Grand River Source Protection Area

ASSESSMENT REPORT

Chapter 13: County of Brant

Version 10

July 29, 2025

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13.0 COUNTY OF BRANT

13.1 Drinking Water Systems

Four municipal drinking water systems are located within the County of Brant within the Grand River Source Protection Area: Airport, Mount Pleasant, St. George, and Paris. Each system is solely sourced by groundwater. **Table 13-1** and **Table 13-2** provide information for each of these systems.

The 2017 municipal serviced areas are presented on **Map 13-1** for the Airport, Mount Pleasant, St. George and Paris drinking water systems.

Table 13-1: Drinking Water System Information for the County of Brant Municipal Residential Drinking Water Systems in the Grand River

DWS Number	MDWL/DWWP Name	Operating Authority	Groundwater or Source water	System Classification[1]	Number of Users served[2]
220002743	Airport Drinking Water System	County of Brant	Groundwater	Large Municipal Residential System	800
210000069	Mount Pleasant Drinking Water System	County of Brant	Groundwater	Large Municipal Residential System	1,882
220002734	St. George Drinking Water System	County of Brant	Groundwater	Large Municipal Residential System	3,678
220002752	Paris Drinking Water System	County of Brant	Groundwater	Large Municipal Residential System	18,057

[1] as defined by O. Reg. 170/03 (Drinking Water Systems) made under the Safe Drinking Water Act, 2002.

[2] County of Brant, 2023

Table 13-2: Annual and Monthly Average Pumping Rates for the County of Brant Municipal Residential Drinking Water Systems in the Grand River (m^3/d)

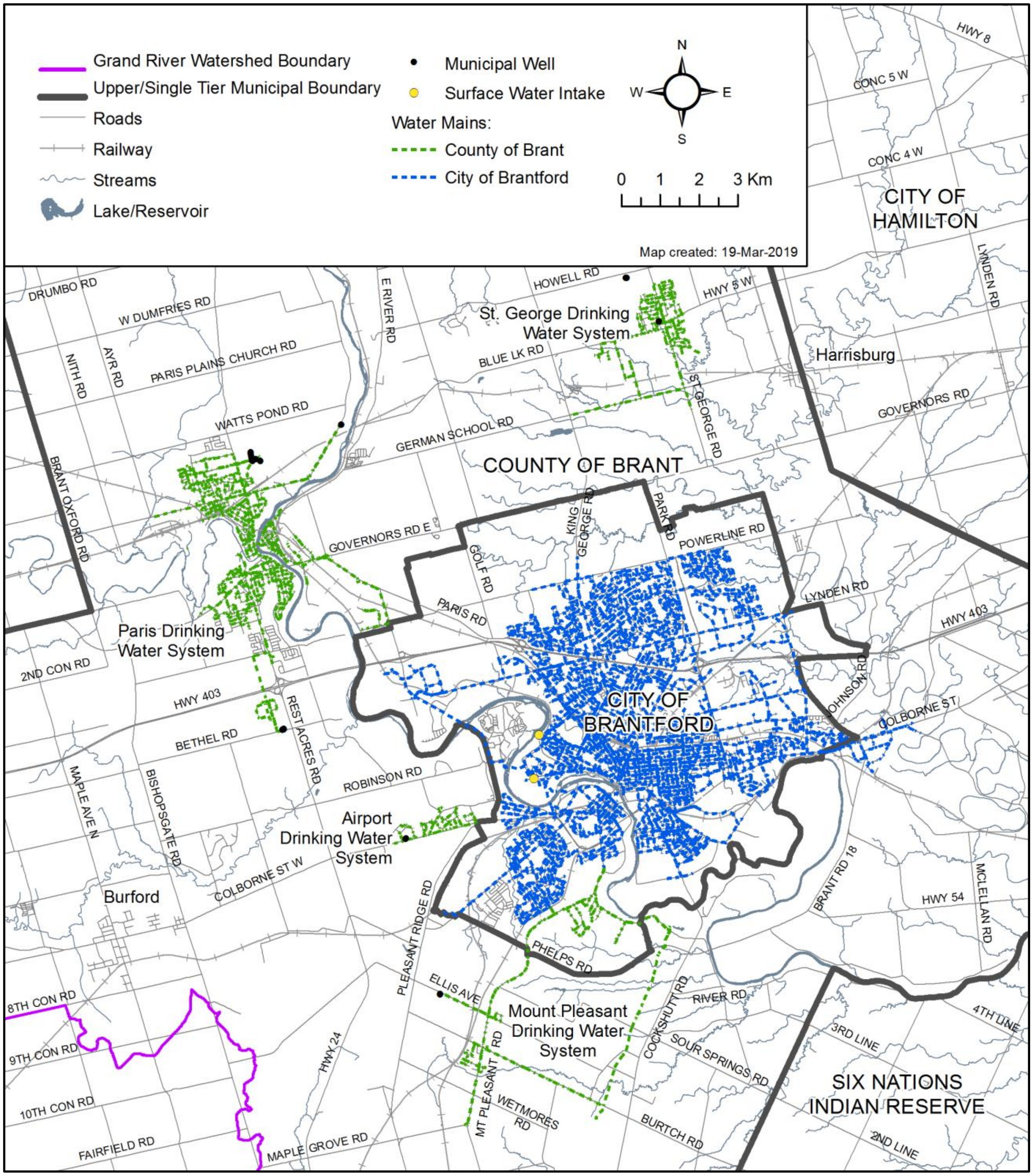
Location	Well	Annual	Jan[1]	Feb[1]	Mar[1]	Apr[1]	May[1]	Jun[1]	Jul[1]	Aug[1]	Sep[1]	Oct[1]	Nov[1]	Dec[1]
Airport	Well 1	135	93	93	124	106	174	221	3 203	157	166	101	91	82
Airport	Well 2	124	96	88	61	103	132	226	150	145	180	122	88	111
Mount Pleasant	Well 1	438	398	375	269	310	553	576	531	496	553	411	389	410
Mount Pleasant	Well 2	432	184	325	309	336	568	821	592	474	486	450	383	360
St. George	Well 1	329	368	387	349	376	92	219	437	392	403	330	281	322
St. George	Well 2	425	323	288	336	444	913	842	411	325	358	304	270	278
St. George	Well 3	110	69	68	107	77	89	168	136	125	110	116	167	120
St. George	TW 1/16[2]	0	0	0	0	0	0	0	0	0	0	0	0	0
St. George	TW 2/16[2]	0	0	0	0	0	0	0	0	0	0	0	0	0
Telfer Wellfield (Paris)	P31 (Overburden)	193	276	279	274	170	170	164	159	90	184	167	252	147
Telfer Wellfield (Paris)	P32 (Bedrock)	567	271	313	1231	460	669	1050	349	1307	399	179	269	276
Gilbert Wellfield-Overburden (Paris)	P210	242	225	209	212	261	258	250	262	227	248	292	216	238
Gilbert Wellfield-Overburden (Paris)	P211	196	226	211	214	156	133	114	124	179	227	288	242	232
Gilbert Wellfield-Overburden (Paris)	P212	48	33	26	54	65	56	51	56	26	56	34	62	57
Gilbert Wellfield-Overburden (Paris)	P213	205	202	193	195	231	213	202	206	173	190	249	194	207
Gilbert Wellfield-Overburden (Paris)	P214	638	313	251	608	1010	980	956	988	857	505	241	382	424
Gilbert Wellfield-Overburden (Paris)	P215	682	962	885	474	399	557	539	551	483	819	956	788	779
Gilbert Wellfield-Bedrock (Paris)	P28	1769	661	531	1647	2146	2090	2002	2045	1836	1980	2268	1918	2016

Location	Well	Annual	Jan[1]	Feb[1]	Mar[1]	Apr[1]	May[1]	Jun[1]	Jul[1]	Aug[1]	Sep[1]	Oct[1]	Nov[1]	Dec[1]
Gilbert Wellfield-Bedrock (Paris)	P29	865	1964	1820	320	868	889	748	840	286	767	449	698	817
Bethel Road Wellfield (Paris)	P51	104	81	106	84	77	119	163	68	104	145	100	86	113
Bethel Road Wellfield (Paris)	P52	65	54	67	53	49	69	97	63	64	87	60	49	65
Bethel Road Wellfield (Paris)	P53	108	86	105	85	78	122	167	105	106	142	98	86	111
Bethel Road Wellfield (Paris)	P54	106	87	99	83	77	119	162	104	103	142	97	84	112

[1] Source: Supervisory Control and Data Acquisition (SCADA), 2023

[2] Wells are not currently tied to Municipal Drinking Water System

Map 13-1: Brant County and City of Brantford Water Supply Serviced Areas



13.1.1 Airport Well Supply

The Airport wellfield is operated by the County of Brant, and services the surrounding area (referred to as the “Airport/Oak Hill” service area). The wellfield is located 6 kilometres west of the Brantford town centre, at the intersection of Colborne Street West (County Road 53) and Airport Road.

The serviced area for the Airport well supply is shown on **Map 13-1**. The wellfield currently consists of two operational pumping wells (W1 and W2) that services approximately 285 residences and 29 commercial water users as of the end of 2023 according to the County of Brant Airport Drinking Water System Annual Report.

Well W1, constructed in 1967, is screened between 30.9 and 35.6 mbgs (metres below ground surface) in an unconfined overburden aquifer. Well W2, constructed in 2014, is screened in the same unconfined aquifer between 30.0 and 34.2 mbgs. Neither of the wells are classified as groundwater under the direct influence of surface water (GUDI) as per the criteria outlined in Ministry of Environment (MOE) (2001b).

The hydrostratigraphic interpretation at the Airport well site and surrounding area indicates that the aquifer supplying the municipal wells is unconfined (Earthfx, 2017). The aquifer consists mainly of sand, gravel and silt with these sediments extending to the ground surface. At the municipal well site, the aquifer is approximately 25 metres in thickness and includes a significant component of fine to coarse sand and gravel. Currently, Well W1 is permitted to operate at a maximum rate of 27.3 L/s and Well W2 is permitted to operate at a maximum of 30.8 L/s. The maximum permitted rate for the Airport municipal supply system is therefore 58.1 L/s.

13.1.2 Mount Pleasant Well Supply

The municipal groundwater supply system for Mount Pleasant is located at 328 Ellis Avenue. There are two production wells at the site, referred to as Well 1 and Well 2. Both wells are within a single pump house located approximately 1.3 kilometres northwest of the village.

Well 1 was constructed in 1981 and screened from 29.6 to 36.0 mbgs in an unconfined sand plain / outwash aquifer defined as a part of the Whitemans Tier 3 hydrostratigraphic model (Earthfx, 2018a). Well 2 was constructed in 1995 and screened in the same aquifer as Well 1 from 30.2 to 36.4 mbgs. Neither of the wells are classified as GUDI as per the criteria outlined in MOE (2001b). Currently, each well is permitted to operate at a daily maximum rate of 26.5 L/s.

The serviced area for the village of Mount Pleasant is shown in **Map 13-1.** The Mount Pleasant water supply system services approximately 670 residences and 36 commercial water users according to the 2023 County of Brant Mount Pleasant Drinking Water System Annual Report. The Mount Pleasant drinking water system source aquifer is primarily composed of the extensive unconfined glaciolacustrine deposits of the Norfolk Sand Plain. There is some local confinement in the vicinity of the wellfield, the Wentworth Till Aquitard. Across the majority of this area, the sand plain aquifer is in direct contact with the underlying sands and gravels of the Grand River Valley outwash aquifer, effectively forming a single unconfined sand and gravel aquifer unit with a thickness up to 65 metres (Earthfx, 2018a).

13.1.3 St. George Well Supply

The St. George municipal supply system is located near the centre of the village as presented on **Map 13-1**, and consists of three overburden production wells (Well 1, Well 2 and Well 3). The wells are currently operated out of a single pump house located at 20 Church Avenue in St. George. The overburden sediment thickness in the St. George area is estimated to vary from approximately 20 to 70 metres, with the three overburden wells screened within these sediments from 15 to 23 mbgs.

According to the County of Brant 2023 Annual Drinking Water Report, the wells service approximately 1,309 residences, 107 commercial accounts, and one bulk truck-fill station. The rated capacity of the existing municipal wells is limited to 9,961.9 m^3/d or an annual daily average of 6,030.7 m^3/d as set out by the current Permit to Take Water.

The community of St. George requires an additional water supply for redundancy and to support future growth. A Class Environmental Assessment for St. George Water Servicing identified the preferred alternative to be the construction of new bedrock test wells at a previous monitoring site located to the northwest of the community centre. The new wells are cased through 57 metres of overburden and completed as open holes in the bedrock to 67 mbgs. A 65-hour pumping test indicated that the two wells were capable of producing 45 L/s, or 22.5 L/s per well. None of the municipal wells are considered GUDI.

At surface, an aquitard unit overlies a confined or semi-confined sand and gravel aquifer. The aquitard thickness in the vicinity of the municipal well site ranges from approximately 5 to 15 metres. The underlying aquifer includes a sequence of sand, gravel and silt sediments up to approximately 40 metres in thickness. A glacial till aquitard underlies the sand and gravel aquifer and overlies the bedrock subcrop. The bedrock surface in the St. George area has been mapped as dolostone belonging to the Guelph Formation.

13.1.4 Paris Well Supply

The County indicates that there were 6,426 residential connections and 334 commercial connections in 2023 to the Paris Drinking Water System (Gilbert, Telfer, and Bethel wellfields).

Gilbert and Telfer Wellfields

The two northern wellfields in the Paris service area include the Gilbert and Telfer wellfields, as presented on **Map 13-1.**

The Gilbert wellfield contains eight active production wells and is located in a low-lying area to the east of Grand River Street North and south of Watt’s Pond Road. Wells P28 and P29 were constructed in 1990 and 1991, respectively, and are completed in the upper bedrock aquifer. Wells P210, P211, P212, P213, P214 and P215, also located at the Gilbert Wellfield, were constructed in 2001 and are completed in the upper overburden aquifer (sand/gravel). Wells P214 and P215 were brought on-line in 2001 and wells P210, P211, P212 and P213 were connected to the municipal supply system in 2008. The overburden wells at the Gilbert Wellfield are classified as GUDI with effective filtration because of the unconfined nature of the aquifer. The wells are considered GUDI only during a regional storm event.

The Telfer Wellfield is located adjacent to West River Road (approximately 300 metres west of the Grand River) and includes two active production wells (P31, P32). Well P31 (constructed in 1965) is completed in the deep overburden sediments and P32 (constructed in 1974) is completed in the upper bedrock aquifer. An additional well referred to as P36 was constructed in 1996 but is currently not connected to the municipal system. The well is completed in the deep overburden sediments.

The thickness of the overburden varies up to approximately 60 metres and locally along parts of the Grand River the overburden is absent. The surficial overburden deposits are mostly sand and gravel. The overburden deposits occurring beneath the upper aquifer and extending to the bedrock surface have been identified as the intermediate unit. This unit can be separated into an intermediate overburden aquitard and a discontinuous intermediate overburden aquifer. The intermediate aquitard is present across the area and is composed mainly of till, which includes clay and stones, and sandy silt. The intermediate aquitard is absent locally within the Telfer well field. Within this area the upper aquifer extends to the bedrock surface. The aquitard is up to 60 metres in thickness at other locations.

A buried bedrock valley is believed to exist north of the wells and runs in an east-west direction. The upper bedrock is referred to as the lower aquifer. The lithology of this unit (Salina Formation) includes shale, dolostone and gypsum/anhydrite.

Bethel Road Wellfield

The Bethel Road wellfield contains four active production wells (P51, P52, P53 and P54) and is located along Bethel Road, west of the intersection with Rest Acres Road and south of Paris (**Map 13-2**). The four wells are completed in intermediate to deep overburden sediments. The wells are screened in an unconfined aquifer. All four production wells at the Bethel Road wellfield are considered GUDI with effective filtration.

The source aquifer for the Bethel Road wellfield has an upper and lower unit which are partially separated by a till confining unit. The upper aquifer is composed of glaciolacustrine Norfolk Sands. The lower aquifer is composed of sand and gravel referred to as Waterloo Moraine equivalent sediments (Earthfx, 2018b). To the north of the wellfield, the lower aquifer is confined by the Port Stanley Till; however, in the vicinity of the wellfield and to the south of the wellfield, the lower aquifer is unconfined resulting in connectivity between the upper and lower aquifer units.

Below the lower aquifer, the Maryhill Till aquitard and the older Catfish Creek Till aquitard provide vertical confinement for the deeper overburden and bedrock aquifers. The Salina Group (shale, dolostone, and gypsum/anhydrite) forms the bedrock aquifer below the Bethel Road wellfield.

There are three significant surface water features in the Bethel Road area, with the Grand River being the largest. The Grand River is located to the east of the wellfield; Whitemans Creek is located in the southern part of the area and flows in an easterly to north easterly direction eventually discharging into the Grand River. The Nith River is located north of the site and flows in an easterly direction discharging into the Grand River.

13.2 Vulnerability Assessment

13.2.1 WHPA Delineation for the Airport, Mount Pleasant and Bethel Road Wellfields

WHPAs for the Airport, Mt. Pleasant and Bethel municipal wellfields were delineated in 2017 to 2018 (Earthfx, 2018a; Eartfx, 2018b; Earthfx, 2017) using the Whitemans Creek Tier 3 numerical groundwater flow model (Earthfx, 2018c). The Whitemans Creek Tier 3 groundwater flow model was developed using the U.S. Geological Survey (USGS) MODFLOW code (Harbaugh, 2005). The MODFLOW-NWT (Niswonger *et al.*, 2011) version of the code was employed in the Whitemans Tier 3 study because it is well suited for representing thin aquifers and sharp changes in model layer stratigraphy such as those occurring along the incised valleys of Whitemans Creek and the Grand River. The Whitemans Tier 3 conceptual geologic model is comprised of 17 layers, which were used to generate a 12- layer groundwater flow model for the Whitemans Creek area. Refer to the Whitemans Creek Tier 3 Summary Chapter of this report for additional information on the Whitemans Creek Tier 3 groundwater flow model.

Groundwater recharge rates for the WHPA delineation were calculated using the PRMS hydrologic sub-model developed for the Whitemans Creek Tier 3 study (Earthfx, 2018c). The groundwater recharge rates reflect the effects of spatial variation in climate, topography, land cover, and soil properties.

To favour conservative WHPA delineations, pumping rates that reflected the largest expected takings from the municipal supply wells were used. This approach was applied to ensure that areas that fall within the WHPAs during periods of higher than average demands are also included in the final WHPA delineations.

Airport well W1 and well W2 are in close proximity to each other and therefore a single WHPA was delineated for both wells using a combined pumping rate of 46.4 L/s. This rate is representative of 80% of the combined maximum permitted rates for the 2 wells. WHPAs based on the specified time-of-travel zones (2, 5, and 25 years) were delineated using backwards particle tracking. The 25-year capture zone (WHPA-D) extends approximately 5 kilometres to the southwest following the general directions of regional groundwater flow (**Map 13-2**).

Similarly, Mount Pleasant Well 1 and Well 2 are in close proximity to each other and therefore a single WHPA was delineated. Mount Pleasant WHPAs were simulated using a cumulative municipal pumping rate equivalent to 80% of the maximum permitted rate for the wellfield. A continuous rate of 10.6 L/s was applied to Well 1 and Well 2 for a combined rate of 21.2 L/s. The 25-year capture zone (WHPA-D) extends approximately 2.5 kilometres west following the general direction of regional groundwater flow (**Map 13-2**).

For the Bethel Road wellfield WHPA, the Whitemans Creek Tier 3 model was updated to incorporate the Brant Business Park storm water management pond and infiltration gallery, located 300 metres north of the wellfield. Manual water level data in the pond and infiltration gallery were used to understand the influence these features have on local groundwater flow patterns. The modelled recharge rates within the area included the contribution from the Brant Business Park infiltration gallery.

WHPAs for Bethel municipal wells P51, P52, P53, and P54 were delineated based on four different model configurations designed to investigate capture zone sensitivity. The scenarios are as follows:

1. Wellfield pumping rate set to the Whitemans Tier 3 allocated pumping rate (15.9 L/s); infiltration gallery not simulated;
2. Wellfield pumping rate set to the average instantaneous pumping rate between 2016 and 2018 (18.26 L/s); infiltration gallery not simulated;
3. Wellfield pumping rate set to the average instantaneous pumping rate between 2016 and 2018 (18.26 L/s); infiltration gallery simulated;
4. Wellfield pumping rate set to maximum available drawdown identified in Whitemans Tier 3 study (19.48 L/s); infiltration gallery simulated

The WHPAs were delineated based on the largest composite of the four sensitivity scenarios. The 25-year capture zone (WHPA-D), which extends approximately 1.5 kilometres to the west upgradient of the general direction of regional groundwater flow, is approximately 1 kilometre wide across the centre (**Map 13-2**).

A WHPA-E was not delineated for the Bethel municipal wells at this time as further information is required to do so. Work is currently ongoing to acquire the information to delineate a WHPA-E and will be completed as a Section 34 amendment in the near future.

13.2.2 WHPA Delineation for the St. George Wellfield

A numerical groundwater flow model and a hydrologic model for the Fairchild Creek subwatershed were developed to delineate WHPAs for the St. George Drinking Water System (Earthfx, 2018d).

Groundwater recharge rates for the study area were estimated using the USGS PRMS hydrologic modelling code. The model was calibrated to match observed streamflow at Water Survey of Canada gauges on Fairchild and Spencer creeks. In addition, updated conceptual geologic and hydrostratigraphic models were developed as part of this study, which incorporated geologic datasets from the Ontario Geological Survey and previous work by Earthfx (2010).

Five pumping configurations were evaluated to investigate a range of operational conditions for the St. George wells by varying pumping rates and porosity. A composite WHPA was generated based on these scenarios. Separate WHPAs were delineated for the existing St. George supply wells (Wells 1, 2, 3) which are screened in the overburden, and the new supply wells (TW1/16 and TW2/16), which extend to the bedrock aquifer. Both WHPAs extend to the northwest, where they are limited by a groundwater divide across Galt Moraine. The St. George well supply WHPA is presented on **Map 13-3.**

13.2.3 WHPA Delineation for the Gilbert and Telfer Wellfields

WHPAs for the Gilbert and Telfer wellfields were generated using a calibrated numerical groundwater flow model developed for the Paris area (WNMC, 2011). The municipal overburden wells of north Paris are completed within the upper and intermediate aquifers and the municipal bedrock wells are completed within the Salina Formation.

With the model calibrated to existing conditions, the pumping rates were adjusted and the model was re-run to examine the extent of the hypothetical capture zone that would result under pumping the municipal wells at the forecast pumping rates. A backward particle tracking method was used to delineate the WHPAs for the Paris Drinking Water System.

The WHPAs for the north Paris wellfields were also delineated using a backward particle tracking method. The results indicated that the capture zones extend to the northwest up to 8 kilometres. The north Paris overburden WHPAs have been combined with the north Paris bedrock WHPAs in **Map 13-3**.

13.2.4 Uncertainty in the Delineation of Wellhead Protection Areas

An uncertainty analysis related to the various components of each of the WHPA delineation studies was completed as there is a level of uncertainty associated with all subsurface analyses. A review of what is assessed during an uncertainty analysis (i.e., Technical Rules 13 and 14) is described in Chapter 3: Water Quality Threat Assessment Methodology.

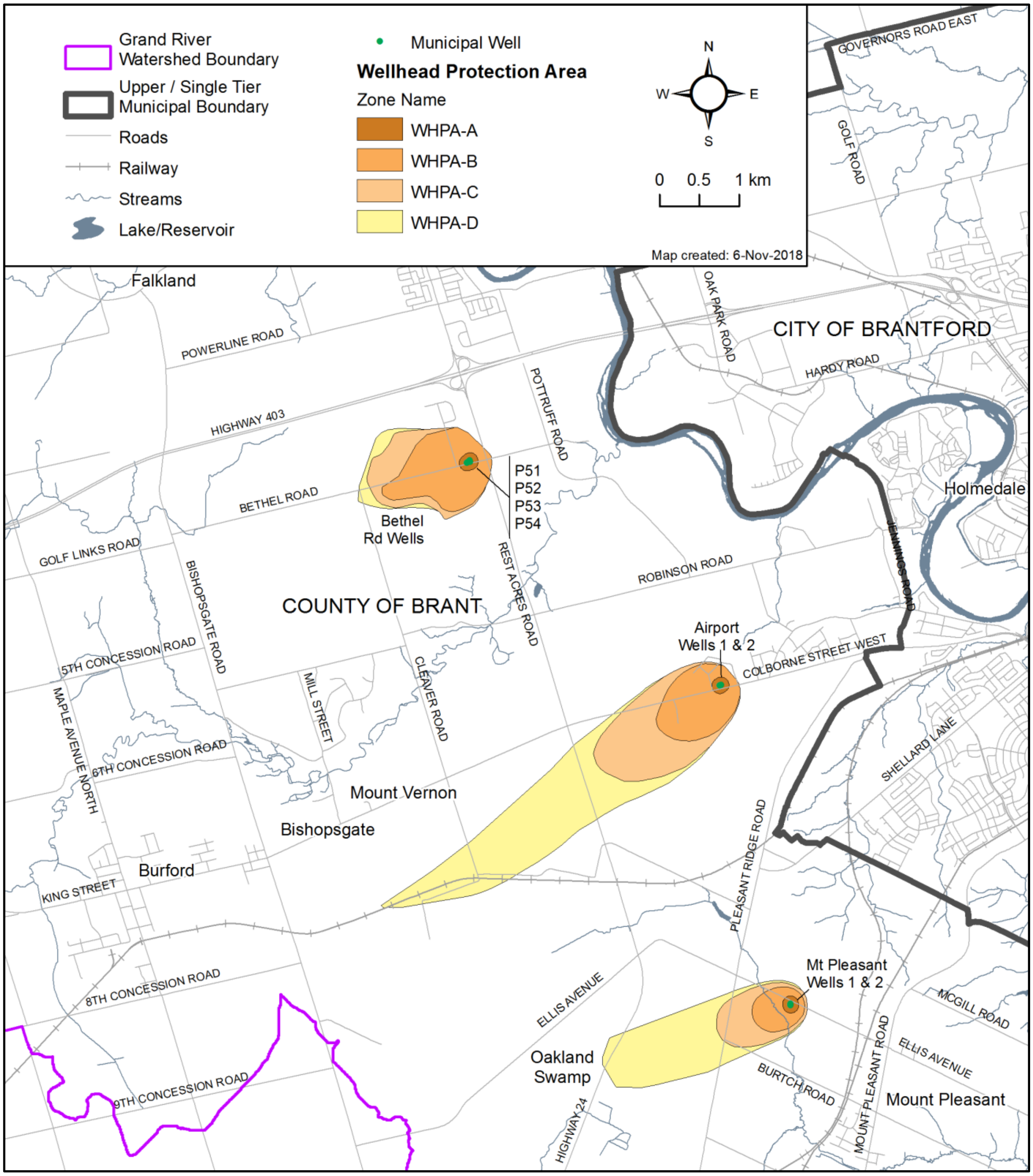
The overall uncertainty for the Airport WHPA delineation is low. Much of the low uncertainty in the groundwater flow patterns result from the relatively uniform composition of the municipal source aquifer.

A conservative approach to uncertainty analysis was used for the delineation of the Gilbert and Telfer wellfields which accounts for the intrinsic variations that naturally exist in hydrogeologic environments (i.e. hydraulic conductivity and recharge).

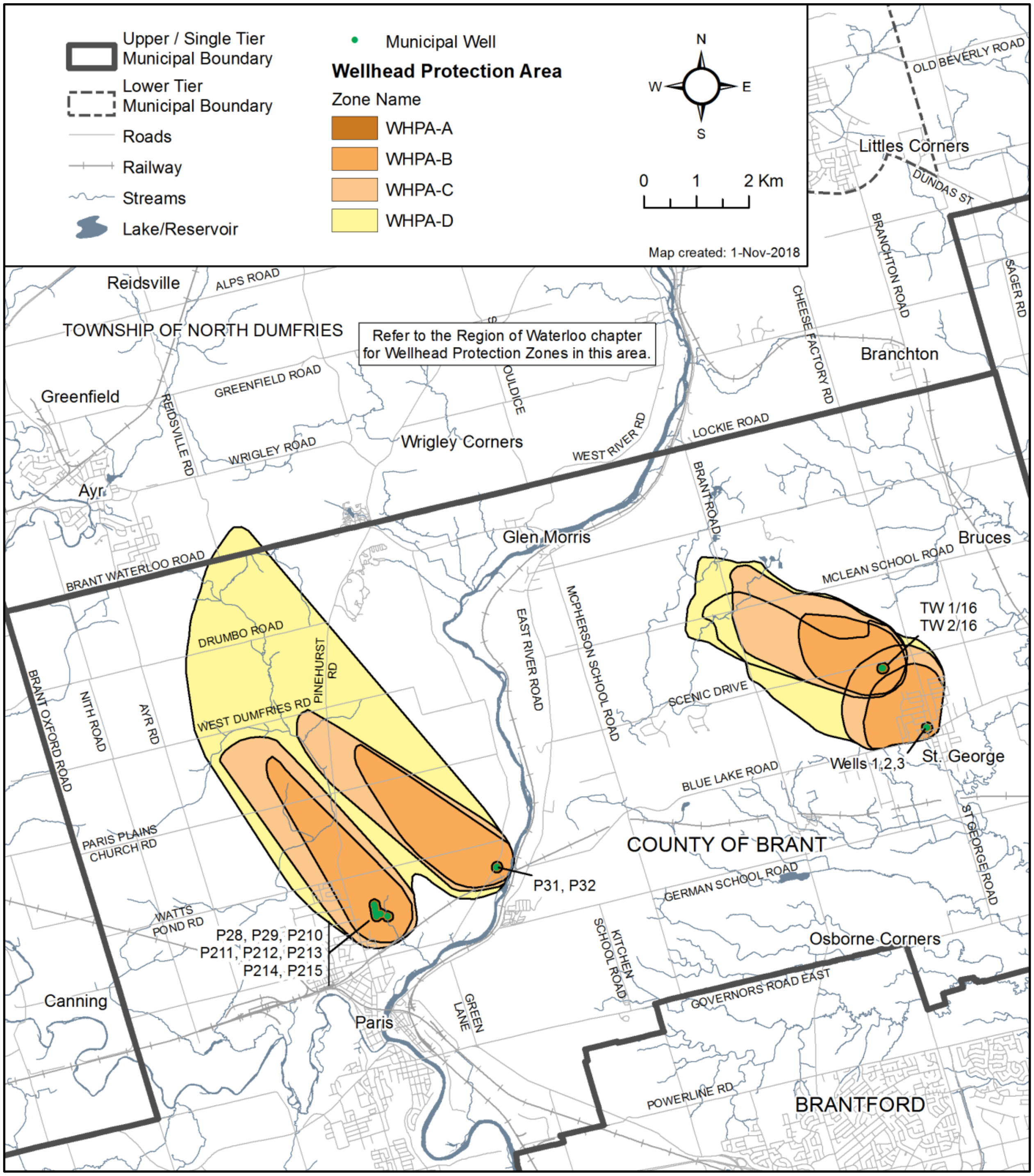
The overall uncertainty for the Bethel and Mount Pleasant WHPA delineations is high. Although low uncertainty is associated with the quality of the Whitemans Creek Tier 3 model, there is a high level of uncertainty associated with vulnerability scoring due to the complex geology near the wellfield and predicting contaminant transport behavior in groundwater.

The overall uncertainty for the St. George WHPA delineation is high. While a good overall calibration was achieved, the Fairchild Creek model over predicts drawdown and under predicts water levels in the St. George area.

Map 13-2: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Areas



Map 13-3: Paris and St. George Water Supply Wellhead Protection Areas



13.2.5 Initial Vulnerability Scoring in Wellhead Protection Areas

Within the County of Brant, SWAT aquifer vulnerability mapping was used as the basis for the vulnerability scoring with some adjustments made to this mapping to account for local conditions in the area. Details on SWAT methodology is discussed in Chapter 3. Initial vulnerability scoring is shown on **Map 13-4, Map 13-7 and Map 13-9**.

13.2.6 Adjusted Vulnerability Scoring to Account for Transport Pathways in the County of Brant

Following a review of the initial vulnerability scoring maps, an assessment of transport pathways was completed to determine whether adjustments to the vulnerability assessment were warranted. Modification of the vulnerability score was completed by increasing the vulnerability of the underlying aquifer vulnerability map from either a low to moderate value or moderate to high value.

Vulnerability scores were not adjusted for wells within the MECP WWIS identified as transport pathways because of the potential inaccuracy in their location or condition. It is recommended that the vulnerability not be increased for the presence of non-municipal wells until a well inventory is completed to verify their location and status.

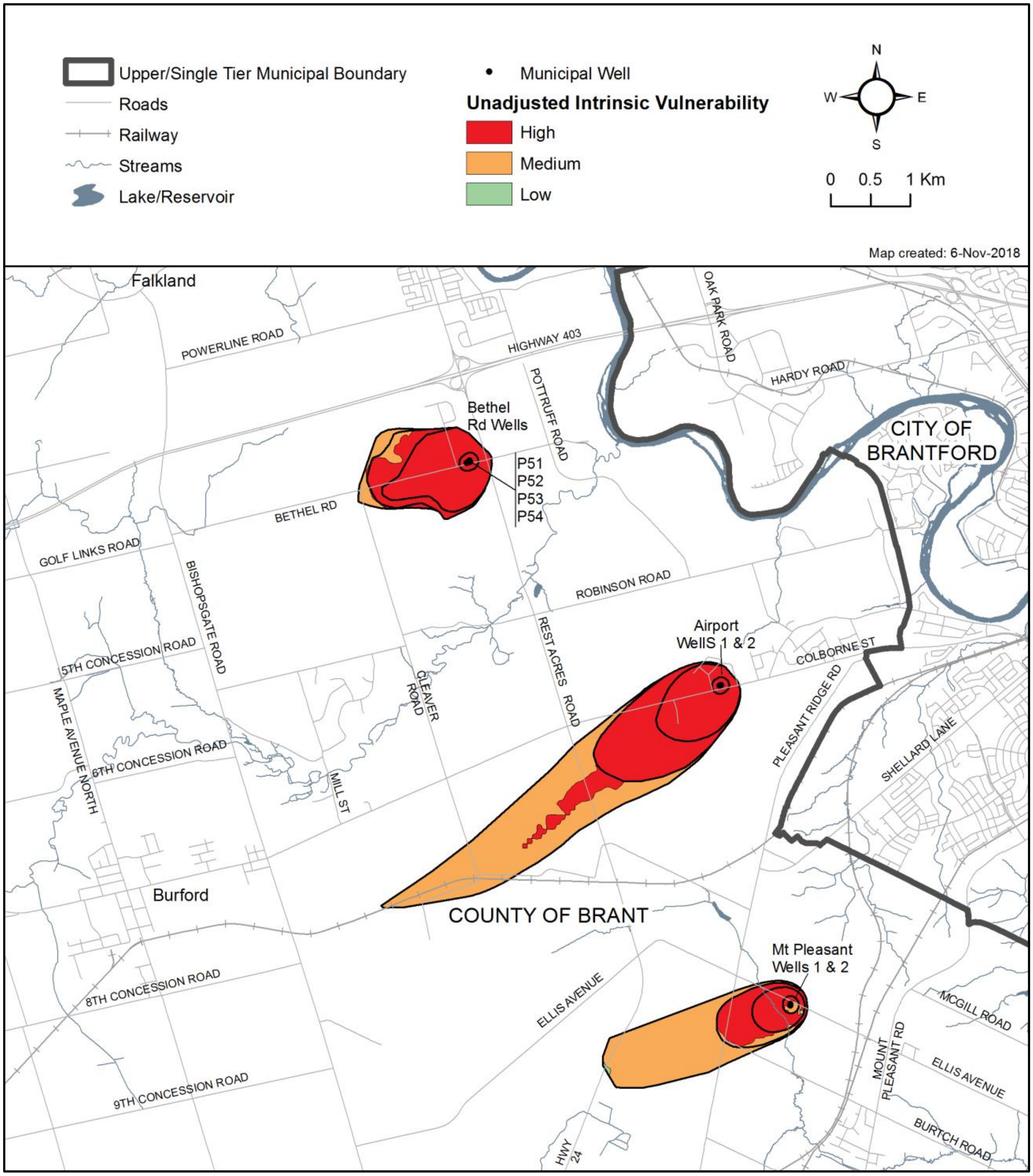
Existing and historical aggregate operations in the Airport area were reviewed; no changes were made to the vulnerability assessment as all areas have high vulnerability. For the Airport well, WHPA-A and WHPA-B (a blend of commercial-industrial and rural area) both show a vulnerability of 10. Moving outside the 2-year zone, WHPA-C has a score of 8 and WHPA-D (mostly rural area) shows a vulnerability of 4 with some vulnerability 6 (**Map 13-6**).

There is one active aggregate operation that lies partially within the delineated WHPAs for the Mount Pleasant wellfield. Vulnerability scores were adjusted within the aggregate operation limits (primarily within WHPA-D) to reflect the increased risks posed by the potential reduced surface to well travel times (**Map 13-5**). For Mount Pleasant, WHPA-A and WHPA-B have a vulnerability score of 10. WHPA-C scores mostly 8 with some 6 around the southern edge. Most of WHPA-D has a vulnerability of 4 with the increased vulnerability score of 6 where the aggregate operation is present (**Map 13-6**).

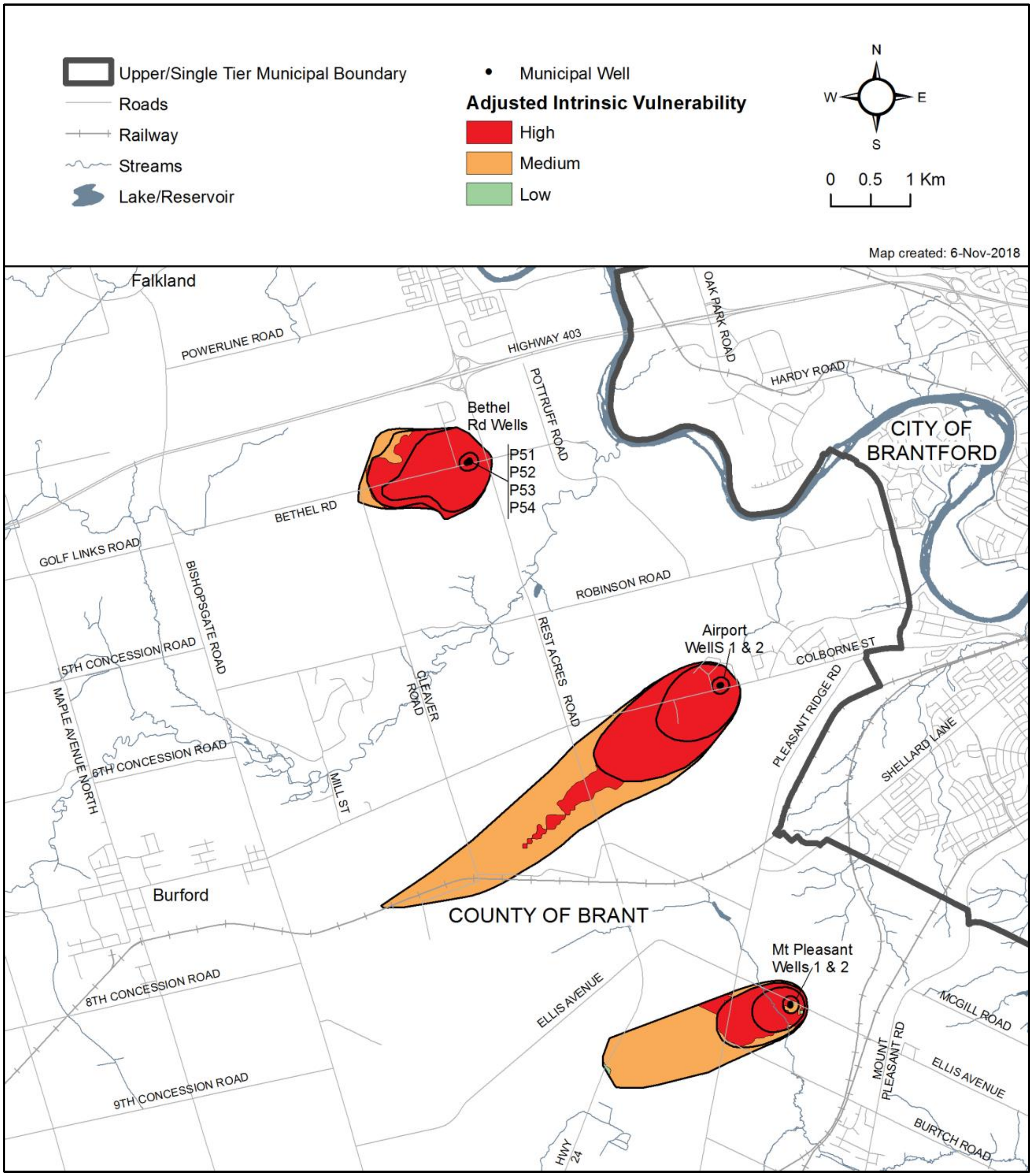
Within the Bethel Road WHPAs, one active aggregate pit operation located to the south of the wellfield, and the Brant Business Park storm water management pond to the north, lie within the vulnerable area. No adjustments to the vulnerability levels were required as the pit and pond are already located in an area of high vulnerability. The vulnerability scoring for the Bethel Road wellfields shows WHPA-B with a vulnerability score of 10. WHPA-C has a vulnerability score of 8/6 and WHPA-D a vulnerability score of 4, with vulnerability score 6 to the south of the WHPA (**Map 13-6**). The aggregate operations in the northern part of Paris were included in the transport pathways analysis, which resulted in no changes to the vulnerability assessment of the upper aquifer as it is already classified as having a high vulnerability. Vulnerability mapping for the northern Paris wells is shown in **Map 13-8**.

There are no preferential pathways were identified within the St. George WHPAs that could increase the vulnerability scores. Both WHPA-As have a vulnerability score of 10 for the bedrock and overburden wells, as well as WHPA-B for the overburden wells. Due to the overlapping nature of the WHPAs there are multiple vulnerability scores in each WHPA zone. The St. George vulnerability scoring is presented on **Map 13-10**.

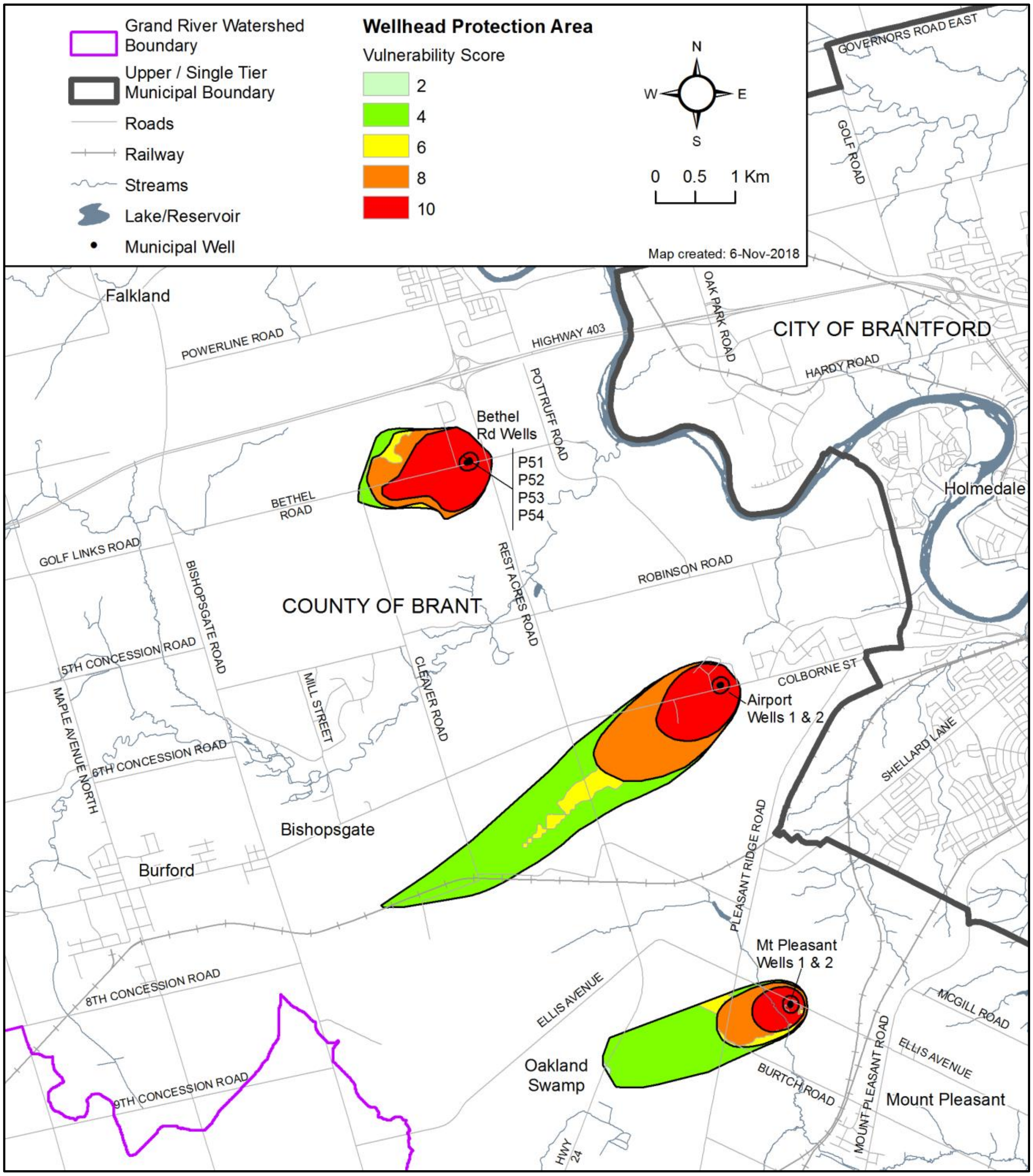
Map 13-4: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Area Unadjusted Intrinsic Vulnerability



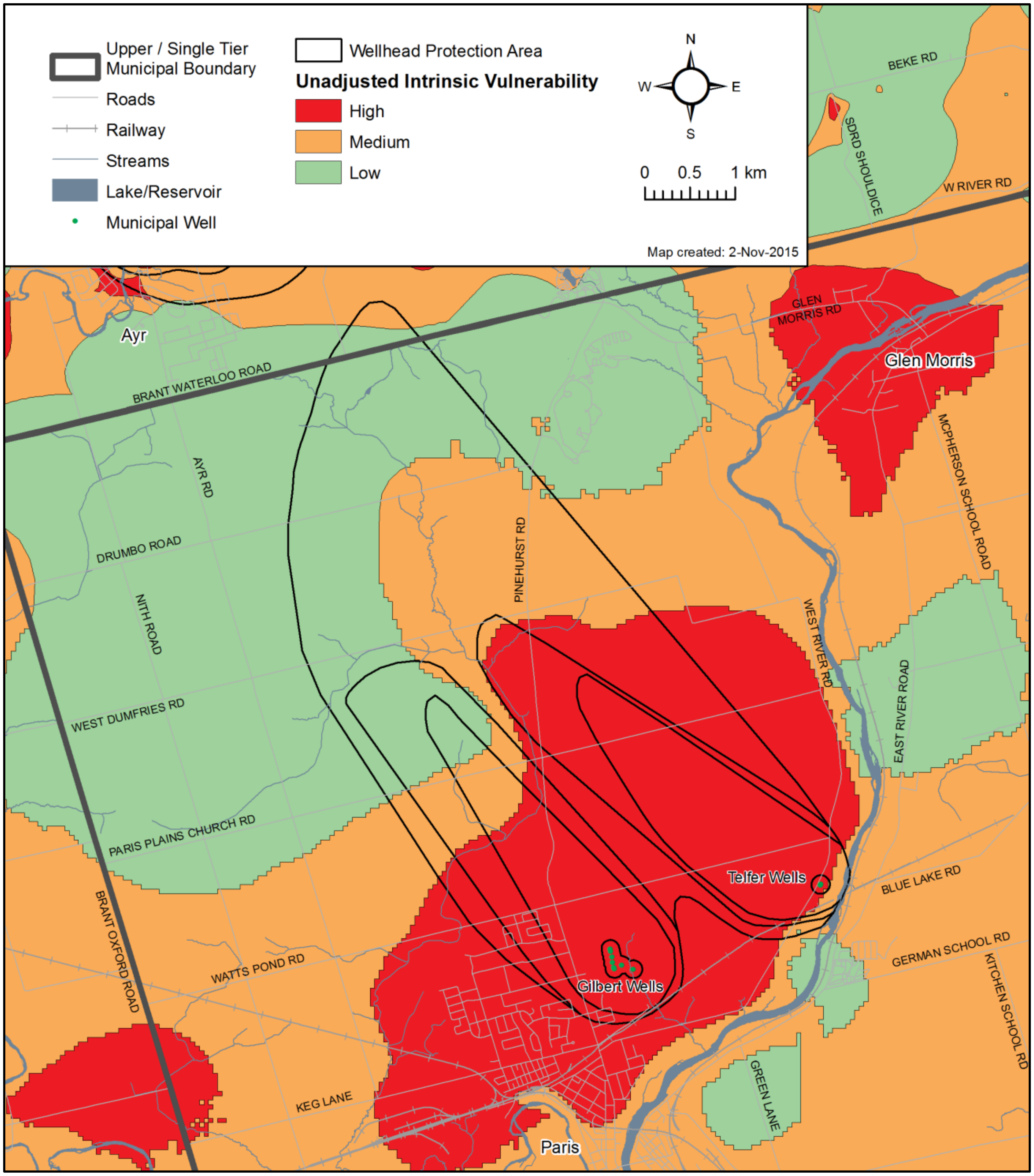
Map 13-5: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Area Adjusted Intrinsic Vulnerability – Including Transport Pathways



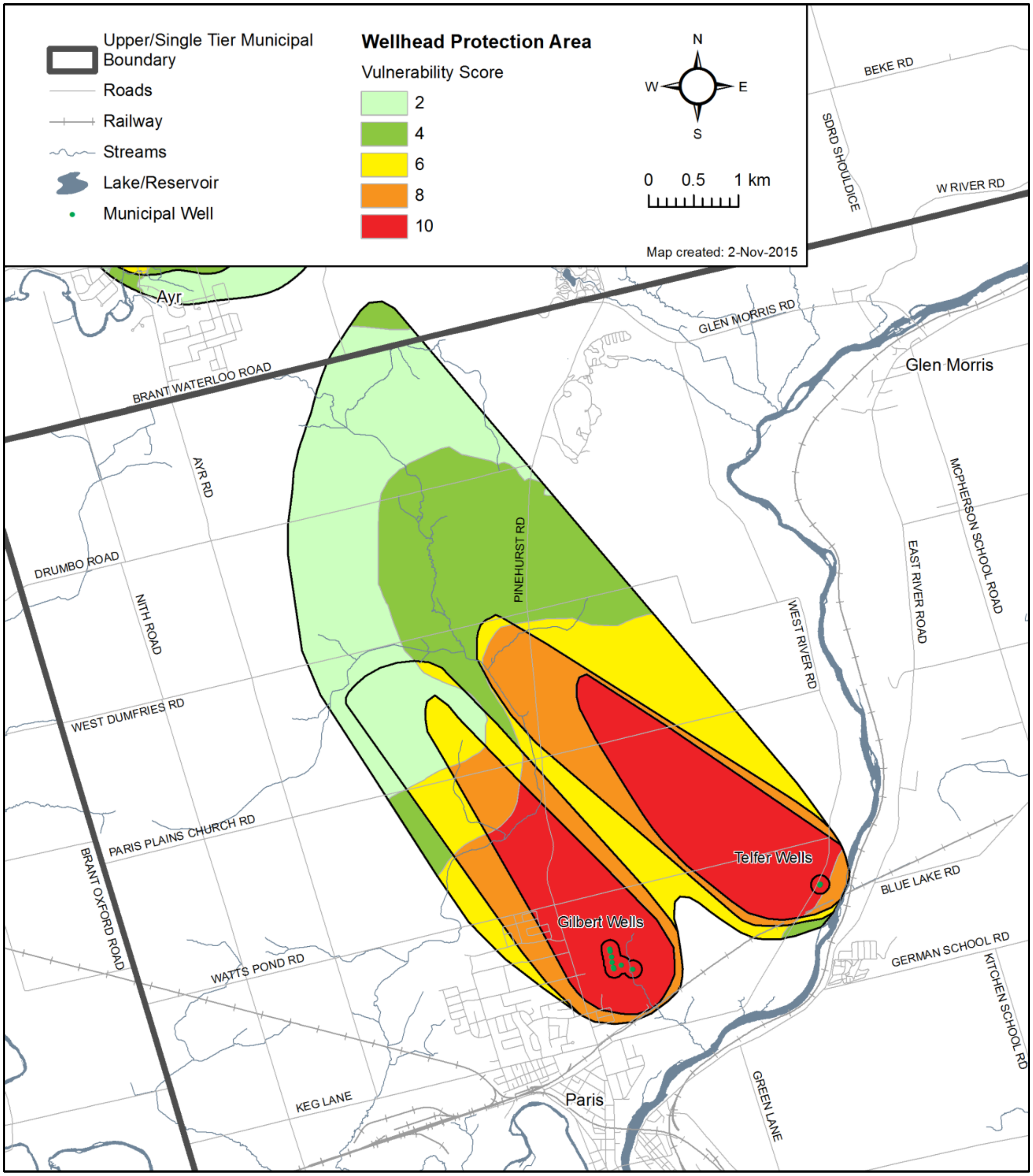
Map 13-6: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Area Vulnerability



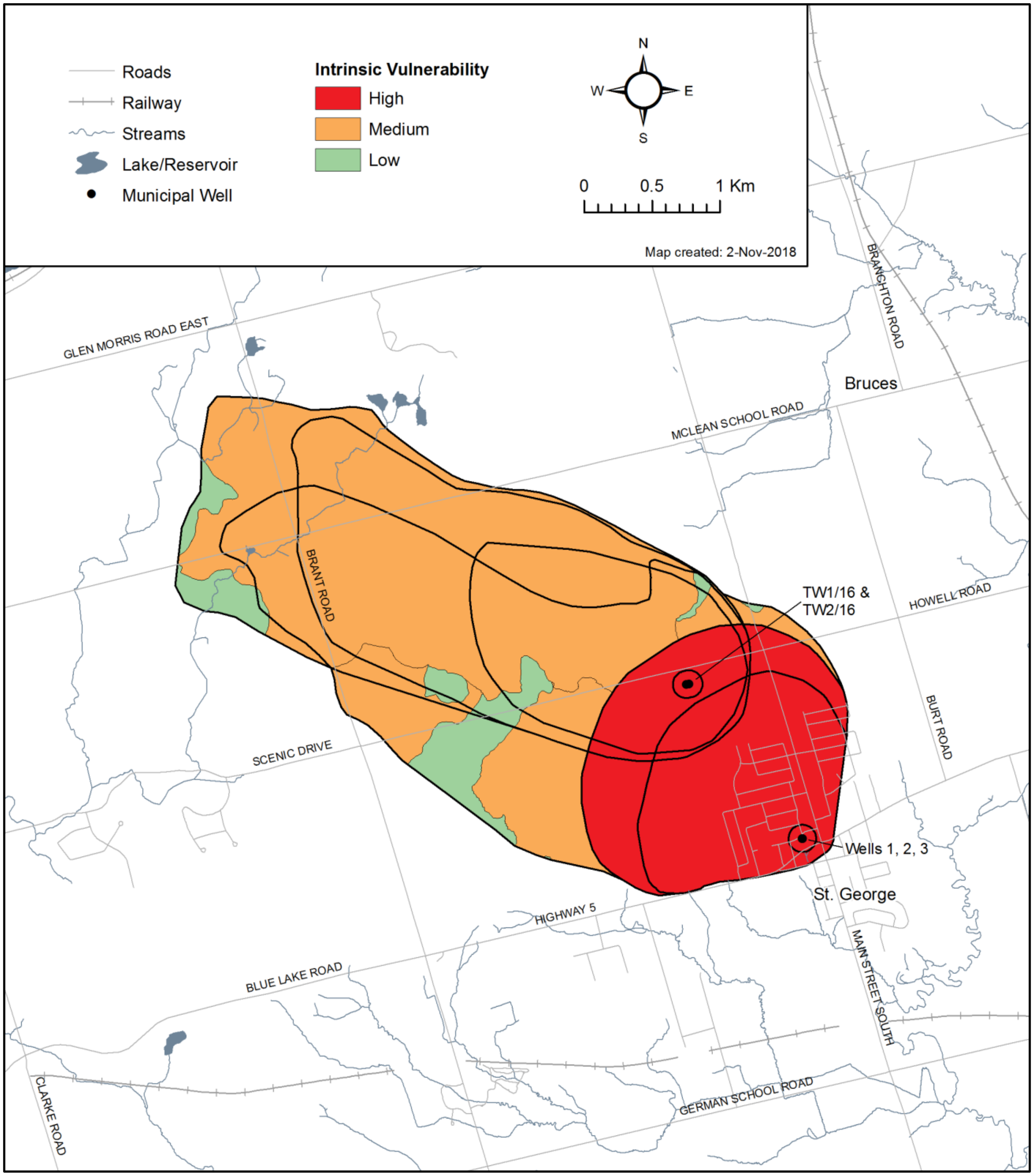
Map 13-7 Paris Water Supply Wellhead Protection Area Unadjusted Intrinsic Vulnerability



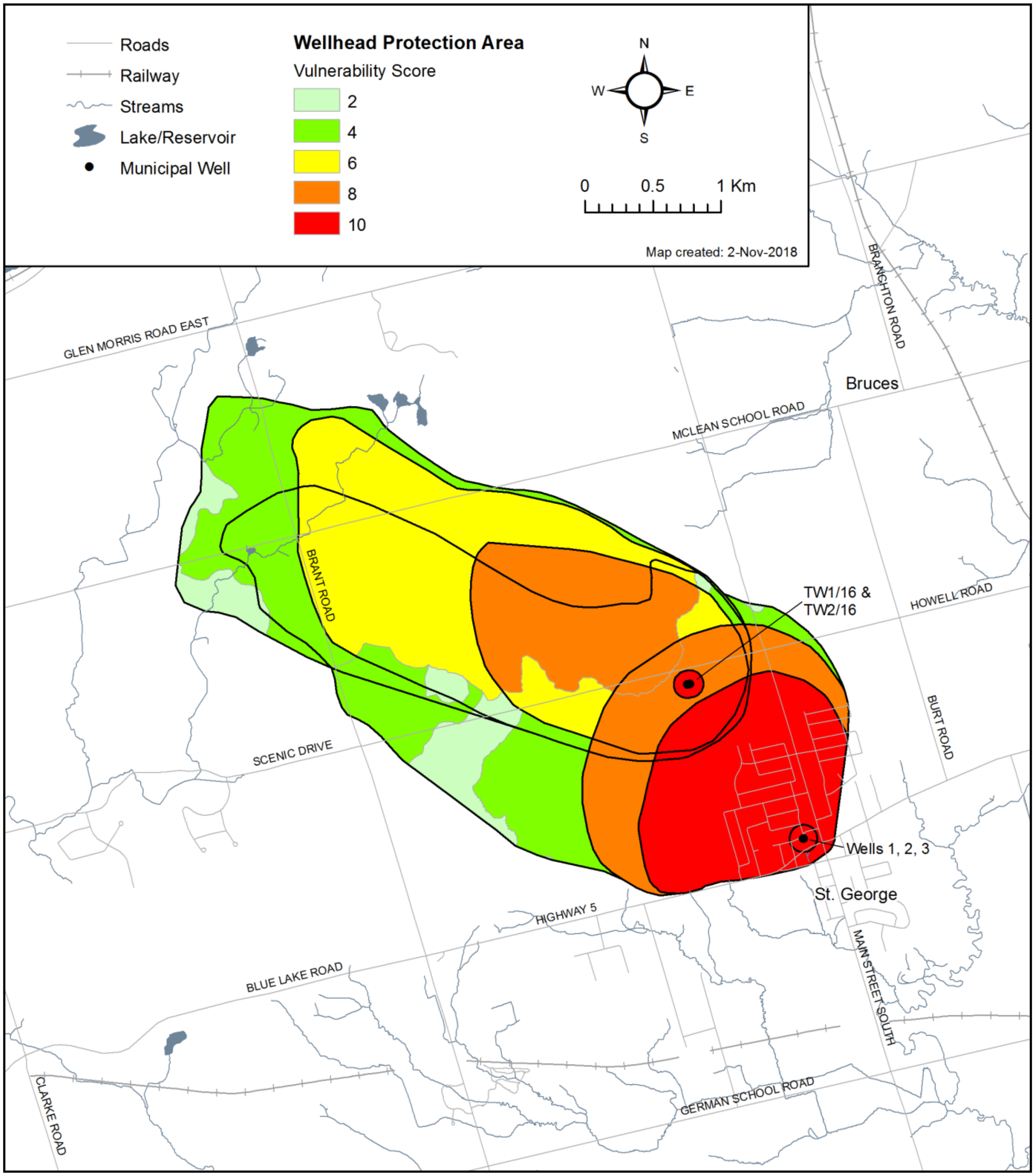
Map 13-8: Paris Water Supply Wellhead Protection Area Vulnerability



Map 13-9 St. George Wellhead Protection Area Unadjusted Intrinsic Vulnerability



Map 13-10: St. George Wellhead Protection Area Vulnerability

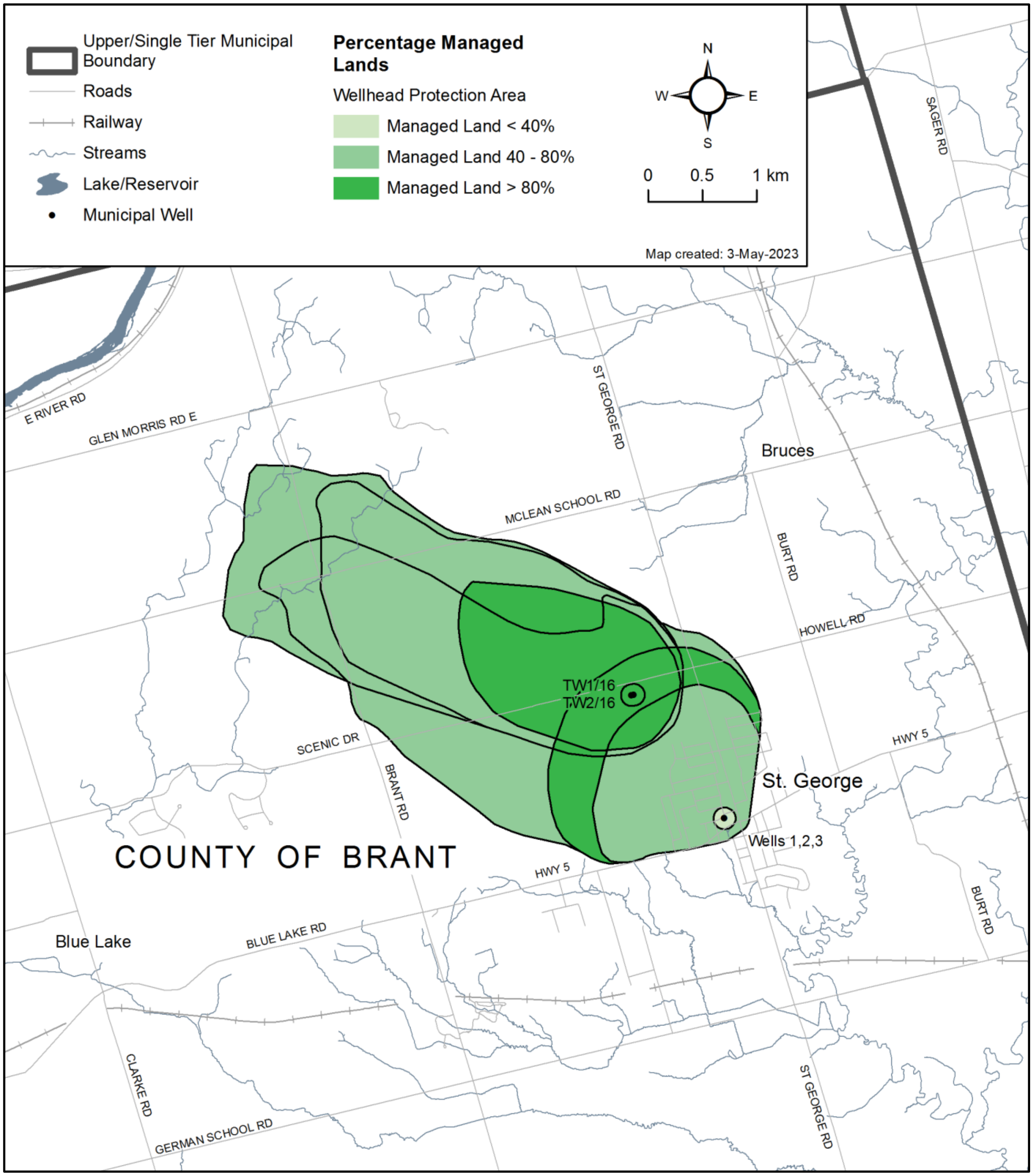


13.2.7 Managed Lands within the County of Brant Wellhead Protection Areas

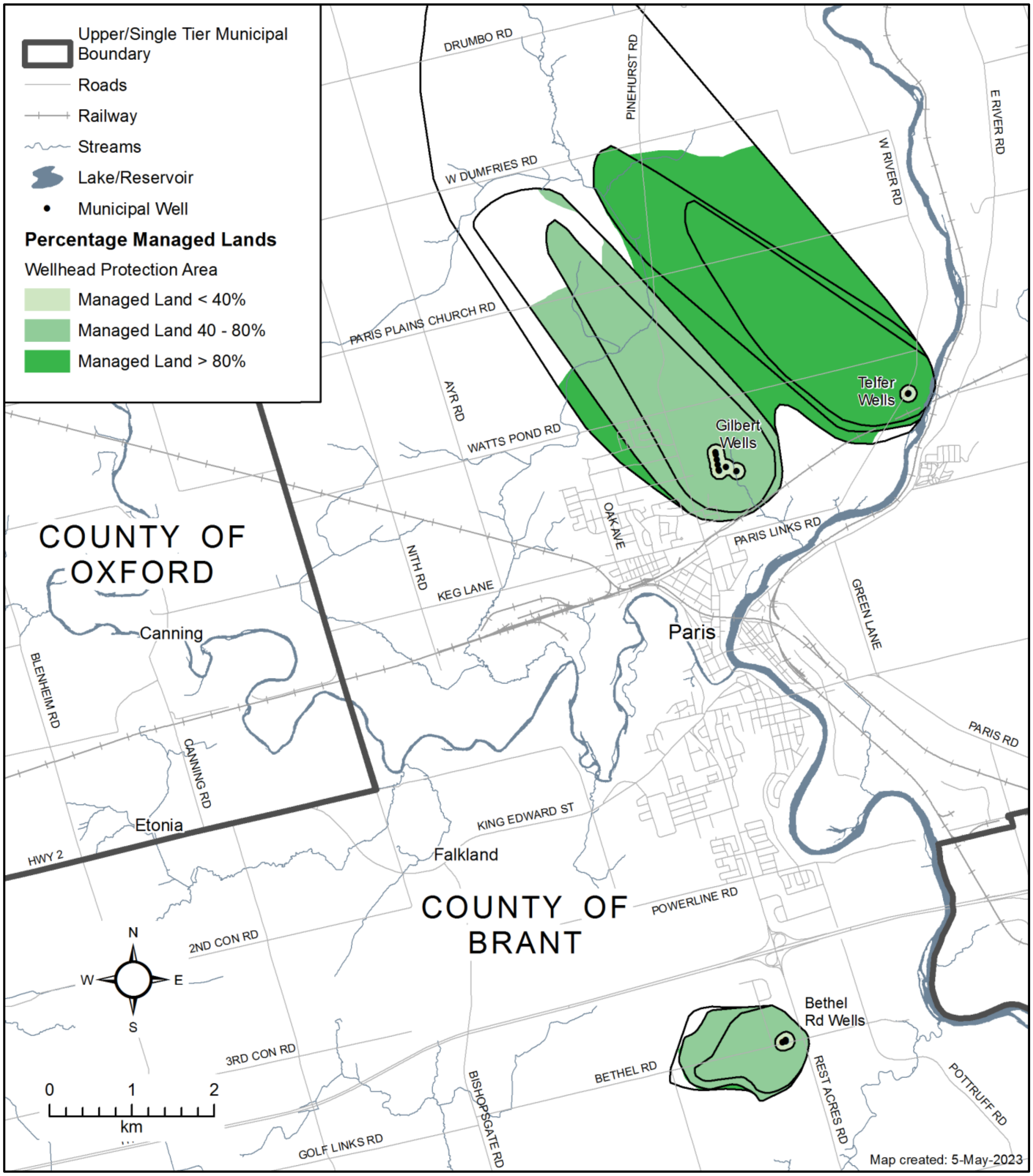
Managed Lands are lands to which nutrients are applied and are categorized into two groups: agricultural managed land and non-agricultural managed land. Agricultural managed land includes areas of cropland, fallow, and improved pasture that may receive nutrients. Non-agricultural managed land includes golf courses, sports fields, lawns and other built-up grassed areas that may receive nutrients (primarily commercial fertilizer). A detailed methodology of the managed lands evaluation is provided in Chapter 3.

Managed lands calculations were completed for all WHPAs with a vulnerability score of 6 or greater within the County of Brant. For the Paris drinking water system, calculations were updated in 2022 to account for urban growth in those WHPAs. The percent managed lands for the County of Brant WHPAs is illustrated on **Map 13-11**, **Map 13-12** and **Map 13-13.**

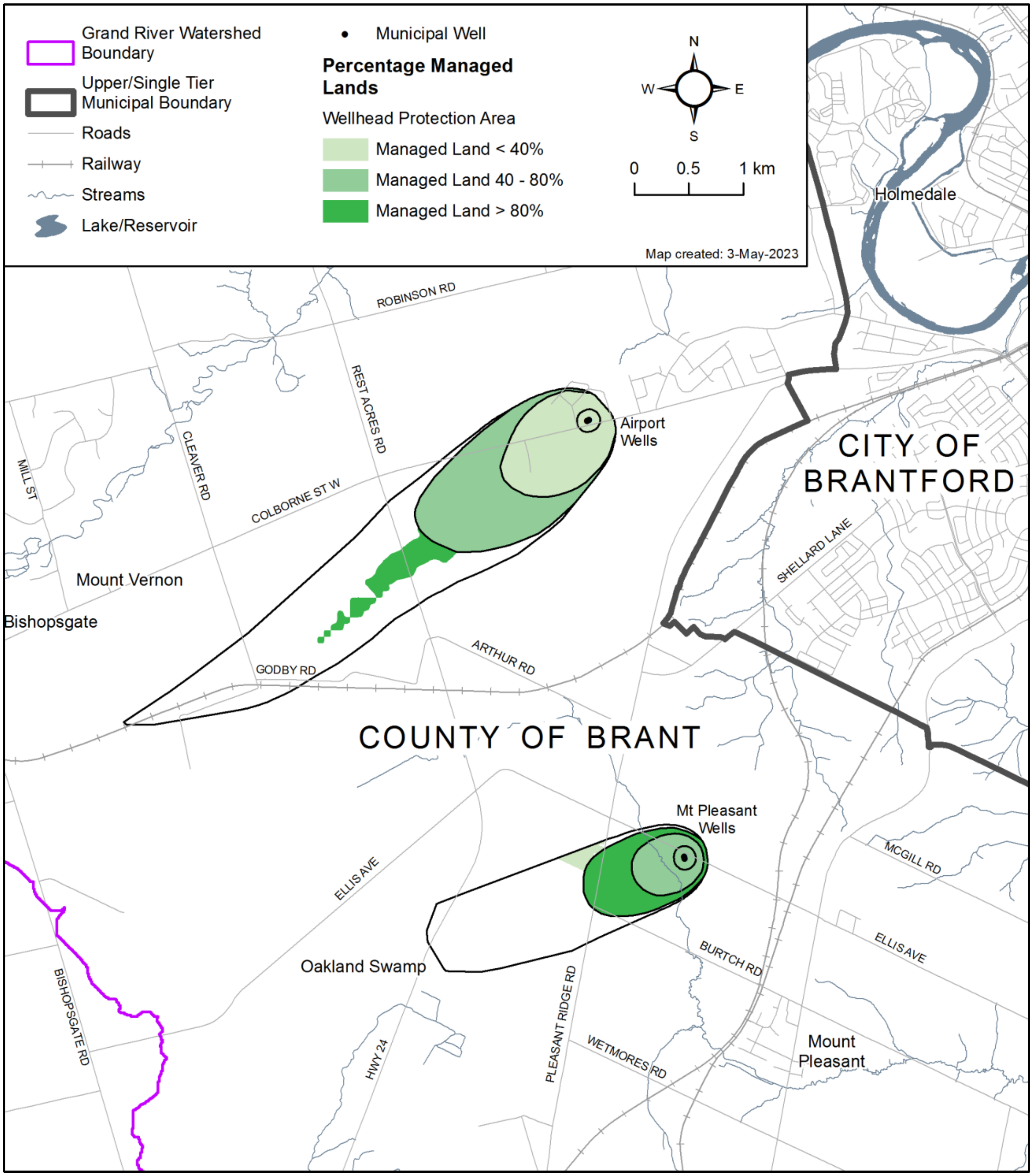
Map 13-11: St. George Water Supply Percent Managed Lands



Map 13-12: Paris Water Supply Percent Managed Lands



Map 13-13: Airport & Mt. Pleasant Water Supply Percent Managed Lands



13.2.8 Livestock Density within the County of Brant WHPAs

The calculation of livestock density is required to determine the amount of Nutrient Units (NUs) generated in each vulnerable Wellhead Protection Area scenario. This calculation is only completed when there are building structures that could house livestock on a farm parcel that intersects a vulnerable WHPA.

Livestock density calculations were completed for all WHPAs with a vulnerability score of 6 or greater within the County of Brant. For the Paris drinking water system, calculations were updated in 2022 to account for urban growth in those WHPAs. The livestock density for the WHPAs is illustrated on **Map 13-14**, **Map 13-15** and **Map 13-16.**

13.2.9 Percentage of Impervious Surface within the County of Brant WHPAs

The Technical Rules (MECP, 2021) require the calculation of percentage impervious surface in any area where the application of de-icing salt can be a low, moderate, or significant drinking water threat. In Brant, this includes the WHPA-A, -B, -C, and -D where the vulnerability score is six or greater. The Technical Rules (MECP, 2021) also require the calculation of percentage impervious surface for any WHPA-ICA delineated for sodium and/or chloride after these Rules came into effect. In the case of Brant, this includes the WHPA-ICA delineated for Bethel Road (see **Section 13.5.6**).

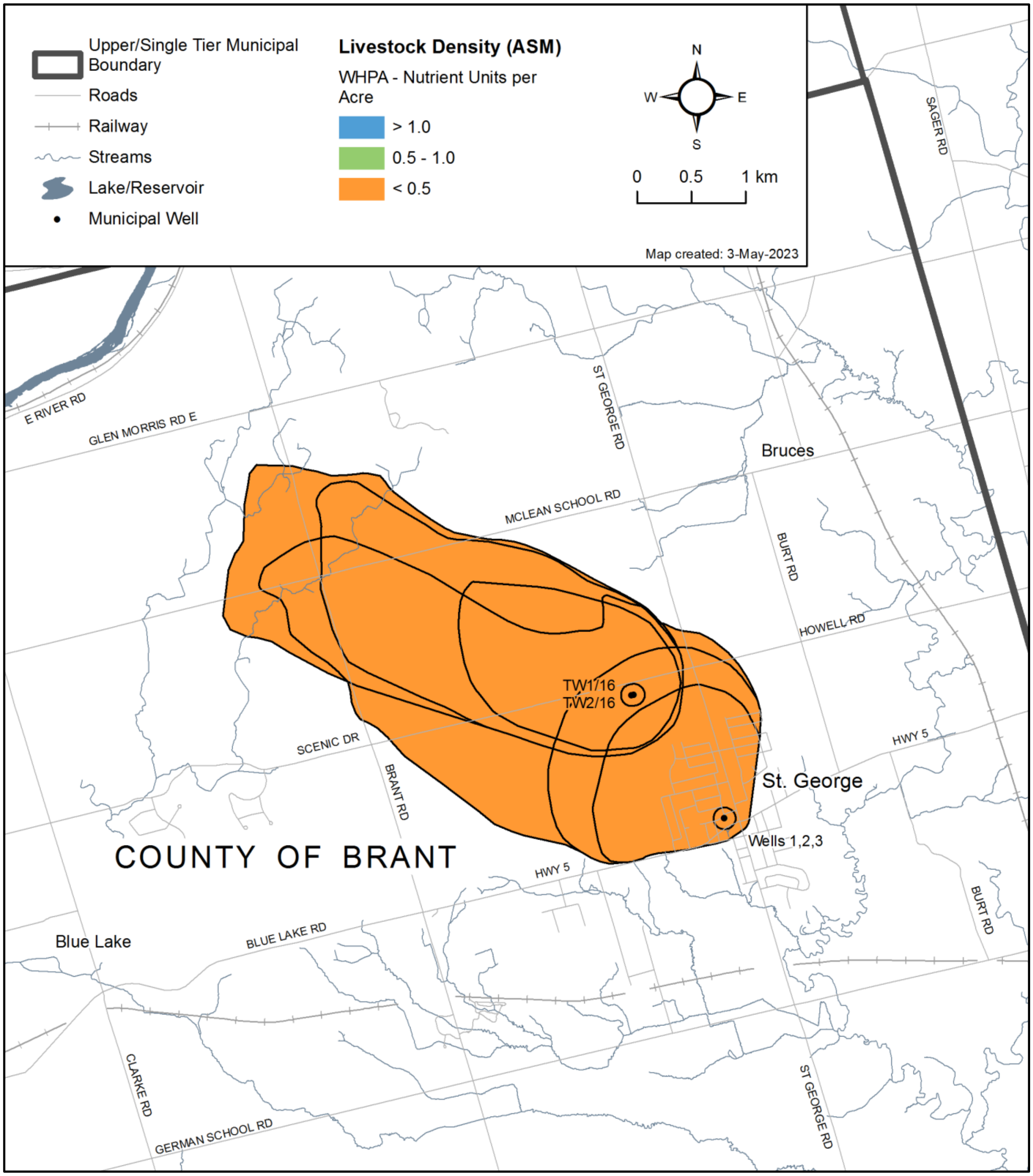
Further details on percentage impervious surface area and how it is calculated are provided in **Chapter 3**. For each system, the method was chosen based on the available input data, and results that best represent the impact of salt application on the landscape while remaining practical for implementation.

For St. George, the location of impervious surfaces was estimated using the Southern Ontario Land Resource Information System (SOLRIS) GIS layer, with percentage impervious surface calculations made using a 1 kilometre by 1 kilometre grid. Due to areas of high percent impervious surfaces in the St. George WHPAs, the application of road salt can be a significant threat (**Map 13-17**).

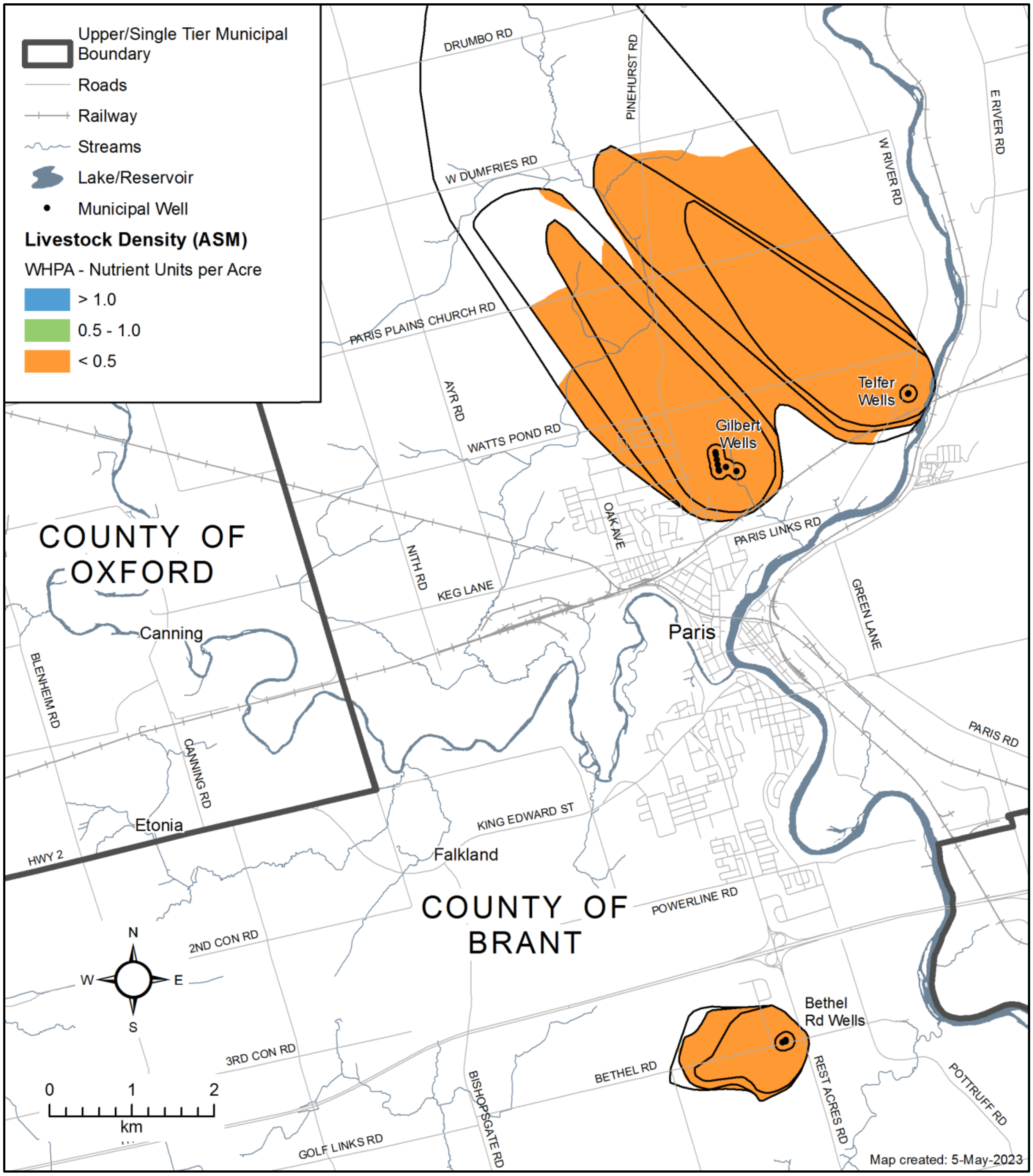
For Paris North, the Ontario Road Network (ORN) and Ontario Hydrology Network (OHN) were used to estimate the location of impervious surfaces, along with a land-classification layer generated by 4DM Inc. Percentage impervious surface calculations were made using the moving-window average technique, with a circular, linear-weighted window, and a 250 metre radius. For Bethel Road, the location of impervious surfaces was mapped using manual digitization of 2022 orthoimagery. Percentage impervious surface calculations were made using the moving-window average technique, with a circular, linear-weighted window, and a 250 metre radius. Due to areas of high percent impervious surfaces in the Paris WHPAs (Paris North and Bethel Road), the application of road salt can be a significant threat (**Map 13-18** & **Map 13-19**). It should be noted that this activity can also be a significant threat anywhere within the chloride and sodium WHPA-ICA delineated for Bethel Road (**Section 13.5.6**).

For Airport and Mount Pleasant, the location of impervious surfaces was estimated using the SOLRIS GIS layer, with percentage of impervious surface calculations made using the moving-window average technique with a 1 kilometre by 1 kilometre square window. Due to the low percent impervious surfaces in the Airport and Mount Pleasant WHPAs, the application of road salt cannot be a significant threat (**Map 13-20**).

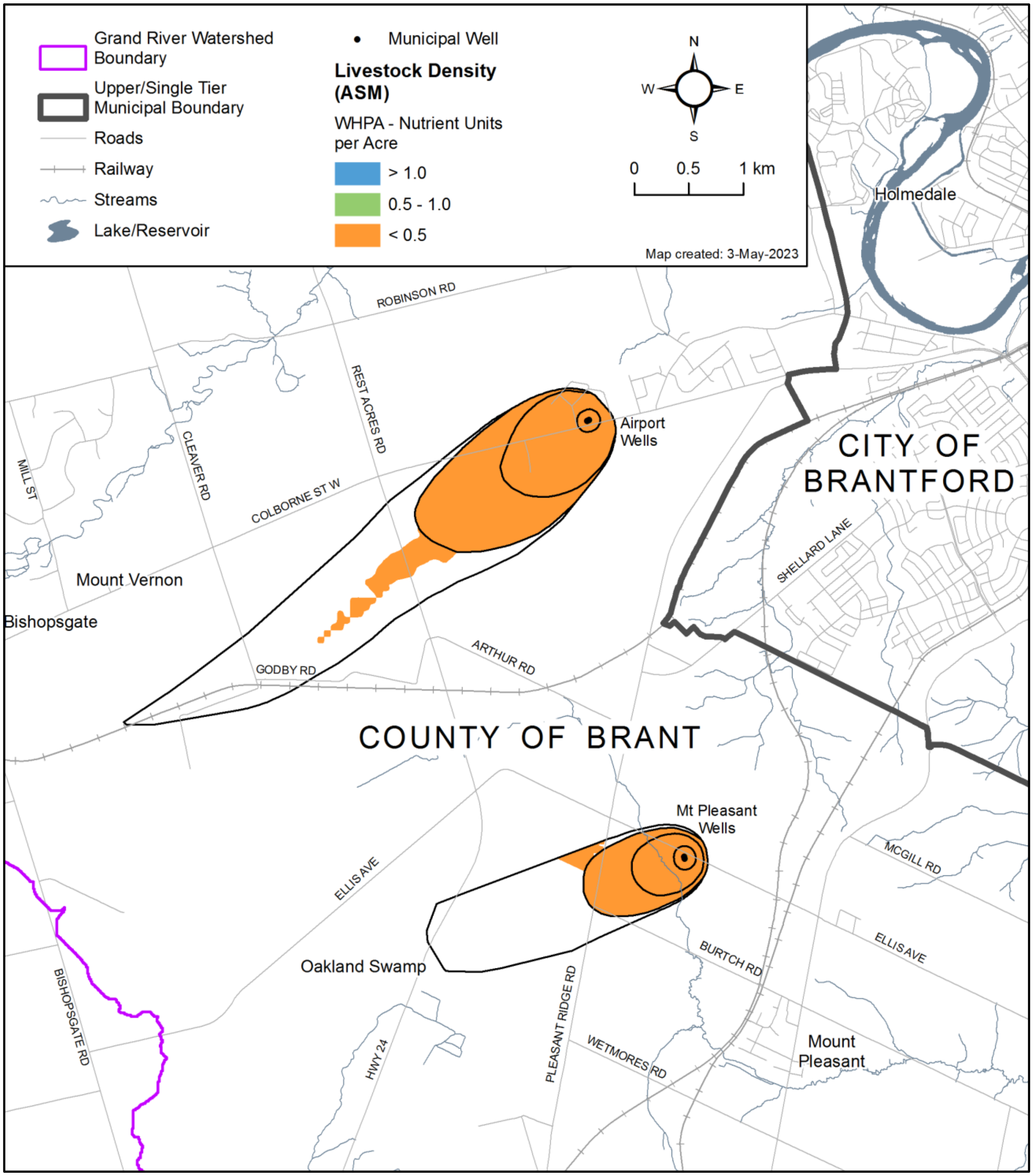
Map 13-14: St. George Water Supply Livestock Density



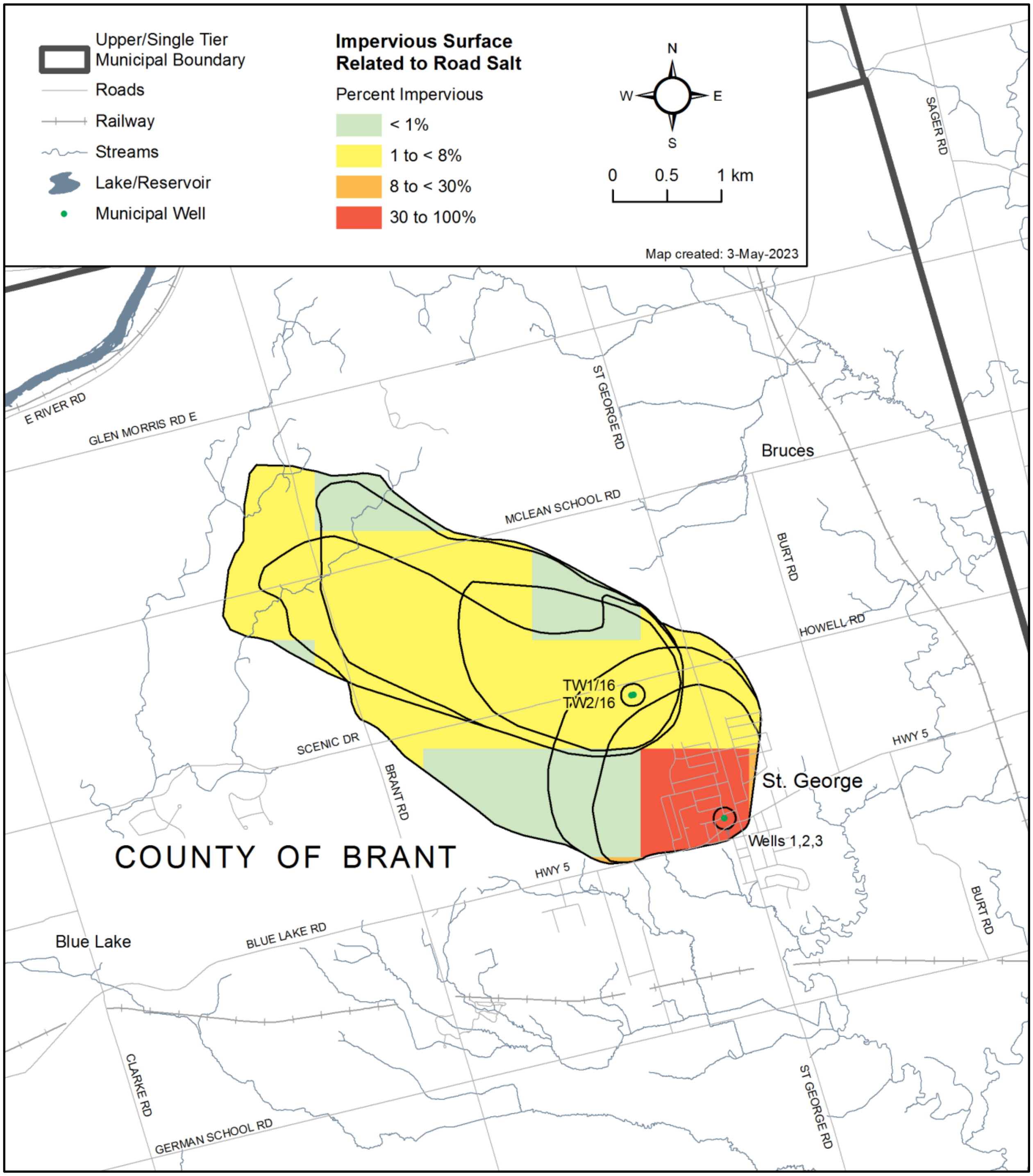
Map 13-15: Paris Water Supply Livestock Density



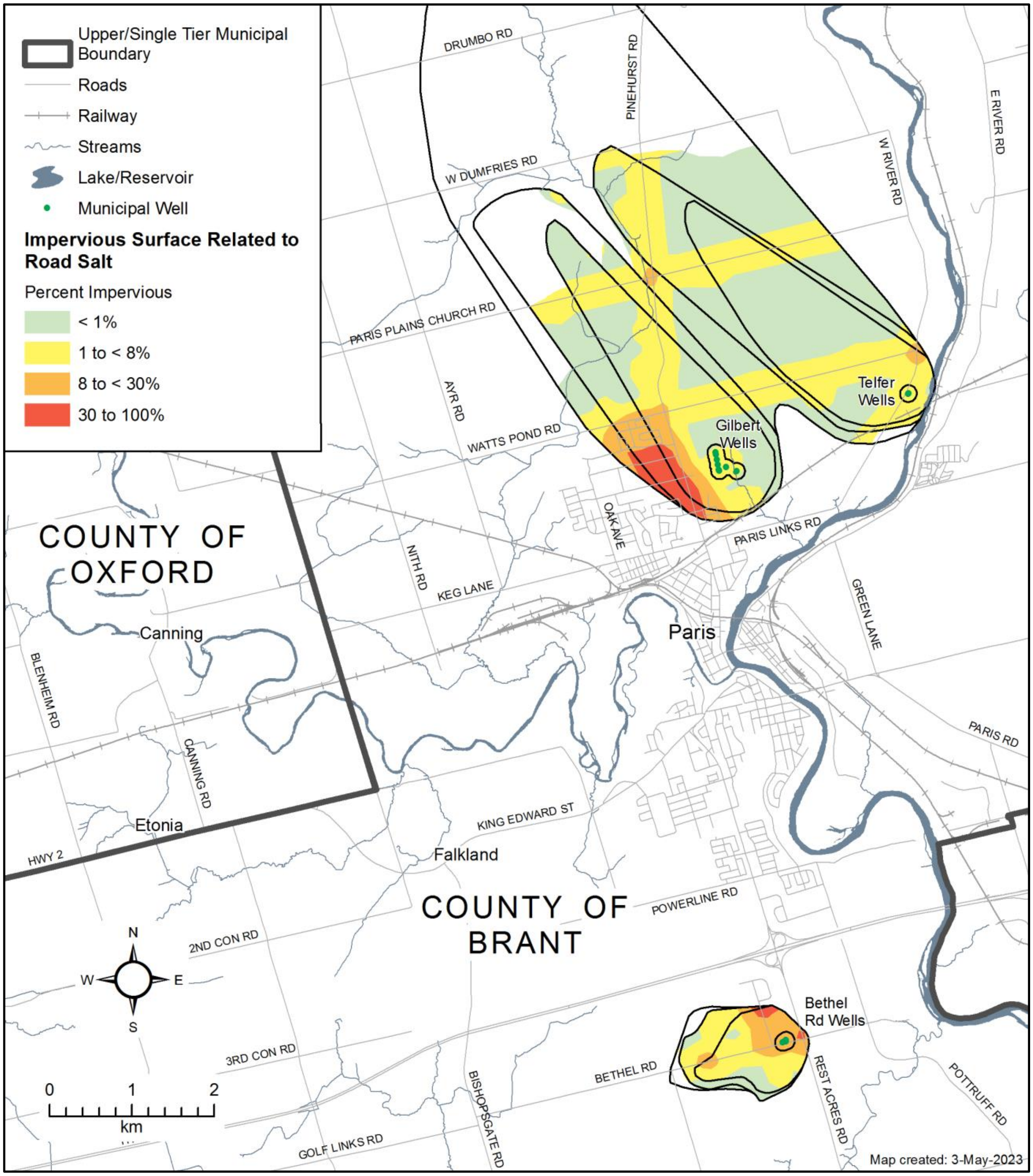
Map 13-16: Airport & Mt. Pleasant Water Supply Livestock Density



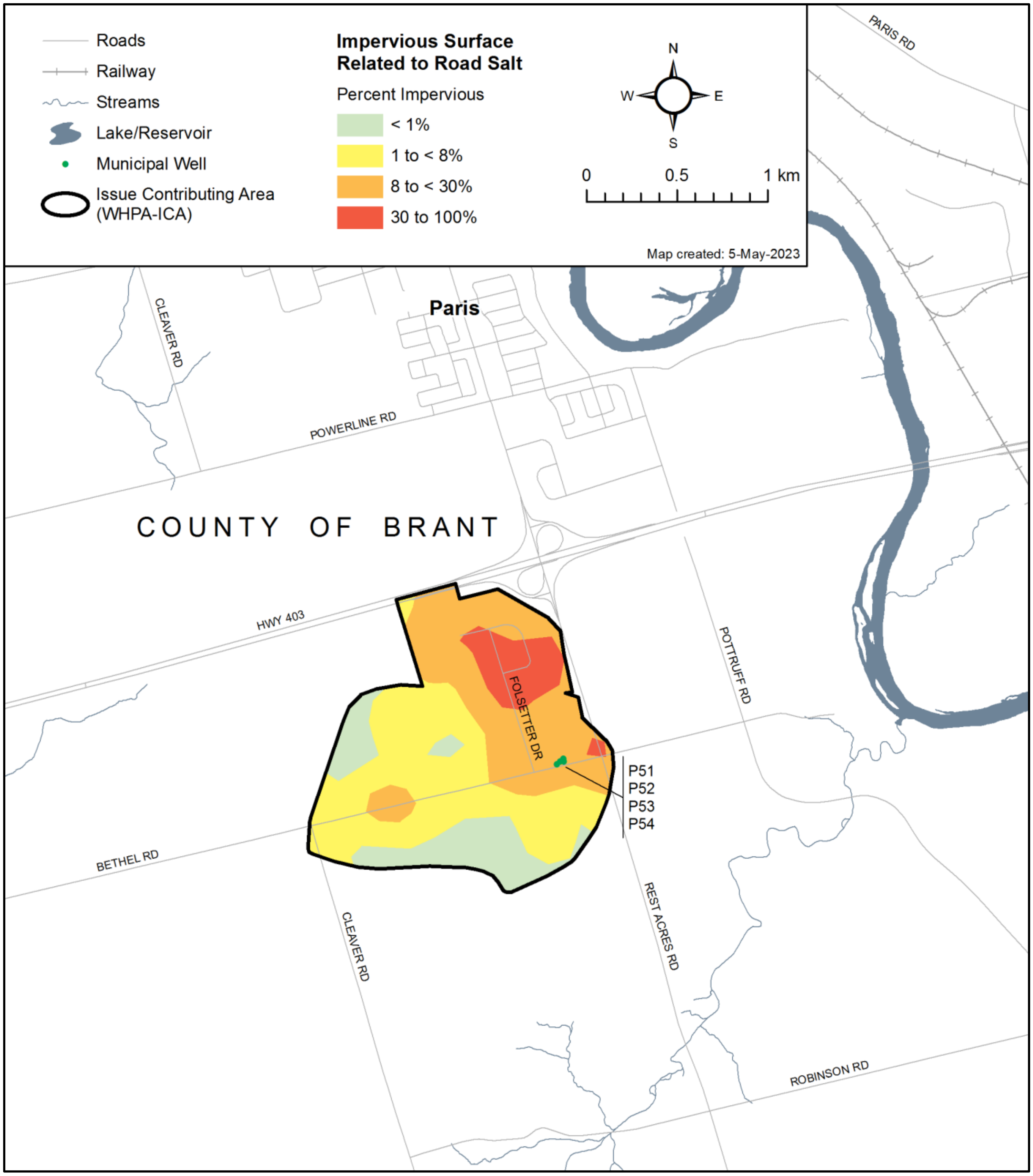
Map 13-17: St. George Water Supply Percent of Impervious Surfaces



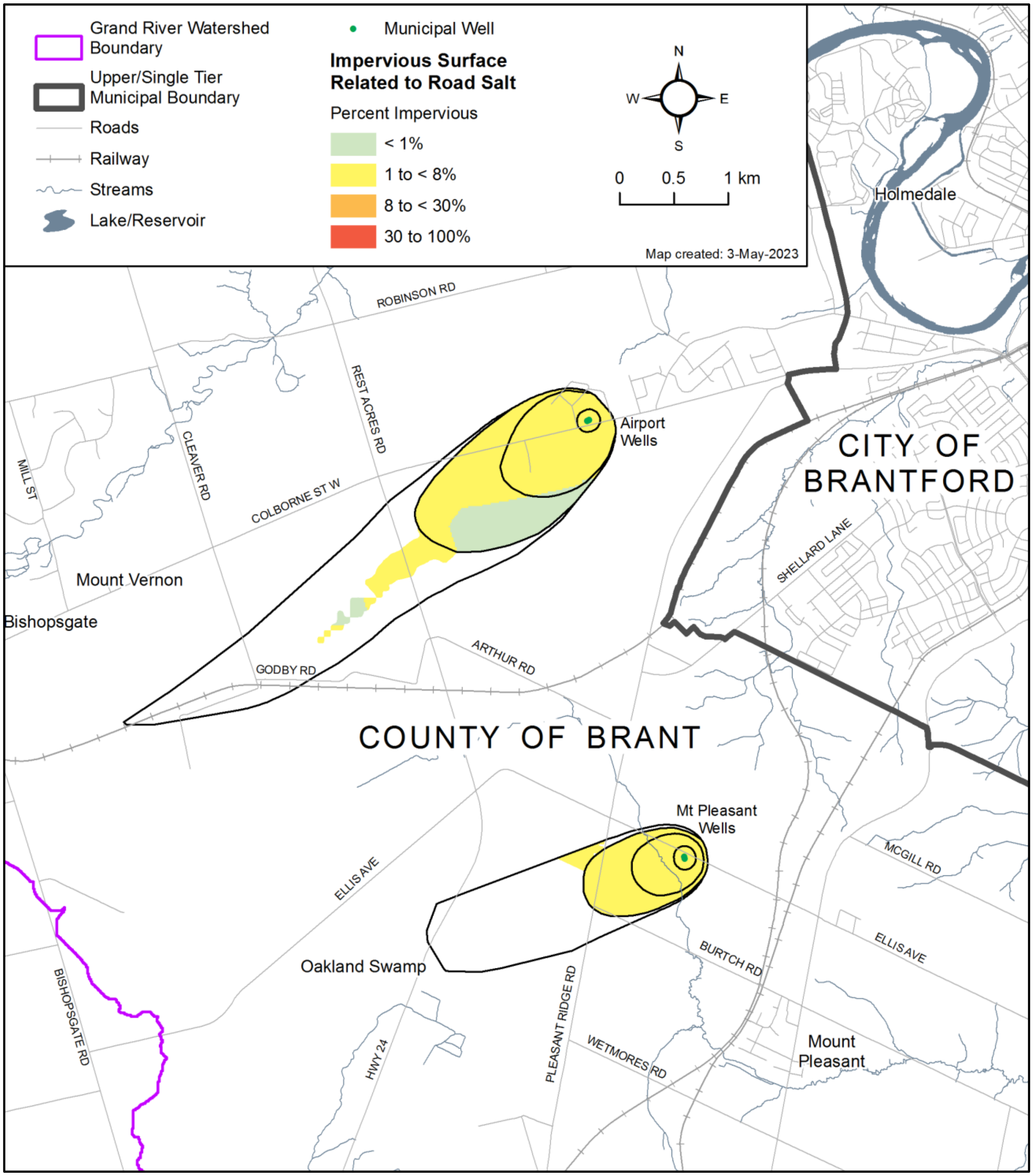
Map 13-18: Paris Water Supply Percent of Impervious Surfaces



Map 13-19: Bethel Issue Contributing Area (WHPA-ICA) Percent of Impervious Surfaces



Map 13-20: Airport & Mt. Pleasant Water Supply Percent of Impervious Surfaces



13.3 Drinking Water Quality Threats Assessment

The *Clean Water Act, 2006* defines a Drinking Water Threat as "an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water, and includes an activity or condition that is prescribed by the regulation as a drinking water threat." A Prescribed Drinking Water Threats table in Chapter 3 lists all possible drinking water threats.

13.3.1 Identification of Significant, Moderate and Low Drinking Water Threats for the County of Brant Well Supply Systems

Table 13-3, Table 13-4, Table 13-5, Table 13-6 and **Table 13-7** provide a summary of the threat levels possible in the County of Brant Well Supply System for Chemical, Dense Non-Aqueous Phase Liquid (DNAPL) and Pathogens. "Yes" indicates that the threat classification level is possible for the indicated threat type under the corresponding vulnerable area / vulnerability score; "No" indicates that it is not. The colours shown for each vulnerability score correspond to those shown in the maps.

Table 13-3: Identification of Drinking Water Quality Threats in the Airport Well Supply WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
Chemicals	WHPA-A & B	10	Yes	Yes	Yes
Chemicals	WHPA-C	8	Yes	Yes	Yes
Chemicals	WHPA-D	6	No	Yes	Yes
Chemicals	WHPA-D	4	No	No	No
DNAPLs	WHPA-A, B & C	Any Score	Yes	No	No
DNAPLs	WHPA-D	6	No	No	Yes
DNAPLs	WHPA-D	4	No	No	No
Pathogens	WHPA-A & B	10	Yes	Yes	No
Pathogens	WHPA-C & D	Any Score	No	No	No

Table 13-4: Identification of Drinking Water Quality Threats in the Mount Pleasant WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
Chemicals	WHPA-A & B	10	Yes	Yes	Yes
Chemicals	WHPA-B & C	8	Yes	Yes	Yes
Chemicals	WHPA-B, C & D	6	No	Yes	Yes
Chemicals	WHPA-D	4	No	No	No
Chemicals	WHPA-D	2	No	No	No
DNAPLs	WHPA-A, B & C	Any Score	Yes	No	No

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
DNAPLs	WHPA-D	6	No	No	Yes
DNAPLs	WHPA-D	4	No	No	No
DNAPLs	WHPA-D	2	No	No	No
Pathogens	WHPA-A & B	10	Yes	Yes	No
Pathogens	WHPA-B	8	No	Yes	Yes
Pathogens	WHPA-B	6	No	No	Yes
Pathogens	WHPA-C & D	Any Score	No	No	No

Table 13-5: Identification of Drinking Water Quality Threats in the St. George WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
Chemicals	WHPA-A & B	10	Yes	Yes	Yes
Chemicals	WHPA-B & C	8	Yes	Yes	Yes
Chemicals	WHPA-B & C	6	No	Yes	Yes
Chemicals	WHPA-D	4	No	No	No
Chemicals	WHPA-C & D	2	No	No	No
DNAPLs	WHPA-A, B & C	Any Score	Yes	No	No
DNAPLs	WHPA-D	4	No	No	No
DNAPLs	WHPA-D	2	No	No	No
Pathogens	WHPA-A & B	10	Yes	Yes	No
Pathogens	WHPA-B	8	No	Yes	Yes
Pathogens	WHPA-B	6	No	No	Yes
Pathogens	WHPA-C & D	Any Score	No	No	No

Table 13-6: Identification of Drinking Water Quality Threats in the Paris (Gilbert and Telfer) WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
Chemicals	WHPA-A & B	10	Yes	Yes	Yes
Chemicals	WHPA-B & C	8	Yes	Yes	Yes
Chemicals	WHPA-B, C & D	6	No	Yes	Yes
Chemicals	WHPA-D	4	No	No	No
Chemicals	WHPA-C & D	2	No	No	No
DNAPLs	WHPA-A, B & C	Any Score	Yes	No	No
DNAPLs	WHPA-D	6	No	No	Yes

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
DNAPLs	WHPA-D	4	No	No	No
DNAPLs	WHPA-D	2	No	No	No
Pathogens	WHPA-A & B	10	Yes	Yes	No
Pathogens	WHPA-B	8	No	Yes	Yes
Pathogens	WHPA-B	6	No	No	Yes
Pathogens	WHPA-C & D	Any Score	No	No	No

Table 13-7: Identification of Drinking Water Quality Threats in the Paris (Bethel Road) WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Significant Threats	Moderate Threats	Low Threats
Chemicals	WHPA-A & B	10	Yes	Yes	Yes
Chemicals	WHPA-C	8	Yes	Yes	Yes
Chemicals	WHPA-C & D	6	No	Yes	Yes
Chemicals	WHPA-D	4	No	No	No
DNAPLs	WHPA-A, B & C	Any Score	Yes	No	No
DNAPLs	WHPA-D	6	No	No	Yes
DNAPLs	WHPA-D	4	No	No	No
Pathogens	WHPA-A & B	10	Yes	Yes	No
Pathogens	WHPA-C & D	Any Score	No	No	No

13.4 Conditions Evaluation for the County of Brant Well Supply Systems

There were no Conditions identified for the Airport, Mount Pleasant, or Paris Well Supply Systems. However, two Condition sites associated with former fuel service stations exist at the St. George system. Data in the monitoring reports for these sites indicate the presence of select parameters, such as BTEX and F1-F4 petroleum hydrocarbons, that exceed the potable groundwater standard as set out in Table 2 of the Soil, Groundwater and Sediment Standards. Some exceedances were measured at wells located on off-site properties (Golder, 2010f), which serves as evidence for potential contaminant migration towards the municipal supply wells. As a result, the hazard rating for these Conditions is 10 based on Technical Rule 139(1). These Condition sites overlap the St. George WHPA-A and WHPA-B with vulnerability scores of 10. According to Technical Rule 138, this results in a risk score of 100. These Conditions meet the criteria presented in Technical Rule 140 to be identified as significant threats.

13.5 Drinking Water Quality Issues Evaluation

The objective of the Issues evaluation is to identify drinking water Issues where the existing or trending concentration of a parameter or pathogen at an intake or monitoring location would result in the deterioration of the quality of water for use as a source of drinking water. The parameter or pathogen must be listed in Schedule 1, 2 or 3 of the Ontario Drinking Water Quality Standards (ODWQS) or Table 4 of the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (Technical Rules XI.1 (114 – 117)). Raw water quality data available for review was compared to the ODWQS and the Technical Support Document to identify parameters approaching or exceeding the respective standard.

Issues were originally identified through a review of raw production well water quality data provided by the County for the period between 2000 and 2008 and through discussions with County staff. A subsequent analysis of raw production well water quality data was completed for the period between 2008 to 2017 to re-evaluate the previously identified Issues and/or identify any additional Issues. This included a review of microbiological data to evaluate if there were instances when *Escherichia coli (E. coli)* and/or total coliforms were detected. Water quality monitoring data beyond 2017 was recently reviewed for select wellfields. Specifically, the following were examined: nitrate concentrations at the St. George overburden wellfield; nitrate concentrations at the Paris North (Gilbert and Telfer) wellfields; and chloride and sodium concentrations at the Paris (Bethel) wellfield.

13.5.1 Drinking Water Quality Issues Evaluation for the Airport Well Supply

No previous Issues were identified for the Airport Well Supply as per analysis conducted prior to 2008. Analysis of the raw production well water for the period between 2008 and 2017 indicated that no health-related parameters or pathogens were measured at concentrations that exceeded the ODWQS. Specifically, the raw production well water quality data demonstrated that chloride (less than 30 mg/L) and nitrate (less than 4 mg/L) concentrations were not an Issue at the Airport Well Supply despite the relatively high vulnerability within the WHPAs. In addition, the results of the microbiological testing of the raw production well water at the Airport Well Supply from 2008 to 2017 (526 samples) found that *E. coli* and total coliforms were not detected in any samples. Therefore, no water quality Issues were identified for the Airport Well Supply.

13.5.2 Drinking Water Quality Issues Evaluation for the Mount Pleasant Well Supply

Water quality analysis conducted prior to 2008 for the raw production well water in the Mount Pleasant Well Supply identified chloride as an Issue under Technical Rule 114. There were instances when chloride concentrations in Well 1 surpassed the aesthetic objective of 250 mg/L from 2008 to 2010. However, the concentration of chloride within the raw production well water in Well 1 and Well 2 steadily decreased for the period between 2008 to 2017. For the period between 2013 and 2017, chloride concentrations were between 100 mg/L and 190 mg/L for Well 1 and between 65 mg/L and 94 mg/L for Well 2 and did not exceed the aesthetic objective of 250 mg/L. The decreased chloride concentrations since 2008 can likely be attributed to the construction of a salt storage dome near the wellfield and the ceasing of outdoor salt storage since 2006. Given that the concentration of chloride declined since 2008 and was no longer above the ODWQS of 250 mg/L, chloride is no longer identified as an Issue under Technical Rule 114 for the Mount Pleasant Well Supply System.

The sodium concentrations for the raw production well water in Well 1 were slightly elevated in 2008 (135 mg/L) and 2009 (158 mg/L). These values exceeded the reporting requirement as per the MOE technical support document (2003), whereby the local Medical Officer of Health is required to be notified when sodium concentrations reach above 20 mg/L in order to pass this information on to local physicians. No exceedances above the aesthetic objective of 200 mg/L were noted. The concentration of sodium steadily declined in both Well 1 and Well 2 for the period between 2008 and 2017, to 84 mg/L and 42 mg/L, respectively, in 2017. Similar to chloride, this declining trend can likely be attributed to the change in land use activities, namely the construction of the salt storage dome near the wellfield.

Manganese concentrations within the raw production well water were solely reported for 2009 and exceeded the aesthetic objective of 0.05 mg/L for Well 1. In particular, the concentration of manganese in the raw production well water was 0.08 mg/L for Well 1 and 0.03 mg/L for Well 2 in 2009. Since manganese was not reported since 2009, no trend could be reviewed for this parameter. It should be noted that elevated manganese concentrations in the raw production well water may be due to naturally occurring minerals and may also be enhanced by microbiological activity and chemical processes occurring in the well and in the aquifer close to the well.

Hardness was solely reported for Well 2 in 2009 and exceeded the operational guideline of 80 to 100 mg/L. In particular, the hardness was reported as 340 mg/L for Well 2 in 2009; however, no trend could be extrapolated for the period between 2009 and 2017 due to a lack of further reported hardness concentrations.

Nitrate concentrations for the Mount Pleasant Well Supply were relatively low (<0.1 to 4.3 mg/L) based on concentrations measured for the period between 2008 and 2017. No nitrate concentrations for Well 1 or Well 2 exceeded the Maximum Acceptable Concentration (MAC) of 10 mg/L for the period between 2008 and 2017.

Microbiological test results for Well 1 (519 samples) and Well 2 (507 samples) for the period between 2008 and 2017 indicated that *E. coli* was not detected in any drinking water samples for the Mount Pleasant Well Supply. Total coliforms were detected at low concentrations of up to 2 CFU/100 mL and 6 CHU/100 mL in 2008 and 2014, respectively.

Ultimately, no water quality Issues were identified for the Mount Pleasant Well Supply based on the analysis of raw production well water conducted for the period between 2008 and 2017.

13.5.3 Drinking Water Quality Issues Evaluation for the St. George Well Supply

The raw production well water analyzed for the St. George Well Supply (overburden wells) for the period between 2008 and 2017 indicated that no parameters, namely chloride and nitrate, exceeded the ODWQS. Analysis of nitrate data up to August 2021 confirms that nitrate remains below the MAC of 10 mg/L.

Nitrate was previously identified as an Issue for the St. George Well Supply under Technical Rule 114, due to slightly elevated nitrate concentrations and an increasing trend observed from 2000 to 2008. Raw water nitrate concentrations (**Figure 13-1**) were above the nitrate half MAC (5 mg/L) for the period of 2006 to 2010. For the period of 2010 to 2021, raw water nitrate concentrations generally fluctuate around the half MAC with no prominent increasing or decreasing trend. Nitrate remains identified as an Issue under Technical Rule 114 for the St. George Well Supply (overburden wells) due to elevated concentrations and the unknown source of nitrate contamination. Nitrate concentrations will continue to be monitored for the St. George Well Supply to determine if an Issue remains present over time.

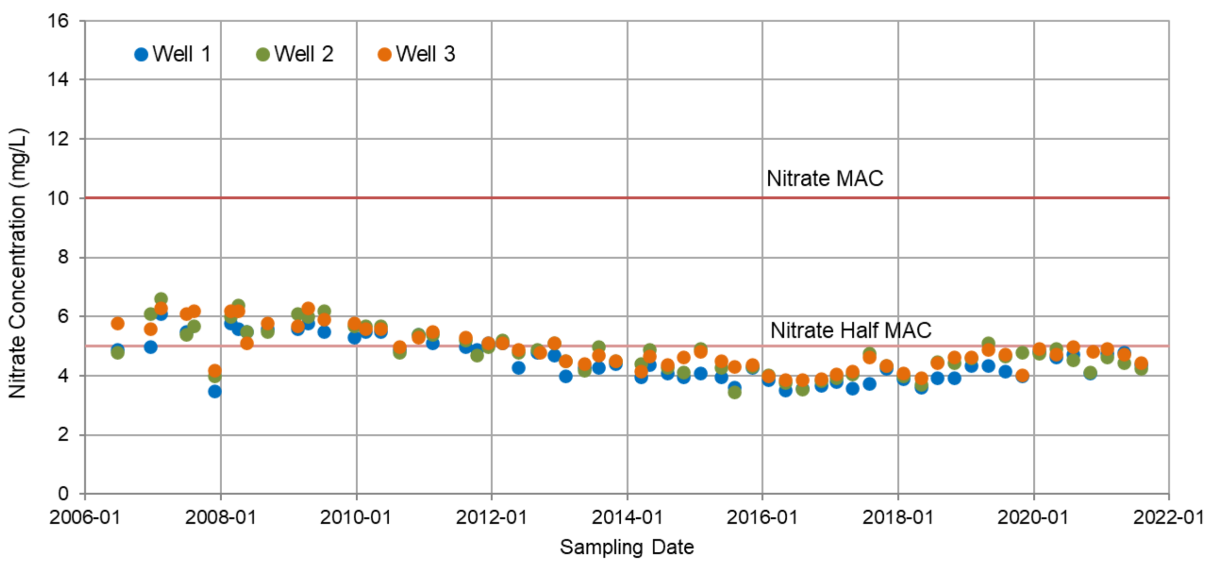


Figure 13-1: Nitrate trends in raw water at the St. George wellfield

Microbiological test results for Well 1 (514 samples), Well 2 (523 samples) and Well 3 (515 samples) were reviewed for the St. George Well Supply and indicated that there were some detections of E. coli or total coliforms at low concentrations in the raw production well water during the period between 2008 and 2017. *E. coli* was detected up to 1 CFU/100 mL for Well 2 in 2014. In addition, total coliforms were detected up to 3 CFU/100 mL for Well 2 in 2010, Well 3 in 2011, and Well 2 in 2014.

13.5.4 Drinking Water Quality Issues Evaluation for the Paris North (Gilbert and Telfer) Well Supply

Based on the analysis of the raw production well water for the Gilbert and Telfer wellfields, elevated levels of sulphate and nitrate were found. In the Gilbert wellfield, from 2008 to 2017, there were instances where the concentration of sulphate was approaching and/or exceeded the aesthetic objective of 500 mg/L. In particular, the wells P28 and P29 ranged from 360 mg/L to 436 mg/L and 530 mg/L to 823 mg/L, respectively. The raw production well water data pertaining to each of these wells also displayed slightly decreasing trends from 2008 to 2017. The elevated sulphate concentrations were interpreted to result from the dissolution of minerals (gypsum) within the bedrock aquifer. In the Telfer wellfield, the concentration of sulphate reported in 2008 was slightly elevated for the well P32 (365 mg/L). No exceedances above the aesthetic objective for sulphate were noted in this wellfield for the period between 2008 and 2017.

Raw water nitrate concentrations at the Gilbert overburden supply wells (**Figure 13-2**) from 2008 to 2021 were elevated with concentrations fluctuating from approximately 5 mg/L to 11 mg/L. Nitrate concentrations at the Gilbert overburden supply wells exceeded the MAC on several occasions, more notably from 2018 to 2021. Raw water nitrate concentrations at the Telfer supply wells (**Figure 13-3**) from 2008 to 2021 were elevated with concentrations fluctuating from approximately 5 mg/L to 10 mg/L with no prominent increasing or decreasing trend. Nitrate concentrations at the Telfer supply wells have not exceeded the MAC since February 2012. Nitrate Issues were identified for the Gilbert and Telfer wellfields based on previous analysis of raw production well water conducted prior to 2008. Given the continued occurrence of elevated nitrate concentrations at the Gilbert and Telfer wellfields for the period between 2008 and 2021, nitrate remains identified as an Issue for the Gilbert wellfield (overburden wells) and Telfer wellfield under Technical Rule 114.

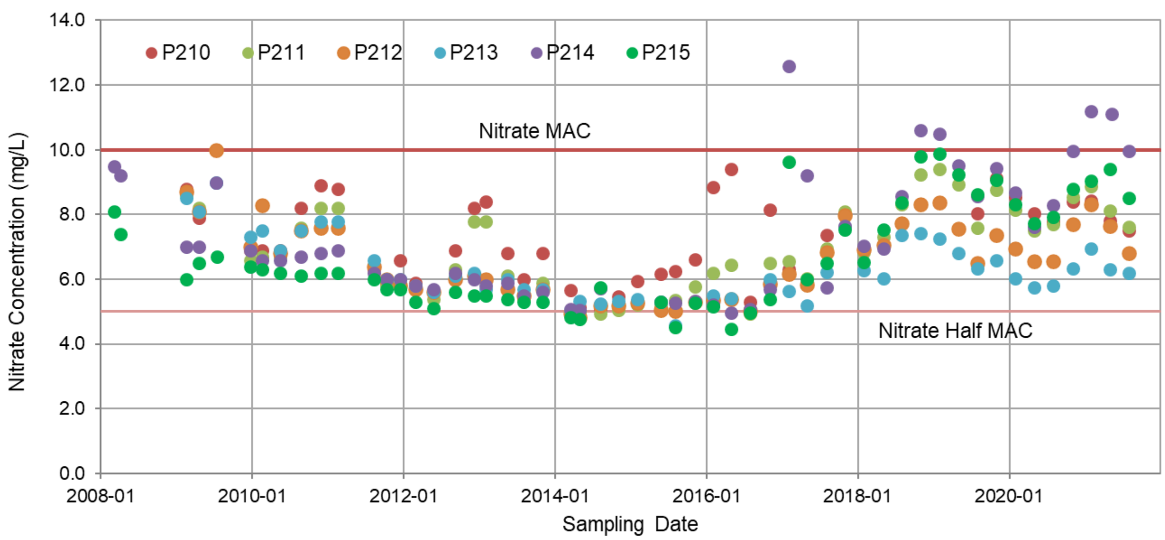


Figure 13-2: Nitrate trends in raw water at the Gilbert overburden wellfield

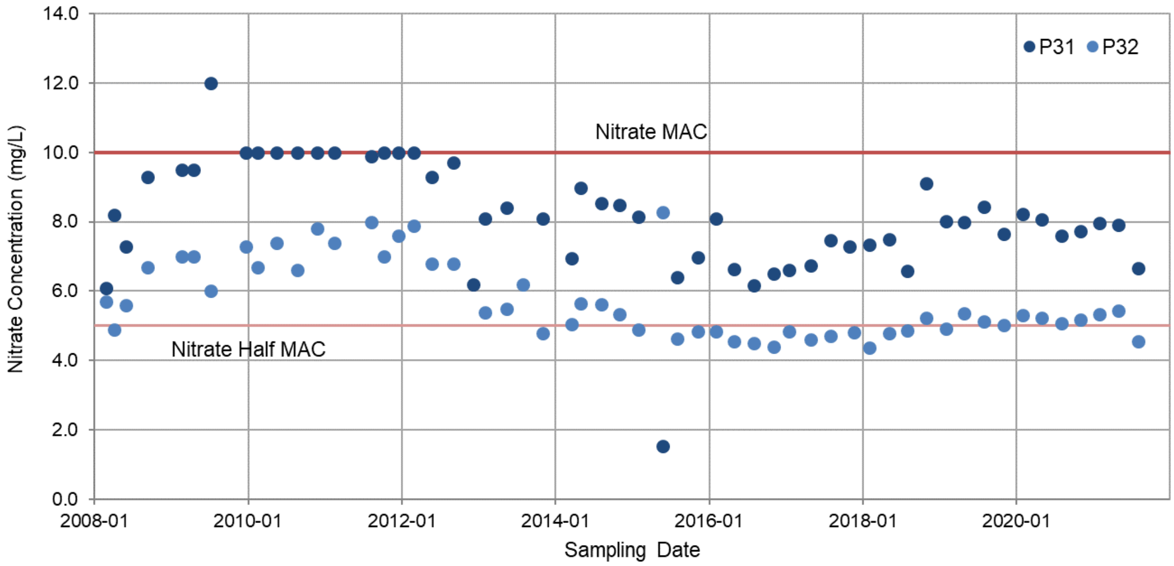


Figure 13-3: Nitrate trends in raw water at the Telfer wellfield

A review of the microbiological data corresponding to the Gilbert wellfield consisted of the analysis of samples collected for the wells P28 (511 samples), P29 (522 samples), P210 (499 samples), P211 (502 samples), P212 (492 samples), P213 (493 samples), P214 (499 samples), and P215 (487 samples). *E. coli* was detected at low concentrations in 2010 and 2016 for P29 (1 CFU/100 mL) and P213 (0 to 2 CFU/100 mL). In addition, total coliforms were detected occasionally at low concentrations for the wells within the Gilbert wellfield that were typically in the range of 0 to 7 CFU/100 mL. Two instances occurred where total coliforms were also detected at higher concentrations of 0 to 40 CFU/100 mL and 0 to 116 CFU/100 mL for the well P211 in 2009 and 2013, respectively. No *E. coli* was detected throughout the period between 2008 and 2017 for the wells within the Telfer wellfield; however total coliforms were detected at a concentration of up to 1 CFU/100 mL for the well P31 in 2013.

13.5.5 Drinking Water Quality Issues Evaluation for the Paris (Bethel) Well Supply

A nitrate Issue was identified for the Bethel wellfield based on previous analysis of raw production well water conducted prior to 2008. Since it was observed that the nitrate concentrations have decreased since 2008 and displayed no further exceedances, nitrate is no longer identified as an Issue for the Bethel wellfield.

The concentration of chloride at the Bethel wellfield (**Figure 13-4**) has shown an increasing trend for the period between 2013 and 2022. Concentrations first exceed the half aesthetic objective (125 mg/L) in early 2017 and reach 210 mg/L in 2022. Given the elevated concentrations and increasing trend, chloride has been identified as an Issue under Technical Rule 114 for the Bethel wellfield. Chloride concentrations will continue to be monitored to determine if an Issue remains present over time.

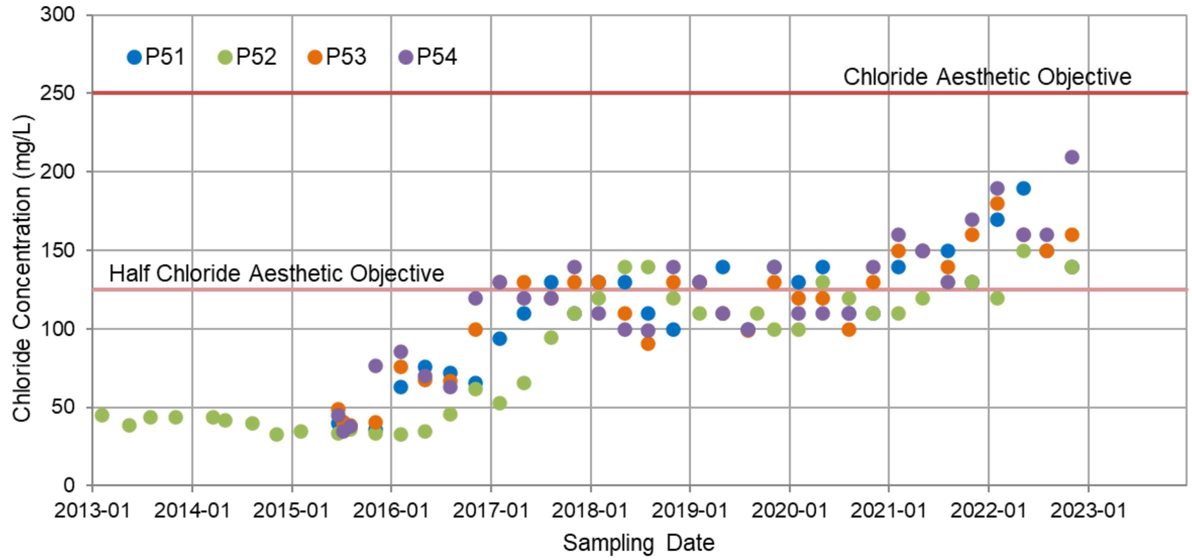


Figure 13-4: Chloride trends in raw water at the Bethel wellfield

Recent water quality analysis has identified rising concentrations of sodium at the Bethel wellfield (**Figure 13-5**) for the period between 2018 and 2023. Concentrations first exceed the half aesthetic objective (100 mg/L) in late 2022 and reach 120 mg/L in 2023. The sodium concentrations at the Bethelwellfield exceed 20 mg/L, which is the threshold whereby the local Medical Officer of Health must be notified. Given the elevated concentrations and increasing trend, sodium has been identified as an Issue under Technical Rule 114 for the Bethel wellfield. Sodium concentrations will continue to be monitored to determine if an Issue remains present over time.

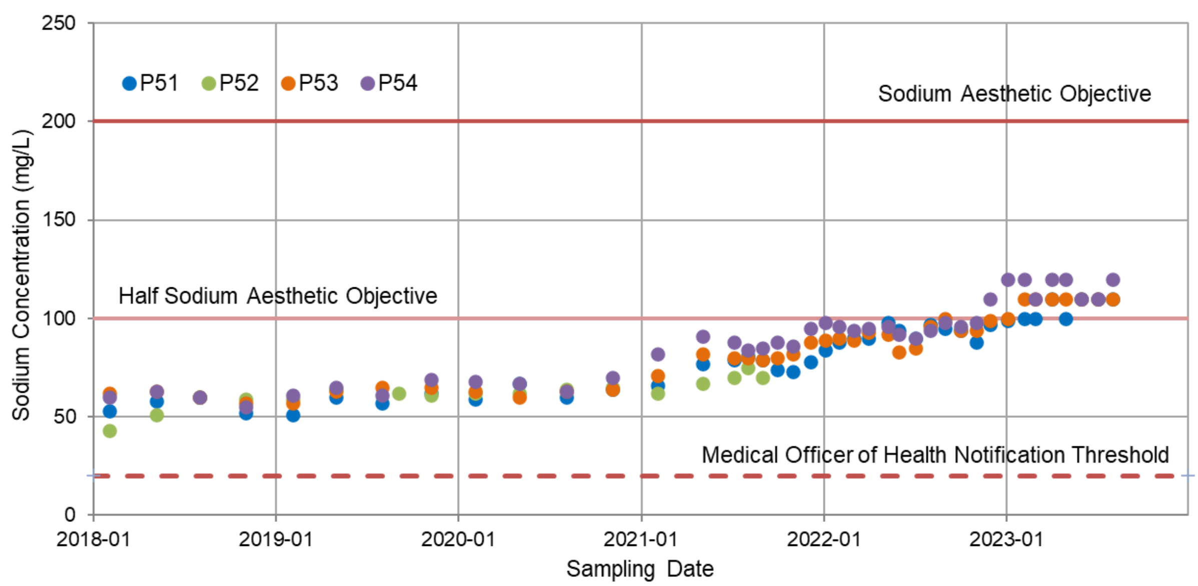


Figure 13-5: Sodium trends in raw water at the Bethel wellfield

Microbiological testing was conducted for the wells P51 (128 samples), P52 (237 samples), P53 (128 samples), and P54 (128 samples) within the Bethel wellfield for the period between 2013 and 2017. *E. coli* was detected at a concentration of up to 2 CFU/100 mL for the well P52 in 2014. In addition, total coliforms were detected throughout this period at concentrations that ranged between 0 - 3 CFU/100 mL to 0 - 45 CFU/100 mL for the wells P52 and P53.

13.5.6 Issue Contributing Areas for County of Brant Well Supplies

For the nitrate Issue at the St. George Well Supply, the monitoring data suggest the possibility of contamination from agriculture and/or septic systems. The entire WHPA-D (i.e., 25-year time of travel zone) for the St. George wellfield (overburden) is included in the Issue Contributing Area (WHPA-ICA) (**Map 13-21**).

For the Gilbert wellfield (overburden) and Telfer wellfield, agricultural activity within the WHPA is interpreted to be the main cause of the elevated nitrate concentrations. Septic systems may also contribute to elevated levels of nitrate. The WHPA-ICAs for the Gilbert and Telfer wellfields (**Map 13-21**) were delineated using the same model as the WHPAs but instead applied average pumping rates from the years 2008 to 2010 (WNMC, 2011). These zones are thought to represent where the source water for the wells has come from in the past rather than the area that should be protected in the future. The delineated WHPA-D based on average 2008 to 2010 pumping rates is considered the WHPA-ICA for the associated wellfields.

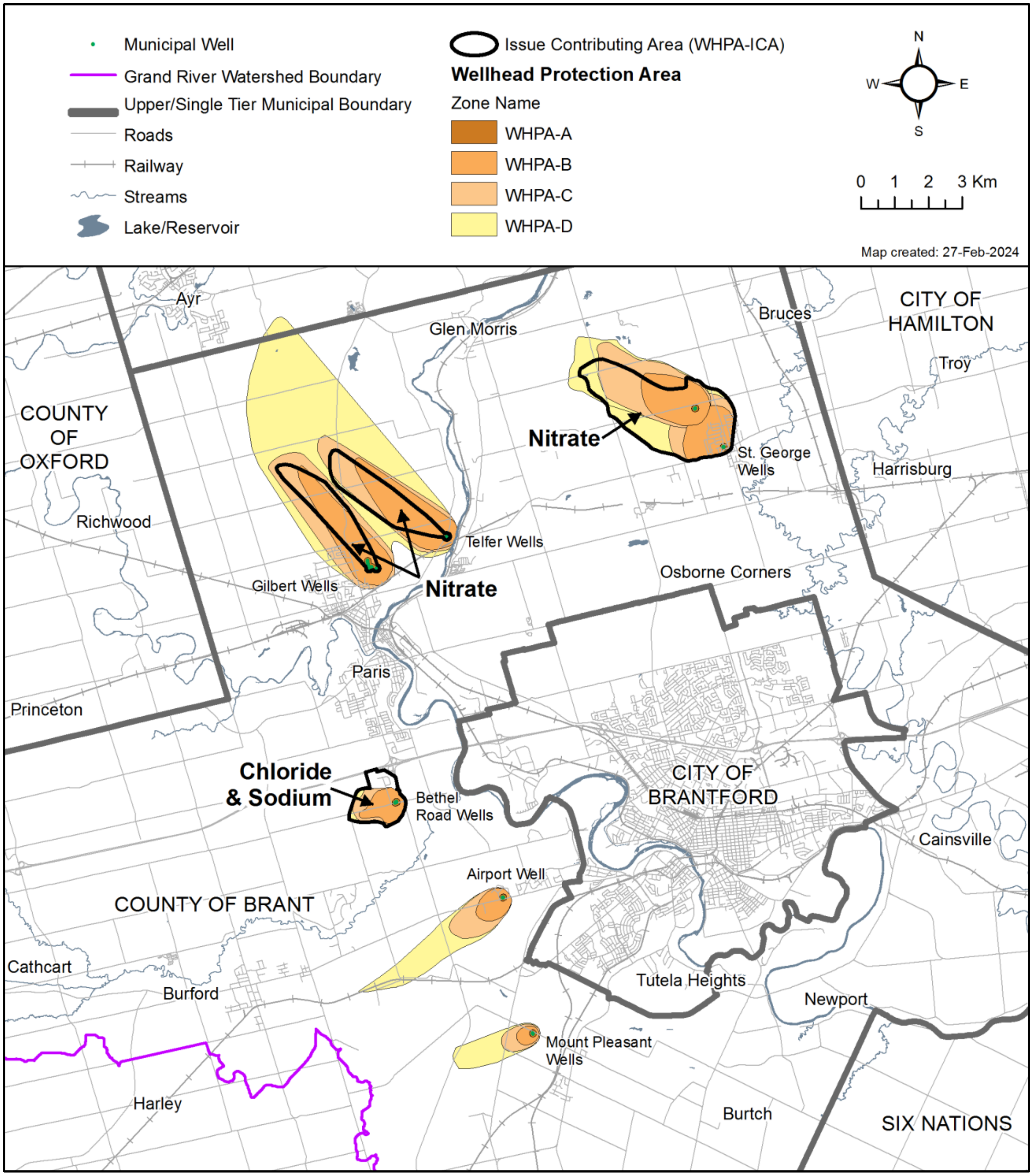
The source of chloride and sodium at the Bethel Road wellfield is likely linked to road salt application at the nearby Brant Business Park. The Technical Rules (MECP, 2021) allow for the extension of the WHPA-ICA outside of the existing wellhead protection area where there is evidence that the extended area is hydraulically connected to the supply wells and contributing to the Issue. In 2018, a field and modelling investigation determined that the Brant Business Park stormwater management pond is hydraulically connected to the municipal source aquifer through an infiltration gallery (Earthfx, 2018e). It was subsequently demonstrated that increasing chloride and sodium concentrations at the Bethel Road wellfield may be the result of road salt contaminated stormwater (from the Brant Business Park) being re-infiltrated from the stormwater management pond (Cambium, 2021). As a result, the WHPA-ICA includes the entirety of the WHPA-D in addition to the drainage area of the stormwater management pond, where the Brant Business Park is located (**Map 13-21**). The drainage area of the Brant Business Park was determined based on the engineered drawings included as part of the detailed design report for the Brant Business Park stormwater management facility (Meritech, 2012).

As part of the threats assessment for these wellfields, any threat that may contribute to the Issue is considered a significant threat regardless of the vulnerability. A summary of the WHPA-ICAs for the St. George, Gilbert, Telfer, and Bethel wellfields is provided in **Table 13-8.**

Table 13-8: Issues and Issue Contributing Areas (WHPA-ICAs) for County of Brant Well Supplies

Well	Issue Contributing Area (WHPA-ICA)	Chemical of Concern
St. George Wellfield (overburden): Wells 1, 2 and 3	WHPA-D	Nitrate
Paris North Gilbert Wellfield (overburden): Wells P210 – P215	WHPA-D based on average pumping rates from 2008 - 2010	Nitrate
Paris North Telfer Wellfield: Wells P31 and P32	WHPA-D based on average pumping rates from 2008 - 2010	Nitrate
Paris Bethel Wellfield: Wells P51 – P54	WHPA-D plus Brant Business Park drainage area	Chloride and Sodium

Map 13-21: Issue Contributing Areas (WHPA-ICAs) for the County of Brant Water Supply



13.6 Enumeration of Significant Drinking Water Quality Threats

The Technical Rules require an estimation of the number of locations at which an activity is a significant drinking water threat.

13.6.1 Airport, Mount Pleasant, St. George and Bethel Road WHPAs

An update to the original significant threats assessment was completed in 2018 based on updated aerial photography corresponding to the revised WHPAs. This enumeration was completed according to the 2017 Technical Rules (MOECC, 2017). Threats were re-enumerated in 2024 to align with the 2021 Technical Rules (MECP, 2021). All activities that may contribute to an identified Issue located within an Issue Contributing Area (WHPA-ICA) are significant drinking water threats and are included in the tables below. **Table 13-9**, **Table 13-10**, **Table 13-11**, **Table 13-12** and **Table 13-13** summarize the significant threats for the Airport, Mount Pleasant, St. George and Bethel Road Well Supply.

Table 13-9: Airport Well Supply Significant Drinking Water Quality Threats (current to September 2024)

Threat Subcategory[1]	Number of Activities	Vulnerable Area
1.12 Storage of subject waste at a waste generation facility: site requires generator registration under Section 3 of O. Reg. 347	6	WHPA-A WHPA-B
1.13 Storage of waste at a waste generation facility: site that is exempt or excluded from generator registration requirements	6	WHPA-A WHPA-B
2.1 Industrial effluent discharges	5	WHPA-A WHPA-B
2.2 Onsite sewage works	21	WHPA-B
2.5 Wastewater collection facilities and associated parts: Sanitary sewers	1	WHPA-A WHPA-B
13.1 Handling and storage of road salt – exposed to precipitation or runoff	15	WHPA-A WHPA-B
13.2 Handling and storage of road salt – potentially exposed to precipitation or runoff	15	WHPA-A WHPA-B
14.1 Storage of snow on a site	5	WHPA-A WHPA-B
15.1 Handling and storage of fuel	6	WHPA-A WHPA-B

Threat Subcategory[1]	Number of Activities	Vulnerable Area
16.1 Handling and storage of a dense non-aqueous phase liquid (DNAPL)	3	WHPA-A WHPA-B
17.1 Handling and storage of an organic solvent	18	WHPA-A WHPA-B
Total Number of Activities	**101**	
Total Number of Properties	**33**	

[1] Threats enumerated according to the 2021 Technical Rules (MECP, 2021)

Note: Certain types of incidental activities on residential properties may constitute significant drinking water threats but are not enumerated. These threats include the application of commercial fertilizer and pesticides; the handling and storage of organic solvents and dense non-aqueous phase liquids; the storage of fuel (e.g., heating fuel tanks) in natural gas serviced areas; and the handling and storage of road salt that may be exposed or potentially exposed to precipitation or runoff.

Table 13-10: Mount Pleasant Well Supply Significant Drinking Water Quality Threats (current to September 2024)

Threat Subcategory[1]	Number of Activities	Vulnerable Area
2.2 Onsite sewage works	5	WHPA-A WHPA-B
13.1 Handling and storage of road salt – exposed to precipitation or runoff	1	WHPA-A
13.2 Handling and storage of road salt – potentially exposed to precipitation or runoff	1	WHPA-A
17.1 Handling and storage of an organic solvent	6	WHPA-A WHPA-B
Total Number of Activities	**13**	
Total Number of Properties	**8**	

[1] Threats enumerated according to the 2021 Technical Rules (MECP, 2021)

Note: Certain types of incidental activities on residential properties may constitute significant drinking water threats but are not enumerated. These threats include the application of commercial fertilizer and pesticides; the handling and storage of organic solvents and dense non-aqueous phase liquids; the storage of fuel (e.g., heating fuel tanks) in natural gas serviced areas; and the handling and storage of road salt that may be exposed or potentially exposed to precipitation or runoff.

Table 13-11: St. George Overburden Well Supply Significant Drinking Water Quality Threats (current to September 2024)

Threat Subcategory[1]	Number of Activities	Vulnerable Area
1.1 Disposal of hauled sewage to land	1	WHPA-A WHPA-B WHPA-ICA
1.12 Storage of subject waste at a waste generation facility: site requires generator registration under Section 3 of O. Reg. 347	1	WHPA-A
1.13 Storage of waste at a waste generation facility: site that is exempt or excluded from generator registration requirements	1	WHPA-A
2.2 Onsite sewage works	4	WHPA-A WHPA-B WHPA-ICA
2.3 Storm water management facilities and drainage systems: Outfall from a storm water management facility or storm water drainage system	1	WHPA-B WHPA-ICA
2.5 Wastewater collection facilities and associated parts: Sanitary sewers	1	WHPA-B WHPA-ICA
3.1 Application of agricultural source material (ASM) to land	1	WHPA-A WHPA-B WHPA-ICA
4.1 Storage of agricultural source material (ASM)	1	WHPA-B WHPA-ICA
7.1 Handling and storage of non-agricultural source material (NASM)	1	WHPA-B WHPA-ICA
9.1 Handling and storage of commercial fertilizer	1	WHPA-B WHPA-ICA
10.1 Application of pesticide to land	1	WHPA-A WHPA-B
11.1 Handling and storage of a pesticide	1	WHPA-B
12.1 Application of road salt	35	WHPA-A WHPA-B
13.1 Handling and storage of road salt – exposed to precipitation or runoff	27	WHPA-A WHPA-B

Threat Subcategory[1]	Number of Activities	Vulnerable Area
13.2 Handling and storage of road salt – potentially exposed to precipitation or runoff	27	WHPA-A WHPA-B
15.1 Handling and storage of fuel	4	WHPA-A WHPA-B
16.1 Handling and storage of a dense non-aqueous phase liquid (DNAPL)	2	WHPA-A
17.1 Handling and storage of an organic solvent	33	WHPA-A WHPA-B
22.1 Conveyance of a liquid hydrocarbon by a pipeline	1	WHPA-A WHPA-B
Total Number of Activities	**144**	
Total Number of Conditions	**2**	
Total Number of Properties	**47**	

[1] Threats enumerated according to the 2021 Technical Rules (MECP, 2021)

Note: Certain types of incidental activities on residential properties may constitute significant drinking water threats but are not enumerated. These threats include the application of commercial fertilizer and pesticides; the handling and storage of organic solvents and dense non-aqueous phase liquids; the storage of fuel (e.g., heating fuel tanks) in natural gas serviced areas; and the handling and storage of road salt that may be exposed or potentially exposed to precipitation or runoff.

Table 13-12: St. George Bedrock Well Supply Significant Drinking Water Quality Threats (current to September 2024)

Threat Subcategory[1]	Number of Activities	Vulnerable Area
1.1 Disposal of hauled sewage to land	6	WHPA-A WHPA-B
1.2 Application of processed organic waste to land	8	WHPA-A WHPA-B
2.2 Onsite sewage works	13	WHPA-A WHPA-B
3.1 Application of agricultural source material (ASM) to land	7	WHPA-A WHPA-B
4.1 Storage of agricultural source material (ASM)	4	WHPA-B
6.1 Application of non-agricultural source material (NASM) to land	7	WHPA-A WHPA-B
7.1 Handling and storage of non-agricultural source material (NASM)	4	WHPA-B
8.1 Application of commercial fertilizer to land	7	WHPA-A WHPA-B
9.1 Handling and storage of commercial fertilizer	4	WHPA-B
10.1 Application of pesticide to land	7	WHPA-A WHPA-B
11.1 Handling and storage of a pesticide	4	WHPA-B
15.1 Handling and storage of fuel	5	WHPA-A WHPA-B
17.1 Handling and storage of an organic solvent	10	WHPA-A WHPA-B
21.1 Agricultural source material (ASM) generation – livestock grazing or pasturing	2	WHPA-B
21.2 Agricultural source material (ASM) generation – outdoor confinement area (OCA) or farm animal yard	2	WHPA-B
Total Number of Activities	**90**	
Total Number of Properties	**17**	

[1] Threats enumerated according to the 2021 Technical Rules (MECP, 2021)

Note: Certain types of incidental activities on residential properties may constitute significant drinking water threats but are not enumerated. These threats include the application of commercial fertilizer and pesticides; the handling and storage of organic solvents and dense non-aqueous phase liquids; the storage of fuel (e.g., heating fuel tanks) in natural gas serviced areas; and the handling and storage of road salt that may be exposed or potentially exposed to precipitation or runoff

Table 13-13: Bethel Road Well Supply Significant Drinking Water Quality Threats (current to September 2024)

Threat Subcategory[1]	Number of Activities	Vulnerable Area
1.12 Storage of subject waste at a waste generation facility: site requires generator registration under Section 3 of O. Reg. 347	1	WHPA-A
1.13 Storage of waste at a waste generation facility: site that is exempt or excluded from generator registration requirements	1	WHPA-A
2.1 Industrial effluent discharges	4	WHPA-A WHPA-B WHPA-ICA
2.2 Onsite sewage works	13	WHPA-A WHPA-B
2.3 Storm water management facilities and drainage systems: Outfall from a storm water management facility or storm water drainage system	1	WHPA-B WHPA-ICA
2.4 Storm water management facilities and drainage systems: Storm water infiltration facility	1	WHPA-B WHPA-ICA
2.5 Wastewater collection facilities and associated parts: Sanitary sewers	1	WHPA-A WHPA-B
2.7 Wastewater collection facilities and associated parts: Sewage pumping station or lift station wet well, a holding tank or a tunnel	1	WHPA-A
2.8 Wastewater treatment facilities and associated parts	1	WHPA-A
3.1 Application of agricultural source material (ASM) to land	2	WHPA-B
4.1 Storage of agricultural source material (ASM)	2	WHPA-B
7.1 Handling and storage of non-agricultural source material (NASM)	2	WHPA-B
9.1 Handling and storage of commercial fertilizer	2	WHPA-B
10.1 Application of pesticide to land	2	WHPA-B

Threat Subcategory[1]	Number of Activities	Vulnerable Area
11.1 Handling and storage of a pesticide	2	WHPA-B
12.1 Application of road salt	1	WHPA-B WHPA-ICA
13.1 Handling and storage of road salt – exposed to precipitation or runoff	11	WHPA-A WHPA-B WHPA-ICA
13.2 Handling and storage of road salt – potentially exposed to precipitation or runoff	16	WHPA-A WHPA-B WHPA-ICA
14.1 Storage of snow on a site	13	WHPA-A WHPA-B WHPA-ICA
15.1 Handling and storage of fuel	4	WHPA-A WHPA-B
16.1 Handling and storage of a dense non-aqueous phase liquid (DNAPL)	2	WHPA-A WHPA-B
17.1 Handling and storage of an organic solvent	14	WHPA-A WHPA-B
21.2 Agricultural source material (ASM) generation – outdoor confinement area (OCA) or farm animal yard	1	WHPA-B
Total Number of Activities	**98**	
Total Number of Properties	**28**	

[1] Threats enumerated according to the 2021 Technical Rules (MECP, 2021)

Note: Certain types of incidental activities on residential properties may constitute significant drinking water threats but are not enumerated. These threats include the application of commercial fertilizer and pesticides; the handling and storage of organic solvents and dense non-aqueous phase liquids; the storage of fuel (e.g., heating fuel tanks) in natural gas serviced areas; and the handling and storage of road salt that may be exposed or potentially exposed to precipitation or runoff.

13.6.2 Paris North (Telfer and Gilbert) WHPAs

The original threats enumeration was compiled using data from various sources. Following preliminary research, field assessments were completed to verify and complete the threats enumeration process. As a conservative measure, no effort to include the impact of management techniques that may be employed at any threat location was considered. It can therefore be concluded that the level of uncertainty associated with this enumeration is high.

A drive-by roadside inspection of the WHPAs on January 25, 2011 was completed to verify and complement the dataset compiled during the records review portion of the assessment. The inspection consisted of a fence line/roadside documentation of the properties and their land uses included in the WHPA.

An update to the significant threats assessment was completed in 2013-2014 based on updated aerial photography, slightly revised WHPAs, and limited windshield surveys. This enumeration was completed according to the 2009 Technical Rules (MOE, 2009b). Threats were re-enumerated in 2024 to align with the 2021 Technical Rules (MECP, 2021).

All activities that may contribute to an identified Issue located within the Issue Contributing Area (WHPA-ICA) are significant drinking water threats and are included in the table below. **Table 13-14** summarizes the significant threats for the Paris North Well Supply.

Table 13-14 Paris North Well Supply Significant Drinking Water Quality Threats (current to September 2024)

Threat Subcategory[1]	Number of Activities	Vulnerable Area
1.1 Disposal of hauled sewage to land	13	WHPA-A WHPA-B WHPA-ICA
1.2 Application of processed organic waste to land	15	WHPA-B WHPA-ICA
1.12 Storage of subject waste at a waste generation facility: site requires generator registration under Section 3 of O. Reg. 347	4	WHPA-B
1.13 Storage of waste at a waste generation facility: site that is exempt or excluded from generator registration requirements	4	WHPA-B
2.1 Industrial effluent discharges	6	WHPA-B WHPA-ICA
2.2 Onsite sewage works	26	WHPA-A WHPA-B WHPA-ICA
2.3 Storm water management facilities and drainage systems: Outfall from a storm water management facility or storm water drainage system	1	WHPA-B WHPA-ICA
2.4 Storm water management facilities and drainage systems: Storm water infiltration facility	1	WHPA-B WHPA-ICA

Threat Subcategory[1]	Number of Activities	Vulnerable Area
2.5 Wastewater collection facilities and associated parts: Sanitary sewers	1	WHPA-B WHPA-ICA
3.1 Application of agricultural source material (ASM) to land	21	WHPA-A WHPA-B WHPA-ICA
4.1 Storage of agricultural source material (ASM)	7	WHPA-A WHPA-B WHPA-ICA
6.1 Application of non-agricultural source material (NASM) to land	16	WHPA-B WHPA-ICA
7.1 Handling and storage of non-agricultural source material (NASM)	7	WHPA-A WHPA-B WHPA-ICA
8.1 Application of commercial fertilizer to land	16	WHPA-B WHPA-ICA
9.1 Handling and storage of commercial fertilizer	6	WHPA-A WHPA-B WHPA-ICA
10.1 Application of pesticide to land	18	WHPA-A WHPA-B
11.1 Handling and storage of a pesticide	7	WHPA-A WHPA-B
12.1 Application of road salt	12	WHPA-B
13.1 Handling and storage of road salt – exposed to precipitation or runoff	21	WHPA-A WHPA-B
13.2 Handling and storage of road salt – potentially exposed to precipitation or runoff	21	WHPA-A WHPA-B
14.1 Storage of snow on a site	1	WHPA-B
15.1 Handling and storage of fuel	10	WHPA-A WHPA-B
16.1 Handling and storage of a dense non-aqueous phase liquid (DNAPL)	2	WHPA-B WHPA-C
17.1 Handling and storage of an organic solvent	38	WHPA-A WHPA-B

Threat Subcategory[1]	Number of Activities	Vulnerable Area
21.1 Agricultural source material (ASM) generation – livestock grazing or pasturing	3	WHPA-B WHPA-ICA
21.2 Agricultural source material (ASM) generation – outdoor confinement area (OCA) or farm animal yard	3	WHPA-B WHPA-ICA
Total Number of Activities	**280**	
Total Number of Properties	**60**	

[1] Threats enumerated according to the 2021 Technical Rules (MECP, 2021)

Note: Certain types of incidental activities on residential properties may constitute significant drinking water threats but are not enumerated. These threats include the application of commercial fertilizer and pesticides; the handling and storage of organic solvents and dense non-aqueous phase liquids; the storage of fuel (e.g., heating fuel tanks) in natural gas serviced areas; and the handling and storage of road salt that may be exposed or potentially exposed to precipitation or runoff.