

10. ROSEHILL, FORT ERIE WATER TREATMENT PLANT

The Rosehill Water Treatment Plant (WTP) is located in Fort Erie, Ontario and provides treated drinking water to the Town of Fort Erie. With a total capacity of 50 million litres per day, the plant services a population of approximately 27,000. The Rosehill WTP receives raw water from Lake Erie via an intake pipe that is located over 450 m from the shore and approximately 2.7 m deep. A map showing the local setting of the Rosehill WTP and its intake is shown in Figure 10.1.

A surface water vulnerable area and water quality threats assessment has been completed for the Rosehill WTP intake. The methodology used for this assessment is described in Chapter 5 and specific results are outlined in Sections 10.1 through 10.7. Data sources used for each task are listed in Appendix B.

10.1 Classification of Intake

The Rosehill WTP draws raw water from Lake Erie. Therefore, the Rosehill WTP intake is classified as **Type A – Great Lake**.

TR 55 TR 1(1)

10.2 Delineation of Surface Water Intake Protection Zones

The following sections describe the delineation of the primary (IPZ-1) and secondary (IPZ-2) Intake Protection Zones.

10.2.1 Primary Zone (IPZ-1) Delineation

The IPZ-1 (Figure 10.2) for the Rosehill WTP was delineated in accordance with the TR. The resulting IPZ-1 is a circle centred on the intake crib with a radius of 1,000 m. Where IPZ-1 touches land, a setback distance of 120 m or the area of the Conservation Authority Regulation Limit was applied.

TR 61-64

10.2.2 Secondary Zone (IPZ-2) Delineation

The IPZ-2 (Figure 10.2) for the Rosehill WTP was delineated in three components: in-water, upland, and up-tributary. The development of each of these components is described in further detail below.

10.2.2.1 In-water

The in-water component was established using a 2-Dimensional Horizontal (2-DH) Advanced Circulation Model (ADCIRC) which provided inputs for a refined 3-dimensional (3D) ADCIRC model along with Acoustic Doppler Current Profiler (ADCP) deployment data (2007), 10-year return period inputs and a 2-hour Time Of Travel (TOT) factor. The lakewide ADCIRC model used Port Colborne wind conditions and design winds for the eight (8) primary compass directions (HCCL, 2008b and 2009).

Simulations were performed for three events of combined 10-year design winds and waves: (i) winds from SW with 5.7 m, 10s waves from N240E, (ii) winds from S with 2.4 m, 7s waves from N180E, and (iii) winds from E with 2.0 m, 5s waves from N90E.

The results of the in-water modelling are shown in Figure 10.3. As can be observed from Figure 10.3, with a 2-hour TOT, the in-water IPZ-2 for the Rosehill WTP generally extends alongshore 8,500 m west, 2,450 m east and 2,850 m offshore, at its furthest extent.

TR 65-66

10.2.2.2 Upland – Transport Pathways

Where the IPZ-2 touches land and is not impacted by watercourses and/or drains, it was generally extended inland 120 m as this was typically greater than the area of the Conservation Authority Regulation Limit. Where the in-water IPZ-2 was impacted by watercourses and/or drains appropriate upland delineations were applied, as described below.

As required by the TR, any storm sewershed that could contribute water to the intake within the modelled TOT (2-hours), must be included as part of IPZ-2. Therefore, the upland portion of the IPZ-2 includes the following three storm sewer catchment areas:

- Crystal Beach;
- Thunder Bay; and
- Crescent Park.

These catchment areas are assumed to have 13 outfalls within the IPZ-2 and were included in the upland delineation in their entirety, as illustrated in Figure 10.4. The catchment extents were identified in concert with Town of Fort Erie staff from a consideration of land elevation, the storm sewer network and reports provided by NPCA (Marshall, Macklin, Monaghan, 1998).

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) tile drained area data (OMAFRA, 2009a) were reviewed and it was determined that no tile drains exist along the extents of watercourses delineated in the up-tributary analysis, or along the shoreline. Therefore tile drained areas were not included in the upland delineation.

TR 65(2)

10.2.2.3 Up-Tributary

The following watercourses discharge within Rosehill’s IPZ-2 (Figure 10.3):

Unnamed Drain 1	Unnamed Drain 2	Thunder Bay Drain	Six Mile Creek Br.1
Six Mile Creek Br. 2	Windmill Point Drain	Unnamed Drain 3	Unnamed Drain 4
Bertie Bay Drain	Unnamed Drain	Hollister Drain	Unnamed Drain
Kraft Drain			

Cross sections were surveyed for the Thunder Bay Drain and the Kraft Drain (Chambers and Associates, 2009). Cross sectional data for the Six Mile Creek were provided in a watershed hydrology study (Marshal Macklin Monaghan, 1989). Using the information gathered, an average of the bankfull (1:2 year flow) velocity (0.8 m/s) was calculated and assumed for the remaining watercourses within the study area for which information was unavailable. Using velocity and residual TOTs, the up-tributary distances for the watercourses were calculated. Where the calculated up-tributary extent exceeded the actual length of the watercourse the delineation was terminated at the headwaters with a circular cap radius of 120 m. The 120 m watercourse setback was applied to the upland extent however, where the area of the Conservation Authority Regulation Limit was greater, the IPZ-2 was extended to that limit. Where the topography or subwatershed boundaries indicated that overland flow traveled away from the watercourse, the 120 m watercourse setback was truncated (refer to Figure 10.2).

TR 72-75

10.3 Assignment of Vulnerability Scores

As described in Section 5.3, a vulnerability score must be determined for each IPZ to represent the susceptibility of the intake to contaminants. The vulnerability score is calculated using the area and source vulnerability factors using the methodology described in Section 5.3.

TR 8(2), 9(1)(c)(iv), 86-96

10.3.1 Area Vulnerability Factor

The TR prescribe an IPZ-1 area vulnerability factor of 10 for all intake types. Therefore, the IPZ-1 area vulnerability factor for Rosehill is 10. In the case of IPZ-2, the TR require that the area vulnerability factor be not less than 7 and not more than 9 (refer to Table 5.3).

TR 88-89

An area vulnerability factor of 8 was determined for the Rosehill IPZ-2 as summarized in Table 10.1.

Table 10.1: Rosehill WTP IPZ-2 Area Vulnerability Factor		
Factor	Description	Supports an Area Vulnerability Factor of :
Percent Land	<ul style="list-style-type: none"> • 49% of the IPZ-2 is land 	Moderate
Land Characteristics	<ul style="list-style-type: none"> • Poorly drained soils • Approximately 47% impervious surface • Overland slopes <1% 	Moderate
Transport Pathways	<ul style="list-style-type: none"> • 13 storm sewer outfalls • 11 municipal drains • One watercourse 	High
Overall Area Vulnerability Factor		Moderate (=8)

10.3.2 Source Vulnerability Factor

The source vulnerability factor is based on intake properties. The TR require that the source vulnerability factor be between 0.5 to 0.7 for Type A intakes (refer to Table 5.3).

TR 95

A source vulnerability factor of 0.7 was determined for the Rosehill intake as summarized in Table 10.2.

Table 10.2: Rosehill WTP Source Vulnerability Factor		
Factor	Description	Supports a Source Vulnerability Factor of :
Depth of intake	2.7 m depth below water surface	High
Distance of intake from land	Located 457 m from shoreline and is within the wave breaking zone	High
Historical raw water quality concerns	Excellent historical raw water quality recorded at intake	Low
Overall Source Vulnerability Factor		High (=0.7)

10.3.3 Overall Vulnerability Scores

The calculated vulnerability score was determined to be 7.0 for IPZ-1 and 5.6 for IPZ-2. These results are summarized in Table 10.3.

Table 10.3: Rosehill WTP Vulnerability Score Summary					
Intake Type	Area Vulnerability Factor (V_{f,a})		Source Vulnerability Factor (V_{f,s})	Vulnerability Score (V)	
	IPZ-1	IPZ-2		IPZ-1	IPZ-2
Type A	10	8	0.7	10 x 0.7 = 7.0	8 x 0.7 = 5.6

10.4 Identification of Threats

Surface water quality threats are defined as activities or conditions that pose a potential risk to source water quality. Threats may be identified by an activity or condition. An activity is a land use; for example the storage, application or discharge of a substance including chemicals and pathogens. A condition is an existing situation as a result of a past activity; for example, contaminated sediment.

The TR require consideration of the following activities and conditions:

- Activities that are prescribed as drinking water threats in O.Reg. 287/07,
- Non-prescribed, locally based activities, and
- Conditions resulting from past land use activities.

Each of the above were evaluated and described in detail in Sections 10.4.1 through 10.4.3, respectively.

10.4.1 Prescribed Activities

Section 5.4.1 lists the activities that are prescribed as drinking water threats for a vulnerable area in paragraphs 1 through 18 and paragraph 21 of subsection 1.1(1) of O.Reg. 287/07.

TR 7(3), 118

To determine the number of activities that constitute significant, moderate or low drinking water threats (if they were to occur) within the Rosehill IPZs, the Tables of Drinking Water Threats (TDWT) were truncated by vulnerability score, as described in Section 5.4.1. Table 10.4 provides Appendix reference numbers for the Provincial Tables of Circumstances corresponding with significant, moderate and low threats for each IPZ (both chemical and pathogen).

IPZ	Vulnerability Score	Provincial Table Reference - Chemical Threats			Provincial Table Reference - Pathogen Threats		
		Sig.	Mod.	Low	Sig.	Mod.	Low
1	7.0	--	Appendix C.7	Appendix C.12	--	Appendix C.21	Appendix C.26
2	5.6	--	--	Appendix C.14	--	--	Appendix C.28

There are no potential significant threats in Rosehill’s IPZ-1 and IPZ-2 because of the low vulnerability scores.

TR 118.1

Figure 10.5 illustrates areas where activities are or would be significant, moderate or low drinking water quality threats. This figure should be viewed in conjunction with the appendices referenced in Table 10.4 to determine specific activities within an IPZ that would be significant, moderate or low drinking water quality threats. For example, if one wants to determine activities that would be moderate threats within Rosehill’s IPZ-1, one should reference Appendices C.7 and C.21.

TR 8(4), 9(1)(c)(ix), 127-129, 132-137

10.4.2 Non-Prescribed Activities

The NPSPC has included additional (locally based) activities other than those already identified as prescribed threats (Section 5.4.2).

Transportation threats were enumerated by cross-referencing the intake zone vulnerability scores with Table 1 (Appendix E, MOE letter May, 2011) and then identifying roads, railways and marine transport pathways within the IPZ where these transport corridors could be threats (Stantec Consulting Limited, 2010).

Table 10.5: Rosehill WTP Reference for Non-Prescribed (Transportation) Activities

IPZ	Vulnerability Score	Appendix E - Chemical Threats			Appendix E - Pathogen Threats		
		Sig.	Moderate	Low	Sig.	Moderate	Low
1	7.0	--	--	Table 1	--	Table 1	Table 1
2	5.6	--	--		--	--	

TR 7(3), 119-122, 125

10.4.3 Conditions

The TR state that conditions may exist in a vulnerable area if the presence of a single mass of more than 100 litres of dense non-aqueous phase liquids occurs in the surface water of an IPZ and/or if there is the presence of a contaminant in the surface soil or sediment.

TR 126

Sediment data were available from an Environmental Canada Report (Dove et al., 2003) for the Kraft Drain and Thunder Bay Creek which discharge into the Rosehill IPZ-2. The data in this report were compared with the Table 4 Soil Standards (MOE, 2008b). Based on this analysis, no parameters were present at concentrations exceeding the soil standard and are therefore there are no conditions.

As described in Section 5.4.3, a condition is determined to represent a significant threat if it has a risk score greater than 80, a moderate threat for scores between 60 and 80 and a low threat for scores between 40 and 60. A condition is also considered significant if it is associated with a drinking water quality issue or if there is evidence that it may be causing off-site contamination.

The following contaminated sites registries were also reviewed to assist with further identification of conditions within the WTP vulnerable area:

- Provincial Brownfield Sites Registry (MOE, 2009c);
- Federal Contaminated Sites Inventory (TBCS, 2009);
- MOE IPZ-1 Threats Database for Niagara Region (MOE, 2009d);
- MOE Spills Database for Niagara Region (WHI, 2005);
- Brownfield site GIS layer (NPCA, 2009c); and
- Closed landfill GIS layer (WHI, 2005).

After reviewing the available data sources listed above, no conditions were identified that result from past activities.

The collection of additional soil and sediment data is noted as a future consideration in Section 5.9.

TR 7(4), 9(3)(c), 126, 139

10.5 Enumeration/Listing of Existing Threats

The TR require the enumeration of locations at which:

- A person is engaging in an activity that is or would be a significant threat; and
- A condition resulting from a past activity is a significant drinking water threat.

TR 9(1)(e) and (f)

Existing moderate threats have also been enumerated as these may be addressed in the Source Protection Plan. Enumeration of each of these threat types is described in further detail in Sections 10.5.1 and 10.5.2.

10.5.1 Activities

As described in Section 5.5, land use information and other data were obtained from various sources and compared with threat circumstances from the TDWT to determine existing threats within each IPZ.

For this analysis, existing threats are defined as activities that could occur because infrastructure is in place. For example if there are two livestock enterprises in operation and a third has an empty barn with no livestock, then three livestock enterprises are counted because the third barn could have livestock brought in the next day.

With low vulnerability scores of 7.0 and 5.6, no activities representing significant drinking water treats exist within Rosehill’s IPZ-1 or IPZ-2, respectively.

There were two (2) moderate threat activities identified in total as shown below in Table 10.6.

Table 10.6: Enumeration of Locations At Which A Person is Engaging in An Activity That is Or Would Be A Moderate Threat		
Threat Category	TDWT Circumstances	Number - Count
Rosehill IPZ-1		
2. The establishment, operation or maintenance of a system that collected, stores, transmits, treats or disposes of sewage	568-630	2

The number count per TDWT circumstance indicates the number of parcels within the IPZ for which these activities or the potential for this activities has been identified. There are two parcels identified within the IPZ-1 for each of these moderate TDWT circumstances. These circumstances refer to the operation and/or maintenance of a system that:

- discharges to surface water and has as its primary function the collection, transmission or treatment of industrial sewage;
- is part of a facility for which National Pollutant Release Inventory (NPRI) reporting is required; and
- The discharge may results in the presence of arsenic or one or more of its compounds containing arsenic in surface water.

For additional explanations of individual circumstances please refer to the appropriate Provincial Table of Circumstances in Appendix C (refer to Table 10.4).

10.5.2 Conditions

As described in Section 10.4.3, no conditions were identified that result from past activities. Therefore, no conditions represent a significant drinking water threat.

10.5.3 Non-Prescribed Activities

Two transportation corridor roadway threats were identified as moderate pathogen threats in the Rosehill IPZ-1 (Figure 10.6), transportation of:

- Agricultural source material; and
- Non-agricultural source material (sewage biosolids).

10.6 Evaluation of Drinking Water Quality Issues

To determine if any drinking water issues exist, the methodology described in Section 5.6 was applied for the Rosehill WTP raw water quality data.

1. Collect raw water quality data

Drinking Water Information System (DWIS) data for the years 2003-2008 and Drinking Water Surveillance Program (DWSP) data for the years 1990-2007 was collected from the MOE for the Rosehill WTP intake.

2. Establish issues benchmarks

Issues benchmarks established by the NPSPC are listed in Table 5.7.

3. Identify “parameters of interest”

As described in Section 5.6, parameters of interest are those that consistently measure above 10% of their regulatory criteria and often above 25%. The following parameters of interest were identified for the Rosehill WTP intake:

- Aluminum;
- Colour;
- Hardness;
- Iron;
- Organic nitrogen;
- pH;
- Temperature; and
- Turbidity.

4. Identify “potential water quality issues”

Parameters of interest were plotted and analyzed to determine if they were regularly present at their benchmark values and/or trending upwards toward their benchmarks. Based on an analysis of the above parameters of interest, only four non health related potential water quality issues were identified for the Rosehill WTP vulnerable area. pH was identified based upon an upward trend approaching the drinking water quality issue benchmark (Table 5.7). Turbidity was identified because of several values above the benchmark and an increasing trend. Hardness and organic nitrogen were also identified as potential water quality issues because of consistent concentrations above the benchmark.

5. Identify “issues”

The potential water quality issues were further evaluated to determine if they are directly related to human health considerations and/or can be attributed to artificial source(s). It was found that none of the potential water quality issues are directly related to human health considerations. Furthermore, pH, turbidity and hardness have been attributed to naturally occurring processes and characteristics. For these reasons, pH, turbidity and hardness are not considered drinking water quality issues.

In the case of organic nitrogen, the information available does not clearly indicate an absolute source(s) and therefore further investigation should be undertaken. Information related to the source(s) of organic nitrogen is identified as an item for future consideration in Section 5.9.

In summary, no water quality issues were identified for the Rosehill WTP IPZs. The high quality of raw water received at the Rosehill WTP combined with its diligent operation ensures a safe supply of treated drinking water.

TR 6, 9(1)(c)(xii),
114-115, 131, 134.1

10.7 Evaluation of Uncertainty

The TR require a description of every uncertainty analysis conducted as part of the surface water quality assessment.

TR 9(2)(f), 13-14

Descriptions of the sources of uncertainty considered for each major task are outlined in Table 10.7. As indicated in Table 10.7, the overall level of uncertainty for the Rosehill WTP surface water vulnerability assessment is low.

Table 10.7: Evaluation of Sources of Uncertainty for Rosehill WTP		
Task	Description of Uncertainty	Uncertainty
Section 10.1: Classification of Intake		
Intake classification	The TR prescribe Lake Erie to be a Great Lake.	Low
Section 10.2: Delineation of IPZs		
IPZ-1 Delineation	Dimensions for the IPZ-1 delineation are prescribed by the TR. Abutted shore setbacks were determined using the topographic surface and area of the Conservation Authority Regulation Limit both of which were provided by the NPCA and have low uncertainty associated with the accuracy of the information.	Low
IPZ-2 Delineation	Data acquired for modelling was of sufficient quality to conceptualize the in-water IPZ-2. However available data were insufficient for a rigorous calibration and verification therefore as a future consideration more work is required to fully understand physical processes in Lake Erie.	High
Section 10.3: Assignment of Vulnerability Scores		
Vulnerability Scores	Data contributing to the area and source vulnerability factors are from reliable provincial and federal monitoring programs, Niagara Region Water Operations staff, and Town of Fort Erie staff.	Low
Section 10.5: Enumeration/Listing of Existing Threats		
Identification of Land Use Activities	The data used to find specific parcels were provided by government resources and were of a sufficient quality. Multiple resources were used to identify the land use activities present on parcels within the vulnerable areas. The	Low

Table 10.7: Evaluation of Sources of Uncertainty for Rosehill WTP		
Task	Description of Uncertainty	Uncertainty
	quality and quantity of these resources was also sufficient.	
Section 10.6: Evaluation of Issues		
Issues Evaluation	The issues evaluation was based upon raw water quality data provided by the MOE. The data spanned 17 years; however, the frequency of sampling for each parameter varied. The methodology was tailored to suit the quality and quantity of available data and was appropriate for the issues evaluation.	Low