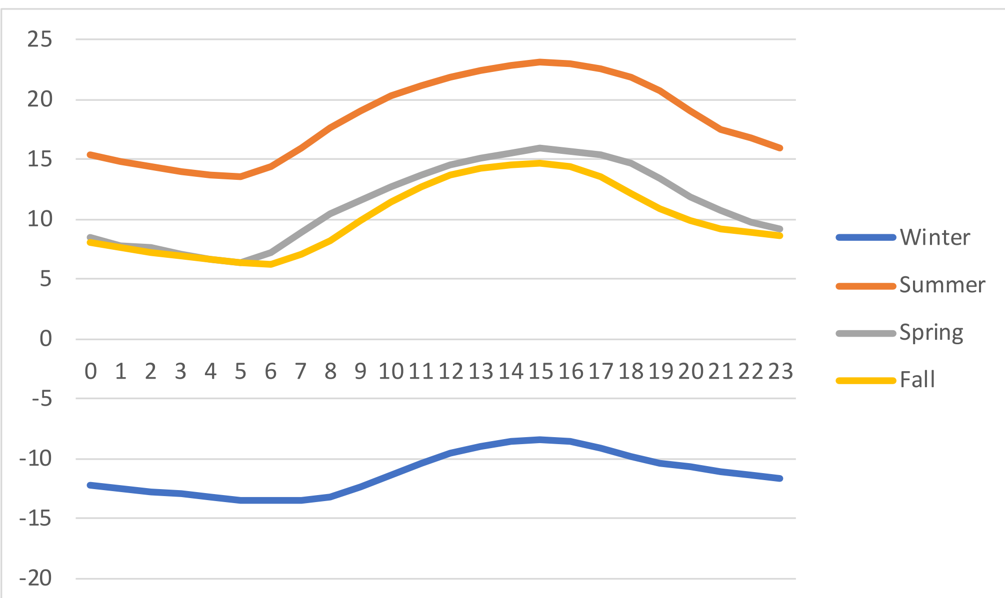
-5
-10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Winter
Summer
Spring
Fall

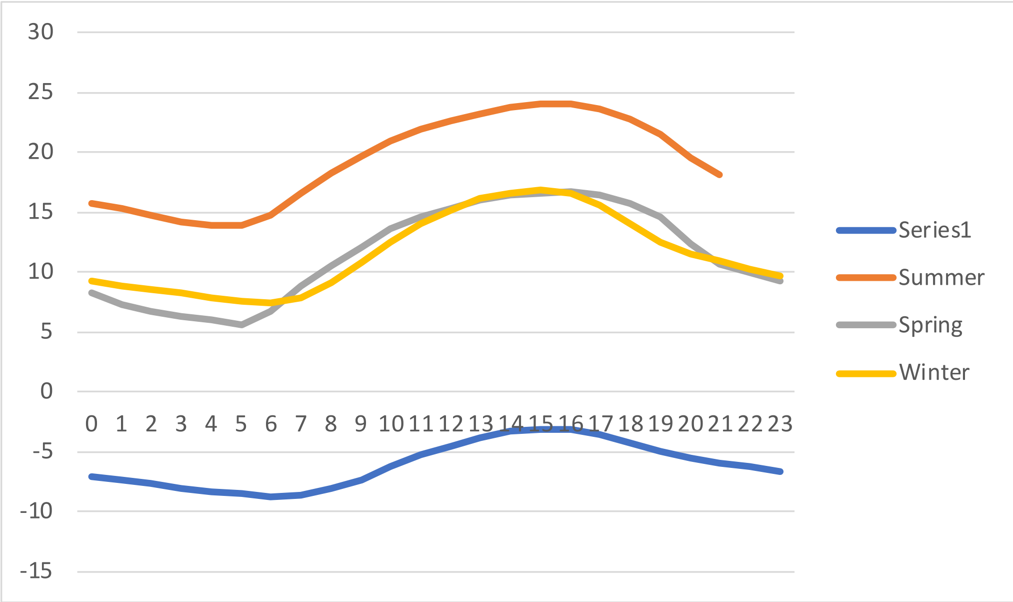
Table I.2 Updated statistical distributions for adjusted 2014 and 2015 meteorology (using Winnipeg A CS station temperatures)

stat	2014				2015			
	P	T	WS	RH	P	T	WS	RH
max	1,014	33.1	18.9	99	1,016	34.0	20.0	100
99	1,007	27.5	13.1	98	1,009	28.6	13.3	98
95	1,002	24.0	10.8	95	1,001	24.5	10.3	96
90	998	20.8	9.2	93	998	22.1	8.9	93
75	992	15.0	6.9	85	992	16.2	6.4	86
50	986	3.7	5.0	75	986	6.1	4.7	75
25	980	-10.9	3.3	64	981	-5.1	3.1	61
10	975	-20.9	2.2	51	976	-16.5	2.2	45
min	956	-37.1	0.3	8	952	-34.0	0.3	6.9

Note: P=pressure in mb; T=temperature in ^{0}C; WS=wind speed in m/s; RH=relative humidity in %

Figure I.2 Updated diurnal temperature plots (2014 and 2015 in sequence)





Upper Air Data

The READ62 processor was used to read the input upper air data from The Pas station downloaded from https://ruc.noaa.gov/raobs/. This processor flags problematic soundings based on internal thresholds (missing levels, etc). Upper air soundings were also downloaded from Bismarck station in North Dakota so that any problematic sounding in The Pas data set could be entirely replaced with a Bismarck sounding. No other data checks were completed on the upper air data.

Attachment II

Additional Air Quality Modelling Data

24-hour 98th percentile $PM_{2.5}$ model results by year (µg/m³) - Phase 1

Receptor	2014	2015	2016	2017	2018	max 3yr avg	max + bg
MPOI	29.7	26.6	23.6	27.4	24.6	26.6	44.6
1	0.1	0.1	0.1	0.1	0.1	0.1	18.1
2	0.1	0.1	0.1	0.1	0.1	0.1	18.1
3	0.1	0.1	0.1	0.1	0.1	0.1	18.1
4	0.5	0.6	0.4	0.4	0.5	0.5	18.5
5	0.0	0.0	0.0	0.0	0.0	0.0	18.0
6	0.2	0.2	0.4	0.2	0.3	0.3	18.3
7	0.2	0.3	0.2	0.3	0.3	0.3	18.3
8	0.6	0.6	0.7	0.5	0.6	0.6	18.6

24-hour 98th percentile $PM_{2.5}$ model results by year (µg/m³) - Phase 2

Receptor	2014	2015	2016	2017	2018	max 3yr avg	max + bg
MPOI	31.6	27.2	27.5	28.9	34.2	30.2	48.2
1	0.2	0.1	0.2	0.1	0.2	0.2	18.2
2	0.2	0.1	0.1	0.1	0.1	0.1	18.1
3	0.2	0.2	0.2	0.2	0.2	0.2	18.2
4	0.8	0.7	0.7	0.7	0.7	0.7	18.7
5	0.1	0.1	0.1	0.1	0.1	0.1	18.1
6	0.3	0.4	0.7	0.3	0.5	0.5	18.5
7	0.4	0.4	0.4	0.4	0.4	0.4	18.4
8	1.0	0.9	1.2	0.8	1.0	1.0	19.0

Annual $PM_{2.5}$ model results by year (µg/m³) - Phase 1

Receptor	2014	2015	2016	2017	2018	Max 5yr + bg
MPOI	5.5	6.3	4.8	5.8	5.3	11.8
1.0	0.0	0.0	0.0	0.0	0.0	6.0
2.0	0.0	0.0	0.0	0.0	0.0	6.0
3.0	0.0	0.0	0.0	0.0	0.0	6.0
4.0	0.1	0.1	0.1	0.1	0.1	6.1
5.0	0.0	0.0	0.0	0.0	0.0	6.0
6.0	0.0	0.0	0.0	0.0	0.0	6.0
7.0	0.0	0.0	0.0	0.0	0.0	6.0
8.0	0.1	0.1	0.1	0.1	0.1	6.1

Annual $PM_{2.5}$ model results by year ($\mu g/m^3$) - Phase 2

Receptor	2014	2015	2016	2017	2018	Max 5yr + bg
MPOI	6.9	7.8	6.0	7.4	6.8	13.4
1.0	0.0	0.0	0.0	0.0	0.0	6.0
2.0	0.0	0.0	0.0	0.0	0.0	6.0
3.0	0.0	0.0	0.0	0.0	0.0	6.0
4.0	0.2	0.2	0.1	0.2	0.1	6.2
5.0	0.0	0.0	0.0	0.0	0.0	6.0
6.0	0.0	0.0	0.1	0.0	0.0	6.1
7.0	0.1	0.1	0.1	0.1	0.1	6.1
8.0	0.1	0.2	0.2	0.1	0.1	6.2

Maximum 1-hour NO_2 model results by year, 100% conversion method ($\mu g/m^3$) - Phase 1

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	307.0	319.4	284.3	292.1	246.1	373.0
1	1.8	1.7	1.6	1.6	2.0	55.6
2	1.8	1.6	1.1	1.3	1.7	55.4
3	3.0	2.4	3.0	2.0	1.9	56.6
4	8.9	6.2	7.3	8.8	5.0	62.5
5	1.2	1.2	1.5	0.9	0.9	55.1
6	5.8	6.9	5.5	6.1	5.8	60.5
7	5.4	3.3	4.6	6.2	5.1	59.8
8	14.7	21.3	18.5	13.0	15.9	74.9

Maximum 1-hour NO_2 model results by year, 100% conversion method ($\mu g/m^3$) - Phase 2

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	458.2	444.9	372.6	387.0	365.4	511.8
1	3.0	2.8	3.2	2.2	3.7	57.3
2	3.0	2.8	1.7	2.1	2.7	56.6
3	4.1	4.1	5.1	3.9	3.4	58.7
4	13.1	9.6	11.2	14.7	7.9	68.3
5	1.7	1.9	2.4	1.3	1.6	56.0
6	9.0	10.5	9.1	7.3	7.9	64.1
7	8.6	5.2	5.5	9.4	6.6	63.0
8	17.2	21.3	22.0	13.0	16.9	75.6

Maximum 24-hour NO_2 model results by year, 100% conversion method (µg/m^3) - Phase 1

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	71.4	76.5	68.2	86.2	55.7	125.0
1.0	0.3	0.2	0.2	0.2	0.2	39.1
2.0	0.2	0.2	0.1	0.2	0.2	39.0
3.0	0.4	0.2	0.3	0.3	0.2	39.2
4.0	1.1	1.0	0.9	1.1	0.8	39.9
5.0	0.1	0.1	0.1	0.1	0.1	38.9
6.0	0.5	0.7	1.0	0.9	0.6	39.8
7.0	0.6	0.5	0.4	1.1	0.5	39.9
8.0	1.1	1.2	1.8	0.9	1.3	40.6

Maximum 24-hour NO_2 model results by year, 100% conversion method (µg/m^3) - Phase 2

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	97.4	105.4	88.2	115.7	73.6	154.5
1.0	0.5	0.3	0.3	0.3	0.3	39.3
2.0	0.4	0.3	0.2	0.3	0.3	39.2
3.0	0.6	0.4	0.4	0.5	0.3	39.4
4.0	1.7	1.4	1.4	1.9	1.2	40.7
5.0	0.2	0.1	0.1	0.2	0.1	39.0
6.0	0.9	1.2	1.7	1.2	0.8	40.5
7.0	0.9	0.8	0.7	2.0	0.7	40.8
8.0	1.6	1.6	2.2	1.2	2.0	41.0

Annual NO_2 model results by year (µg/m^3) - Phase 1

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	8.9	10.3	10.1	7.6	8.8	24.6
1.0	0.0	0.0	0.0	0.0	0.0	14.3
2.0	0.0	0.0	0.0	0.0	0.0	14.3
3.0	0.0	0.0	0.0	0.0	0.0	14.3
4.0	0.1	0.1	0.1	0.1	0.1	14.4
5.0	0.0	0.0	0.0	0.0	0.0	14.3
6.0	0.0	0.0	0.0	0.0	0.0	14.3
7.0	0.0	0.1	0.1	0.0	0.1	14.4
8.0	0.1	0.1	0.1	0.1	0.1	14.4

Annual NO_2 model results by year (µg/m^3) - Phase 2

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	12.2	13.9	13.7	10.6	11.9	28.3
1.0	0.0	0.0	0.0	0.0	0.0	14.3
2.0	0.0	0.0	0.0	0.0	0.0	14.3
3.0	0.0	0.0	0.0	0.0	0.0	14.3
4.0	0.2	0.2	0.2	0.2	0.2	14.5
5.0	0.0	0.0	0.0	0.0	0.0	14.3
6.0	0.0	0.1	0.1	0.1	0.1	14.4
7.0	0.1	0.1	0.1	0.1	0.1	14.4
8.0	0.2	0.2	0.2	0.2	0.2	14.5

Maximum 1-hour CO model results by year (µg/m^3) - Phase 1

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	762.7	812.3	728.7	736.5	630.9	813.2
1	4.5	3.7	2.9	4.0	4.0	5.4
2	3.9	3.2	3.1	2.9	4.2	5.1
3	7.5	4.9	6.9	4.5	3.8	8.4
4	21.1	14.5	15.2	18.7	11.4	22.0
5	2.9	2.9	4.1	2.2	2.0	5.0
6	13.7	17.2	12.0	19.0	17.7	19.9
7	13.7	7.8	9.2	18.2	13.3	19.1
8	40.8	65.8	54.1	39.4	47.2	66.7

Maximum 8-hour CO model results by year (µg/m^3) - Phase 1

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	326.0	306.1	256.2	316.2	263.2	326.8
1.0	1.9	1.0	1.1	1.0	1.5	2.7
2.0	1.1	1.2	0.7	1.4	2.8	3.6
3.0	1.9	1.2	1.9	1.9	1.5	2.7
4.0	6.1	7.2	4.5	7.5	1.1	8.3
5.0	0.7	0.6	0.9	0.8	1.9	2.7
6.0	2.4	3.0	5.0	5.6	2.2	6.4
7.0	3.7	2.3	3.3	3.5	2.2	4.5
8.0	9.3	8.6	15.2	7.6	1.9	16.0

Maximum 1-hour CO model results by year (µg/m³) - Phase 2

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	1017.2	1023.6	877.3	896.2	776.0	1024.5
1	5.9	5.5	5.4	5.0	10.8	11.7
2	5.9	5.2	3.4	4.2	7.9	8.8
3	9.4	7.8	9.6	7.0	9.4	10.5
4	28.2	19.6	21.7	28.5	7.0	29.4
5	3.7	4.0	4.7	2.7	7.4	8.3
6	19.1	22.9	17.7	19.0	6.3	23.8
7	17.0	10.5	9.8	18.2	6.2	19.1
8	44.9	65.8	60.0	39.4	6.7	66.7

Maximum 8-hour CO model results by year (µg/m³) - Phase 2

Receptor	2014	2015	2016	2017	2018	max 5yr + bg
MPOI	409.7	378.0	311.4	387.4	309.8	410.5
1.0	2.8	1.7	1.7	1.5	2.3	3.6
2.0	1.7	1.7	1.1	2.0	3.4	4.2
3.0	2.4	1.6	2.5	2.8	1.9	3.6
4.0	8.6	8.6	6.4	11.1	1.6	11.9
5.0	0.9	0.8	1.0	1.2	2.4	3.2
6.0	3.5	5.2	7.0	7.2	2.9	8.0
7.0	4.7	3.2	3.9	6.8	2.9	7.6
8.0	9.3	10.0	17.2	8.3	2.6	18.0

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Appendix F

List of Species in the Lake Manitoba Plain Ecoregion

Table F.1 Subnational (S) conservation status ranks (MBCDC 2019a)

Table F.2 List of plant species in the Lake Manitoba Plain Ecoregion (MBCDC 2019a)

Table F.3 List of animal species in the Lake Manitoba Plain Ecoregion (MBCDC 2019a)

Table F.1 Subnational (S) conservation status ranks (MBCDC 2019a)

Rank	Status	Definition
SX	presumed extirpated	Species is believed to be extirpated from Manitoba. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. [equivalent to “Regionally Extinct” in IUCN Red List terminology].
SH	possibly extirpated	Known from only historical records but still some hope of rediscovery. There is evidence that the species may no longer be present in Manitoba, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching and / or some evidence of significant habitat loss or degradation; (2) that a species has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in Manitoba.
S1	critically imperiled	At very high risk of extirpation in Manitoba due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
S2	imperiled	At high risk of extirpation in Manitoba due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3	vulnerable	At moderate risk of extirpation in Manitoba due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
S4	apparently secure	At a fairly low risk of extirpation in Manitoba due to an extensive range and / or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
S5	secure	At very low or no risk of extirpation in Manitoba due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

Table F.2 List of plant species in the Lake Manitoba Plain Ecoregion (MBCDC 2019a)

Common Name	Scientific Name	Family	Subnational Rank	ESEA Status	SARA Status
Indian rice grass	*Achnatherum hymenoides*	Poaceae	S2	n/a	n/a
prairie trefoil	*Acmispon americanus*	Fabaceae	S2S3	n/a	n/a
rough agalinis	*Agalinis aspera*	Scrophulariaceae	S2	Endangered	Schedule 1, Endangered
Gattinger's agalinis	*Agalinis gattingeri*	Scrophulariaceae	S1	Endangered	Schedule 1, Endangered
narrow-leaved agalinis	*Agalinis tenuifolia*	Scrophulariaceae	S2S3	n/a	n/a
common agrimony	*Agrimonia gryposepala*	Rosaceae	S1S2	n/a	n/a
narrow-leaved water-plantain	*Alisma gramineum*	Alismataceae	S1	n/a	n/a
sandbur	*Ambrosia acanthicarpa*	Asteraceae	S1	n/a	n/a
false indigo	*Amorpha fruticosa*	Fabaceae	S1S2	n/a	n/a
plantain-leaved everlasting	*Antennaria plantaginifolia*	Asteraceae	S1S2	n/a	n/a
jack-in-the-pulpit	*Arisaema triphyllum ssp. triphyllum*	Araceae	S1S2	n/a	n/a
whorled milkweed	*Asclepias verticillata*	Apocynaceae	S3	n/a	n/a
neglected milkvetch	*Astragalus neglectus*	Fabaceae	S1	n/a	n/a
silver saltbush	*Atriplex argentea var. argentea*	Chenopodiaceae	S2	n/a	n/a
red bulrush	*Blysmopsis rufa*	Cyperaceae	S2?	n/a	n/a
white boltonia	*Boltonia asteroides var. recognita*	Asteraceae	S2S3	n/a	n/a
pale moonwort	*Botrychium pallidum*	Ophioglossaceae	SH	n/a	n/a
side-oats grama	*Bouteloua curtipendula*	Poaceae	S2	n/a	n/a
wild chess	*Bromus kalmii*	Poaceae	S2S3	n/a	n/a
Porter's chess	*Bromus porteri*	Poaceae	S2S3	n/a	n/a
plains reed grass	*Calamagrostis montanensis*	Poaceae	S3	n/a	n/a
pine reed grass	*Calamagrostis rubescens*	Poaceae	S1	n/a	n/a
spring cress	*Cardamine bulbosa*	Brassicaeae	SH	n/a	n/a
Crawe's sedge	*Carex crawei*	Cyperaceae	S3?	n/a	n/a
crested sedge	*Carex cristatella*	Cyperaceae	S1?	n/a	n/a
Douglas' sedge	*Carex douglasii*	Cyperaceae	S2	n/a	n/a
Emory's sedge	*Carex emoryi*	Cyperaceae	S2?	n/a	n/a

Common Name	Scientific Name	Family	Subnational Rank	ESEA Status	SARA Status
Hall's sedge	*Carex hallii*	Cyperaceae	S1S2	n/a	n/a
porcupine sedge	*Carex hystericina*	Cyperaceae	S3	n/a	n/a
livid sedge	*Carex livida*	Cyperaceae	S3	n/a	n/a
Parry's sedge	*Carex parryana*	Cyperaceae	S3	n/a	n/a
necklace sedge	*Carex projecta*	Cyperaceae	S3?	n/a	n/a
dioecious sedge	*Carex sterilis*	Cyperaceae	S2	n/a	n/a
weak sedge	*Carex supina ssp. spaniocarpa*	Cyperaceae	S2S3	n/a	n/a
rigid sedge	*Carex tetanica*	Cyperaceae	S3	n/a	n/a
fox sedge	*Carex vulpinoidea*	Cyperaceae	S3	n/a	n/a
hackberry	*Celtis occidentalis*	Ulmaceae	S1?	Threatened	n/a
large enchanter's-nightshade	*Circaea canadensis ssp. canadensis*	Onagraceae	S2	n/a	n/a
field thistle	*Cirsium discolor*	Asteraceae	S1	n/a	n/a
western virgin's-bower	*Clematis ligusticifolia*	Ranunculaceae	S1	n/a	n/a
virgin's-bower	*Clematis virginiana*	Ranunculaceae	S2?	n/a	n/a
American bugseed	*Corispermum americanum var. americanum*	Chenopodiaceae	S3	n/a	n/a
hairy bugseed	*Corispermum villosum*	Chenopodiaceae	S1S2	n/a	n/a
alternate-leaved dogwood	*Cornus alternifolia*	Cornaceae	S3	n/a	n/a
Canadian honewort	*Cryptotaenia canadensis*	Apiaceae	S1	n/a	n/a
red-root flatsedge	*Cyperus erythrorhizos*	Cyperaceae	S1	n/a	n/a
Houghton's umbrella-sedge	*Cyperus houghtonii*	Cyperaceae	S2S3	n/a	n/a
Schweinitz's flatsedge	*Cyperus schweinitzii*	Cyperaceae	S2	n/a	n/a
small white lady's-slipper	*Cypripedium candidum*	Orchidaceae	S1	Endangered	Schedule 1, Endangered
hairy prairie-clover	*Dalea villosa var. villosa*	Fabaceae	S2S3	Threatened	Schedule 1, Special Concern
beggar's-lice	*Desmodium canadense*	Fabaceae	S2	n/a	n/a
white-haired panic-grass	*Dichanthelium linearifolium*	Poaceae	S2?	n/a	n/a
creeping whitlow-grass	*Draba reptans*	Brassicaceae	S2	n/a	n/a
American waterwort	*Elatine americana*	Elatinaceae	S1	n/a	n/a
Nuttall's waterweed	*Elodea nuttallii*	Hydrocharitaceae	S1?	n/a	n/a

Common Name	Scientific Name	Family	Subnational Rank	ESEA Status	SARA Status
various-glumed wild rye	*Elymus diversiglumis*	Poaceae	S1S2	n/a	n/a
bottle-brush grass	*Elymus hystrix*	Poaceae	S2	n/a	n/a
creeping teal love grass	*Eragrostis hypnoides*	Poaceae	S3	n/a	n/a
prostrate spurge	*Euphorbia geyeri*	Euphorbiaceae	S2	n/a	n/a
plains rough fescue	*Festuca hallii*	Poaceae	S3	n/a	n/a
nodding fescue	*Festuca subverticillata*	Poaceae	S1	n/a	n/a
black ash	*Fraxinus nigra*	Oleaceae	S2S3	n/a	n/a
cleavers	*Galium aparine*	Rubiaceae	S3	n/a	n/a
downy gentian	*Gentiana puberulenta*	Gentianaceae	S2	n/a	n/a
tuberous-rooted sunflower	*Helianthus nuttallii ssp. rydbergii*	Asteraceae	S2	n/a	n/a
water star-grass	*Heteranthera dubia*	Asteraceae	S2S3	n/a	n/a
false heather	*Hudsonia tomentosa*	Cistaceae	S3	n/a	n/a
two-flowered dwarf-dandelion	*Krigia biflora*	Asteraceae	S2S3	n/a	n/a
woodland lettuce	*Lactuca floridana*	Asteraceae	SH	n/a	n/a
pinweed	*Lechea intermedia*	Cistaceae	S1?	n/a	n/a
rice cutgrass	*Leersia oryzoides*	Poaceae	S3	n/a	n/a
grooved yellow flax	*Linum sulcatum*	Linaceae	S3	n/a	n/a
narrow-leaved puccoon	*Lithospermum incisum*	Boraginaceae	S3	n/a	n/a
marble-seed	*Lithospermum parviflorum*	Boraginaceae	S1	n/a	n/a
whorled loosestrife	*Lysimachia quadriflora*	Primulaceae	S2	n/a	n/a
Canada moonseed	*Menispermum canadense*	Menispermaceae	S3	n/a	n/a
foxtail muhly	*Muhlenbergia andina*	Poaceae	S1	n/a	n/a
leafy musineon	*Musineon divaricatum*	Apiacea	S1S2	n/a	n/a
sundrops	*Oenothera perennis*	Onagraceae	S1	n/a	n/a
Louisiana broom-rape	*Orobanche ludoviciana*	Orobanchaceae	S2	n/a	n/a
one-flowered broom-rape	*Orobanche uniflora*	Orobanchaceae	S1	n/a	n/a
hairy sweet cicely	*Osmorhiza claytonii*	Apiaceae	S2?	n/a	n/a
blunt-fruited sweet cicely	*Osmorhiza depauperata*	Apiaceae	S2	n/a	n/a

Common Name	Scientific Name	Family	Subnational Rank	ESEA Status	SARA Status
hop-hornbeam	*Ostrya virginiana*	Betulaceae	S2	n/a	n/a
western dwarf cliffbrake	*Pellaea glabella ssp. occidentalis*	Pteridaceae	S2	n/a	n/a
ditch-stonecrop	*Penthorum sedoides*	Crassulaceae	S1S2	n/a	n/a
lopseed	*Phryma leptostachya*	Verbenaceae	S3	n/a	n/a
whorled milkwort	*Polygala verticillata*	Polygalaceae	S2	n/a	n/a
whorled milkwort	*Polygala verticillata var. isocycla*	Polygalaceae	S2	n/a	n/a
Illinois pondweed	*Potamogeton illinoensis*	Potamogetonaceae	S1?	n/a	n/a
blood-root	*Sanguinaria canadensis*	Papaveraceae	S2	n/a	n/a
leathery grape-fern	*Sceptridium multifidum*	Ophioglossaceae	S3	n/a	n/a
prairie spike-moss	*Selaginella densa*	Selaginellaceae	S3	n/a	n/a
annual skeletonweed	*Shinnersoseris rostrata*	Asteraceae	S1S2	n/a	n/a
white-eyed grass	*Sisyrinchium campestre*	Brassicaceae	S3	n/a	n/a
riddell's goldenrod	*Solidago riddellii*	Asteraceae	S2S3	Threatened	Schedule 1, Special Concern
tall dropseed	*Sporobolus compositus*	Poaceae	S1	n/a	n/a
annual dropseed	*Sporobolus neglectus*	Poaceae	S2S3	n/a	n/a
western silvery aster	*Symphyotrichum sericeum*	Asteraceae	S2S3	Threatened	Schedule 1, Threatened
silky townsend-daisy	*Townsendia exscapa*	Asteraceae	S2	n/a	n/a
bracted vervain	*Verbena bracteata*	Verbenaceae	S3	n/a	n/a
white vervain	*Verbena urticifolia*	Verbenaceae	S1	n/a	n/a
western ironweed	*Vernonia fasciculata*	Asteraceae	S1	Endangered	n/a
Culver's-root	*Veronicastrum virginicum*	Scrophulariaceae	S1S2	Threatened	n/a
early blue violet	*Viola labradorica*	Violaceae	S3	n/a	n/a

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Table F.3 List of animal species in the Lake Manitoba Plain Ecoregion (MBCDC 2019a)

Common Name	Scientific Name	Taxonomic Group	Subnational Rank	ESEA Status	SARA Status
western grebe	*Aechmophorus occidentalis*	bird	S4B	n/a	Schedule 1, Special Concern
threeridge	*Amblema plicata*	mollusk	S3	n/a	n/a
western tiger salamander	*Ambystoma mavortium*	amphibian	S4S5	n/a	Schedule 1, Special Concern
Baird's sparrow	*Ammodramus bairdii*	bird	S1B	Endangered	Schedule 1, Special Concern
grasshopper sparrow	*Ammodramus savannarum*	bird	S3B	n/a	n/a
Sprague's pipit	*Anthus spragueii*	bird	S2B	Threatened	Schedule 1, Threatened
whip-poor-will	*Antrostomus vociferus*	bird	S3B	Threatened	Schedule 1, Threatened
great blue heron	*Ardea herodias*	bird	S5B	n/a	n/a
short-eared owl	*Asio flammeus*	bird	S2S3B	Threatened	Schedule 1, Special Concern
burrowing owl	*Athene cunicularia*	bird	S1B	Endangered	Schedule 1, Endangered
green heron	*Butorides virescens*	bird	S1B	n/a	n/a
chestnut-collared longspur	*Calcarius ornatus*	bird	S2B	Endangered	Schedule 1, Threatened
Canada warbler	*Cardellina canadensis*	bird	S3B	Threatened	Schedule 1, Threatened
northern cardinal	*Cardinalis cardinalis*	bird	S1B, SUN	n/a	n/a
chimney swift	*Chaetura pelagica*	bird	S2B	Threatened	Schedule 1, Threatened
piping plover	*Charadrius melodus*	bird	S1B	Endangered	Schedule 1, Endangered
snapping turtle	*Chelydra serpentina*	reptile	S3	n/a	Schedule 1, Special Concern
black tern	*Chlidonias niger*	bird	S4B	n/a	n/a
common nighthawk	*Chordeiles minor*	bird	S3B	Threatened	Schedule 1, Threatened
olive-sided flycatcher	*Contopus cooperi*	bird	S3B	Threatened	Schedule 1, Threatened
eastern wood-pewee	*Contopus virens*	bird	S4B	n/a	Schedule 1, Special Concern
yellow rail	*Coturnicops noveboracensis*	bird	S3B	n/a	Schedule 1, Special Concern
trumpeter swan	*Cygnus buccinator*	bird	S1B	Endangered	n/a
monarch	*Danaus plexippus*	insect	S3S4B	n/a	n/a
bobolink	*Dolichonyx oryzivorus*	bird	S4B	n/a	Schedule 1, Threatened
horned lark	*Eremophila alpestris*	bird	S3B, SUM	n/a	n/a
wabash pigtoe	*Fusconaia flava*	mollusk	S3	n/a	n/a

Common Name	Scientific Name	Taxonomic Group	Subnational Rank	ESEA Status	SARA Status
plains pocket gopher	*Geomys bursarius*	mammal	S3	n/a	n/a
Dakota skipper	*Hesperia dacotae*	insect	S2	n/a	n/a
barn swallow	*Hirundo rustica*	bird	S4B	n/a	Schedule 1, Threatened
Caspian tern	*Hydroprogne caspia*	bird	S3B	n/a	n/a
least bittern	*Ixobrychus exilis*	bird	S2B	Endangered	Schedule 1, Threatened
loggerhead shrike	*Lanius ludovicianus excubitorides*	bird	S1B	Endangered	Schedule 1, Threatened
loggerhead shrike	*Lanius ludovicianus migrans*	bird	S1B	Endangered	Schedule 1, Endangered
herring gull	*Larus argentatus*	bird	S4B	n/a	n/a
ring-billed gull	*Larus delawarensis*	bird	S5B	n/a	n/a
white heelsplitter	*Lasmigona complanata*	mollusk	S3	n/a	n/a
black sandshell	*Ligumia recta*	mollusk	S3	n/a	n/a
northern leopard frog	*Lithobates pipiens*	amphibian	S4	n/a	Schedule 1, Special Concern
red-headed woodpecker	*Melanerpes erythrocephalus*	bird	S3B	Threatened	Schedule 1, Threatened
black-crowned night-heron	*Nycticorax nycticorax*	bird	S4B	n/a	n/a
calico crayfish	*Orconectes immunis*	crustacean	S3	n/a	n/a
American white pelican	*Pelecanus erythrorhynchos*	bird	S4B	n/a	n/a
double-crested cormorant	*Phalacrocorax auritus*	bird	S5B	n/a	n/a
northern prairie skink	*Plestiodon septentrionalis*	reptile	S1	n/a	n/a
horned grebe	*Podiceps auritus*	bird	S4B	n/a	Schedule 1, Special Concern
eared grebe	*Podiceps nigricollis*	bird	S4B	n/a	n/a
mapleleaf mussel	*Quadrula quadrula*	mollusk	S1	n/a	n/a
bank swallow	*Riparia riparia*	bird	S5B	n/a	Schedule 1, Threatened
plains spadefoot toad	*Spea bombifrons*	amphibian	S2S3	n/a	n/a
Forster's tern	*Sterna forsteri*	bird	S4B	n/a	n/a
common tern	*Sterna hirundo*	bird	S5B	n/a	n/a
great gray owl	*Strix nebulosa*	bird	S4	n/a	n/a
riverine clubtail	*Stylurus amnicola*	insect	S3	n/a	n/a
western plains garter snake	*Thamnophis radix*	reptile	S4	n/a	n/a

Common Name	Scientific Name	Taxonomic Group	Subnational Rank	ESEA Status	SARA Status
red-sided garter snake	*Thamnophis sirtalis*	reptile	S4	n/a	n/a
red-sided garter snake	*Thamnophis sirtalis parietalis*	reptile	S4	n/a	n/a
golden-winged warbler	*Vermivora chrysoptera*	bird	S3B	Threatened	Schedule 1, Threatened

ESEA: Endangered Species and Ecosystems Act

Appendix G

Correspondence

Manitoba Conservation Data Centre Search (Email, Colin Murray, 15 August 2019)

Heritage Screening (Letter, Historic Resources Branch, 3 September 2019)

MacBride, Lyndsey

From: Murray, Colin (SD) <Colin.Murray@gov.mb.ca>
Sent: August 15, 2019 3:41 PM
To: MacBride, Lyndsey
Subject: Data request L MacBride SNC 20190902 PeaCanola 148 Nature Park Way

Hi Lyndsey
Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's (CDC) rare species database for your area of interest. This includes the primary location as defined in the request; and a two kilometer radius buffer from the edge of the location boundary.

The search resulted in the following occurrences:

1. Within the footprint or primary location(s):

No listed or tracked species occurrences found at this time.

2. Within 2km of the footprint boundary:

TAXGROUP	SCINAME	COMNAME	SRANK	ESEA	SARA
Vascular Plant	Asclepias verticillata	(Whorled Milkweed)	S3	NA	NA
Vascular Plant	Nassella viridula	(Green Needle Grass)	S3S4	NA	NA

3. General area records low locational accuracy:

None found.

4. Found in broader area and similar habitat:

None found.

Further information on this ranking system can be found on our website at: http://www.natureserve.org/conservation-tools/conservation-status-assessment.
These designations can be found at:
http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php,
https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html and
http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1.

Manitoba's recommended setback distances can be found at: https://www.gov.mb.ca/sd/pubs/conservation-data-centre/mbcdc_bird_setbacks.pdf.

The information provided in this letter is based on existing data known to the Manitoba CDC of the Wildlife and Fisheries Branch at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. **An absence of data does not confirm the absence of any rare or endangered species.** Many areas of the province have never been thoroughly surveyed, however, and the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should, therefore, not be regarded as a final statement on the occurrence of any species of concern nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilised.

Third party requests for products wholly or partially derived from the Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife and Fisheries Branch, Manitoba Sustainable Development.

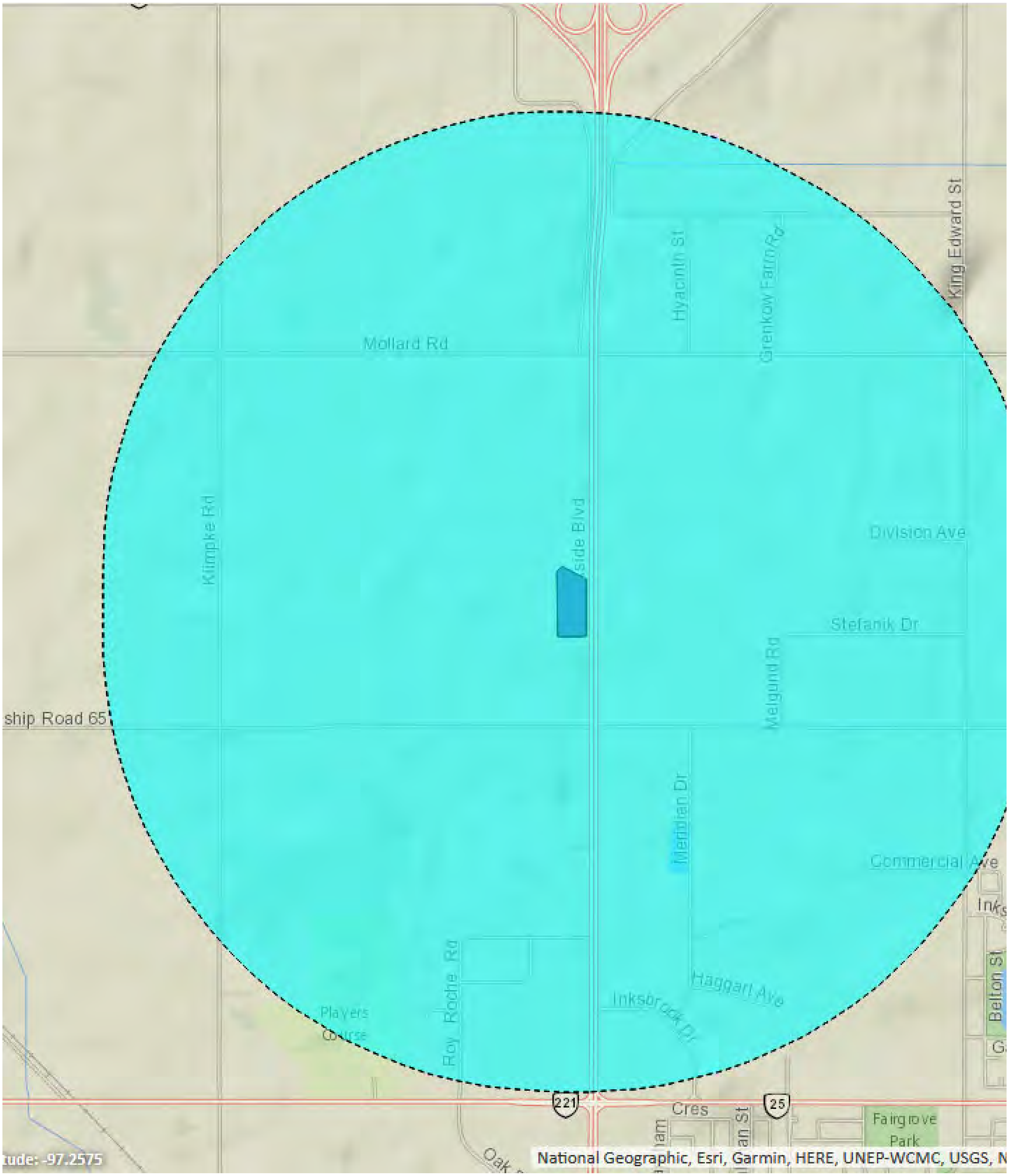
This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7760.

Colin

Reference screen clip:



Colin Murray
Information Manager
Manitoba Conservation Data Centre
Wildlife and Fisheries Branch
Department of Sustainable Development

200 Saulteaux Crescent
Winnipeg, Manitoba, R3J3W3
204-945-7760
colin.Murray@gov.mb.ca
http://www.gov.mb.ca/sd/cdc/index.html

-----Original Message-----
From: +WPG969 - Form Submissions (FIN) <noreply@gov.mb.ca>
Sent: August-14-19 5:34 PM
To: Murray, Colin (SD) <Colin.Murray@gov.mb.ca>
Subject: WWW Form Submission

Below is the result of your feedback form. It was submitted by CDC Information Request () on Wednesday, August 14, 2019 at 17:33:39

DocumentID: Manitoba_Sustainable_Development

Project Title: Merit Pea Canola Processing Plant

Date Needed: 2019/09/02

Name: Lyndsey MacBride

Company/Organization: SNC-Lavalin Inc.

Address: 148 Nature Park Way

City: Winnipeg

Province/State: MB

Phone: 204-479-1468

Email: lyndsey.macbride@snclavalin.com

Project Description: I am requesting a CDC screening for a proposed pea canola protein processing plant near Winnipeg, Manitoba. Merit Functional Foods plans to develop a 20,000-tonne per year pea and canola processing facility, referred to as the Merit Pea Canola Processing Plant. The project is scheduled to commence construction in approximately 4 weeks, hence we are requesting a rush request. The proposed facility is located on Lots 6, 7 and 8 of the BrookPort Industrial Park at 400 Goldenrod Drive, on formerly cultivated lands, in the RM of Rosser, Manitoba. The screening will also support the Class 2 Environment Act Proposal for the facility, which is required prior to operation.

Information Requested: historical occurrences of rare species

Format Requested: ArcView Shapefile

Location:
I will send maps in an email...site corners are:

PointCornerEasting (m)Northing (m)
1NW626807.73135536444.788
2N626827.57515536465.955
3NE626936.58715536412.939
4SE626943.77955536164.339
5SW626817.5735536160.688

Manitoba
Sport, Culture and Heritage

Memorandum

DATE: **2019-09-03**

TO: **Lyndsey MacBride**
Operations Manager, Impact Assessment & Community Engagement
SNC-Lavalin
148 Nature Park Way
Winnipeg, MB R3P 0X7

FROM: **Christina Nesbitt**
Impact Assessment Archaeologist
Historic Resources Branch
Main Floor – 213 Notre Dame Avenue
Winnipeg, Manitoba, R3B 1N3

PHONE: (204) 945-8145
FAX: (204) 948-2384
E-MAIL: Christina.nesbitt@gov.mb.ca

SUBJECT: **Merit Functional Foods**
Pea canola protein processing plant
RM of Rosser
SE 43-11-2 E
AAS-19-14904

Further to your memo requesting a heritage screening for the above development, the Historic Resources Branch (HRB) has examined the area proposed for development in conjunction with the Branch's records for areas of potential concern and can advise you that HRB has low concerns with the project at this time.

However, pleased be advised that if any heritage resources are encountered in association with the Planned Area during development, the Developer is required to notify HRB and HRB may require that a heritage resource management strategy be implemented to mitigate the effects of development on the heritage resources.

If you have any questions or comments, please feel free to contact the undersigned at the above noted address, phone number, or e-mail.

Archaeological Assessment Services Unit

SNC·LAVALIN

148 Nature Park Way
Winnipeg, Manitoba, Canada R3P 0X7
204.475.4133
www.snclavalin.com