Appendix A - Groundwater Model Development - Trout Creek

1.0 BACKGROUND

The town of Trout Creek (part of the Municipality of Powassan) relies on groundwater supplies for the residents, and given the concentration of water wells in the central area of the townsite, these supplies are considered to be "well clusters" (i.e. a large number of low yield wells clustered in one geographical area). No precise definition of a well cluster has been made (by the Ministry of the Environment) in the current legislation, although under the Clean Water Act (2006) a provision has been made to consider certain groundwater systems as Type 2 groundwater systems if they comprise (and service) 6 or more residential units on a single well (or multiple wells).

For Trout Creek, the number of wells in the local area well cluster is interpreted to exceed 130 wells. Figure A1 presents the known distribution of water wells in the townsite area, based on the available Ministry of the Environment water well records.

A 1983 study by Northland Engineering Limited identified that, of 181 water supplies canvassed in the study, 63 % were shallow overburden (dug) wells, 36 % were deeper drilled wells and 1 % were surface water spring supplies. The water quality in the dug wells was identified as having several exceedences of the Provincial drinking water quality criteria, including nitrates and dissolved organic carbon, which suggested impacts due to chemical loadings from the on-site sewage systems in Trout Creek (Northland Engineering Limited, 1983).

The 1983 study recommended the drilling of new well installations, and the proper abandonment of any wells no longer in use. Also identified in the study report was the constraints placed upon the siting of new wells in relation to on-site septic systems, due to the relatively small lot sizes established in the townsite area. As well, seasonal high water table conditions were identified across the study area.

Based on out review of the water well database, and records held in the Ministry of the Environment's Technical Support Section (Sudbury), following the release of the Northland Engineering Limited report, many new drilled wells were constructed (i.e. in 1984) in the Trout Creek area. These wells were typically extended through a thick silty clay unit to be completed in either the bedrock (as bedrock well constructions) or were terminated in a sand and gravel layer immediately above the bedrock surface. These constructions were in keeping with the recommendations of the Northland Engineering Limited report's recommendations to avoid use of the shallow aquifer (due to water quality concerns).

Unfortunately, the 1984-era well records did not always contain sufficient information on the pumping tests conducted at the time of drilling, and in many cases, test information was lacking completely. Therefore, in the present study, a review of all of the available

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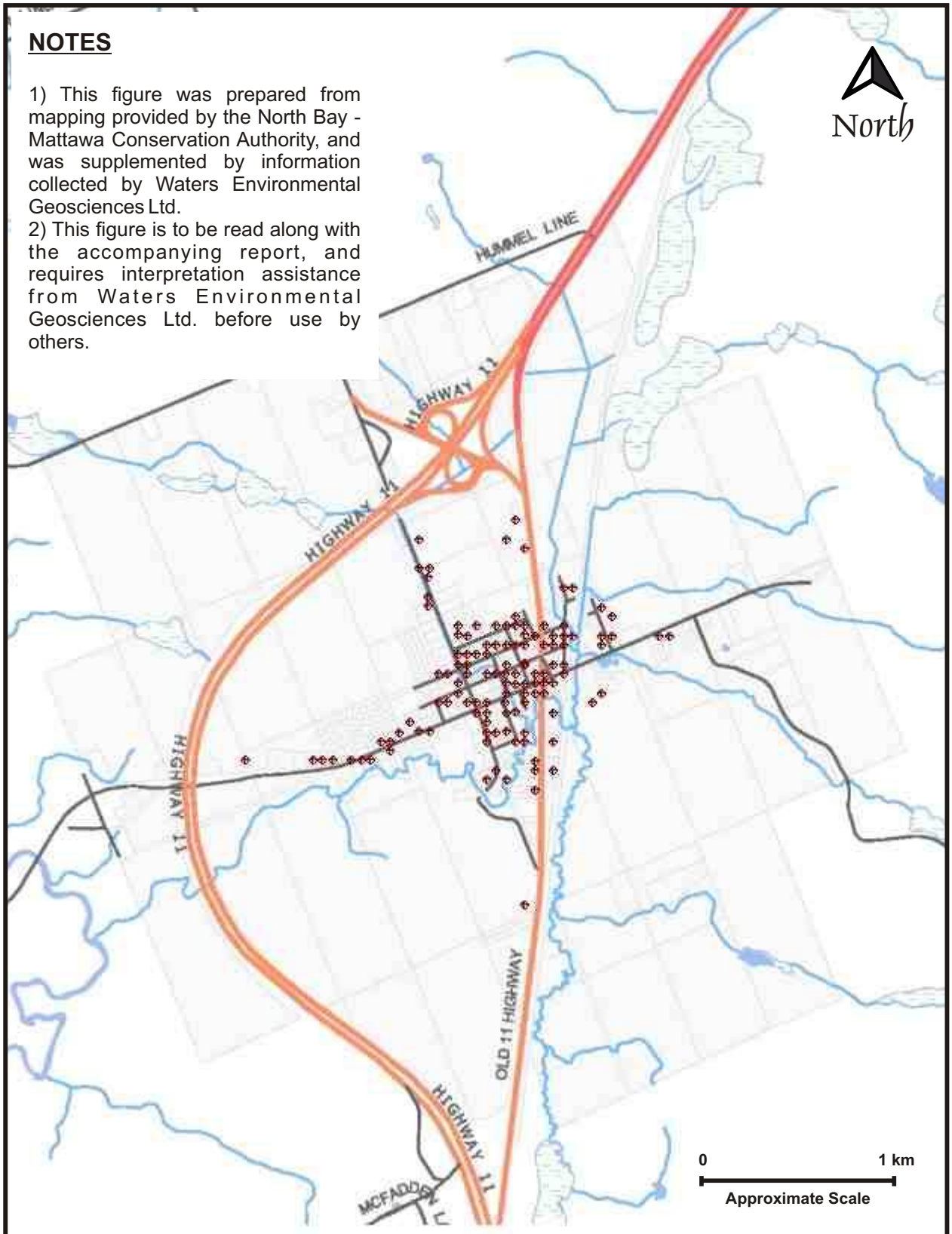


Figure A1	**Water Well Locations**	**Project Number 29- 216**
		Date : March, 2010
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

information was undertaken to determine the soil and bedrock properties which would assist with the development of a representative groundwater model for Trout Creek. These data sources are referenced in the main body of this report.

2.0 CONCEPTUAL MODEL DEVELOPMENT

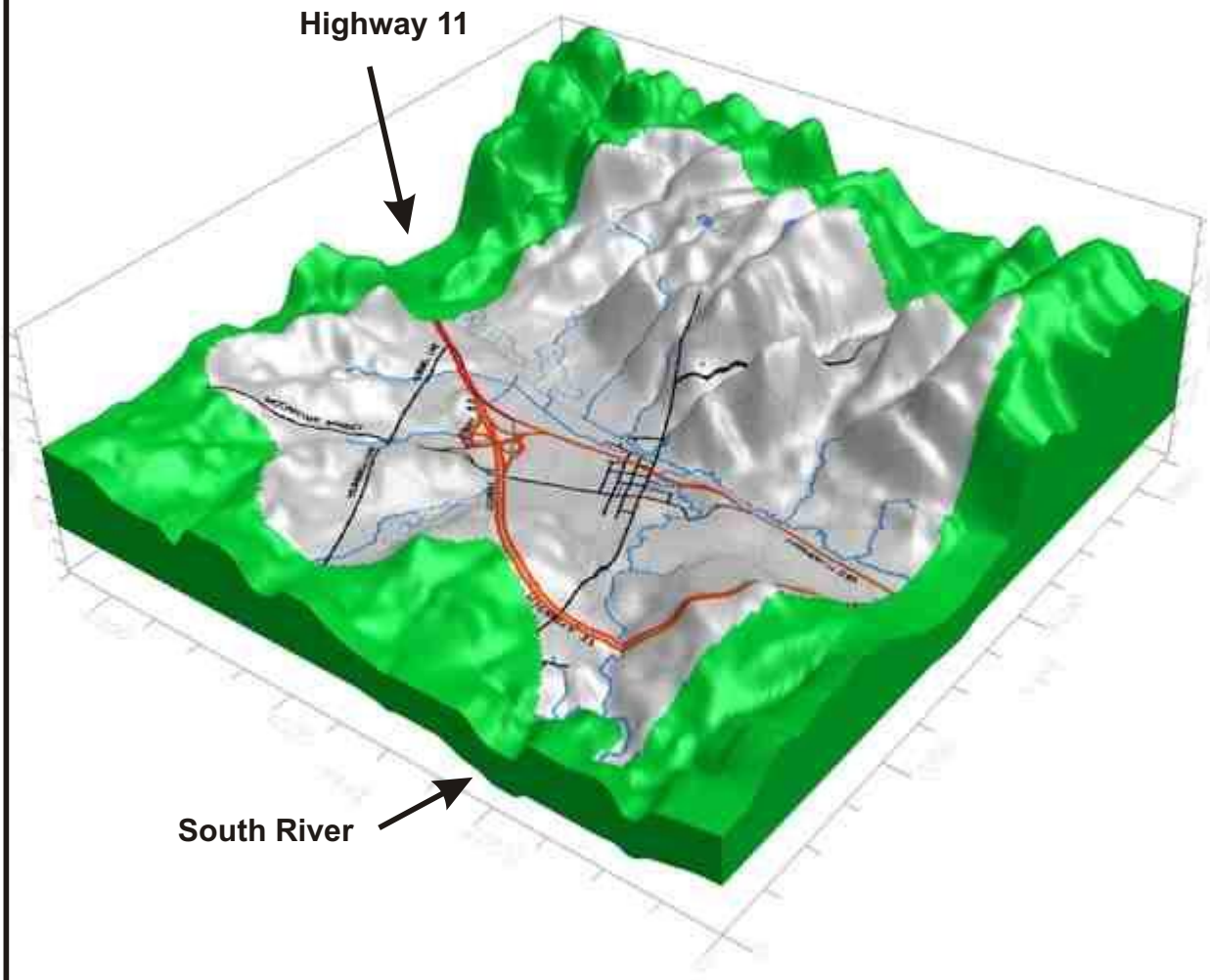
Trout Creek is situated in a flat-lying area bounded by significant topographic highlands to the east, and more subdued highland areas to the north, west and south (Figure A2). The available topographic mapping and digital elevation (DEM) databases (obtained from GeoBase.ca) were used to define the boundaries of the sub-watershed that encloses the Trout Creek townsite area. Care was taken to insure that a representative contributing area was delineated, without making the boundaries of the study area excessively large. Areas considered to be outside of the sub-watershed are shaded green in Figure A2.

The sub-watershed defined in Figure A2 was set as the outer model boundaries for the groundwater modelling part of the present study. South River, which is present in the bottom of the oblique view of Figure A2, is the discharge area for all flow within the study boundaries, including both surficial drainage and groundwater discharge.

Based on information contained in the water well records and geotechnical borehole information, the typical subsurface conditions in the well cluster area consist of between 2 m and 6 m of sandy outwash material, overlying approximately 20 m of silty clay, which overlies approximately 3 m of sand and gravel till, which in turn overlies bedrock. The surficial drainage features are interpreted to be underlain by silty alluvium deposits, which were encountered in geotechnical boreholes advanced for a creek crossing on the Highway 11 by-pass.

The subsurface geology of Trout Creek can therefore be approximated by these five units. The surficial sandy outwash comprises an upper unconfined aquifer, while the sand and gravel till and bedrock zone comprise a lower confined aquifer. In the immediate vicinity of the surficial drainage courses, it is interpreted that the surficial materials comprise silty alluvium to the depth of the underlying sand and gravel till. The silty clay zone constitutes an aquitard that separates the two water producing zones, and thereby creates two separate groundwater regimes in Trout Creek. It is interpreted that the two groundwater systems eventually report to the South River, mainly via groundwater discharge to the un-named creek which passes through the central townsite area.

Input data required for the groundwater model included the hydraulic conductivities of the various hydrostratigraphic units. The hydraulic conductivity is a property of a geologic formation that is related to the ability of the material to allow water to move through it, and can be determined though either detailed pump testing of wells or by an examination of the composition and materials that make up the water bearing units in the subsurface.



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2) The oblique view is facing northeast.
3) Areas outside of the model domain are coloured green.
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Figure A2	**Oblique View of Trout Creek**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

2.1 Bedrock Characterization

As indicated previously, the pump test information for the aquifers in Trout Creek is limited to the information contained in the water well records themselves. These records were reviewed in the present study, and an assessment of the bedrock aquifer hydraulic conductivity was made using the available data. In total, 25 records contained sufficient data to allow analysis of the apparent transmissivities of the bedrock formations, and the analysis was carried out following an iterative procedure using the Cooper-Jacob equation, as referenced in Fetter (2001). For this analysis, the bedrock storativity was assumed to be equal to 1×10^{-4} (dimensionless), typical of fractured rock aquifers and confined aquifer settings.

Of the 25 records reviewed, 10 records were from wells having diameters 127 mm or larger, with the remainder being 51 mm borehole wells. The small diameter wells were excluded from further analysis (due to concerns for non-representative water level measurement in the narrow casings), and the remaining transmissivity values were equated to an apparent hydraulic conductivity value by noting the saturated thickness of the formation at each well.

The apparent hydraulic conductivity values were plotted as a function of the depth of penetration into the bedrock, and a drop in hydraulic conductivity with increasing depth of penetration into the bedrock was noted (Figure A3). From this analysis, a sharp decrease in hydraulic conductivity of the bedrock with increasing penetration depth (from 0 m to 30 m) was noted, and it was interpreted that the uppermost (weathered) zone of the bedrock constitutes the most productive aquifer for the bedrock formation.

Regionally, the bedrock is mapped as felsic igneous rock of the Central Gneiss Belt (Ontario Geological Survey, 1991). The variation in hydraulic conductivity, on Figure A3, ranged from 2.6×10^{-5} cm/sec to 1.8×10^{-3} cm/sec, which is well within the range of fractured igneous and metamorphic rocks (Freeze and Cherry, 1979). This range is not considered low enough (or a great enough contrast to the aquifer hydraulic conductivity above it) to exclude the bedrock zone from being part of the modeled groundwater flow system beneath the townsite. Therefore, by this analysis, the groundwater model assumed a bedrock hydraulic conductivity value in the range of 2.6×10^{-5} cm/sec to 1.8×10^{-3} cm/sec.

By way of comparison, groundwater models in overburden aquifers typically consider the bedrock to be a no-flow boundary, and are usually excluded from the model. As reported in Harrison (1972), the local bedrock is characterized as being highly weathered in some areas, which may explain the higher hydraulic conductivity estimates calculated in the present analysis.

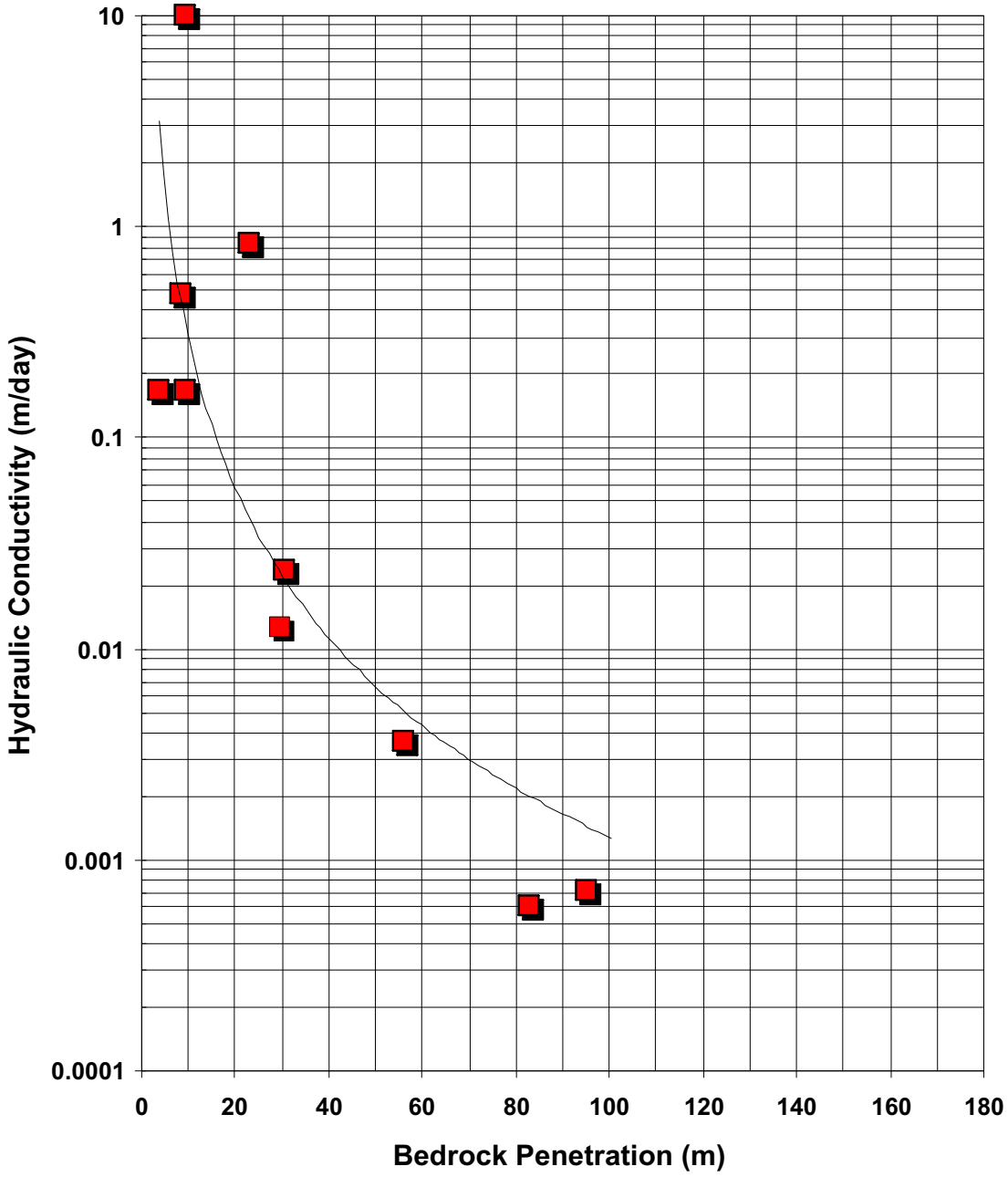

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Figure A3	**Bedrock Hydraulic Conductivity vs Penetration Depth**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

2.2 Overburden Characterization

2.2.1 Till Unit

The till unit is the oldest surficial geological unit in the Trout Creek area (related to the last glacial events approximately 10,000 years ago), and lies directly on the underlying bedrock, both at depth (i.e. beneath the silty clay zone) and at surface in areas of bedrock outcrop (usually along the flanks of the bedrock ridges and knobs). In some localized areas, erosion by subsequent glacial lake action may have removed portions of the till unit; however, it is reported consistently enough across the study area that it is interpreted to be a continuous unit (and was considered as such in the groundwater model development).

The composition of the till unit ranges from sand and gravels to a more silty sand and gravel deposit, consistent with a subaqueous depositional environment (Harrison, 1972). Several subsurface borehole investigations were carried out in the Trout Creek area, in support of highway re-alignment and by-pass constructions along the Highway 11 and Highway 522 corridors. As part of these geotechnical engineering studies, undertaken on behalf of the Ministry of Transportation, representative soil samples were obtained from various geologic strata, and these samples were subjected to detailed analysis.

Grainsize analyses of samples recovered during geotechnical drilling along the Highway 11 corridor and Highway 522 corridor indicate that the hydraulic conductivities of the till deposits range from 6.3×10^{-6} cm/sec to 1.4×10^{-2} cm/sec (by Hazen's method), giving a geometric mean value of 4.5×10^{-4} cm/sec (for a total of 10 samples tested).

These materials comprise the deep aquifer beneath Trout Creek, and for the purposes of the groundwater model development, an average thickness of 3 m has been assumed (based on the available typical unit thicknesses in boreholes and water well records). Along the flanks of bedrock knobs and the flanks of bedrock highland areas, the till unit is interpreted to rise to ground surface and thereby receives direct recharge from rainfall infiltration. Additional recharge to the till aquifer may come from the underlying bedrock formation, which itself receives direct recharge in the exposed bedrock knob and highland areas.

2.2.2 Silty Clay Unit

Above the sand and gravel till aquifer lies a sequence of overburden soils, the most significant of which is the lower permeability silty clay deposits. These materials are the result of glacial lake erosion and re-deposition of the original till deposits which covered the entire study area, and reflect deeper water deposits of fine grained clays and silts. Although the present discussion conceptualizes these materials as one geologic unit, due

to variations in deposition and erosion history, the silty clay unit has a variable composition, and in some places the soils become finer in grainsize when moving upwards through the stratigraphy (i.e. from the top of the aquifer upwards towards the ground surface).

Grainsize analyses of samples recovered during geotechnical drilling along the Highway 11 corridor and Highway 522 corridor indicate that the hydraulic conductivities of the silty clay deposits range from 6.4×10^{-7} cm/sec to 2.0×10^{-5} cm/sec (by Hazen's method), giving a geometric mean value of 4.8×10^{-6} cm/sec (for a total of 15 samples tested).

Compared to the underlying till, the silty clay is up to approximately 100 times less permeable than the underlying aquifer, and is considered to be an aquitard in the groundwater model development. These materials, where present, effectively cap the lower till aquifer, making it a confined aquifer and isolating the deeper aquifer from surface water influences. The thickness of the silty clay unit varies from location to location (due to variations in the elevation of the bedrock surface beneath Trout Creek), and was not observed in some of the boreholes and well records from areas near bedrock rises. Generally, the top of the silty clay aquitard is relatively flat and rarely exceeds an elevation of approximately 312 m (above mean sea level).

2.2.3 Sandy Outwash Unit

Above the silty clay aquitard lies a deposit of sand to silty sand glacial outwash materials. These materials are the result of erosion and re-deposition of materials from more distant locations by glacial flood waters which covered portions of the study area, and reflect higher energy deposits than the underlying fine grained clays and silts. Although the present discussion conceptualizes these materials as one geologic unit, due to variations in deposition and erosion history, the sandy outwash unit has a variable composition across the study area.

Grainsize analyses of samples recovered during geotechnical drilling along the Highway 11 corridor and Highway 522 corridor indicate that the hydraulic conductivities of the sandy outwash deposits range from 3.6×10^{-3} cm/sec to 2.9×10^{-2} cm/sec (by Hazen's method), giving a geometric mean value of 7.2×10^{-3} cm/sec (for a total of 6 samples tested).

Compared to the underlying silty clay unit, the sandy outwash materials are up to approximately 1500 times more permeable than the underlying silty clay aquitard, and is considered to constitute a shallow upper aquifer in the groundwater model development. These materials, where present, offer a significant potential for recharge infiltration, but the presence of the underlying lower permeability silty clay aquitard, over the central portions of the study area, effectively limits the deep recharge of infiltration from the shallow aquifer to the deeper aquifer.

Shallow groundwater flow in this unit is considered to be dominantly horizontal and directed to any nearby surface water feature, such as deep roadside ditches or surface water streams. Based on the available borehole and water well data, the typical thickness of this unit (as applied in the groundwater model development) was assumed to be 6 m in the central parts of the townsite, and thinning to the edges of the deposit.

2.2.4 Alluvium Unit

Although there were no grainsize analyses available for the alluvium unit, these materials were sporadically-referenced in the geotechnical borehole logs, in the immediate vicinity of the surface water creeks. Since surface water drainage systems are typically underlain by silty to sandy alluvium deposits, and recognizing that the surficial drainage networks can penetrate the underlying strata (and deposit new sediment materials), the groundwater model assumed the presence of alluvium deposits in the immediate vicinity of the modeled surface water features. For the purpose of the present assessment, the alluvium soils were interpreted to penetrate the underlying soils to a depth equal to the top of the deep confined aquifer, creating a localized “window” between the deep confined aquifer and the surface water creeks in the study area.

An initial hydraulic conductivity value of 1×10^{-4} cm/sec was assigned to this unit, similar to the value used in the alluvium deposits for the nearby Powassan groundwater model (Waters Environmental Geosciences Ltd., 2009).

3.0 MODFLOW ANALYSIS

3.1 Model Features

The Trout Creek groundwater model was created using a commercial software package (VisualMODFLOW, Version 3.4, by Waterloo Hydrologic Inc.). MODFLOW is a three dimensional finite-difference groundwater flow model that was initially developed by the United States Geological Survey (USGS) in the 1980s, and is used worldwide to simulate groundwater flow in simple to complex geological settings. VisualMODFLOW is an adaption of the public domain USGS MODFLOW software, and was created to run on personal computers.

The present VisualMODFLOW model comprised a uniformly-spaced horizontal grid of 151 rows by 154 columns, with 3 overburden layers of varying thicknesses and a bottom bedrock layer having a minimum thickness of 30 m. The total number of cells in the present groundwater model was 93,020. The model was run using the MODFLOW2000 engine, with a BiCGSTAB-P Matrix Solver (Waterloo Hydrologic Software).

The model's areal extent (or domain) is presented in Figure A4, and was based largely on the position of the surficial drainage divides as interpreted from 1:20,000 scale topographic mapping and DEM survey data. In Figure A4, the outer boundary of the groundwater flow model is represented by the darker shading.

A total of 5 stratigraphic units (i.e. a total of five different hydraulic conductivity values) were incorporated into the model, reflecting a simplified hydrogeological setting for Trout Creek (as discussed previously). Figures A5 (along Highway 11B), A6 (along McCarthy Street) and A7 (along Highway 522) present a cross-sectional view through the townsite, as was simulated in the model.

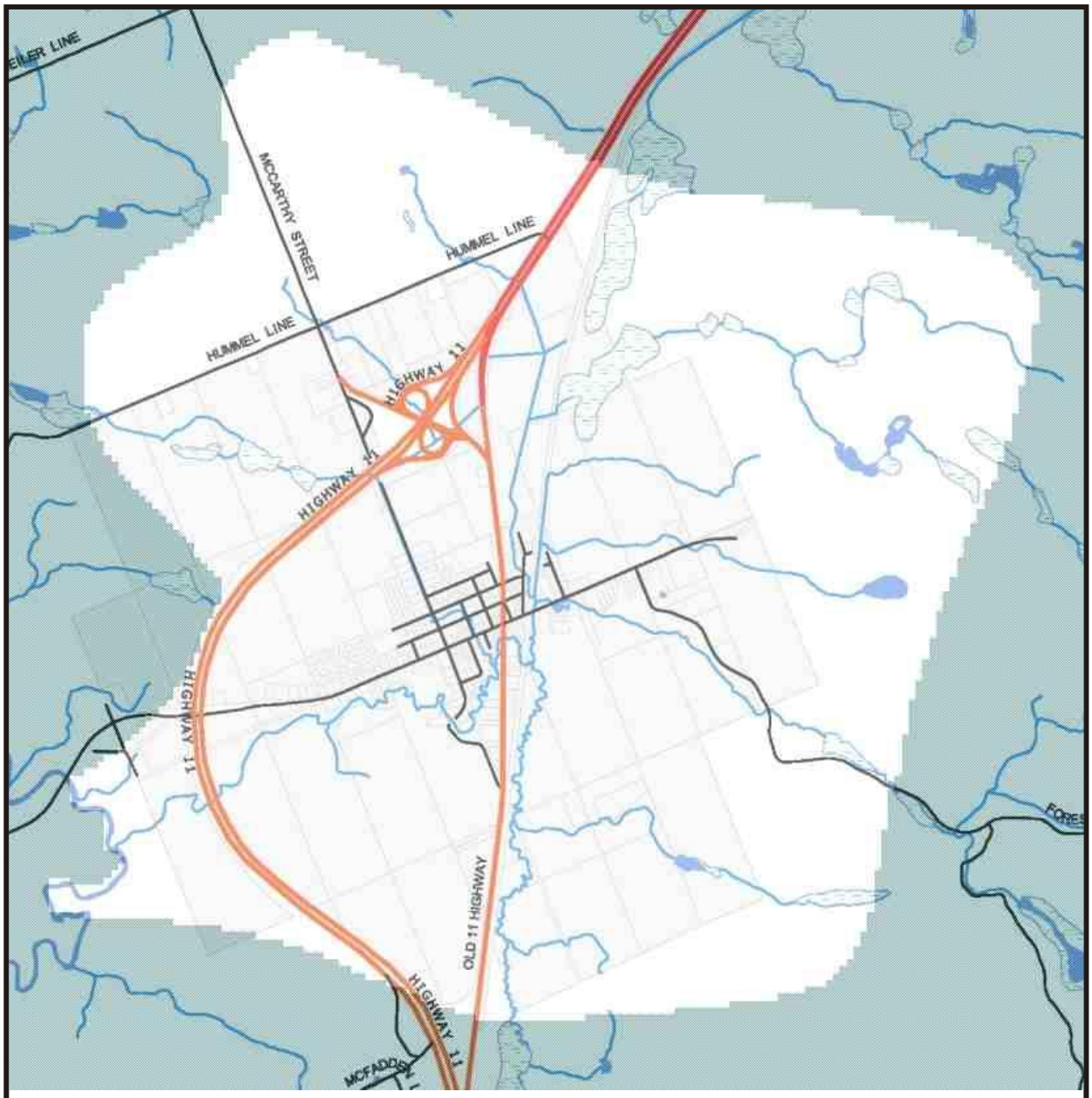
Constant head boundaries were assigned to the South River (at the southwestern edge of the modelled area, at an assigned elevation of 292 m). The un-named creek which parallels Highway 522 and discharges to South River was simulated in the model as being a river boundary type, with various sections of the creek having a linear grade in slope (reflecting the assumed profile of the free water surface) from 309 m to 292 m. A second creek system was included to the north of the townsite, starting at Hummel Line and crossing beneath Highway 11 before turning south to join the un-named creek near the Main Street - Old Highway 11 intersection. The elevations assigned to this creek system ranged from 315 m to 309 m. The third creek segment included in the model ran parallel to Old Highway 11 and the Ontario Northland Railway corridor, at a constant elevation of 309 m.

The indicated surface water elevations were interpreted from available DEM data and 1:20,000 topographic mapping. No water profile elevations were available to confirm these assumed elevations, however the values used were assumed to be sufficient for the present modelling exercise.

Smaller surface water tributaries to the un-named creek were not assigned as river or drain boundaries in the model; instead, the mapped elevations of these smaller tributaries were used during the calibration process as an aid in evaluating the water table profile. By this methodology, the water table surface was not "forced" to match the smaller streams in the area (which, when modelling with numerous drain boundaries, can lead to errors in the overall model performance).

3.2 Calibration

The sequence of soils described in the preceding sections reflect a complex geological history for the Trout Creek study area, and play a significant role in the generation of groundwater flow patterns from the recharge areas to the individual well capture zones. During the groundwater model development, the identified ranges of hydraulic conductivity were used as "initial" quantities, and the recharge values assigned to each geological unit were adjusted until a reasonable fit of the flow data to the observed field conditions was



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North

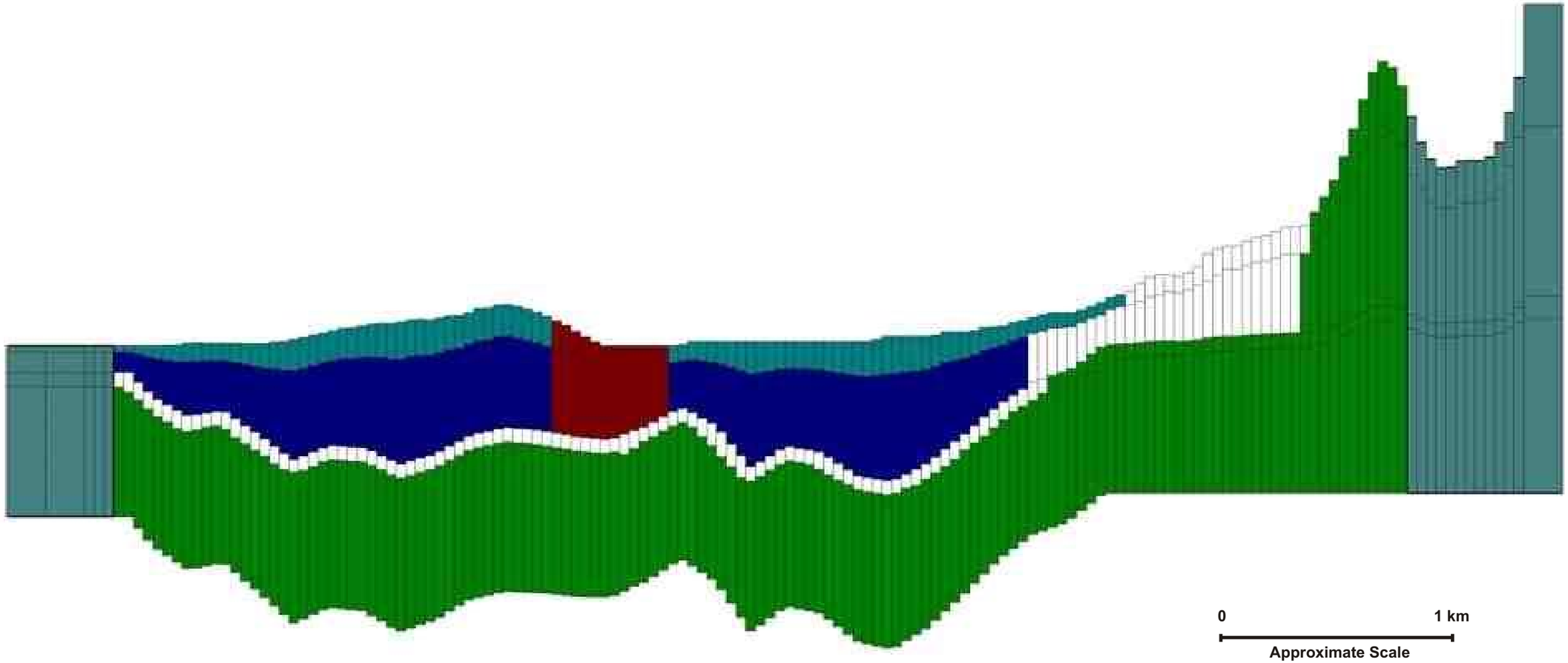
0 1 km

Approximate Scale

Figure A4	**Study Area and Model Boundaries**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

South

North



0 1 km

Approximate Scale

- Alluvium
- Sandy Outwash
- Silty Clay
- Till
- Bedrock
- Model Boundary

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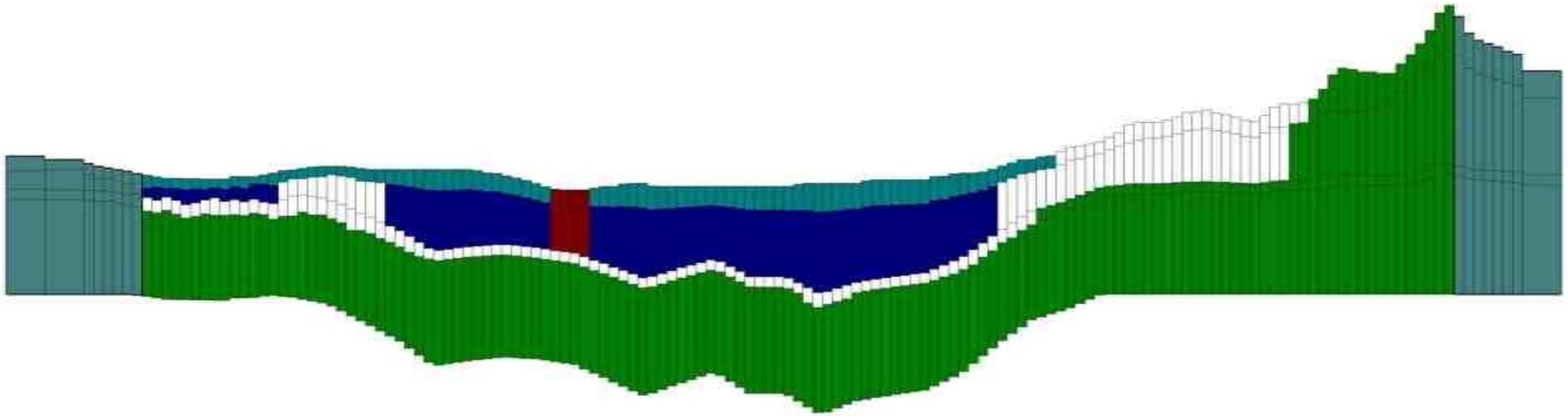
Figure A5	**Hydrostratigraphic Section Along Old Highway 11**	**Project Number 29 - 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

South

North



0 1 km

Approximate Scale

- Alluvium
- Sandy Outwash
- Silty Clay
- Till
- Bedrock
- Model Boundary

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Figure A6	**Hydrostratigraphic Section Along McCarthy Road**	**Project Number 29 - 216**
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Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

West

East

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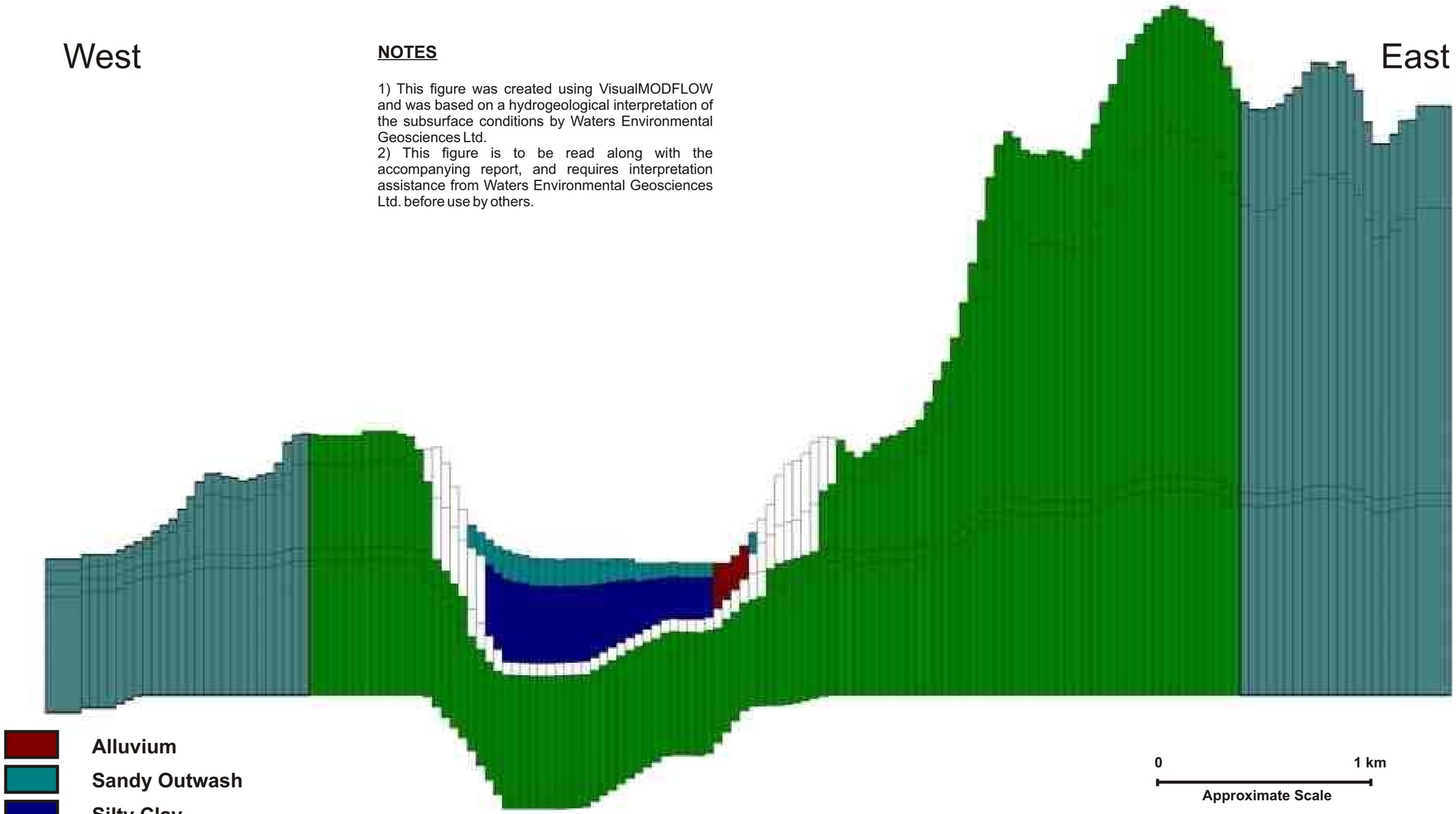

- Alluvium
- Sandy Outwash
- Silty Clay
- Till
- Bedrock
- Model Boundary

0 — 1 km

Approximate Scale

Figure A7	Hydrostratigraphic Section Along Highway 522	Project Number 29 - 216 Date : March, 2010
Waters Environmental Geosciences Ltd.	Trout Creek Well Cluster	

made. As the model conceptualization process proceeded, adjustments were then made to the various hydraulic conductivity values of the geologic formations, resulting in a final calibrated model for the Trout Creek groundwater flow system.

Due to a lack of dedicated observation wells in the study area, the model was calibrated by adjusting the values of recharge and hydraulic conductivity (within reasonable ranges, described previously), until the water levels in the indicated formations agreed with the subsurface conditions reported in the various reports, well records and borehole logs used in the model construction. As well, the water elevations in the upper unit were correlated to mapped surface water features. Finally, the water levels in the various formations were checked to insure that upwards trending gradients were maintained in the well cluster area, reflecting known groundwater conditions reported in the water well database.

The level of detail applied to the modelling effort was considered reasonable for the data inputs used. However, any model is a generalization of real world conditions, and simplifications in the stratigraphy were made when required to assist in achieving a working groundwater model for this site, particularly in areas of steep topographic relief.

As discussed previously, the process followed during calibration was an iterative process, and the main constraints applied to the calibration were to manage the hydraulic conductivity values of each respective stratigraphic unit within the previously determined ranges (indicated above), or to values within typical published ranges. In the case of the aquifer storage terms (specific yield and porosity), typical values were selected from published literature (as these were not measured in any of the field reports used in the model conceptualization).

The final calibrated parameters used in the model are listed in the following table.

Table A1 - Model Parameters at Calibration

Zone	Material	$k_x = k_y$ (cm/sec)	k_z (cm/sec)	Recharge (mm/year)	S_s (1/m)	S_y	$n_{eff} = n_{tot}$
1	till	3×10^{-3}	3×10^{-4}	100	6×10^{-5}	0.24	0.35
2	silty clay	5×10^{-6}	5×10^{-7}	n/a	3×10^{-4}	0.05	0.45
3	bedrock	9×10^{-4}	9×10^{-4}	80	1×10^{-6}	0.04	0.1
4	sandy outwash	1×10^{-2}	1×10^{-3}	125	1×10^{-4}	0.18	0.35
5	alluvium	1×10^{-3}	1×10^{-4}	80	6×10^{-7}	0.18	0.25

In the above table, "n/a" indicates that there is no recharge value applicable to the silty clay aquitard because the unit does not appear in the uppermost layer (i.e. recharge only applies to the uppermost

layer of the model). The symbol "k" refers to the hydraulic conductivities, with the subscripts indicating the direction in which the parameter is measured (corresponding to the x, y and z axes). The symbol "S_s" refers to the specific storage, "S_y" refers to the specific yield and "$n_{eff} = n_{tot}$" refers to the effective and total porosity (set equal to each other in this case). With the exception of the bedrock unit, an anisotropy ratio of 1:10 was used for the vertical to horizontal hydraulic conductivity values.

3.3 Water Well Simulation

The groundwater study of Trout Creek focused on the evaluation of groundwater takings from the two aquifers using private residential wells. The wells were assigned pumping rates based on the net consumptive use from each aquifer, with the recognition that the deeper confined aquifer well use was 100 % consumptive (in that the water taken from this aquifer was not immediately returned to the aquifer, and was lost to the upper aquifer via septic system discharge and evapotranspiration). The shallow aquifer well use was assigned a 20 % consumptive use value.

For the purposes of the model development, the deep confined wells were assigned a pumping rate of 1.125 m^3/day (per well), while the shallow wells were assigned a pumping rate of 0.225 m^3/day (per well). Please refer to the main body of the report for additional details regarding the well conceptualization.

3.4 Particle Tracking

Using VisualMODFLOW, the amount of time needed for the water "particles" to travel through the aquifer to a given well can be determined, allowing the contributing areas to be defined by their respective travel times (or time of travel values). The technique applied in this analysis is commonly referred to as a "particle tracking" method.

The calibrated model was run in a steady-state configuration, and the pathways that groundwater takes in moving through the groundwater flow system were identified by the particle tracking analysis. The exact technique used is referred to as "backward particle tracking", using the MODPATH computer code module contained in the VisualMODFLOW software package.

In the present analysis, a total of 134 particles were assigned to the various well locations in the model, 118 particles being assigned to the model locations representing the deeper aquifer wells, and 16 particles being assigned to the model locations representing shallow aquifer wells. Although the model was run as a steady-state model, particle tracking allows the position (or travel distance) of each particle to be tracked over time. This is the basis of the time-of-travel assessments done using MODPATH (within the VisualMODFLOW package).

Using MODPATH, the particle tracks were displayed for various travel times in each aquifer. Figures A8, A9 and A10 show the particle traces for groundwaters moving to the well clusters in the shallow unconfined aquifer. The respective times of travel are represented by 730 days (2 years), 1825 days (5 years) and 9125 days (25 years), as per the Technical Rules (2008). Similarly, Figures A11, A12 and A13 show the particle traces for groundwaters moving to the well clusters in the deeper confined aquifer. Again, the respective times of travel are represented by 730 days, 1825 days and 9125 days.

Based on our analysis, there was no indication of any GUDI (groundwaters under the direct influence of surface water) conditions for the Trout Creek well cluster, and the identified surface water features constituted local groundwater discharge areas for the two aquifers in the model.

The particle tracking analysis was used to develop the WHPA mapping, and the results are presented as Figure 4 (shallow unconfined aquifer) and Figure 5 (deep confined aquifer) in the main report. The various WHPA zones, defined by these of travel assessments, were incorporated into the subsequent risk assessment portions of the main study report, following the guidance provided in the Technical Rules (2008).

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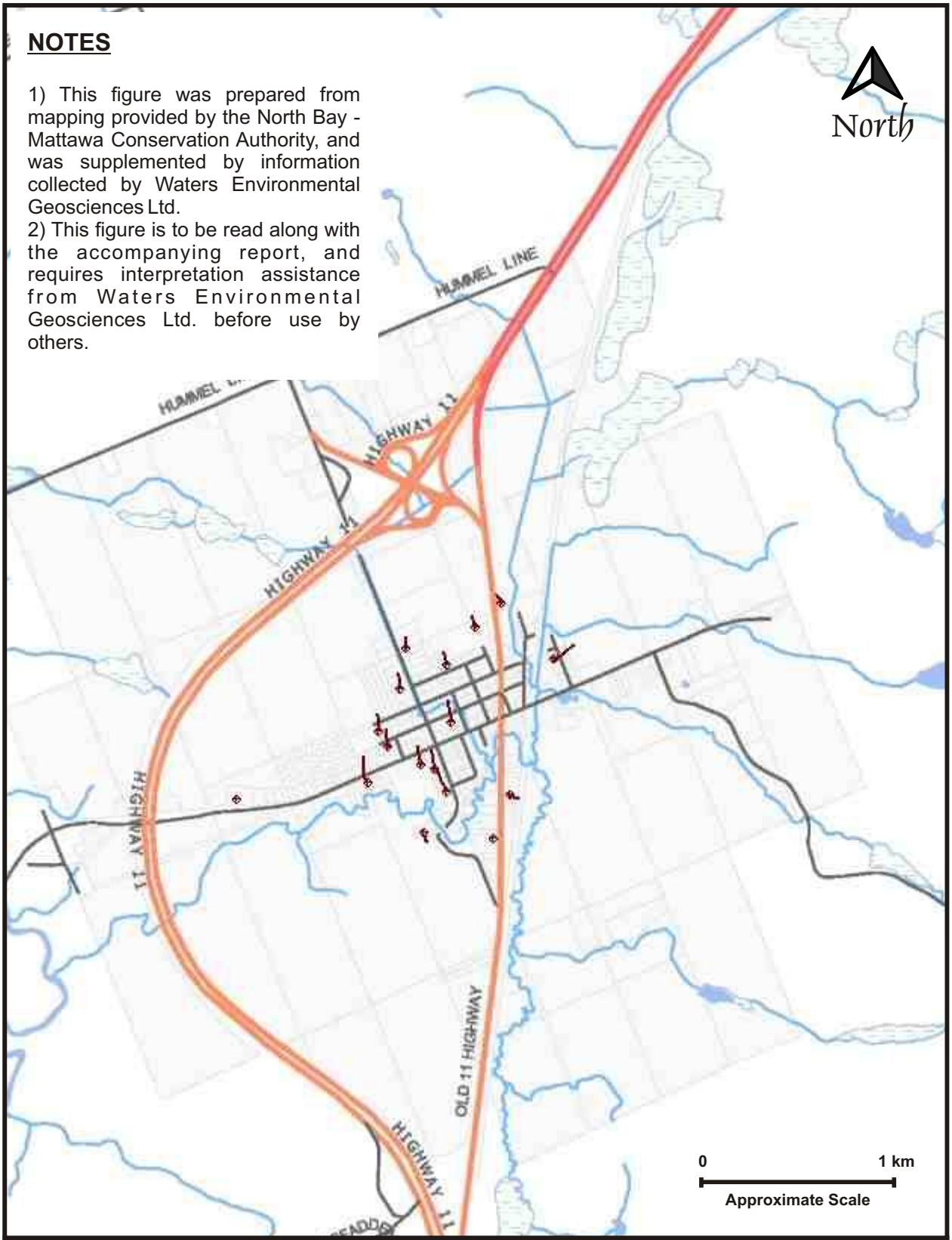

Figure A8	**Particle Tracking - 730 Days Upper Unconfined Aquifer**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

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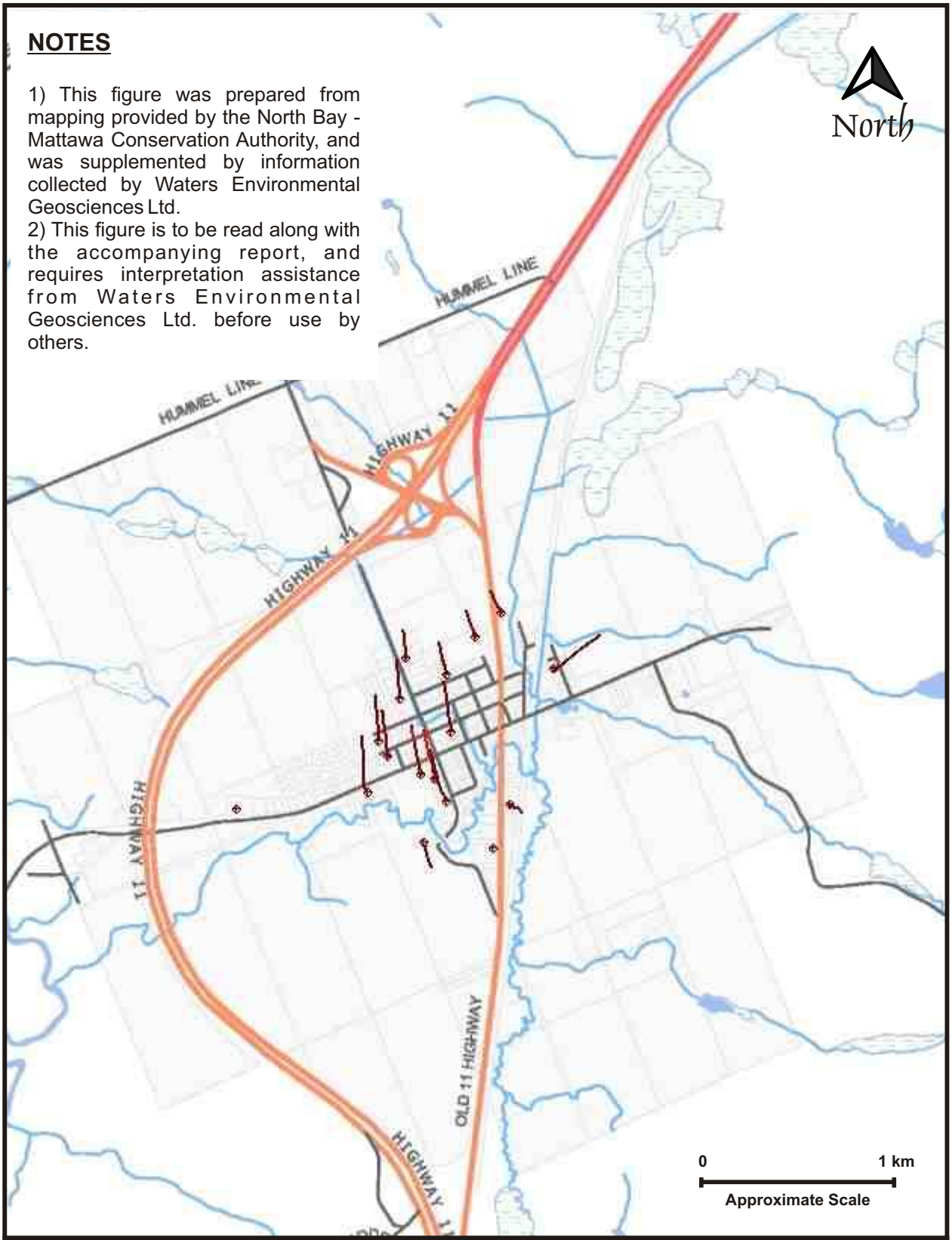

Figure A9	**Particle Tracking - 1825 Days Upper Unconfined Aquifer**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

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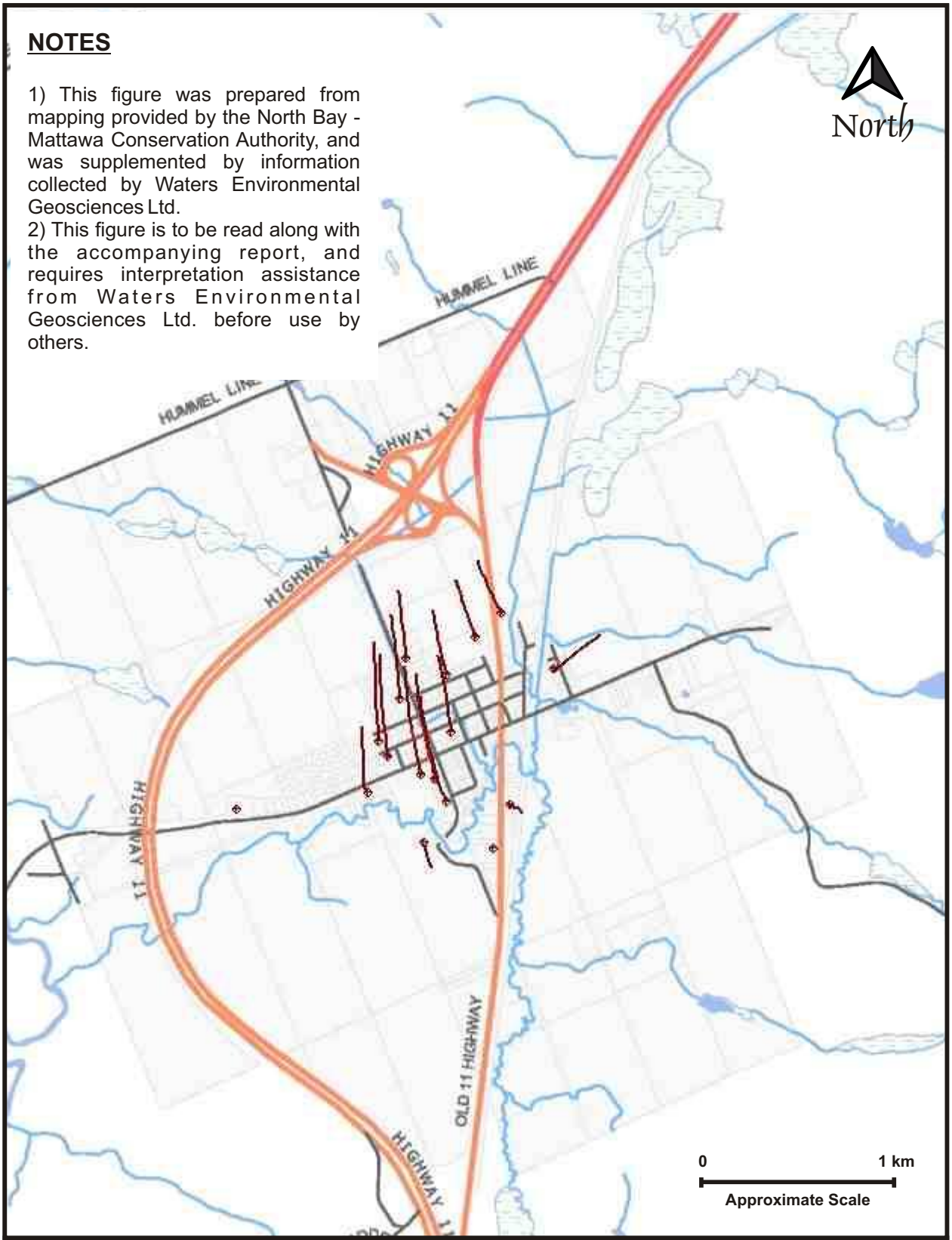

Figure A10	**Particle Tracking - 9125 Days Upper Unconfined Aquifer**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

NOTES

1) This figure was prepared from mapping provided by the North Bay - Mattawa Conservation Authority, and was supplemented by information collected by Waters Environmental Geosciences Ltd.
2) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

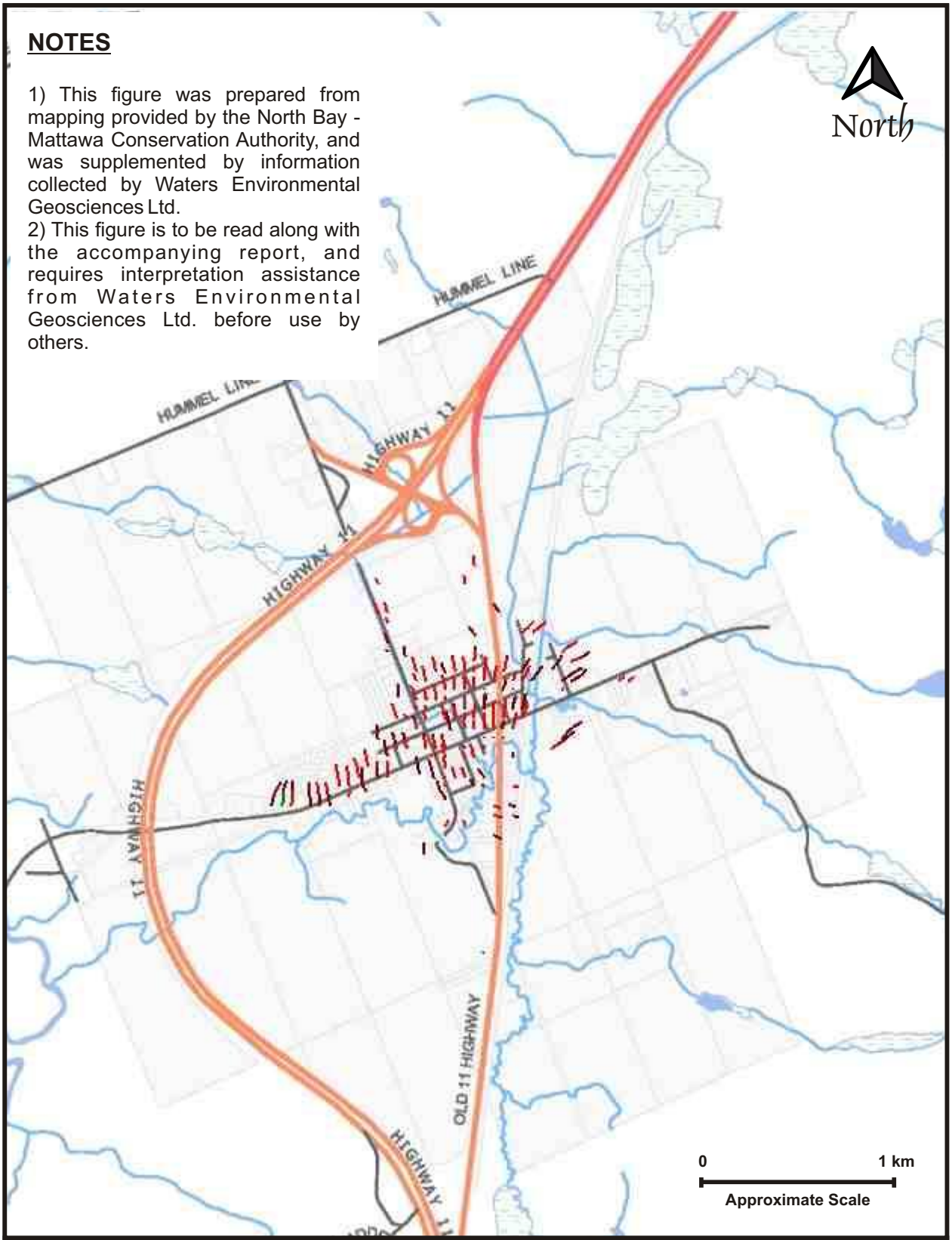

Figure A11	**Particle Tracking - 730 Days Lower Confined Aquifer**	**Project Number 29- 216**
		Date : March, 2010
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

NOTES

1) This figure was prepared from mapping provided by the North Bay - Mattawa Conservation Authority, and was supplemented by information collected by Waters Environmental Geosciences Ltd.
2) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

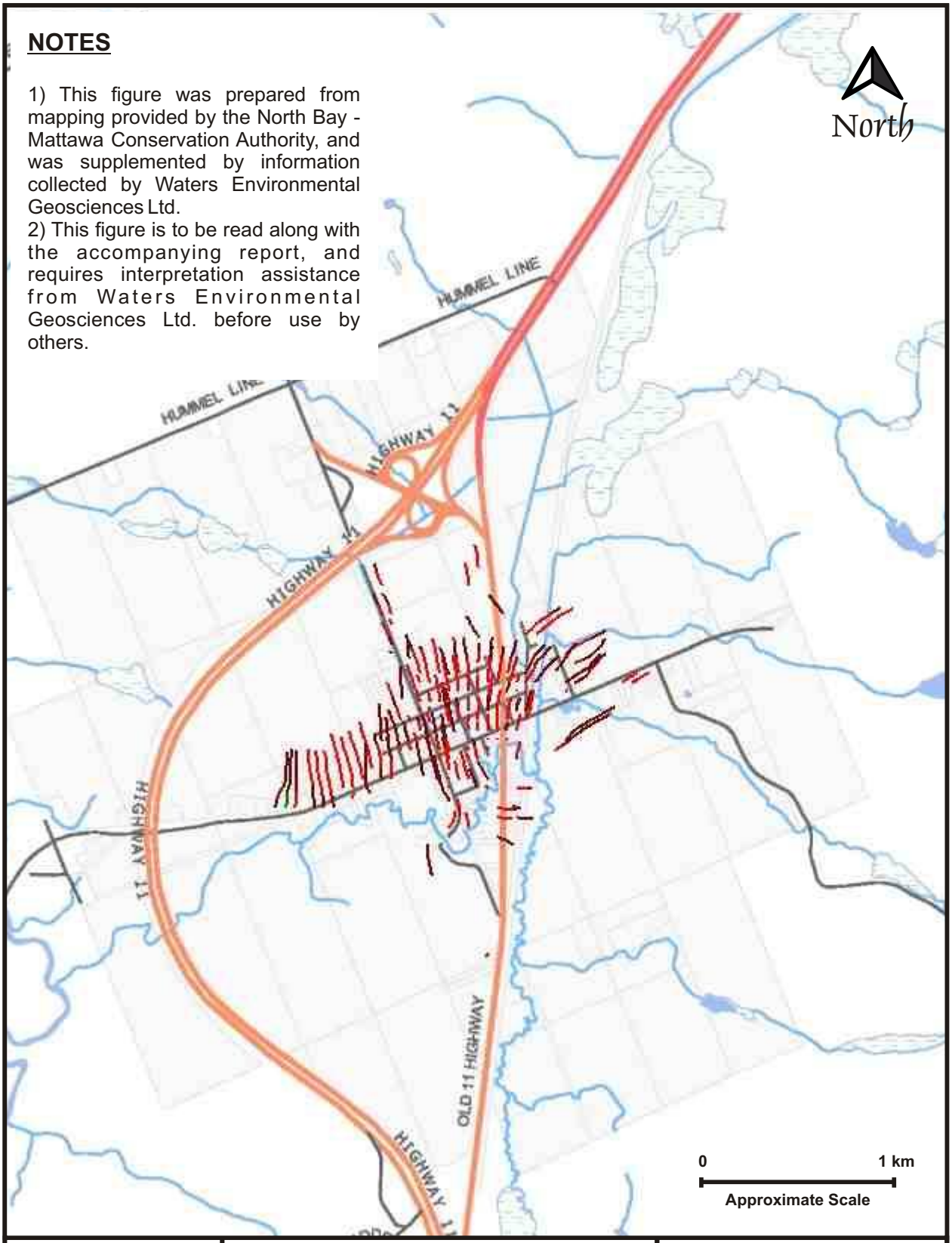

Figure A12	**Particle Tracking - 1825 Days Lower Confined Aquifer**	**Project Number 29- 216** **Date : March, 2010**
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

NOTES

1) This figure was prepared from mapping provided by the North Bay - Mattawa Conservation Authority, and was supplemented by information collected by Waters Environmental Geosciences Ltd.
2) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

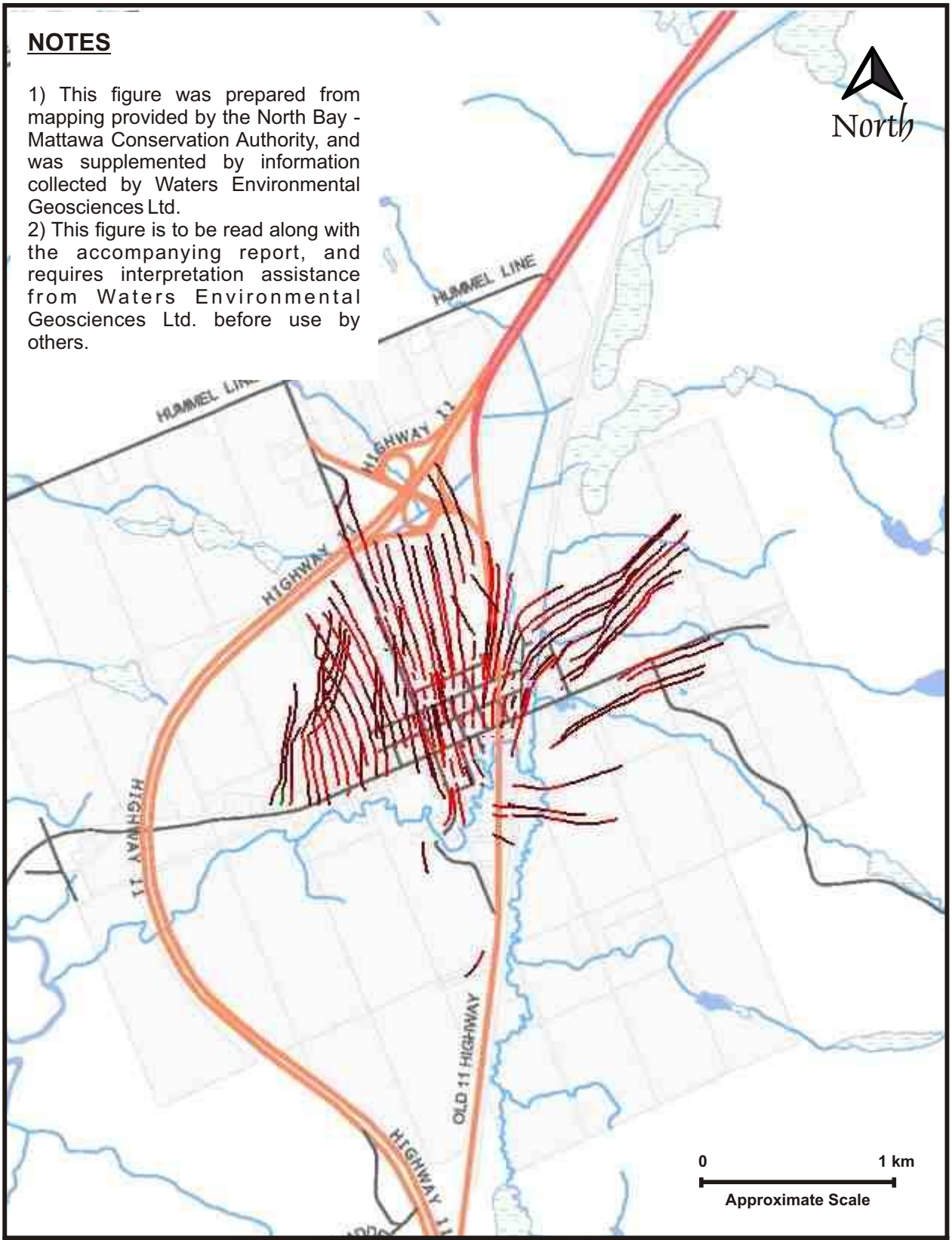

Figure A13	**Particle Tracking - 9125 Days Lower Confined Aquifer**	**Project Number 29- 216**
		Date : March, 2010
Waters Environmental Geosciences Ltd.	**Trout Creek Well Cluster**	

REFERENCES

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Appendix B **ECOLOG ERIS REPORT** **Project 29-216**

As part of the background data research carried out for the risk assessment report, the services of EcoLog ERIS Inc. (Toronto) were retained to carry out an environmental database search. Their report is attached.

Canada's Primary Environmental Risk Information Service

Project Site:	**Trout Creek** **104 Main Street** **Trout Creek, ON**
Client:	**Peter Richards** **Waters Environmental GeoSciences Ltd.** **P. O. Box 69** **Lively, ON P3Y 1M2**
ERIS Project No:	**20090820019**
Report Type:	**Custom Report – .25km Search Radius**
Prepared By:	**Daniela Nigro** dnigro@eris.ca
Date:	**August 31, 2009**

Table of Contents

Order Number: 20090820019
Site Name: Trout Creek
Site Address: 104 Main Street Trout Creek, ON
Report Type: Custom Report, 0.25 km Search Radius

Report Summary

Order Number: 20090820019
Site Name: Trout Creek
Site Address: 104 Main Street Trout Creek, ON
Report Type: Custom Report, 0.25 km Search Radius

Number of Mappable Records Surrounding the Site

Database		Selected	On-site	Within 0.25	0.25km to 0.25km	Total
AAGR	Abandoned Aggregate Inventory	Y	0	0	0	0
AGR	Aggregate Inventory	Y	0	0	0	0
AMIS	Abandoned Mine Information System	Y	0	0	0	0
ANDR	Anderson's Waste Disposal Sites	Y	0	3	0	3
AUWR	Automobile Wrecking & Supplies	Y	0	0	0	0
CA	Certificates of Approval	Y	0	0	0	0
CFOT	Commercial Fuel Oil Tanks	Y	0	0	0	0
CHEM	Chemical Register	Y	0	0	0	0
COAL	Coal Gasification Plants	Y	0	0	0	0
CONV	Compliance and Convictions	Y	0	0	0	0
DRL	Drill Hole Database	Y	0	0	0	0
EBR	Environmental Registry	Y	0	0	0	0
EEM	Environmental Effects Monitoring	Y	0	0	0	0
EHS	ERIS Historical Searches	Y	0	0	0	0
EIIS	Environmental Issues Information System	Y	0	0	0	0
FCON	Federal Convictions	Y	0	0	0	0
FCS	Contaminated Sites on Federal Land	Y	0	0	0	0
FOFT	Fisheries & Oceans Fuel Storage Tanks	Y	0	0	0	0
FST	Fuel Storage Tank	Y	0	0	0	0
GEN	Ontario Regulation 347 Waste Generators Summary	Y	0	0	0	0
IAFT	Indian & Northern Affairs Fuel Tanks	Y	0	0	0	0
MINE	Canadian Mine Locations	Y	0	0	0	0
MNR	Mineral Occurrences	Y	0	1	0	1
NATE	National Analysis of Trends in Emergencies System (NATES)	Y	0	0	0	0
NCPL	Non-Compliance Reports	Y	0	0	0	0
NDFT	National Defence & Canadian Forces Fuel Storage Tanks	Y	0	0	0	0
NDSP	National Defence & Canadian Forces Spills	Y	0	0	0	0
NDWD	National Defence & Canadian Forces Waste Disposal Sites	Y	0	0	0	0
NEES	National Environmental Emergencies System (NEES)	Y	0	0	0	0
NPCB	National PCB Inventory	Y	0	0	0	0
NPRI	National Pollutant Release Inventory	Y	0	0	0	0
OGW	Oil and Gas Wells	Y	0	0	0	0
OOGW	Ontario Oil and Gas Wells	Y	0	0	0	0
OPCB	Inventory of PCB Storage Sites	Y	0	0	0	0
PAP	Canadian Pulp and Paper	Y	0	0	0	0
PCFT	Parks Canada Fuel Storage Tanks	Y	0	0	0	0
PES	Pesticide Register	Y	0	0	0	0
PRT	Private and Retail Fuel Storage Tanks	Y	0	0	0	0
REC	Ontario Regulation 347 Waste Receivers Summary	Y	0	0	0	0
RSC	Record of Site Condition	Y	0	0	0	0
RST	Retail Fuel Storage Tanks	Y	0	0	0	0
SCT	Scott's Manufacturing Directory	Y	0	0	0	0

Report Summary

Order Number: 20090820019
Site Name: Trout Creek
Site Address: 104 Main Street Trout Creek, ON
Report Type: Custom Report, 0.25 km Search Radius

Database		Selected	On-site	Within 0.25	0.25km to 0.25km	Total
SPL	Ontario Spills	Y	0	2	0	2
SRDS	Wastewater Discharger Registration Database	Y	0	0	0	0
TANK	Anderson's Storage Tanks	Y	0	0	0	0
TCFT	Transport Canada Fuel Storage Tanks	Y	0	0	0	0
WDS	Waste Disposal Sites - MOE CA Inventory	Y	0	0	0	0
WDSH	Waste Disposal Sites - MOE 1991 Historical Approval Inventory	Y	0	1	0	1
WWIS	Water Well Information System	N	0	222	0	222
		TOTAL	0	229	0	229

The databases chosen by the client as per the submitted order form are denoted in the 'Selected' column in the above table. Counts have been provided outside the primary buffer area for cursory examination only. These records have not been examined or verified, therefore, they are subject to change.

SITE DIAGRAM

ECOLOG ERIS
Pinpointing Your Environmental Risks
12 Concorde Pl, Suite 800 North York, ON M3C 4J2
416-510-5204

Project Property: Trout Creek
104 Main Street
Trout Creek, ON

ERIS Project #: 20090820019

Date: AUG-31-2009

LEGEND

- Project Property
- Database Location

Points of Interest
- Chimney
- Silo

Pipe & Transmission Lines
- Pipeline
- Transmission Line
- Transmission Tower
- Transformer Station

Rail
- Railway - Main
- Railway - Sidetrack
- Railway - Abandoned
- Bridge
- Tunnel

Transportation - Other
- Embankment
- Trail
- Runway

Hydrographic Features
- Permanent Waterway
- Intermittent Waterway
- Open Reservoir
- Dyke/Levee
- Dam
- Breakwall
- Wetland

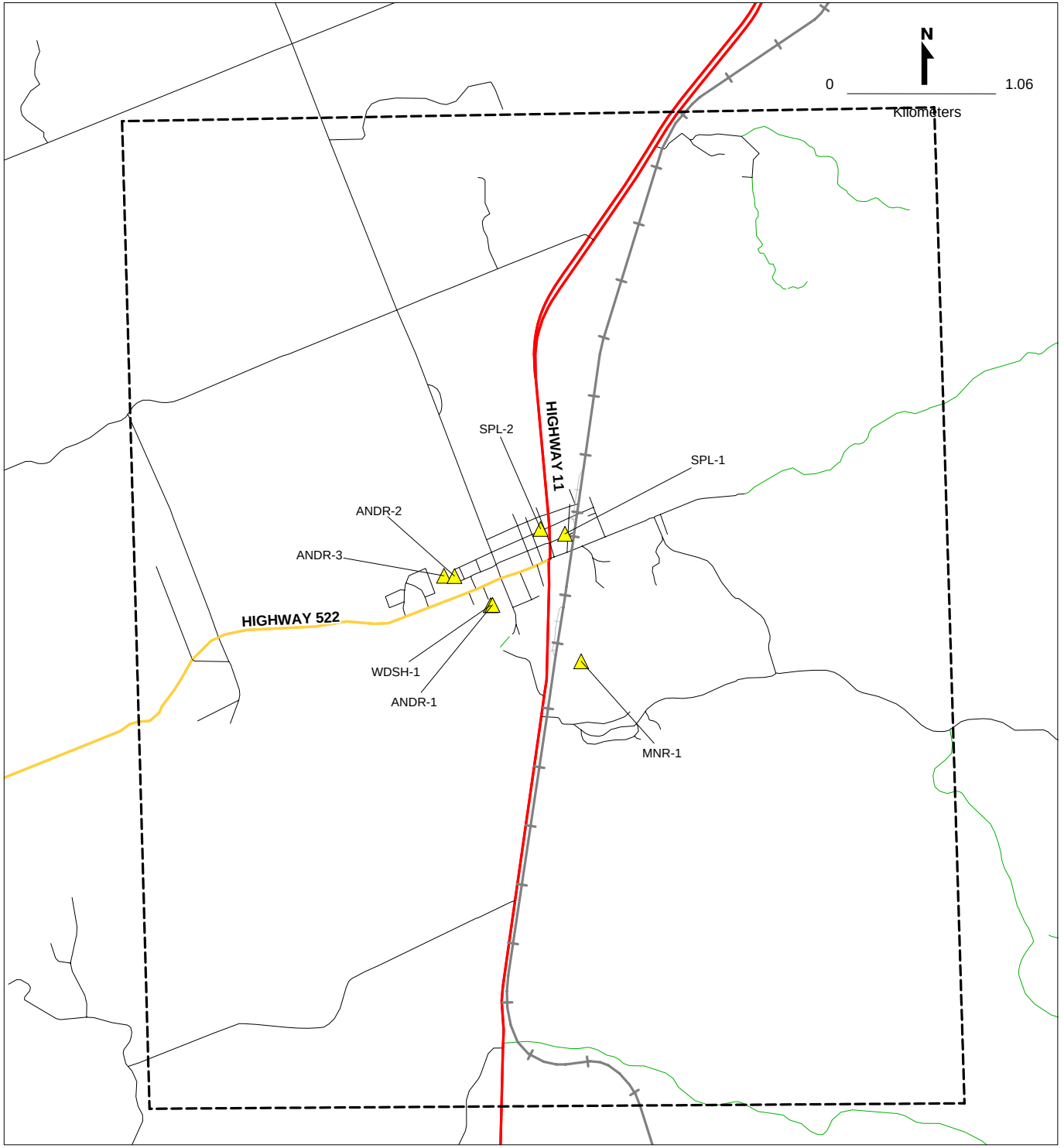
Landuse Classifications
- Open Area
- Residential
- Commercial
- Resource and Industrial
- Government and Institutional
- Parks and Recreational
- Waterbody

Recreation
- Golf Course/Driving Range
- Park/Sports Field
- Other Recreation Area
- Sports/Race Track
- Cemetery
- Campground

Vegetation
- Wooded Area
- Orchard
- Vineyard

Industrial Resources
- Conveyor
- Crane: Moveable
- Crane: Stationary
- Tank
- Rock Cut
- Auto Wrecker
- Lumber Yard
- Pit

This diagram is to be used solely for relative street location purposes. It may not accurately portray street or site positions.



Note: Topographic information not available for this area.

Site Report

Order Number: 20090820019
Site Name: Trout Creek
Site Address: 104 Main Street Trout Creek, ON
Report Type: Custom Report, 0.25 km Search Radius

FOR COMPLETE INFORMATION, REFER TO DETAIL REPORT

A search has been conducted for this site (address) and company name. No records were found, within the database(s) selected, that meet either of these criteria.

Detail Report

Order Number: 20090820019
Site Name: Trout Creek
Site Address: 104 Main Street Trout Creek ON
Report Type: Custom Report, 0.25 km Search Radius

If information is required for sites located beyond the selected address, please contact your ERIS representative.

Anderson's Waste Disposal Sites

Automobile Wrecking & Supplies

Ontario Regulation 347 Waste Generators Summary

Mineral Occurrences

Retail Fuel Storage Tanks

Scott's Manufacturing Directory

Ontario Spills

Waste Disposal Sites - MOE 1991 Historical Approval Inventory

Anderson's Waste Disposal Sites

Map Key	Name	Facility	Location	City/Town	Known Active Decade	Reference #
ANDR-1	Main & McCarthy Dump **Related Site(s)**	Dump	on-site sports track & arena, on-site u/g gas pipeline, 125m S of Highway 522 [Main St*], 75m W of McCarthy St*, 100m N of Trout Creek	Trout Creek	1960s	MOEE 1309
ANDR-2	Main St junkyard 1969 **Related Site(s)**	Auto junkyard	pt wooded, 50m N of Highway 522 [Main St*], approx 700m W of Highway 11	Trout Creek	1960s, 1970s	JY PSD1 1969
ANDR-3	Main St junkyard 1988 **Related Site(s)**	Auto junkyard	75m N of Highway 522, 700m W of Highway 11	Trout Creek	1980s	JY PSD1 1988

Automobile Wrecking & Supplies

Map Key	Company	Address	Facility	Description
n/a	MCKENNY AUTO WRECKERS	605 SWEEZY W TROUT CREEK	Automobile Wrecking & Recycling	

Ontario Regulation 347 Waste Generators Summary

Map Key	Company	Address	SIC Code	SIC Description	Waste Code	Waste Description
n/a	DUNC MCKENNY AUTO WRECKING LTD.	510 SWEEZY STREET TROUT CREEK P0H 2L0	0007	LETTER ACKNOWLEDG.		
			Generator #:	ON0444200		
			Approval Yrs:	86,87,88,89,90		
n/a	DUNC MCKENNY AUTO WRECKING LTD. 13-083	510 SWEEZY STREET TROUT CREEK P0H 2L0	0007	LETTER ACKNOWLEDG.		
			Generator #:	ON0444200		
			Approval Yrs:	92,93,94		
n/a	Trout Creek Planing Mill Limited	77 Hwy 522 Trout Creek	321999	All Other Miscellaneous Wood Product Manufacturing	212	ALIPHATIC SOLVENTS
					213	PETROLEUM DISTILLATES
			Generator #:	ON5961545	251	OIL SKIMMINGS & SLUDGES
			Approval Yrs:	06	252	WASTE OILS & LUBRICANTS

Mineral Occurrences

Map Key	Company	Address	Easting	Northing	Zone	MDI No	Deposit Status
MNR-1	Unknown		627298.92	5093182.78	17	MDI31E14NW00007	DISCRETIONARY OCCURRENCE

Mining Division:
Geological District: SUDBURY
Claim Map: N/A
Access Description: N/A

Year	Name	Twp/Area	Con/Lot/Sec	Commodity	Deposit Characteristic
9999	Unknown	HIMSWORTH	LOT: 24 CON: 2	GOLD	

Retail Fuel Storage Tanks

Map Key	Company	Address	Facility	Description
n/a	LANG'S PETRO-CANADA SERVICE STATION & RESTAURANT	3782 HWY 11 TROUT CREEK	Service Stations-Gasoline, Oil & Natural Gas	

Scott's Manufacturing Directory

Map Key	Company	Address	Established	Plant Size (ft²)	Employment	SIC/NAICS Code	Description
n/a	TROUT CREEK PLANNING MILL LTD.	TROUT CREEK P0H 2L0	0000	0	20	2421	SAWMILLS AND PLANING MILLS, GENERAL
n/a	TROUT CREEK PLANNING MILL LTD.	PO BOX 40 STN MAIN P0H 2L0		0	20	2421	SAWMILLS & PLANING MILLS, GENERAL
n/a	Trout Creek Planing Mill Ltd.	76 Hwy 522 Trout Creek P0H 2L0	1946			321911 321919	Wood Window and Door Manufacturing Other Millwork
n/a	Trout Creek Planing Mill Limited	3824 Hwy 11 S Trout Creek	1946		15	321911 321919	Wood Window and Door Manufacturing Other Millwork
n/a	Trout Creek Planing Mill Ltd.	3824 Hwy 522B Trout Creek P0H 2L0	1946		15	321911 321919	Wood Window and Door Manufacturing Other Millwork

Ontario Spills

Map Key	Company	Address	Ref No.	Incident Dt	MOE Reported Dt	Contaminant Name	Contaminant Quantity
SPL-1	ONTARIO HYDRO	NEAR 108 MORRISON ST. MRS LEE'S HOUSE TRANSFORMER TROUT CREEK TOWN	30487	1/28/1990	1/29/1990		
			Incident Summary:	ONTARIO HYDRO - 2 L. PCB CONTAMINATED OIL (71PPM) TO SNOW & SIDE OF HOUSE			
			Incident Cause:	COOLING SYSTEM LEAK			
			Incident Reason:	FIRE/EXPLOSION			
			Nature of Impact:	Other			
			Receiving Medium:	LAND			
			Environmental Impact:	CONFIRMED			
SPL-2	PRIVATE OWNER	208 SWEEZEY ST STORAGE TANK/BARREL TROUT CREEK TOWN	77303	//	10/7/1992		
			Incident Summary:	PRIVATE RESIDENCE -APPROX700L FURNACE OIL SOAKED INTO GROUND.			
			Incident Cause:	ABOVE-GROUND TANK LEAK			
			Incident Reason:	EQUIPMENT FAILURE			
			Nature of Impact:	Soil contamination			
			Receiving Medium:	LAND			
			Environmental Impact:	CONFIRMED			

Waste Disposal Sites - MOE 1991 Historical Approval Inventory

**Note: Status as of October 30, 1990.

Map Key	Company	Address	Site No.	Region	County	Concession	Lot
WDSH-1		37 29 HIMSWORTH, SOUTH	X1309	NORTHEAST	PARRY SOUND	29	37

Easting: 626650
Northing: 5093350
Zone: 17
Date Closed 1961
Status: CLOSED
Classification: A8 - POTENTIAL HUMAN IMPACT-RURAL MUNICIPAL/DOMESTIC WASTE - CLOSED >20 YRS
%CommericialWste: n/a
%DomesticWste Rec: n/a
%LiquidWste Rec: n/a
%HazardousWste Rec: n/a
%Non-haz.Wste Rec: n/a
%Sewage/Sludge Rec: n/a
%Other Wste Rec: n/a

Appendix: Ontario Database Descriptions

EcoLog Environmental Risk Information Services Ltd can search the following databases. The extent of historical information varies with each database and current information is determined by what is publicly available to EcoLog ERIS at the time of update. **Note:** Databases denoted with "*" indicates that the database will no longer be updated. See the individual database descriptions for more information.

Provincial Government Source Databases:

Abandoned Aggregate Inventory **Up to Sept 2002** **AAGR**

The MAAP Program maintains a database of all abandoned pits and quarries. Please note that the database is only referenced by lot and concession and city/town location. The database provides information regarding the location, type, size, land use, status and general comments.

Aggregate Inventory **Up to Mar 2008** **AGR**

The Ontario Ministry of Natural Resources maintains a database of all active pits and quarries. Please note that the database is only referenced by lot\concession and city/town location. The databases provides information regarding the registered owner/operator, location, status, licence type, and maximum tonnage.

Abandoned Mines Information System **1800-2005** **AMIS**

The Abandoned Mines Information System contains data on known abandoned and inactive mines located on both Crown and privately held lands. The information was provided by the Ministry of Northern Development and Mines (MNDM), with the following disclaimer: "the database provided has been compiled from various sources, and the Ministry of Northern Development and Mines makes no representation and takes no responsibility that such information is accurate, current or complete". Reported information includes official mine name, status, background information, mine start/end date, primary commodity, mine features, hazards and remediation.

Certificates of Approval **1985-Sept 2002** **CA**

This database contains the following types of approvals: Certificates of Approval (Air) issued under Section 9 of the Ontario EPA; Certificates of Approval (Industrial Wastewater) issued under Section 53 of the Ontario Water Resources Act ("OWRA"); and Certificates of Approval (Municipal/Provincial Sewage and Waterworks) issued under Sections 52 and 53 of the OWRA. For more current Certificate of Approval information please see the EBR database, which will include information such as 'Approval for discharge into the natural environment other than water (i.e. Air) (EPA s.9)', and Approval for sewage works (OWRA s.53(1).

TSSA Commercial Fuel Oil Tanks **1948-Jan 2009** **CFOT**

Since May 2002, Ontario developed a new act where it became mandatory for fuel oil tanks to be registered with Technical Standards & Safety Authority (TSSA). This data would include all commercial underground fuel oil tanks in Ontario with fields such as location, registration number, tank material, age of tank and tank size.

Coal Gasification Plants **1987, 1988*** **COAL**

This inventory of all known and historical coal gasification plants was collected by the Ministry of Environment. It identifies industrial sites that produced and continue to produce or use coal tar and other related tars. Detailed information is available and includes: facility type, size, landuse, soil condition, site operators/occupants, site description, and potential environmental impacts. This information is effective to 1988, but the program has since been discontinued.

Compliance and Convictions **1989-Jun 2009** **CONV**

This database summarizes the fines and convictions handed down by the Ontario courts beginning in 1989. Companies and individuals named here have been found guilty of environmental offenses in Ontario courts of law.

Drill Holes **1886-2005** **DRL**

The Ontario Drill Hole Database contains information on more than 113,000 percussion, overburden, sonic and diamond drill holes from assessment files on record with the department of Mines and Minerals. Please note that limited data is available for southern Ontario, as it was the last area to be completed. The database was created when surveys submitted to the Ministry were converted in the Assessment File Research Image Database (AFRI) project. However, the degree of accuracy (coordinates) as to the exact location of drill holes is dependent upon the source document submitted to the MNDM. Levels of accuracy used to locate holes are: centering on the mining claim; a sketch of the mining claim; a 1:50,000 map; a detailed company map; or from submitted a "Report of Work".

Environmental Registry **1994-Jun 2009** **EBR**

The Environmental Registry lists proposals, decisions and exceptions regarding policies, Acts, instruments, or regulations that could significantly affect the environment. Through the Registry, thirteen provincial ministries notify the public of upcoming proposals and invite their comments. For example, if a local business is requesting a permit, licence, or certificate of approval to release substances into the air or water; these are notified on the registry. Data includes things like; Approval for discharge into the natural environment other than water (i.e. Air), Permit to Take Water (PTTW), Certificate of Property Use (CPU), Approval for a waste disposal site, Order for preventative measures.(EPA s. 18), Order for conformity with Act for waste disposal sites.(EPA s. 44), Order for remedial work.(EPA s. 17) and many more.

TSSA Fuel Storage Tanks **Current to Dec 2008** **FST**

The Technical Standards & Safety Authority (TSSA), under the *Technical Standards & Safety Act* of 2000 maintains a database of registered private and retail fuel storage tanks in Ontario with fields such as location, tank status, license date, tank type, tank capacity, fuel type, installation year and facility type.

Ontario Regulation 347 Waste Generators Summary **1986-Jun 2009** **GEN**

Regulation 347 of the Ontario EPA defines a waste generation site as any site, equipment and/or operation involved in the production, collection, handling and/or storage of regulated wastes. A generator of regulated waste is required to register the waste generation site and each waste produced, collected, handled, or stored at the site. This database contains the registration number, company name and address of registered generators including the types of hazardous wastes generated. It includes data on waste generating facilities such as: drycleaners, waste treatment and disposal facilities, machine shops, electric power distribution etc. This information is a summary of all years from 1986 including the most currently available data. Some records may contain, within the company name, the phrase "See & Use…" followed by a series of letters and numbers. This occurs when one company is amalgamated with or taken over by another registered company. The number listed as "See & Use", refers to the new ownership and the other identification number refers to the original ownership. This phrase serves as a link between the 2 companies until operations have been fully transferred.

Mineral Occurrences **1846-Sept 2008** **MNR**

In the early 70's, the Ministry of Northern Development and Mines created an inventory of approximately 19,000 mineral occurrences in Ontario, in regard to metallic and industrial minerals, as well as some information on building stones and aggregate deposits. Please note that the "Horizontal Positional Accuracy" is approximately +/- 200 m. Many reference elements for each record were derived from field sketches using pace or chain/tape measurements against claim posts or topographic features in the area. The primary limiting factor for the level of positional accuracy is the scale of the source material. The testing of horizontal accuracy of the source materials was accomplished by comparing the planimetric (X and Y) coordinates of that point with the coordinates of the same point as defined from a source of higher accuracy.

Non-Compliance Reports **1992(water only), 1994-2007** **NCPL**

The Ministry of the Environment provides information about non-compliant discharges of contaminants to air and water that exceed legal allowable limits, from regulated industrial and municipal facilities. A reported non-compliance failure may be in regard to a Control Order, Certificate of Approval, Sectoral Regulation or specific regulation/act.

Ontario Oil and Gas Wells **1800-Jan 2009** **OOGW**

In 1998, the MNR handed over to the Ontario Oil, Gas and Salt Resources Corporation, the responsibility of maintaining a database of oil and gas wells drilled in Ontario. Information available for all wells in the ERIS database include well owner/operator, location, permit start date, well cap date, licence number, status, depth and the primary target (rock unit) of the well being drilled.

Ontario Inventory of PCB Storage Sites **1987-Oct 2004** **OPCB**

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of PCB storage sites within the province. Ontario Regulation 11/82 (Waste Management - PCB) and Regulation 347 (Generator Waste Management) under the Ontario EPA requires the registration of inactive PCB storage equipment and/or disposal sites of PCB waste with the Ontario Ministry of Environment. This database contains information on: 1) waste quantities; 2) major and minor sites storing liquid or solid waste; and 3) a waste storage inventory.

Pesticide Register **1988-Nov 2008** **PES**

The Ontario Ministry of Environment maintains a database of all manufacturers and vendors of registered pesticides.

Private and Retail Fuel Storage Tanks **1989-1996*** **PRT**

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks and licensed retail fuel outlets. This database includes an inventory of locations that have gasoline, oil, waste oil, natural gas and/or propane storage tanks on their property. The MCCR no longer collects this information. This information is now collected by the Technical Standards and Safety Authority (TSSA).

Ontario Regulation 347 Waste Receivers Summary **1986-2005** **REC**

Part V of the Ontario Environmental Protection Act ("EPA") regulates the disposal of regulated waste through an operating waste management system or a waste disposal site operated or used pursuant to the terms and conditions of a Certificate of Approval or a Provisional Certificate of Approval. Regulation 347 of the Ontario EPA defines a waste receiving site as any site or facility to which waste is transferred by a waste carrier. A receiver of regulated waste is required to register the waste receiving facility. This database represents registered receivers of regulated wastes, identified by registration number, company name and address, and includes receivers of waste such as: landfills, incinerators, transfer stations, PCB storage sites, sludge farms and water pollution control plants. This information is a summary of all years from 1986 including the most currently available data.

Record of Site Condition **1997-Sept 2001, Oct 2004-Jun 2009** **RSC**

The Record of Site Condition (RSC) is part of the Ministry of the Environment's Brownfields Environmental Site Registry. Protection from environmental cleanup orders for property owners is contingent upon documentation known as a record of site condition (RSC) being filed in the Environmental Site Registry. In order to file an RSC, the property must have been properly assessed and shown to meet the soil, sediment and groundwater standards appropriate for the use, such as residential, proposed to take place on the property. The Record of Site Condition Regulation (O. Reg. 153/04) details requirements related to site assessment and clean up. Information available includes Registration Number, Filing Owner, Property Address, Filing Date and Municipality.

Ontario Spills **1988-2008** **SPL**

This database identifies information such as location (approximate), type and quantity of contaminant, date of spill, environmental impact, cause, nature of impact, etc. Information from 1988-2002 was part of the ORIS (Occurrence Reporting Information System). The SAC (Spills Action Centre) handles all spills reported in Ontario. Regulations for spills in Ontario are part of the MOE's Environmental Protection Act, Part X.

Wastewater Discharger Registration Database **1990-2006** **SRDS**

Information under this heading is combination of the following 2 programs. The Municipal/Industrial Strategy for Abatement (MISA) division of the Ontario Ministry of Environment maintained a database of all direct dischargers of toxic pollutants within nine sectors including: Electric Power Generation; Mining; Petroleum Refining; Organic Chemicals; Inorganic Chemicals; Pulp & Paper; Metal Casting; Iron & Steel; and Quarries. All sampling information is now collected and stored within the Sample Result Data Store (SRDS).

Waste Disposal Sites - MOE CA Inventory **1970-Sept 2002** **WDS**

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of known open (active or inactive) and closed disposal sites in the Province of Ontario. Active sites maintain a Certificate of Approval, are approved to receive and are receiving waste. Inactive sites maintain Certificate(s) of Approval but are not receiving waste. Closed sites are not receiving waste. The data contained within this database was compiled from the MOE's Certificate of Approval database. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number. For more current information for Waste Disposal Sites please see the EBR database, which will include information such as 'Approval for a waste disposal site (EPA s.27)' and 'Approval for use of a former waste disposal site (EPA s.46)'.

Waste Disposal Sites - MOE 1991 Historical Approval Inventory **Up to Oct 1990*** **WDSH**

In June 1991, the Ontario Ministry of Environment, Waste Management Branch, published the "June 1991 Waste Disposal Site Inventory", of all known active and closed waste disposal sites as of October 30st, 1990. For each "active" site as of October 31st 1990, information is provided on site location, site/CA number, waste type, site status and site classification. For each "closed" site as of October 31st 1990, information is provided on site location, site/CA number, closure date and site classification. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number.

Water Well Information System **1955-2008** **WWIS**

This database describes locations and characteristics of water wells found within Ontario in accordance with Regulation 903. Geographic coordinates are reliable according to the given percentage. Wells that are identified with lot and concession only are now also included in the database and is no longer provided as a separate report.

Federal Government Source Databases: Diagram Identifier:

Environmental Effects Monitoring **1992-2007*** **EEM**

The Environmental Effects Monitoring program assesses the effects of effluent from industrial or other sources on fish, fish habitat and human usage of fisheries resources. Since 1992, pulp and paper mills have been required to conduct EEM studies under the Pulp and Paper Effluent Regulations. This database provides information on the mill name, geographical location and sub-lethal toxicity data.

Environmental Issues Inventory System **1992-2001*** **EIIS**

The Environmental Issues Inventory System was developed through the implementation of the Environmental Issues and Remediation Plan. This plan was established to determine the location and severity of contaminated sites on inhabited First Nation reserves, and where necessary, to remediate those that posed a risk to health and safety; and to prevent future environmental problems. The EIIS provides information on the reserve under investigation, inventory number, name of site, environmental issue, site action (Remediation, Site Assessment), and date investigation completed.

Federal Convictions **1988-Jun 2007** **FCON**

Environment Canada maintains a database referred to as the "Environmental Registry" that details prosecutions under the Canadian Environmental Protection Act (CEPA) and the Fisheries Act (FA). Information is provided on the company name, location, charge date, offence and penalty.

Contaminated Sites on Federal Land **June 2000-May 2009** **FCS**

The Treasury Board of Canada Secretariat maintains an inventory of all known contaminated sites held by various Federal departments and agencies. This inventory does not include properties owned by Crown corporations, but does contain non-federal sites for which the Government of Canada has accepted some or all financial responsibility. All sites have been classified through a system developed by the Canadian Council of Ministers of the Environment. The database provides information on company name, location, site ID #, property use, classification, current status, contaminant type and plan of action for site remediation.

Fisheries & Oceans Fuel Tanks **1964-Sept 2003** **FOFT**

Fisheries & Oceans Canada maintains an inventory of all aboveground & underground fuel storage tanks located on Fisheries & Oceans property or controlled by DFO. Our inventory provides information on the site name, location, tank owner, tank operator, facility type, storage tank location, tank contents & capacity, and date of tank installation.

Indian & Northern Affairs Fuel Tanks **1950-Aug 2003** **IAFT**

The Department of Indian & Northern Affairs Canada (INAC) maintains an inventory of all aboveground & underground fuel storage tanks located on both federal and crown land. Our inventory provides information on the reserve name, location, facility type, site/facility name, tank type, material & ID number, tank contents & capacity, and date of tank installation.

National Analysis of Trends in Emergencies System (NATES) **1974-1994*** **NATE**

In 1974 Environment Canada established the National Analysis of Trends in Emergencies System (NATES) database, for the voluntary reporting of significant spill incidents. The data was to be used to assist in directing the work of the emergencies program. NATES ran from 1974 to 1994. Extensive information is available within this database including company names, place where the spill occurred, date of spill, cause, reason and source of spill, damage incurred, and amount, concentration, and volume of materials released.

National Defence & Canadian Forces Fuel Tanks **Up to May 2001*** **NDFT**

The Department of National Defence and the Canadian Forces maintains an inventory of all aboveground & underground fuel storage tanks located on DND lands. Our inventory provides information on the base name, location, tank type & capacity, tank contents, tank class, date of tank installation, date tank last used, and status of tank as of May 2001. This database will no longer be updated due to the new National Security protocols which have prohibited any release of this database.

National Defence & Canadian Forces Spills **Mar 1999-Oct 2007** **NDSP**

The Department of National Defence and the Canadian Forces maintains an inventory of spills to land and water. All spill sites have been classified under the "Transportation of Dangerous Goods Act - 1992". Our inventory provides information on the facility name, location, spill ID #, spill date, type of spill, as well as the quantity of substance spilled & recovered.

National Defence & Canadian Forces Waste Disposal Sites **2001-April 2007** **NDWD**

The Department of National Defence and the Canadian Forces maintains an inventory of waste disposal sites located on DND lands. Where available, our inventory provides information on the base name, location, type of waste received, area of site, depth of site, year site opened/closed and status.

National Environmental Emergencies System (NEES) 1974-2003 **NEES**

In 2000, the Emergencies program implemented NEES, a reporting system for spills of hazardous substances. For the most part, this system only captured data from the Atlantic Provinces, some from Quebec and Ontario and a portion from British Columbia. Data for Alberta, Saskatchewan, Manitoba and the Territories was not captured. However, NEES is also a repository for all previous Environment Canada spill datasets. NEES is composed of the historic datasets – or Trends – which dates from approximately 1974 to present. **NEES Trends** is a compilation of historic databases, which were merged and includes data from NATES (National Analysis of Trends in Emergencies System), ARTS (Atlantic Regional Trends System), and NEES. In 2001, the Emergencies Program determined that variations in reporting regimes and requirements between federal and provincial agencies made national spill reporting and trend analysis difficult to achieve. As a consequence, the department has focused efforts on capturing data on spills of substances which fall under its legislative authority only (CEPA and FA). As such, the NEES database will be decommissioned in December 2004.

National PCB Inventory 1988-June 2004 **NPCB**

Environment Canada's National PCB inventory includes information on in-use PCB containing equipment in Canada including federal, provincial and private facilities. All federal out-of-service PCB containing equipment and all PCB waste owned by the federal government or by federally regulated industries such as airlines, railway companies, broadcasting companies, telephone and telecommunications companies, pipeline companies, etc. are also listed. Although it is not Environment Canada's mandate to collect data on non-federal PCB waste, the National PCB inventory includes some information on provincial and private PCB waste and storage sites.

National Pollutant Release Inventory 1993-2007 **NPRI**

Environment Canada has defined the National Pollutant Release Inventory ("NPRI") as a federal government initiative designed to collect comprehensive national data regarding releases to air, water, or land, and waste transfers of 178 specified substances.

Parks Canada Fuel Storage Tanks 1920-Jan 2005 **PCFT**

Canadian Heritage maintains an inventory of all known fuel storage tanks operated by Parks Canada, in both National Parks and at National Historic Sites. The database details information on site name, location, tank install/removal date, capacity, fuel type, facility type, tank design and owner/operator.

Transport Canada Fuel Storage Tanks 1970-March 2007 **TCFT**

With the provinces of BC, MB, NB, NF, ON, PE, and QC; Transport Canada currently owns and operates 90 fuel storage tanks. This inventory will also include The Pickering Lands, which refers to the 7,530 hectares (18,600 acres) of land in Pickering, Markham and Uxbridge - owned by the Government of Canada since 1972. Properties on this land has been leased by the government since 1975, falls under the Site Management Policy of Transport Canada, but administered by Public Works and Government Services Canada. Our inventory provides information on the site name, location, tank age, capacity and fuel type.

Private Source Databases:

Anderson's Waste Disposal Sites 1860s-Present **ANDR**

The information provided in this database was collected by examining various historical documents which aimed to characterize the likely position of former waste disposal sites from 1860 to present. The research initiative behind the creation of this database was to identify those sites that are missing from the *Ontario MOE Waste Disposal Site Inventory*, as well as to provide revisions and corrections to the positions and descriptions of sites currently listed in the MOE inventory. In addition to historic waste disposal facilities, the database also identifies certain auto wreckers and scrap yards that have been extrapolated from documentary sources. *Please note that the data is not warranted to be complete, exhaustive or authoritive. The information was collected for research purposes only.*

Automobile Wrecking & Supplies 2001-Feb 2009 **AUWR**

This database provides an inventory of all known locations that are involved in the scrap metal, automobile wrecking/recycling, and automobile parts & supplies industry. Information is provided on the company name, location and business type.

Chemical Register 1992, 1999-Feb 2009 **CHEM**

This database includes information from both a one time study conducted in 1992 and private source and is a listing of facilities that manufacture or distribute chemicals. The production of these chemical substances may involve one or more chemical reactions and/or chemical separation processes (i.e. fractionation, solvent extraction, crystallization, etc.).

ERIS Historical Searches 1999-Apr 2009 **EHS**

EcoLog ERIS has compiled a database of all environmental risk reports completed since March 1999. Available fields for this database include: site location, date of report, type of report, and search radius. As per all other databases, the ERIS database can be referenced on both the map and "Statistical Profile" page.

Canadian Mine Locations 1998-2006 **MINE**

This information is collected from the Canadian & American Mines Handbook. The Mines database is a national database that provides over 290 listings on mines (listed as public companies) dealing primarily with precious metals and hard rocks. Listed are mines that are currently in operation, closed, suspended, or are still being developed (advanced projects). Their locations are provided as geographic coordinates (x, y and/or longitude, latitude). As of 2002, data pertaining to Canadian smelters and refineries has been appended to this database.

Oil and Gas Wells Oct 2001-Jun 2009 **OGW**

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickles' database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at www.nickles.com.

Canadian Pulp and Paper 1999, 2002, 2004, 2005 **PAP**

This information is part of the Pulp and Paper Canada Directory. The Directory provides a comprehensive listing of the locations of pulp and paper mills and the products that they produce.

Retail Fuel Storage Tanks 2000-Feb 2009 **RST**

This database includes an inventory of retail fuel outlet locations (including marinas) that have on their property gasoline, oil, waste oil, natural gas and / or propane storage tanks. Information is provided on company name, location and type of business.

Scott's Manufacturing Directory 1992-Jun 2008 **SCT**

Scott's Directories is a data bank containing information on over 70,000 manufacturers in Ontario. Even though Scott's listings are voluntary, it is the most comprehensive database of Ontario manufacturers available. Information concerning a company's address, plant size, and main products are included in this database. This database begins with 1992 information and is updated annually.

Anderson's Storage Tanks 1915-1953* **TANK**

The information provided in this database was collected by examining various historical documents, which identified the location of former storage tanks, containing substances such as fuel, water, gas, oil, and other various types of miscellaneous products. Information is available in regard to business operating at tank site, tank location, permit year, permit & installation type, no. of tanks installed & configuration and tank capacity. *Data contained within this database pertains only to the city of Toronto and is not warranted to be complete, exhaustive or authoritative. The information was collected for research purposes only.*

Additional Anderson Report - Historical Summary

ID: 303193

Company Name:	Main St junkyard 1988
City:	Trout Creek
Postal Code:	P0H 2L0
Legal Description:	S Himsworth Con 3 Lot 25 pt
Location Description:	75m N of Highway 522, 700m W of Highway 11
Municipality:	Trout Creek Town
Current Municipality:	Trout Creek Town
RM:	Parry Sound District
Facility:	Auto junkyard
Date Active:	1988
Date Begun:	
Date Complete:	
Area (Ha):	1.5
Diameter (m):	200
Waste Type:	
Landfill Type:	
Group Name:	
Operated By:	McKenny Auto Wreckers
Serial:	JY PSD1 1988
NTS:	31E14
UTM X Nad 27:	626300
UTM Y Nad 27:	5093550
UTM Zone:	17
Historical Summary:	Main St junkyard 1988 1990 NTS Map 31E14 Junkyard marked, 200m x 75m, 75m N of Highway 522 [Main St*], 700m W of Highway 11 [1990 NTS 1:50,000 Map South River ON Sheet 31E14 Edition 4 (information 1988, Publication 1990)]. *Ontario Ministry of Transportation (1983) Ontario Transportation Map Sheet 4 [YUML: G3501 P2 250 1983 sheet 4].

Additional Anderson Report - Historical Summary

ID: 303907

Company Name:	Main St junkyard 1969
City:	Trout Creek
Postal Code:	P0H 2L0
Legal Description:	S Himsworth Con 3 Lot 25 pt
Location Description:	pt wooded, 50m N of Highway 522 [Main St*], approx 700m W of Highway 11
Municipality:	Trout Creek Town
Current Municipality:	Trout Creek Town
RM:	Parry Sound District
Facility:	Auto junkyard
Date Active:	1969
Date Begun:	
Date Complete:	
Area (Ha):	1.6
Diameter (m):	200
Waste Type:	
Landfill Type:	
Group Name:	
Operated By:	
Serial:	JY PSD1 1969
NTS:	31E14
UTM X Nad 27:	626375
UTM Y Nad 27:	5093550
UTM Zone:	17
Historical Summary:	Main St junkyard 1969 1975 NTS Map 31E14 Junkyard marked, 200m x 80m, pt wooded, 50m N of Highway 522 [Main St*] [1975 NTS 1:50,000 Map South River ON Sheet 31E14 Edition 3 (air photos 1969-70, culture check 1971, publication 1975)]. 1963 NTS Map 31E14 Not marked [1963 NTS 1:50,000 Map South River ON Sheet 31E14 Edition 2 (air photos 1951, publication 1963)]. *Ontario Ministry of Transportation (1983) Ontario Transportation Map Sheet 4 [YUML: G3501 P2 250 1983 sheet 4].

Additional Anderson Report - Historical Summary

ID: 303986

Company Name:	Main & McCarthy Dump
City:	Trout Creek
Postal Code:	P0H 2L0
Legal Description:	S Himsworth Con 2 Lot 26
Location Description:	on-site sports track & arena, on-site u/g gas pipeline, 125m S of Highway 522 [Main St*], 75m W of McCarthy St*, 100m N of Trout Creek
Municipality:	South Himsworth Township
Current Municipality:	South Himsworth Township
RM:	Parry Sound District
Facility:	Dump
Date Active:	1961
Date Begun:	
Date Complete:	1961
Area (Ha):	
Diameter (m):	
Waste Type:	
Landfill Type:	
Group Name:	Trout Creek
Operated By:	
Serial:	MOEE 1309
NTS:	31E14
UTM X Nad 27:	626650
UTM Y Nad 27:	5093350
UTM Zone:	17
Historical Summary:	Main & McCarthy Dump MOEE 1994 South Himsworth Con 29 Lot 37 cited as a closed waste disposal site [Ontario Ministry of the Environment [1994] Waste disposal site inventory, [Toronto]: Ontario Environment, 1994., i, 196 pp., maps, ISBN 0772984093]. This legal description does not exist. Datapoint plost to S Himsworth Con 2 Lot 26. 1963 NTS Map 31E14 Not marked, wooded site, on-site u/g gas pipeline, 125m S of Highway 522 [Main St*], 75m W of McCarthy St*, 100m N of Trout Creek [1963 NTS 1:50,000 Map South River ON Sheet 31E14 edition 2 (air photos 1951, compiled 1963)]. 1975 NTS Map 31E14 Not marked, on-site sports track & arena [1975 NTS 1:50,000 Map South River ON Sheet 31E14 edition 3 (air photos 1969, 1970; Culture check 1971, printed 1975)]. *Ontario Ministry of Transportation (1983) Ontario Transportation Map Sheet 4 [YUML: G3501 P2 250 1983 sheet 4].

Appendix C THREATS INVENTORY SPREADSHEET Project 29-216

A spreadsheet of the various drinking water threats identified in each vulnerable area of the Well Head Protection Area (WHPA), of each aquifer, was developed based on available environmental database records, dialogue with municipal and provincial agencies, public input via presentations and through the preliminary reconnaissance work carried out by Waters Environmental Geosciences Ltd.

Appendix C
Drinking Water Threats Inventory - Trout Creek WHPA

WHPA	Vulnerability Score	Uncertainty Score	Threat Location ID	Threat Description	Source Type	Confirmation Code	Threat Classification	Table 1 or Table 2 Reference No.
Shallow Unconfined Aquifer								
B	10	high	3	fill area <1ha, discharge of nitrate to gw or sw	point	1	moderate	1646
			6	fuel storage below grade, >2500 litres	point	5	significant	312,313,314,315,316
			7	fuel storage below grade, >2500 litres	point	5	significant	312,313,314,315,316
			8	fuel storage below grade, >2500 litres	point	5	significant	312,313,314,315,316
			12	road salt application, >8% impervious, <80 % impervious	corridor	5	moderate	92,93
			13	pesticide application (>1 ha but < 10 ha)	corridor	5	significant	68,70,71,72,73
			14	leaching bed systems	point	2	significant	1955
C	8	high	1	fuel storage above grade, > 250 litres but <2500 litres	point	5	low	172,173,174,175
			12	road salt application, >8% impervious, <80 % impervious	corridor	5	moderate	92,93
			13	pesticide application (>1 ha but < 10 ha)	corridor	5	moderate	68,70,71,72,73
			14	leaching bed systems	point	2	moderate	1955
D	6	high	12	road salt application, >8% impervious, <80 % impervious	corridor	5	low	92,93
			13	pesticide application (>1 ha but < 10 ha)	corridor	5	low	68,70,71,72,73
			14	leaching bed systems	point	2	low	1955
Deep Confined Aquifer								
B	8	low	8	fuel storage below grade, >2500 litres	point	5	moderate	312,313,314,315,316
			14	leaching bed systems	point	2	moderate	1955
	6	low	3	fill area <1ha, discharge of nitrate to gw or sw	point	1	low	1646
			7	fuel storage below grade, >2500 litres	point	5	low	312,313,314,315,316
			12	road salt application, >8% impervious, <80 % impervious	corridor	5	low	92,93
			13	pesticide application (>1 ha but < 10 ha)	corridor	5	low	68,70,71,72,73
			14	leaching bed systems	point	2	low	1955
C	4	low	1	fuel storage above grade, > 250 litres but <2500 litres	point	5	low	172,173,174,175
			6	fuel storage below grade, >2500 litres	point	5	low	312,313,314,315,316
			11	fuel storage above grade, > 250 litres but <2500 litres	point	5	low	172,173,174,175
			12	road salt application, >8% impervious, <80 % impervious	corridor	5	low	92,93
			13	pesticide application (>1 ha but < 10 ha)	corridor	5	low	68,70,71,72,73
			14	leaching bed systems	point	2	low	1955
D	4	low	15	road salt application, >8% impervious, <80 % impervious	corridor	5	low	92,93

NOTES a) vulnerability scores were obtained from Figures 12 and 13
b) uncertainty score was assigned based on the model assumptions relating to known well locations
c) source type is either point source, non-point source or corridor source
d) confirmation code was (1) for ECOLOG database search, (2) for Waters' field reconnaisance survey, (3) for airphoto / map / GIS interpretation, (4) for on-site interview with owner and (5) for unconfirmed
e) threat classification is either low, moderate or significant
f) Table 1 / Table 2 Drinking Water Threat reference number refers to the December 12, 2008 Table of Drinking Water Threats