# Appendix A

# Hydrostratigraphic Model of Cambridge, Ontario

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# Table of Contents

# List of Figures

# List of Tables

# Section 1
# Introduction

This report documents the development of the hydrostratigraphic model for the bedrock in the area of Cambridge, Ontario. The analyses described in this report build on the fundamental efforts of Frank Brunton, Ontario Geology Survey (Brunton 2008, 2009). Jinhui Zhang has conducted the analyses and Christopher Neville is responsible for internal review.

Hydrogeologic analyses in development for the Cambridge area incorporate layers representing both overburden and bedrock units; however, during the development of the hydrostratigraphic model, particular attention is directed toward the bedrock. This emphasis reflects the fact that groundwater supplies in the Cambridge area are derived primarily from bedrock wells. Recent well testing in the Pinebush Well Field (PBPW1-06) and Clemens Mill Well Field (CMPW1-06 and CMPW2-06) also focused on the bedrock (Golder, 2011a).

In several instances, the developed layers correspond to the stratigraphic units identified in Brunton (2008, 2009). However, there are instances in which model layers are delineated to represent key aquifer and aquitard units that are not tied to a particular geological formation. For example, a separate layer is defined to represent the interface between the overburden and the top of rock. Therefore, the work presented here is referred to as a hydrostratigraphic model, following the terminology of Maxey (1964) and Seaber (1988). A hydrostratigraphic unit is defined as a body of rock that composes a geologic framework for a reasonably distinct hydrologic system (Maxey. 1964; p. 126). These units are intended to serve as a fundamental unit for describing hydrogeologic systems in the field based on the properties of the rock that affect groundwater conditions (Seaber, 1988).

Previous groundwater models of the Cambridge area have not incorporated analyses of the bedrock structure with comparable detail (Golder, 1991; Beak et al., 1995; and Duke Engineering, 1998). An immediate question that arises is: why is it now necessary to revisit the bedrock hydrostratigraphy in the Cambridge area? The groundwater modelling for the Cambridge area provides an opportunity to incorporate the recent advances made by the Ontario Geological Survey in characterizing the bedrock (Brunton, 2008, 2009). The framework developed by the Ontario Geological Survey provides for the first time a context for understanding the important differences in the characteristics of the bedrock across the Cambridge area. This framework guides the systematic interpretation of hydrogeologic data, and is predictive in the sense that it provides a defensible structure for the extrapolation of data beyond areas of concentrated data. This framework is essential in an analysis that is extended to natural hydrologic boundaries. The Ontario Geological Survey framework also provides a foundation for predicting the effects of developing additional groundwater resources in areas that do not have the benefit of long-term performance records.

# Section 2
# The study area and the model surfaces

The limits of the Cambridge hydrostratigraphic model analyses are shown in **Figure 2-1**. The limits of the hydrostratigraphic model extend beyond the limits of the groundwater flow model that has been developed recently for the Cambridge area. The limits of the hydrostratigraphic model were extended deliberately beyond the limits of the groundwater model to ensure that the groundwater model could have been enlarged, had that been deemed necessary. When generating surfaces it is also simpler to work in a rectangular domain that the irregular limits of the groundwater flow model. Independent analyses of groundwater flow in the Guelph and Cambridge areas are being developed to support Tier 3 Water Budget studies in the City of Guelph, the Region of Waterloo, and an environmental assessment for the Cambridge East area. There is significant overlap of the study areas for Guelph and Cambridge and it is important that the hydrostratigraphic model be sufficiently large to extend across the area of overlap.

The Guelph Tier 3 model builds on the recent studies of the Ontario Geological Survey (Brunton, 2008, 2009). Brunton's proposed revisions to the Silurian stratigraphy are shown in **Figure 2-2** alongside the previous designations of Johnson et al. (1992). As will be discussed in detail in Sections 7 and 8, a key element of the recent Ontario Geological Survey work is the identification of members of the Eramosa Formation that have significantly different characteristics. The hydrostratigraphic model for the Guelph Tier 3 study is shown in **Figure 2-3**. The Guelph Tier 3 model includes 14 model layers to represent the overburden and 13 bedrock stratigraphic units, with some lumping of units within model layers. In collaboration with Frank Brunton, Golder Associates developed estimates of the elevations of the tops of seven of these units, indicated by the red triangles in the figure.

The layer structure for the Cambridge model is shown in **Figure 2-4**. The model includes the overburden and 12 geologic units. The top of the Cabot Head Formation is set as the bottom of the model. As discussed in Section 10, the hydraulic conductivity of the Cabot Head Formation is sufficiently low that groundwater flow within the unit is likely insignificant. The elimination of a model layer to represent the Cabot Head will allow incorporation of an additional layer to refine the representation of the overburden without increasing the overall size of the analysis. The red triangles indicate the surfaces for which estimates of elevations are available in the Cambridge area.

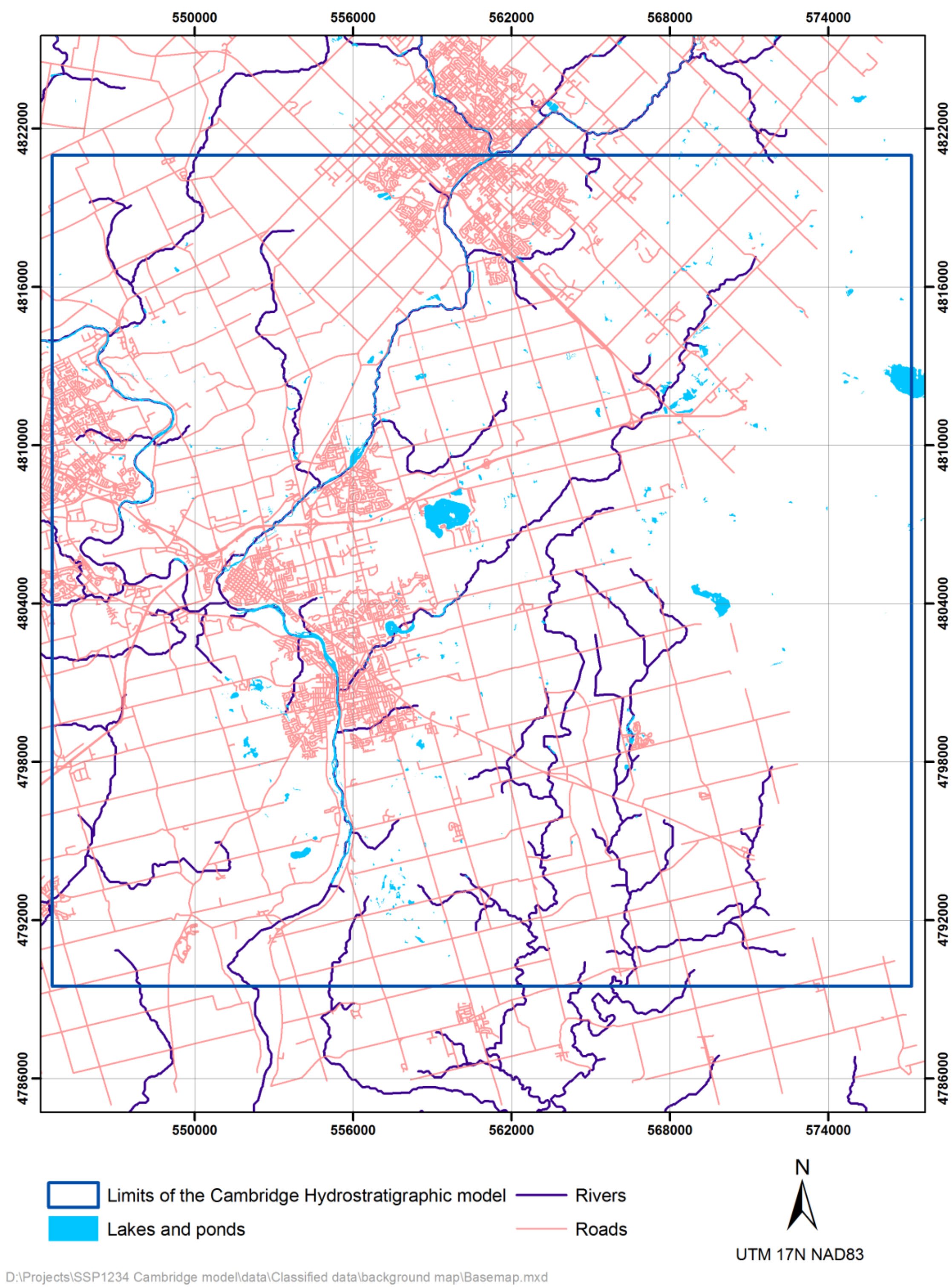



**Figure 2-1 Limits of the study area**

| Johnson et al. (1992) | Brunton (2008, 2009) Guelph/Cambridge: Formation | Brunton (2008, 2009) Guelph/Cambridge: Member |
|---|---|---|
| Guelph Fm. | Guelph | Hanlon |
| | | Wellington |
| Eramosa Mbr. of Guelph Fm. | Eramosa | Stone Road |
| | | Reformatory Quarry |
| | | Vinemount |
| Amabel Fm.<br>Unsubdivided members and Irondequoit Fm. | Goat Island | Ancaster |
| | | Niagara Falls |
| | Gasport | Pekin ? (Might be present at Shades Mill) |
| | | Gothic Hill |
| | Rochester | |
| | Irondequoit | |
| Reynales Fm. | Rockway | |
| | Merritton (= Upper Fossil Hill) | |
| Cabot Head Fm. | Cabot Head | |

Not to scale

**Figure 2-2 Johnson et al. (1992) and Brunton (2008, 2009) stratigraphic designations**

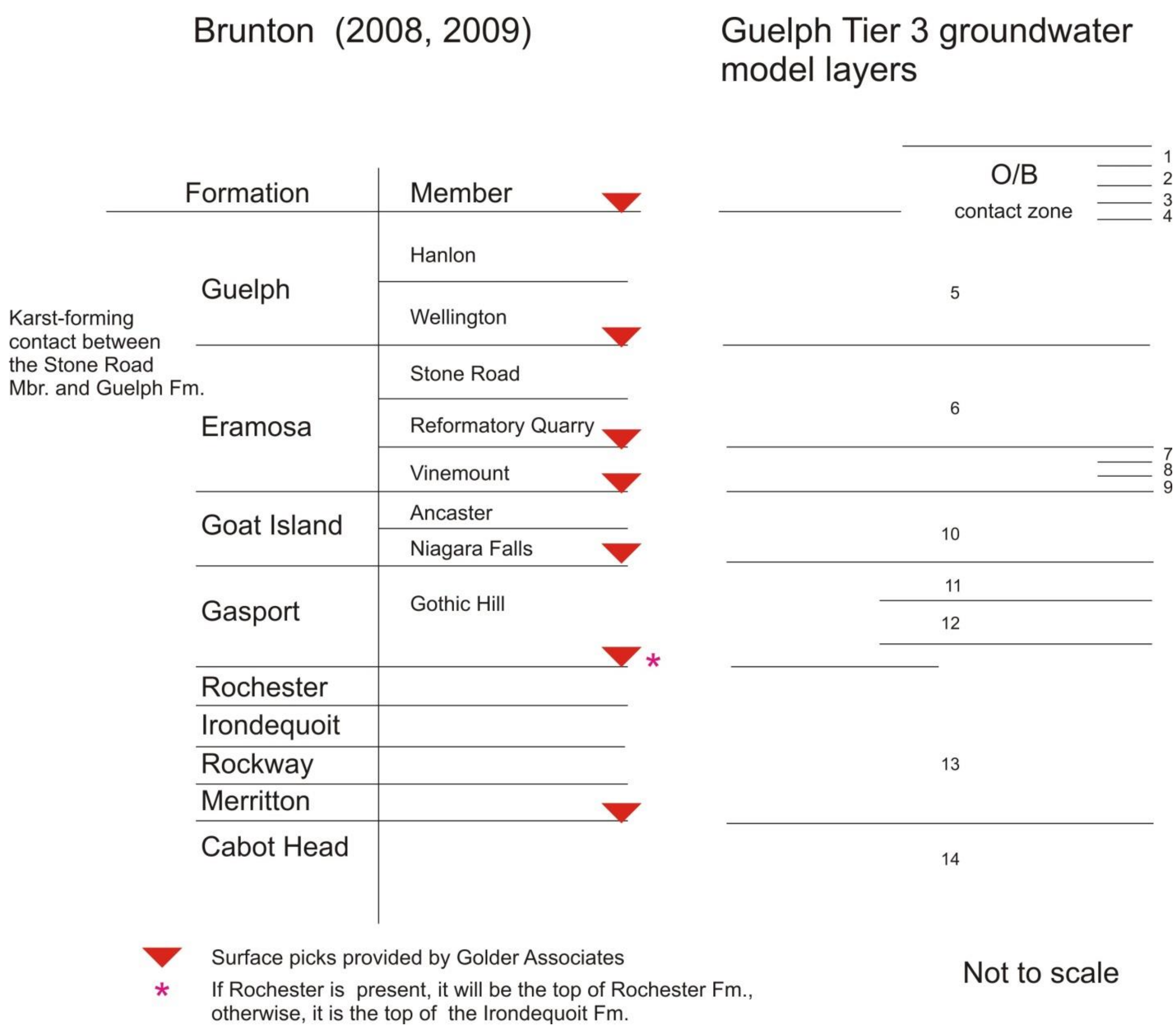



**Figure 2-3 Brunton (2008, 2009) stratigraphic units and Guelph Tier 3 groundwater model layers**

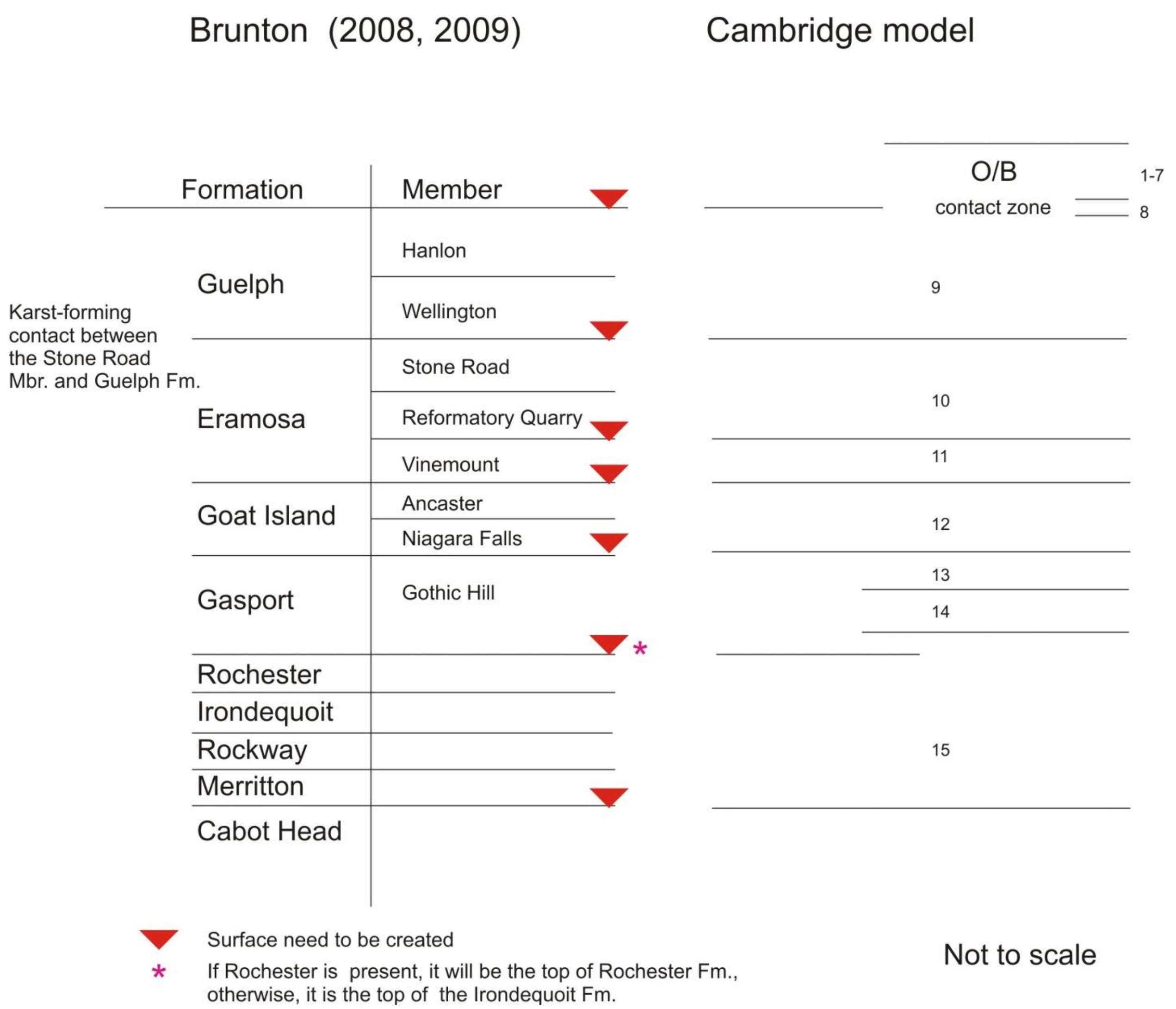



**Figure 2-4 Brunton (2008, 2009) stratigraphic units and Cambridge groundwater model layers**

# Section 3
# General approach for developing the model surfaces

The analysis of groundwater flow in the Cambridge area extends from the ground surface to the top of the Cabot Head Formation. The Cabot Head Formation is a shale unit that has relatively low hydraulic conductivity and in previous regional studies has been treated as the lower limit of significant regional groundwater flow (Golder, 1991; Beak et al., 1995; Lotowater, 1997; Duke, 1998; CRA, 2008; Stantec, 2011a; Stantec, 2011b; Golder, 2009b; Golder, 2009c). As discussed in Section 11, the available estimates of the transmissivity of the Cabot Head Formation are consistently relatively small such that neglecting flow in this unit is not likely to be a significant source of error (Clark et al., 1989; Beak et al., 1995; CRA, 2000; CRA, 2008; SSP&A, 2009).

The following surfaces were considered key for the development of the groundwater model:

- Ground surface;
- Top of bedrock (top of the Guelph Formation);
- Top of the Reformatory Quarry Member of the Eramosa Formation;
- Top of the Vinemount Member of the Eramosa Formation;
- Top of the Goat Island Formation;
- Top of the Gasport Formation; and
- Top of the Cabot Head Formation.

Brunton (2008, 2009) identified a third member of the Eramosa Formation in the Guelph area, the Stone Road Member. This unit overlies the Reformatory Quarry Member and is likely not present in the Cambridge area.

With the exception of the top surfaces of the Vinemount Member and the Goat Island Formation, all surfaces are interpolated from the elevations of the units identified primarily by Frank Brunton, referred to here as the “picks” in the borehole logs. For the Vinemount Member and Goat Island Formation, the thicknesses of the layers are interpolated first; the top surfaces are then calculated using the thicknesses and the bottom elevations of the formation. The top surface of the Goat Island Formation is calculated by adding its thickness to the top surface of the Gasport Formation. Similarly, the top surface of the Vinemount Member is calculated by adding its thickness to the top surface of the Goat Island. Checks are incorporated in the development of the surfaces to confirm that the derived elevations match the observed elevations of the surfaces at boreholes.

The available information and procedures for generating each surface are described in detail in the following sections.

# Section 4
# Ground surface elevations

Ground surface elevations for the model are interpolated from the Tri-City Digital Elevation Model (DEM) and MNR 10 m DEM version 2 (MNR, 2005). AquaResource Inc. supplied both DEMs for this analysis. As shown in **Figure 4-1**, the Tri-City DEM has a high resolution (1 m), but does not cover the full model area. In contrast, the MNR 10 m DEM has a coarser resolution but covers the entire model area. The interpolation is conducted so that elevations from the Tri-City DEM are used where they are available, with elevations for the remainder of the area taken from the MNR DEM. To assess the consistency between two DEMs, mapped elevations are compared across the model area. The absolute elevation differences between the Tri-City DEM and the MNR 10 m DEM are presented in **Figure 4-2**. In general, the elevations from the two DEMs are consistent. Over most of the area of overlap, the differences in the elevations are less than 2 m. Large differences are generally limited to the edges of the area of the Tri-City DEM. Close examination of the edges of the Tri-City DEM revealed that the elevations near the edge were not smooth, and edge effects of the data were clearly visible.

The locations of cross-sections along which the MNR 10 m and Tri-City DEMs are compared are also shown in **Figure 4-1**. Profiles along the sections are shown in **Figure 4-3** to **Figure 4-5**. In general, the elevations along the cross-sections are consistent; differences are typically less than 2 m. However, differences in excess of 20 m are observed at the beginning of cross-section A-A′; this is likely caused by errors at the edge of the Tri-City DEM. The interpolation has been repeated excluding the area of the Tri-City DEM coverage where the edge effects are observed. The absolute differences between the two DEMs for after re-interpolation are shown in **Figure 4-6**. The results shown in **Figure 4-6** still suggest that relatively large differences exist around the Cambridge East Landfill. Review of the original DEM data suggests that the Tri-City DEM elevations are about 10-20 m higher than the MNR 10 m DEM in this area. The elevations from the Tri-City DEM have been used in this area; further investigation may be required to confirm the reliability of these elevations. The final interpolated ground surface elevations across the model are presented in **Figure 4-7**.

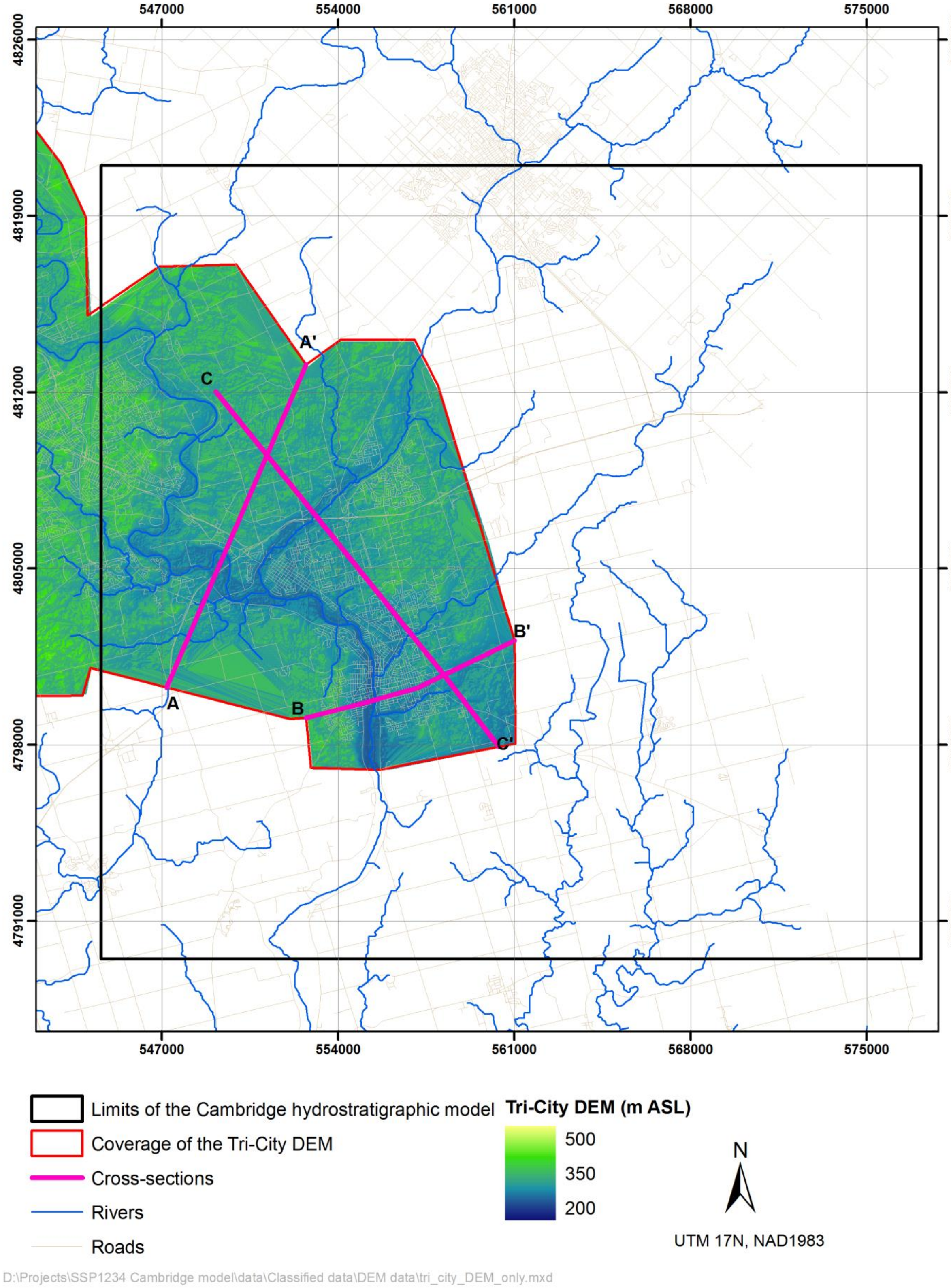



**Figure 4-1 Coverage of the Tri-City DEM**

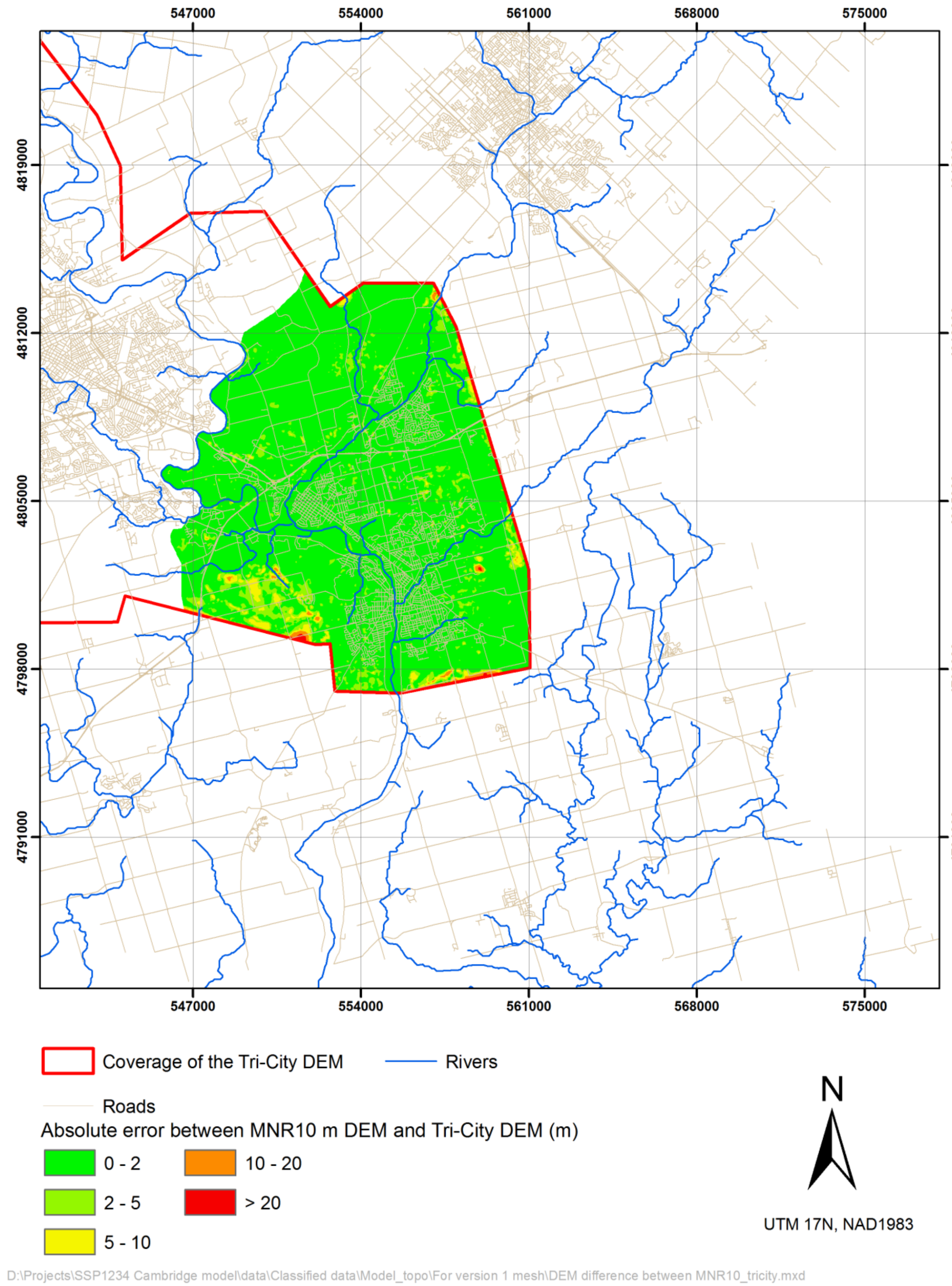



**Figure 4-2 Absolute elevation differences between the Tri-City and MNR 10 m DEMs**

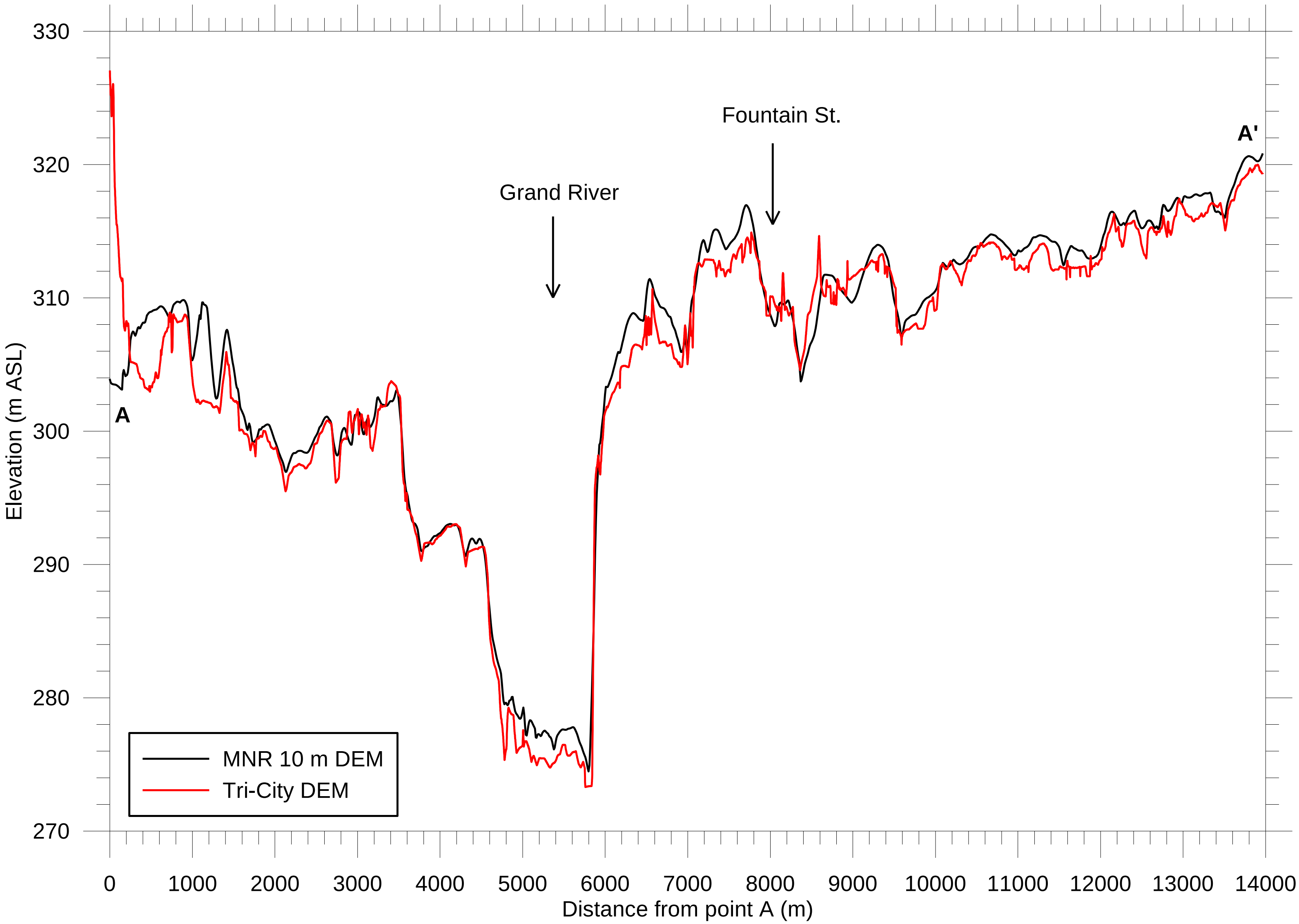



**Figure 4-3 Profile of ground surface along line A-A′**


**Figure 4-4 Profile of ground surface along line B-B′**

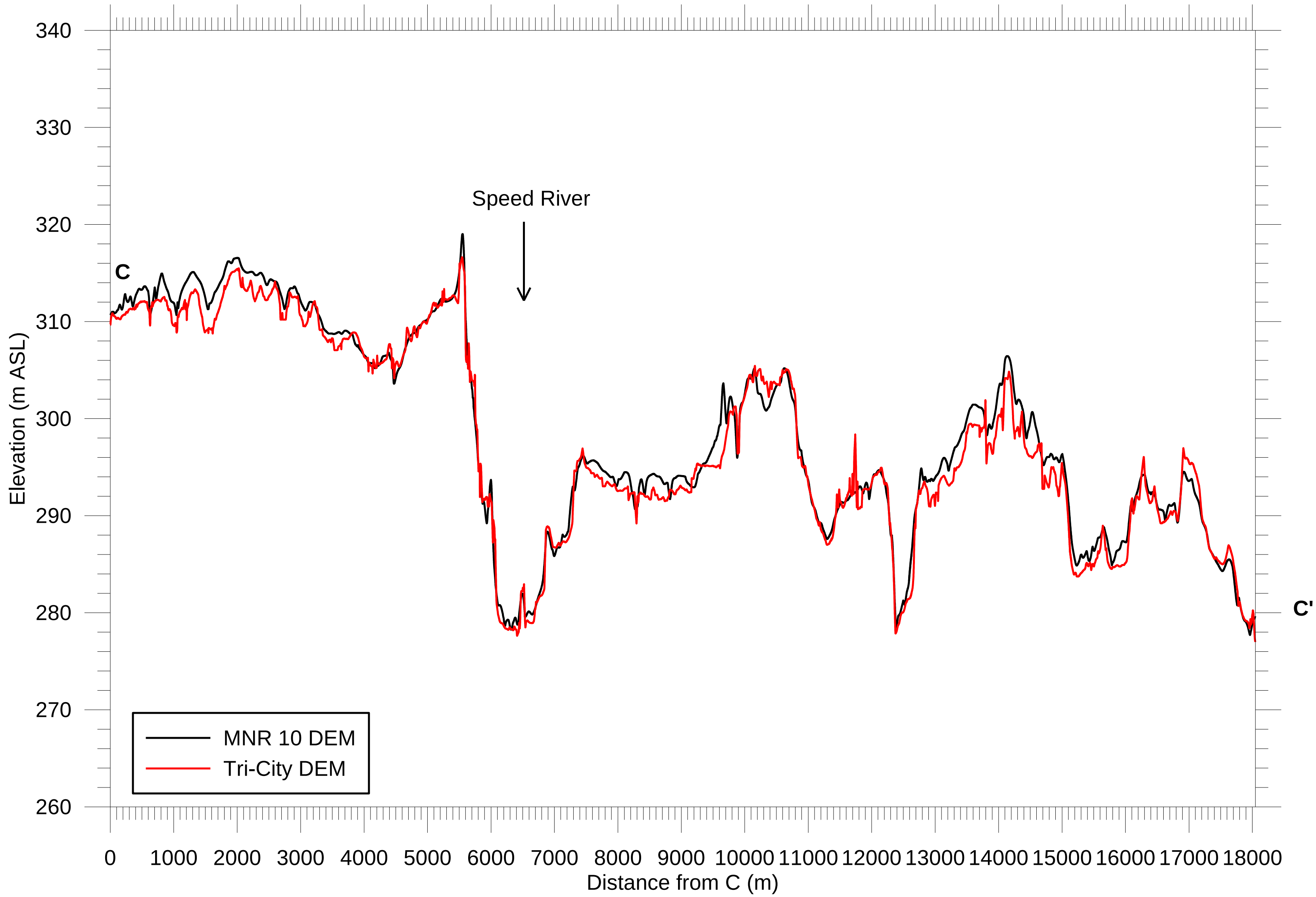



**Figure 4-5 Profile of ground surface along line C-C′**

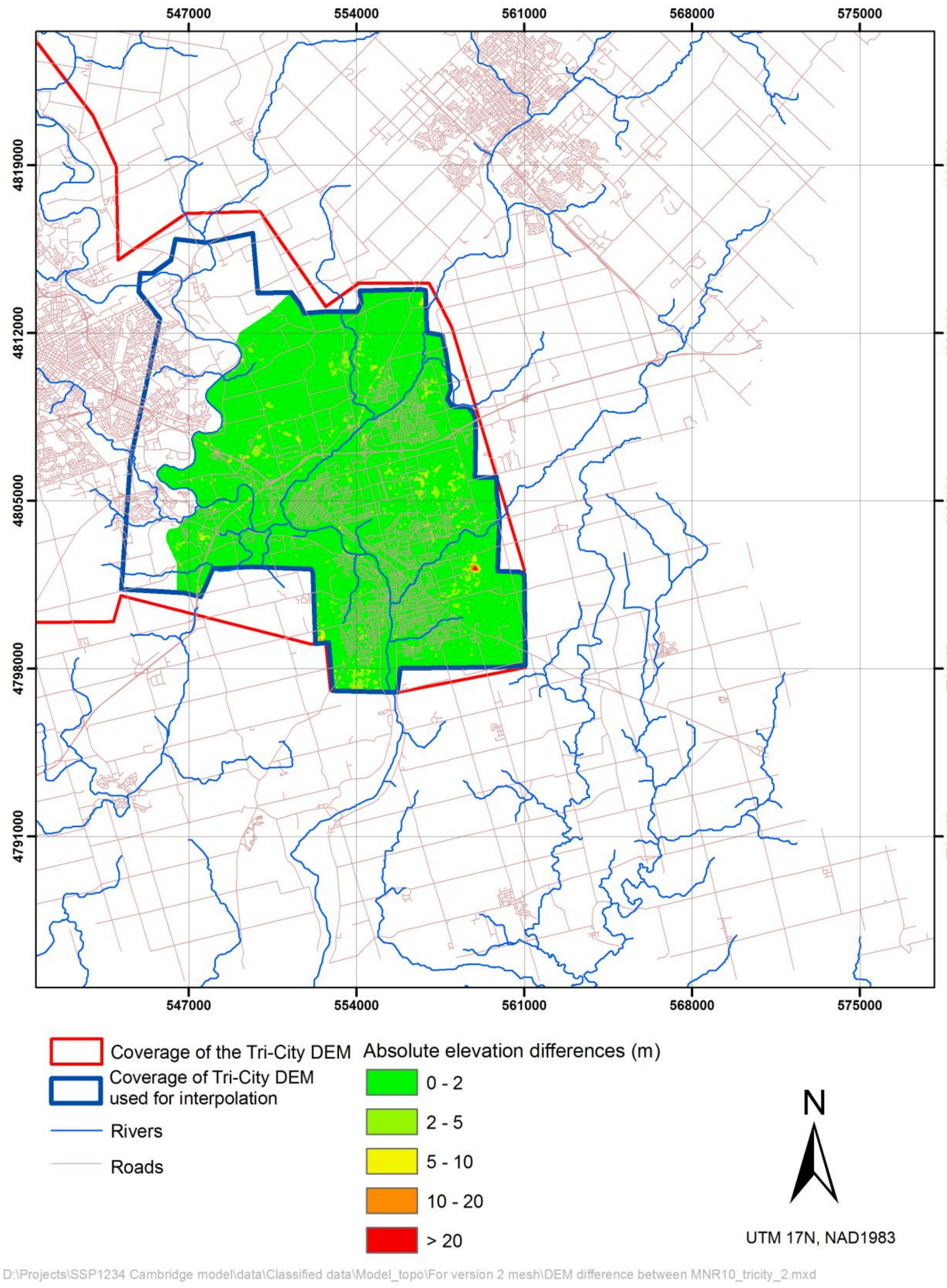
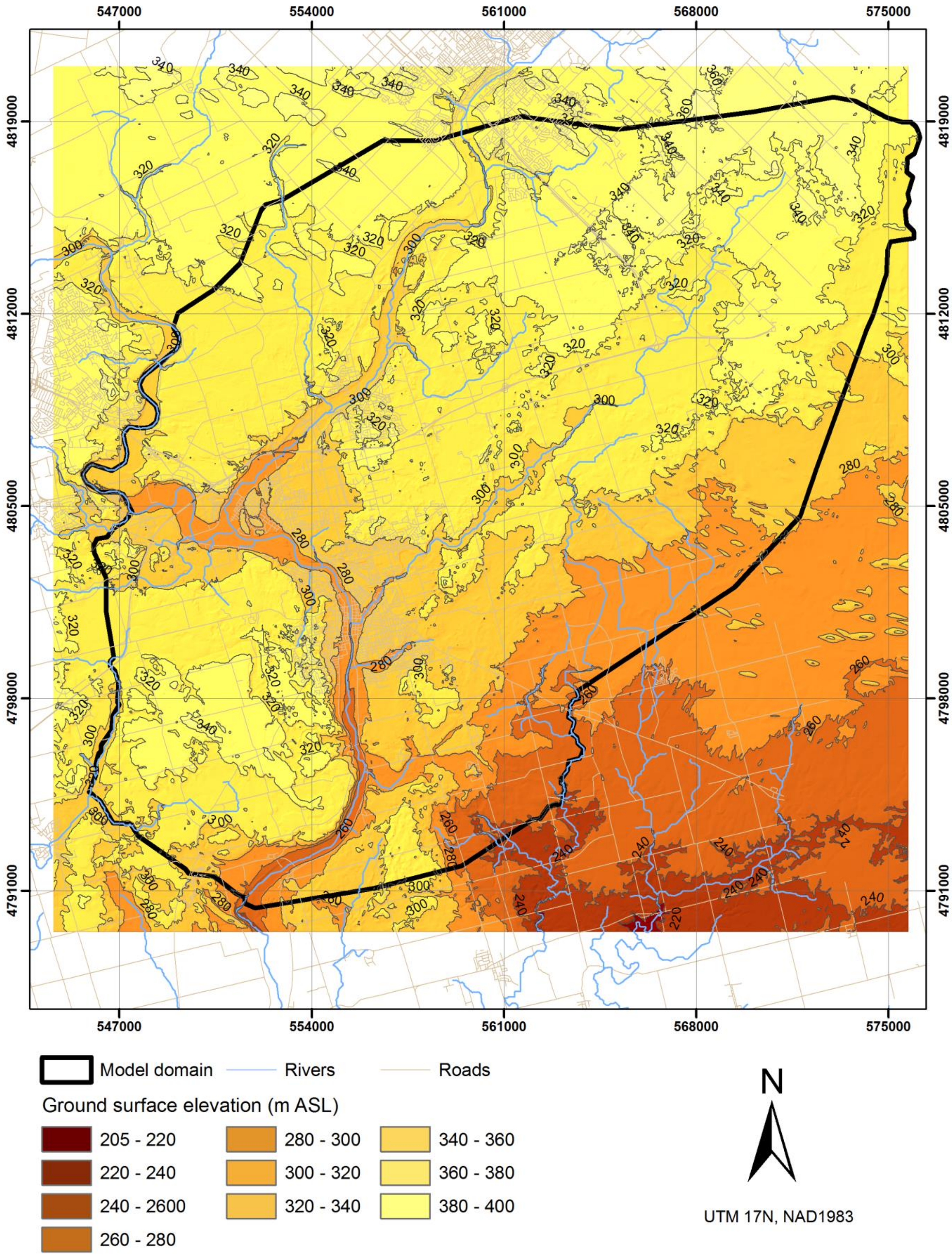



**Figure 4-6 Absolute differences in elevations between the Tri-City and MNR 10 m DEM after re-interpolation**




D:\Projects\SSP1234 Cambridge model\data\Classified data\Model_topo\For version 2 mesh\Interpolated ground surface.mxd

**Figure 4-7 Final interpolated ground surface elevations**

# Section 5
# Overburden model layers

The bulk of existing and planned groundwater supplies in the Cambridge area are obtained from wells that are open across the bedrock. Therefore, in contrast to Waterloo and Kitchener, the focus of the Cambridge analyses is the bedrock rather than the overburden. The Ontario Geological Survey geological model of the overburden includes 19 units for the area (Bajc and Shirota, 2007). The OGS geologic model for the overburden does not extend over the full extents of the study area. Furthermore, not all of these units are present or significant in the Cambridge model area. Golder (2011a) indicates that among the 19 overburden units, only seven are significant in the Cambridge area. These seven units are: ATA2, AFA2, ATB1, AFB1, ATB3, ATC1 and AFD1. For the purposes of supporting a tractable numerical groundwater model, some of these units are lumped based on their lithologic and hydrogeologic characteristics. Overburden units ATA2, AFA2, ATB1 and AFB1 are combined in model layer 1. Overburden units ATB3 and ATC1 are combined in model layer 2. Model layer 3 represents AFD1, which is present only in the vicinity of P16.

Due to the discontinuity of the overburden units and the lack of information over the whole model area, the model layer surfaces for the overburden are interpolated using cross-sections based on borehole picks where detailed information is available. For the remainder of the model domain, the surfaces from the OGS overburden model are used where they are available. Beyond the limits of the OGS overburden model, the thickness of the overburden is subdivided into three layers of equal thickness.

The data considered in the development of the overburden model layers are extracted from cross-sections developed from the OGS overburden model, Tier 3 studies, IUS studies, and the Cedar Creek groundwater model (WESA and SSPA, 2005). The locations of the cross-sections are shown in **Figure 5-1.** The sources of the sections are listed on **Table 5-1**. A detailed description of the development of the overburden layers in the Cambridge area is presented in AquaResource (2012).

**Table 5-1 Sources of overburden cross-sections**

| Category | Source | Detail data | Format |
|---|---|---|---|
| Tier 3 study | Cambridge east well field (Golder, 2011a) | 12 cross-sections | PDF Figures |
| | Cambridge NW well field (Stantec, 2011a) | 4 cross-sections | PDF Figures |
| | Cambridge SW well field (Stantec, 2011b) | 3 cross-sections | PDF Figures |
| | Parkway and Strasburg well field (Stantec, 2012) | | PDF figures |
| | Fountain street well field (Golder, 2009d) | 1 cross-section | PDF Figures |
| IUS study | P16 area (Golder, 2009a) | 12 cross-sections | PDF figures and Excel picks |
| | Cambridge East landfill (Golder, 2008) | 18 cross-sections | PDF and Excel picks |
| Others | Cedar Creek model (WESA and SSPA, 2005) | 8 cross-sections | Cross-sections |
| | OGS overburden model (Bajc and Shirota, 2007) | | Electronic surfaces |

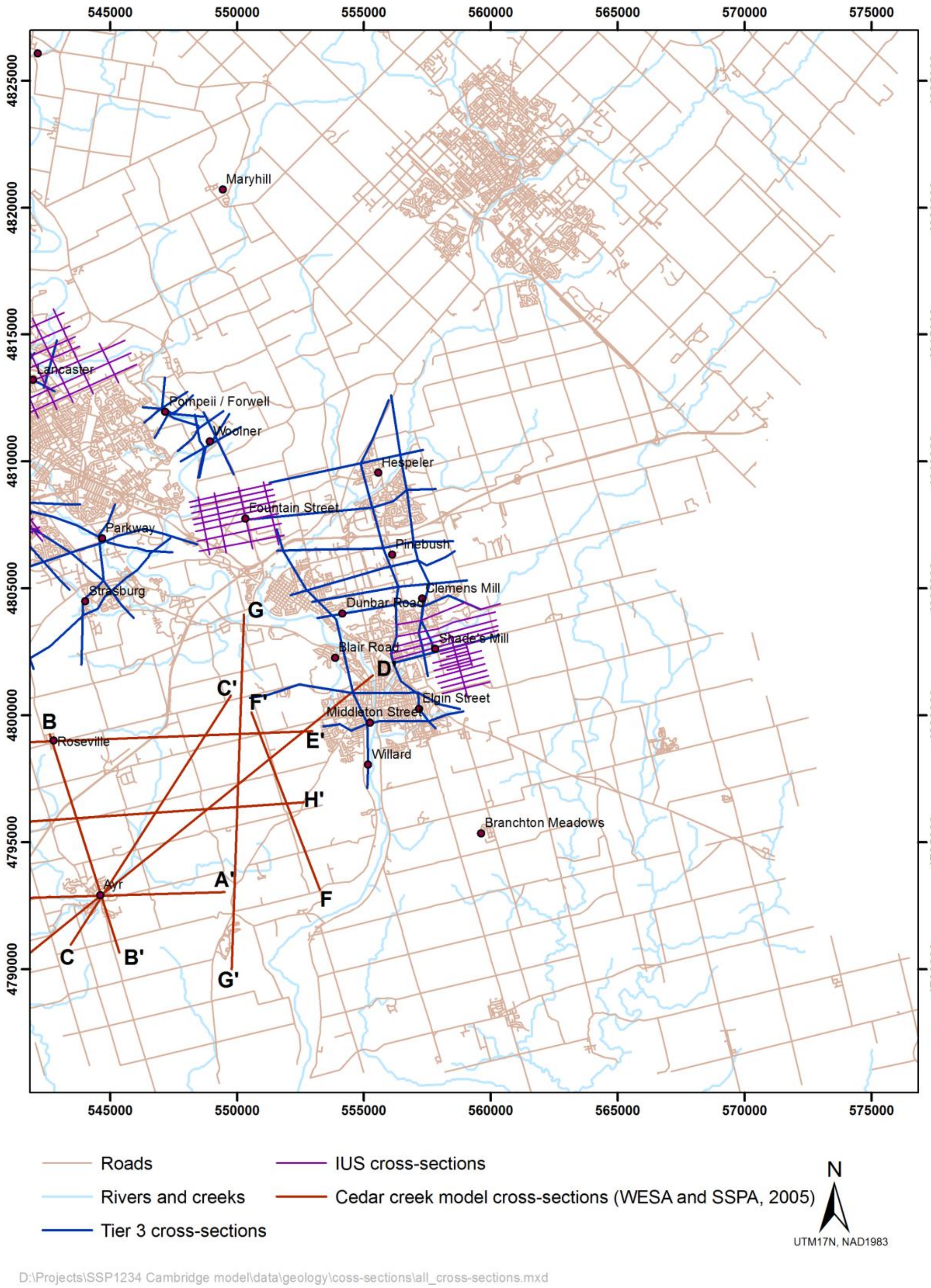



**Figure 5-1 Locations of overburden cross-sections**

# Section 6
# Bedrock topography, overburden thicknesses and the Contact Aquifer

## 6.1 Data sources

The following data were used to construct the bedrock surface for the Cambridge model:

- OGS bedrock picks (Gao et al., 2006);
- WRAS+ database (version 2, supplied by AquaResource);
- Data points from the Dundas Valley study (AquaResource, 2007);
- Bedrock picks for Tier 3 study (supplied by Golder);
- Bedrock picks for Tier 3 study (supplied by Stantec);
- Cross-sections from the Cedar Creek groundwater model (WESA and SSPA, 2007); and
- Bajc 2008 picks data (supplied by AquaResource)

Maps of the surficial geology also showed that bedrock outcrops over some portions of the model area (Karrow, 1987; Ontario Geology Survey, 2003). Control points were added in these areas with the elevations of the bedrock surface set equal to ground surface.

The surface of the bedrock was developed through multiple iterations. For example, the surface was developed initially using dataset that excludes the data points from Bajc and Shirota (2007), and the Bajc and Shirota data were used for quality checking. During the quality checking, it was found that Bajc and Shirota (2007) contained additional data that are critical to the development of the bedrock surface. The bedrock surface was re-developed by including these additional data.

## 6.2 Data organization and quality control

All data sets were checked and sorted, with duplicate data points removed based on their reliability ranking. The reliability of the data were ranked from high to low in the following order: Stantec's picks, Golder Associates' picks, picks from Dundas Valley study, Bajc's 2008 picks, OGS bedrock picks, digitized points from the Cedar Creek study, and the WRAS+ database.

It is important to note that the labels "Stantec's picks" and "Golder's picks" are used here only the firm that provided the data to us. In reality, Frank Brunton of the Ontario Geological Survey made almost all of the picks. Stantec's picks were considered slightly more reliable that the Golder picks because they were received at a later date. There are some duplicate picks between Stantec and Golder's compilations. In general, the picks at the same locations are consistent. However, there are a few locations where the picks differ. John Piersol, Golder Associates, indicated in a telephone conversation that Stantec's picks should be considered more reliable at these locations, since Stantec were responsible for the drilling and logging of these wells.

The reason why a higher ranking was given to OGS picks over the WRAS+ database is that it was found during the processing that many WRAS+ entries were not consistent with other data sources; differences of over 50 m have been observed with other data sources that are internally consistent. At some locations, it was noted that the WRAS+ database indicates bedrock depths that exceed the depth of the boreholes. This ranking order was used only as a general guide; the consistency of the bedrock elevations with the surrounding points is the most important criterion outside the picks from Stantec and Golder Associates. For instance, although the picks for the Dundas Valley study were considered to be generally highly reliable, it was found that several of the Dundas Valley picks have bedrock elevations that are 20 to 30 m higher than their surroundings; these picks have been flagged and excluded from the final dataset.

Extensive efforts were made to remove duplicate and inconsistent data points. Two of the checks conducted are described below.

1. All of the data within a 1 m search radius were checked to identify duplicate points. If the distance between two data points was less than or equal to 1 m, these points were exported to a separate file for further review. The data points in the exported file were checked carefully one-by-one against other nearby data points. For points that had the same or similar bedrock elevations, only one point was retained, and the others were flagged as *duplicate points* and excluded from the final dataset. Points with elevations that were significantly different from surrounding points were flagged with a message of *inconsistent with surroundings* and were excluded from the final data.; and

2. All of the data within a 50 m search radius were checked to identify outliers. If the bedrock elevations at two points within a 50 m distance differed by more than 10 m, both points were exported to a separate file. Points assembled were reviewed carefully and their bedrock elevations were compared with the surroundings. The points with bedrock elevations that were not consistent with the surroundings were flagged and excluded from the final dataset.

After the checking, the following numbers of points were retained in the final dataset for the bedrock surface:

- OGS bedrock picks [Original set: 6,343, retained 4,562];
- WRAS + database [Original set: 3,019, retained 894];
- Data points from the Dundas Valley study [Original set: 324, retained 170];
- Bedrock picks from Golder [Original set: 53, retained 40];
- Bedrock picks from Stantec [Original set: 125, retained 121];
- Digitized cross-section points from Cedar Creek study [Original set: 2,462, retained 2,460]; and
- Bajc's 2008 picks data [Original set: 1,754, retained 1,167 ];

It was suggested subsequently that data points in the vicinity of P16 and the Cambridge East Landfill be removed and that only the picks compiled during the Golder Associates IUS studies be used. After this step, the numbers of data points retained from each data source were:

- OGS bedrock picks: 4,508 (a further reduction of 54);
- WRAS Plus database: 828 (a further reduction of 66);
- Data points from the Dundas Valley study: 128 (a further reduction of 42);
- Bedrock picks from Golder: 37 (a further reduction of 3);
- Bedrock picks from Stantec: 121 (unchanged);
- Digitized cross-section points from Cedar Creek study: 2,460 (unchanged);
- Bajc 2008 picks data: 1,124 (a further reduction of 44);
- Picks from Cambridge East Landfill IUS study: 65(additions);
- Picks from P16 IUS study: 23 (additions); and
- Data points from AquaResource's final Cambridge Master Table Picks (supplied on April, 23rd, 2010): 4(additions).

The additional four data points from AquaResource's final Cambridge Master Table Picks were supplied to SSPA after AquaResource reviewed the new preliminary bedrock surface. Three Golder picks, G5-TW1-08, H4-TW1-08 and H5-TW1-09, were removed based on the suggestion of John Piersol, Golder Associates[1]. He indicated that the information given in these wells was not based on surveyed elevations, and were only the top of core provided to Mr. Frank Brunton. Based on his familiarity with the area around P9, P15 and G5, he suggested removing any WRAS and OGS picks with a bedrock elevation exceeding 295 m ASL.

A total of 3,488 data points were also incorporated in the dataset at locations of bedrock outcrops. The metadata for this study includes a listing of all data points, with an indication of which points have been excluded from the final dataset.

## 6.3 Mill Creek bedrock valley

Another issue that was raised during the March 26, 2010 meeting was the presence of a bedrock valley near Mill Creek. Few high-reliability data points in the current dataset were available to define the extent and depth of this bedrock valley. To investigate further the potential presence of this bedrock valley, several additional interpretations were reviewed (Ontario Department of Mines, 1963; IWS, 1974; Lotowater, 1997; and Bajc and Shirota, 2007).

The Ontario Department of Mines presented a map of the bedrock surface in 1963 (Map M2030), which was cited in the Golder Associates study of Cambridge (Golder, 1991). The relevant section of the map is reproduced in **Figure 6-1.** The bedrock valley was different from the current Mill Creek channel and not connected to the Grand River. The elevation of the deepest part of the valley was about 250 m ASL.

[1] Email communication with John Piersol (Golder Associates) on May 6, 2010.

Bedrock topography maps included in IWS (1974) and Lotowater (1997) suggested a bedrock valley near Mill Creek. Contours of the bedrock elevations, as mapped in IWS (1974) and Lotowater (1997), were digitized and are presented in **Figure 6-2** and **Figure 6-3,** respectively. The units of the original bedrock topography in the IWS (1974) map were in feet; for comparison with other studies, the unit of the bedrock elevations in **Figure 6-2** was converted to metres.

Although there are differences between the contours shown in **Figure 6-2** and **Figure 6-3,** both maps show a continuous bedrock valley from Mill Creek to the Grand River. The depth and width of the valley in the two maps are different. The valley in IWS's map follows the present channel of Mill Creek; in contrast, the Lotowater mapping suggests some offset from the present channel. Very little description was provided in IWS (1974) regarding the development of the bedrock surface. Lotowater (1997) included a gravity survey at Soper Park, which indicated that the depth of the bedrock valley ranges from 10 m to 40 m, and that the valley may split toward the northeast.

The Ontario Geology Survey published a bedrock topography map in 2006 (Gao et al., 2006). As shown in **Figure 6-4**, the bedrock valley was not interpreted to be continuous up to the Grand River. The deepest point of the valley has an elevation of 260 m ASL; however, the bedrock surface rises to an elevation of 270 m between Mill Creek and the Grand River.

A portion of the map of the top of bedrock developed by Bajc and Shirota (2007) is reproduced in **Figure 6-5**. A bedrock valley near Mill Creek was not evident in their interpretation.

The bedrock surface for the present model incorporated the bedrock valley near Mill Creek following the Lotowater (1997) interpretation. The Lotowater (1997) mapping was taken as the most reliable because it incorporated the results of a local gravity survey. The bedrock topography map from the Lotowater report (1997) was digitized, and points near Mill Creek were included in the dataset as control points.

The locations of all control points for the final dataset for the top of bedrock surface are shown in **Figure 6-6.**

## 6.4 Interpolated bedrock surface and inferred overburden thicknesses

The initial continuous surface of the top of bedrock was developed by interpolation of the control points, using Surfer 9 (Golden Software, 2009). Ordinary Kriging with the default linear variogram was used. The resulting surface of the top of the bedrock exceeded ground surface in some areas, likely reflecting errors introduced by the interpolation around the areas of bedrock outcrop. In these areas, the bedrock surface was revised to match ground surface.

The observed top of bedrock elevations in the boreholes are plotted in **Figure 6-7** against the interpolated elevations at the same locations. The comparison indicated that the interpolated elevations were generally consistent with the elevations of the control points. Discrepancies between the elevations of the control points and the interpolated elevations were identified at some locations; these points generally coincided with the locations of the OGS picks or WRAS+ points. The largest discrepancies occurred between points that are in close proximity; at these locations the OGS and WRAS+ elevations were not consistent with other data sources. A significant effort was devoted to removing unreliable points. A cumulative probability plot of the differences between the elevation of the control points and the interpolated elevation is shown in **Figure 6-8**. Over 98% of the points differed by less than 2 m and the mean and mean absolute differences were 0.03 m and 0.32 m, respectively. The differences at about 70% of the locations approximated a normal distribution.

The final interpolated bedrock surface is presented in **Figure 6-9**. The elevations of the bedrock surface ranged from 220 to 330 m ASL across the model domain. The bedrock valley near Mill Creek is clearly visible in a more detailed view of the bedrock surface near the area in **Figure 6-10**.

The overburden thicknesses were calculated by subtracting the continuous bedrock surface from the ground surface. After the first pass, negative thicknesses were calculated at some locations. Close inspection revealed that the cause of the negative thicknesses was due either to artefacts of the interpolation or inconsistent data. In general, the negative thickness values corresponded to locations in the WRAS+ database or to errors at bedrock outcrops.

One example of inconsistent data is described here. At borehole MI-OW1-92, Golder Associates reported a bedrock elevation of 287.9 m ASL; in contrast, Stantec reported an elevation of 263.2 m ASL. The ground surface elevation of the DEM at this point was only 264.5 m ASL. Golder Associates reported a bedrock elevation of 263 m ASL at borehole BH1-93, located about 150 m northwest of MI-OW1-92. The Stantec value seemed more reliable since it was consistent with both the ground surface elevation and surrounding boreholes. The interpolation was repeated using the value reported by Stantec. During the second pass, areas with problematic top of bedrock elevations were reviewed. Potentially unreliable elevations were flagged, and the thickness of the overburden was re-calculated. The bedrock surface was re-calculated by subtracting the overburden thicknesses from the ground surface elevations. The bedrock surface shown in **Figure 6-9** reflects these revisions. The final interpreted overburden thicknesses are presented in **Figure 6-11**.

As shown in **Figure 6-11**, the interpreted overburden thicknesses are consistent with the interpreted areas of bedrock outcrops presented in Karrow (1987) and OGS (2003). The observed and interpreted overburden thicknesses at the locations of boreholes are compared in **Figure 6-12.** For this comparison, only the high-reliability picks from Stantec and Golder Associates were used. In general, the absolute differences between the observed and interpreted overburden thickness were less than 2 m.

More significant differences were evident at 7 wells: OW7–95, TW15–60, SMTW4–08, TW2-60, OW10-95, TW1-55 and TW15A/80. The elevations of ground surface and bedrock surface from the high-reliability picks, and SSPA interpolated surfaces for these 7 boreholes, are listed on **Table 6-1**. Data on **Table 6-1** show that the interpolated bedrock surface closely approximates the bedrock elevations based on the picks at all 7 wells. However, the ground surface elevations for the picks differed from the ground surface elevations from the DEM. Comparing the last two columns on **Table 6-1**, it appears that much of the differences in the interpreted overburden thickness can be attributed to the differences in the estimated ground surface elevations. The DEM effectively synthesized information on ground surface elevations over the full extent of the study area. Similarly, the interpolated bedrock surface extended over the full area, and was consistent with the elevations picked from the 7 apparent outliers. Therefore, we retained the interpreted overburden thicknesses at these locations. These points are evident in **Figure 6-13**. As shown in **Figure 6-13**, the cumulative probability distribution of the differences between observed and interpolated overburden thickness for most data points approximates a straight line.

## 6.5 Contact Aquifer

To provide flexibility in the representation of conditions at the interface between the overburden and the upper bedrock, a distinct hydrostratigraphic unit designated the Contact Aquifer was incorporated in the analysis. The Contact Aquifer was represented with a single model layer. The Contact Aquifer was assigned a uniform thickness of 2 m, corresponding to 1 m above and below the top of bedrock surface. In areas where the bedrock outcropped, the full 2 m thickness was subtracted from the upper bedrock units.

**Table 6-1 Bedrock surface elevations at 7 apparent outlier wells**

| Borehole name | Ground elevation from picks (m ASL) | Bedrock elevation from picks (m ASL) | Overburden thickness from picks (m ASL) | Ground elevation from DEM (m ASL) | Interpolated bedrock elevation (m ASL) | Interpreted overburden thickness (m) | Difference in interpreted overburden thickness (m) | Difference in interpreted ground surface elevation (m) |
|---|---|---|---|---|---|---|---|---|
| OW10-95 | 319.00 | 280.00 | 39.00 | 323.16 | 280.87 | 42.29 | -3.29 | -4.16 |
| OW7-95 | 277.30 | 266.61 | 10.69 | 290.06 | 266.12 | 23.94 | -13.25 | -12.76 |
| SMTW4-08 | 320.90 | 277.92 | 42.98 | 296.66 | 277.28 | 19.38 | 23.60 | 24.24 |
| TW1-55 | 290.00 | 277.81 | 12.19 | 288.32 | 278.67 | 9.65 | 2.54 | 1.68 |
| TW15A/80 | 311.0 | 291.50 | 19.50 | 308.55 | 291.52 | 17.03 | 2.47 | 2.45 |
| TW15-60 | 296.79 | 258.68 | 38.11 | 291.33 | 259.56 | 31.77 | 6.34 | 5.46 |
| TW2-69 | 309.38 | 257.87 | 51.51 | 306.01 | 257.87 | 48.14 | 3.37 | 3.37 |

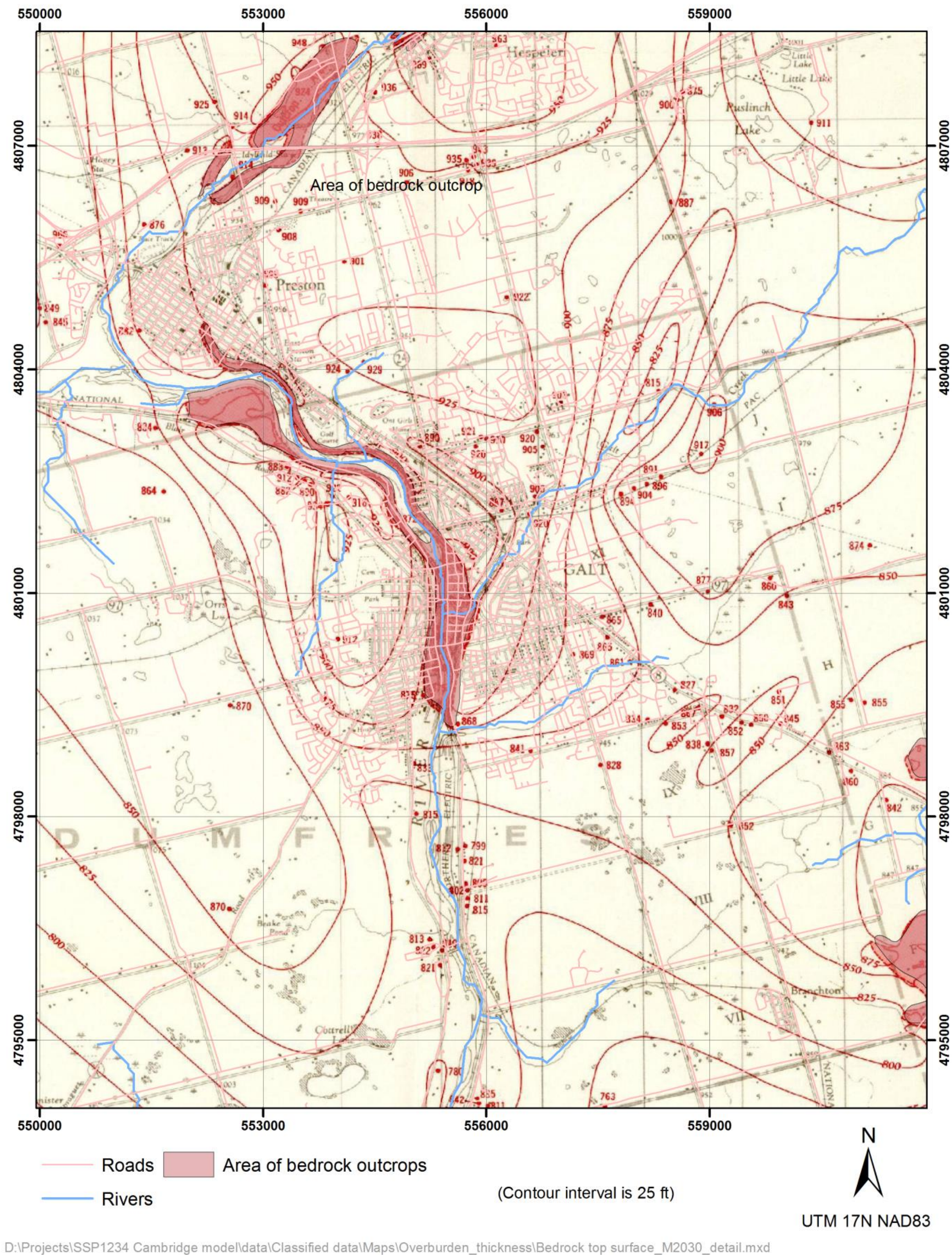



**Figure 6-1 Bedrock topography (Department of Mines, Ontario, 1963, Map M2030)**

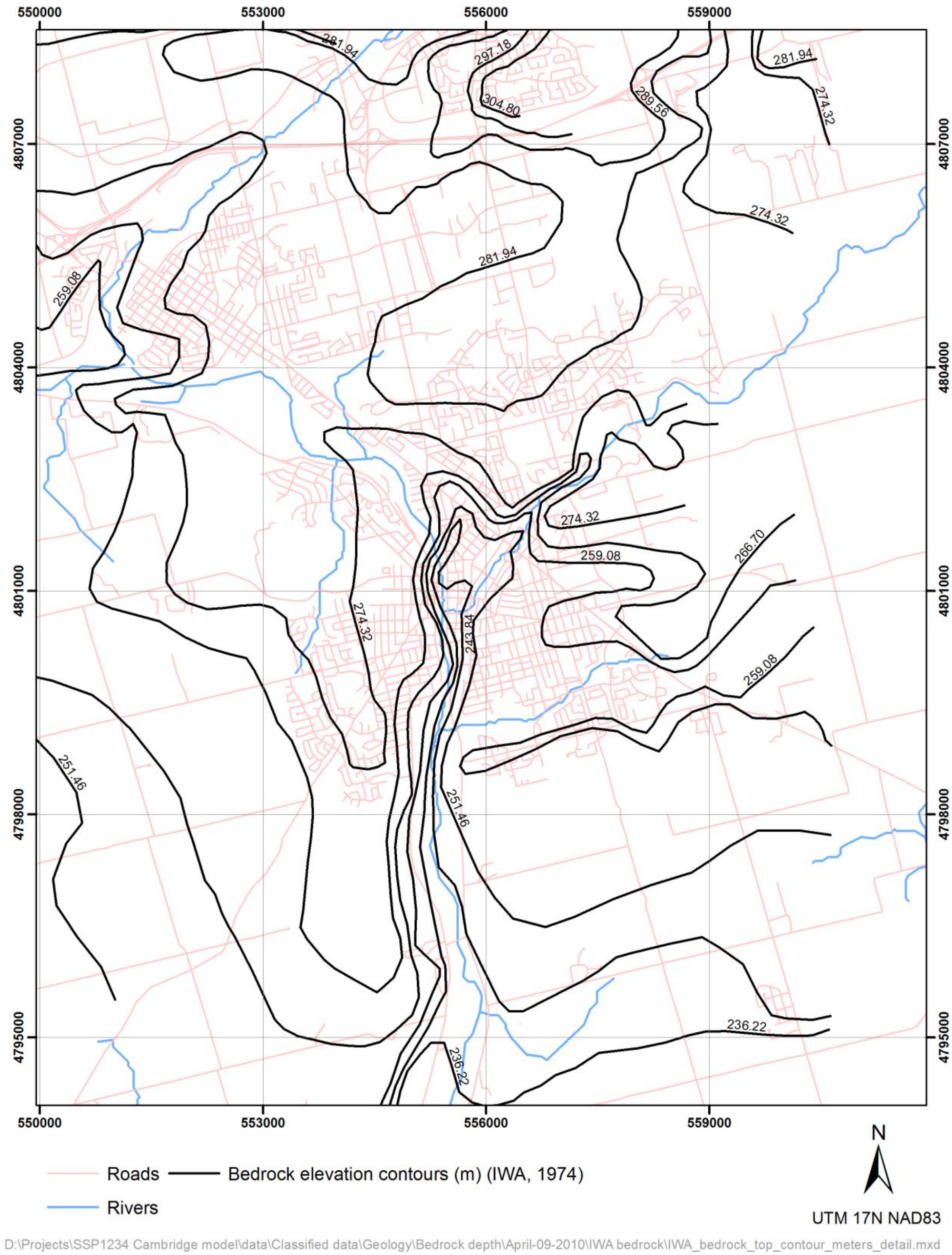



**Figure 6-2 Bedrock topography (IWS, 1974)**

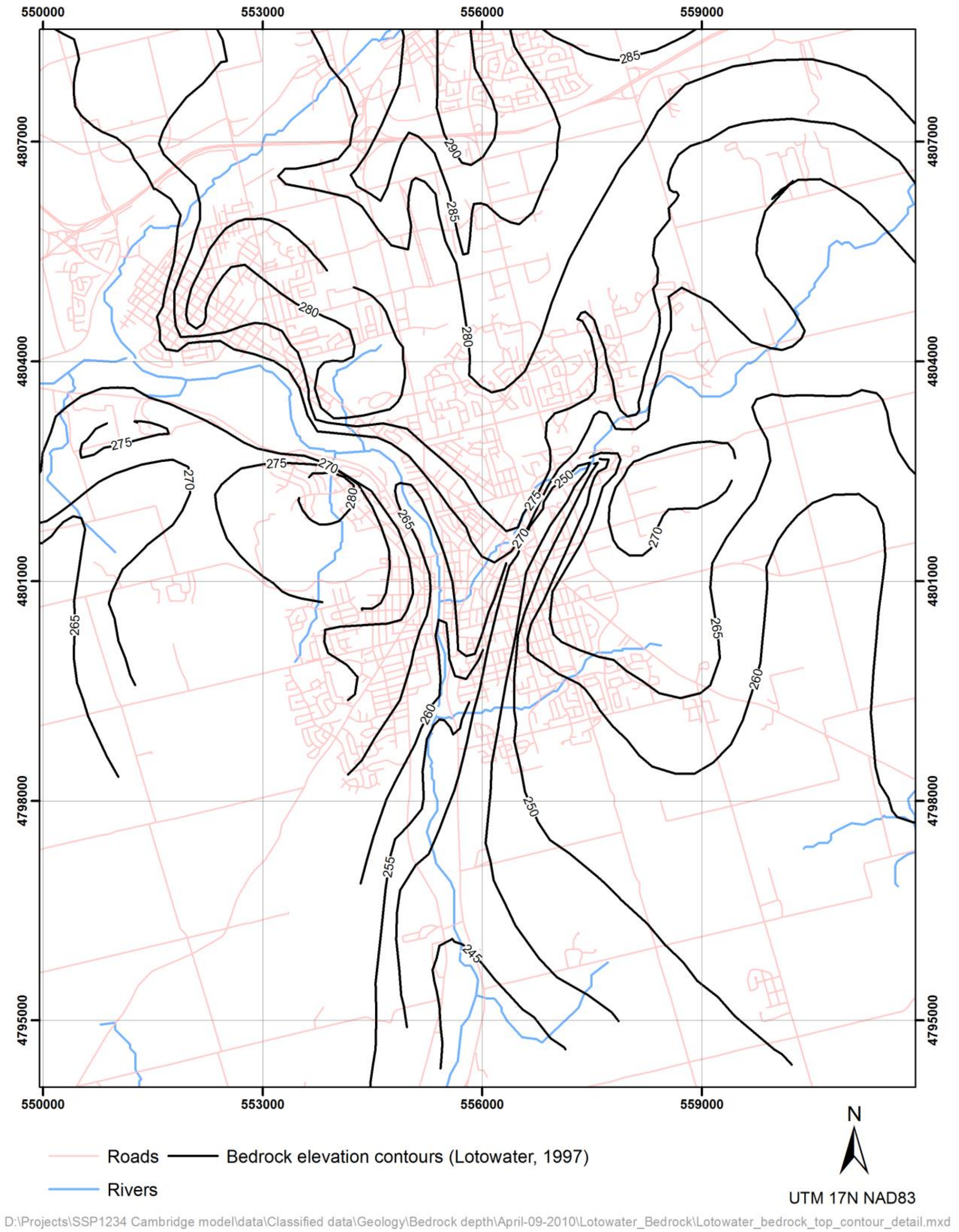



**Figure 6-3 Bedrock topography (Lotowater, 1997)**

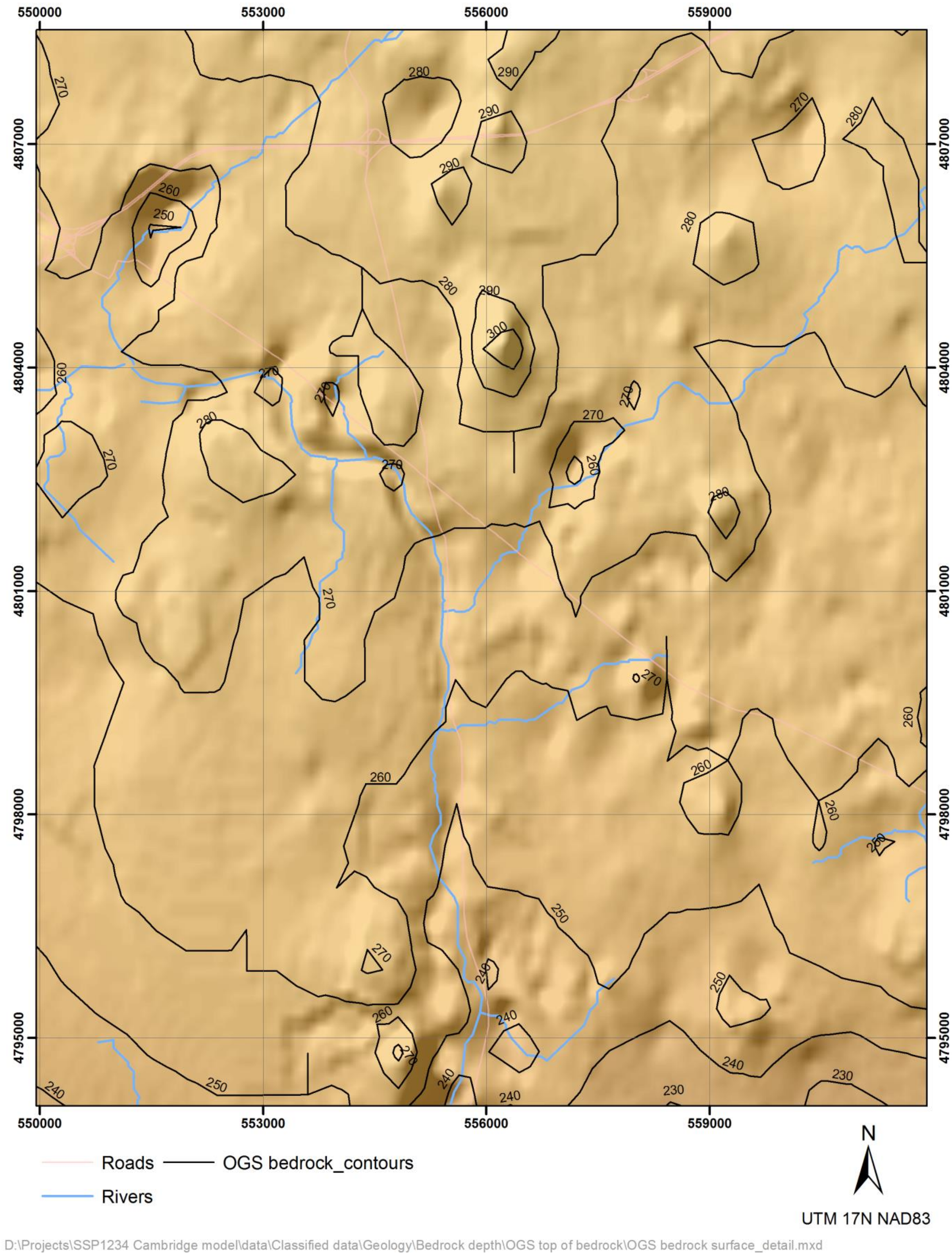



**Figure 6-4 Bedrock topography (Gao et al., 2006)**

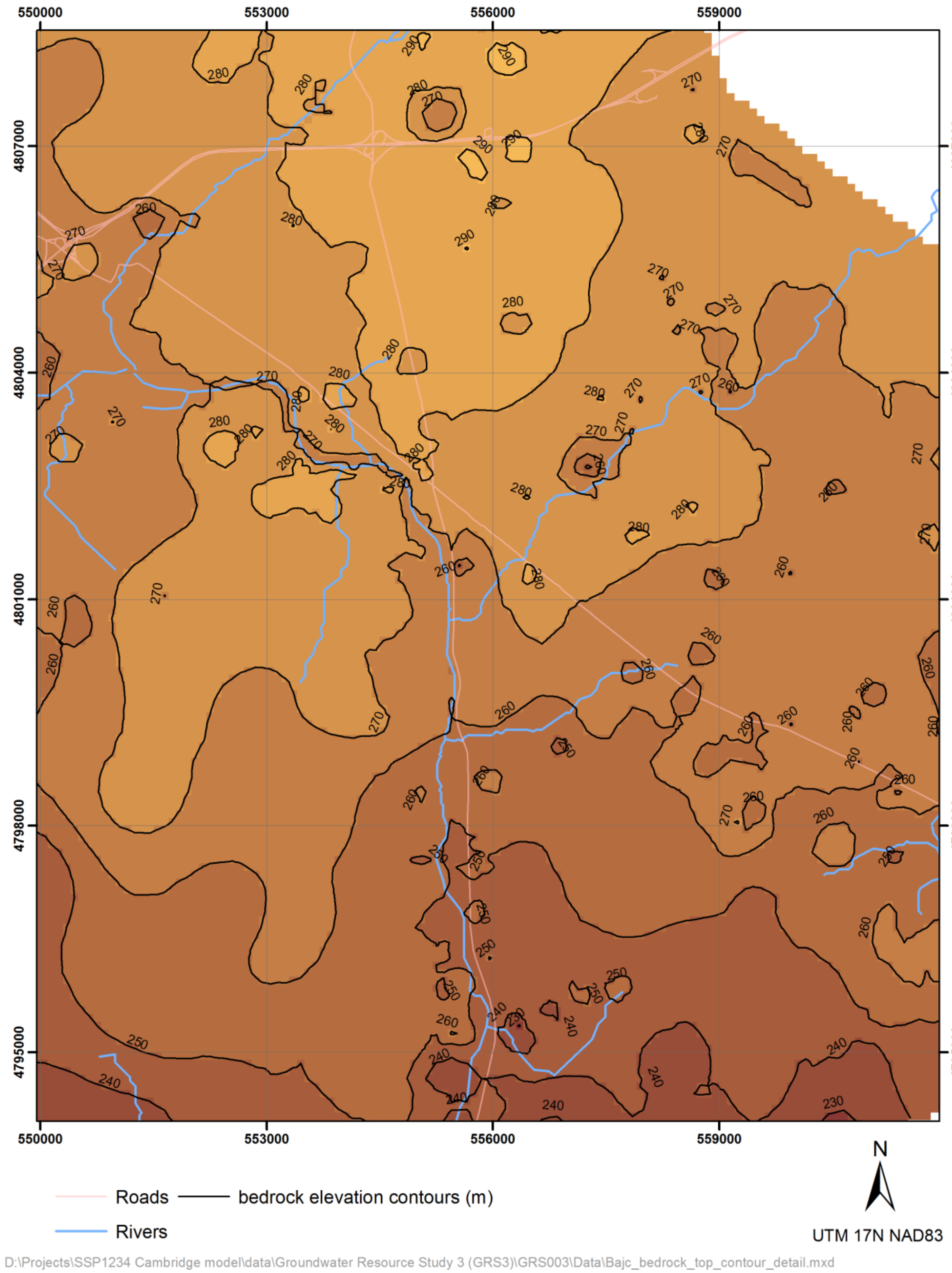



**Figure 6-5 Bedrock topography (Bajc and Shirota, 2007)**

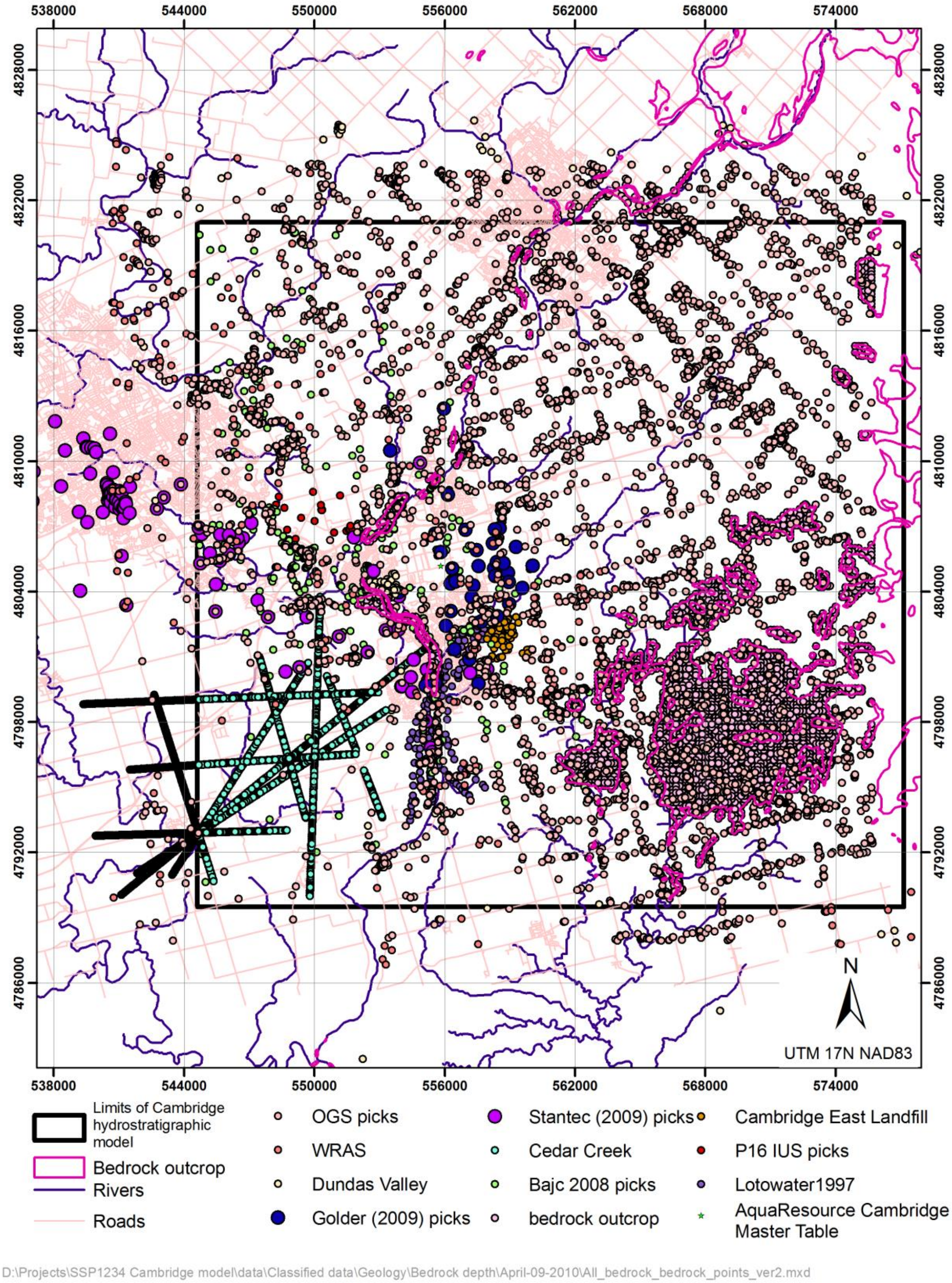



**Figure 6-6 Locations of the top of bedrock control points in the final dataset**

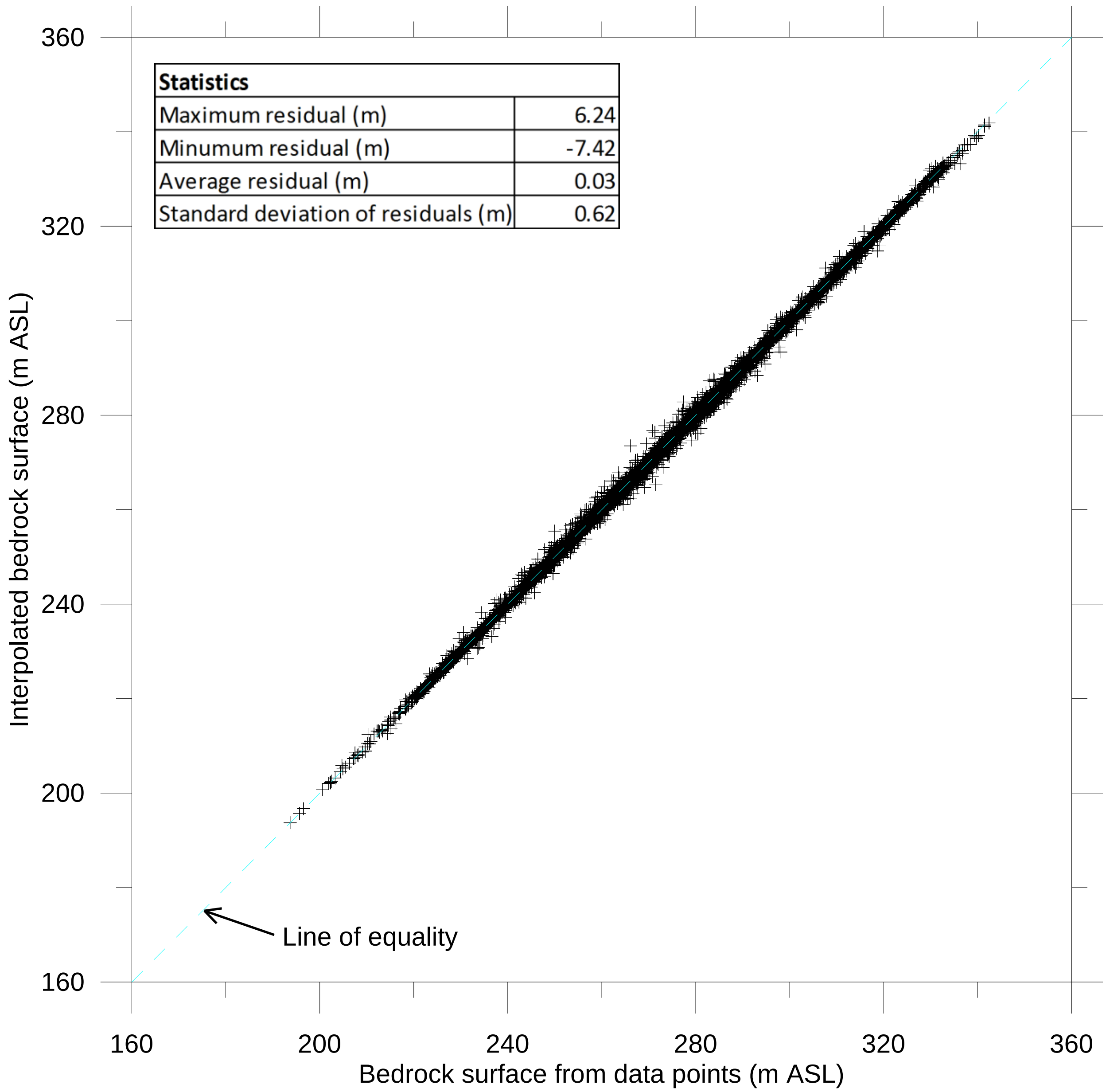



**Figure 6-7 Measured and interpolated elevations of the top of bedrock**

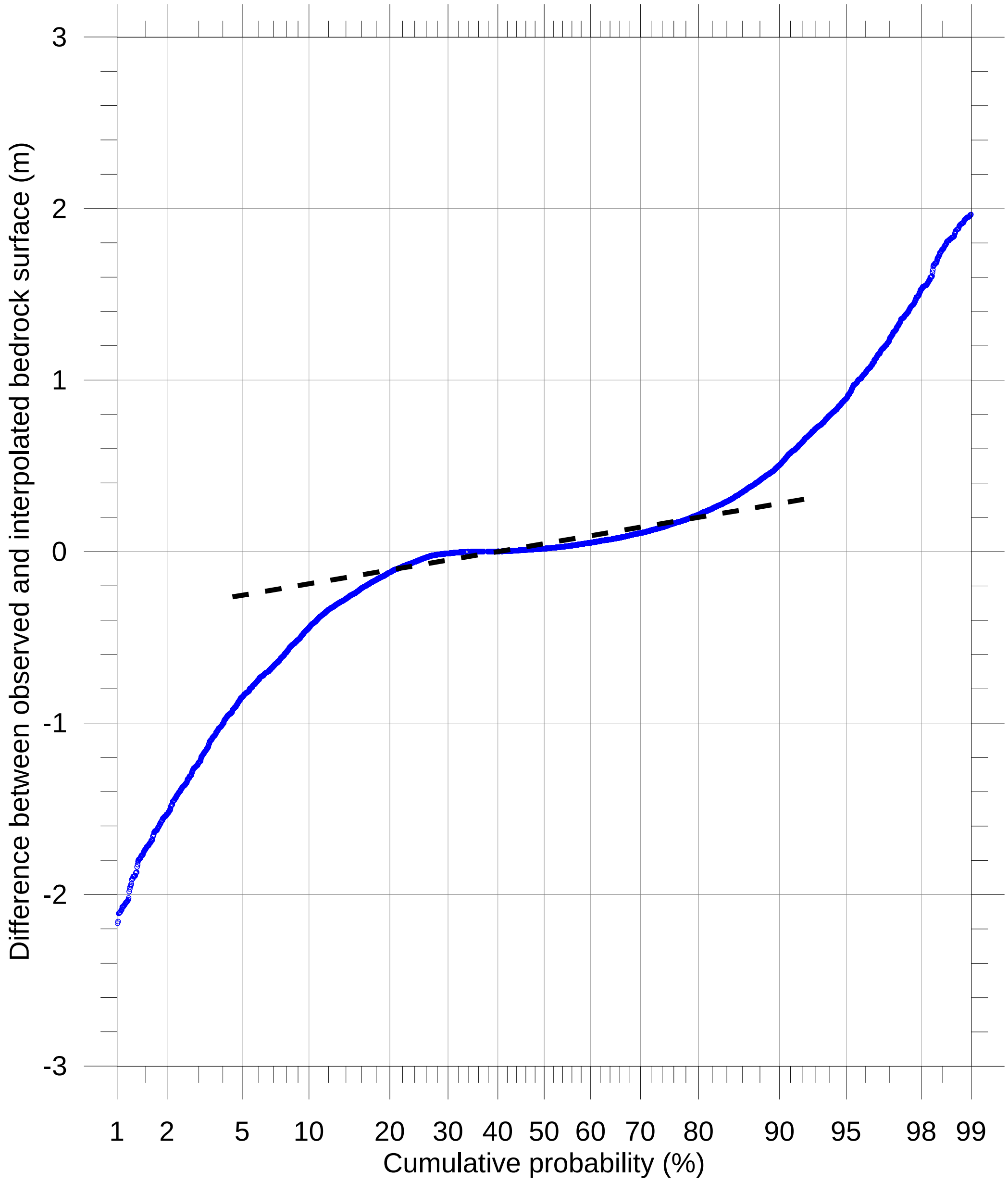



**Figure 6-8 Cumulative probability distribution of the differences between the observed and interpolated elevations of the top of bedrock**

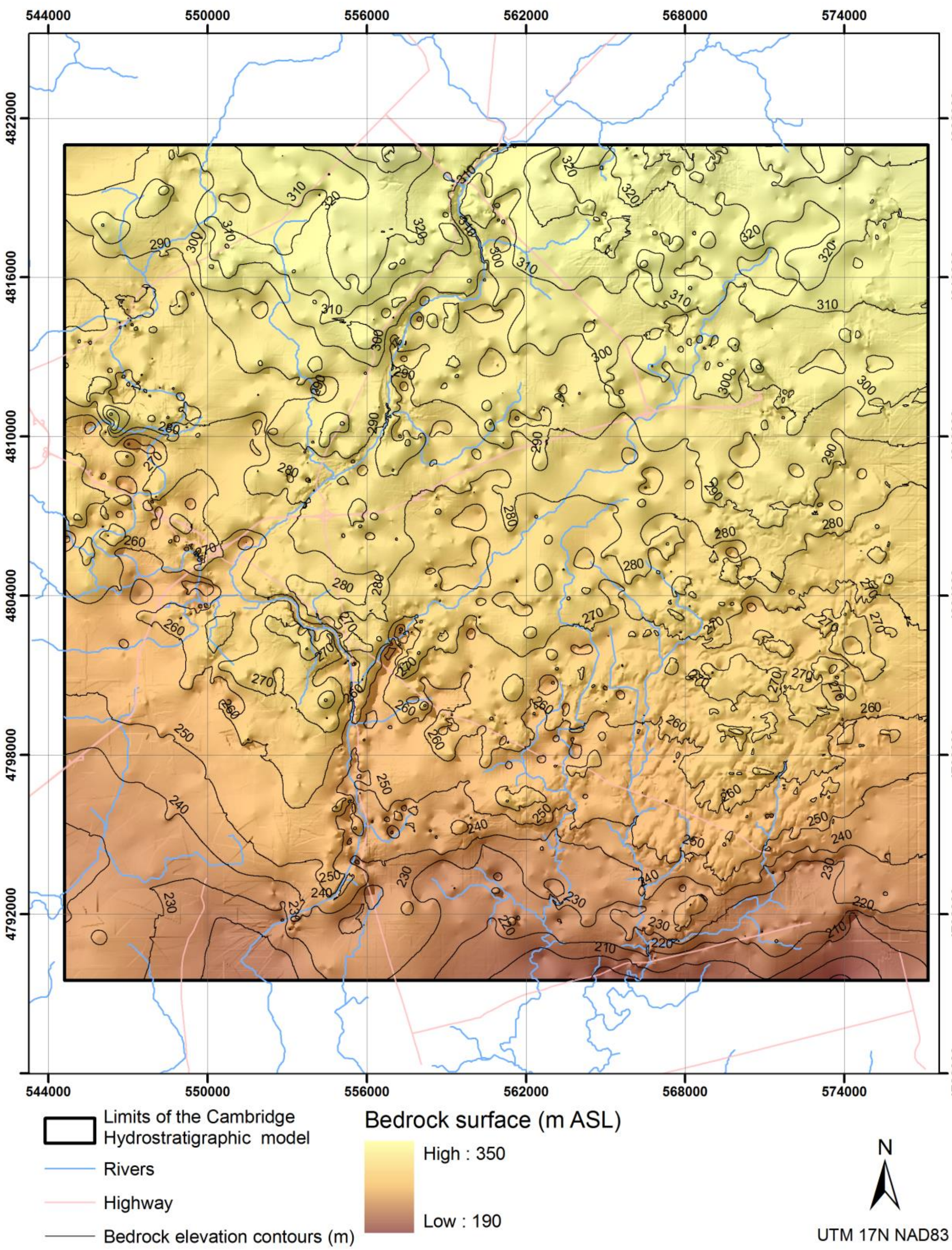



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**Figure 6-9 Final interpolated bedrock surface**

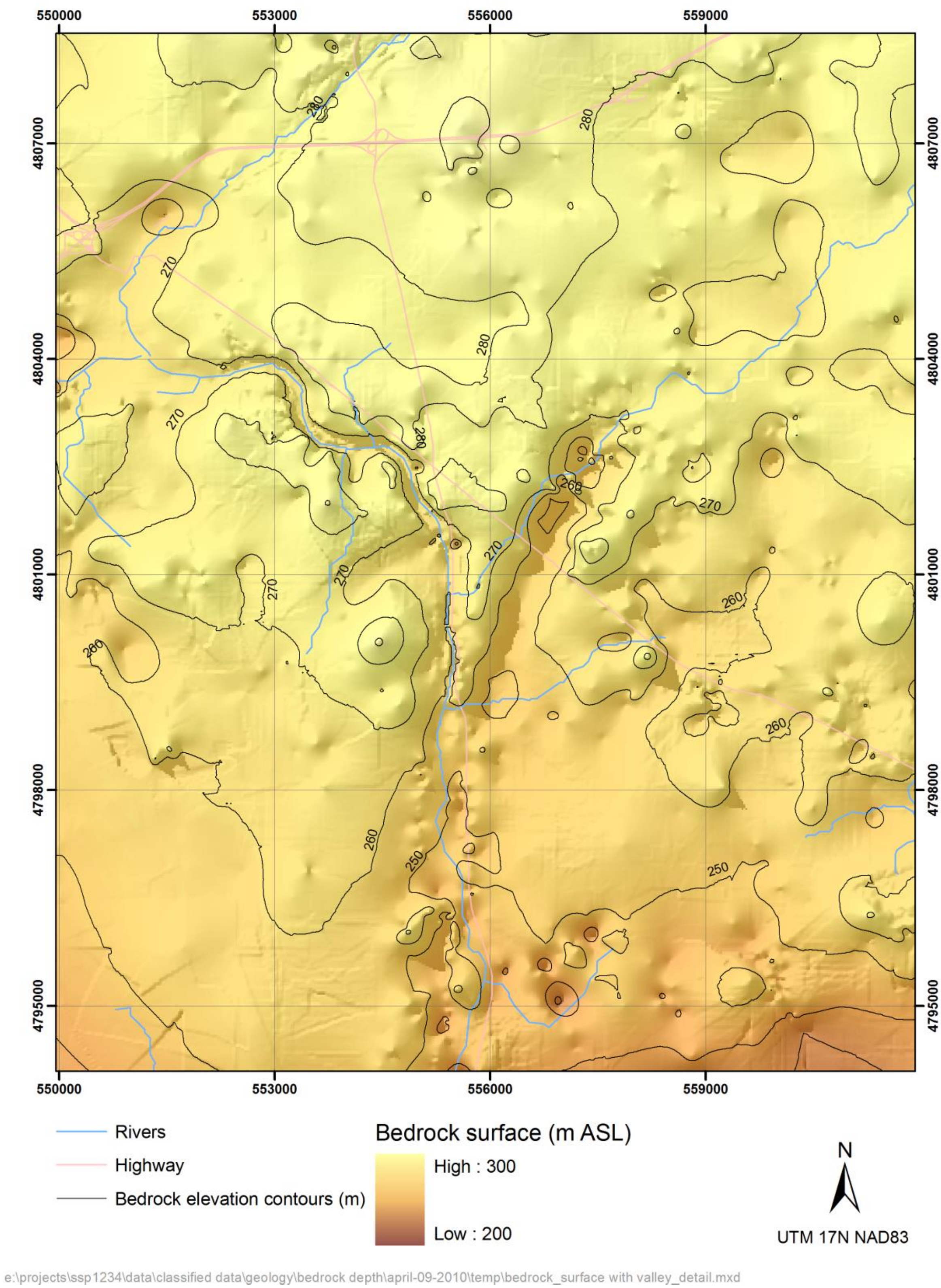


**Figure 6-10 Final interpolated bedrock surface near Mill Creek**

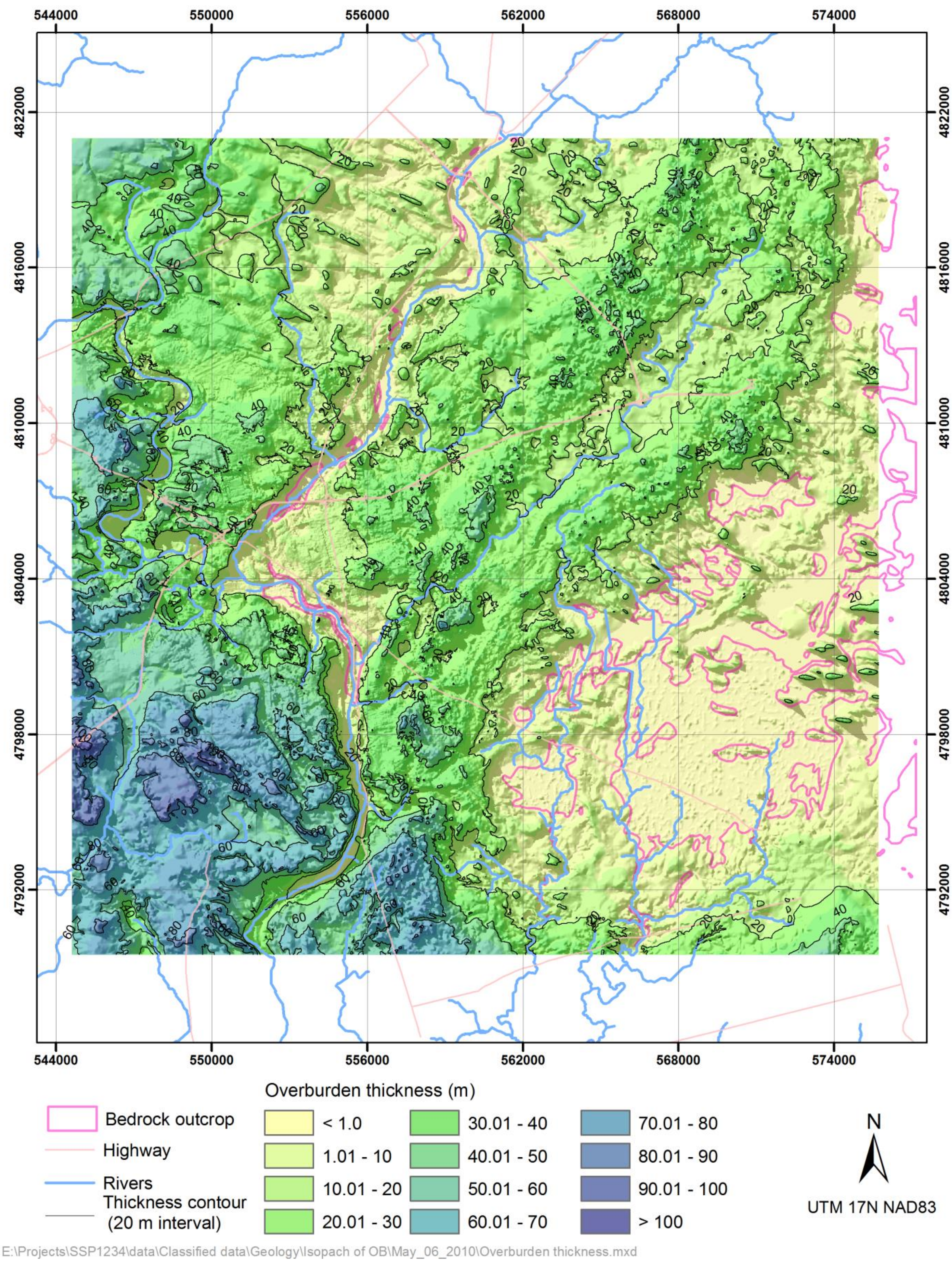


**Figure 6-11 Final interpreted overburden thicknesses**

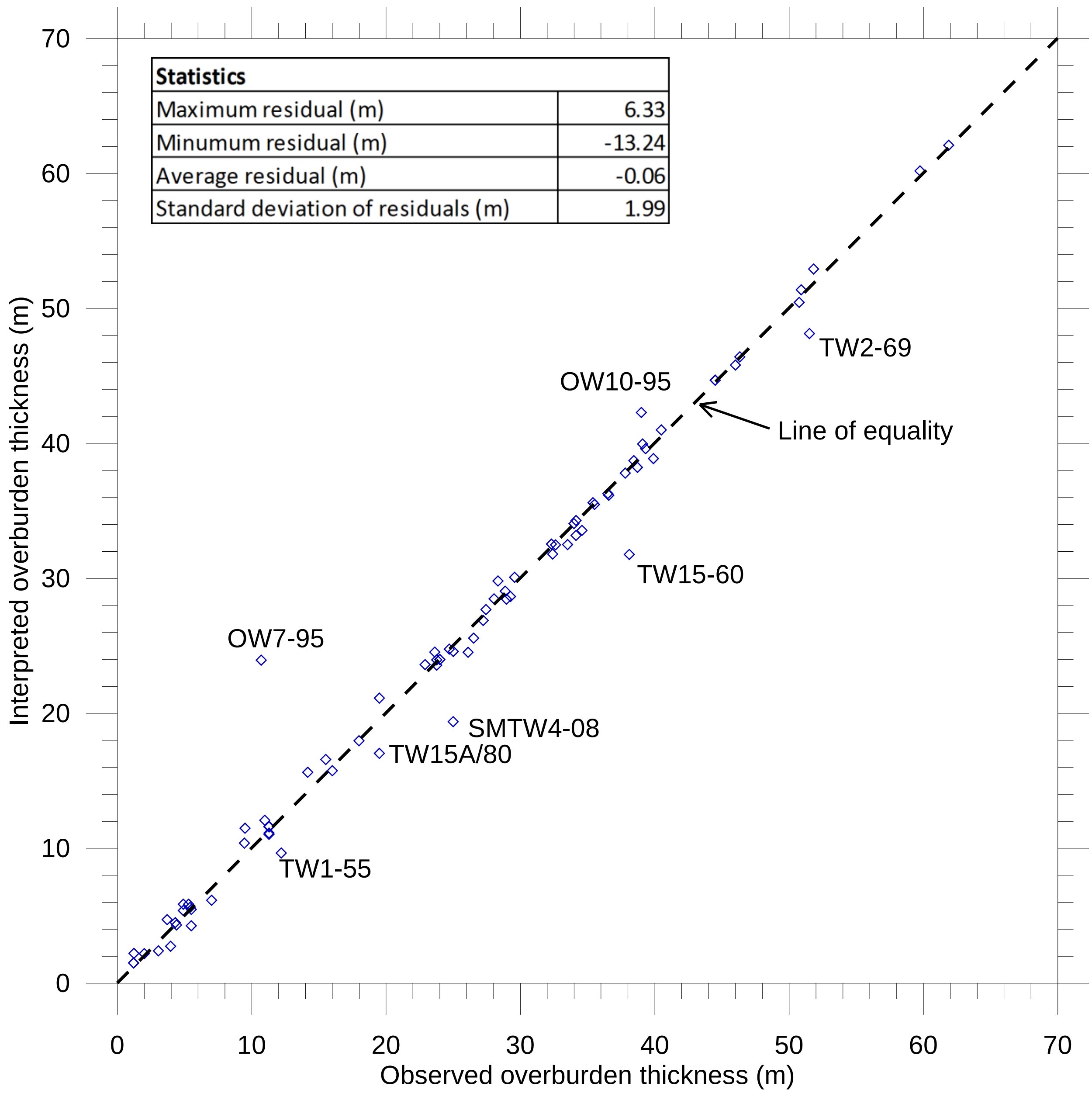


**Figure 6-12 Comparison of observed and interpreted overburden thicknesses at locations of boreholes**

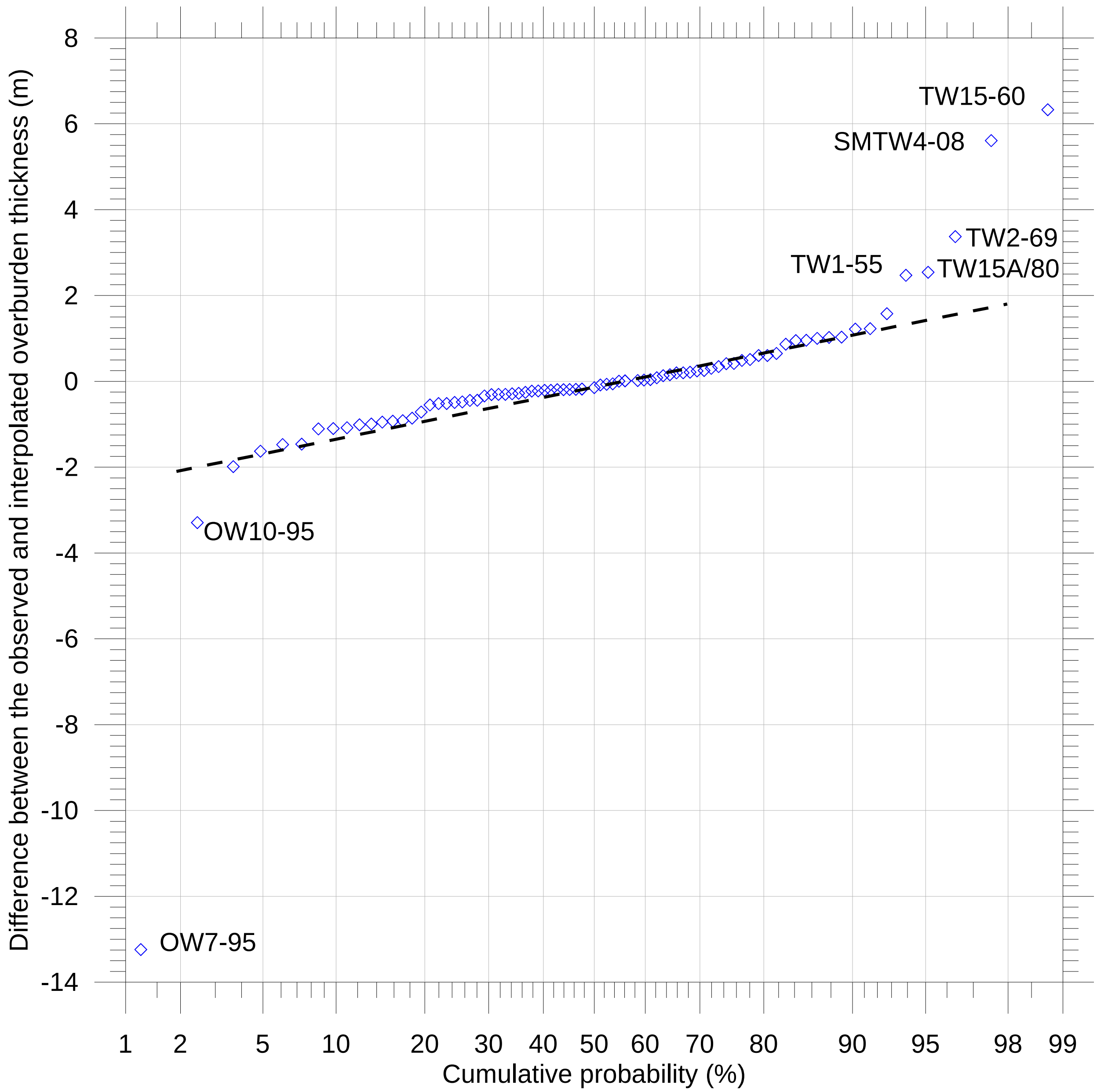


**Figure 6-13 Cumulative probability distribution of the differences between the observed and interpolated overburden thicknesses at locations of boreholes**

# Section 7
# The Reformatory Quarry Member of the Eramosa Formation

## 7.1 Data sources

A key revision of the Silurian stratigraphy of southern Ontario proposed recently by the Ontario Geological Survey was the treatment of the rocks identified previously as the Eramosa Member of the Guelph Formation (Johnson et al., 1992; Brunton, 2008, 2009). Brunton (2008, 2009) proposed that the Eramosa be reinterpreted as a formation with distinct members. In the Guelph area, three members were proposed for the Eramosa Formation: the Stone Road Member, the Reformatory Quarry Member, and the Vinemount Member. Brunton identified the latter two members in the Cambridge area.

The revisions proposed by Brunton were particularly important with respect to groundwater flow in the Guelph and Cambridge areas, as they provided a framework for understanding the variable role that the Eramosa unit appeared to play as an aquitard. For example, geologic logs at the Syngenta site in Cambridge indicated that the Eramosa is present; however, water level and water quality data and the results of hydraulic testing did not suggest that the unit acts as an aquitard (Turner, 2001; Burns, 2005; Plett, 2006). The reinterpretation of the geology of this area suggested that, although the Eramosa was present at the site, it was limited to the Reformatory Quarry Member. Where the Vinemount Member of the Eramosa Formation was absent, the Eramosa Formation was not necessarily a confining unit.

The following data were used to construct the top surface of the Reformatory Quarry Member for the Cambridge East groundwater model:

- Bedrock picks from Golder Associates Ltd.: 43 points ;
- Bedrock picks from Stantec: 14 points; and
- Data points used for the Guelph Tier 3 study: 173 points (including 72 artificial control points).

During the development of the top surface of the Reformatory Quarry Member, Brunton (2009, written communication) suggested that the bedrock present at surface in the east and southeast portions of the model area were the Reformatory Quarry Member. Along the Speed River, it was primarily the Guelph Formation that was present at surface. Following Brunton’s suggestion, additional points with elevations equal to the ground surface were added at the locations of bedrock outcrops in the eastern and southern portions of the model area.

## 7.2 Data organization and quality control

All data sets were checked and duplicate points removed based on their reliability ranking and consistency with the surrounding points. The numbers of data points left were:

- Bedrock picks from Golder Associates Inc.: 38 points;
- Bedrock picks from Stantec: 7 points; and
- Data points for the Guelph Tier 3 study: 127 points (including 72 artificial control points).

A complete listing of the borehole picks, including an indication of those points that were excluded from the interpretation, is included as part of the metadata for this study. A total of 3,289 data points were added to represent the outcrops of the Reformatory Quarry Member in the east and southeast portion of the study area. Another 8 control points were added at the southwest corner of the model domain to reflect the south-westward dipping of the surface. The locations of all control points used to define the top surface of the Reformatory Quarry are shown in **Figure 7-1**. During the development of the surface, 877 additional control points with surface elevations extracted from the Guelph Tier 3 surface for the top of the Reformatory Quarry Member were added along the eastern domain boundary to ensure consistency between the Guelph and Cambridge surface models.

## 7.3 Methodology and results

The top surface of the Reformatory Quarry Member was developed using interpolation with an Ordinary Kriging algorithm and a linear variogram. The resulting surface was compared with both the bedrock surface and the top of the underlying Vinemount Member to ensure that no surfaces overlapped. Control points were added to the data sets in those areas where surface overlaps were due to interpolation artefacts, and the interpolation was repeated through successive iterations. The final interpolated surface of the top of the Reformatory Quarry Member is shown in **Figure 7-2**. The observed and interpolated elevations of the top of the Reformatory Quarry Member at the locations of the control points are compared in **Figure 7-3**. The scatterplot shown in **Figure 7-3** suggests that the interpolated values are consistent with the observations. A plot of the cumulative probability distribution of the differences between the observed and interpolated elevations is presented in **Figure 7-4**. The mean absolute error in the interpolation was 0.16 m. The differences at over 98% of the control points were less than 1.0 m.

The thickness of the Guelph Formation was calculated by subtracting the top surface of Reformatory Quarry Member from the final bedrock surface. The resulting map of the thickness of the Guelph Formation is presented in **Figure 7-5**. The areas of bedrock outcrops are also indicated in **Figure 7-5**. Brunton (2009, written communication) indicated that the Reformatory Quarry Member is the uppermost bedrock unit over these areas. Therefore, the outcrop areas also corresponded to areas where the Guelph Formation was absent.

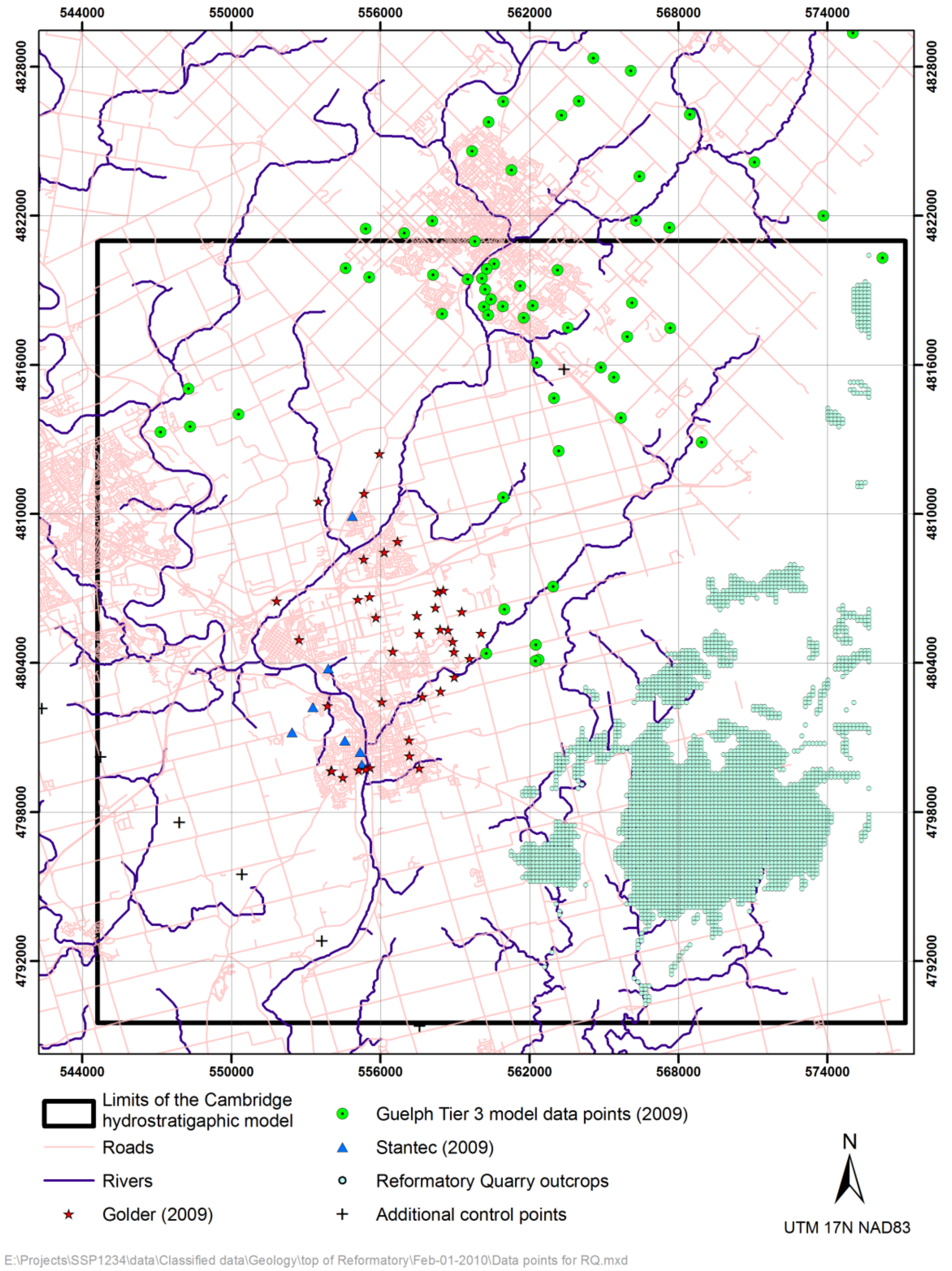


**Figure 7-1 Available control points for the top of the Reformatory Quarry Member of the Eramosa Formation**

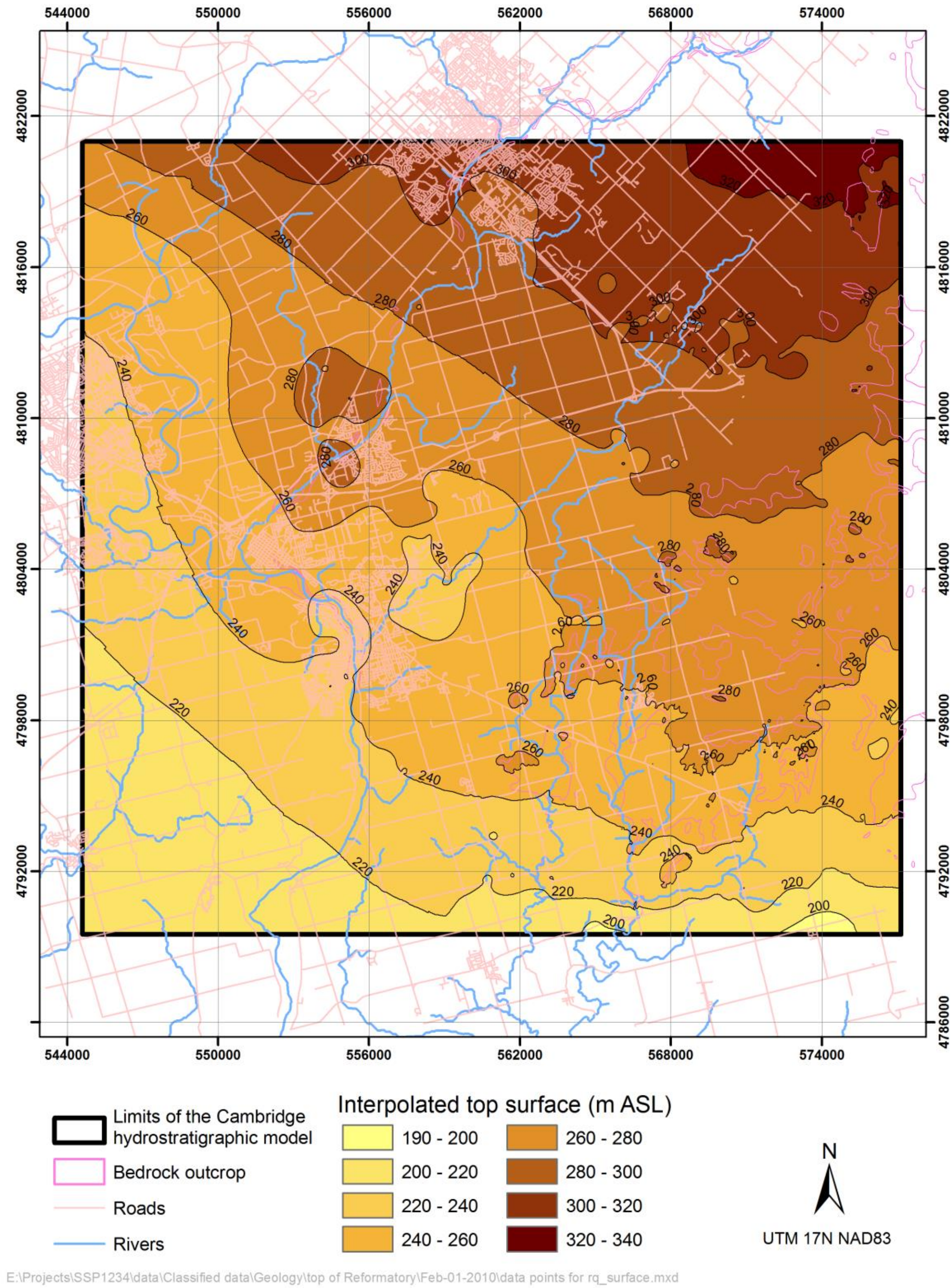


**Figure 7-2 Interpolated elevations of the top of the Reformatory Quarry Member**

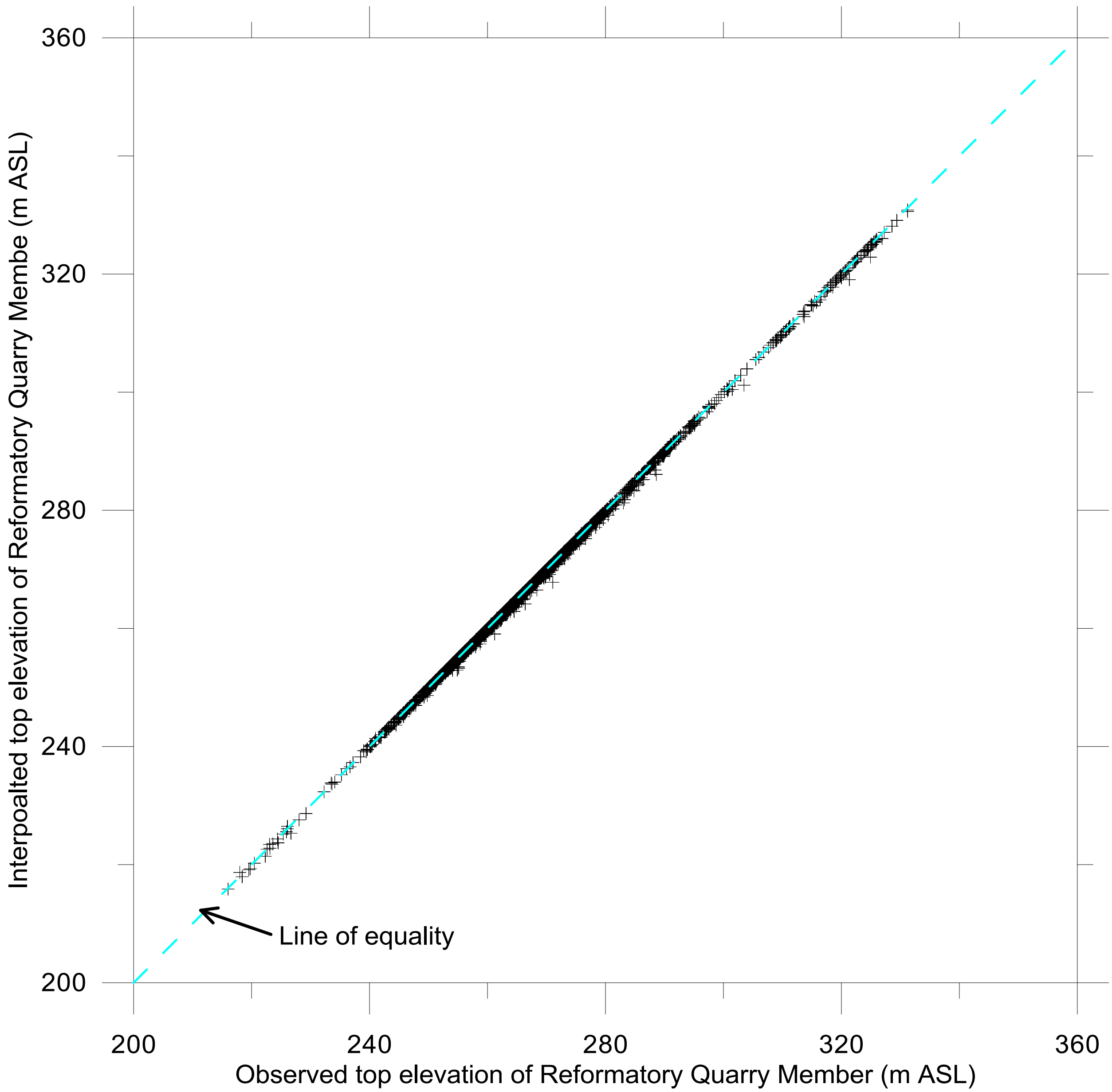


**Figure 7-3 Observed and interpolated elevations of the top of the Reformatory Quarry Member**

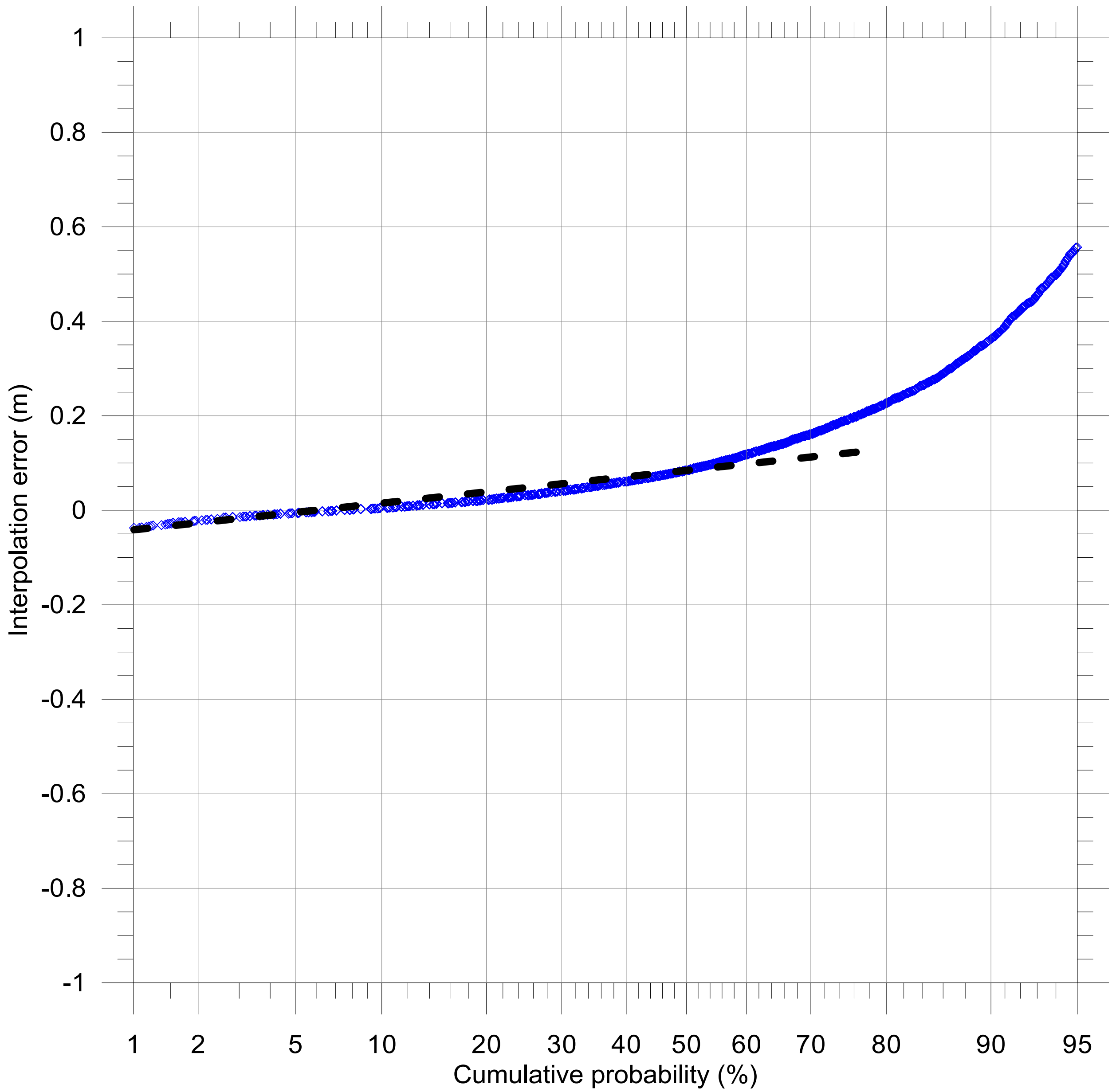


**Figure 7-4 Cumulative probability distribution of errors in the interpolated elevations of the top of the Reformatory Quarry Member**

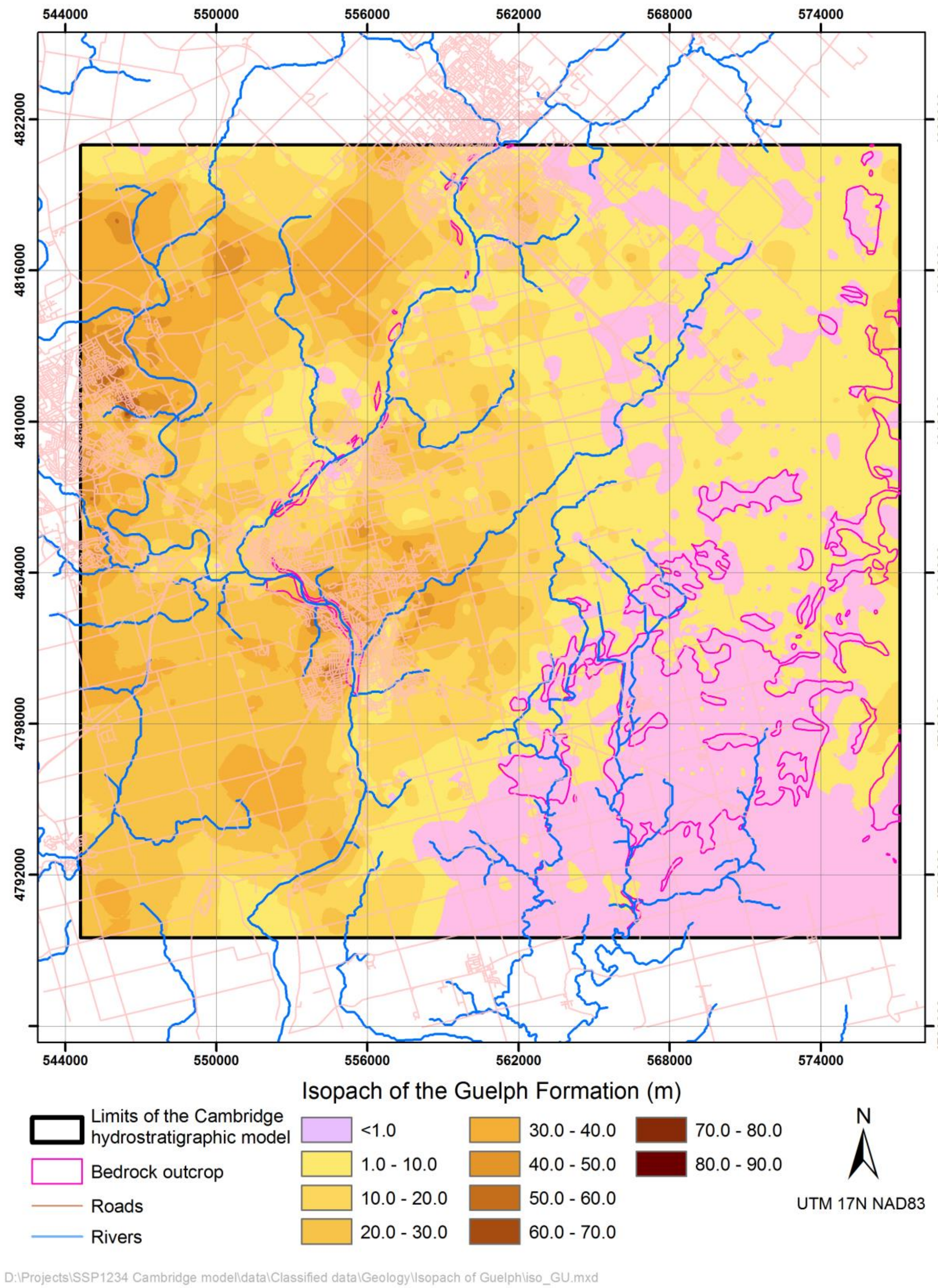


**Figure 7-5 Interpreted thicknesses of the Guelph Formation**

# Section 8
# The Vinemount Member of the Eramosa Formation

## 8.1 Data sources

The Vinemount Member of the Eramosa Formation was a critical hydrogeologic unit for the study area. Hydrogeologic data from the Guelph area indicated that, where present, the Vinemount Member acted as an aquitard between the Guelph Formation and the Gasport Formation (Golder, 2011a). The development of the model layer representing the Vinemount Member differed from the overlying units because it was not present over the entire model area. It was particularly important to represent the areas where the Vinemount Member was absent as correctly as possible. To increase accuracy, a map of the thicknesses of the Vinemount Member was initially developed and the elevations of its top surface were estimated by adding the thicknesses of the member to the elevations of the top of the underlying Goat Island Formation. The following data were used to map the thicknesses of the Vinemount Member:

- Bedrock picks from Golder Associates Ltd.: 29 points;
- Bedrock picks from Stantec: 5 points; and
- Data points used for the Guelph Tier 3 study: 151 points (including 93 artificial control points).

## 8.2 Data organization and quality control

All data sets were checked and the duplicate data points removed based on their relative reliability ranking and consistency with surrounding data points. The numbers of data points that were retained from the different sources were:

- Bedrock picks from Golder Associates Ltd.: 28 points;
- Bedrock picks from Stantec: 3 points; and
- Data points that are used for the Guelph Tier 3 study: 151 points (including 93 artificial control points).

The Stantec picks, Golder picks, and the picks made for the Guelph Tier 3 study were assigned equal weighting. In general, the locations of all data points are presented in **Figure 8-1**.

The inference of the extent of the Vinemount Member was a crucial element of the hydrostratigraphic model; however, as suggested in **Figure 8-1**, borehole control for this unit was relatively sparse.

To ensure that the Vinemount Member remained present after interpolation from the borehole data, additional control points were incorporated in the southeastern corner of the study area. The Vinemount Member was assigned a thickness of 4 m in the area, based on the approach adopted for the Guelph Tier 3 model. The approach for the Guelph Tier 3 model was in turn based on the suggestion that the thickness of the Vinemount Member in that area ranges between 0 and 10 m (Brunton, personal communication, 2009).

## 8.3 Methodology and results

A continuous distribution of thickness of the Vinemount Member was developed using interpolation with Ordinary Kriging and a linear variogram. The top surface of the Vinemount Member was calculated by adding its interpolated thickness to the top surface of the underlying Goat Island Formation. The resulting surface was checked to ensure that it lay at or below the surface of the overlying Reformatory Quarry Member. During the checking, it was found that cross-cutting occurred occasionally along the eastern boundary. After the top surface of the Vinemount Member was finalized, the thicknesses of the Vinemount Member were re-calculated by subtracting the elevations of the bottom of the Vinemount Member from the top.

The final interpreted thicknesses of the Vinemount Member are shown in **Figure 8-2**. The thicknesses ranged from 0 to 16 m. The Vinemount Member was predicted to be absent over the extreme eastern portion of the interpolation area. This prediction was consistent with the interpretation from the Guelph Tier 3 study of the same area.

The line of zero thickness developed through interpolation corresponds to the boundary between the pink and yellow areas in **Figure 8-2**. Subsequent to the present analyses, Golder Associates provided a line of zero thickness, indicated by the thick blue line in the figure. The relatively close correspondence between the two interpretations of the extent of the Vinemount Member provided an independent confirmation of the reliability of the analyses.

The observed and interpolated thicknesses of the Vinemount Member at the location of boreholes compared are shown in **Figure 8-3**. As shown in the scatterplot, the thicknesses observed in boreholes and interpolated at the same locations match closely. A plot of the cumulative probability distribution of the differences between the observed and interpolated thicknesses is shown in **Figure 8-4**. The differences approximated a straight line when plotted on a normal probability axis, which suggested that the differences were distributed randomly. The mean absolute error in the interpolation was less than 0.03 m. The differences at over 96% of the control points were less than 0.2 m.

The elevations of the final top surface of the Vinemount Member are shown in **Figure 8-5**. In general, the elevations decline toward the southwest. To check the quality of the interpreted elevations, the elevations were compared with the data from the borehole picks. This comparison is presented in **Figure 8-6**. The calculated elevations of the top of the Vinemount Member approximate closely the data from the borehole picks.

The thickness of the Reformatory Quarry Member was calculated by subtracting the final top surface of the Vinemount Member from the final top surface of the Reformatory Quarry Member. The results are presented in **Figure 8-7**. Some thin areas (less than 1 m) near the eastern boundary of the study area are shown in this figure. These areas reflect a lack of borehole control in that area; the interpolated elevations of the tops of both the Reformatory Quarry and Vinemount Members generally exceeded the elevations of the top of the bedrock. During the development of the final model surfaces, the elevations of the tops of the Reformatory Quarry and Vinemount Members were shifted downward to ensure that no surfaces overlapped. This adjustment was essentially cosmetic with respect to the development of groundwater model, as this area is beyond the limits of the groundwater model.

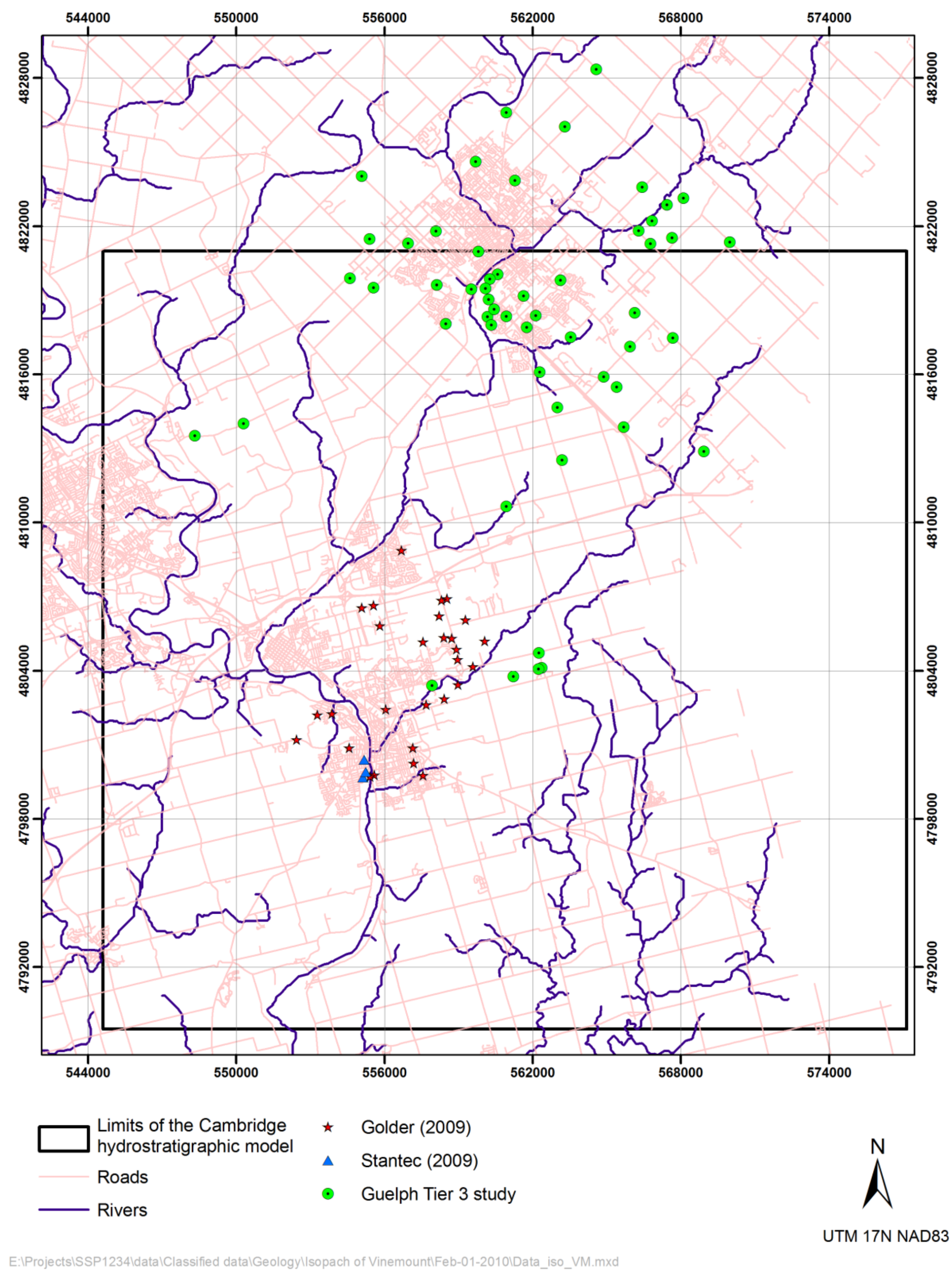


**Figure 8-1 Available data points for the thicknesses of the Vinemount Member of the Eramosa Formation**

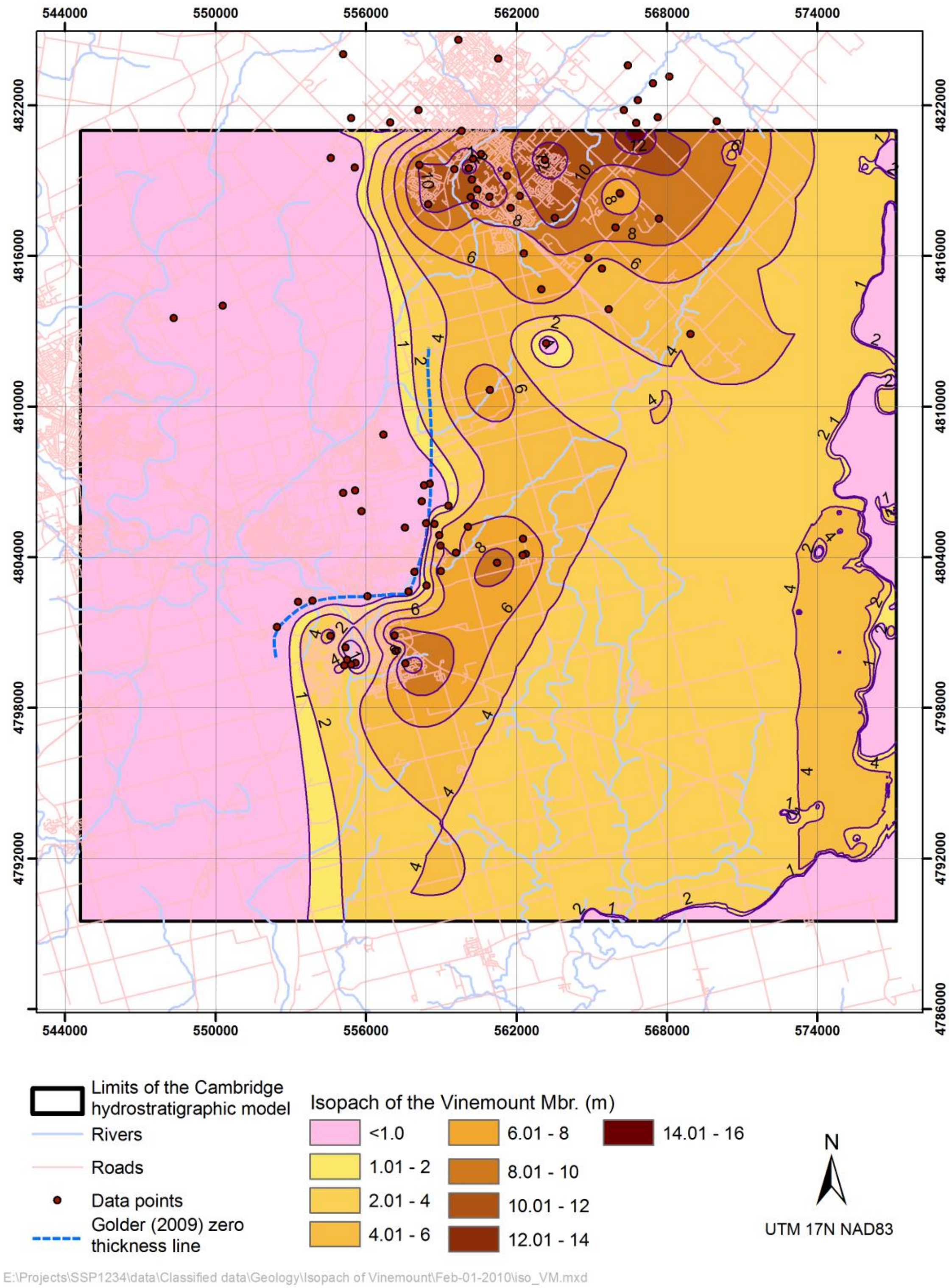


**Figure 8-2 Interpolated thicknesses of the Vinemount Member**

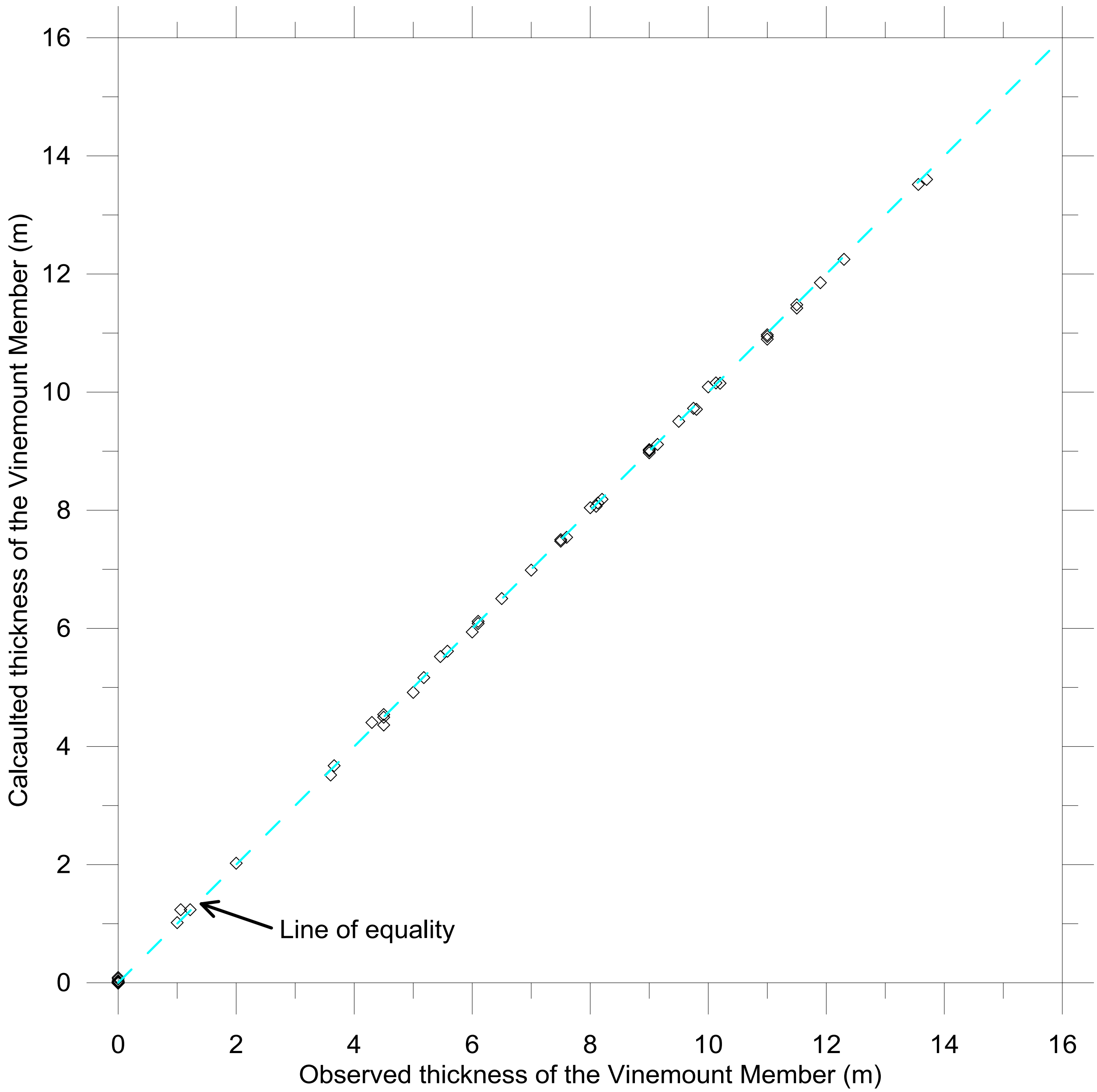


**Figure 8-3 Comparison of observed and calculated thicknesses of the Vinemount Member**

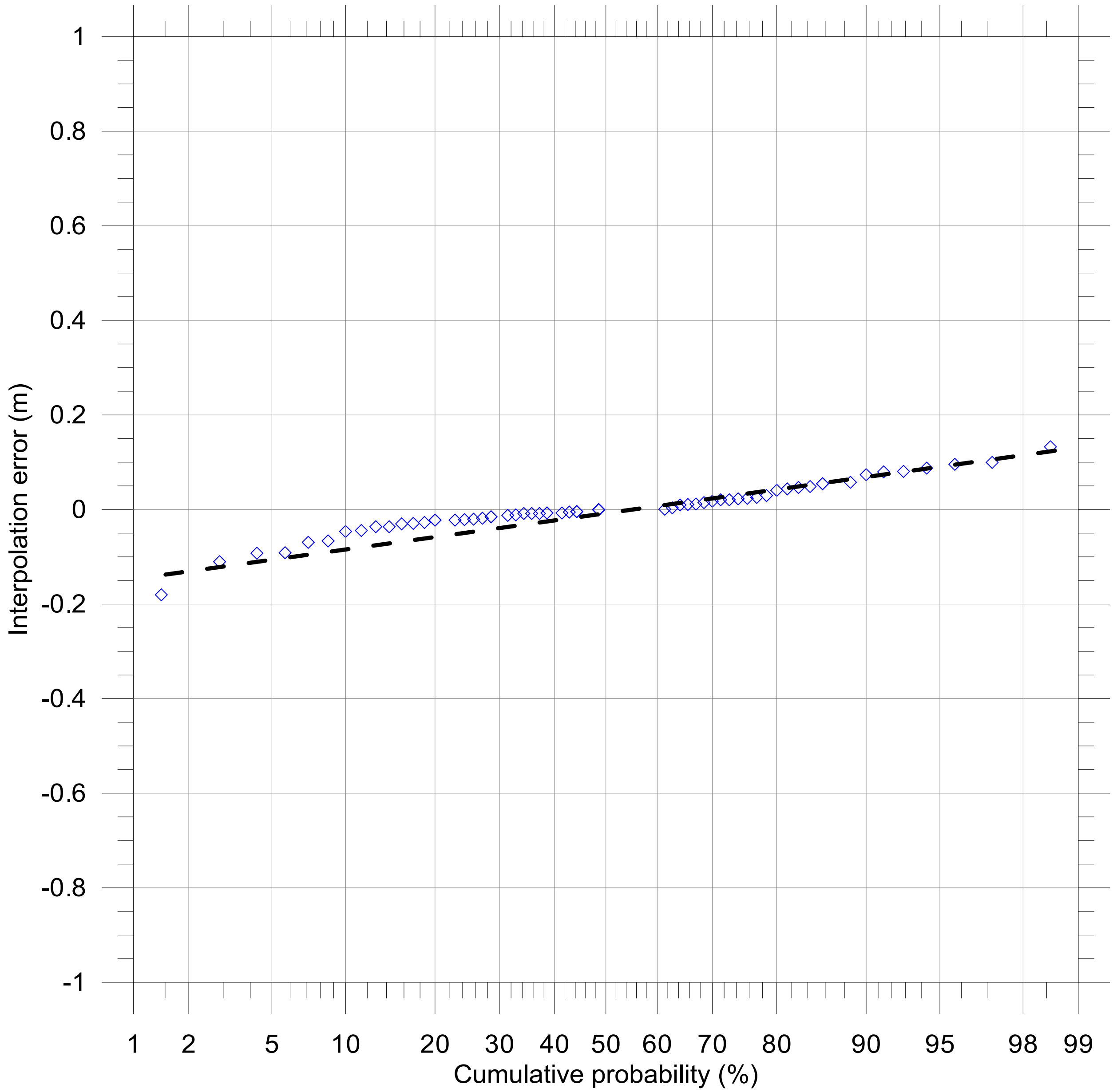


**Figure 8-4 Cumulative probability distribution of differences between observed and interpolated thicknesses of the Vinemount Member**

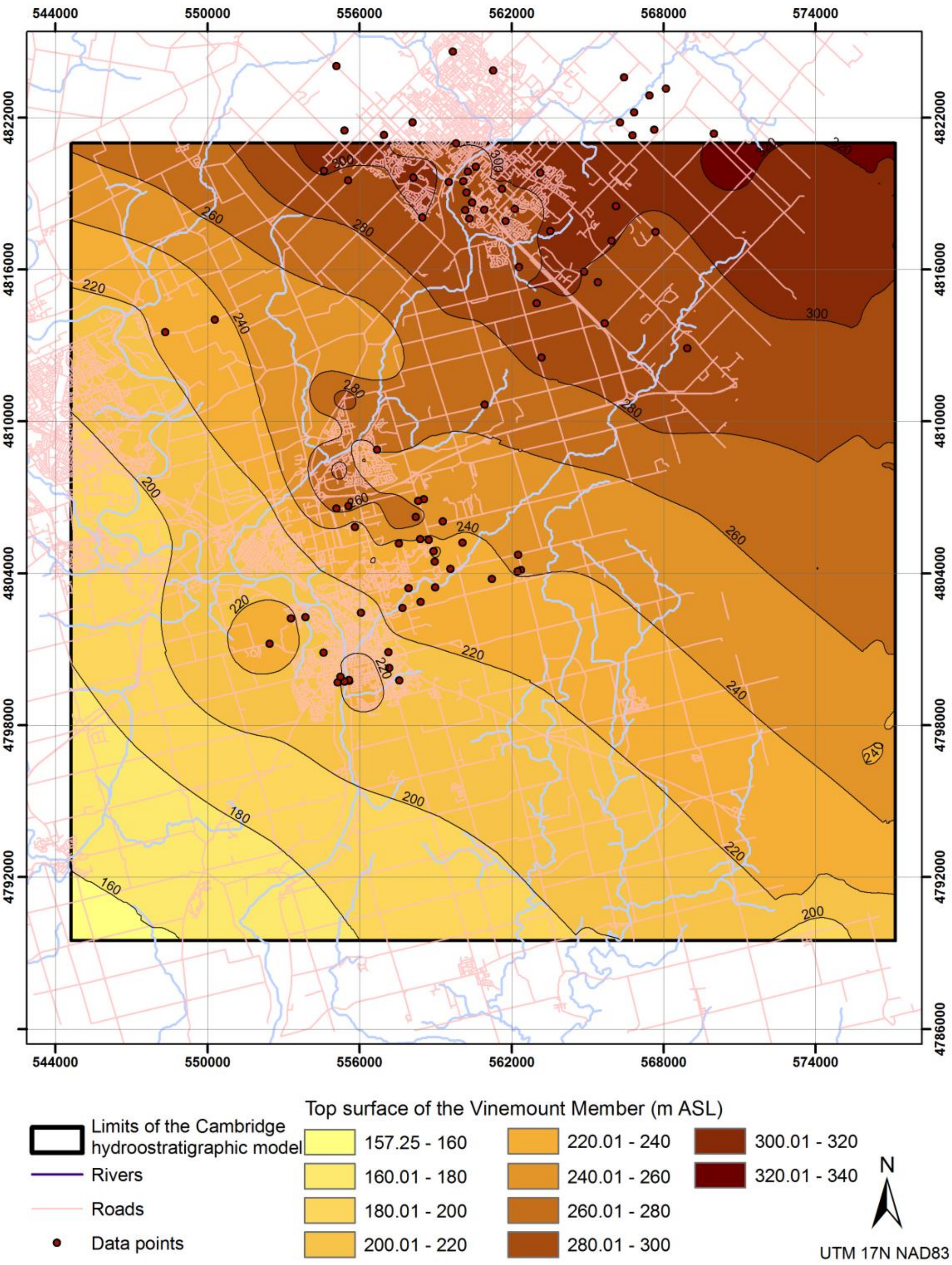


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**Figure 8-5 Calculated elevations of the top of the Vinemount Member**

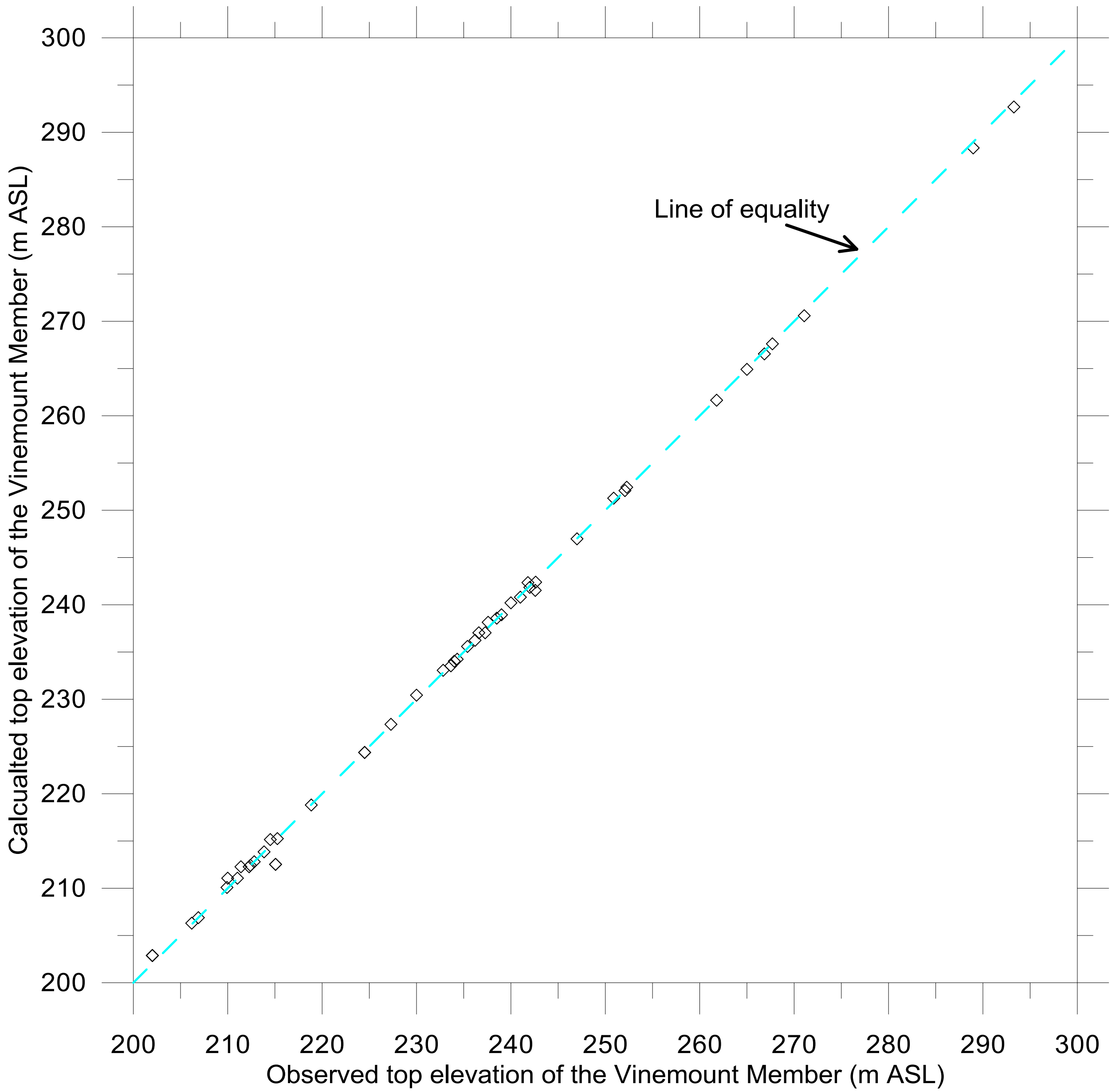


**Figure 8-6 Comparison of observed and calculated elevations of the top of the Vinemount Member**

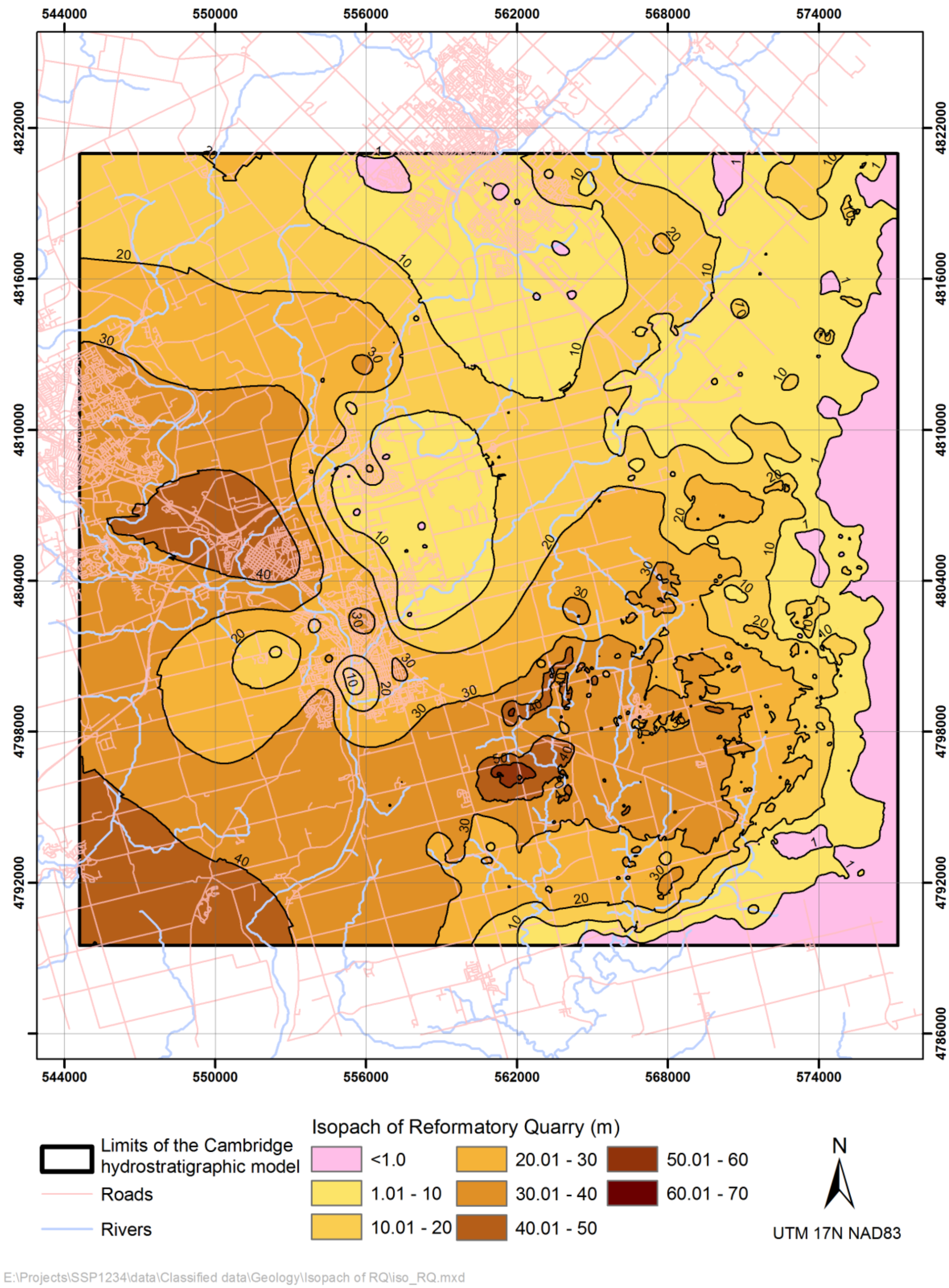


**Figure 8-7 Thicknesses of the Reformatory Quarry Member of the Eramosa Formation**

# Section 9
# The Goat Island Formation

## 9.1 Data sources

The development of the model layer representing the Goat Island Formation was treated the same way as the Vinemount Member. The thicknesses of the unit were estimated and then its top surface developed. This approach was adopted because data characterizing the elevations of the top of the Goat Island Formation are relatively sparse, while a rough idea of its thickness is available. The following data were available to map the thickness of the Goat Island Formation:

- Bedrock picks from Golder: 38 points;
- Bedrock picks from Stantec: 11 points; and
- Data points used for the Guelph Tier 3 study: 187 points (including 86 artificial control points).

## 9.2 Data organization and quality control

All data sets were checked and duplicate data points removed based on their relative reliability and consistency with surrounding data points. The following data were retained from the different sources:

- Bedrock picks from Golder: 29 points;
- Bedrock picks from Stantec: 10 points; and
- Data points used for the Guelph Tier 3 study: 187 points (including 86 artificial control points).

A complete listing of the borehole picks, including an indication of those points were been excluded from the interpretation, is included in the metadata for this project. The locations of all data points are shown in **Figure 9-1**. Additional points with a thickness of 5 m were added in the southeast part of the study area where control points were lacking. This thickness is the same as the default thickness as adopted in the Guelph Tier 3 study.

## 9.3 Methodology and results

A map of the thicknesses of the Goat Island Formation was developed by an Ordinary Kriging interpolation with a linear variogram. The thicknesses ranged from 0 to 55 m. In general, the unit thickened westward, consistent with the general impression of Frank Brunton (personal communication, 2009).

The surface of the top of the Goat Island Formation was calculated by adding its thickness to the surface of the top of the Gasport Formation. The elevations of the top of the Goat Island Formation were adjusted in areas where they were initially calculated to exceed the elevations of the top of the overlying Vinemount Member. This overlay occurred near the eastern boundary of the study area. The final thicknesses of the Goat Island Format are shown in **Figure 9-2**.

The observed and interpolated thicknesses of the Goat Island Formation are compared in **Figure 9-3**. As shown in the scatterplot, there is a close correspondence between the thicknesses observed in boreholes and the interpolated thicknesses at the same locations. A plot of the cumulative probability distribution of the differences between the observed and interpolated thicknesses is shown in **Figure 9-4**. The differences approximate a straight line when plotted on a normal probability axis, which suggests that the differences are distributed randomly. In general, the differences between the observed and interpolated thicknesses at the locations of the boreholes are relatively small. The mean absolute error in the interpolation is about 0.07 m.

The final top surface of the Goat Island is presented in **Figure 9-5**. In general, the surface dips toward the southwest, which is consistent with the regional geologic setting. To check the calculated surface, the interpolated top elevations of the Goat Island Formation at the locations of borehole picks were compared with the borehole picks. The comparison is presented in **Figure 9-6**. The results shown in the scatterplot confirm that the interpolated elevations match the observed elevations at the boreholes.

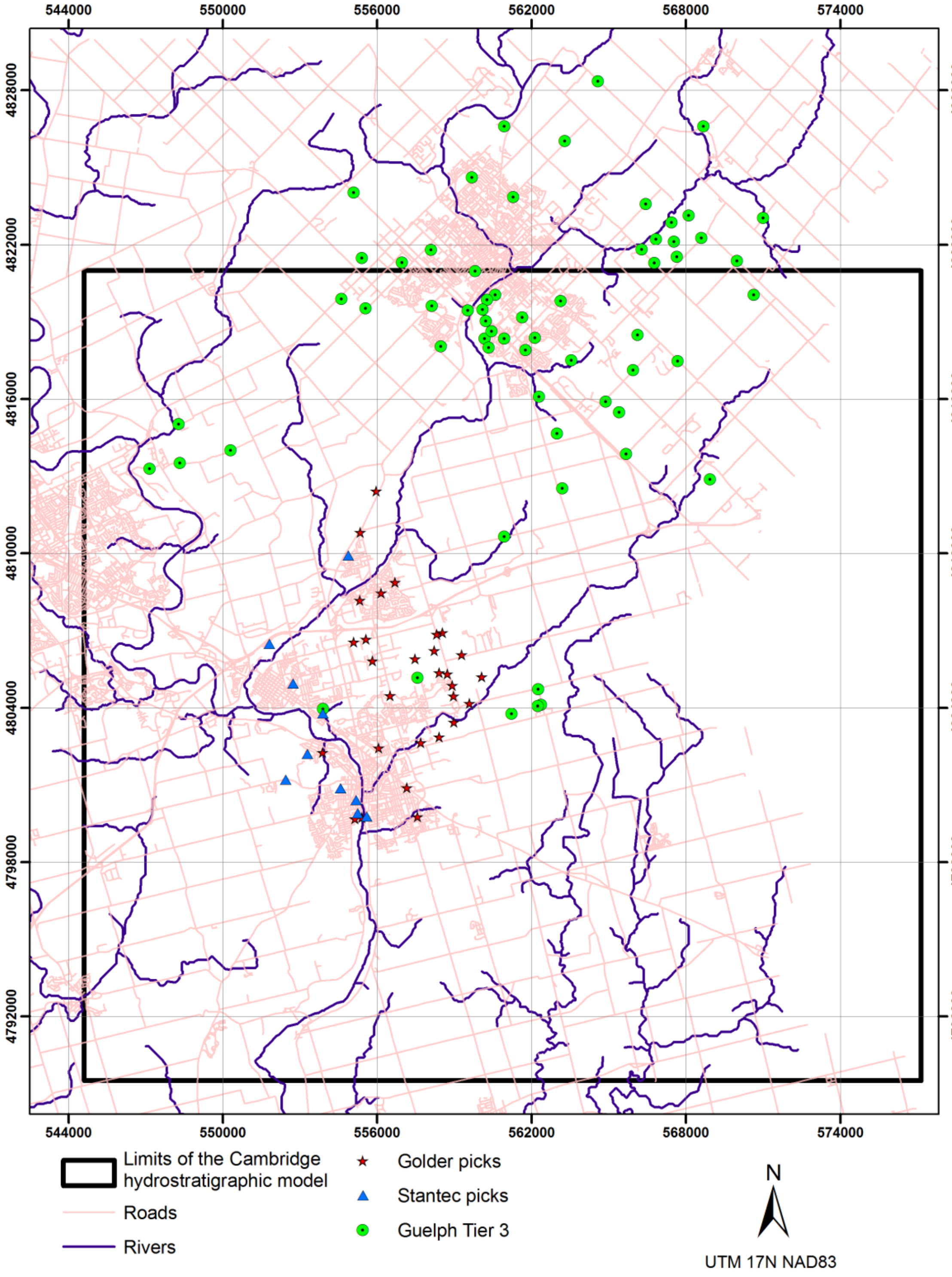


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**Figure 9-1 Available data points for the thicknesses of the Goat Island Formation**

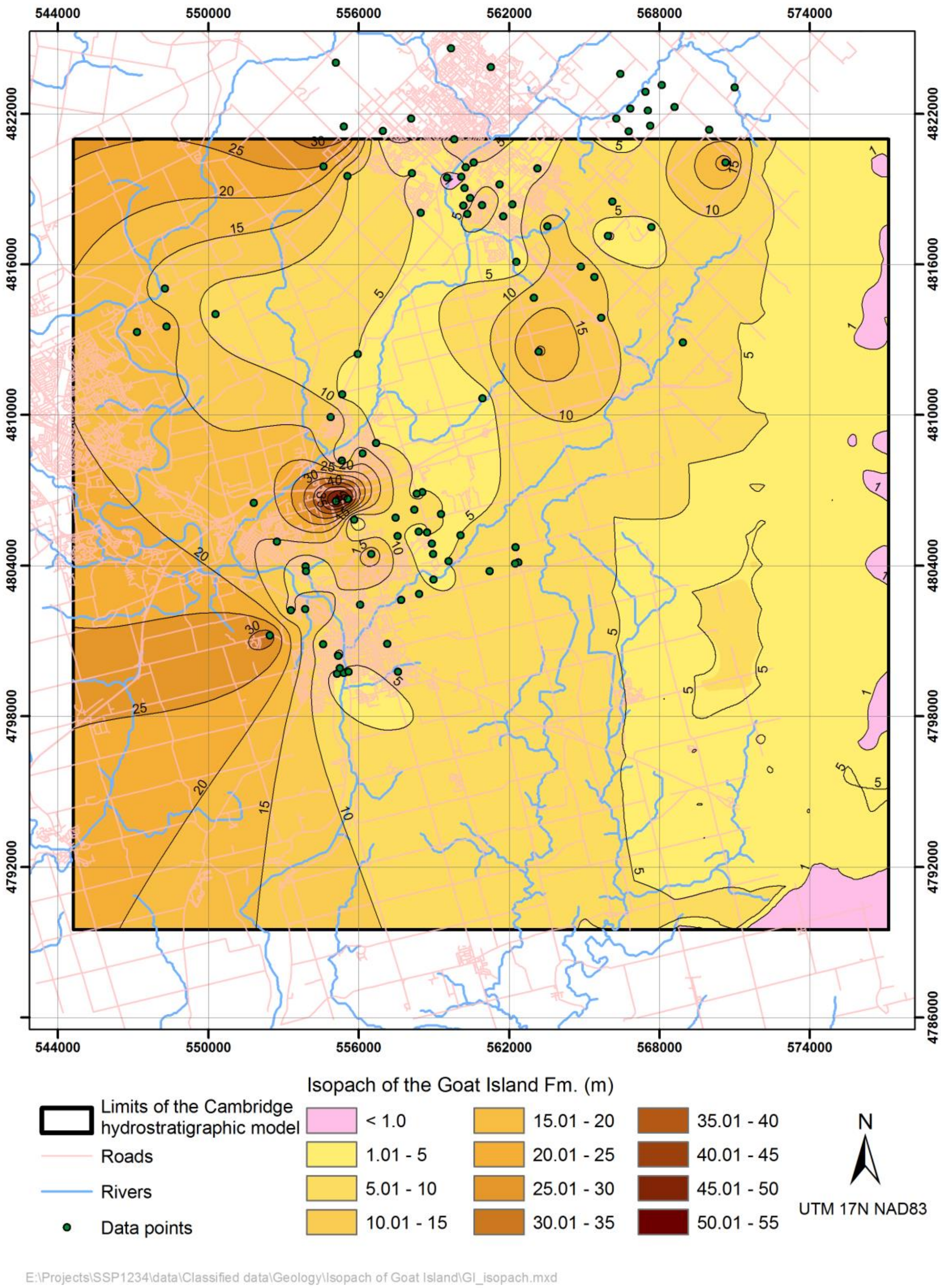


**Figure 9-2 Interpolated thicknesses of the Goat Island Formation**

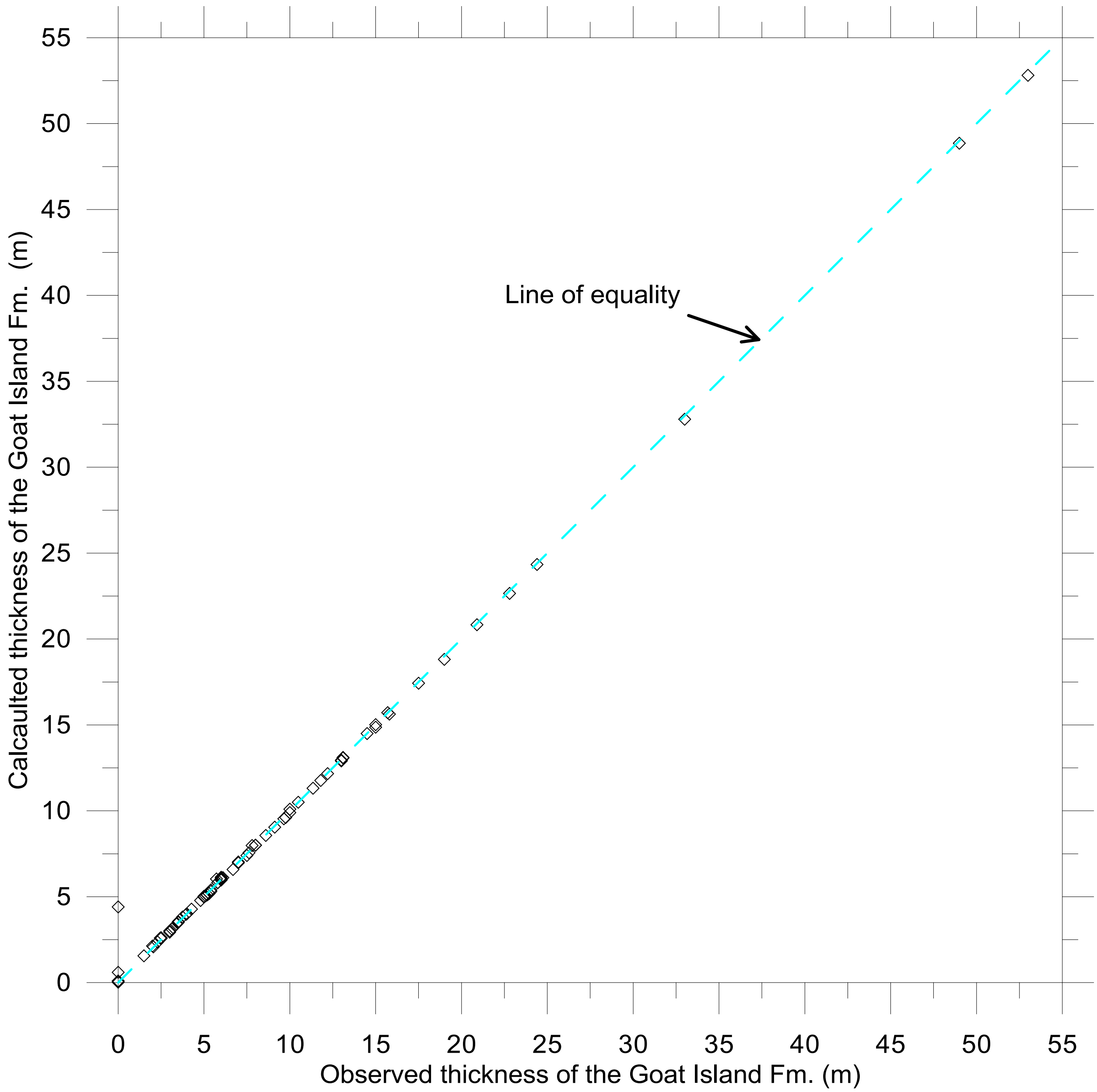


**Figure 9-3 Observed and calculated thicknesses of the Goat Island Formation**

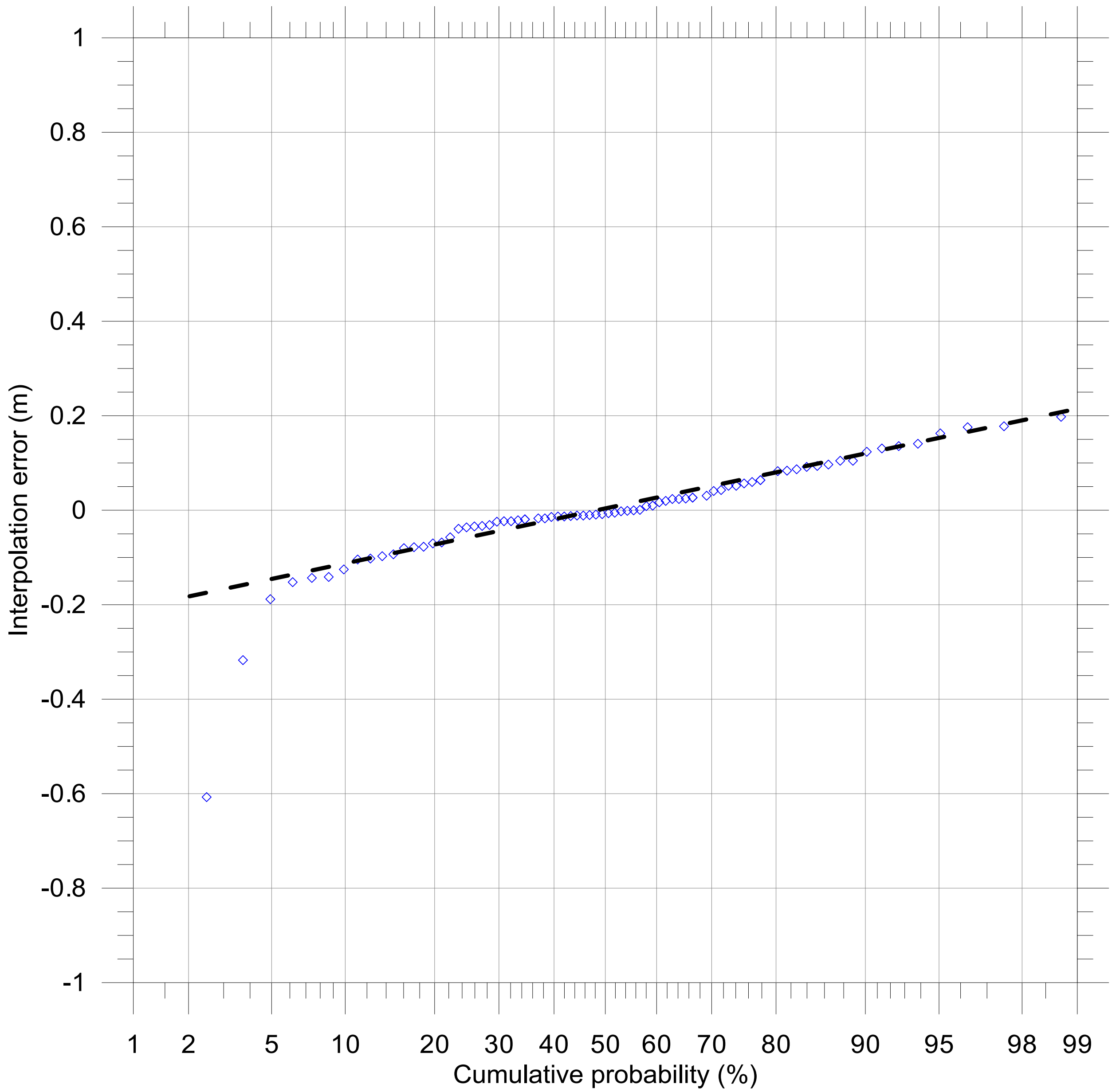


**Figure 9-4 Cumulative probability distribution of errors in the interpolated thicknesses of the Goat Island Formation**

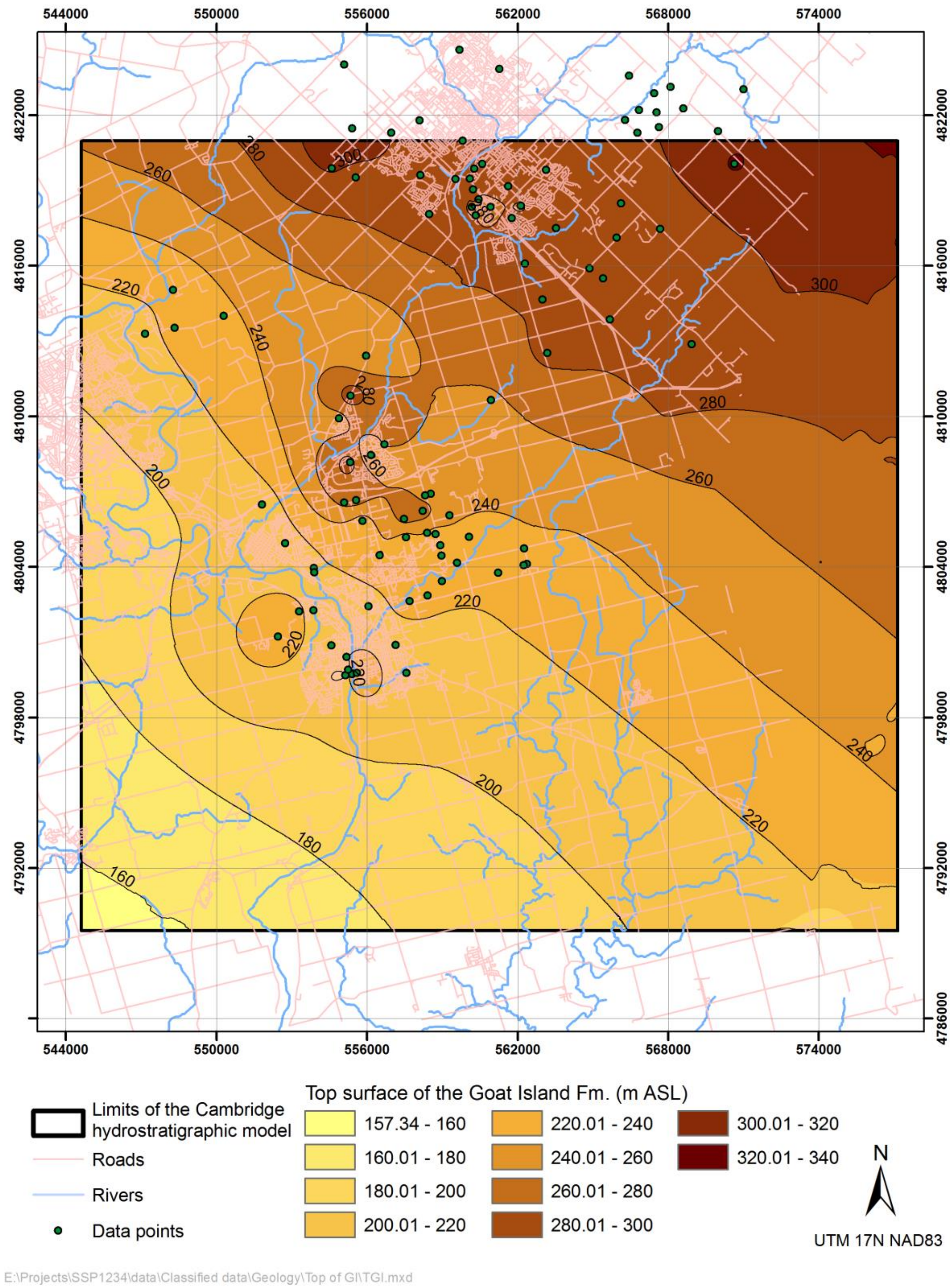


**Figure 9-5 Interpolated elevations of the top of the Goat Island Formation**

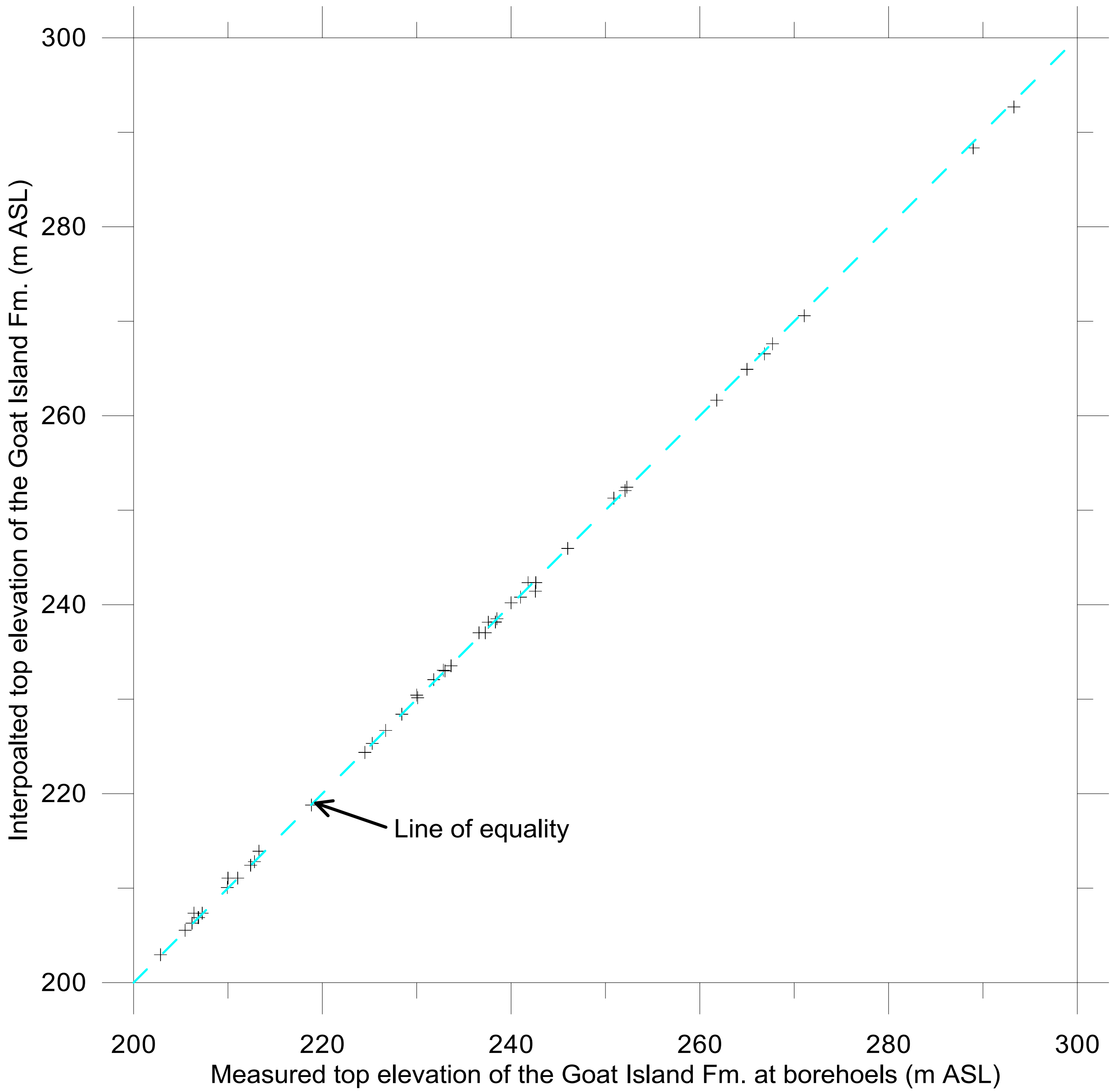


**Figure 9-6 Comparison of observed and interpolated elevations of the top of the Goat Island Formation**

# Section 10
# The Gasport Formation

## 10.1 Data sources

The definition of the Gasport Formation is critical for the development of the Cambridge hydrostratigraphic model. The Gasport Formation and Guelph Formation are the primary bedrock aquifers for the Cambridge area (Golder, 1991). The following data were used to develop the surface of the top of the Gasport Formation:

- Bedrock picks from Golder: 31 points;
- Bedrock picks from Stantec: 9 points; and
- Data points that are used for the Guelph Tier 3 study: 313 points (including 206 artificial control points).

## 10.2 Data organization and quality control

All data sets were checked and duplicate data points removed based on their reliability and consistency with the surrounding data points. The numbers of data points that were retained from the different sources were:

- Bedrock picks from Golder: 29 points;
- Bedrock picks from Stantec: 9 points; and
- Data points that are used for the Guelph Tier 3 study: 312 points (including 206 artificial control points).

A complete listing of the borehole picks, including an indication of those points that were excluded from the interpretation, is included as part of the metadata for this project. The locations of all data points are presented in **Figure 10-1**. There are relatively large portions of the model area over which there are no well controls for the elevations of the top of the Gasport Formation.

The control points listed above were supplemented with data from well ASRTW6-08, located outside of the model area, and information obtained from the recent drilling of two boreholes in the vicinity of the Middleton Street well field, OW1-09 and OW2-09. The initial development of the top surface of the Gasport Formation did not include information from these two locations. However, in light of their significance, the finalized picks from these two boreholes were incorporated into the complete data set and used to develop the final surface of the top of the Gasport Formation.

Borehole OW2-09 is located in an area where the elevations of the units change abruptly corresponding to the inferred edge of a reef mound in the Gasport Formation. An impression of the predictive capabilities of the geologic model was gained by comparing the elevations of the top of the units predicted prior to the receipt of any information on borehole OW2-09 with the data from the finalized geologic logs that Stantec provided. These elevations are listed on **Table 9-1**. As indicated on the table, the predicted elevations of the bedrock units are relatively close to the geologic logs. A key difference between the initial interpretation at OW2-09 and the data from the geologic log is the thickness of the Vinemount Member. In the initial interpretation, a thickness of 2.72 m was estimated through interpolation. The final geologic log of OW2-09 shows the Vinemount Member is absent at this location. The data from the OW2-09 were used in the development of final thickness of the Vinemount Member.

**Table 10-1 Comparison of predicted and observed elevation at OW2-09**

| Surface | Predicted elevation at OW2-09 (m ASL) | Observed elevation at OW2-09, from finalized geologic logs (m ASL) |
|---|---|---|
| Top of bedrock | 267.59 | 265.28 |
| Top of Reformatory Quarry Mbr. | 230.17 | 226.06 |
| Top of Vinemount Mbr. | 215.03 | 218.85 |
| Top of Goat Island Fm. | 212.31 | 218.52 |
| Top of Gasport Fm. | 208.42 | 207.50 |

## 10.3 Methodology and results

The top surface of the Gasport Formation was developed using interpolation with Ordinary Kriging with a linear variogram. To check for cross-cutting, the resulting surface was compared with the final surface of the top of the overlying Goat Island Formation. The elevations at points where the top of the Gasport Formation exceeded the top of the Goat Island Formation were adjusted. This occurred primarily near the eastern boundary of the study area. These locations are beyond the limits of the Cambridge groundwater flow model area, and do not affect the analyses.

The final top surface of the Gasport Formation is presented in **Figure 10-2**. In general, the surface dips toward the southwest. The contours reveal mounds in the top of the Gasport Formation at the Middleton Street well field and at other locations. The measured and calculated elevations of the top of the Gasport Formation are compared in **Figure 10-3**. The scatterplot confirms the consistency between the calculated and observed surface elevations at the locations of the borehole picks. The cumulative probability distribution of the differences between the interpolated surface and the logged elevations at the boreholes is presented in **Figure 10-4**. The mean absolute difference is 0.18 m. Over 90 % of borehole picks have an absolute difference of less than 0.5 m. The majority of the data points on the cumulative probability distribution plot approximate a straight line, which suggests that the differences are random.

The Cambridge model was simplified slightly by combining the lower portion of the Gasport Formation with the underlying four thin units: Rochester Formation, Irondequoit Formation, the Rockway Formation and Merriton Formation (referred to collectively as the R-I-R-M Formations). Limited information is available for these units, apart from the regional interpretation that they are relatively thin [see for example Golder (1991); Figure 2.6]. The available borehole picks in the study area indicate that the average total thickness of the four units is about 4.5 m. In comparison, the thickness of the Gasport Formation itself ranges from 20 to 100 m. These units have relatively low hydraulic conductivity and are not hydrogeologically significant compared to the Gasport Formation (Golder, 1991; Blair and McFarland, 1992). The thicknesses of the Gasport Formation plus the four underlying units were calculated by subtracting the top surface of the Cabot Head Formation from the final top surface of the Gasport Formation. The resulting thicknesses are shown in **Figure 10-5**.

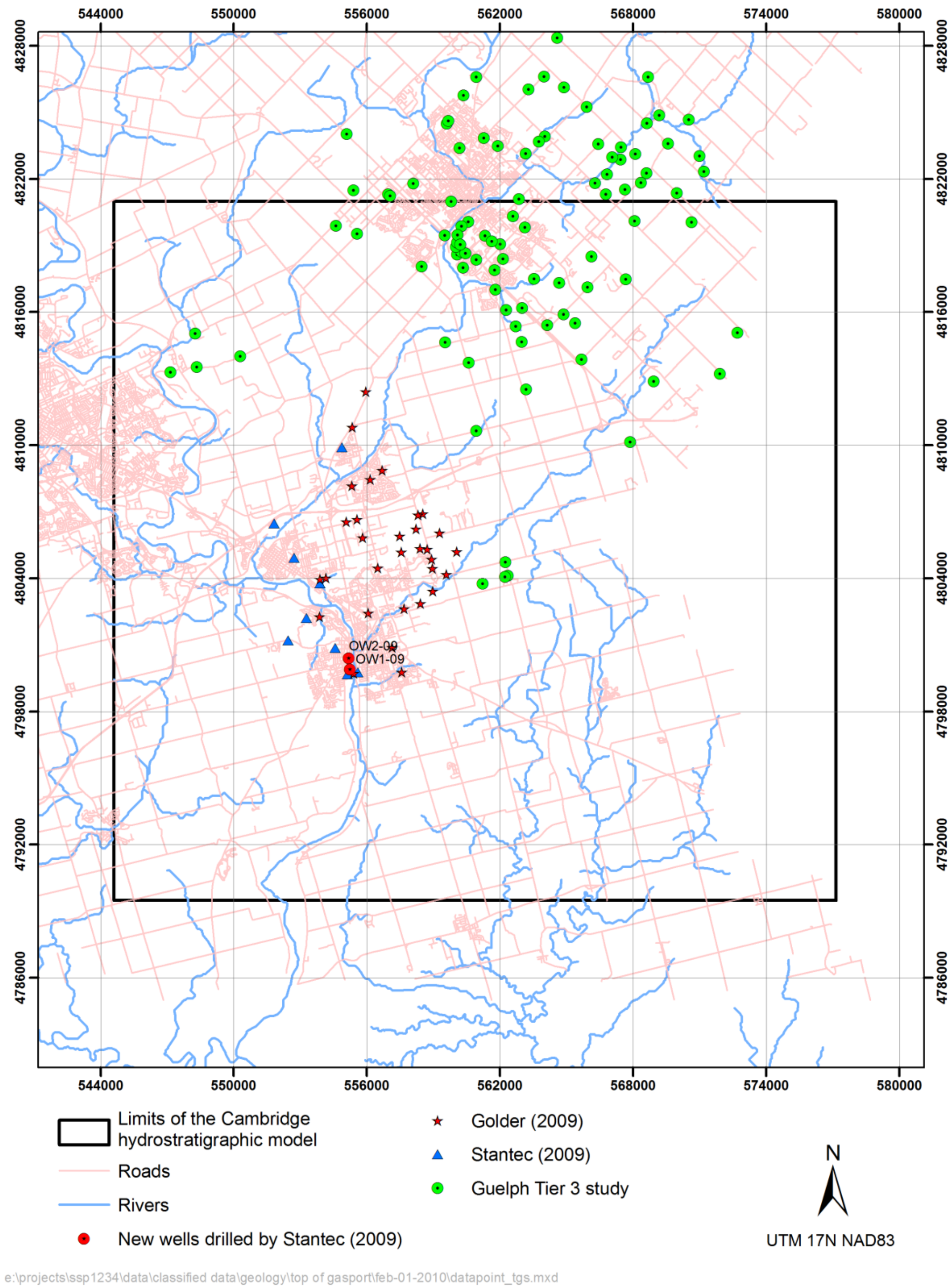


**Figure 10-1 Available data points for the top of the Gasport Formation**

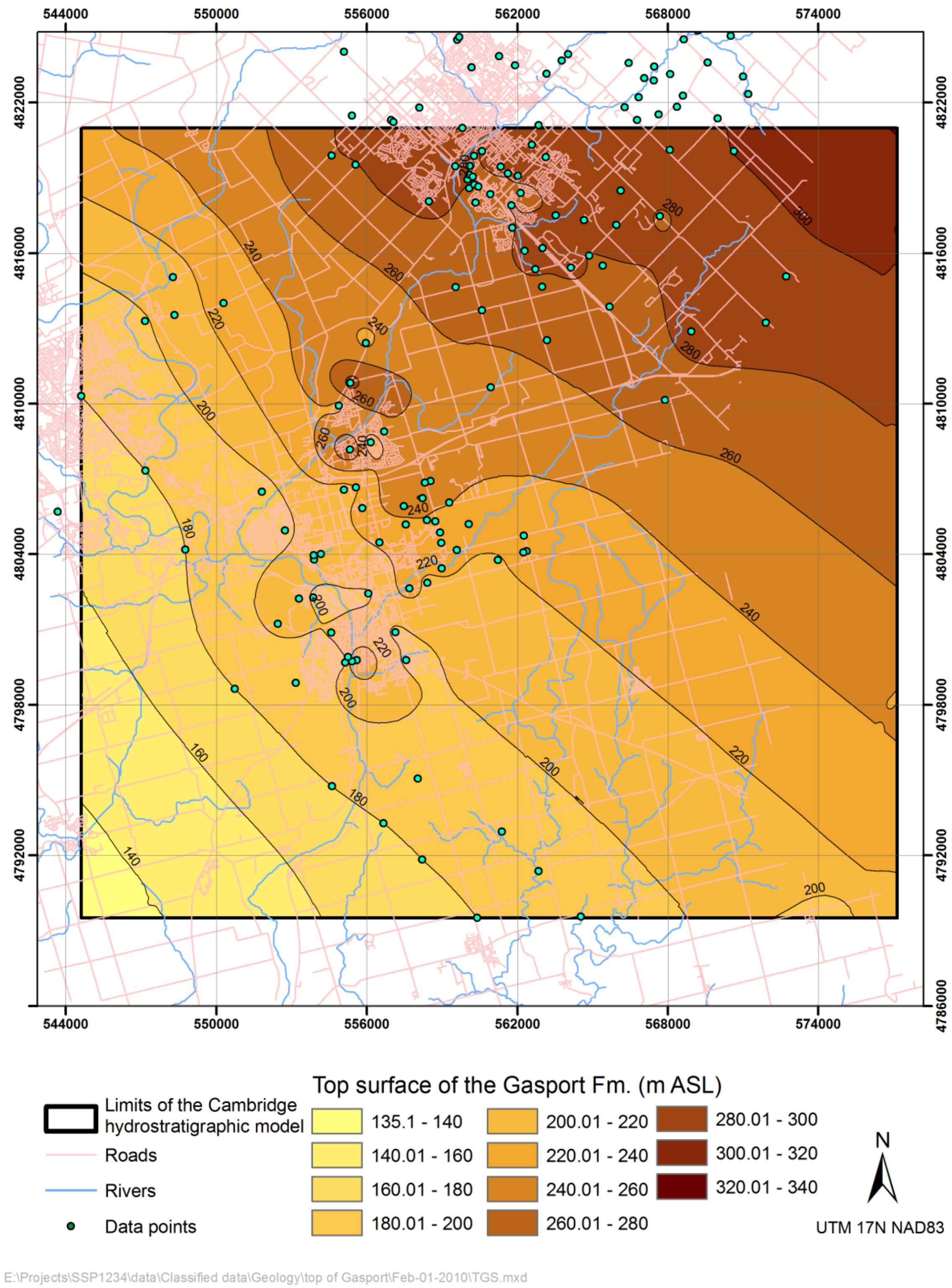


**Figure 10-2 Interpolated surface of the top of the Gasport Formation**

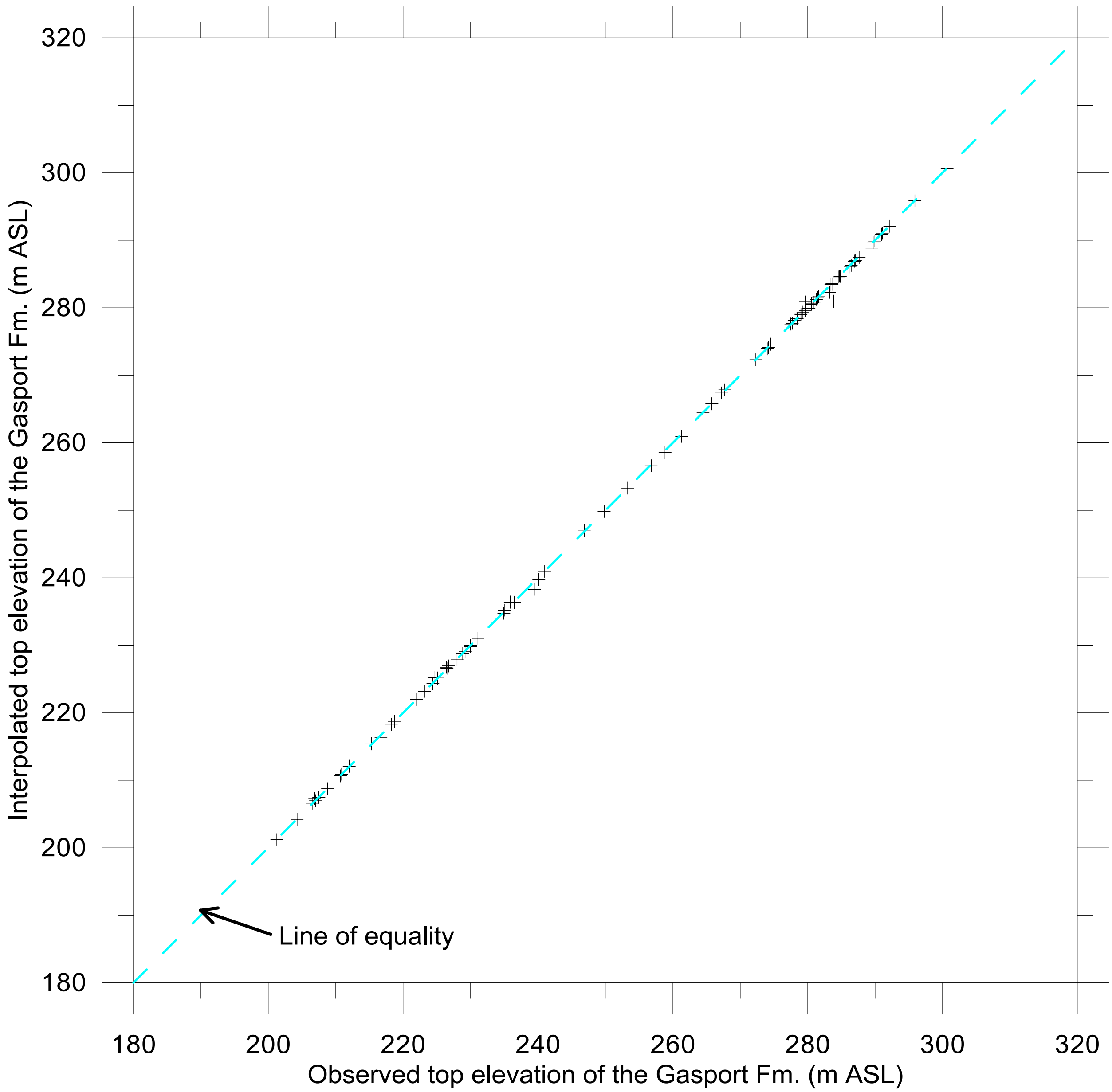


**Figure 10-3 Comparison of observed and calculated top elevations of the Gasport Formation**

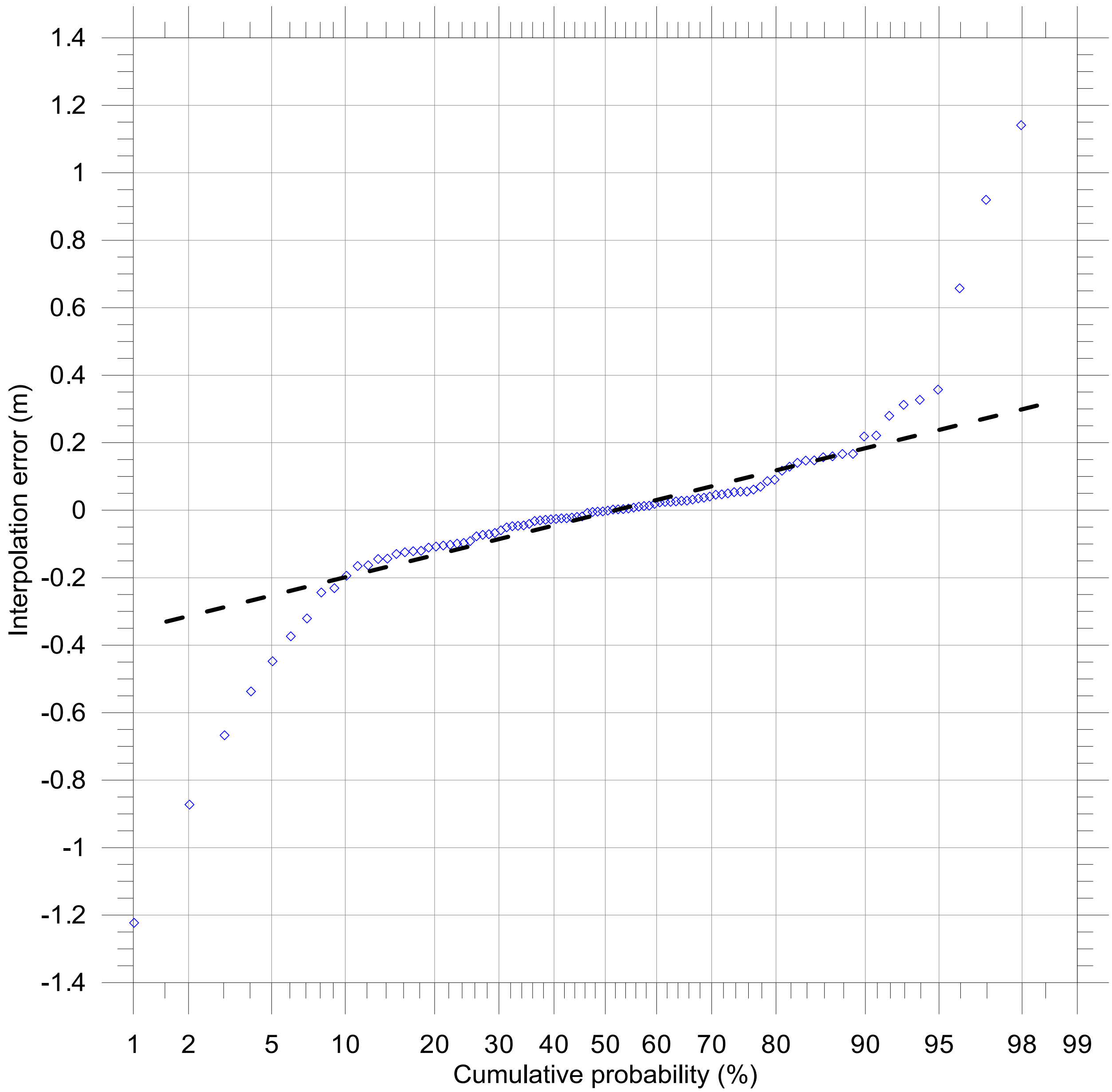


**Figure 10-4 Cumulative probability distribution of differences between the interpolated and observed top elevations of the Gasport Formation**

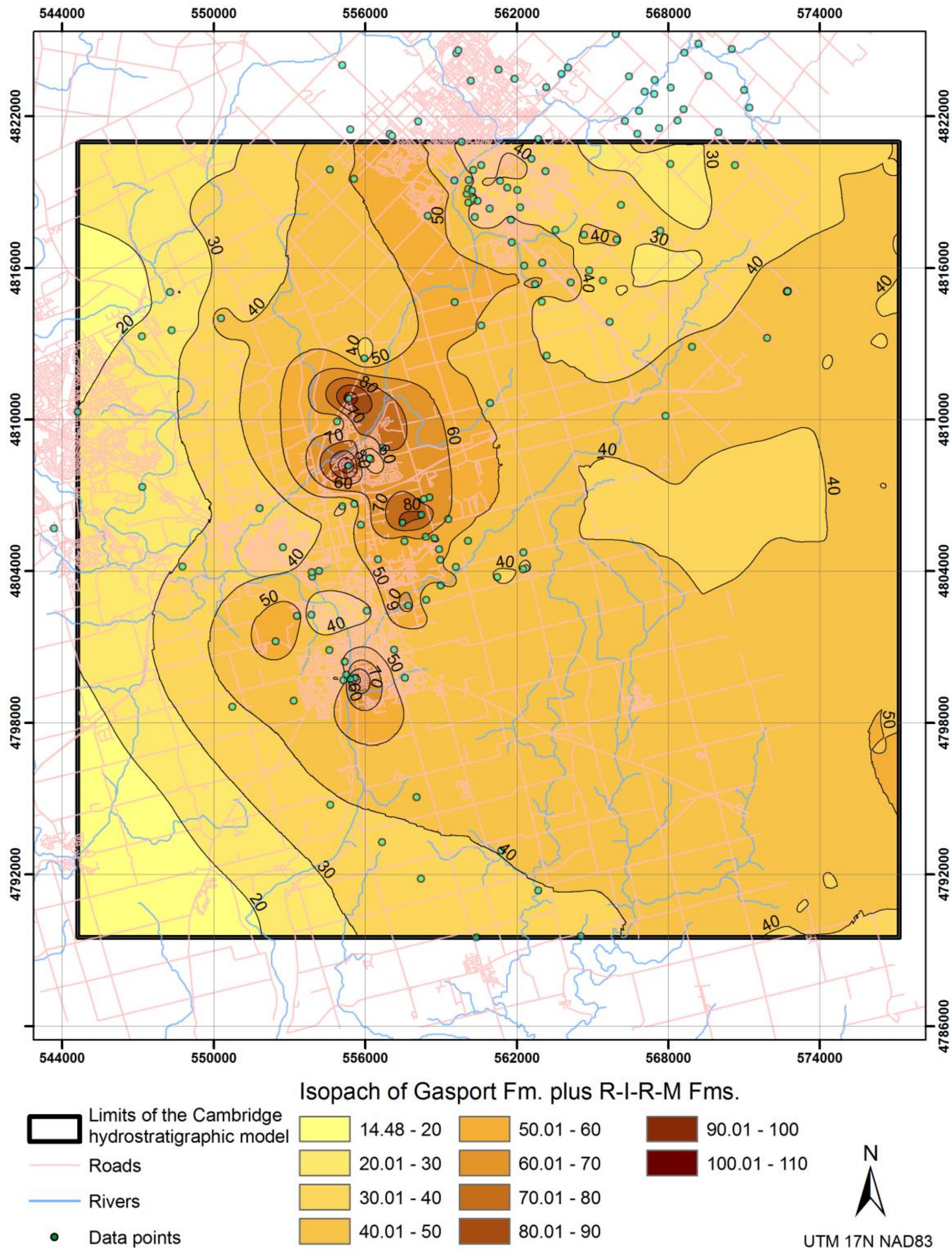


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**Figure 10-5 Thicknesses of the Gasport Formation plus R-I-R-M Formations**

# Section 11
# Potential production zone in the Gasport Formation in the Cambridge area

## 11.1 Introduction

In the Guelph area, a zone of high transmissivity has been observed in the middle of the Gasport Formation. This zone is referred to as the Guelph Production Zone, and is a feature being targeted for additional high-capacity production wells (Brunton et al., 2007). The evidence for a continuous zone of elevated transmissivity in the middle of the Gasport Formation in the Cambridge area is not clear cut. A review of borehole flowmeter profiles across the Cambridge area suggests that there are distinct zones of concentrated flow, but they are not aligned in a single zone.

To afford flexibility in the assignment of the properties of the Gasport Formation, the Gasport Formation was subdivided into three layers in the Cambridge model. The delineation of the second layer followed an approach similar to that adopted to represent the Gasport Production Zone in the Guelph area. In this section, development of the top and bottom surfaces of the Production Zone of the Gasport Formation in the Cambridge area is described.

## 11.2 The "Guelph Production Zone"

Based on borehole logs and testing in the Guelph area, Golder Associates suggested that the Gasport Production Zone could be idealized as a layer with a uniform dip toward the southwest and an average thickness of about 12 m. The thickness of the Gasport Production Zone decreases close to the Niagara Escarpment, as the Gasport Formation pinches out. The thickness of the Gasport Production Zone in the Guelph Tier 3 model is shown in **Figure 11-1.** Linear regression using elevations from 3 selected locations of the top of the Gasport Production Zone in the Guelph Tier 3 model revealed that the elevations of the top of the Gasport Production Zone can be approximated with the following plane:

$$Z = 2.74 \times 10^{-3} \cdot X + 3.3 \times 10^{-3} \cdot Y - 17166.01 \qquad (1)$$

Where Z is the elevation of the top of the Gasport Production Zone in metres above mean sea level, and X and Y are the UTM Easting and Northing coordinates (m).

A similar linear regression yielded the following equation for the bottom of the Production Zone in the Guelph Tier 3 model:

$$Z = 2.74 \times 10^{-3} \cdot X + 3.3 \times 10^{-3} \cdot Y - 17178.57 \qquad (2)$$

The difference between the two estimated surfaces was 12.6 m, which was consistent with the previous suggestion of an average thickness of about 12 m. The difference was likely due to round-off error. The elevations of the top and bottom of the Gasport Production Zone retrieved from the Guelph model are compared in **Figure 11-2** and **Figure 11-3** with the elevations calculated using Equations (1) and (2). In general, the equations match closely the elevations specified in the Guelph Tier 3 model.

## 11.3 Layer representing a potential production zone in Cambridge

Golder Associates summarized the results of flow profiling conducted in 2009 at 27 bedrock boreholes from four well fields in the eastern portion of the Cambridge East area. The inferred elevations of the top and bottom of the zone of major inflow in the Gasport Formation are summarized on **Table 11-1**. Strong flows were identified in the middle portion of the Gasport Formation at 12 of the 27 boreholes. The average thickness of the Production Zone in the Gasport Formation inferred from the profiling is about 14 m, about 2 m greater than the thickness assumed for the Gasport Production Zone in the Guelph Tier 3 model.

**Table 11-1 Top and bottom elevations of the Production Zone within the Gasport Formation at selected boreholes in Cambridge based on flow profiling (data from Golder Associates)**

| Borehole ID | UTM Easting | UTM Northing | Elevations of the Top of the Production Zone (m ASL)[1] | Elevations of the bottom of the Production Zone (m ASL)[1] |
|---|---|---|---|---|
| H3-TW1-09 | 555322.60 | 4808181.60 | 208.9 | 198.9 |
| H4-TW1-08 | 556687.00 | 4808883.00 | 220.8 | 200.8 |
| H5-TW1-09 | 555342.70 | 4810824.40 | 210.8 | 207.8 |
| OW1-95 | 554877.00 | 4809921.00 | 207.9 | 203.9 |
| OW2-95 | 556154.00 | 4808464.00 | 215.6 | 201.6 |
| PBPW2-08 | 557478.20 | 4805910.80 | 218.8 | 203.8 |
| PBPW1-06 | 558217.20 | 4806229.10 | 213.2 | 198.2 |
| CMPW2-06 | 558967.10 | 4804450.60 | 203.6 | 189.6 |
| CMPW1-06 | 558400.00 | 4805353.20 | 216.9 | 201.9 |
| SMTW2-07 | 557688.70 | 4802637.60 | 198.6 | 183.6 |
| SMTW4-08 | 558980.00 | 4803436.00 | 211.6 | 191.6 |
| SM3-93 | 557938.00 | 4803409.80 | 206.0 | 186.0 |

1. The elevations were calculated by subtracting the depths of the flow interval in the middle Gasport Formation from the ground surface elevations. The depths of the flow intervals were taken from Table E3 of Golder Associates (2010)

In the Cambridge model, three model layers (layers 13, 14, and 15) are used to represent the Gasport Formation and the four formations between the Gasport Formation and the Cabot Head Formation. Layer 14 is included to accommodate a Production Zone in the middle of the Gasport Formation.

As a first approximation, it was assumed that the Gasport Production Zone in the Cambridge area coincided with the zone in the Guelph Tier 3 model and that regression equation (1) could be used to approximate its top. The bottom surface was developed using Equation (2) with a change of the intercept to ensure an average thickness of 14 m. Both surfaces were then compared with the elevations of the tops of the Gasport Formation and Cabot Head Formation. The comparison showed that the initial top surface of the Production Zone was higher than the top of the Gasport Formation in the mid-west portion of the model, and that the bottom surface was lower than the top of the Cabot Head Formation at the south end of the model. Adjustments were needed to the top and bottom surfaces to eliminate cross-cutting with the neighboring model layers. The adjustments to the initial surfaces were based on the following assumptions:

- The lower Gasport Formation (model layer 15) has a minimum thickness of 4.5 m. This thickness is the average thickness of the four intermediate formations between the Gasport Formation and the Cabot Head Formation estimated from the borehole logs; and
- The upper Gasport Formation (model layer 13) has a minimum thickness of 2 m. If the initial top of the Production Zone exceeds the top of the Gasport Formation, it is pushed down 2 m below the top of the Gasport Formation. This ensures that the model layer is continuous even in the western portion of the model where the Gasport Formation is thinner.

The final interpolated top and bottom elevations of the Production Zone at the locations of the 12 boreholes listed on **Table 11-1** are listed on **Table 11-2**. The results shown on **Table 11-2** confirm that the majority of the high productivity intervals in the Gasport Formation fall within model layer 14.

**Table 11-2 Comparison of top and bottom elevations of the Production Zone within the Gasport Formation at selected boreholes**

| Borehole ID | UTM Easting | UTM Northing | Elevations of the Top of the Production Zone (m ASL)[1] | Elevations of the bottom of the Production Zone (m ASL)[1] | Top of the model layer 14 (m ASL)[2] | Bottom of model layer 14 (m ASL)[3] |
|---|---|---|---|---|---|---|
| H3-TW1-09 | 555322.60 | 4808181.60 | 208.9 | 198.9 | 211.91 | 197.91 |
| H4-TW1-08 | 556687.00 | 4808883.00 | 220.8 | 200.8 | 217.97 | 203.97 |
| H5-TW1-09 | 555342.70 | 4810824.40 | 210.8 | 207.8 | 220.68 | 206.68 |
| OW1-95 | 554877.00 | 4809921.00 | 207.9 | 203.9 | 216.43 | 202.43 |
| OW2-95 | 556154.00 | 4808464.00 | 215.6 | 201.6 | 215.12 | 201.12 |
| PBPW2-08 | 557478.20 | 4805910.80 | 218.8 | 203.8 | 210.34 | 196.34 |
| PBPW1-06 | 558217.20 | 4806229.10 | 213.2 | 198.2 | 213.41 | 199.41 |
| CMPW2-06 | 558967.10 | 4804450.60 | 203.6 | 189.6 | 209.60 | 195.60 |
| CMPW1-06 | 558400.00 | 4805353.20 | 216.9 | 201.9 | 211.02 | 197.02 |
| SMTW2-07 | 557688.70 | 4802637.60 | 198.6 | 183.6 | 200.12 | 186.12 |
| SMTW4-08 | 558980.00 | 4803436.00 | 211.6 | 191.6 | 206.29 | 192.29 |
| SM3-93 | 557938.00 | 4803409.80 | 206.0 | 186.0 | 203.35 | 189.35 |

1. From Table 1, based on flow profiling data from Golder Associates.
2. Calculated with Equation (1).
3. Elevation of top of model layer 14 minus 14 m.

Limited data from hydraulic testing were available to test the hypothesis that there is a production zone in the Gasport Formation elsewhere in the Cambridge model area. Packer testing was conducted at 6 wells (BH-1, BH-2A, BH-2B, BH-3A, BH-4, and BH-5) in the Middleton Street well field in 1995 (Beak et al., 1995). Only the tests in BH-1 extended across the middle and lower part of the Gasport Formation; the remainder of the tests were conducted only over the upper part of the Gasport Formation (BH-2B, BH-3) or were above the Gasport Formation (BH-2A, BH-4 and BH-5).

The results of the testing in BH-1 are plotted in **Figure 11-4.** The results suggest highly transmissive zones within the Gasport Formation at depths of 86 and 101 m below the top of casing. In the absence of detailed information, it was assumed that the reported depths are from ground surface (some errors were expected in doing so, but it should be less than about 1 m). Using the interpolated ground surface elevation at BH-1 from the DEM, the highly transmissive interval in the Gasport Formation was estimated to extend from 162.8 to 178.7 m ASL (**Figure 11-4**). The largest part of this interval falls within the Gasport Production Zone in the Cambridge model (168.9 -182.9 m ASL).

The final top and bottom elevations of model layer 14 representing the Production Zone in the Gasport Formation are presented in **Figure 11-5** and **Figure 11-6**, respectively. The cross-sections near the Middleton Street well field are presented in **Figure 11-7** and **Figure 11-8**. The inferred reef mound in the Gasport Formation is evident in these figures.

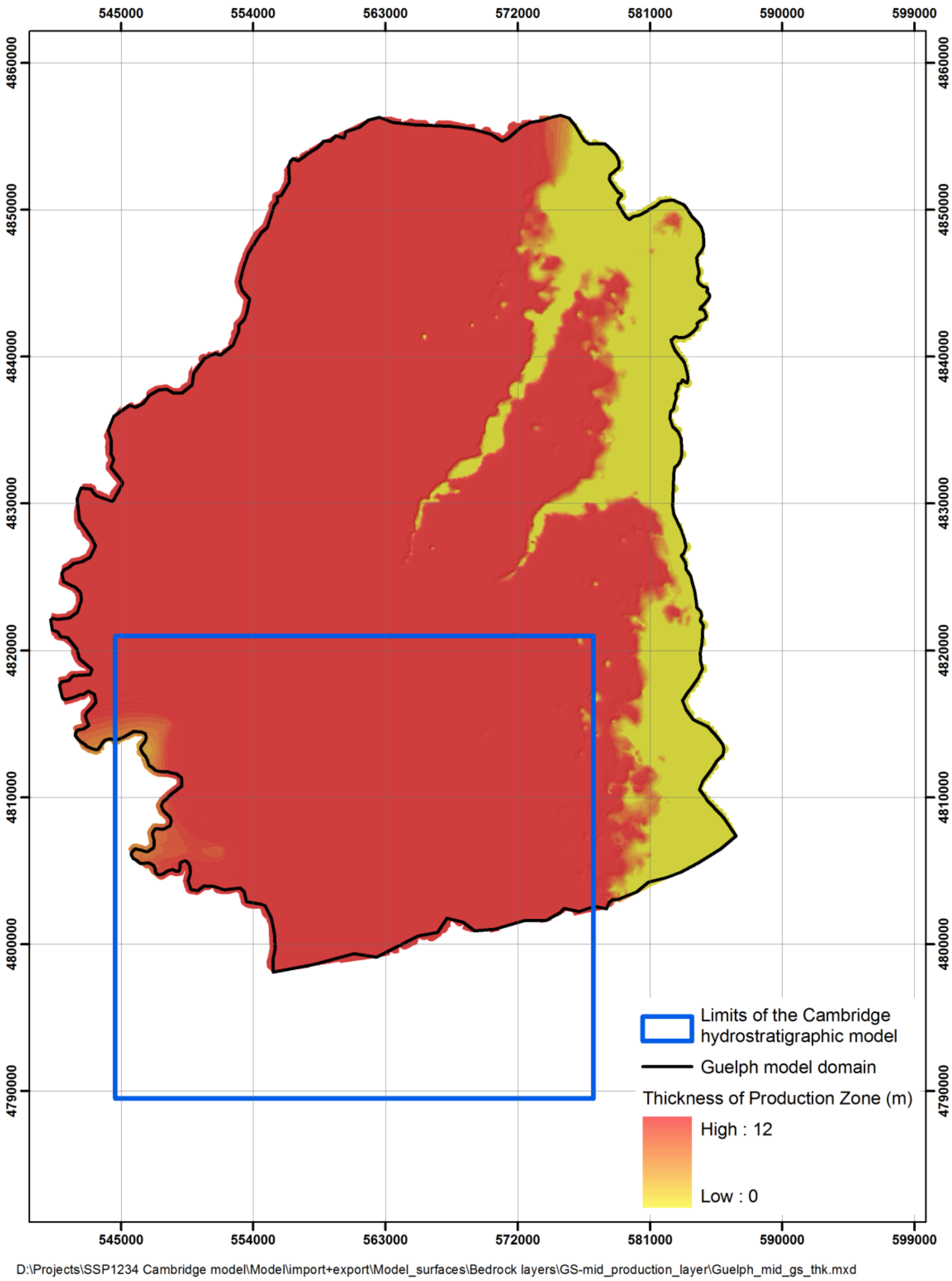


**Figure 11-1 Thickness of the Gasport Production Zone in the Guelph Tier 3 Model**

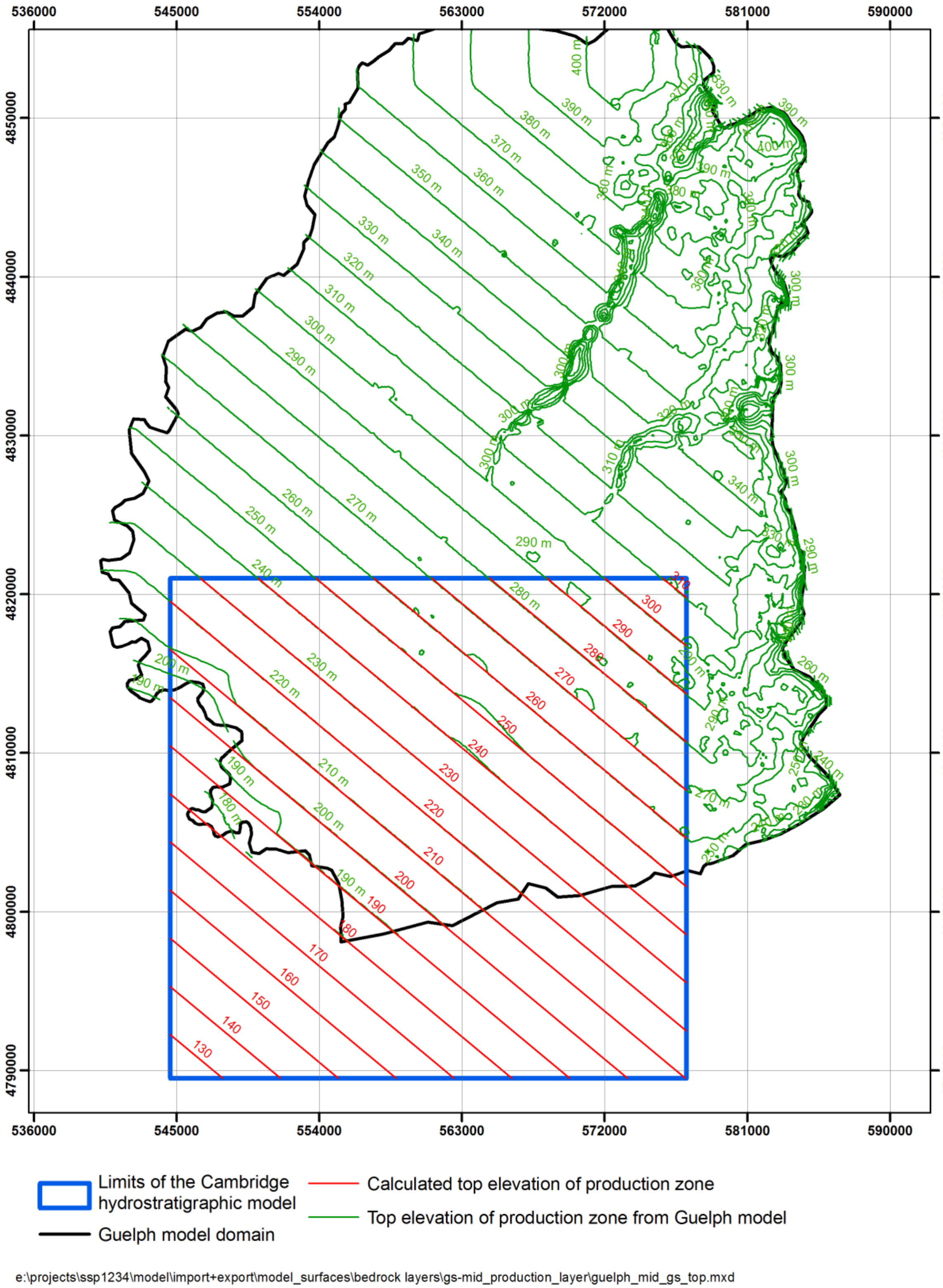


**Figure 11-2 Elevations of the top of the Gasport Production Zone from the Guelph Tier 3 model**

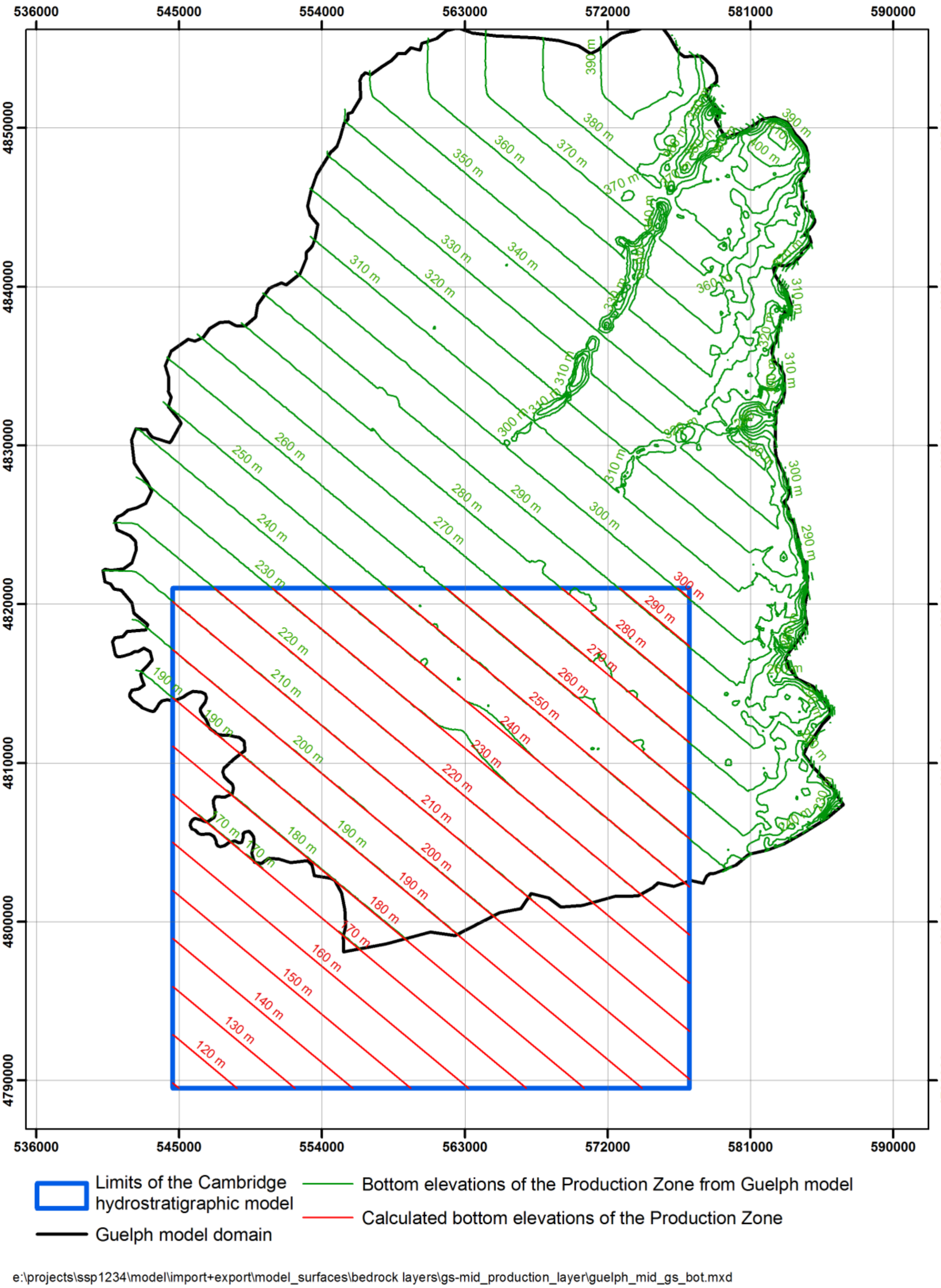


**Figure 11-3 Elevations of the bottom of the Gasport Production Zone from the Guelph Tier 3 model**

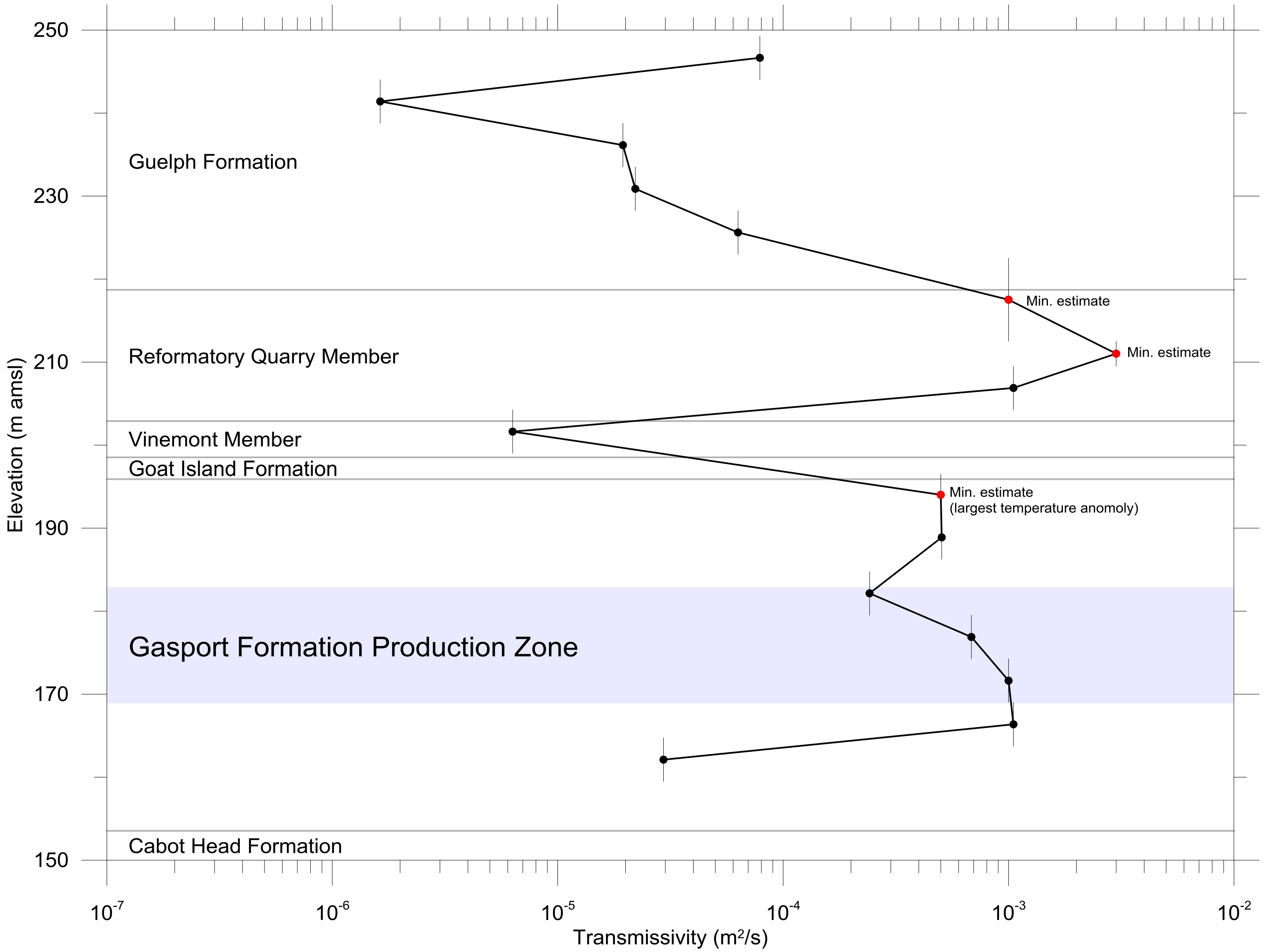


**Figure 11-4 Packer testing results at BH-1, Middleton Street well field (data from Beak et al., 1995)**

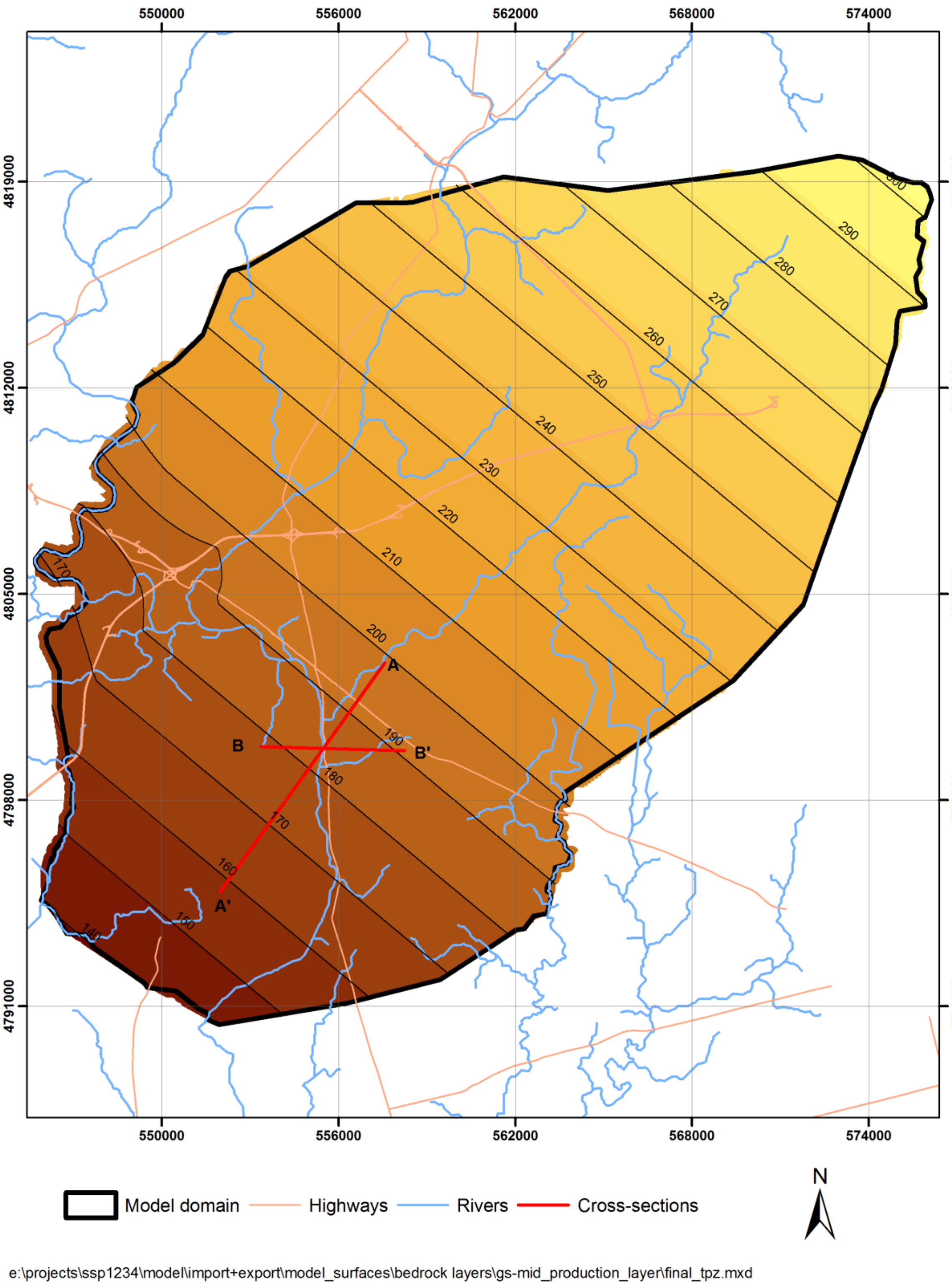


**Figure 11-5 Final elevations of the top of the Gasport Production Zone (model layer 14)**

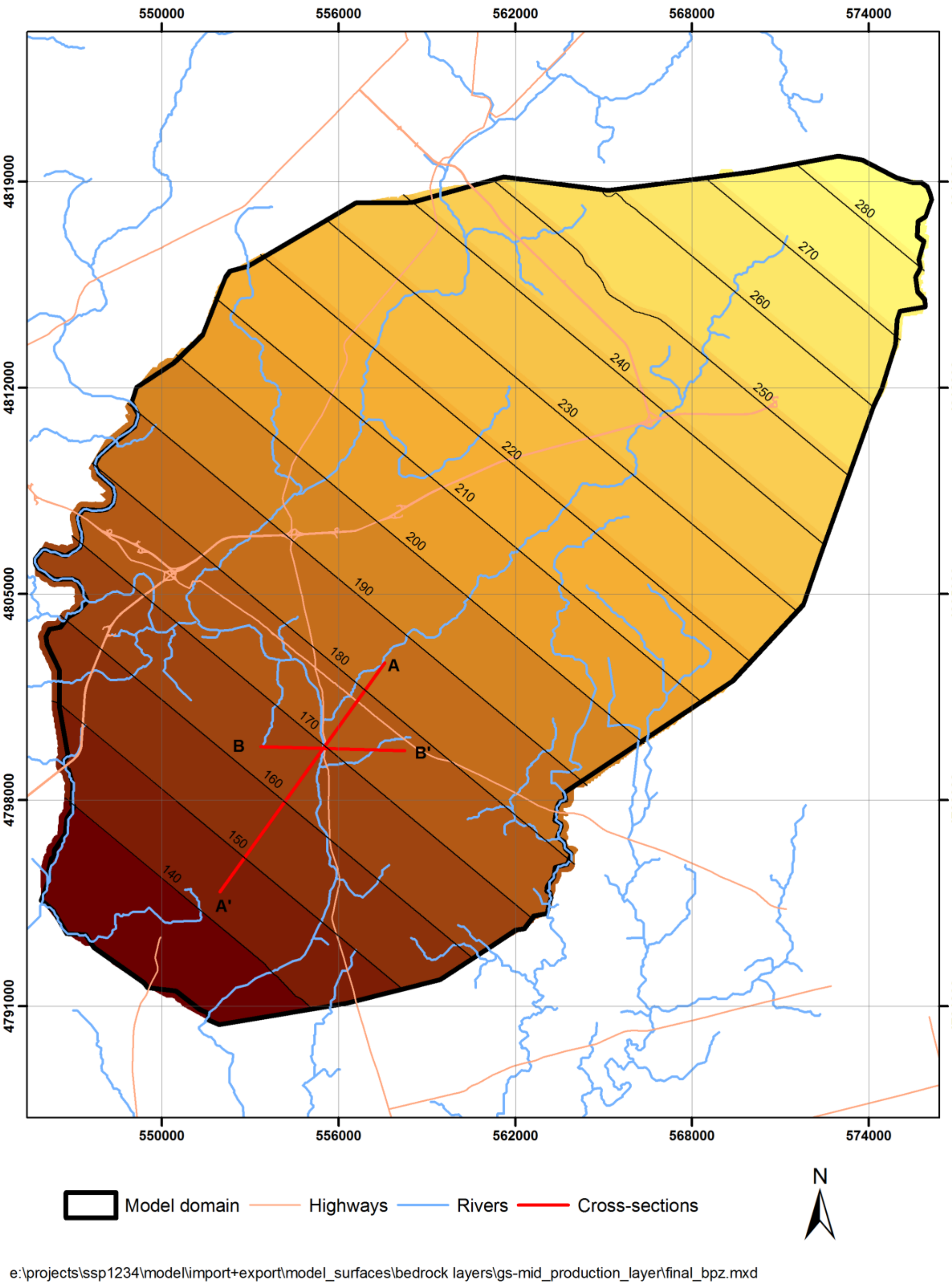


**Figure 11-6 Elevations of the bottom of the Gasport Production Zone (model layer 14)**

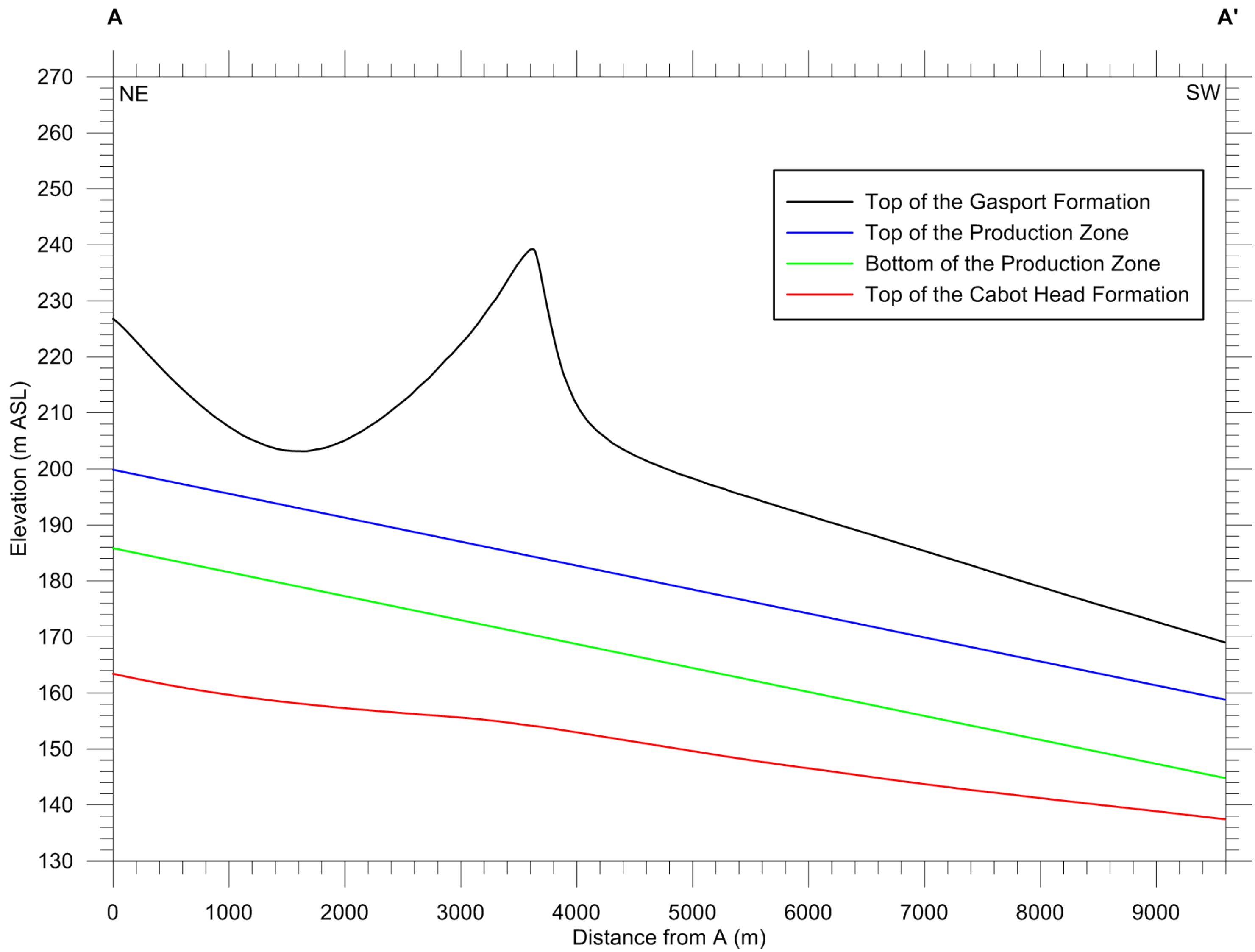


**Figure 11-7 Cross section A-A' through the Middleton Street well field**

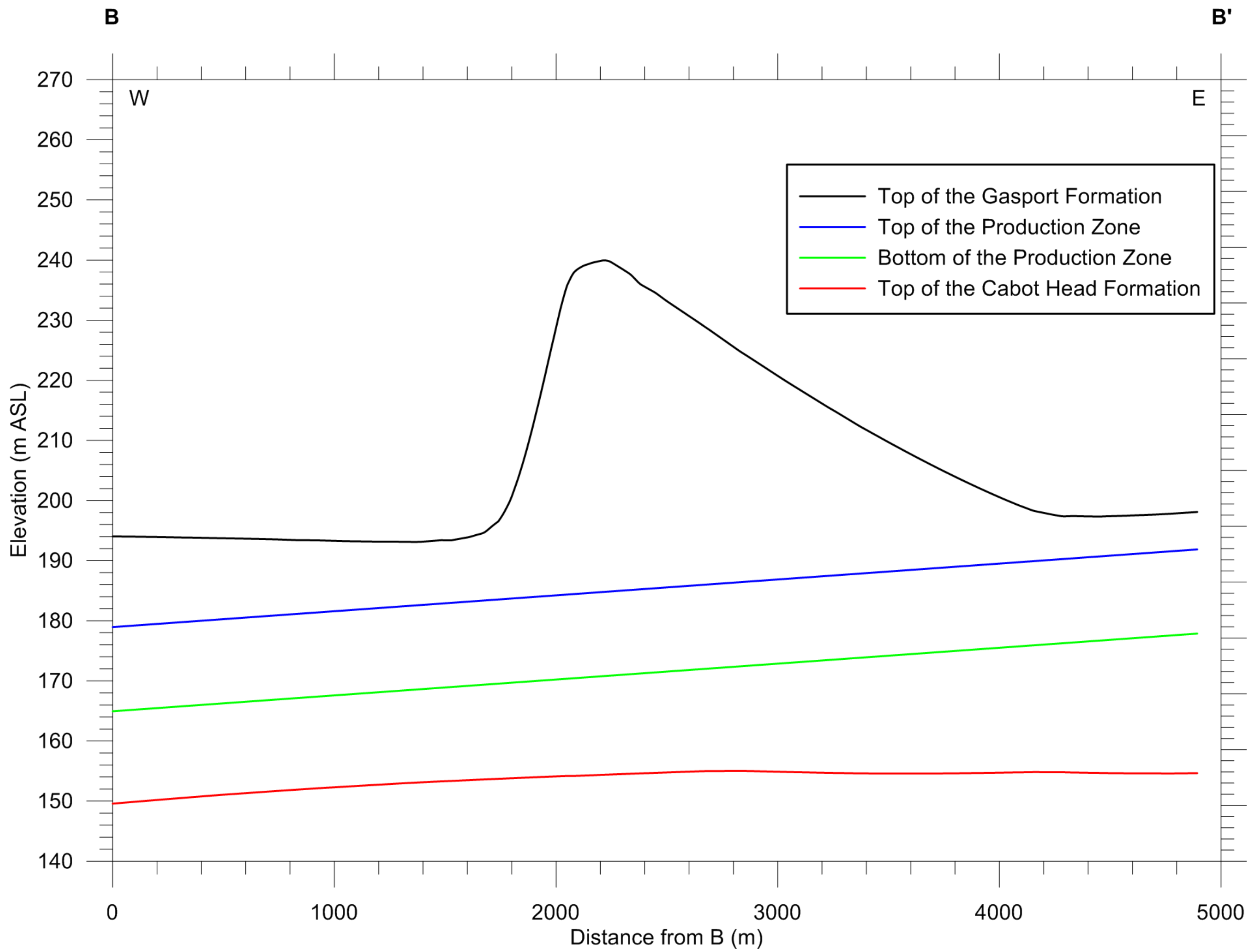


**Figure 11-8 Cross section B-B’ through the Middleton Street well field**

# Section 12
# The Cabot Head Formation

## 12.1 Significance of the Cabot Head Formation

The top of the Cabot Head Formation has typically been treated as the lower limit of significant groundwater flow in the Cambridge area (Golder, 1991; Beak et al., 1995; Lotowater, 1997; Duke, 1998; Stantec, 2007; Stantec, 2011a,b; Golder, 2009b,c, 2011a). The results of hydraulic tests conducted in the Cabot Head Formation at various locations are listed on **Table 12-1**. The hydraulic conductivity values range from $1.9\times10^{-7}$ to $5.6\times10^{-4}$ cm/s; these values are two orders of magnitude or less than the hydraulic conductivity values of the Gasport Formation. The data compiled on **Table 12-1** provide support for setting the top of the Cabot Head Formation as the bottom of the Cambridge hydrostratigraphic model.

**Table 12-1 Summary of hydraulic conductivity values for the Cabot Head Formation**

| Source | Mean hydraulic conductivity (cm/s) | Comments |
|---|---|---|
| Middleton St well field (Beak et al., 1995) | $5.6\times10^{-4}$ | Packer test at BH-1, 2 order of magnitude lower than the overlaying formation |
| Proposed Flamborough Quarry (SSPA, 2009) | $9.1\times10^{-7}$ | Packer test at MWB4-II for a interval that cross the interface between the Cabot Head Formation and the Amabel Formation |
| | $2.5\times10^{-5}$ | Packer test at MWB7-II for a interval that cross the interface between the Cabot Head Formation and Fossil Hill Formation |
| Acton Quarry (CRA, 2008) | $5.0\times10^{-5}$ | Packer test at OW1-86 |
| | $<3.2\times10^{-6}$ | Packer test at OW2-86 |
| | $4.5\times10^{-5}$ | Packer test at OW3-86 |
| | $<1.3\times10^{-6}$ | Packer test at OW4-86 |
| | $1.7\times10^{-5}$ | Packer test at OW5-86 |
| | $2.7\times10^{-6}$, $8.3\times10^{-7}$ | Packer test at OW22a |
| | $7.5\times10^{-6}$ | Packer test at OW1C1 |
| | $1.9\times10^{-7}$ | Packer test at OW1C2 |

## 12.2 Data sources, organization and quality control

The following data were available for the development of the top surface of the Cabot Head formation:

- Bedrock picks from Golder: 30 points;
- Bedrock picks from Stantec: 1 point; and
- Data points from the Guelph Tier 3 study: 143 points (including 55 artificial control points).

All data sets were checked and duplicate data points removed based on their reliability and consistency with the surrounding data points. After the checking was completed, the numbers of data points retained from the different sources were:

- Bedrock picks from Golder: 30 points;
- Bedrock picks from Stantec: no points; and
- Data points from the Guelph Tier 3 study: 143 points (including 55 artificial control points).

Data from the borehole ASRTW6-08 were included for control on the top of the Cabot Head Formation in the western part of the study area.

A complete listing of the borehole picks, including an indication of those points that were excluded from the interpretation, are included as part of the metadata for this project.

The locations of the control points for defining the surface of the top of the Cabot Head Formation are shown in **Figure 12-1**. As shown in the figure, there is relatively sparse coverage in the Cambridge area. Many of the control points developed for the Guelph Tier 3 study are a significant distance from the Cambridge model area.

As part of their groundwater protection study for the township of Puslinch, Golder Associates developed an interpretation of the bottom surface of the Amabel Formation (Golder, 2006). To incorporate additional control, the contours from the Golder interpretation were digitized and incorporated into this analysis.

Brunton (personal communication, 2009) has urged caution when interpreting maps of the bottom of the Amabel Formation. Problems may arise because the bottom of the Amabel has not always been interpreted correctly in previous investigations. Brunton indicated in his revisions to the Silurian stratigraphy of southern Ontario that the bottom of the Amabel Formation is correctly interpreted as the bottom of the Gasport Formation. He suggested that several previous investigations have mistakenly interpreted the bottom of the Rochester Formation or the Irondequoit Formation as the bottom of the Amabel Formation.

Brunton indicated that the Golder (2006) interpretation is one of the cases in which the reported bottom of the Amabel Formation lies below the actual bottom of the Gasport Formation. In the Cambridge area, the difference between the two elevations is on the order of 4.5 m. Since the Gasport Formation is relatively thick in the Cambridge area, errors arising from confounding the bottom of the Rochester Formation/Irondequoit Formation with the bottom of the Gasport Formation are not particularly significant. However, to be as consistent as possible, an average thickness of the Rochester Formation/Irondequoit Formation was added to the elevations digitized from the Golder (2006) interpretation. In total, 1081 additional control points were added from the Golder (2006) interpretation. The locations of the additional control points are shown in **Figure 12-2**.

## 12.3 Methodology and results

The continuous surface of the top of the Cabot Head Formation was developed using Ordinary Kriging with a linear variogram. The interpolated surface is shown in **Figure 12-3**. In general, the surface dips toward the southwest. The measured and interpolated elevations of the top of the Cabot Head Formation at the borehole control points are compared in **Figure 12-4**. As shown in the figure, the interpolated elevations match the observations closely. The cumulative probability distribution of the difference between the interpolated elevation and the elevation at boreholes is shown in **Figure 12-5**. The mean absolute error of the interpolation is about 0.18 m. Over 95% of the borehole picks have an absolute error of less than 0.2 m. Most of the points on the cumulative probability distribution plot approximate a straight line; this suggests that the interpolation errors are distributed randomly.

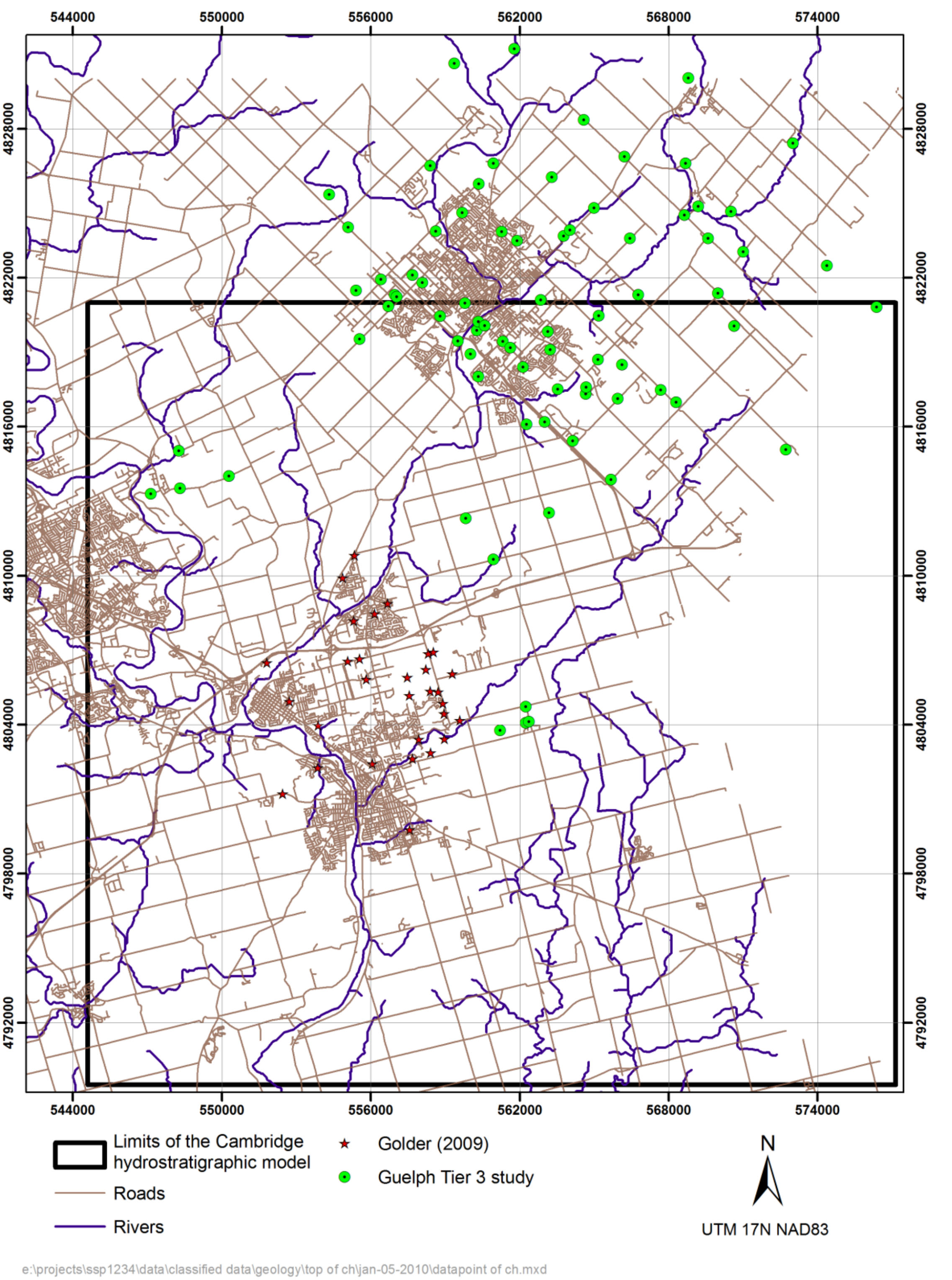


**Figure 12-1 Available borehole control for the top of the Cabot Head Formation**

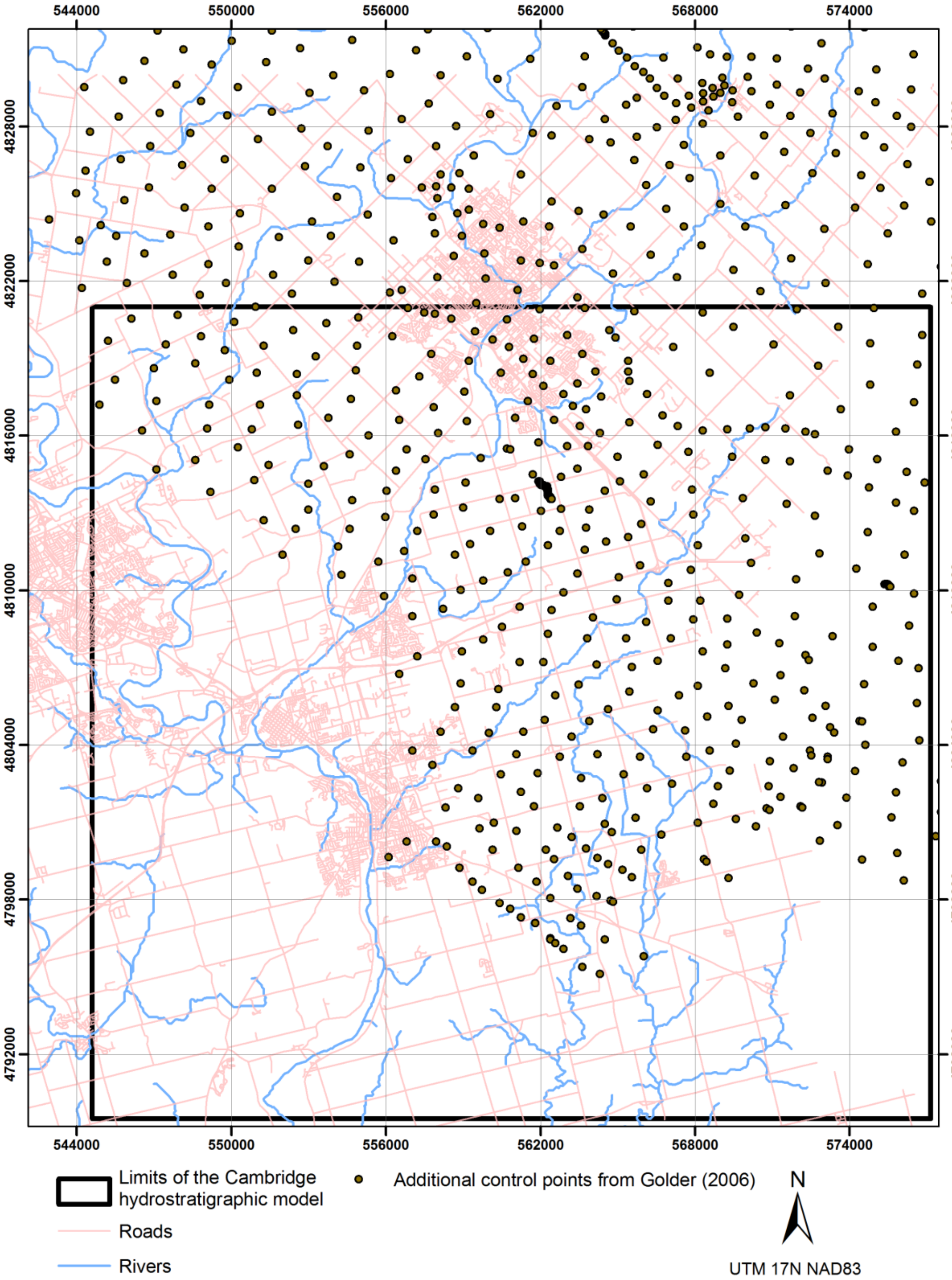


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**Figure 12-2 Additional control points for the top of the Cabot Head Formation**

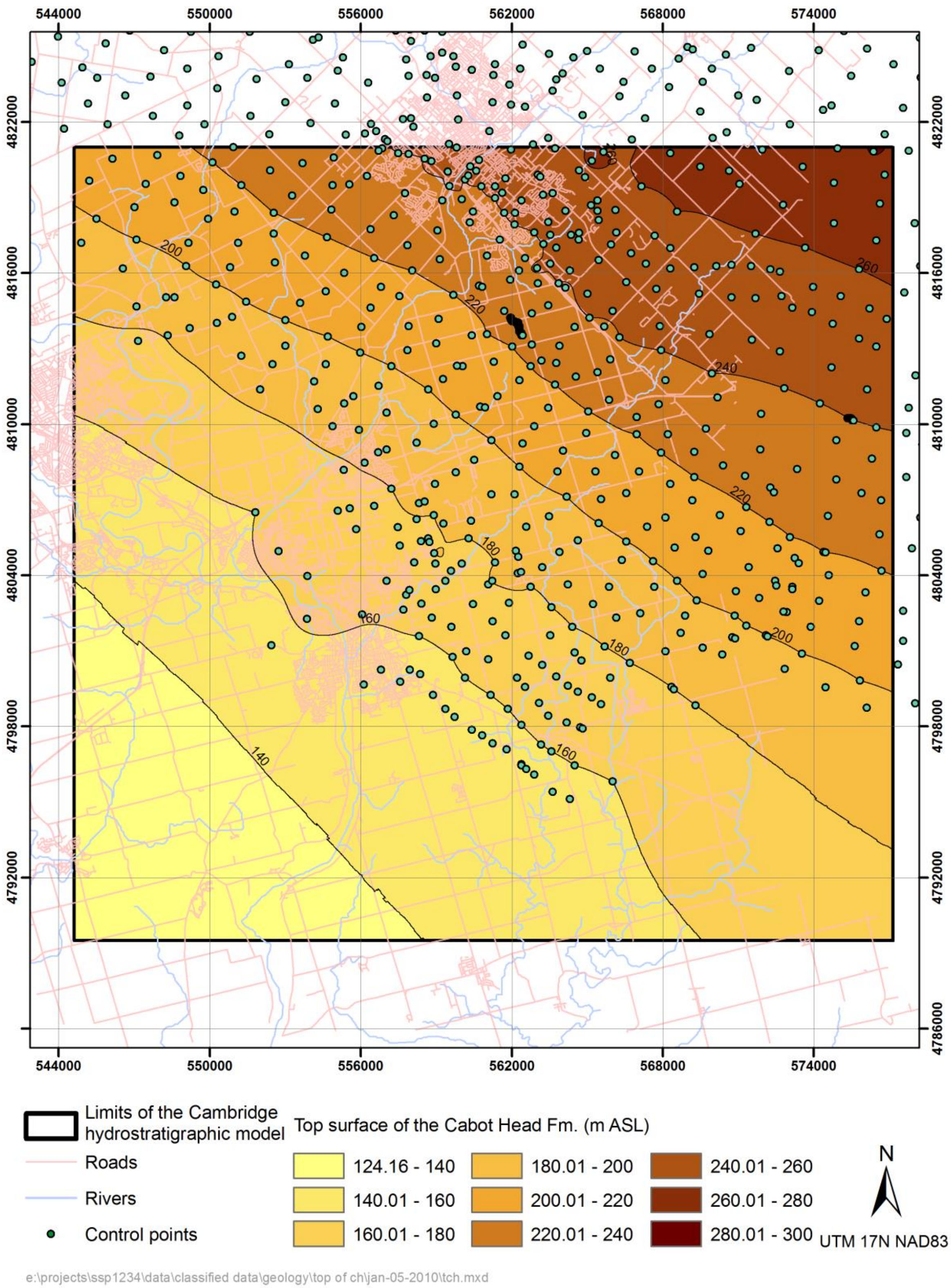



**Figure 12-3 Interpolated elevations of the top the Cabot Head Formation**

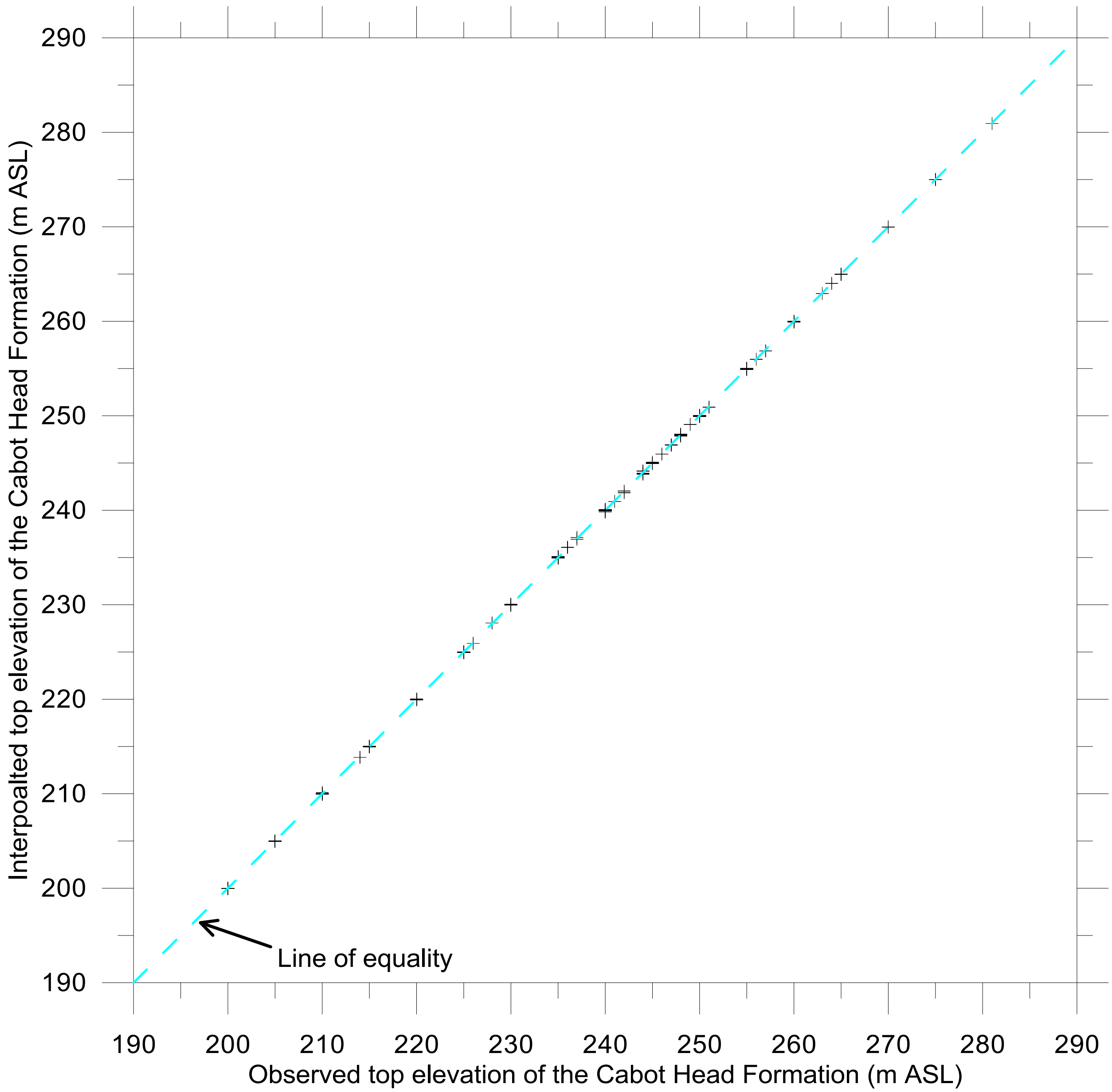



**Figure 12-4 Observed and interpolated elevations of the top of the Cabot Head Formation**

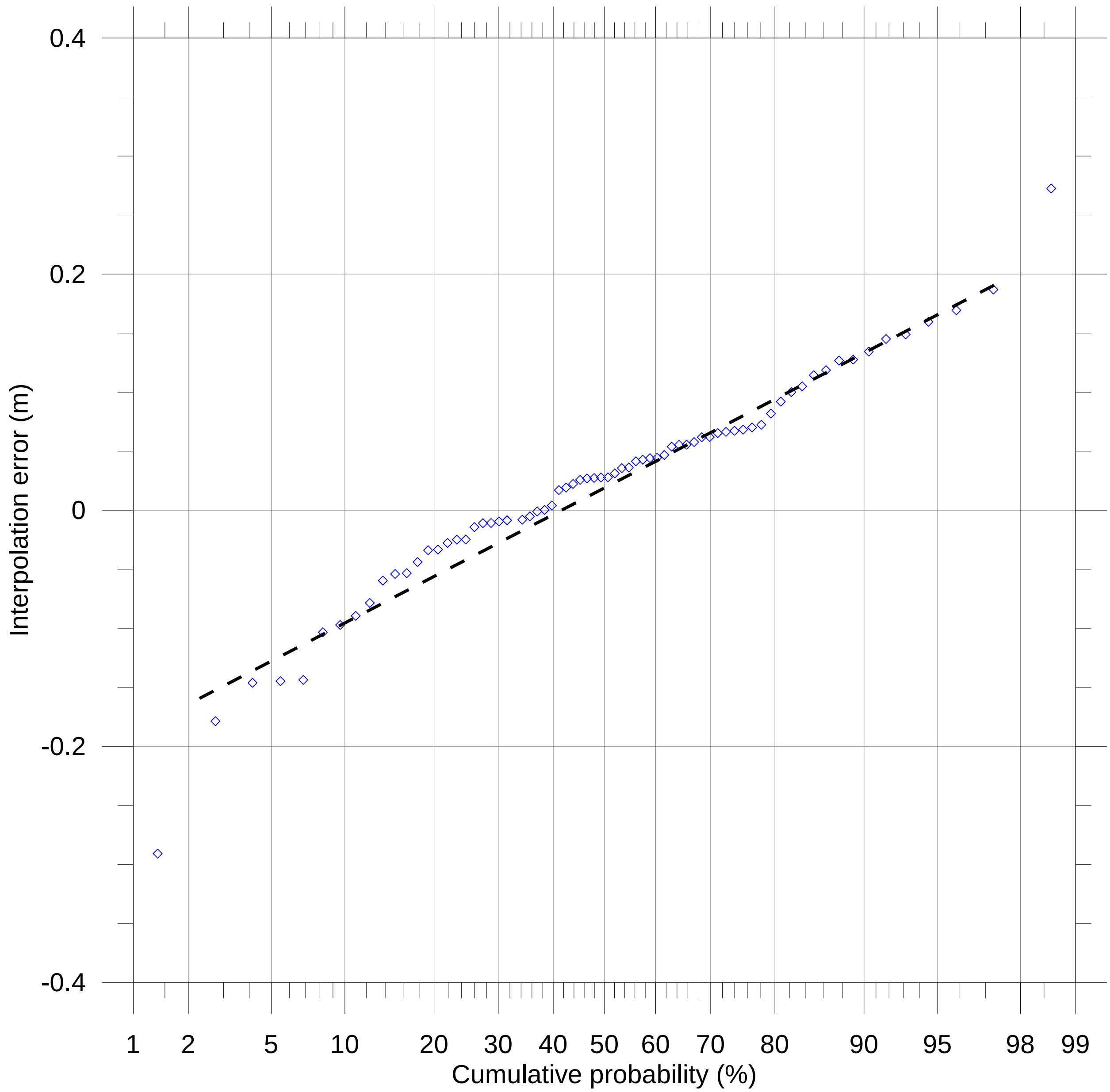



**Figure 12-5 Cumulative probability distribution of differences in the interpolated elevations of the top of the Cabot Head Formation**

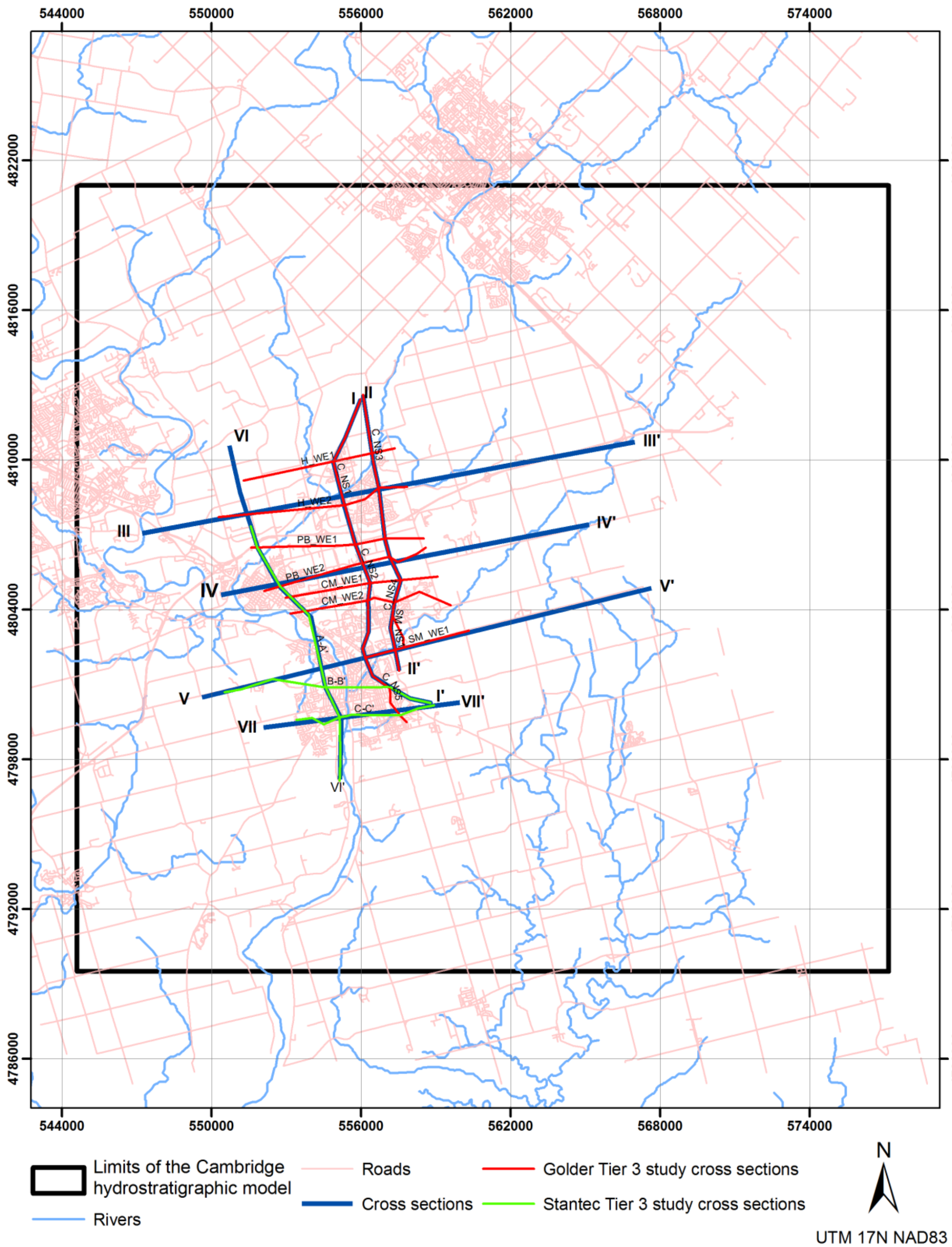
# Section 13
# Hydrostratigraphic cross-sections

As a final check on the surfaces developed for the Cambridge hydrostratigraphic model, cross-sections through the final model were prepared. These sections were aligned with the interpretations developed for the Region of Waterloo Tier 3 study (Golder, 2011a; Stantec 2011a). The locations of the cross-sections are indicated in **Figure 13-1**, and the correspondences between the cross-sections are listed on **Table 13-1**.

**Table 13-1 Listing of comparison cross-sections**

| Cross-section through the present hydrostratigraphic model | Tier 3 cross-section |
|---|---|
| Figure 13-2; I-I' | Golder (2011a) C_NS1, C_NS2 |
| Figure 13-3; II-II' | Golder (2011a) C_NS3, C_NS4<br>Golder (2011a) SM_NS1 |
| Figure 13-4; III-III' | Golder (2011a) H_WE2 |
| Figure 13-5; IV-IV' | Golder (2011a) PB_WE2 |
| Figure 13-6; V-V' | Stantec (2011a) B-B'<br>Golder (2011a) SM_WE1 |
| Figure 13-7; VI-VI' | Stantec (2011a) A-A' |
| Figure 13-8; VII-VII' | Stantec (2011a) C-C' |

Review of **Figure 13-2** through **Figure 13-8** suggests that there is a close correspondence with the cross-sections presented in the Tier 3 reports. The sections were developed independently; therefore, this is in some sense a test of the consistency between the expert interpretations incorporated in the sections prepared for the Tier 3 study and the hydrostratigraphic model developed here.




E:\Projects\SSP1234\data\Classified data\Surface result\Location of XS.mxd

**Figure 13-1 Locations of cross-sections**

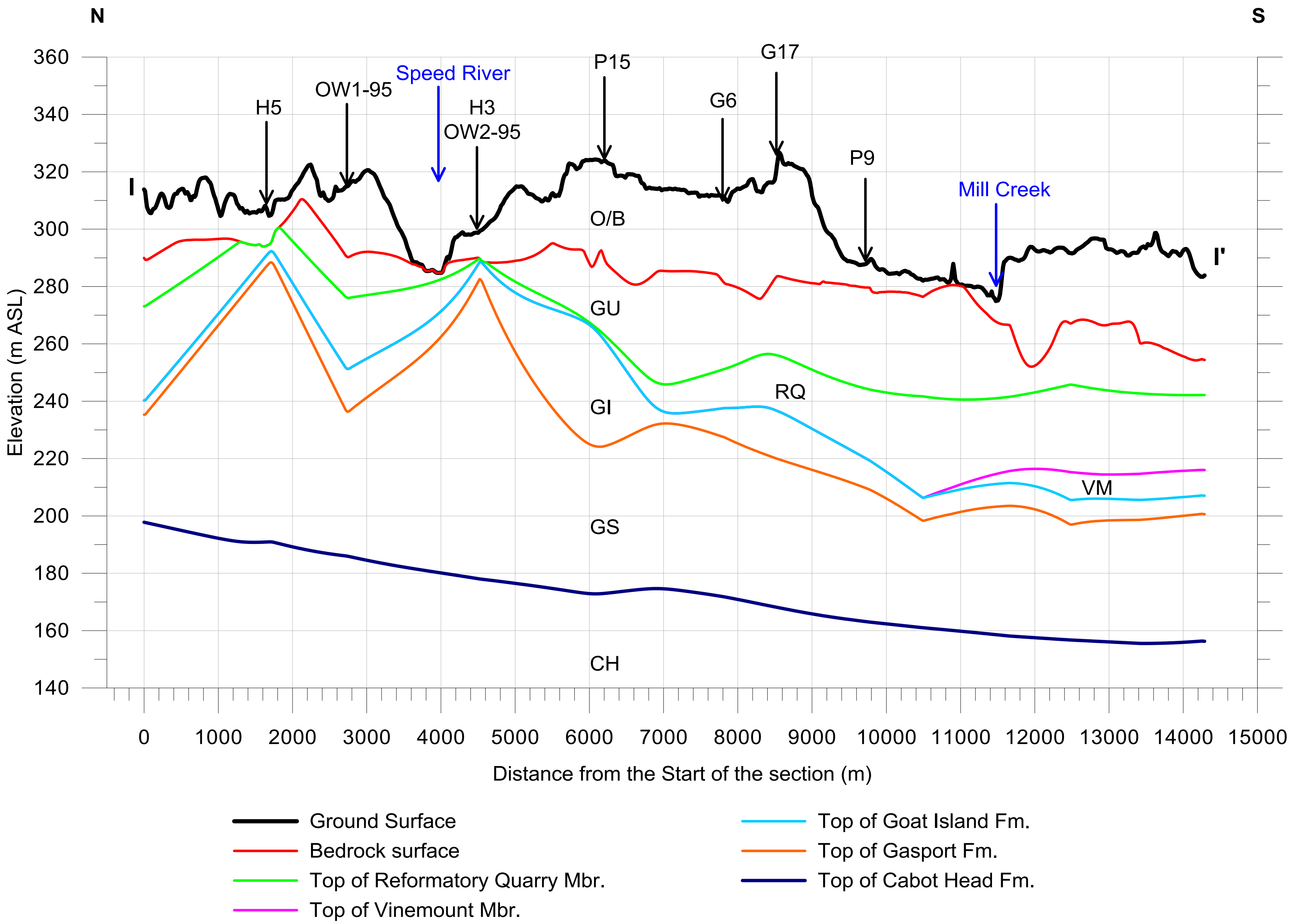



**Figure 13-2 Cross-section I-I'**

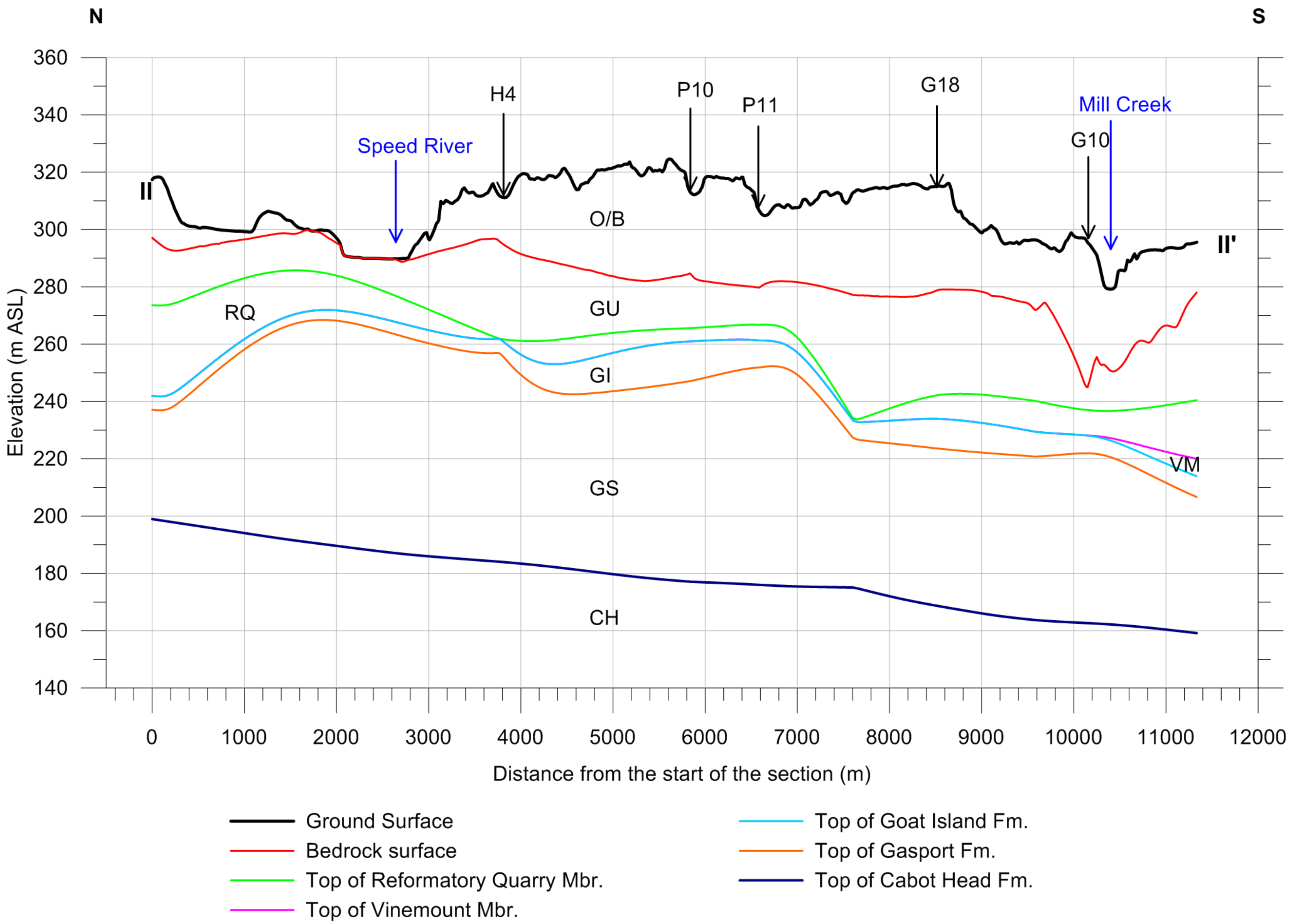



**Figure 13-3 Cross-section II-II'**

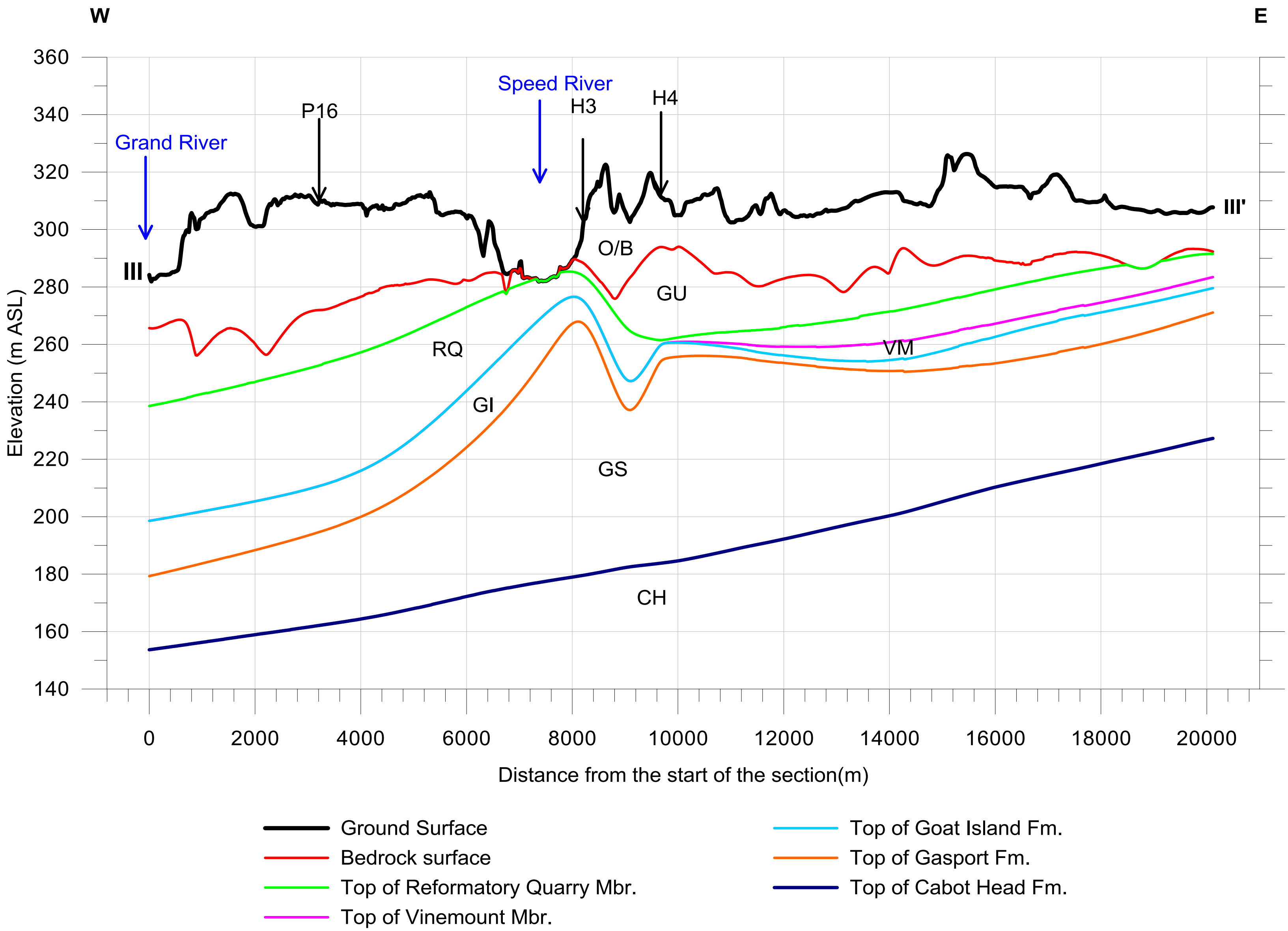



**Figure 13-4 Cross-section III-III'**

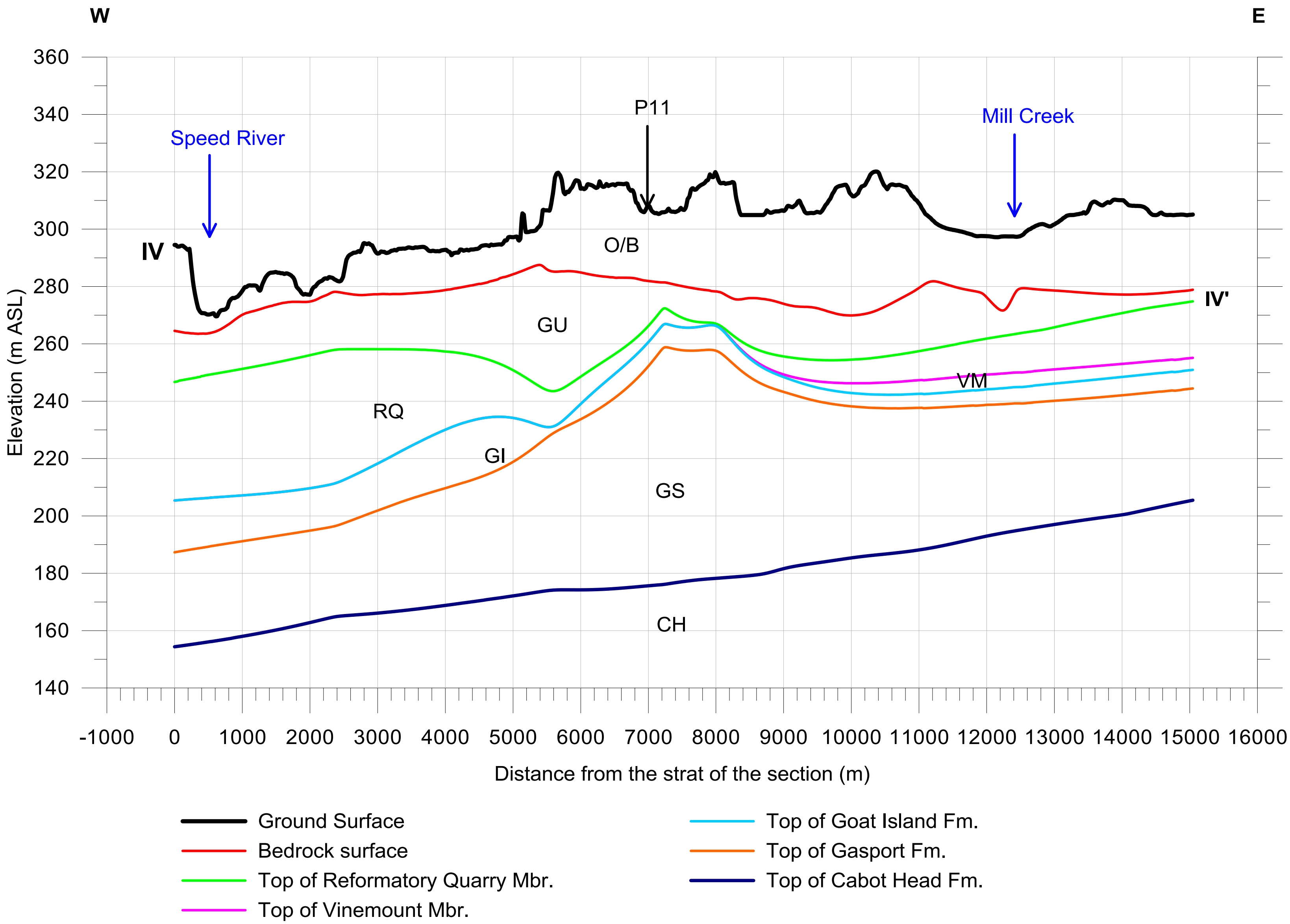



**Figure 13-5 Cross-section IV-IV'**

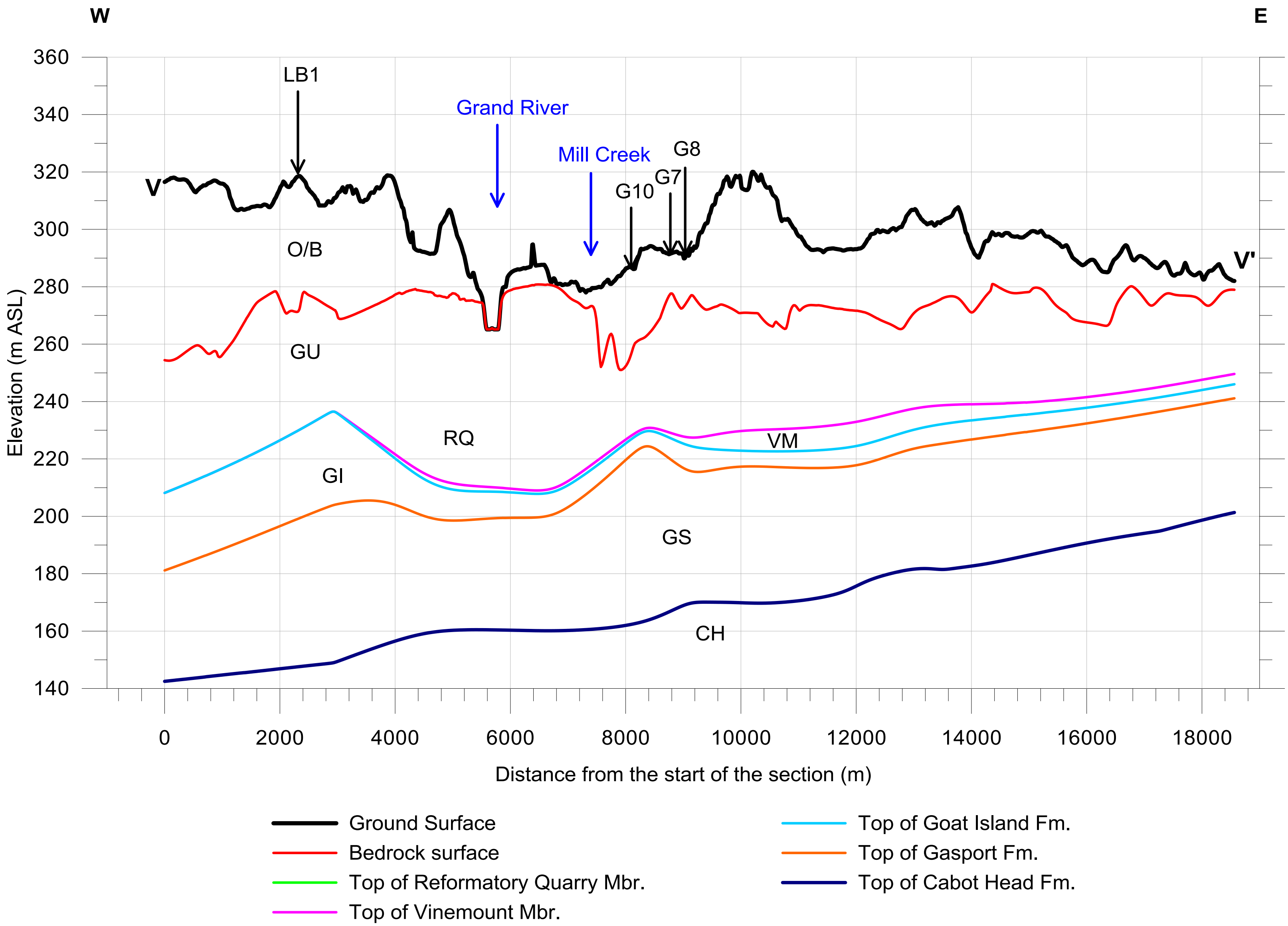



**Figure 13-6 Cross-section V-V'**

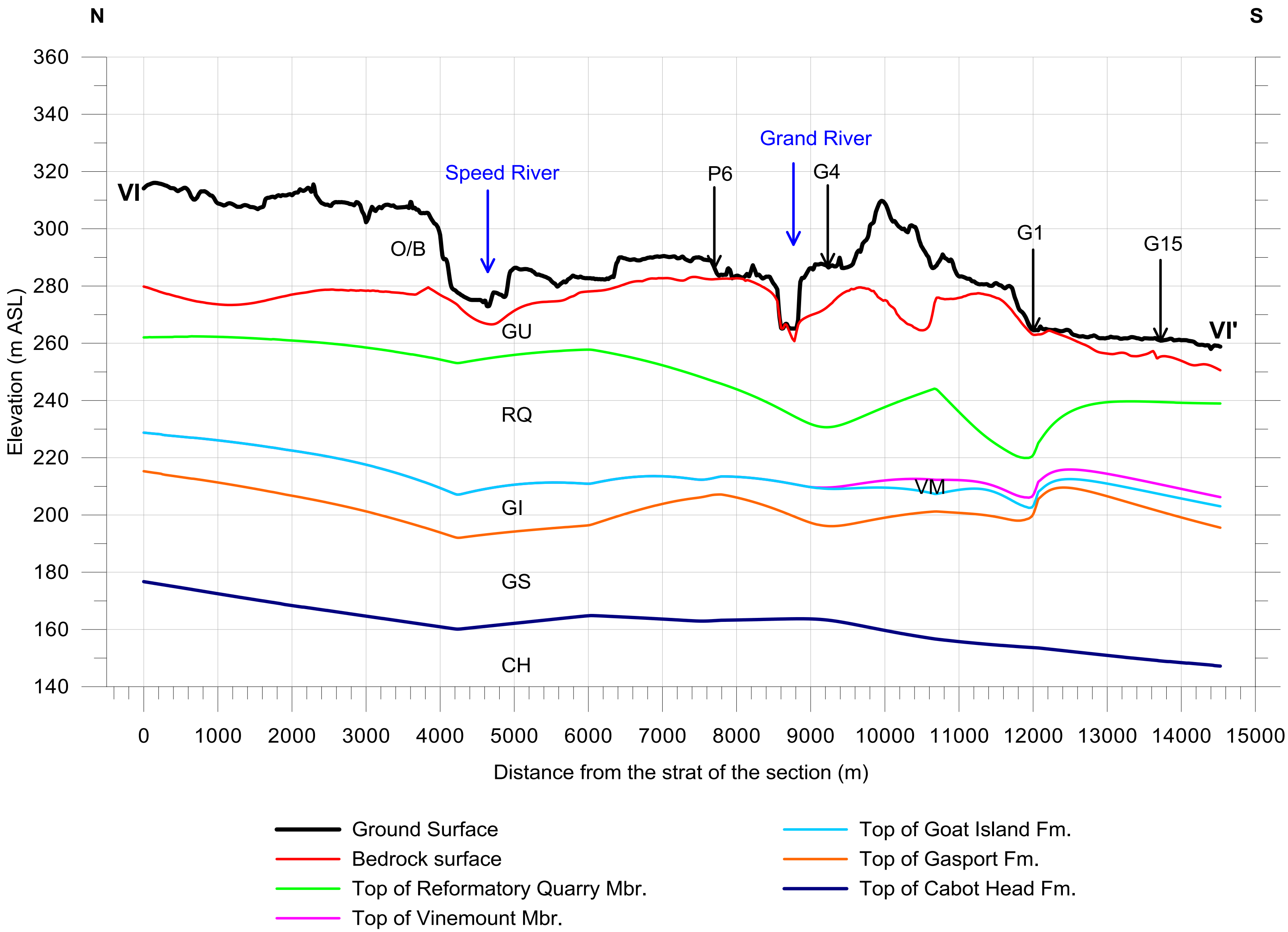



**Figure 13-7 Cross-section VI-VI'**

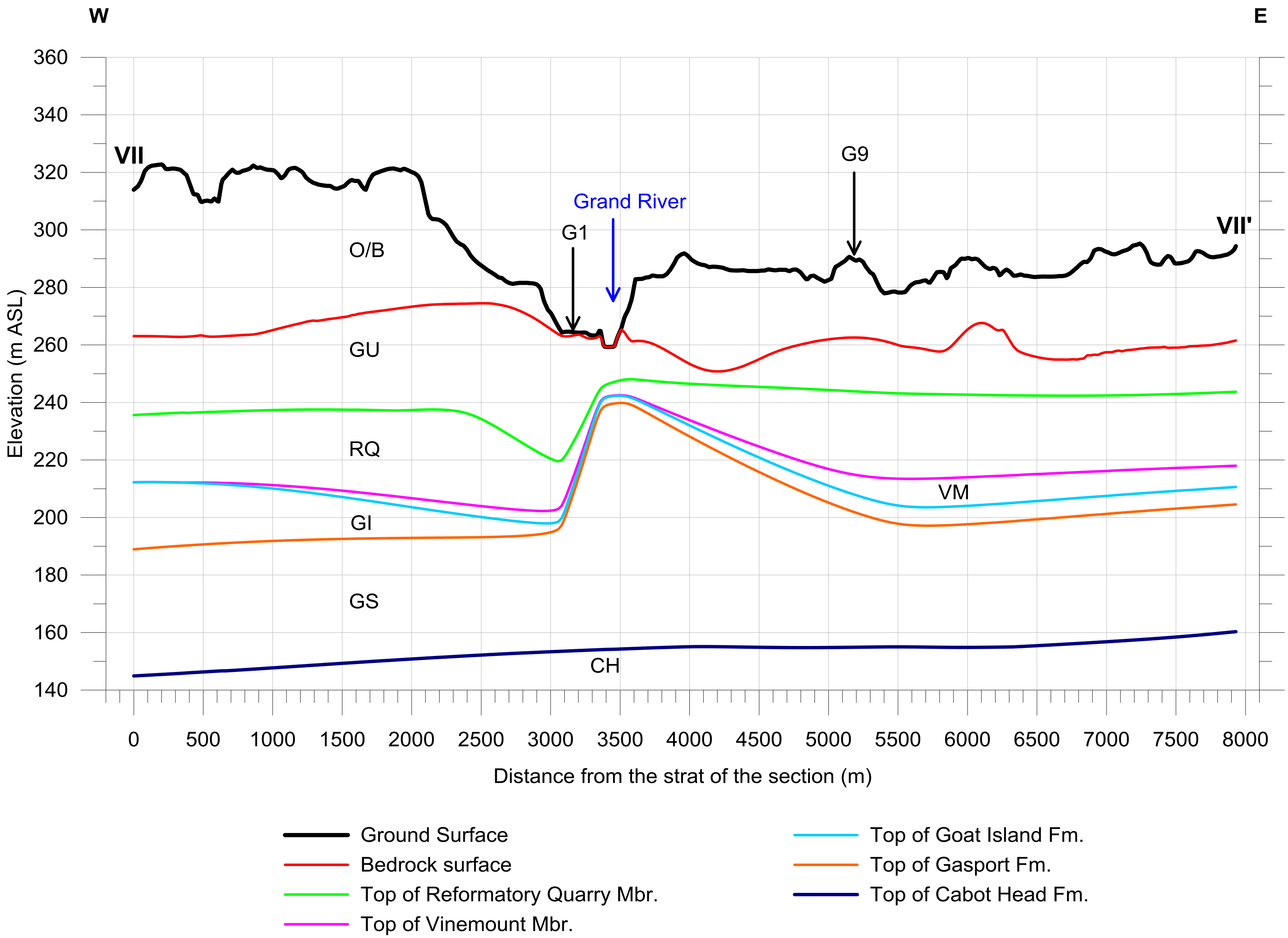



**Figure 13-8 Cross-section VII-VII'**

# Section 14
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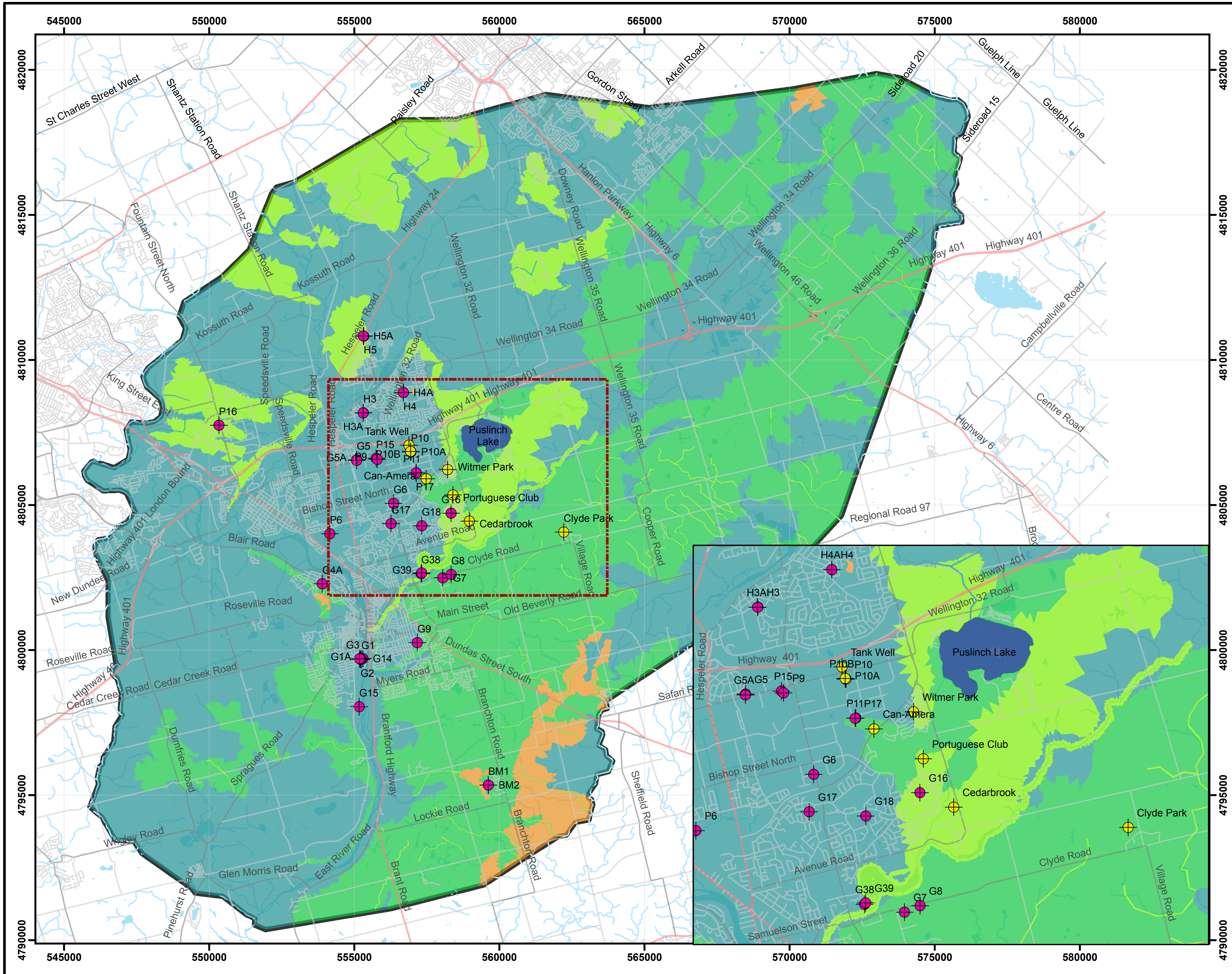
# Appendix B

## Cambridge East Model Calibration:

## Calibrated Hydraulic Conductivity




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

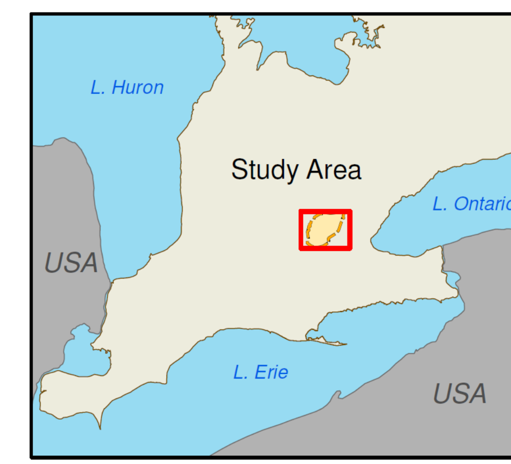
Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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**Figure 1**

Horizontal Hydraulic Conductivity: Model Layer 1: Overburden

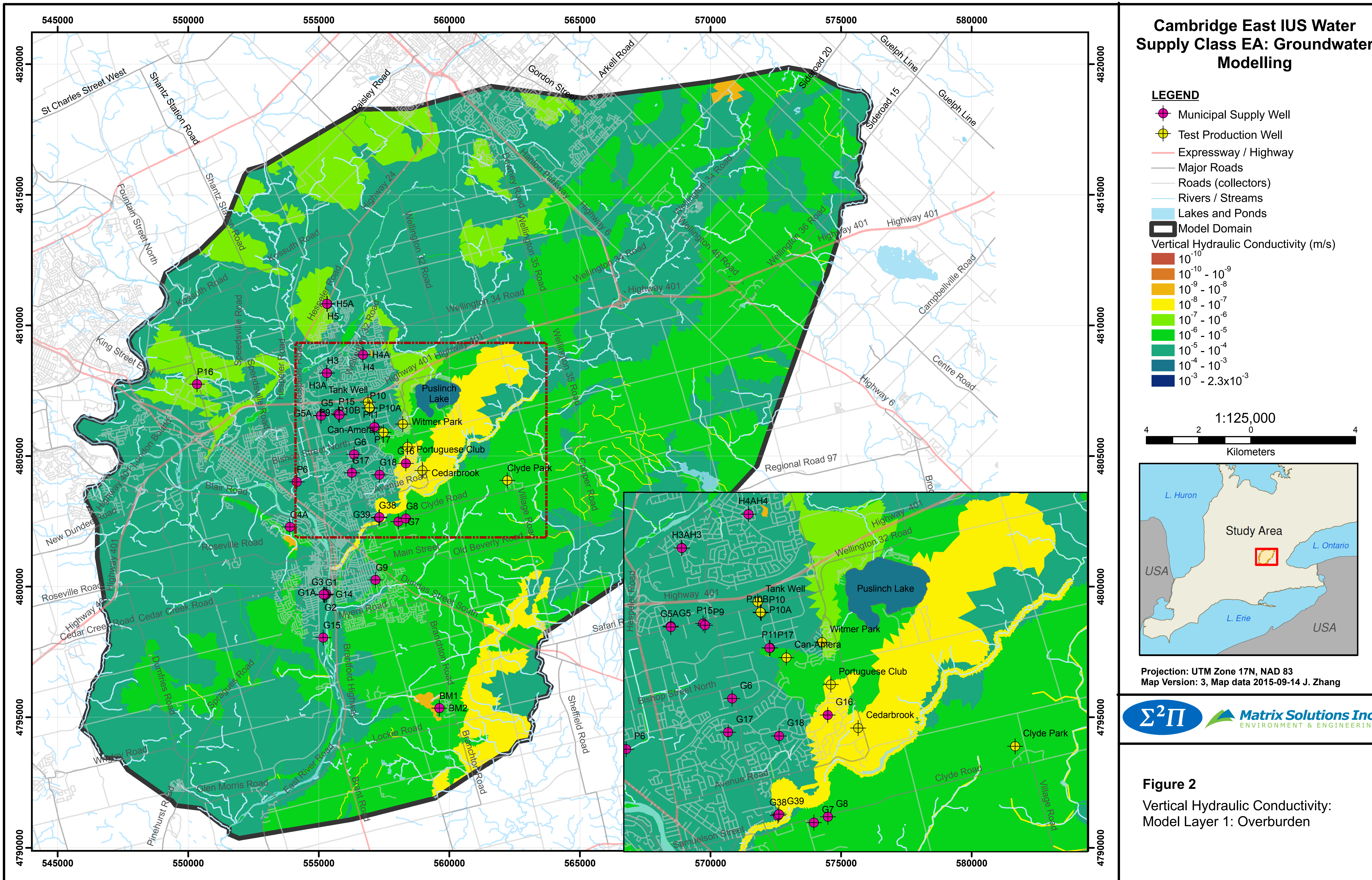
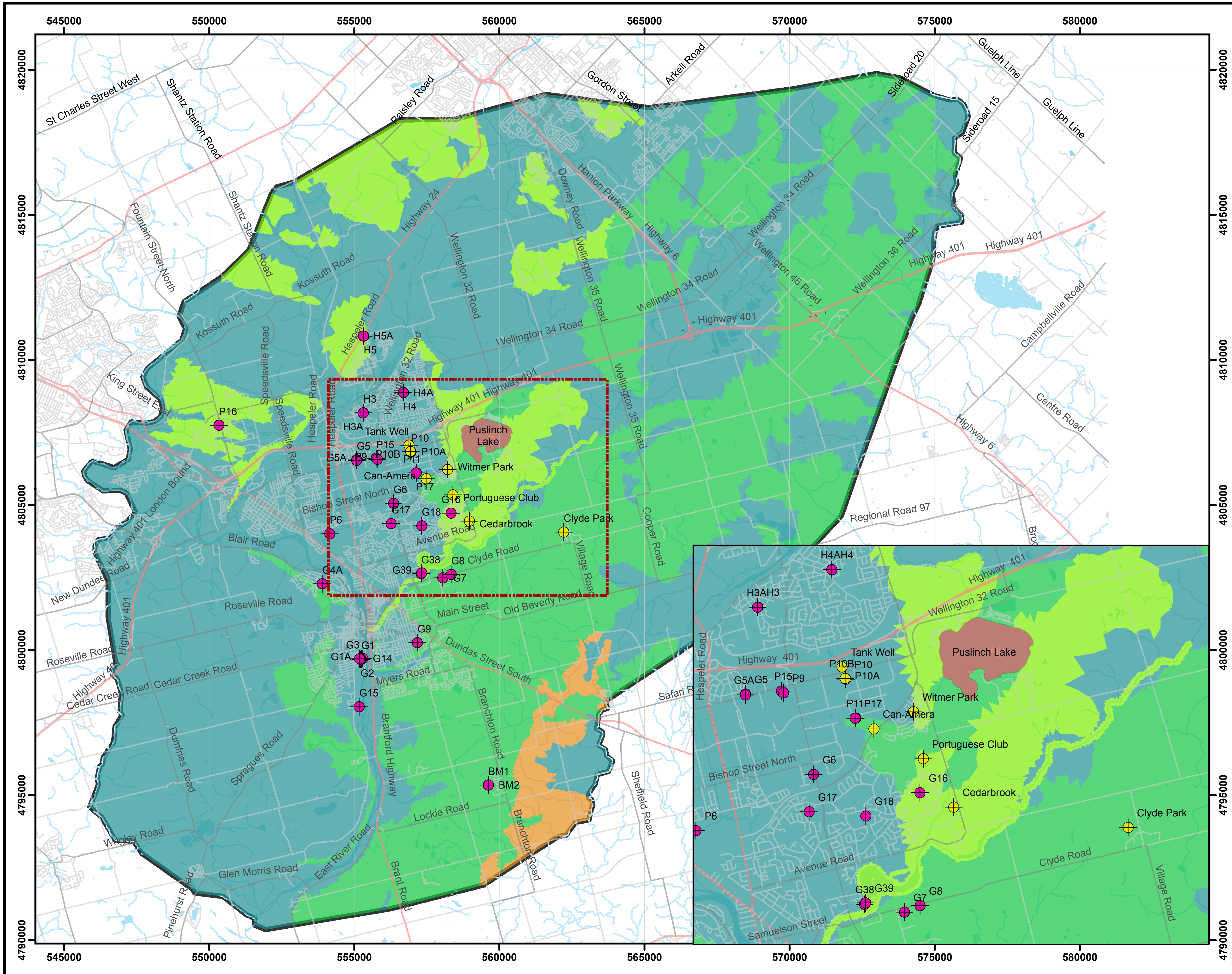



**Figure 2**

Vertical Hydraulic Conductivity: Model Layer 1: Overburden

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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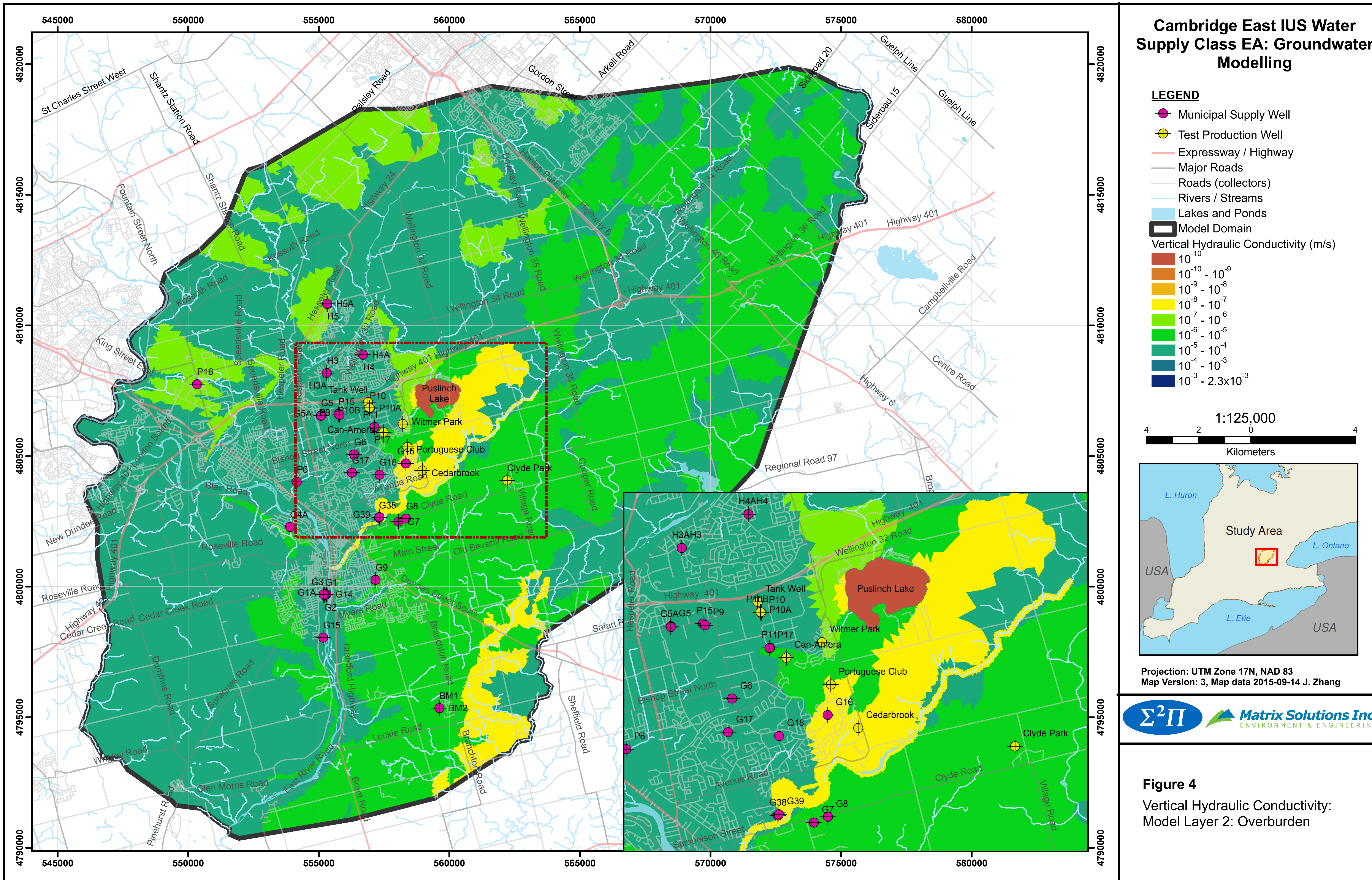
**Figure 3**

Horizontal Hydraulic Conductivity: Model Layer 2: Overburden




Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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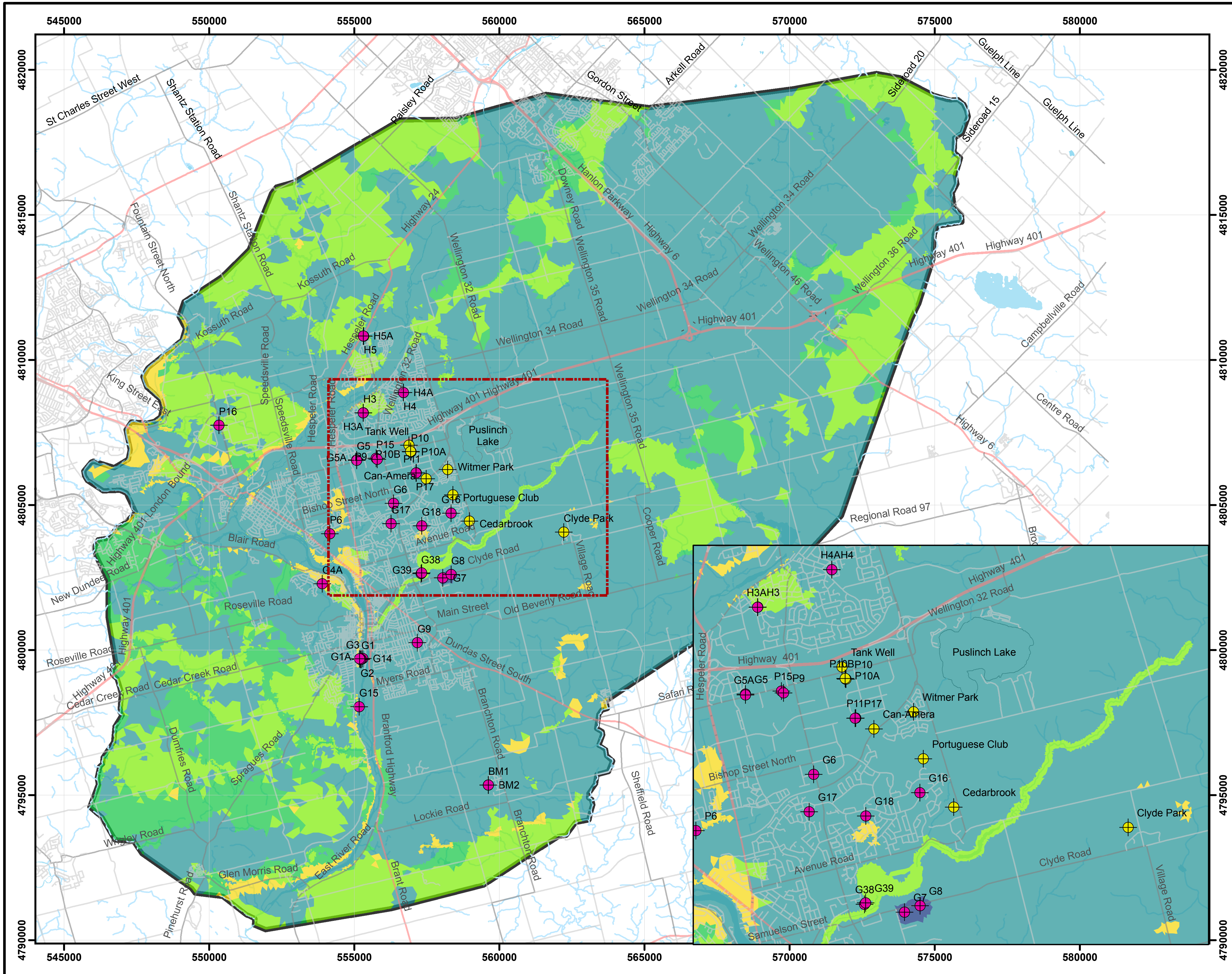
**Figure 4**

Vertical Hydraulic Conductivity: Model Layer 2: Overburden




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

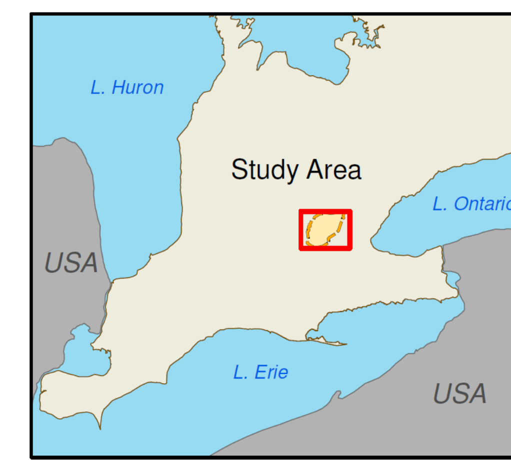
Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
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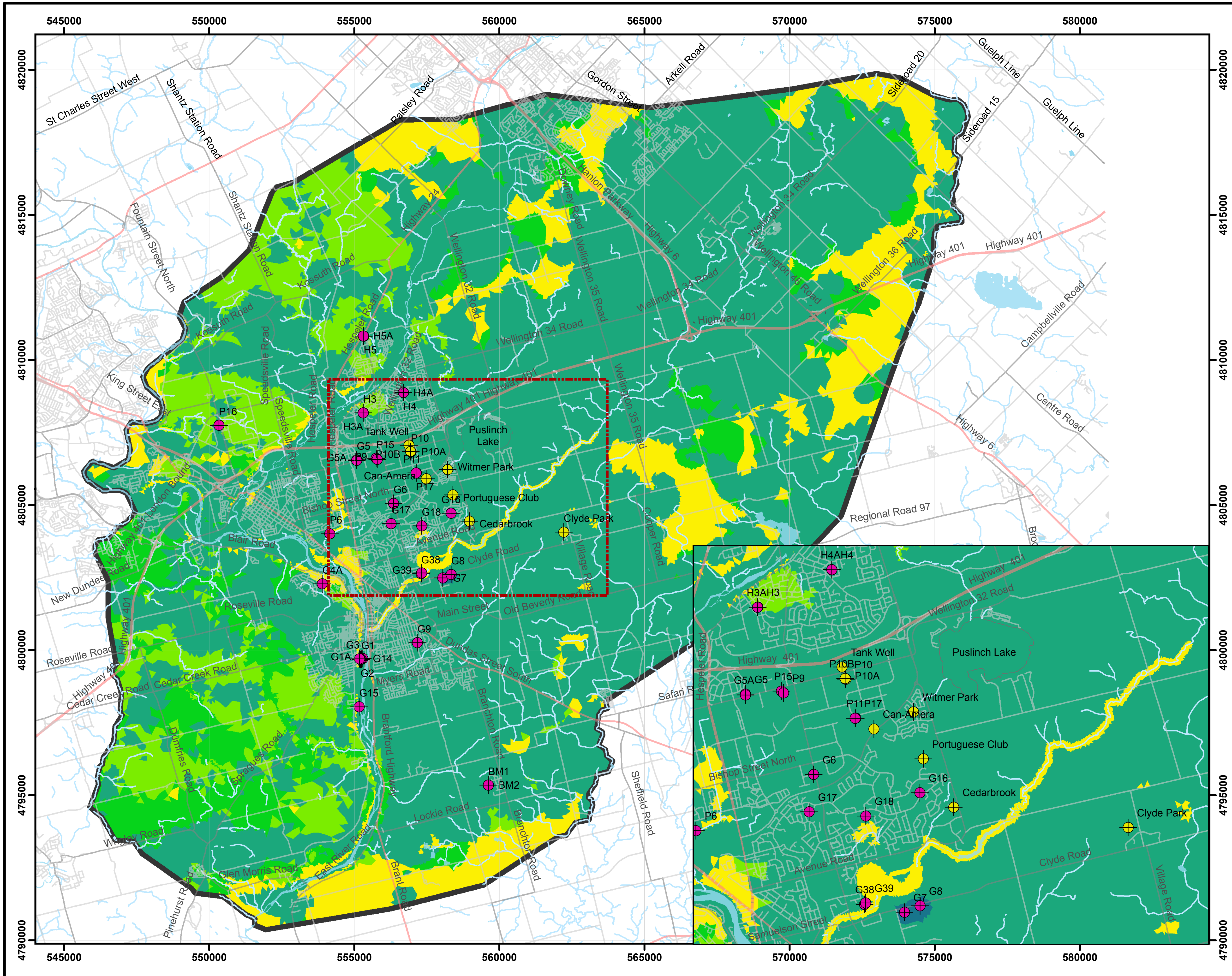
**Figure 5**

Horizontal Hydraulic Conductivity: Model Layer 3: Overburden




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3\times10^{-3}$

1:125,000

4 2 0 4

Kilometers

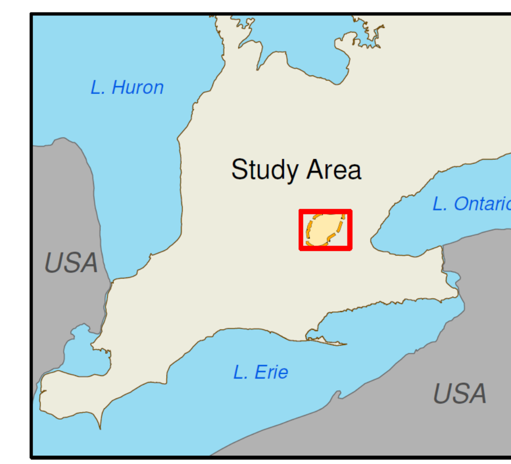



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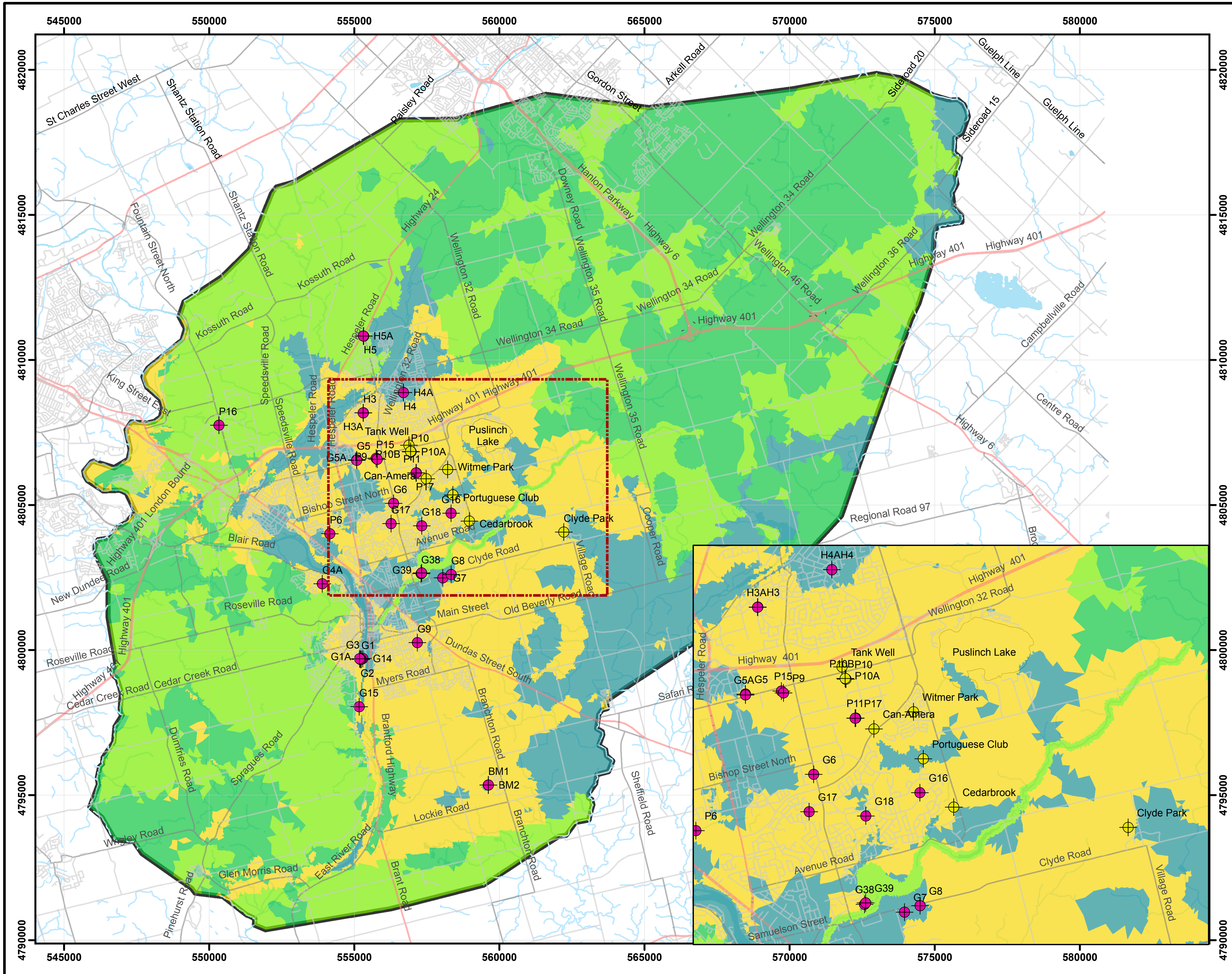
**Figure 6**

Vertical Hydraulic Conductivity:
Model Layer 3: Overburden

## Cambridge East IUS Water Supply Class EA: Groundwater Modelling




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

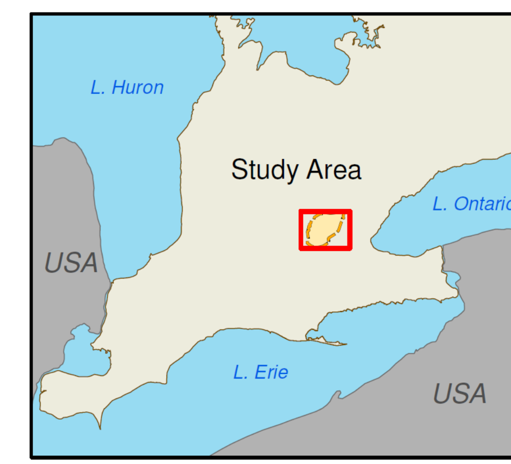
Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
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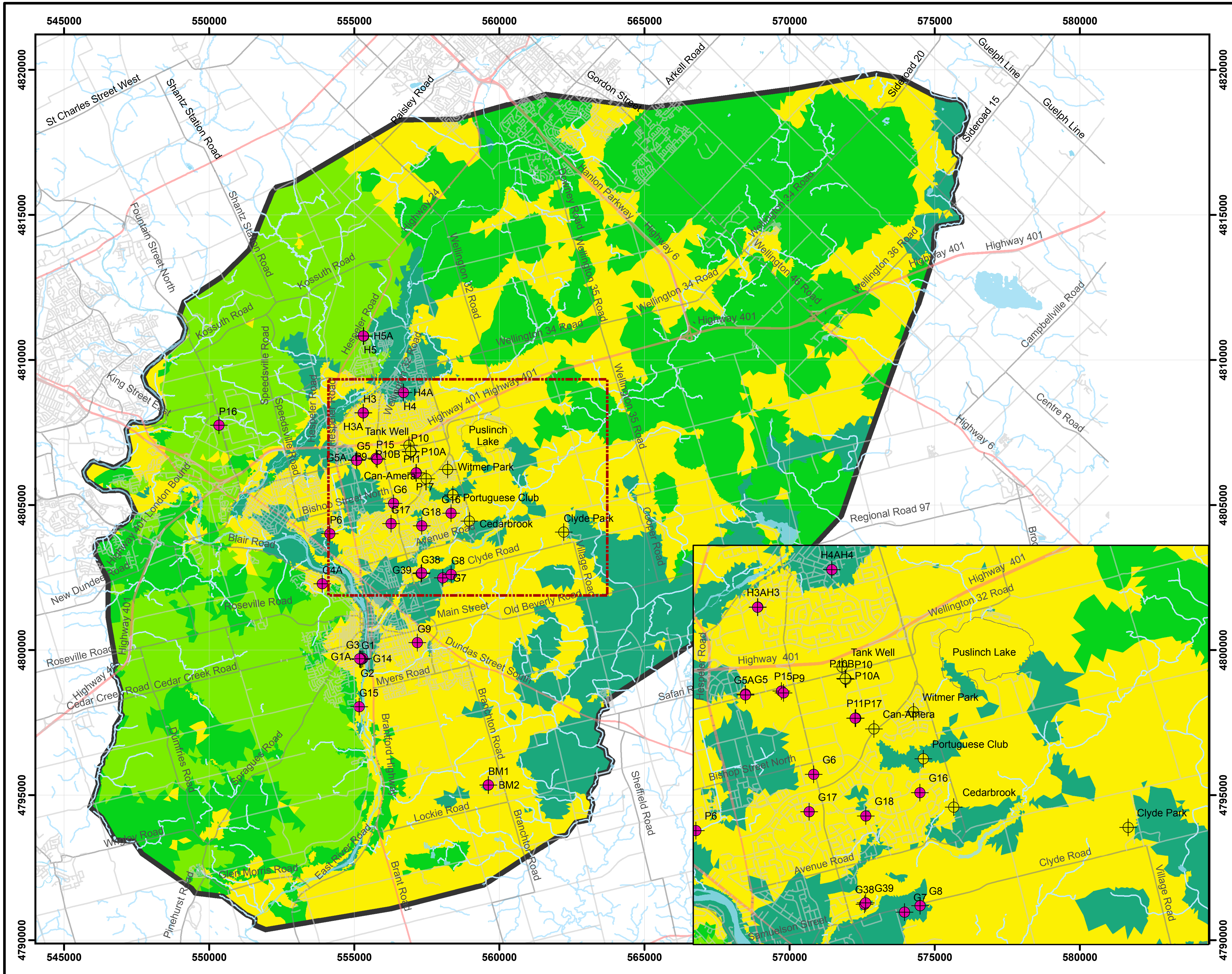
**Figure 7**

Horizontal Hydraulic Conductivity:
Model Layer 4: Overburden

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




## LEGEND

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

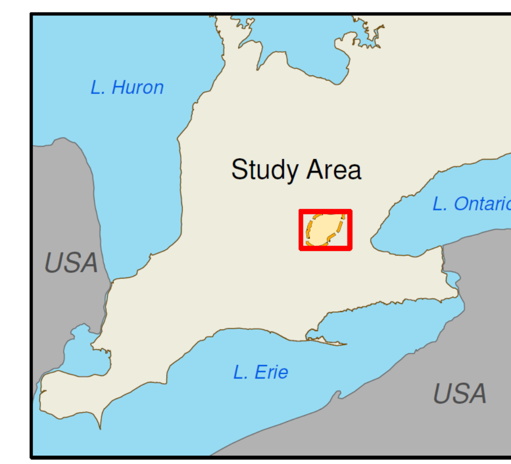
Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3x10^{-3}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
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**Figure 8**

Vertical Hydraulic Conductivity:
Model Layer 4: Overburden

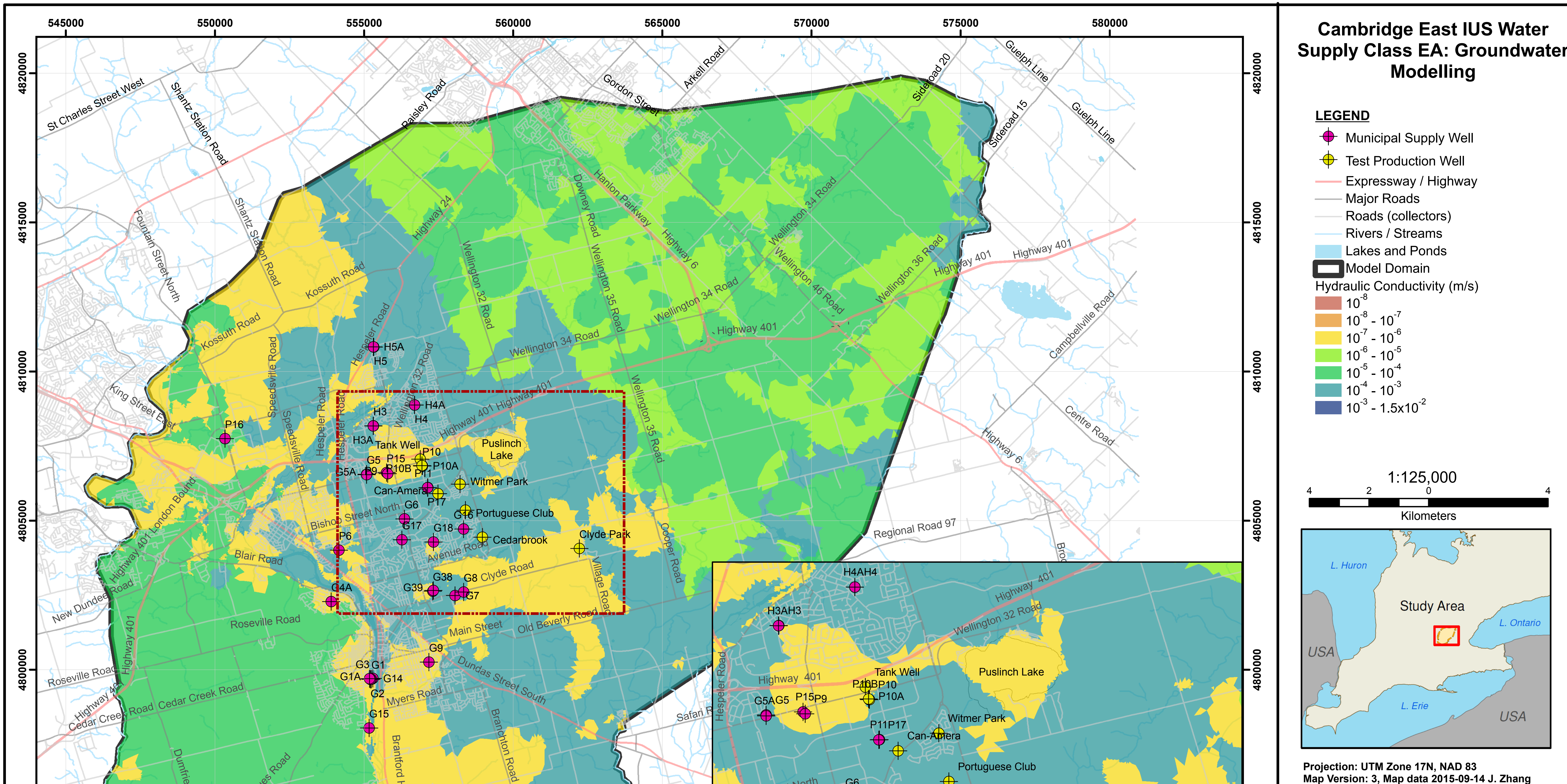


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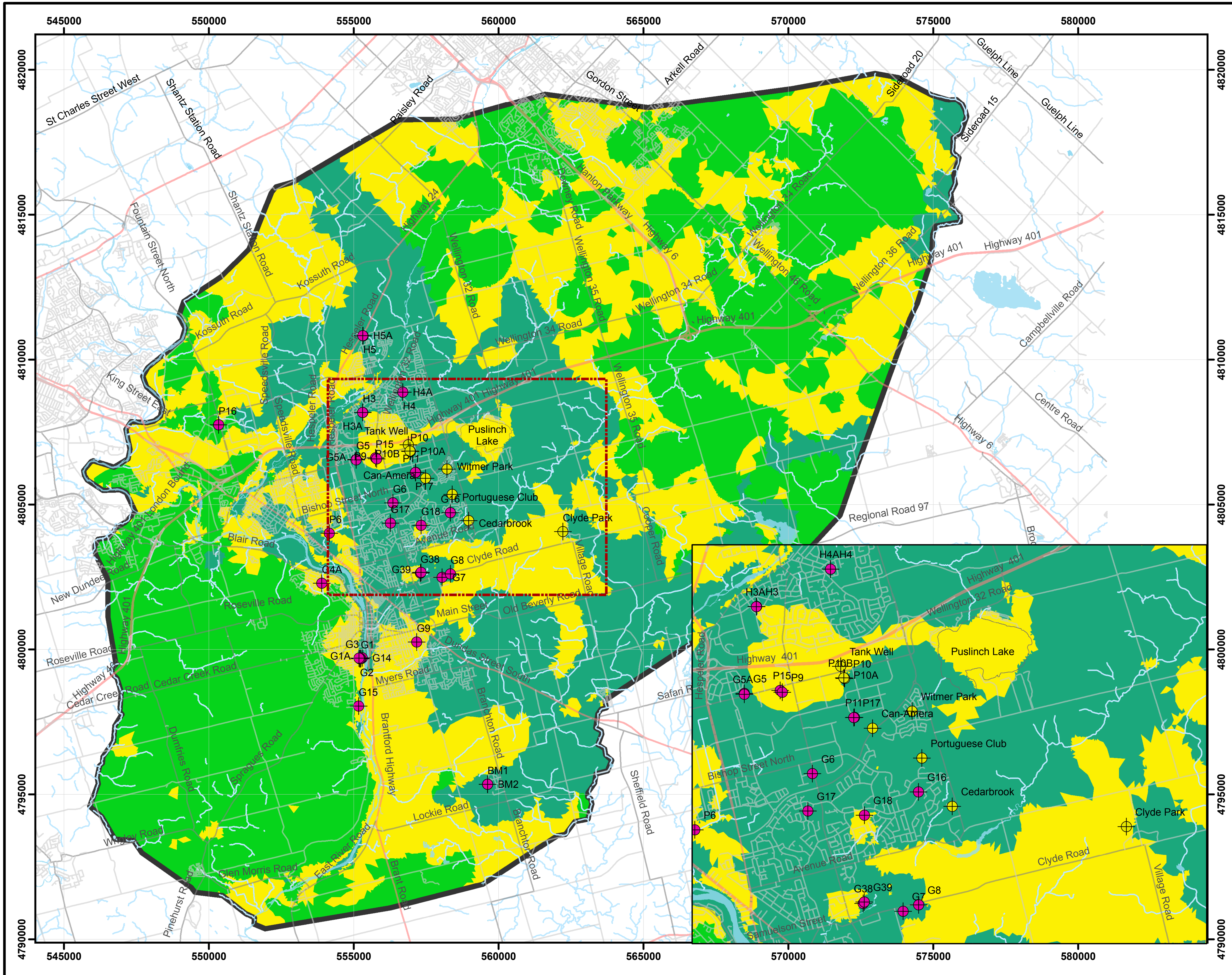
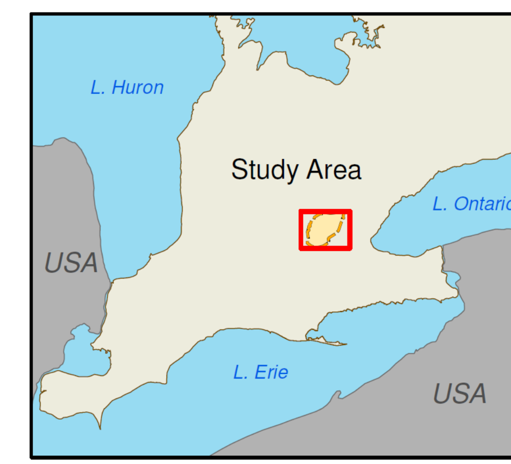
**Figure 9**

Horizontal Hydraulic Conductivity: Model Layer 5: Overburden

**Cambridge East IUS Water Supply Class EA: Groundwater Modelling**




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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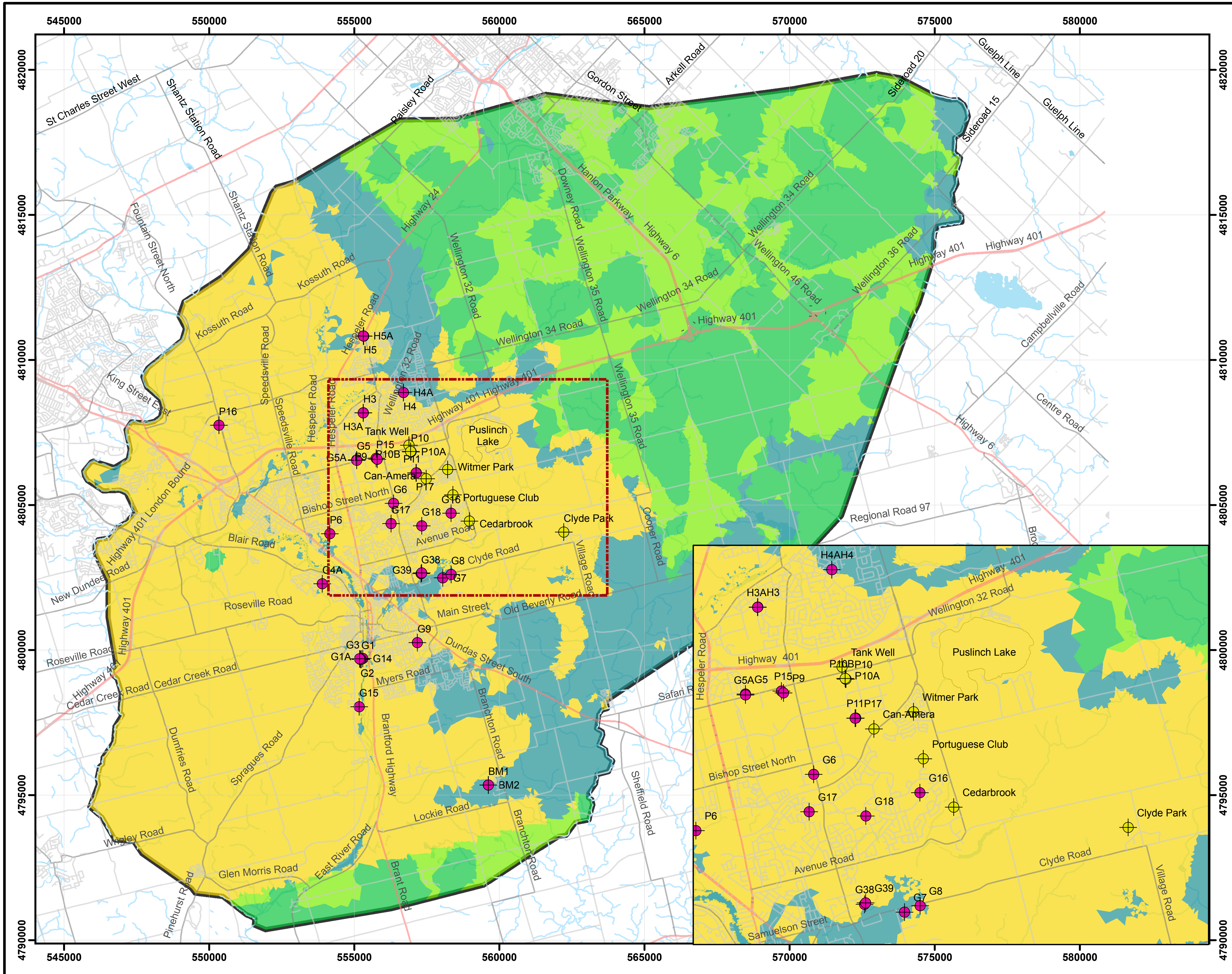
**Figure 10**

Vertical Hydraulic Conductivity: Model Layer 5: Overburden




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

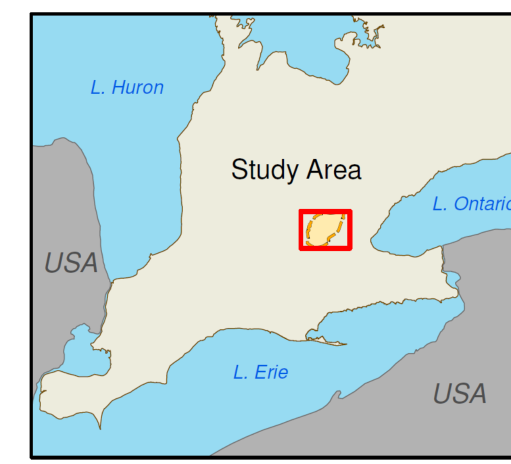
Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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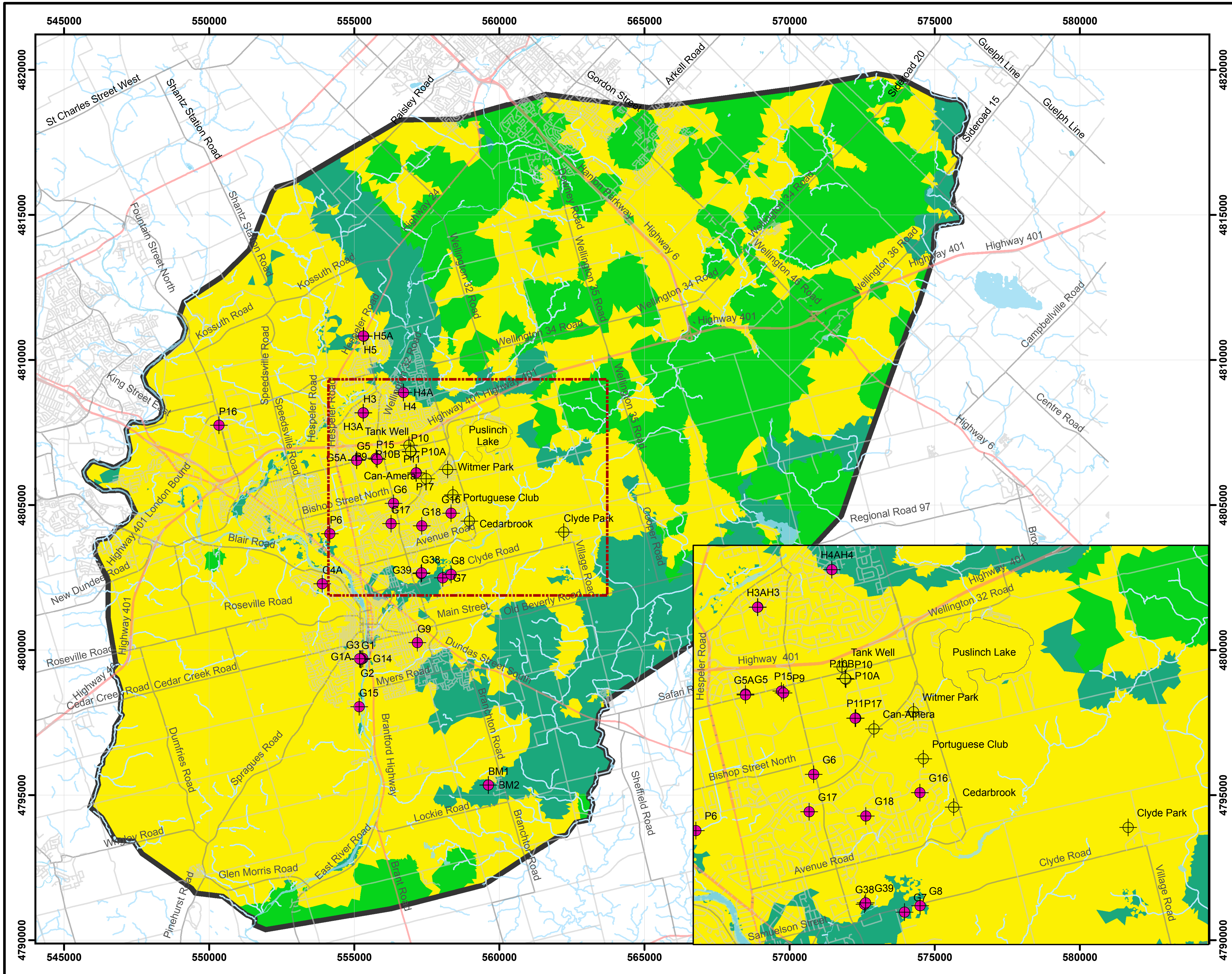
**Figure 11**

Horizontal Hydraulic Conductivity:
Model Layer 6: Overburden

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

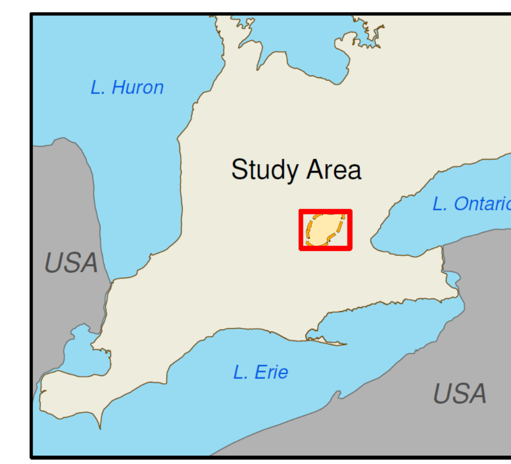
Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3x10^{-3}$

1:125,000

4 2 0 4

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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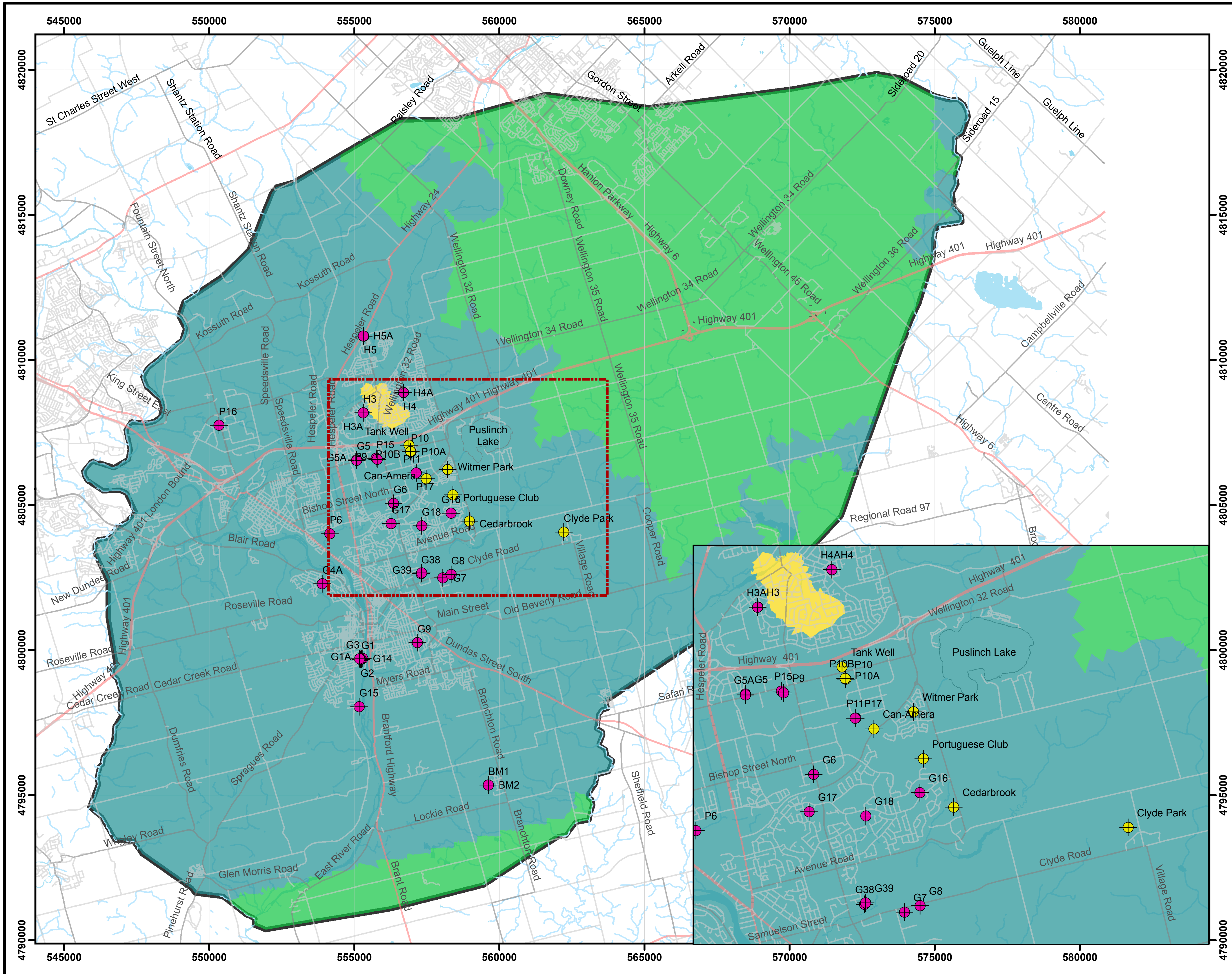
**Figure 12**

Vertical Hydraulic Conductivity:
Model Layer 6: Overburden




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers

L. Huron

Study Area

L. Ontario

USA

L. Erie

USA

**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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**Figure 13**

Horizontal Hydraulic Conductivity:
Model Layer 7: Overburden

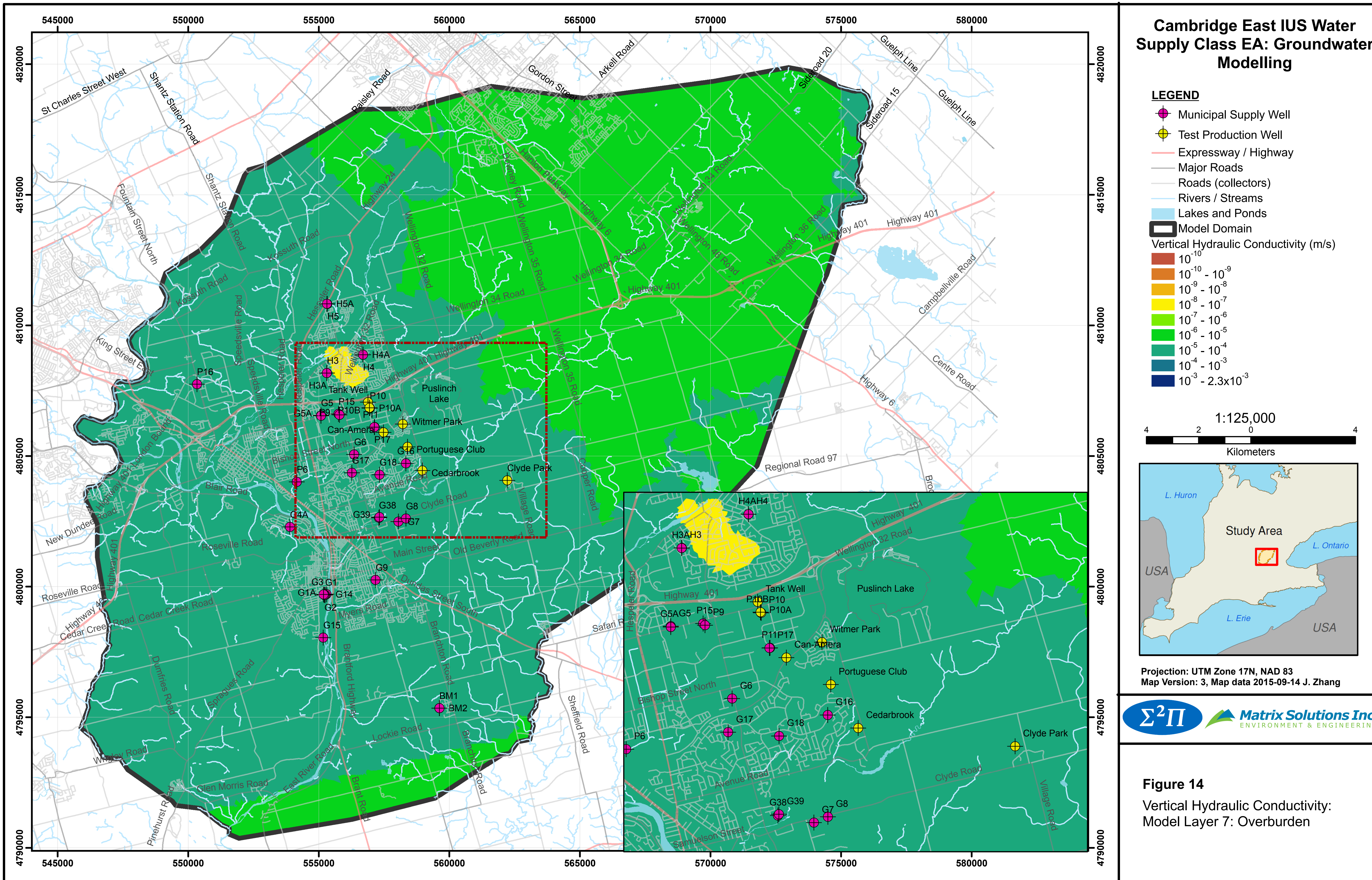
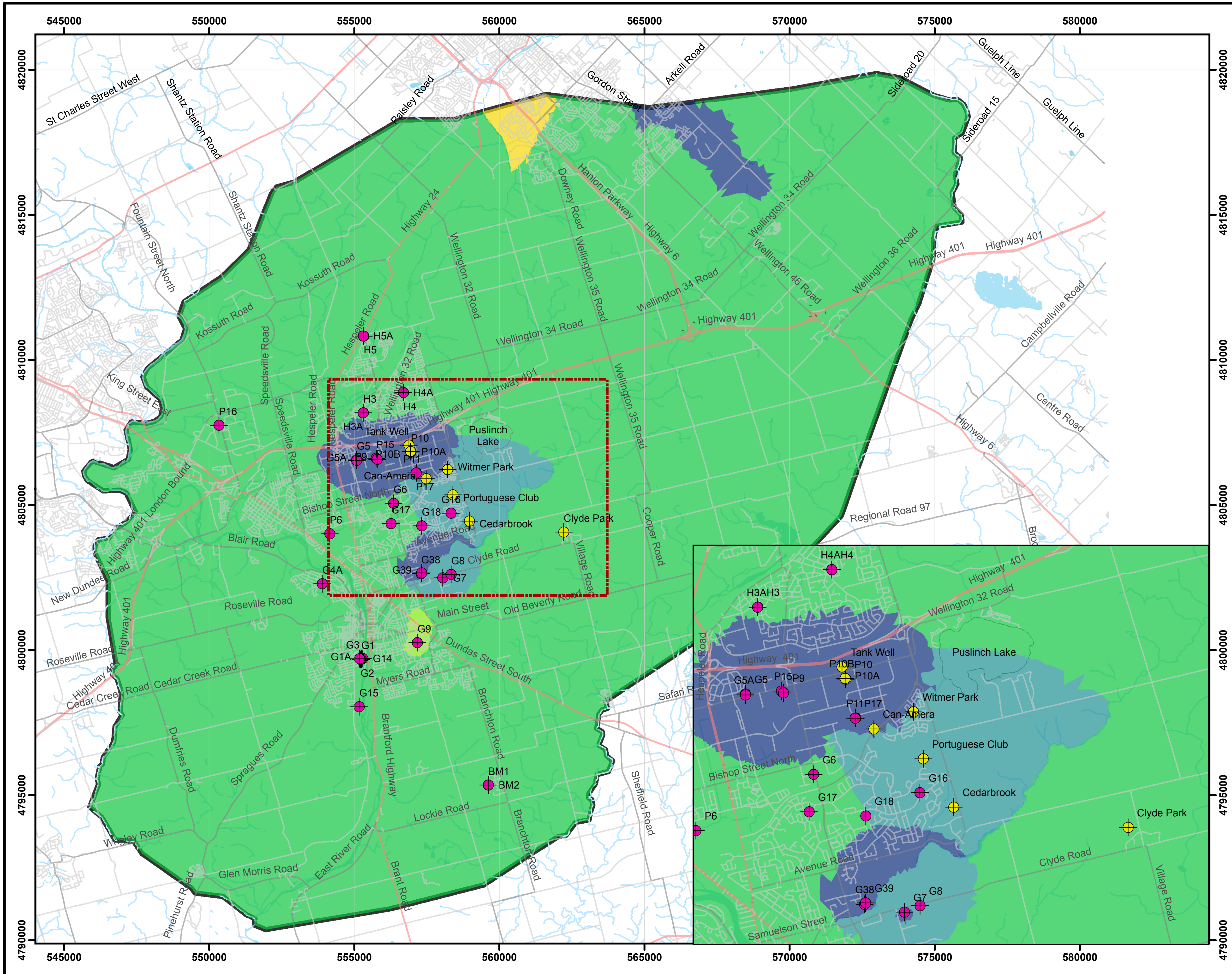



**Figure 14**

Vertical Hydraulic Conductivity: Model Layer 7: Overburden

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




Projection: UTM Zone 17N, NAD 83
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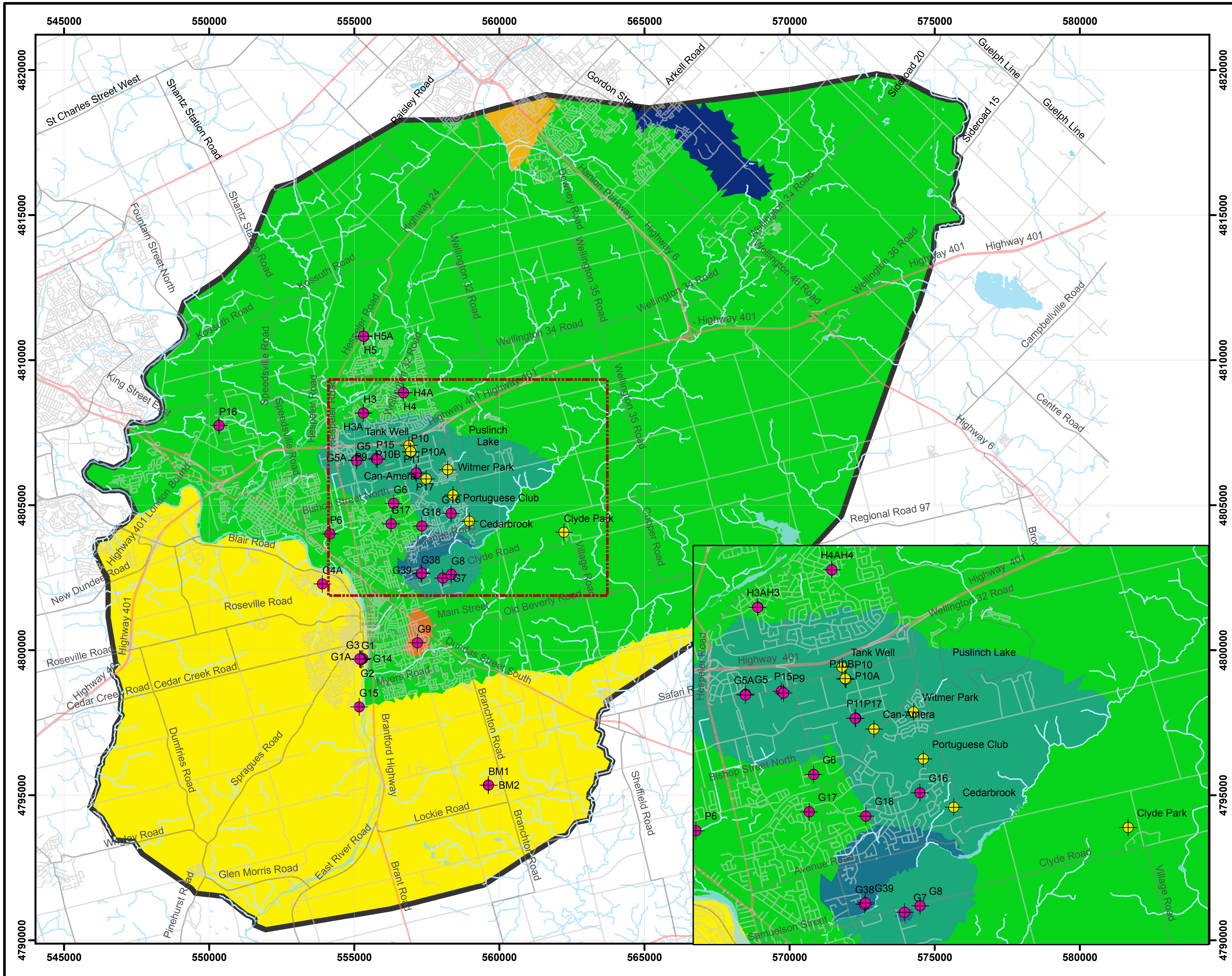
**Figure 15**

Horizontal Hydraulic Conductivity: Model Layer 8: Contact Aquifer

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




## LEGEND

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

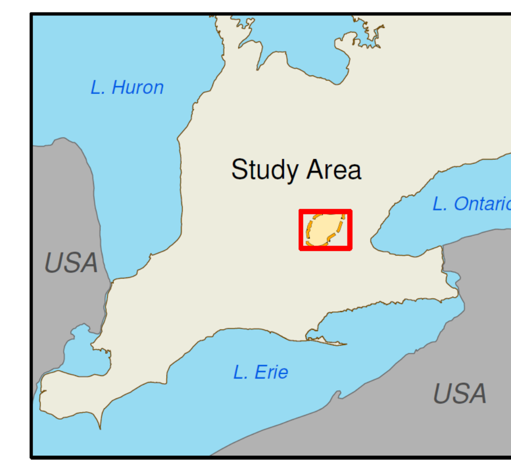
Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3x10^{-3}$

1:125,000

4 2 0 4

Kilometers

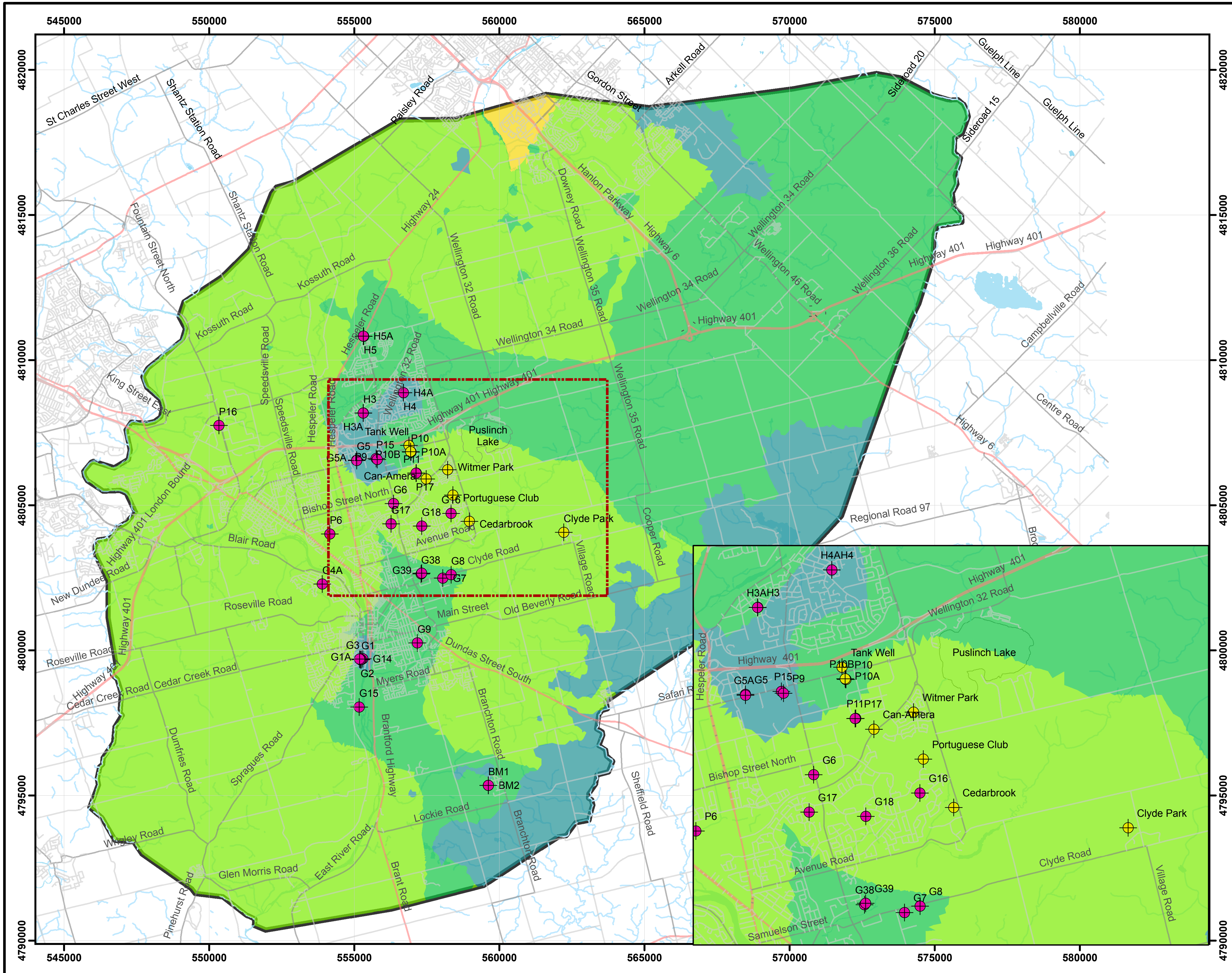



**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

$\Sigma^2\Pi$ Matrix Solutions Inc. ENVIRONMENT & ENGINEERING

**Figure 16**

Vertical Hydraulic Conductivity: Model Layer 8:Contact Aquifer




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5\times10^{-2}$

1:125,000

4 2 0 4

Kilometers



**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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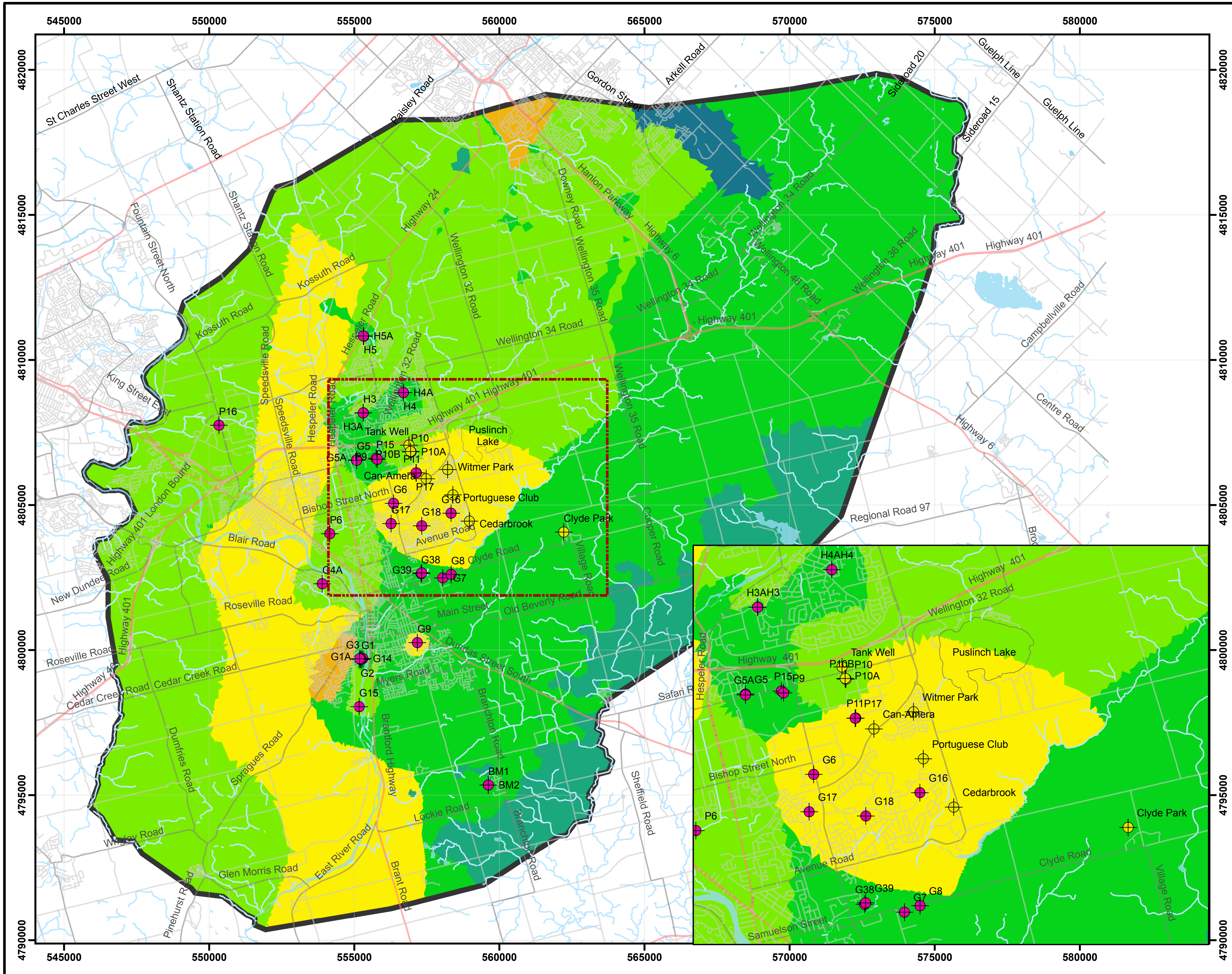
**Figure 17**

Horizontal Hydraulic Conductivity: Model Layer 9: Guelph Formation




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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**Figure 18**

Vertical Hydraulic Conductivity: Model Layer 9: Guelph Formation

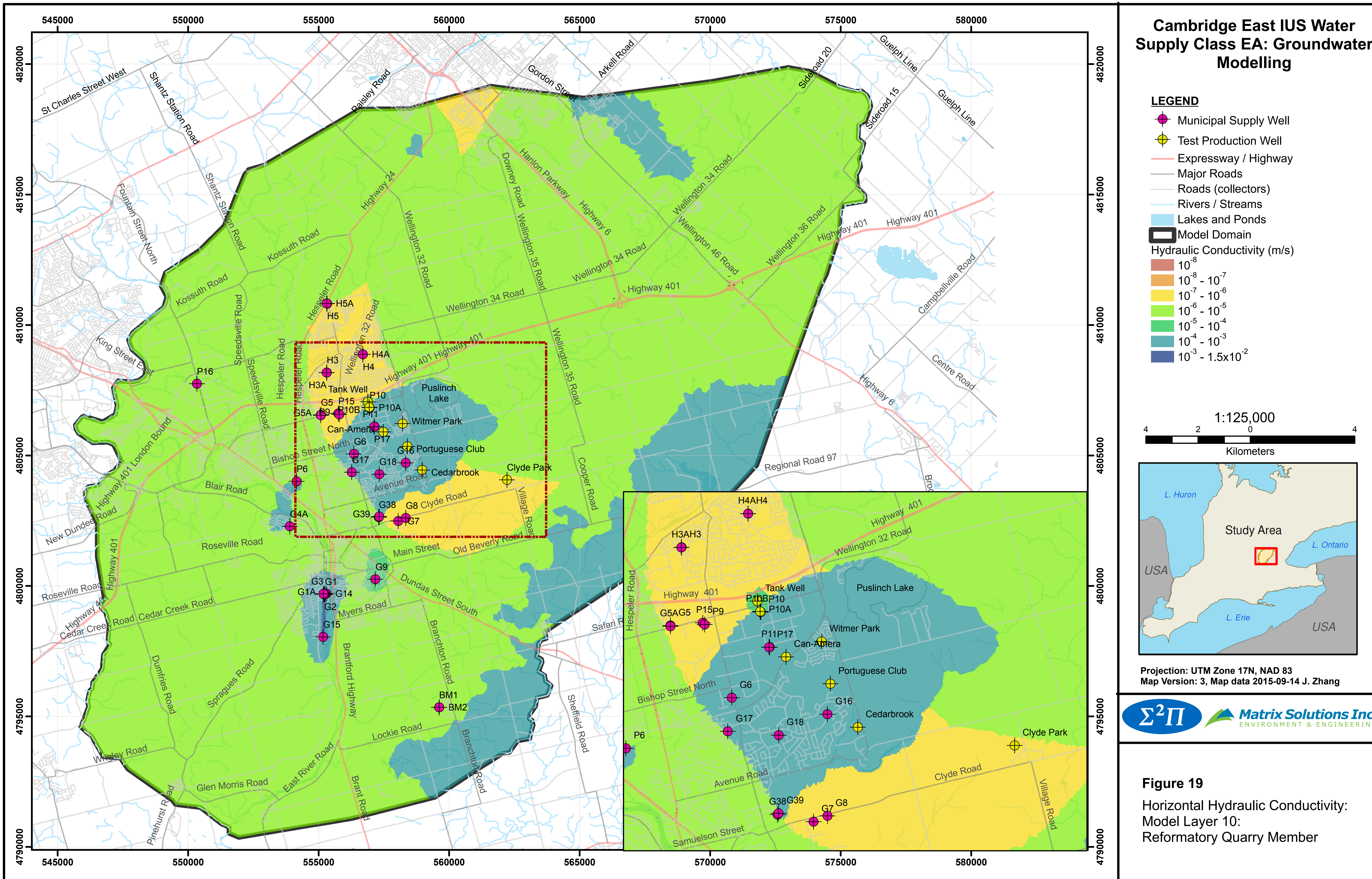
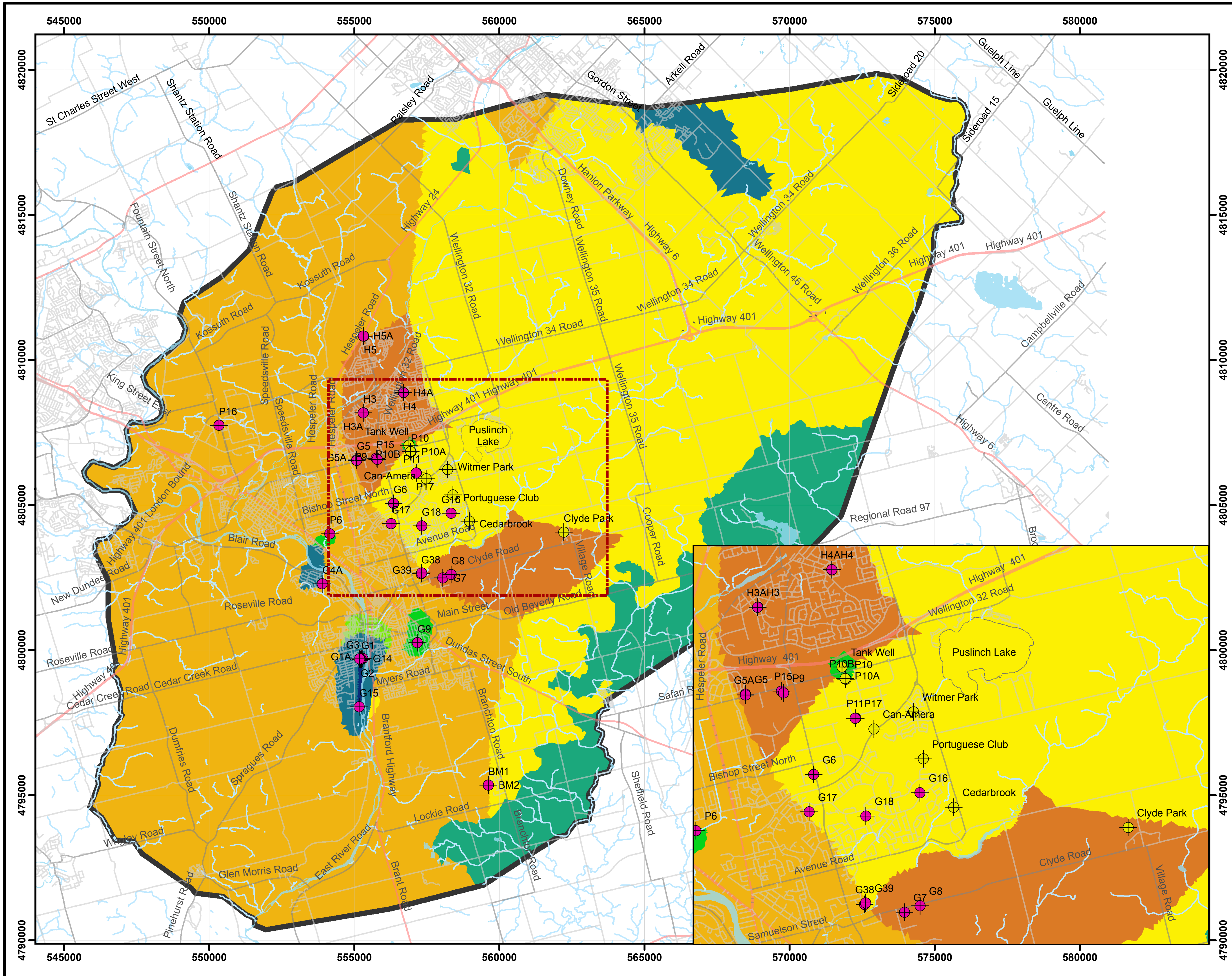



**Figure 19**

Horizontal Hydraulic Conductivity:
Model Layer 10:
Reformatory Quarry Member




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3x10^{-3}$

1:125,000

4 2 0 4

Kilometers



**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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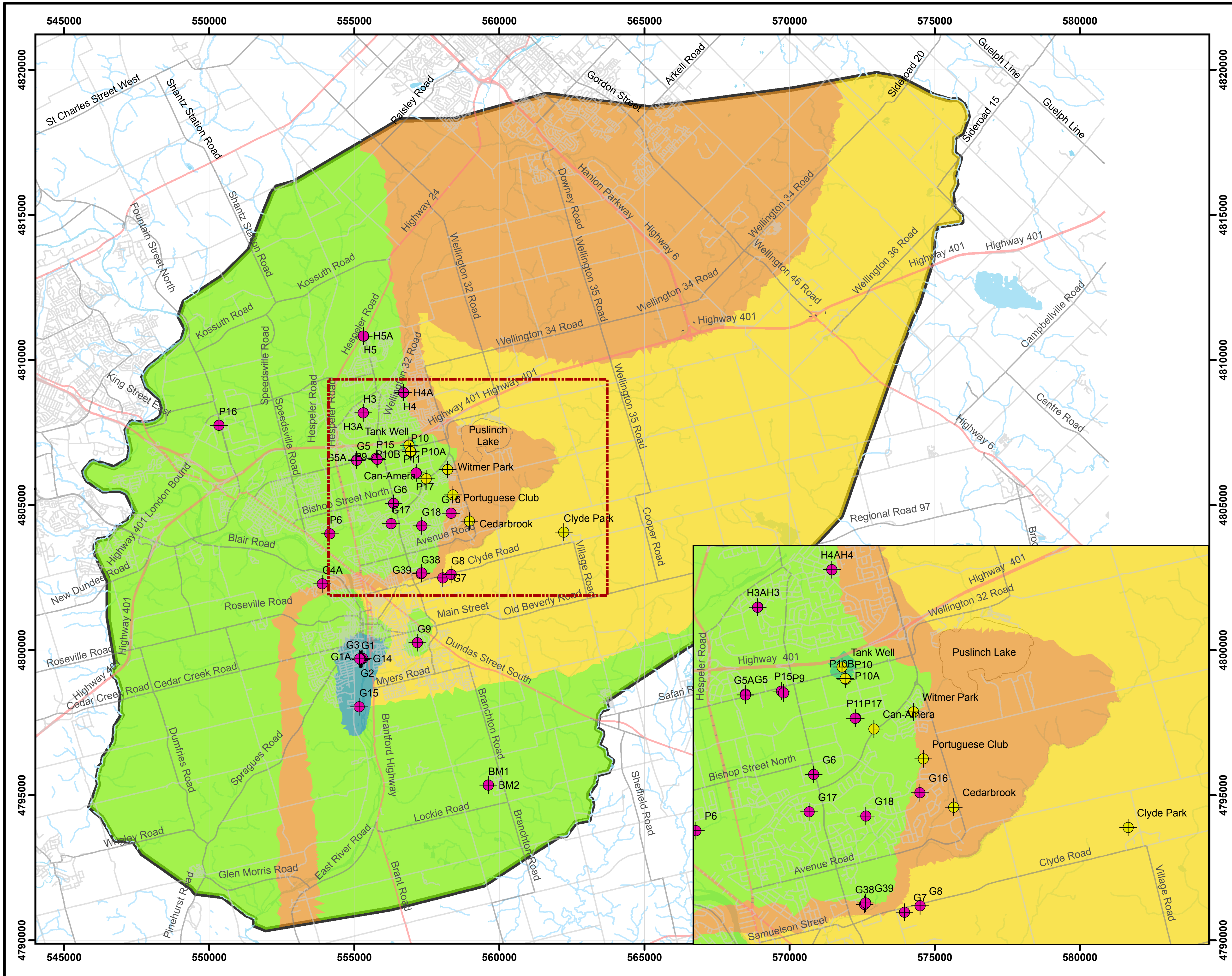
**Figure 20**

Vertical Hydraulic Conductivity:
Model Layer 10:
Reformatory Quarry Member




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

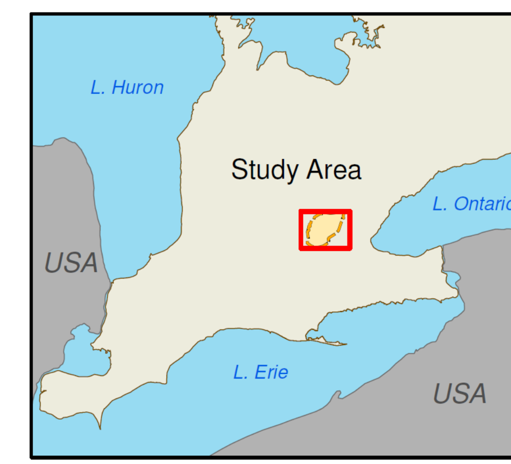
Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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**Figure 21**

Horizontal Hydraulic Conductivity: Model Layer 11: Vinemount Member

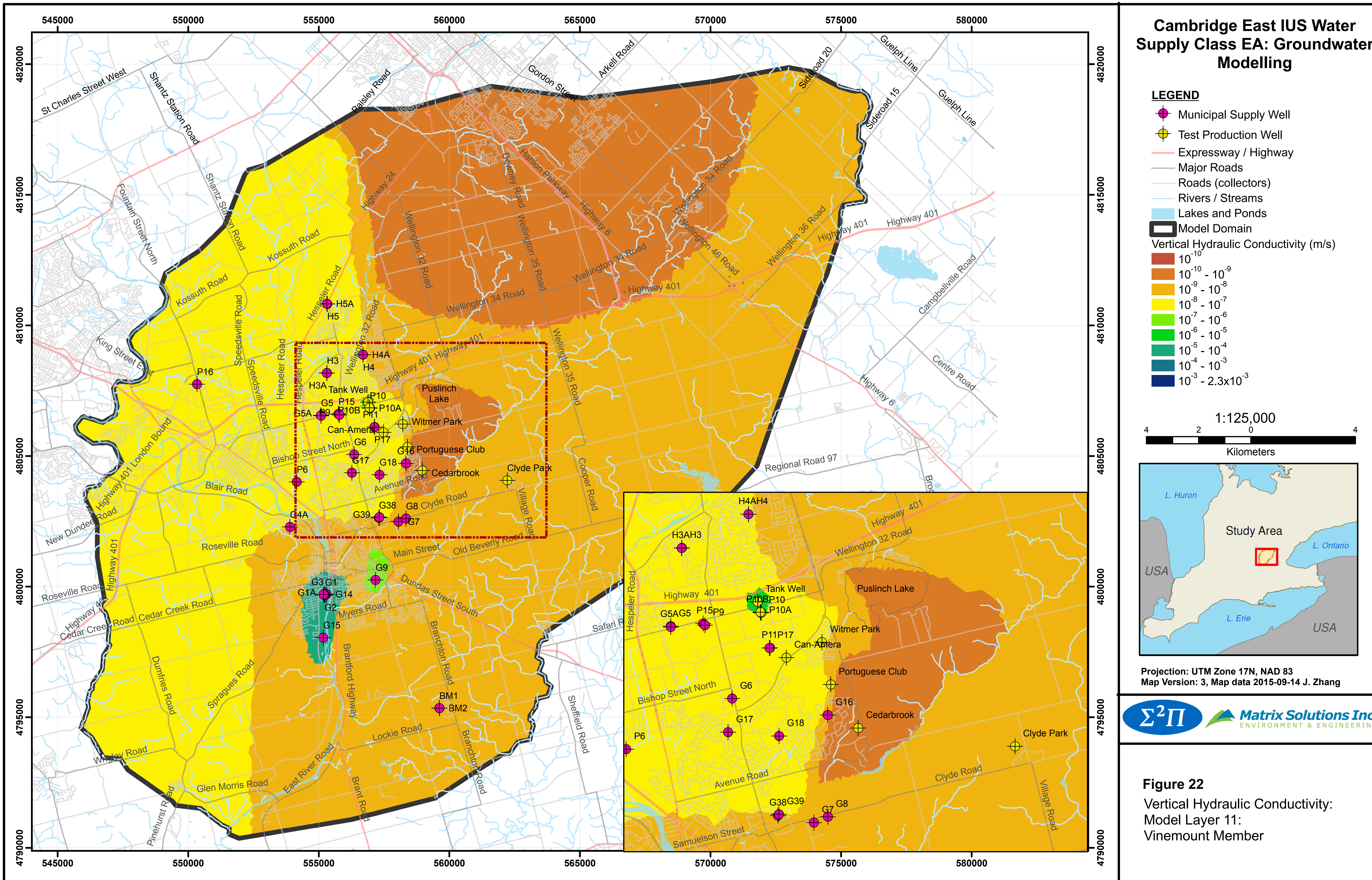
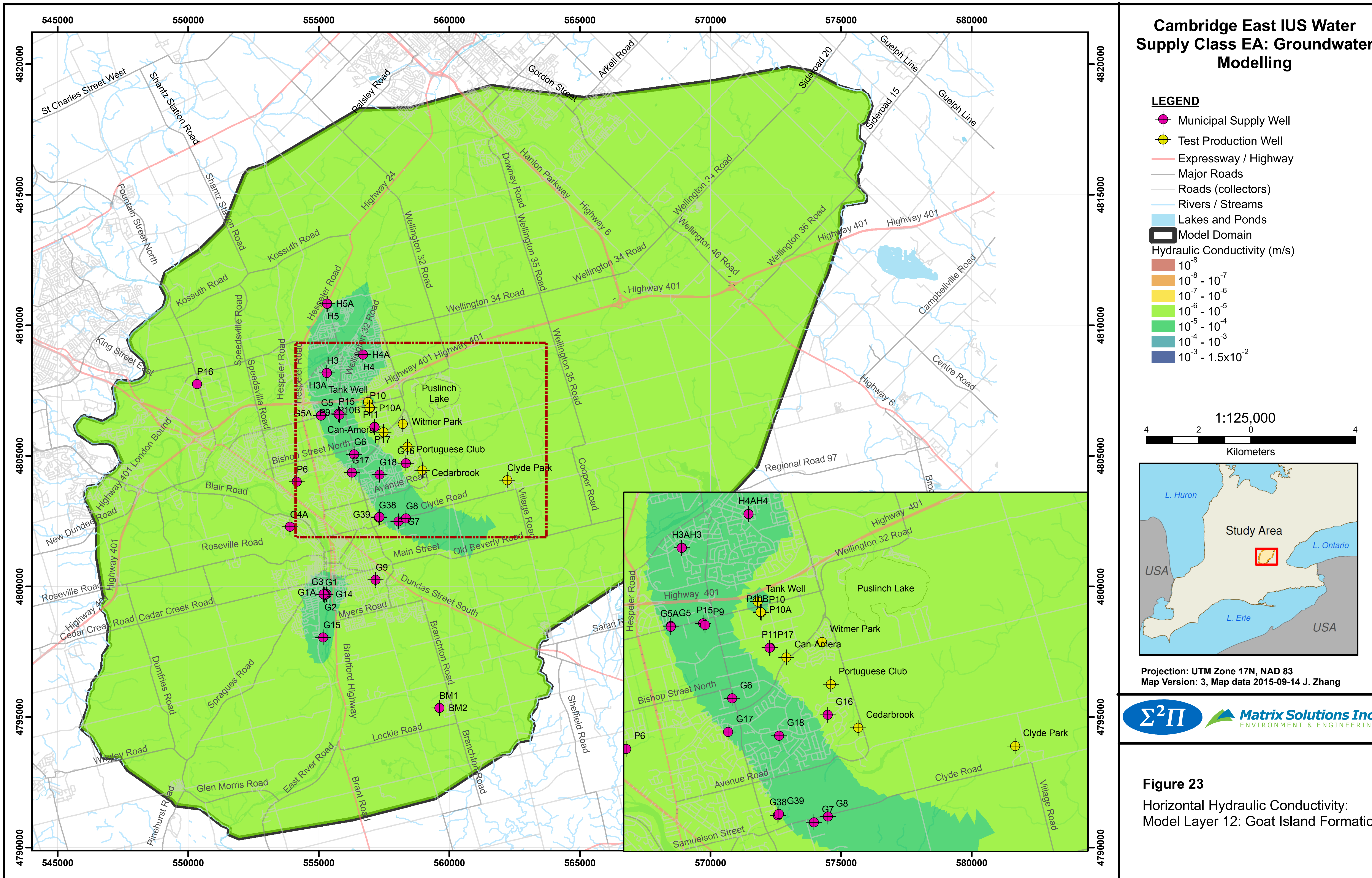



Figure 22

Vertical Hydraulic Conductivity: Model Layer 11: Vinemount Member

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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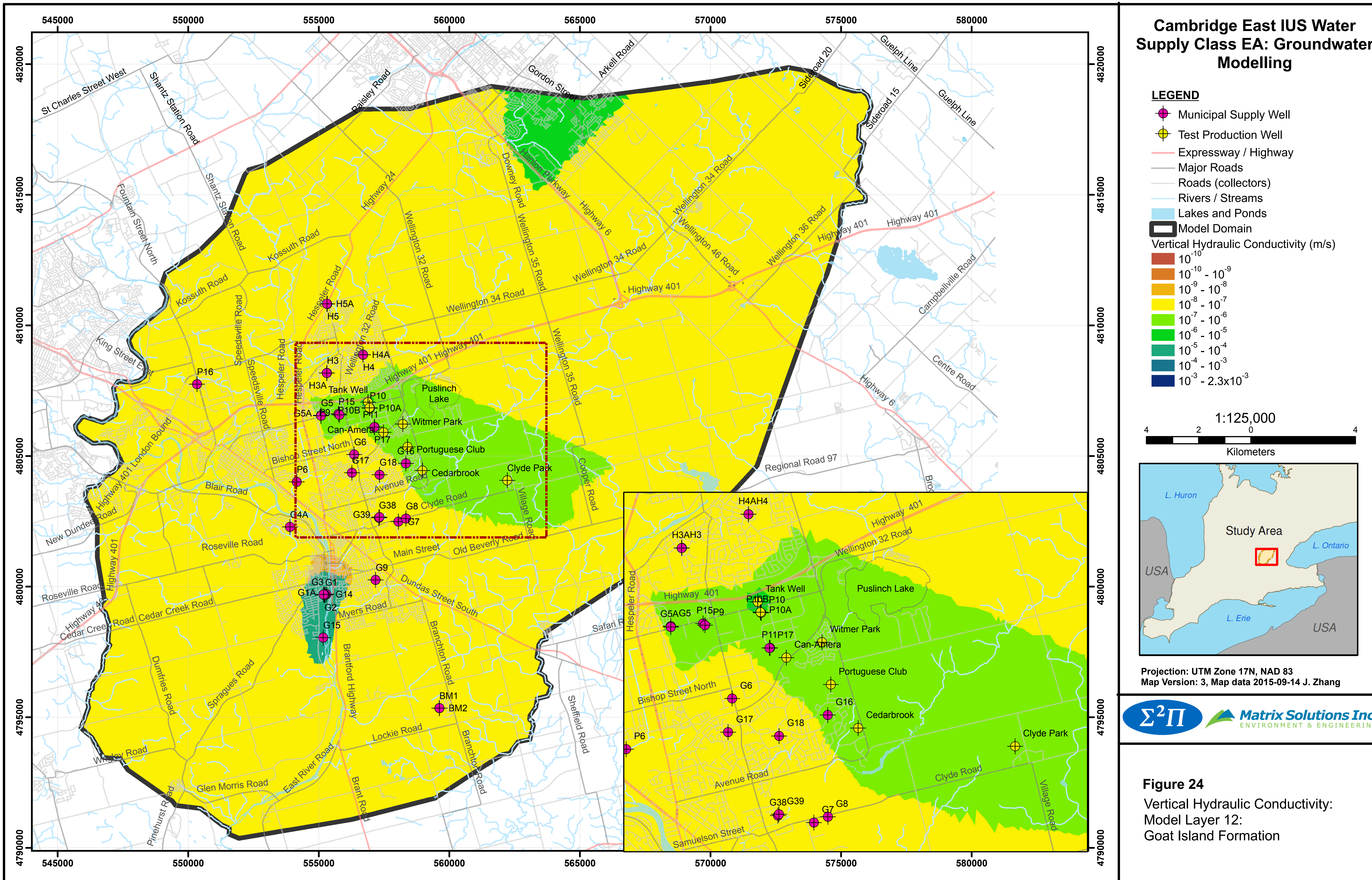
**Figure 23**
Horizontal Hydraulic Conductivity: Model Layer 12: Goat Island Formation

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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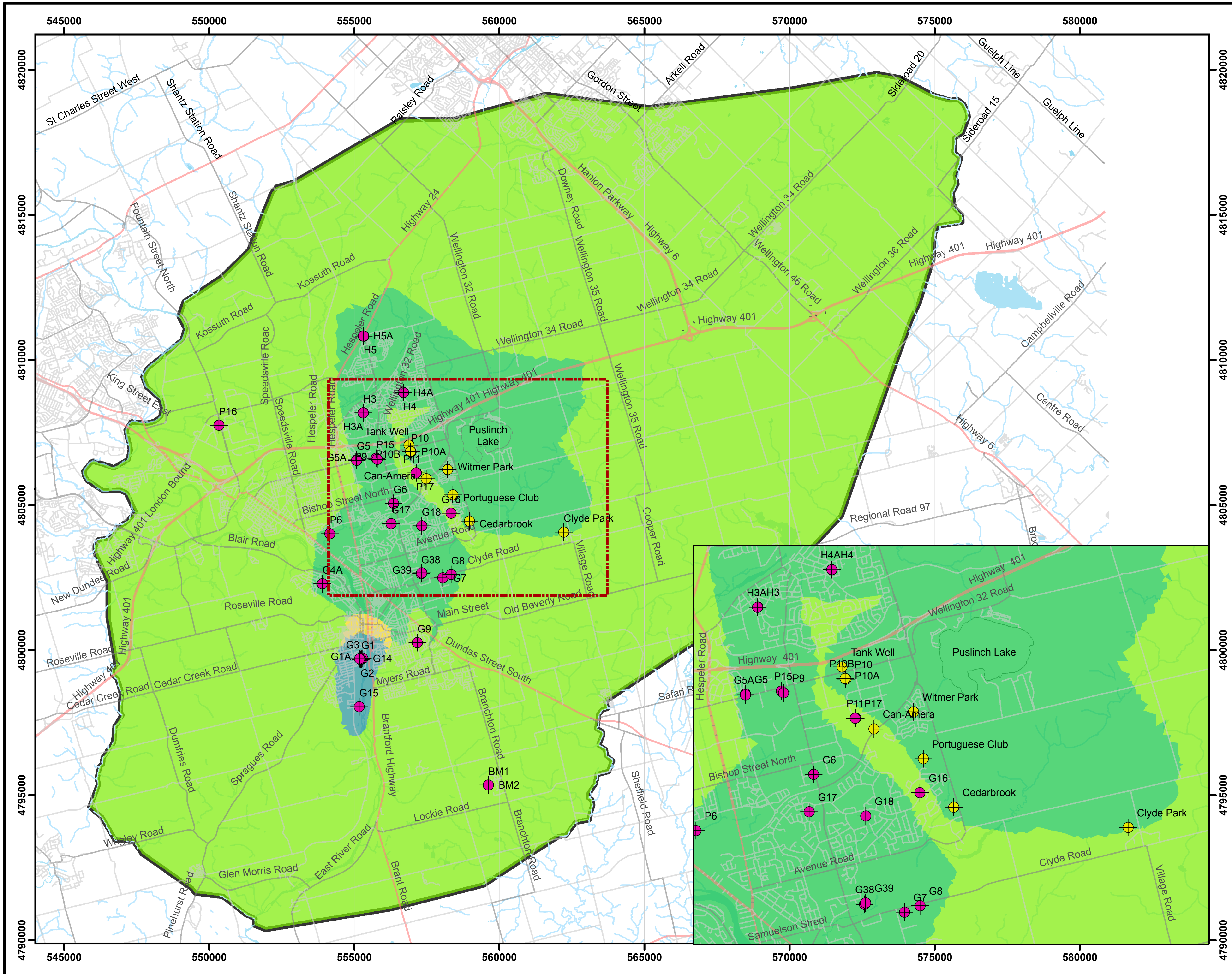
**Figure 24**

Vertical Hydraulic Conductivity:
Model Layer 12:
Goat Island Formation




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5x10^{-2}$

1:125,000

4 2 0 4

Kilometers

L. Huron
Study Area
L. Ontario
USA
L. Erie
USA

**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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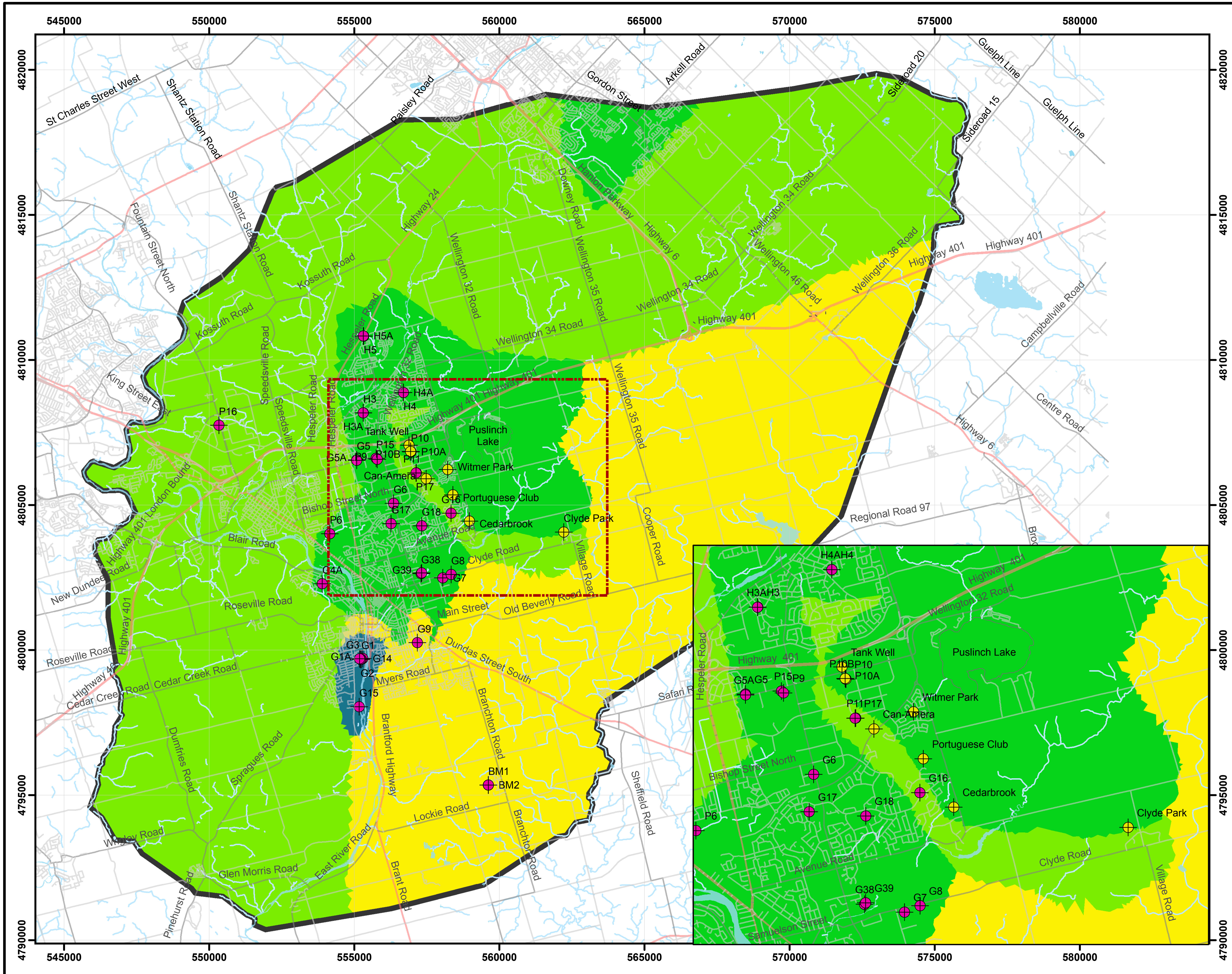
**Figure 25**

Horizontal Hydraulic Conductivity:
Model Layer 13:
Upper Gasport Formation

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

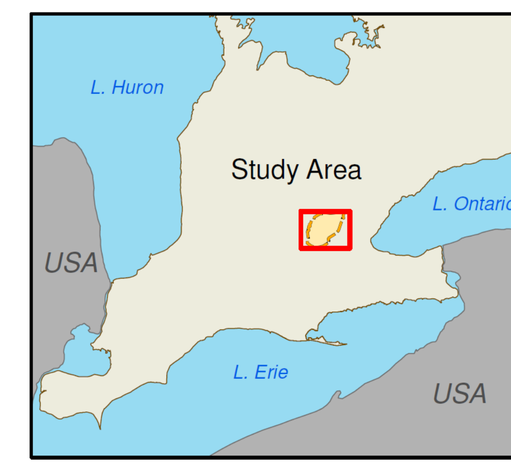
Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3x10^{-3}$

1:125,000

4 2 0 4

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 3, Map data 2015-09-14 J. Zhang

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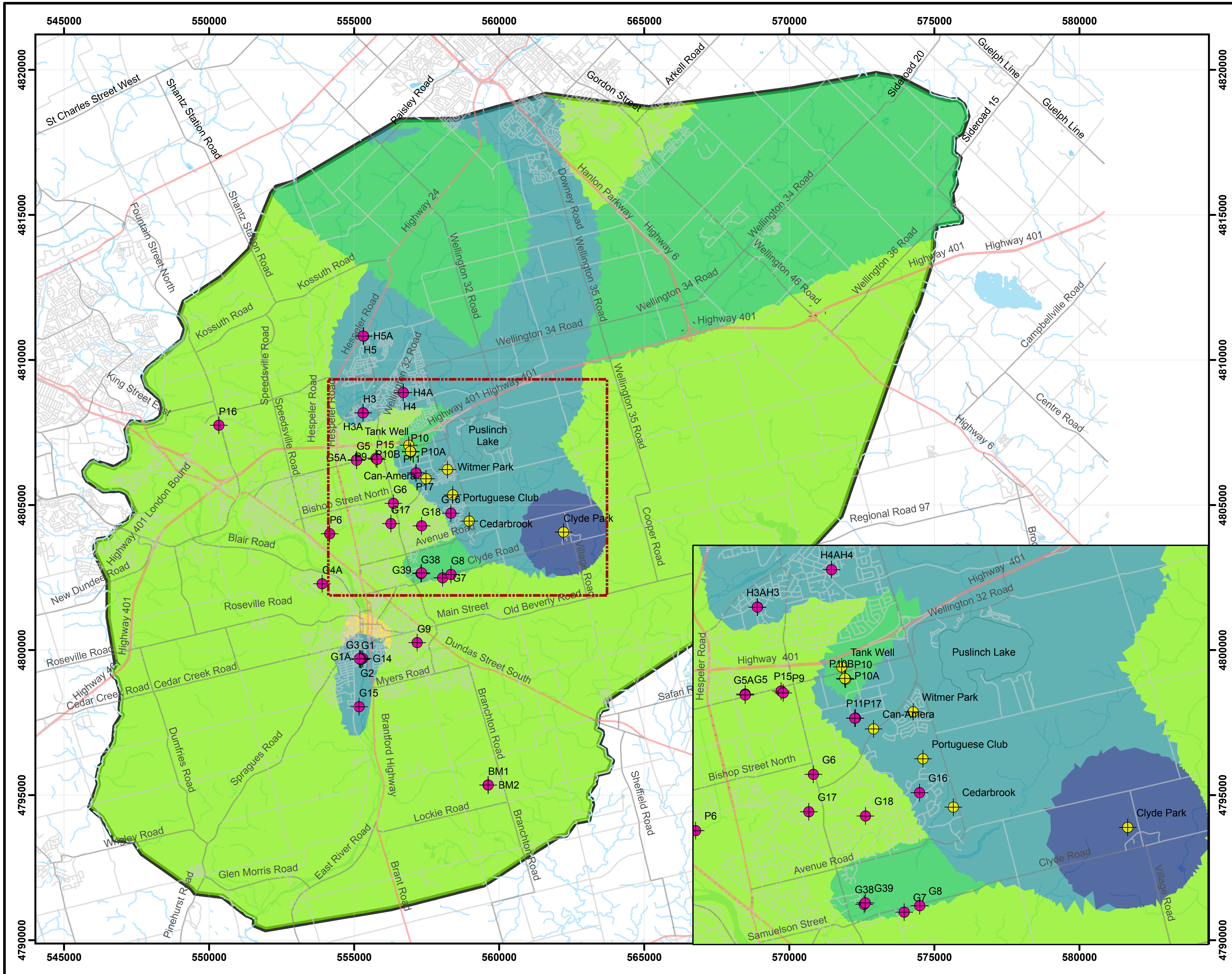
**Figure 26**

Vertical Hydraulic Conductivity:
Model Layer 13:
Upper Gasport Formation




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

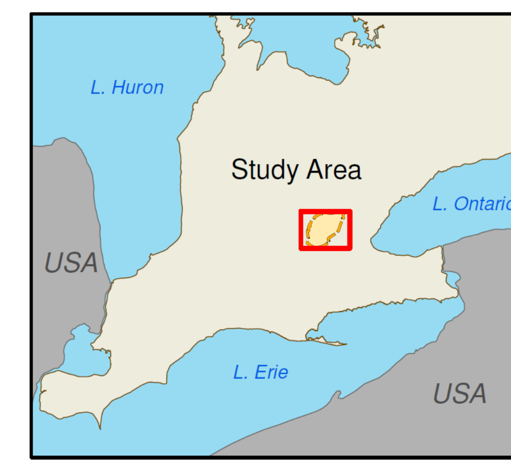
Hydraulic Conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5 \times 10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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**Figure 27**

Horizontal Hydraulic Conductivity:
Model Layer 14:
Middle Gasport Formation

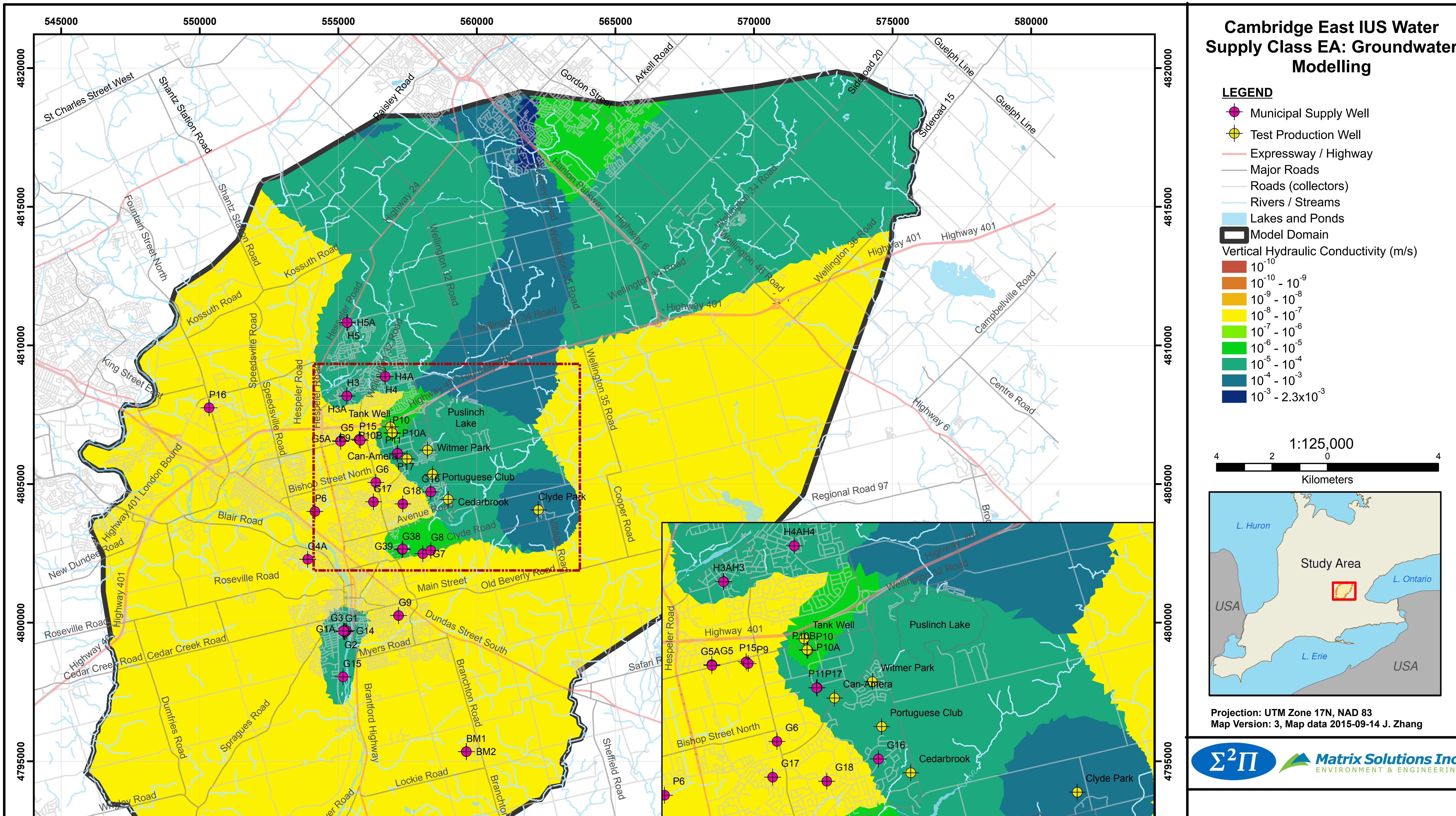
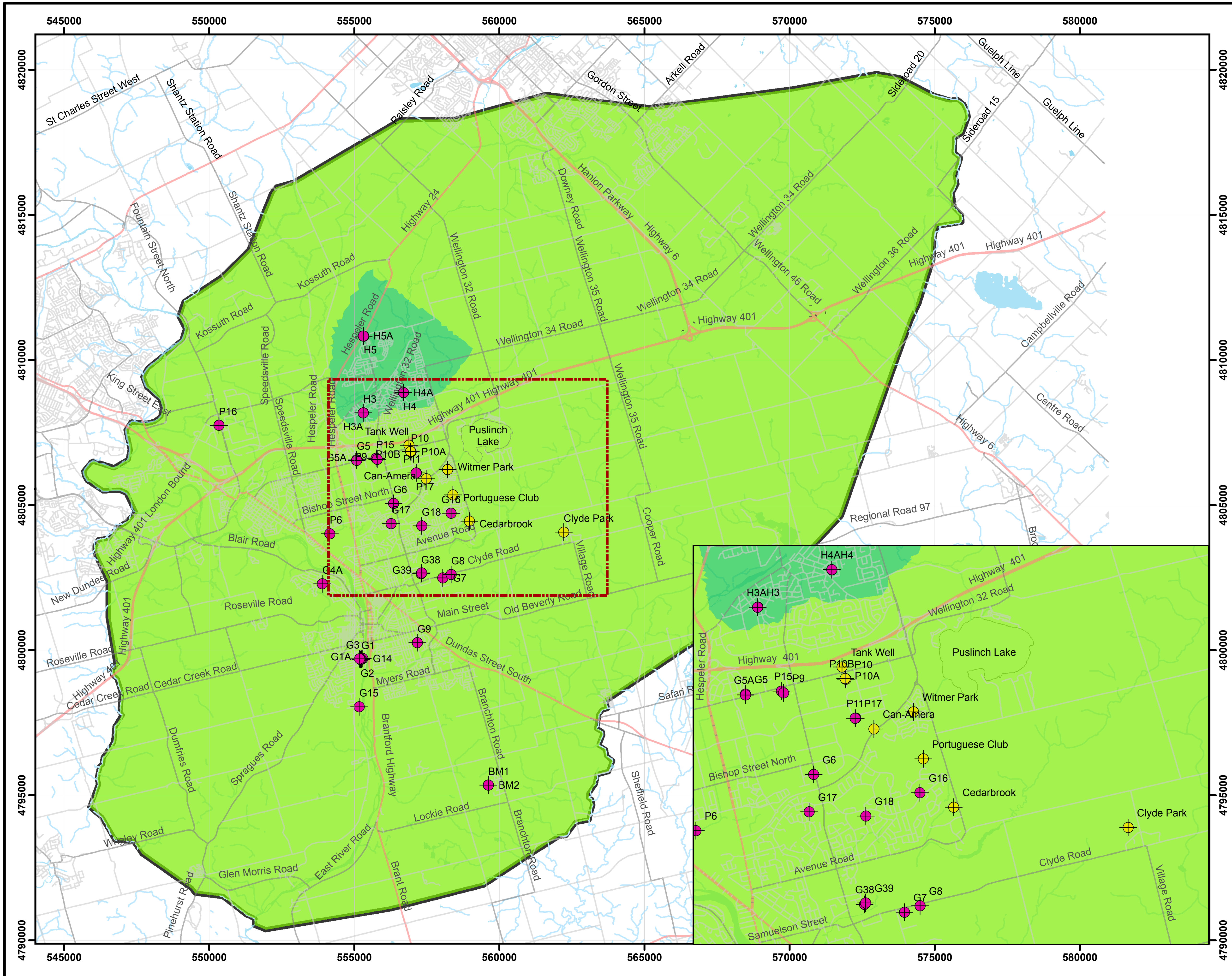



**Figure 28**

Vertical Hydraulic Conductivity:
Model Layer 14:
Middle Gasport Formation




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

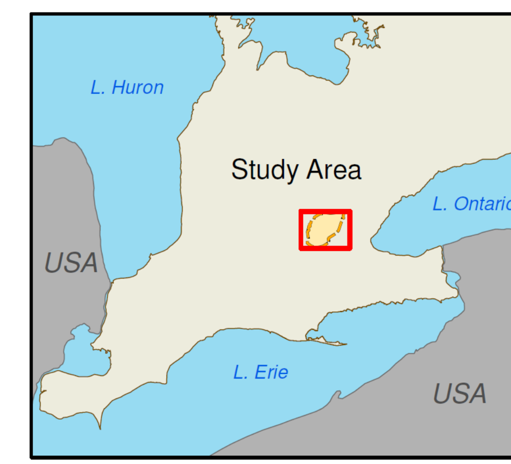
Hydraulic conductivity (m/s)

- $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $1.5\times10^{-2}$

1:125,000

4 2 0 4

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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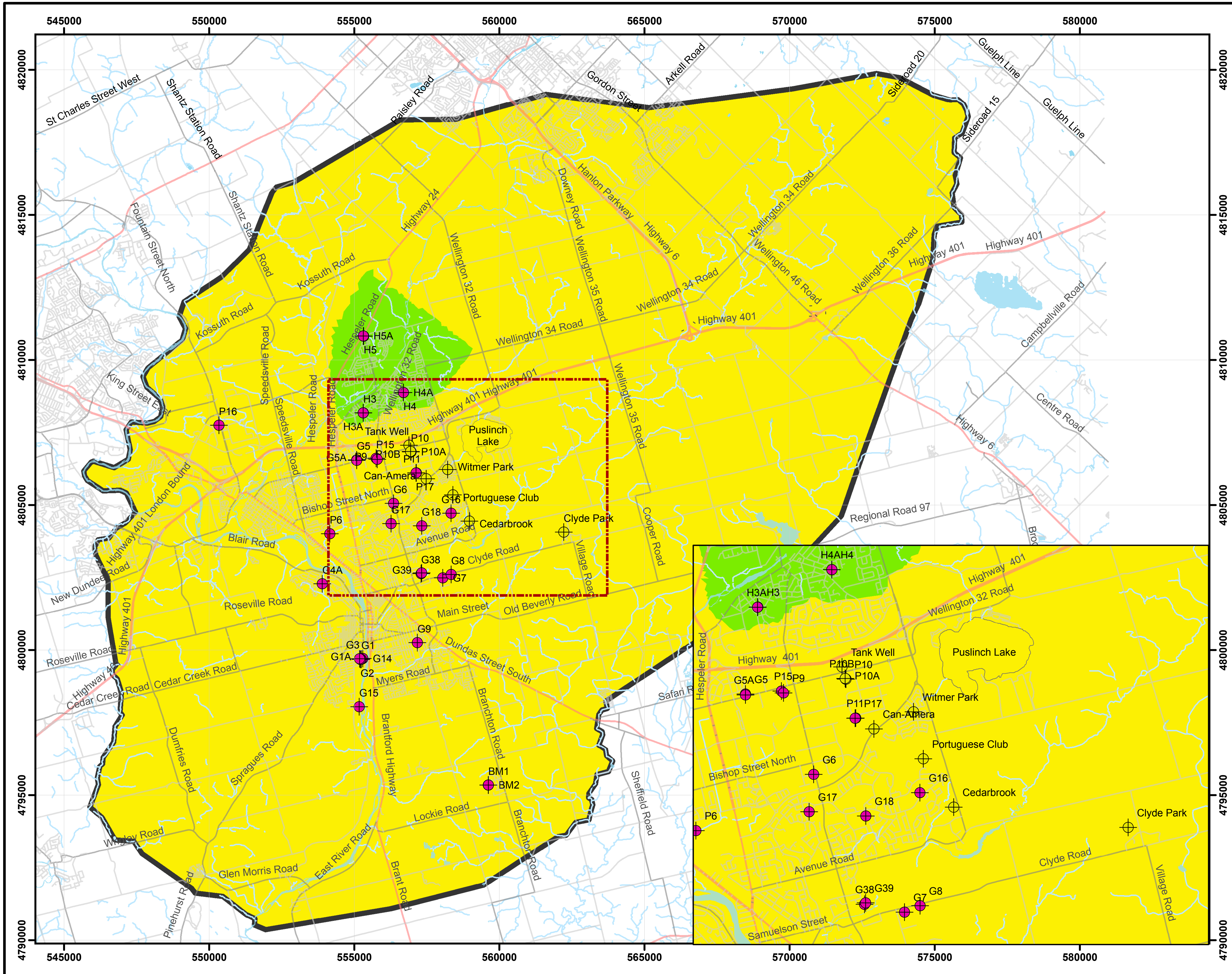
**Figure 29**

Horizontal hydraulic conductivity:
Model layer 15:
Lower Gasport Formation




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds
- Model Domain

Vertical Hydraulic Conductivity (m/s)

- $10^{-10}$
- $10^{-10}$ - $10^{-9}$
- $10^{-9}$ - $10^{-8}$
- $10^{-8}$ - $10^{-7}$
- $10^{-7}$ - $10^{-6}$
- $10^{-6}$ - $10^{-5}$
- $10^{-5}$ - $10^{-4}$
- $10^{-4}$ - $10^{-3}$
- $10^{-3}$ - $2.3x10^{-3}$

1:125,000

4 2 0 4

Kilometers

**Projection: UTM Zone 17N, NAD 83**
**Map Version: 3, Map data 2015-09-14 J. Zhang**

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**Figure 30**

Vertical Hydraulic Conductivity:
Model Layer 15:
Lower Gasport Formation

# Appendix C

# Non-Municipal Permits to Take Water

| Permit No. | Easting (NAD83) | Northing (NAD83) | Specific Purpose | Formation Screened[1] | Average Annual Consumptive Demand ($m^3/d$) |
|---|---|---|---|---|---|
| 7710-6DTL4T | 552507 | 4799223 | Industrial | Overburden | 0 |
| 03-P-2003 | 561056 | 4814413 | Industrial | Overburden | 0 |
| 72-P-0453 | 568922 | 4812609 | Industrial | Overburden | 396 |
| 6064-756QHD | 551093 | 4800879 | Industrial | Overburden | 1 |
| 0717-63RNYF | 548622 | 4797390 | Industrial | Overburden | 98 |
| 3234-74ER7S | 568280 | 4810400 | Industrial | Overburden | 719 |
| 2448-6FUKQ5 | 567290 | 4810630 | Industrial | Overburden | 373 |
| 6064-756QHD | 551093 | 4800879 | Industrial | Overburden | 39 |
| 02-P-2002 | 560055 | 4810875 | Industrial | Overburden | 0 |
| 3830-6W6JHW | 569250 | 4811950 | Industrial | Overburden | 993 |
| 02-P-2002 | 559836 | 4811222 | Industrial | Guelph Formation to Lower Gasport Formation | 13 |
| 03-P-2047 | 560391 | 4798971 | Industrial | Overburden to Lower Gasport Formation | 0 |
| 6512-6WGKW8 | 547590 | 4798226 | Industrial | Overburden | 0 |
| 01-P-2140 | 556235 | 4792616 | Commercial | Overburden | 0 |
| 01-P-2140 | 556259 | 4792611 | Commercial | Overburden | 0 |
| 1743-6RGJA9 | 557585 | 4792061 | Water Supply | Contact Aquifer | 0 |
| 03-P-2099 | 548102 | 4806061 | Water Supply | Overburden | 3 |
| 01-P-2148 | 563705 | 4798651 | Water Supply | Reformatory Quarry Member | 15 |
| 8228-76XLE2 | 569384 | 4813245 | Water Supply | Reformatory Quarry Member | 8 |
| 8228-76XLE2 | 569389 | 4813250 | Water Supply | Middle to Lower Gasport Formation | 10 |
| 3331-73RKYV | 569534 | 4814390 | Water Supply | Reformatory Quarry Member to Vinemount Member | 20 |
| 3331-73RKYV | 569537 | 4814528 | Water Supply | Goat Island Formation | 33 |
| 3331-73RKYV | 569499 | 4814701 | Water Supply | Guelph Formation to Vinemount Member | 74 |
| 3331-73RKYV | 569080 | 4814310 | Water Supply | Reformatory Quarry Member | 2 |
| 1216-6SCL4W | 571022 | 4812087 | Industrial | Overburden to Reformatory Quarry Member | 16 |
| 00-P-2437 | 557428 | 4798325 | Commercial | Overburden | 21 |
| 00-P-2791 | 558358 | 4808902 | Commercial | Overburden | 58 |
| 03-P-2245 | 548975 | 4805598 | Commercial | Overburden | 27 |
| 2540-6PLKFX | 553898 | 4812349 | Commercial | Overburden | 189 |
| 2540-6PLKFX | 553771 | 4812203 | Commercial | Overburden | 1 |
| 00-P-2437 | 557749 | 4797831 | Commercial | Overburden | 7 |
| 00-P-2791 | 558458 | 4808933 | Commercial | Middle Gasport Formation | 58 |
| 0334-6ARJNR | 557026 | 4804566 | Commercial | Overburden | 65 |
| 03-P-2384 | 548934 | 4801969 | Commercial | Contact Aquifer to Reformatory Quarry Member | 204 |
| 03-P-2384 | 548964 | 4801644 | Commercial | Contact Aquifer to Guelph Formation | 197 |
| 03-P-2384 | 548940 | 4801662 | Commercial | Contact Aquifer to Guelph Formation | 191 |
| 00-P-2176 | 555310 | 4799583 | Remediation | Overburden to Guelph Formation | 10 |
| 00-P-2176 | 555345 | 4799590 | Remediation | Overburden to Guelph Formation | 7 |
| 01-P-2245 | 570901 | 4815964 | Miscellaneous | Overburden | 5 |
| 01-P-2245 | 570784 | 4815980 | Miscellaneous | Contact Aquifer | 32 |
| 3878-6Z3JUU | 551100 | 4807800 | Dewatering | Overburden | 43 |
| 3878-6Z3JUU | 551300 | 4807300 | Dewatering | Overburden | 14 |
| 3878-6Z3JUU | 551300 | 4807400 | Dewatering | Overburden | 2 |
| 3878-6Z3JUU | 550900 | 4807800 | Dewatering | Overburden | 104 |
| 3878-6Z3JUU | 551400 | 4807300 | Dewatering | Overburden | 3 |
| 3878-6Z3JUU | 551100 | 4807800 | Dewatering | Overburden | 20 |
| 3878-6Z3JUU | 551000 | 4807300 | Dewatering | Overburden | 0 |
| 2817-6W9P32 | 549872 | 4801566 | Industrial | Overburden | 18 |
| 89-P-2014 | 569462 | 4812611 | Industrial | Reformatory Quarry Member | 5 |
| 5201-6B7HDA | 567598 | 4812203 | Industrial | Middle Gasport Formation | 2 |
| 5201-6B7HDA | 567476 | 4812030 | Industrial | Goat Island Formation | 12 |
| 5201-6B7HDA | 567608 | 4811999 | Industrial | Goat Island Formation | 16 |

[1] The screened formation are inferred from the hydrostratigraphic model using the available screen information of the pumping wells

| Permit No. | Easting (NAD83) | Northing (NAD83) | Specific Purpose | Formation Screened[1] | Average Annual Consumptive Demand ($m^3/d$) |
|---|---|---|---|---|---|
| 7724-73VQCX | 551270 | 4799187 | Industrial | Overburden | 147 |
| 7724-73VQCX | 551402 | 4799113 | Industrial | Overburden | 42 |
| 6661-65YPPD | 558706 | 4801766 | Remediation | Overburden | 2,939 |
| 0700-6YTS5P | 557183 | 4801047 | Remediation | Overburden | 46 |
| 0700-6YTS5P | 557018 | 4801061 | Remediation | Overburden | 9 |
| 0700-6YTS5P | 557049 | 4801038 | Remediation | Overburden | 0 |
| 0882-6FTHMA | 566318 | 4816054 | Water Supply | Overburden | 9 |
| 0882-6FTHMA | 566388 | 4816161 | Water Supply | Overburden | 10 |
| 0882-6FTHMA | 566425 | 4815893 | Water Supply | Guelph Formation to Upper Gasport Formation | 0 |
| 2563-6VKR7T | 552019 | 4811557 | Agricultural | Overburden | 3 |
| 03-P-2408 | 552053 | 4812678 | Agricultural | Guelph Formation | 4 |
| 00-P-2681 | 551316 | 4808472 | Agricultural | Reformatory Quarry Member | 232 |
| 00-P-2782 | 559540 | 4807988 | Water Supply | Overburden | 35 |
| 00-P-2782 | 559451 | 4808040 | Water Supply | Guelph Formation | 35 |
| 00-P-2782 | 559838 | 4808018 | Water Supply | Contact Aquifer | 35 |
| 01-P-2148 | 563728 | 4798440 | Water Supply | Overburden | 15 |
| 01-P-2148 | 563624 | 4798256 | Water Supply | Contact Aquifer to Guelph Formation | 15 |
| 02-P-2064 | 569356 | 4811814 | Agricultural | Vinemount Member | 39 |
| 0302-7CEL63 | 560648 | 4809366 | Commercial | Reformatory Quarry Member | 210 |
| 0302-7CEL63 | 560679 | 4809389 | Commercial | Reformatory Quarry Member | 100 |
| 0302-7CEL63 | 560725 | 4809289 | Commercial | Reformatory Quarry Member | 273 |
| 1065-5VFQ9K | 564140 | 4815443 | Industrial | Contact Aquifer to Lower Gasport Formation | 0 |
| 1743-6RGJA9 | 557585 | 4792061 | Water Supply | Contact Aquifer | 0 |
| 2688-7BRKDG | 557476 | 4801412 | Remediation | Overburden to Contact Aquifer | 213 |
| 2688-7BRKDG | 557425 | 4801474 | Remediation | Overburden to Contact Aquifer | 115 |
| 2688-7BRKDG | 557408 | 4801531 | Remediation | Overburden | 38 |
| 2768-6QXRCC | 557427 | 4815114 | Industrial | Guelph Formation to Goat Island Formation | 79 |
| 3615-79ULJX | 548334 | 4800724 | Commercial | Overburden | 438 |
| 4084-7AXSP4 | 550012 | 4803179 | Water Supply | Overburden | 1,800 |
| 4116-7CELMY | 560640 | 4809381 | Commercial | Reformatory Quarry Member | 264 |
| 4116-7CELMY | 560679 | 4809412 | Commercial | Reformatory Quarry Member | 196 |
| 4116-7CELMY | 560725 | 4809296 | Commercial | Reformatory Quarry Member | 273 |
| 5170-6X9H33 | 568312 | 4816988 | Commercial | Overburden | 186 |
| 6031-7CVQ3X | 555875 | 4809552 | Dewatering | Guelph Formation to Vinemount Member | 26 |
| 6066-6VXQU2 | 561196 | 4803854 | Water Supply | Guelph Formation to Middle Gasport Formation | 34 |
| 6066-6VXQU2 | 561060 | 4803785 | Water Supply | Overburden | 50 |
| 6066-6VXQU2 | 561189 | 4803847 | Water Supply | Guelph Formation to Middle Gasport Formation | 655 |
| 6560-6DYPGH | 570188 | 4811581 | Industrial | Overburden | 250 |
| 6560-6DYPGH | 569847 | 4811446 | Industrial | Overburden | 200 |
| 7316-6GAJ3X | 547976 | 4800065 | Industrial | Overburden | 0 |
| 7316-6GAJ3X | 547738 | 4799810 | Industrial | Overburden | 0 |
| 74-P-2065 | 566615 | 4800491 | Commercial | Reformatory Quarry Member | 12 |
| 7403-6HCMGT | 563572 | 4802239 | | Overburden | 1 |
| 7403-6HCMGT | 563566 | 4802151 | Recreational | Overburden | 1 |
| 7403-6HCMGT | 563569 | 4802197 | | Overburden | 1 |
| 8228-76XLE2 | 569616 | 4813435 | Water Supply | Contact Aquifer to Reformatory Quarry Member | 0 |
| 8228-76XLE2 | 569536 | 4813137 | Water Supply | Contact Aquifer to Middle Gasport Formation | 0 |
| 88-P-2029 | 566601 | 4800523 | Water Supply | Middle Gasport Formation | 0 |
| 88-P-2069 | 558681 | 4816893 | Industrial | Vinemount Member | 655 |
| 88-P-2070 | 559242 | 4792452 | Commercial | Guelph Formation to Reformatory Quarry Member | 0 |
| 88-P-2070 | 559246 | 4792542 | Commercial | Contact Aquifer | 0 |
| 98-P-2064 | 569203 | 4814403 | Water Supply | Goat Island Formation | 164 |

| Permit No. | Easting (NAD83) | Northing (NAD83) | Specific Purpose | Formation Screened[1] | Average Annual Consumptive Demand (m$^3$/d) |
|---|---|---|---|---|---|
| 99-P-2132 | 569100 | 4806163 | Commercial | Contact Aquifer to Vinemount Member | 1,637 |
| 7043-74BL3K | 561798 | 4817015 | Water Supply | Guelph Formation to Lower Gasport Formation | 3,940 |
| 7710-6DTL4T | 568935 | 4812721 | Commercial | Contact Aquifer to Upper Gasport Formation | 2,396 |

# Appendix D

# Simulated vs. Measured Groundwater Elevations for Calibrated Model (Steady-State)

Table D-1 Groundwater level targets derived from MOE water well records

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 1000488 | DW-BULLOCK | A | 559895 | 4798023 | 281.64 | 277.47 | 3 |
| 1000491 | DW-BUDIMLIC | A | 555417 | 4795658 | 266.50 | 272.84 | 7 |
| 1000507 | DW-DETLON | A | 553996 | 4809745 | 300.75 | 299.82 | 10 |
| 1000512 | OW19-94 | A | 549815 | 4811371 | 304.12 | 307.54 | 9 |
| 1000523 | DW-PANDEIRADA | A | 562374 | 4803799 | 298.30 | 294.89 | 3 |
| 6500454 | DW | A | 559163 | 4799061 | 286.52 | 281.33 | 3 |
| 6500462 | DW | A | 559063 | 4799221 | 286.52 | 281.29 | 4 |
| 6500488 |  | A | 558798 | 4798811 | 287.15 | 280.60 | 4 |
| 6500576 |  | A | 557653 | 4800651 | 278.28 | 276.85 | 6 |
| 6500603 |  | A | 558323 | 4802581 | 283.86 | 282.51 | 6 |
| 6500604 |  | A | 558223 | 4802581 | 283.76 | 282.30 | 6 |
| 6500607 | DW | A | 552133 | 4801081 | 307.45 | 307.48 | 6 |
| 6500609 | DW | A | 551913 | 4800931 | 309.42 | 308.85 | 6 |
| 6500610 | DW | A | 551583 | 4800991 | 305.42 | 307.40 | 5 |
| 6500642 | AVE-2A | A | 559166 | 4803651 | 292.92 | 293.18 | 9 |
| 6500648 | AVE-5 | A | 558827 | 4803822 | 275.96 | 292.73 | 9 |
| 6500653 |  | A | 557538 | 4802471 | 278.59 | 280.50 | 3 |
| 6500740 | DW | A | 555613 | 4797096 | 253.29 | 263.89 | 6 |
| 6500892 | TW38-65 | A | 546138 | 4806421 | 281.64 | 280.15 | 6 |
| 1000544 | DW-REINHARDT | A | 549842 | 4808548 | 285.56 | 299.17 | 6 |
| 6500955 | DW | A | 547373 | 4804301 | 280.73 | 286.88 | 7 |
| 6500978 | DW | A | 549123 | 4805946 | 287.55 | 278.71 | 6 |
| 6500980 | DW | A | 549233 | 4805786 | 268.63 | 276.55 | 8 |
| 6500981 | DW | A | 549553 | 4805991 | 286.82 | 279.30 | 7 |
| 6500985 | DW | A | 549293 | 4805901 | 286.21 | 278.09 | 7 |
| 1000546 | DW-CHARLEBOIS | A | 549892 | 4808623 | 286.01 | 299.49 | 7 |
| 6500990 | DW | A | 549213 | 4805941 | 283.46 | 278.39 | 7 |
| 6500991 | DW | A | 548953 | 4806001 | 284.99 | 279.79 | 7 |
| 6501002 | DW | A | 548753 | 4805981 | 285.60 | 280.62 | 6 |
| 6501005 | DW | A | 548508 | 4806231 | 283.17 | 283.10 | 8 |
| 6501021 | DW | A | 548233 | 4806741 | 286.52 | 285.71 | 7 |
| 6501022 | DW | A | 548018 | 4806981 | 282.86 | 286.12 | 7 |
| 6501023 | DW | A | 548153 | 4806871 | 278.59 | 286.01 | 7 |
| 6501024 | DW | A | 548038 | 4806846 | 286.31 | 285.78 | 7 |
| 1000547 | DW-BECHTEL | A | 549867 | 4808619 | 287.76 | 299.48 | 6 |
| 6501028 | DW | A | 547853 | 4806831 | 280.70 | 285.45 | 7 |
| 6501030 | DW | A | 548133 | 4806771 | 278.24 | 285.68 | 7 |
| 6501036 | DW | A | 548173 | 4806811 | 281.34 | 285.85 | 7 |
| 6501037 | DW | A | 548113 | 4806781 | 280.42 | 285.68 | 7 |
| 6501043 | OW17-65 | A | 546113 | 4806371 | 280.42 | 280.15 | 7 |
| 6501044 | OW18-65 | A | 546138 | 4805666 | 276.80 | 278.71 | 8 |
| 6501045 | OW19-65 | A | 545813 | 4805921 | 276.99 | 279.40 | 8 |
| 6501048 | TW32-65 | A | 546233 | 4806271 | 279.81 | 280.25 | 9 |
| 6501049 | TW33-65 | A | 546543 | 4805891 | 284.73 | 280.17 | 7 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6501050 | TW34-65 | A | 546513 | 4806246 | 282.30 | 280.46 | 7 |
| 1000548 | DW77-95 | A | 550970 | 4809772 | 293.95 | 306.84 | 6 |
| 6501051 | TW35-65 | A | 546678 | 4806221 | 285.49 | 280.53 | 7 |
| 6501052 | TW36-65 | A | 546063 | 4805721 | 277.68 | 278.67 | 7 |
| 6501053 | TW37-65 | A | 546413 | 4806321 | 282.55 | 280.44 | 7 |
| 6501080 | DW | A | 548543 | 4808001 | 287.12 | 290.70 | 7 |
| 6501083 | DW | A | 548573 | 4807881 | 284.38 | 290.24 | 7 |
| 6501088 | DW | A | 548553 | 4807861 | 284.38 | 290.12 | 7 |
| 6501116 | DW | A | 549613 | 4805781 | 281.95 | 277.31 | 8 |
| 6501229 | DW | A | 548088 | 4804366 | 282.38 | 284.05 | 7 |
| 6501233 | DW | A | 548063 | 4804471 | 276.46 | 283.61 | 7 |
| 6501235 | DW | A | 547568 | 4804621 | 277.13 | 284.26 | 7 |
| 6501237 | DW | A | 548118 | 4804621 | 278.77 | 282.71 | 8 |
| 1000552 | DW-MILLER | A | 560574 | 4804012 | 296.02 | 297.46 | 6 |
| 6501655 | DW | A | 548663 | 4810186 | 287.72 | 295.23 | 8 |
| 1000556 | DW75-95 | A | 564226 | 4800651 | 265.28 | 264.97 | 10 |
| 1000557 | DW-MATHEWS | A | 555514 | 4796060 | 257.71 | 265.59 | 9 |
| 1000560 | DW-ADAIR | A | 559749 | 4795713 | 270.71 | 263.72 | 10 |
| 1000563 | DW-CORVAGLIA | A | 554913 | 4793874 | 287.77 | 265.34 | 7 |
| 1000565 | DW-SOARES | A | 548188 | 4793518 | 293.59 | 297.55 | 5 |
| 6502927 | DW | A | 560143 | 4795211 | 269.15 | 258.09 | 8 |
| 6502934 | DW | A | 554893 | 4796061 | 288.35 | 283.22 | 5 |
| 6502935 | DW | A | 556533 | 4795521 | 259.69 | 266.28 | 8 |
| 6502937 | DW | A | 558213 | 4800921 | 278.90 | 280.92 | 6 |
| 6502938 | DW | A | 560053 | 4795451 | 269.14 | 259.95 | 8 |
| 6502939 | DW | A | 557873 | 4800321 | 278.90 | 278.64 | 8 |
| 6502991 | DW | A | 555043 | 4796091 | 284.38 | 280.37 | 6 |
| 6502994 | DW | A | 557363 | 4799051 | 274.62 | 276.49 | 4 |
| 6503036 | DW | A | 555093 | 4796161 | 275.84 | 274.44 | 8 |
| 6503039 | DW | A | 559923 | 4801341 | 287.43 | 287.29 | 5 |
| 6503041 | DW | A | 555993 | 4793761 | 256.25 | 262.61 | 7 |
| 6503057 | | A | 549573 | 4810001 | 294.13 | 303.73 | 9 |
| 6503059 | AVE-30 | A | 557463 | 4803391 | 281.24 | 285.91 | 9 |
| 6503062 | DW | A | 554953 | 4796171 | 284.69 | 281.62 | 5 |
| 6503064 | DW | A | 555353 | 4794831 | 260.00 | 272.31 | 10 |
| 6503065 | | A | 556963 | 4810971 | 292.92 | 293.56 | 10 |
| 6503091 | DW | A | 555723 | 4797531 | 258.17 | 263.60 | 9 |
| 6503092 | DW | A | 557943 | 4799351 | 280.42 | 278.97 | 5 |
| 6503095 | AVE-31 | A | 557413 | 4803401 | 281.68 | 285.76 | 9 |
| 6503096 | AVE-35 | A | 557213 | 4803321 | 281.49 | 284.78 | 9 |
| 6503097 | AVE-33 | A | 557363 | 4803371 | 280.35 | 285.46 | 9 |
| 1000581 | DW-91312 ONTARIO INC | A | 547494 | 4802773 | 298.78 | 296.06 | 6 |
| 6503110 | DW | A | 555713 | 4796661 | 255.64 | 264.54 | 9 |
| 6503123 | DW | A | 547813 | 4807421 | 288.65 | 287.63 | 6 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6503124 | DW | A | 553863 | 4809571 | 296.90 | 299.49 | 10 |
| 6503129 | DW | A | 558583 | 4799411 | 284.99 | 280.47 | 9 |
| 6503130 | DW | A | 549663 | 4801761 | 303.41 | 300.81 | 6 |
| 1000583 | DW-KRAEMER | A | 549791 | 4805402 | 279.89 | 274.65 | 7 |
| 6503147 | DW | A | 557963 | 4799321 | 282.25 | 279.01 | 9 |
| 6503149 | DW | A | 552493 | 4793951 | 298.04 | 296.83 | 6 |
| 6503150 | TLR-28 | A | 559124 | 4804147 | 299.83 | 297.30 | 5 |
| 6503154 | TW5-69 | A | 551173 | 4800811 | 306.33 | 310.01 | 6 |
| 6503167 | TW5-69 (McLAUGHLIN) | A | 551766 | 4803878 | 270.25 | 277.01 | 10 |
| 6503178 | | A | 549093 | 4808181 | 284.99 | 294.95 | 9 |
| 6503189 | DW | A | 551153 | 4799331 | 307.85 | 318.40 | 6 |
| 6503200 | DW | A | 555903 | 4811821 | 300.07 | 302.07 | 10 |
| 6503205 | DW | A | 557423 | 4808591 | 300.80 | 298.89 | 9 |
| 6503217 | | A | 552733 | 4808471 | 296.88 | 298.08 | 10 |
| 6503226 | DW | A | 548413 | 4809581 | 282.97 | 295.26 | 9 |
| 6503234 | DW | A | 551513 | 4813471 | 311.21 | 317.58 | 6 |
| 6503255 | DW | A | 555613 | 4797525 | 257.56 | 261.93 | 9 |
| 6503257 | DW | A | 561313 | 4795881 | 254.81 | 249.80 | 10 |
| 6503278 | DW | A | 554253 | 4811921 | 303.25 | 306.66 | 4 |
| 6503282 | DW | A | 557598 | 4798536 | 281.27 | 277.37 | 4 |
| 6503301 | DW | A | 559833 | 4796941 | 275.65 | 271.18 | 10 |
| 6503302 | DW | A | 558501 | 4795611 | 266.70 | 267.07 | 10 |
| 6503315 | DW | A | 560313 | 4794811 | 264.07 | 251.69 | 8 |
| 6503316 | DW | A | 559023 | 4794719 | 268.23 | 262.08 | 4 |
| 6503322 | DW | A | 558103 | 4800881 | 280.12 | 280.97 | 6 |
| 6503327 | DW | A | 557613 | 4798426 | 277.16 | 276.99 | 4 |
| 6503355 | DW | A | 549773 | 4805871 | 284.46 | 278.36 | 7 |
| 6503366 | DW | A | 557263 | 4809821 | 304.55 | 300.22 | 13 |
| 6503380 | DW | A | 560053 | 4795531 | 268.53 | 260.35 | 8 |
| 6503382 | DW | A | 550313 | 4794111 | 297.66 | 300.45 | 6 |
| 6503405 | TW1-71 | A | 557876 | 4803200 | 286.90 | 286.99 | 3 |
| 6503415 | DW | A | 553743 | 4807821 | 280.72 | 284.35 | 10 |
| 6503417 | DW | A | 548383 | 4809521 | 282.91 | 295.17 | 8 |
| 6503444 | DW | A | 557948 | 4797601 | 281.03 | 276.08 | 9 |
| 6503460 | TW2-71 | A | 557653 | 4803280 | 286.45 | 286.48 | 6 |
| 6503462 | TW4-71 | A | 557863 | 4802821 | 284.08 | 282.71 | 3 |
| 6503463 | TW5-71 | A | 558148 | 4801581 | 282.77 | 281.64 | 7 |
| 6503470 | DW | A | 559713 | 4795711 | 270.66 | 264.04 | 10 |
| 6503471 | DW | A | 557943 | 4799381 | 280.73 | 278.99 | 9 |
| 6503472 | DW | A | 560033 | 4796621 | 275.24 | 268.19 | 10 |
| 6503473 | | A | 553538 | 4807501 | 278.59 | 284.96 | 10 |
| 6503475 | DW | A | 559683 | 4797231 | 274.02 | 274.27 | 9 |
| 6503486 | DW | A | 560113 | 4795251 | 270.06 | 258.61 | 5 |
| 6503487 | DW | A | 560103 | 4795391 | 268.23 | 260.74 | 4 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6503488 | DW | A | 557533 | 4798791 | 278.59 | 277.27 | 9 |
| 6503496 | DW | A | 548263 | 4807701 | 282.13 | 289.08 | 6 |
| 6503497 | DW | A | 554053 | 4815071 | 317.74 | 320.71 | 9 |
| 6503502 | DW | A | 548663 | 4806071 | 281.33 | 281.47 | 7 |
| 6503540 | DW | A | 559963 | 4795296 | 269.75 | 259.88 | 5 |
| 6503541 | DW | A | 547533 | 4793506 | 293.22 | 296.17 | 6 |
| 6503563 | DW | A | 551738 | 4796471 | 300.23 | 317.53 | 5 |
| 6503571 | AVE-17 | A | 558888 | 4803821 | 287.73 | 296.45 | 5 |
| 6503636 | DW | A | 559963 | 4795091 | 265.39 | 257.77 | 9 |
| 6503637 | DW | A | 560063 | 4795121 | 267.93 | 257.56 | 9 |
| 6503642 | DW | A | 555063 | 4796171 | 275.08 | 274.71 | 9 |
| 6503644 | DW | A | 560013 | 4795121 | 268.73 | 257.90 | 8 |
| 6503681 | | A | 555993 | 4807561 | 302.05 | 293.99 | 9 |
| 6503684 | DW | A | 559913 | 4795171 | 267.40 | 259.23 | 8 |
| 6503685 | DW | A | 559913 | 4795196 | 268.01 | 259.49 | 5 |
| 6503686 | DW | A | 559913 | 4795221 | 269.75 | 260.92 | 4 |
| 6503687 | DW | A | 550393 | 4800721 | 305.11 | 312.86 | 5 |
| 6503692 | DW | A | 554013 | 4794971 | 298.45 | 301.38 | 5 |
| 6503700 | DW | A | 553663 | 4809421 | 299.01 | 300.46 | 10 |
| 6503706 | TLR-11 | A | 558553 | 4805630 | 305.06 | 299.03 | 6 |
| 6503708 | | A | 560038 | 4799996 | 283.66 | 284.49 | 7 |
| 6503716 | DW | A | 553463 | 4797871 | 309.21 | 301.22 | 6 |
| 6503717 | DW | A | 548413 | 4793671 | 295.44 | 297.92 | 6 |
| 6503740 | DW | A | 559963 | 4795201 | 270.36 | 259.23 | 5 |
| 6503741 | DW | A | 559943 | 4795241 | 267.92 | 259.44 | 9 |
| 6503742 | DW | A | 559933 | 4795261 | 269.45 | 259.64 | 9 |
| 6503745 | AVE-25 | A | 557863 | 4803631 | 285.49 | 288.15 | 9 |
| 6503747 | DW | A | 558653 | 4801001 | 284.71 | 282.82 | 6 |
| 6503806 | DW | A | 560903 | 4798841 | 274.63 | 278.55 | 9 |
| 6503807 | DW | A | 560953 | 4799141 | 270.37 | 279.79 | 9 |
| 6503808 | DW | A | 560963 | 4798681 | 276.15 | 277.43 | 9 |
| 6503809 | DW | A | 561293 | 4798181 | 264.57 | 269.49 | 9 |
| 6503814 | DW | A | 561313 | 4798511 | 269.76 | 273.85 | 9 |
| 6503819 | DW | A | 562033 | 4798721 | 258.78 | 266.26 | 10 |
| 6503828 | DW | A | 563583 | 4799241 | 263.66 | 261.88 | 10 |
| 6503837 | DW | A | 561033 | 4799231 | 277.07 | 280.23 | 9 |
| 6503838 | DW | A | 560813 | 4799931 | 283.17 | 285.12 | 9 |
| 6503839 | DW | A | 561023 | 4799401 | 276.76 | 281.82 | 9 |
| 6503840 | | A | 560893 | 4799511 | 279.20 | 282.99 | 9 |
| 6503848 | DW | A | 560913 | 4800271 | 286.51 | 286.52 | 9 |
| 6503849 | DW | A | 560903 | 4801201 | 288.04 | 288.47 | 8 |
| 6503855 | DW | A | 563343 | 4801781 | 280.42 | 277.64 | 10 |
| 6503857 | DW | A | 563993 | 4800581 | 262.08 | 265.01 | 10 |
| 6503865 | DW | A | 564583 | 4800521 | 267.62 | 264.35 | 10 |
| 6503868 | DW | A | 559863 | 4802921 | 298.70 | 291.86 | 3 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6503873 | DW | A | 561053 | 4801311 | 291.70 | 289.33 | 3 |
| 6503874 | DW | A | 561393 | 4801481 | 291.14 | 289.41 | 9 |
| 6503881 | DW | A | 562073 | 4803301 | 297.19 | 293.67 | 9 |
| 6503882 | DW | A | 562393 | 4803331 | 295.05 | 292.71 | 9 |
| 6503887 | | A | 563553 | 4803861 | 292.68 | 288.15 | 9 |
| 6503888 | DW | A | 563993 | 4802041 | 273.71 | 270.57 | 3 |
| 6503889 | DW | A | 559329 | 4803798 | 295.73 | 296.32 | 6 |
| 6503891 | DW | A | 560433 | 4804281 | 296.28 | 298.18 | 2 |
| 6503893 | DW | A | 561063 | 4803771 | 292.61 | 297.13 | 6 |
| 6503896 | DW | A | 561953 | 4803631 | 297.19 | 294.79 | 8 |
| 6503904 | DW | A | 562443 | 4803831 | 295.66 | 294.42 | 9 |
| 6503907 | DW | A | 562493 | 4803841 | 301.20 | 294.61 | 3 |
| 6503908 | DW | A | 562513 | 4803771 | 298.40 | 293.97 | 8 |
| 6503909 | DW | A | 562493 | 4803941 | 299.62 | 295.03 | 3 |
| 6503910 | | A | 562913 | 4803904 | 300.23 | 292.69 | 6 |
| 6503914 | DW | A | 564403 | 4804221 | 296.29 | 290.43 | 9 |
| 6503915 | DW | A | 564498 | 4804291 | 293.72 | 290.89 | 8 |
| 6503916 | DW | A | 562333 | 4799481 | 263.66 | 268.97 | 10 |
| 6503917 | DW | A | 562413 | 4799571 | 265.48 | 269.66 | 10 |
| 6503918 | DW | A | 562453 | 4799561 | 264.27 | 269.21 | 10 |
| 6503919 | DW | A | 563933 | 4800601 | 267.32 | 265.16 | 10 |
| 6503921 | DW | A | 562553 | 4803641 | 289.57 | 293.30 | 9 |
| 6503944 | DW | A | 564253 | 4799921 | 260.00 | 263.01 | 10 |
| 6504020 | DW | A | 561293 | 4798291 | 266.09 | 271.06 | 9 |
| 6504022 | DW | A | 561333 | 4798376 | 271.88 | 272.00 | 2 |
| 6504027 | DW | A | 564908 | 4799571 | 260.44 | 262.02 | 10 |
| 6504030 | DW | A | 563333 | 4800701 | 262.41 | 269.64 | 10 |
| 6504031 | DW | A | 563748 | 4800601 | 265.79 | 265.56 | 10 |
| 6504032 | DW | A | 564633 | 4800441 | 262.74 | 264.12 | 10 |
| 6504033 | DW | A | 560193 | 4803041 | 294.10 | 292.59 | 9 |
| 6504034 | DW | A | 562473 | 4803721 | 298.70 | 294.20 | 3 |
| 6504035 | DW | A | 563853 | 4802001 | 277.98 | 271.27 | 7 |
| 6504036 | | A | 564573 | 4803161 | 274.02 | 277.22 | 10 |
| 6504037 | DW | A | 561293 | 4804501 | 295.16 | 299.39 | 8 |
| 6504038 | DW | A | 562493 | 4803901 | 295.05 | 294.70 | 9 |
| 6504106 | DW | A | 558873 | 4795021 | 268.49 | 263.85 | 3 |
| 6504115 | DW | A | 563063 | 4801671 | 276.31 | 281.07 | 8 |
| 6504125 | DW | A | 557930 | 4800849 | 280.11 | 279.43 | 9 |
| 6504147 | DW -COUROUX | A | 552153 | 4810111 | 300.84 | 307.50 | 10 |
| 6504172 | DW | A | 561991 | 4803577 | 292.92 | 294.57 | 9 |
| 6504202 | DW | A | 562058 | 4803535 | 293.53 | 294.33 | 9 |
| 6504232 | DW | A | 554552 | 4793567 | 306.33 | 278.42 | 6 |
| 6504240 | DW | A | 560213 | 4794921 | 265.18 | 253.99 | 5 |
| 6504245 | DW | A | 550113 | 4795681 | 313.69 | 312.99 | 6 |
| 6504272 | DW | A | 562693 | 4804761 | 301.75 | 298.84 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6504336 | DW | A | 564233 | 4804221 | 297.49 | 290.52 | 9 |
| 6504344 | DW | A | 563153 | 4801271 | 272.43 | 276.98 | 10 |
| 6504345 | DW | A | 552785 | 4796119 | 308.46 | 311.96 | 6 |
| 6504350 | DW | A | 547967 | 4807000 | 280.27 | 286.07 | 7 |
| 6504360 | DW | A | 557196 | 4794389 | 263.37 | 264.85 | 9 |
| 1000668 | DW-STAGER | A | 553915 | 4809553 | 299.35 | 299.17 | 10 |
| 6504383 | DW | A | 554113 | 4811721 | 297.79 | 305.26 | 10 |
| 6504414 | AVE-32 | A | 557473 | 4803461 | 285.60 | 286.22 | 7 |
| 6504417 | DW | A | 553512 | 4793353 | 293.33 | 285.38 | 6 |
| 6504428 | DW | A | 561633 | 4804601 | 300.16 | 299.49 | 9 |
| 6504464 | DW | A | 563243 | 4800901 | 267.52 | 272.75 | 10 |
| 6504475 | DW | A | 553673 | 4809241 | 301.55 | 299.93 | 10 |
| 6504498 | AVE-18 | A | 557983 | 4803641 | 292.66 | 290.12 | 6 |
| 6504499 | DW | A | 551953 | 4811491 | 313.04 | 312.27 | 6 |
| 6504535 | DW | A | 549653 | 4805691 | 279.50 | 276.45 | 9 |
| 6504548 | DW | A | 559913 | 4799341 | 285.90 | 281.67 | 9 |
| 6504560 | DW | A | 552953 | 4807991 | 282.86 | 294.33 | 9 |
| 6504561 | DW | A | 552973 | 4808041 | 300.54 | 295.45 | 6 |
| 6504570 | DW | A | 560732 | 4804369 | 294.14 | 298.65 | 9 |
| 6504571 | DW | A | 561583 | 4803547 | 295.05 | 295.47 | 9 |
| 6504572 | DW | A | 561887 | 4803612 | 295.84 | 294.88 | 8 |
| 6504573 | DW | A | 563212 | 4804922 | 298.71 | 298.85 | 6 |
| 6504581 | DW | A | 549293 | 4811421 | 299.32 | 304.87 | 7 |
| 6504653 | DW | A | 551733 | 4809861 | 308.46 | 309.12 | 4 |
| 6504658 | DW | A | 550913 | 4806721 | 283.54 | 284.21 | 8 |
| 6504717 | DW | A | 560693 | 4798901 | 279.51 | 279.54 | 3 |
| 6504724 |  | A | 553123 | 4814221 | 326.16 | 319.08 | 6 |
| 6504753 | DW | A | 556333 | 4795461 | 261.53 | 264.47 | 8 |
| 1000688 | DW28-96 | A | 549496 | 4810491 | 289.67 | 303.57 | 7 |
| 6504822 | DW-BRITTAIN | A | 562140 | 4804561 | 295.66 | 299.18 | 6 |
| 6504850 |  | A | 556153 | 4806501 | 294.13 | 292.41 | 12 |
| 6504854 | DW | A | 559913 | 4799141 | 278.89 | 280.83 | 8 |
| 6504859 | DW | A | 558573 | 4803881 | 289.57 | 291.99 | 9 |
| 6504897 |  | A | 549593 | 4800581 | 307.85 | 313.09 | 6 |
| 6504942 | TW1-79 | A | 555913 | 4797161 | 265.11 | 266.85 | 10 |
| 6504958 | DW | A | 550993 | 4806721 | 286.97 | 283.94 | 8 |
| 6504964 | DW | A | 550573 | 4812101 | 311.51 | 314.51 | 4 |
| 6504971 | DW | A | 553193 | 4814241 | 324.62 | 317.92 | 9 |
| 6504990 | DW | A | 558093 | 4803661 | 286.04 | 289.13 | 9 |
| 6504991 | DW | A | 551953 | 4806541 | 264.69 | 278.68 | 10 |
| 6504995 | TW15-79 | A | 555963 | 4812421 | 295.64 | 302.97 | 13 |
| 6505012 | DW | A | 559833 | 4795561 | 275.07 | 263.35 | 3 |
| 6505015 | DW | A | 560693 | 4798381 | 267.62 | 277.04 | 8 |
| 6505016 | DW | A | 560153 | 4795481 | 270.05 | 259.50 | 8 |
| 6505017 | DW | A | 559673 | 4797961 | 288.04 | 277.67 | 3 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6505019 | DW | A | 560133 | 4795521 | 270.66 | 259.80 | 5 |
| 6505020 | DW | A | 550353 | 4801721 | 301.09 | 302.69 | 6 |
| 6505022 | DW | A | 559933 | 4795401 | 266.70 | 260.20 | 10 |
| 6505024 | DW | A | 553473 | 4811901 | 302.64 | 308.06 | 10 |
| 6505030 | DW-WITMER | A | 557205 | 4807071 | 304.94 | 295.56 | 9 |
| 6505040 | DW | A | 559113 | 4798761 | 286.52 | 279.95 | 4 |
| 6505041 | DW | A | 559093 | 4798821 | 286.52 | 280.33 | 4 |
| 6505053 | DW | A | 559209 | 4803781 | 287.75 | 294.54 | 9 |
| 6505059 | DW-BAKER | A | 548425 | 4809519 | 289.87 | 295.41 | 6 |
| 6505060 | DW | A | 553213 | 4816201 | 329.18 | 318.39 | 9 |
| 6505063 | | A | 551753 | 4810261 | 310.29 | 308.57 | 8 |
| 6505074 | DW | A | 548213 | 4805121 | 275.85 | 280.75 | 7 |
| 6505078 | DW | A | 549893 | 4811541 | 307.85 | 309.43 | 6 |
| 6505083 | DW | A | 555733 | 4796561 | 252.38 | 264.30 | 10 |
| 6505102 | | A | 548013 | 4798661 | 306.19 | 316.47 | 5 |
| 6505122 | DW | A | 559653 | 4795721 | 270.66 | 264.49 | 10 |
| 6505127 | DW | A | 551813 | 4793261 | 291.16 | 290.62 | 6 |
| 6505128 | DW | A | 553273 | 4793181 | 293.13 | 282.81 | 6 |
| 6505131 | DW | A | 555353 | 4794561 | 266.09 | 269.24 | 6 |
| 6505133 | DW | A | 555653 | 4798061 | 265.18 | 262.51 | 9 |
| 6505136 | DW | A | 551693 | 4798001 | 308.90 | 320.51 | 5 |
| 6505138 | DW | A | 552213 | 4807141 | 276.33 | 287.53 | 9 |
| 1000724 | DW-MOYER | A | 546747 | 4794696 | 295.79 | 300.61 | 6 |
| 6505178 | DW-OROSZ | A | 564513 | 4800554 | 264.87 | 264.50 | 10 |
| 6505182 | DW-PULINSKI | A | 564897 | 4799796 | 261.83 | 262.50 | 10 |
| 6505183 | DW-LASKOVAR | A | 560125 | 4803016 | 293.52 | 292.20 | 8 |
| 6505185 | DW-MAGNUSSEN | A | 548415 | 4808017 | 286.51 | 290.38 | 7 |
| 6505195 | DW | A | 563133 | 4801401 | 273.29 | 278.63 | 9 |
| 1000728 | DW57-96 | A | 556308 | 4795449 | 259.11 | 264.18 | 9 |
| 6505212 | DW-BEN-TEL | A | 551822 | 4806911 | 280.72 | 286.40 | 9 |
| 6505213 | DW-BENTEL | A | 553512 | 4808948 | 289.10 | 300.82 | 9 |
| 6505214 | DW-PIONEER SPORTSMAN | A | 548271 | 4805144 | 274.46 | 280.53 | 8 |
| 6505223 | DW | A | 555353 | 4796481 | 258.93 | 266.59 | 9 |
| 6505224 | DW | A | 555353 | 4796561 | 252.99 | 266.51 | 7 |
| 6505225 | DW-FILIPOVIC | A | 555486 | 4796111 | 258.17 | 265.94 | 9 |
| 6505226 | DW-ELLSMERE | A | 558808 | 4803815 | 284.69 | 292.70 | 9 |
| 6505228 | DW-JOHNSON | A | 555708 | 4797658 | 260.91 | 263.16 | 10 |
| 1000736 | DW71-96 | A | 560234 | 4802994 | 292.09 | 292.49 | 9 |
| 6505360 | DW-HIPEL | A | 552271 | 4811183 | 312.73 | 310.26 | 3 |
| 6505366 | DW-MUELLER | A | 548005 | 4807751 | 282.43 | 287.38 | 9 |
| 6505374 | DW-MEDEIROS | A | 559994 | 4799396 | 287.13 | 282.67 | 4 |
| 6505387 | DW-SPORTSWORLD | A | 548999 | 4806419 | 283.16 | 283.11 | 9 |
| 6505392 | DW-CORDEIRO | A | 551728 | 4806861 | 281.73 | 285.94 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6505394 | DW-LEWIS | A | 559392 | 4802573 | 300.52 | 288.84 | 8 |
| 6505399 | DW-SMITH | A | 553904 | 4808301 | 283.43 | 290.38 | 10 |
| 6505414 | DW-MCLAUGHLIN | A | 552048 | 4807037 | 281.03 | 286.95 | 9 |
| 6505421 | DW-HALL | A | 562405 | 4799508 | 263.04 | 268.88 | 10 |
| 6505429 | DW-TOEBES | A | 562444 | 4799515 | 266.71 | 268.70 | 10 |
| 6505457 | DW-MORGENWEG | A | 559939 | 4801277 | 288.04 | 287.23 | 5 |
| 6505460 | DW-DONKERS | A | 560782 | 4794964 | 255.35 | 251.00 | 4 |
| 6505464 | DW-BARKER | A | 555621 | 4797353 | 261.22 | 262.59 | 10 |
| 6505467 | DW-DYKSTRA | A | 560943 | 4798248 | 271.90 | 273.48 | 9 |
| 6505468 | DW-INCITTI | A | 559821 | 4799429 | 292.31 | 282.02 | 7 |
| 6505473 | DW-PRONGE PUMP | A | 548984 | 4806475 | 284.38 | 283.73 | 9 |
| 6505474 | DW-SOOTHREN | A | 548525 | 4805923 | 278.28 | 281.27 | 7 |
| 6505479 | DW-GRESBRECHT | A | 552238 | 4815856 | 321.27 | 318.60 | 8 |
| 6505495 | DW-CEKAN | A | 563855 | 4799933 | 265.48 | 263.30 | 10 |
| 6505507 | DW-CITY OF CAMBRIDGE | A | 551974 | 4806730 | 275.44 | 283.91 | 10 |
| 6505542 | DW-PISCIVNERI | A | 555141 | 4803348 | 284.38 | 282.22 | 9 |
| 1000780 | DW-COLLINS | A | 559991 | 4801224 | 285.51 | 287.24 | 5 |
| 6505564 | DW-UNIVERSITY OF GUE | A | 552007 | 4803379 | 268.84 | 281.75 | 10 |
| 6505567 | DW-BAKER | A | 556553 | 4809801 | 291.39 | 294.71 | 9 |
| 6505569 | DW-HESSLER | A | 560237 | 4794877 | 263.77 | 253.48 | 6 |
| 6505570 | DW-INKSETTER | A | 563603 | 4802113 | 276.15 | 273.60 | 2 |
| 6505571 | DW-RHOEKSTRA | A | 558372 | 4799902 | 284.99 | 280.93 | 9 |
| 6505572 | DW-LAMONTAGNE | A | 559688 | 4801296 | 288.04 | 286.88 | 3 |
| 6505575 | DW-WEIGL | A | 555273 | 4796122 | 264.57 | 271.69 | 6 |
| 6505576 | DW-EDWORTHY | A | 550926 | 4797529 | 308.76 | 320.39 | 6 |
| 6505577 | DW-CAMBRIDGE SHRINE | A | 557949 | 4797929 | 277.98 | 276.87 | 9 |
| 6505578 | DW-LAMONTAGNE | A | 559664 | 4801288 | 288.34 | 286.81 | 3 |
| 6505579 | DW-RHOEKSTRA | A | 558400 | 4799882 | 285.29 | 281.38 | 4 |
| 6505580 | DW-SHINGLER | A | 555041 | 4798421 | 263.35 | 259.59 | 9 |
| 6505581 | DW-CITY AUTO WRECKER | A | 558371 | 4801339 | 282.25 | 282.64 | 3 |
| 6505583 | DW-CAMBRIDGE AUTO WR | A | 560015 | 4800825 | 289.23 | 286.59 | 7 |
| 6505661 | DW-GIGNAC | A | 560722 | 4798976 | 277.37 | 279.75 | 8 |
| 6505663 | DW-LANKA & SOLKIE | A | 559858 | 4801184 | 284.38 | 286.97 | 8 |
| 6505667 | DW-FREY | A | 552956 | 4808430 | 283.77 | 299.18 | 10 |
| 6505668 | DW-HILBORN | A | 552454 | 4813722 | 304.19 | 316.58 | 9 |
| 6505669 | DW-OTTMAN | A | 552140 | 4811841 | 311.81 | 313.19 | 8 |
| 6505681 | AVE-8 | A | 558755 | 4803846 | 290.96 | 292.61 | 9 |
| 6505682 | DW-TUCKER | A | 551937 | 4810462 | 301.14 | 308.47 | 10 |
| 6505690 | DW-LOEWEN | A | 553017 | 4808136 | 294.44 | 295.34 | 10 |
| 6505705 | DW-EKKEBUS | A | 560821 | 4798906 | 274.75 | 279.09 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6505706 | DW-CLARKSON | A | 564009 | 4800641 | 265.18 | 265.15 | 10 |
| 1000792 | DW-DASILVA | A | 559984 | 4803036 | 294.02 | 291.90 | 9 |
| 6505718 | DW-SMITH JAMES CONST | A | 551597 | 4806843 | 279.91 | 285.78 | 9 |
| 1000793 | DW-FIORETTI | A | 564201 | 4804058 | 294.83 | 289.34 | 9 |
| 6505724 | DW-JESUS | A | 555719 | 4797544 | 263.35 | 263.50 | 9 |
| 6505725 | DW-TERESI | A | 562677 | 4803985 | 298.71 | 294.52 | 3 |
| 6505726 | DW-MACKIE | A | 559903 | 4802982 | 295.97 | 291.32 | 8 |
| 6505727 | DW-NICKLIN | A | 555709 | 4797616 | 261.83 | 263.21 | 9 |
| 6505728 | DW-ROPOTRYN | A | 559859 | 4802984 | 296.57 | 291.26 | 8 |
| 6505729 | DW-RUNIONS | A | 562306 | 4803763 | 299.93 | 294.96 | 3 |
| 6505730 | DW-MOREIRA | A | 560053 | 4803043 | 292.31 | 292.61 | 6 |
| 1000794 | DW-DAVIES | A | 560472 | 4796455 | 274.07 | 264.38 | 9 |
| 6505733 | DW-HERBERT | A | 561276 | 4798445 | 266.70 | 273.11 | 10 |
| 6505735 | DW-STRYKER | A | 561216 | 4799210 | 266.50 | 279.53 | 9 |
| 6505736 | DW-CAPORORTO | A | 555728 | 4797261 | 264.57 | 267.92 | 6 |
| 6505755 | DW-SANDERS | A | 555021 | 4798290 | 262.74 | 259.90 | 8 |
| 6505756 | DW-BEAVER | A | 552102 | 4810546 | 300.23 | 308.59 | 10 |
| 6505761 | DW-KRUCKEBERG | A | 562637 | 4803908 | 298.41 | 294.32 | 3 |
| 6505762 | DW-RUNIONS | A | 562179 | 4803825 | 299.32 | 295.61 | 3 |
| 6505764 | DW-SHAVER POULTRY | A | 560818 | 4800880 | 290.79 | 287.86 | 8 |
| 6505766 | DW-ROSS | A | 562606 | 4803799 | 297.80 | 293.94 | 3 |
| 6505767 | DW-MUNCH | A | 561174 | 4799281 | 272.50 | 280.32 | 9 |
| 1000798 | DW-CHRISVIEW HOMES | A | 562432 | 4803657 | 299.58 | 294.03 | 3 |
| 6505768 | DW-BENDER HOMES | A | 562575 | 4804006 | 297.79 | 295.02 | 3 |
| 6505779 | DW-BROOKFIELD GOLF | A | 554297 | 4812426 | 307.54 | 308.47 | 10 |
| 1000799 | OW-AB BRADLEY | A | 557018 | 4801061 | 279.58 | 275.77 | 3 |
| 6505780 | DW-REGIONAL READY MI | A | 560613 | 4801786 | 289.87 | 289.05 | 9 |
| 1000800 | DW-HESSLER | A | 560246 | 4794878 | 264.98 | 253.45 | 5 |
| 6505802 | DW-BROWN | A | 558765 | 4799337 | 283.77 | 280.79 | 9 |
| 6505805 | DW-REIDCO | A | 558634 | 4803868 | 291.20 | 292.10 | 8 |
| 6505808 | OW2-86 | A | 554983 | 4802729 | 264.34 | 273.37 | 9 |
| 6505810 | OW1-86 | A | 555071 | 4802645 | 264.45 | 272.96 | 9 |
| 6505811 | OW4-86 | A | 554930 | 4802750 | 264.44 | 272.80 | 9 |
| 6505812 | TW16-86 | A | 552645 | 4796504 | 308.77 | 314.48 | 6 |
| 1000801 | DW-BROUWER | A | 559920 | 4795240 | 270.22 | 259.79 | 5 |
| 6505822 | DW-GRAMBLICKA | A | 549473 | 4803508 | 285.30 | 280.23 | 6 |
| 6505860 | DW-PRONG | A | 553566 | 4814715 | 316.08 | 320.55 | 9 |
| 6505861 | DW-KOOLE | A | 561149 | 4799262 | 271.88 | 280.20 | 9 |
| 6505862 | DW-BEEMER | A | 560281 | 4794803 | 264.57 | 252.47 | 8 |
| 6505863 | TW?-86 | A | 554943 | 4803186 | 274.97 | 280.15 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6505879 | DW-CREZEL | A | 562229 | 4800100 | 267.31 | 278.04 | 9 |
| 6505880 | DW-PINDER | A | 547083 | 4797320 | 283.77 | 309.46 | 7 |
| 6505895 | DW-SANSFILIPPO | A | 555032 | 4798219 | 264.56 | 260.06 | 8 |
| 6505896 | DW-KOELHER | A | 555019 | 4798293 | 270.05 | 260.09 | 7 |
| 6505903 | DW-MILLAR | A | 563872 | 4800604 | 265.79 | 265.25 | 10 |
| 6505923 | DW-MATTHEWS | A | 551663 | 4812218 | 312.77 | 314.07 | 5 |
| 6505931 | DW-HACKNEY | A | 555319 | 4796597 | 262.13 | 267.57 | 6 |
| 6505933 | DW-HAASE | A | 548469 | 4810016 | 287.13 | 294.26 | 8 |
| 6505942 | AVE-27 | A | 557662 | 4803589 | 286.70 | 287.33 | 8 |
| 6505943 | DW-PURDY | A | 557022 | 4810721 | 295.97 | 294.71 | 9 |
| 6505944 | DW-DETTWEILER | A | 552961 | 4808328 | 295.66 | 298.58 | 8 |
| 6505945 | DW-BANNON | A | 553595 | 4809058 | 294.75 | 300.52 | 9 |
| 6505946 | DW-ISLEV | A | 553874 | 4808405 | 282.86 | 292.99 | 10 |
| 6505949 | DW-BONKOFF | A | 549638 | 4805725 | 281.94 | 276.76 | 7 |
| 6505950 | DW-SPORTSWORLD | A | 549090 | 4806150 | 283.47 | 280.58 | 8 |
| 6505953 | DW-BROUWER | A | 561274 | 4798481 | 266.40 | 273.63 | 10 |
| 6505954 | DW-WOOD | A | 554929 | 4797381 | 269.14 | 262.56 | 7 |
| 6505955 | DW-ELLIS | A | 562683 | 4803893 | 297.48 | 294.08 | 2 |
| 6505956 | DW-LEADER | A | 560929 | 4799145 | 277.06 | 279.90 | 8 |
| 6505957 | DW-NICHOLAS | A | 554952 | 4797339 | 268.53 | 263.54 | 6 |
| 6505958 | DW-PEREIRA | A | 553549 | 4798548 | 306.49 | 300.01 | 6 |
| 6505961 | DW-LEDUC | A | 560861 | 4799109 | 275.85 | 279.94 | 9 |
| 6505965 | DW-OSTOPOVICH | A | 562772 | 4804055 | 296.88 | 294.51 | 3 |
| 6505966 | DW-BENDER HOMES | A | 562722 | 4804014 | 297.49 | 294.50 | 3 |
| 6505967 | DW-RUNIONS CONSTRUCT | A | 562155 | 4803806 | 298.10 | 295.59 | 3 |
| 6505968 | DW-FRACEL CUSTOM | A | 562549 | 4803922 | 297.79 | 294.73 | 3 |
| 6505969 | DW-DRY | A | 562482 | 4803965 | 300.14 | 295.18 | 3 |
| 6505973 | DW-FRACEL CUSTOM | A | 562610 | 4803917 | 300.85 | 294.52 | 2 |
| 6505974 | DW-MEDEIROS | A | 561306 | 4799230 | 267.61 | 279.49 | 9 |
| 1000816 | DW-LANG | A | 552328 | 4807990 | 292.98 | 296.68 | 7 |
| 6505991 | DW-HUBERCHECH | A | 549098 | 4806188 | 282.25 | 281.03 | 6 |
| 6505998 | DW-CULLTON | A | 560053 | 4795585 | 264.88 | 260.48 | 10 |
| 6506002 | DW-JONAS | A | 563674 | 4801749 | 275.85 | 272.71 | 10 |
| 6506003 | DW-ZANDER | A | 561081 | 4799293 | 277.68 | 280.67 | 8 |
| 1000817 | DW-WEINHARDT | A | 551780 | 4806832 | 278.66 | 284.92 | 9 |
| 6506011 | DW-BELAND | A | 554881 | 4797434 | 267.01 | 262.62 | 7 |
| 6506012 | DW-MACHADO | A | 558976 | 4799430 | 286.21 | 281.48 | 9 |
| 6506017 | DW-DENOUDEN | A | 551164 | 4797655 | 307.54 | 319.48 | 6 |
| 6506025 | DW-ADAMCHYCK | A | 555637 | 4797720 | 259.39 | 262.10 | 10 |
| 6506026 | DW-NEWMAN | A | 555639 | 4797684 | 259.39 | 262.15 | 10 |
| 6506044 | DW-FITZPATRICK | A | 554886 | 4797409 | 271.88 | 262.46 | 8 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6506050 | DW-BOISVERT | A | 548376 | 4793672 | 297.18 | 297.95 | 6 |
| 6506051 | DW-HAMMER | A | 564083 | 4800662 | 265.18 | 265.13 | 10 |
| 6506053 | DW-CIRCLE SQUARE | A | 546576 | 4806229 | 281.95 | 280.48 | 7 |
| 6506079 | DW-SODTRE | A | 553967 | 4814082 | 314.56 | 317.83 | 9 |
| 6506086 | DW-TIBBITTS | A | 556754 | 4810327 | 288.65 | 300.28 | 12 |
| 6506088 | DW-NEVEN CASEY | A | 562667 | 4803813 | 299.93 | 293.54 | 9 |
| 6506102 | DW-MARTIC | A | 551478 | 4811129 | 309.37 | 311.65 | 9 |
| 6506103 | DW-WATERLOO CB ED | A | 547991 | 4798688 | 307.85 | 316.32 | 5 |
| 6506112 | DW-HELM | A | 549661 | 4803293 | 285.91 | 282.03 | 6 |
| 6506113 | DW-REIS | A | 549481 | 4803313 | 286.21 | 282.88 | 6 |
| 6506130 | DW-SGS PLASTIC | A | 555814 | 4809512 | 283.46 | 298.18 | 10 |
| 6506135 | DW-VANDERPOOL | A | 551695 | 4806846 | 290.31 | 285.82 | 9 |
| 6506136 | DW-ROBERTSON | A | 552450 | 4807433 | 291.70 | 289.86 | 7 |
| 6506137 | DW-GRIER | A | 553895 | 4808312 | 282.55 | 290.92 | 10 |
| 6506138 | DW-HARNACK | A | 553906 | 4808266 | 281.34 | 290.68 | 10 |
| 6506145 | TW2-87 | A | 557173 | 4803261 | 285.92 | 284.39 | 9 |
| 6506149 | DW-TULLIS ESTATE | A | 552362 | 4799642 | 308.76 | 313.84 | 6 |
| 6506152 | DW-BARTHOLOMEW | A | 553498 | 4798140 | 306.64 | 298.40 | 8 |
| 6506154 | DW-WING | A | 555565 | 4795753 | 260.91 | 267.77 | 7 |
| 6506159 | DW-PARRISH | A | 549673 | 4803436 | 286.82 | 279.82 | 6 |
| 1000852 | DW-SILVA | A | 553182 | 4814381 | 312.76 | 318.51 | 9 |
| 6506178 | DW-FALKINER | A | 558135 | 4800901 | 281.34 | 281.17 | 6 |
| 6506179 | DW-GLOADE | A | 553657 | 4809086 | 293.83 | 299.74 | 10 |
| 6506181 | DW-DOHERTY | A | 554013 | 4808051 | 280.42 | 287.46 | 10 |
| 6506187 | DW-RUMPH | A | 560743 | 4798929 | 275.85 | 279.44 | 9 |
| 6506189 | DW-FUNG | A | 562202 | 4803850 | 299.01 | 295.66 | 3 |
| 6506229 | AVE-4 | A | 558844 | 4803825 | 296.70 | 296.37 | 3 |
| 6506231 | DW-LLOYD | A | 553863 | 4807943 | 280.72 | 286.42 | 10 |
| 6506232 | DW-COOK | A | 553887 | 4808364 | 284.27 | 292.37 | 10 |
| 6506233 | DW-SMITH | A | 558647 | 4799831 | 286.21 | 281.93 | 4 |
| 6506235 | DW-PERRIN | A | 554272 | 4793849 | 284.38 | 278.66 | 9 |
| 6506237 | DW-MORGAN | A | 555357 | 4796394 | 257.56 | 266.88 | 8 |
| 6506240 | DW-HOEKSTRA CONST | A | 554610 | 4793666 | 293.83 | 275.14 | 6 |
| 6506244 | DW-RUNIONS CONSTRUCT | A | 562240 | 4803884 | 299.32 | 295.71 | 3 |
| 6506245 | DW-TINKER | A | 554901 | 4797482 | 270.97 | 263.55 | 6 |
| 6506248 | DW-SPELIC | A | 562199 | 4799533 | 264.27 | 270.97 | 9 |
| 6506249 | DW-WOOD | A | 561070 | 4799331 | 275.23 | 281.06 | 9 |
| 6506250 | DW-?ASTAG | A | 555185 | 4796318 | 258.28 | 271.29 | 10 |
| 6506251 | DW-RENDLE | A | 561253 | 4799230 | 268.54 | 279.66 | 9 |
| 6506252 | DW-MILLER | A | 560045 | 4795425 | 269.45 | 262.02 | 3 |
| 6506265 | DW-NEWMASTER | A | 548798 | 4793748 | 298.70 | 299.80 | 6 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6506279 | DW-CRESSMAN | A | 549613 | 4803378 | 285.91 | 281.02 | 5 |
| 6506280 | DW-COLES | A | 556966 | 4810616 | 293.83 | 300.53 | 12 |
| 6506281 | DW-SOLDERA | A | 562284 | 4803819 | 297.48 | 294.96 | 9 |
| 6506293 | DW-BEECRAFT | A | 553655 | 4816296 | 321.87 | 319.81 | 10 |
| 6506295 | DW-HARTNELL | A | 549576 | 4803250 | 286.21 | 283.23 | 6 |
| 6506296 | DW-POLADIAN | A | 549673 | 4803310 | 284.99 | 281.88 | 6 |
| 6506297 | DW-NATURELLA FARMS | A | 559529 | 4796984 | 277.97 | 272.91 | 8 |
| 6506298 | DW-JOANISSE | A | 554536 | 4793585 | 294.44 | 273.03 | 6 |
| 6506299 | DW-SCHELL | A | 554682 | 4793684 | 294.75 | 272.33 | 6 |
| 6506300 | DW-DEIGNAN | A | 561058 | 4799367 | 271.88 | 281.43 | 9 |
| 6506301 | DW-VLASOV | A | 555872 | 4793913 | 258.47 | 260.37 | 9 |
| 6506302 | DW-VLASOV | A | 555875 | 4793879 | 258.47 | 260.61 | 7 |
| 6506309 | DW-BENNETT | A | 550880 | 4803394 | 278.86 | 285.32 | 9 |
| 6506312 | DW-MCLEAN | A | 561397 | 4801440 | 289.50 | 289.33 | 9 |
| 6506339 | DW-ANEJA | A | 551241 | 4806984 | 292.01 | 287.66 | 8 |
| 6506341 | DW-HIGGINS | A | 557051 | 4810641 | 296.26 | 300.54 | 13 |
| 6506344 | DW-TONCIC | A | 551345 | 4806870 | 287.12 | 285.92 | 8 |
| 6506346 | DW-BRADBURRY | A | 563307 | 4800594 | 263.04 | 268.51 | 10 |
| 6506347 | DW-JOHNSON | A | 552346 | 4794456 | 304.20 | 302.78 | 6 |
| 6506348 | DW-PITTENS | A | 561794 | 4801801 | 289.56 | 289.61 | 9 |
| 6506357 | DW-COLES | A | 556997 | 4810619 | 285.91 | 296.22 | 10 |
| 6506358 | DW-BLAIR | A | 553633 | 4809745 | 301.45 | 301.00 | 9 |
| 6506359 | DW-BARTELS | A | 553693 | 4809356 | 294.75 | 300.22 | 9 |
| 6506362 | DW-SOOKRAM | A | 551135 | 4806939 | 289.26 | 287.25 | 7 |
| 6506363 | DW-HUNTER | A | 557025 | 4810632 | 295.35 | 297.63 | 10 |
| 6506389 | OW?-88 | A | 557128 | 4801043 | 281.64 | 276.05 | 3 |
| 6506390 | DW-MACLEOD | A | 554801 | 4798533 | 284.69 | 259.92 | 9 |
| 6506399 | DW-PATTERSON | A | 552973 | 4808607 | 297.80 | 300.30 | 10 |
| 6506400 | DW-DUPUIS | A | 551964 | 4807015 | 282.56 | 287.08 | 9 |
| 6506401 | DW-FILIPOVIC | A | 551634 | 4806842 | 282.26 | 285.82 | 9 |
| 6506402 | DW-SOLOMON | A | 557117 | 4810682 | 292.61 | 297.96 | 10 |
| 1000874 | DW-HUSSON | A | 557734 | 4798085 | 277.09 | 276.78 | 4 |
| 6506417 | DW-MUNSON | A | 561639 | 4799414 | 265.79 | 278.80 | 9 |
| 6506420 | DW-KLEINSTEUBER | A | 562374 | 4803983 | 297.49 | 295.69 | 3 |
| 6506426 | DW-ANEJA | A | 551282 | 4806989 | 286.65 | 287.70 | 9 |
| 6506428 | DW-SOLDERA | A | 562292 | 4803817 | 299.01 | 295.24 | 3 |
| 6506435 | DW-SCHWARR | A | 551780 | 4812027 | 287.13 | 313.60 | 10 |
| 6506441 | DW-BRANCHTON CAMP | A | 558377 | 4795051 | 262.89 | 264.37 | 10 |
| 6506460 | DW-LARSON | A | 555484 | 4796220 | 254.74 | 265.35 | 9 |
| 6506462 | DW-KRUCKEBERG | A | 552988 | 4808546 | 300.84 | 300.06 | 10 |
| 6506467 | DW-PATTERSON | A | 551872 | 4801335 | 309.07 | 305.32 | 6 |
| 6506490 | DW-WHETMAN | A | 553513 | 4813006 | 309.07 | 311.13 | 6 |
| 6506492 | DW-FINK | A | 556251 | 4812717 | 307.55 | 302.03 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6506493 | DW-DUNSTALL | A | 555001 | 4797809 | 266.40 | 261.06 | 6 |
| 6506502 | DW-WELLS | A | 564644 | 4800392 | 259.99 | 263.99 | 10 |
| 6506509 | TW1-91 | A | 555445 | 4798707 | 258.47 | 259.14 | 8 |
| 6506513 | DW-HESSLER | A | 560088 | 4794828 | 266.40 | 253.72 | 8 |
| 6506515 | DW-LOTIMER | A | 551894 | 4805426 | 271.62 | 274.51 | 9 |
| 6506519 | PW3-89 | A | 549781 | 4802863 | 289.89 | 288.01 | 6 |
| 6506520 | DW-DRAWEHN | A | 553755 | 4809425 | 284.99 | 299.67 | 10 |
| 6506538 | DW-CLEMENT | A | 563834 | 4800625 | 265.18 | 265.36 | 10 |
| 6506544 | DW-CEKAN | A | 563910 | 4799953 | 264.87 | 263.30 | 10 |
| 6506559 | DW-MONGEON | A | 556908 | 4810592 | 290.78 | 300.48 | 11 |
| 6506560 | DW-CITY OF KITCHENER | A | 549560 | 4805756 | 290.48 | 276.95 | 9 |
| 6506586 | DW-DEFREITAS | A | 548925 | 4803515 | 282.25 | 284.55 | 6 |
| 6506595 | DW-MCCREADY | A | 551196 | 4806970 | 289.25 | 287.53 | 8 |
| 6506602 | DW-MACMILLAN | A | 555518 | 4795961 | 259.39 | 266.64 | 9 |
| 6506603 | DW-STIELER | A | 554590 | 4793635 | 292.01 | 272.17 | 6 |
| 6506604 | DW-AZEVEDO | A | 559869 | 4795393 | 270.67 | 261.00 | 9 |
| 6506607 | DW-MAPLE MANOR EST | A | 557551 | 4795978 | 267.53 | 270.32 | 3 |
| 6506609 | DW-GOODMAN | A | 564429 | 4800637 | 264.88 | 264.84 | 10 |
| 6506610 | DW-WHITTIER | A | 564270 | 4800156 | 264.26 | 263.54 | 10 |
| 6506611 | DW-TIMELESS HOMES | A | 551151 | 4806957 | 288.04 | 287.45 | 7 |
| 6506614 | DW-COTE | A | 555424 | 4796169 | 258.45 | 267.11 | 8 |
| 6506631 | DW-B&M CONSTRUCTION | A | 553624 | 4809068 | 292.92 | 300.33 | 8 |
| 6506636 | DW-PETRO CANADA | A | 548566 | 4806553 | 276.76 | 284.94 | 8 |
| 1000905 | DW-ELLIOT | A | 553009 | 4796349 | 307.40 | 311.63 | 6 |
| 6506652 | DW-CUNNING | A | 555803 | 4794127 | 256.34 | 259.70 | 6 |
| 1000908 | DW-ED WRIGHT CONSTRU | A | 551345 | 4798621 | 307.33 | 320.63 | 5 |
| 6506679 | DW-RUNIONS | A | 560220 | 4803026 | 290.79 | 292.61 | 9 |
| 6506697 | DW-RUNIONS CONSTRUCT | A | 560433 | 4803096 | 291.70 | 293.55 | 9 |
| 6506698 | DW-DEGRAAF | A | 564714 | 4800126 | 261.82 | 263.34 | 10 |
| 6506699 | DW-AREND | A | 564881 | 4799731 | 261.83 | 262.37 | 10 |
| 6506703 | DW-KOWALESKI | A | 555193 | 4794156 | 266.70 | 262.07 | 9 |
| 6506706 | DW-ENGELHARDT | A | 555001 | 4797739 | 265.29 | 260.63 | 8 |
| 6506707 | DW-GAUCH | A | 555433 | 4794899 | 266.70 | 271.64 | 10 |
| 6506710 | DW-LEE WAYNE CONST | A | 555933 | 4793943 | 252.99 | 261.19 | 9 |
| 6506713 | DW-ROCHA | A | 555154 | 4796298 | 271.15 | 272.03 | 9 |
| 6506714 | DW-OLIVER FOWLIE SUB | A | 551501 | 4798720 | 309.68 | 320.32 | 5 |
| 6506719 | DW-MARKLE | A | 553662 | 4809542 | 295.66 | 300.56 | 10 |
| 6506723 | DW-PANDEIRADA | A | 562363 | 4803789 | 296.58 | 294.89 | 3 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6506725 | DW-HERNER | A | 553149 | 4815476 | 315.16 | 317.86 | 6 |
| 6506726 | DW-SCHWEBRO | A | 552206 | 4812590 | 314.25 | 315.77 | 9 |
| 6506747 | DW-WALDEN | A | 553997 | 4811433 | 300.53 | 304.59 | 10 |
| 6506748 | PS2 | A | 557014 | 4808775 | 299.02 | 299.31 | 11 |
| 6506749 | PS1 | A | 557013 | 4808780 | 299.32 | 298.54 | 9 |
| 6506771 | DW-ULTRAMAR | A | 558668 | 4799780 | 277.84 | 281.66 | 4 |
| 6506774 | DW-OLDFIELD | A | 555635 | 4799249 | 264.26 | 260.42 | 9 |
| 6506775 | DW-PINCOTT | A | 547595 | 4805494 | 279.20 | 281.71 | 7 |
| 6506776 | DW-EASTON | A | 547511 | 4805435 | 275.24 | 281.54 | 7 |
| 6506840 | DW-LE BRUN | A | 555244 | 4794280 | 278.90 | 263.45 | 8 |
| 6506846 | DW-GALT COUNTRY CLUB | A | 553775 | 4803290 | 272.62 | 267.89 | 9 |
| 6506847 | DW-FORD | A | 560085 | 4795250 | 269.48 | 258.72 | 8 |
| 6506848 | DW-LUNGHI | A | 562381 | 4803919 | 301.94 | 295.37 | 3 |
| 6506892 | DW-COUTO | A | 561153 | 4799195 | 268.51 | 279.58 | 9 |
| 6506893 | DW-FRANK ROCHA CONST | A | 562407 | 4804002 | 299.68 | 295.65 | 3 |
| 6506905 | DW-MEYER | A | 552023 | 4806994 | 284.63 | 286.57 | 9 |
| 6506912 | DW-MUIR | A | 559712 | 4795903 | 264.88 | 265.15 | 10 |
| 6506913 | DW-CASATTA | A | 550537 | 4809754 | 303.29 | 305.70 | 7 |
| 6506915 | DW-GREEN | A | 559999 | 4799711 | 287.12 | 283.41 | 9 |
| 6506922 | DW-GOODHAND | A | 562179 | 4798591 | 258.47 | 264.82 | 10 |
| 6506941 | DW-BAUER | A | 548043 | 4807779 | 281.95 | 287.57 | 9 |
| 6506945 | PS3? | A | 557123 | 4808632 | 302.01 | 299.36 | 13 |
| 6506966 | DW-STALKER | A | 564288 | 4801622 | 267.31 | 268.14 | 10 |
| 6506969 | DW-KINGSWOOD | A | 555122 | 4795195 | 276.45 | 277.78 | 6 |
| 6506972 | DW-FURTNEY | A | 554971 | 4793914 | 287.63 | 264.81 | 6 |
| 6507016 | DW-IGEL | A | 562363 | 4803872 | 299.62 | 295.24 | 3 |
| 1000957 | DW-E.D. WRIGHT CO-97 | A | 551356 | 4798670 | 305.89 | 320.56 | 5 |
| 6507019 | DW-SCHIEDEL CONS | A | 547260 | 4799503 | 302.97 | 306.05 | 5 |
| 6507025 | DW-SHIRY | A | 549336 | 4810313 | 288.65 | 302.28 | 6 |
| 1000958 | DW-KOHMAN | A | 564272 | 4800659 | 264.17 | 264.97 | 10 |
| 6507030 | DW-TYSDALE | A | 564737 | 4800234 | 260.91 | 263.58 | 10 |
| 6507031 | DW-WATERLOO CONCRETE | A | 547938 | 4800119 | 302.98 | 310.57 | 6 |
| 6507047 | DW-VANDEL CONTRACTIN | A | 554024 | 4809760 | 302.97 | 299.89 | 10 |
| 6507048 | DW-VANDEL CONTRACTIN | A | 554001 | 4809757 | 302.36 | 299.87 | 10 |
| 6507049 | DW-GONDER | A | 552478 | 4807399 | 278.59 | 289.43 | 9 |
| 6507053 | DW-MOORE | A | 548508 | 4796876 | 302.98 | 318.23 | 5 |
| 6507081 | DW-DUOBAITIS | A | 550128 | 4808686 | 287.96 | 299.96 | 7 |
| 6507102 | DW-PARAGON | A | 563312 | 4800581 | 257.38 | 268.29 | 10 |
| 6507146 | DW-BADDER | A | 555008 | 4797461 | 265.79 | 260.79 | 9 |
| 6507154 | DW-ROSS | A | 556761 | 4810173 | 293.83 | 295.19 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6507155 | DW-BUSHEN | A | 556810 | 4810340 | 292.00 | 294.57 | 10 |
| 6507160 | DW-MORTON | A | 564690 | 4800326 | 255.73 | 263.81 | 10 |
| 6507168 | CL43-91 | A | 558716 | 4802050 | 290.97 | 284.36 | 9 |
| 6507169 | DW-BARTOLO | A | 548365 | 4806060 | 279.73 | 282.69 | 7 |
| 6507192 | DW-SPRATT TM LTD | A | 561291 | 4795919 | 255.12 | 250.38 | 10 |
| 6507193 | DW-GINGRICH | A | 559051 | 4799479 | 285.90 | 281.68 | 5 |
| 6507198 | DW-CREZEL | A | 562317 | 4799530 | 260.61 | 269.84 | 10 |
| 6507214 | DW-NATURALL FARMS | A | 560505 | 4797751 | 276.76 | 273.46 | 9 |
| 6507245 | DW-GRIFFIN GROUNDWAT | A | 553933 | 4809191 | 299.98 | 296.00 | 6 |
| 6507246 | DW-GRIFFIN GROUNDWAT | A | 553948 | 4809281 | 301.05 | 295.96 | 6 |
| 6507248 | DW-GRIFFIN GROUNDWAT | A | 554003 | 4809261 | 303.58 | 295.96 | 3 |
| 6507258 | DW-WEIR | A | 551592 | 4813576 | 312.73 | 317.58 | 6 |
| 6507267 | DW-WEIGL | A | 555307 | 4796185 | 261.22 | 269.00 | 9 |
| 6507294 | DW-CABRAL | A | 559915 | 4801164 | 288.65 | 287.03 | 5 |
| 6507296 | DW-CAMBRIDGE LANDSCA | A | 560992 | 4799245 | 272.80 | 280.47 | 9 |
| 6507320 | DW-ORIENTAL SPORTSCL | A | 560901 | 4799475 | 269.84 | 282.71 | 9 |
| 6507328 | CL-PW2-92 | A | 558797 | 4801787 | 287.74 | 284.49 | 3 |
| 6507329 | DW-PAYNE | A | 560138 | 4795167 | 270.06 | 259.74 | 4 |
| 6507335 | DW-LAUGALYS | A | 553440 | 4809033 | 296.88 | 300.45 | 10 |
| 6507419 | DW-TAYLOR | A | 555458 | 4793693 | 248.57 | 254.53 | 9 |
| 6507455 | DW-JAMES | A | 560041 | 4795598 | 271.72 | 260.79 | 4 |
| 6507456 | DW-PFEIFFER | A | 552175 | 4807266 | 276.86 | 288.98 | 9 |
| 6507457 | DW-DOYLE | A | 553730 | 4808523 | 290.25 | 295.34 | 13 |
| 1001017 |  | A | 550251 | 4795646 | 307.78 | 312.77 | 5 |
| 6507470 | DW-KNUTSON | A | 553967 | 4808021 | 269.30 | 291.79 | 12 |
| 6507471 | DW | A | 561333 | 4798421 | 265.87 | 272.65 | 9 |
| 6507472 | DW | A | 561333 | 4798501 | 260.26 | 273.57 | 10 |
| 6507496 | DW-GOUTEM | A | 553716 | 4808219 | 282.28 | 290.72 | 9 |
| 6507497 | DW-MURCOR | A | 560801 | 4798866 | 279.77 | 279.09 | 7 |
| 6507498 | DW-SOUTHEND | A | 560118 | 4795433 | 270.05 | 259.51 | 5 |
| 6507519 | DW-DETTWEILER | A | 552980 | 4808444 | 300.74 | 299.65 | 6 |
| 6507520 | DW-DOBBIE | A | 552965 | 4808404 | 298.99 | 299.18 | 9 |
| 6507532 | DW-FACH | A | 554664 | 4813231 | 313.94 | 312.78 | 6 |
| 6507533 | DW-SITTLER | A | 563596 | 4800625 | 267.16 | 266.13 | 10 |
| 6507534 | DW-GALVAO | A | 561318 | 4799265 | 271.07 | 279.83 | 9 |
| 1001030 |  | A | 556195 | 4795463 | 258.37 | 264.66 | 10 |
| 6507548 | DW-DAMM | A | 549262 | 4801876 | 301.39 | 298.19 | 6 |
| 6507553 | DW-SOLOMON | A | 548120 | 4806138 | 278.39 | 283.38 | 8 |
| 1001035 |  | A | 547028 | 4799723 | 302.04 | 303.31 | 5 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6507570 | DW-AUTOMATIC TOOLING | A | 551996 | 4807021 | 295.73 | 287.02 | 9 |
| 6507584 | DW-HAFEMANN | A | 552866 | 4814103 | 310.88 | 316.57 | 10 |
| 6507590 | DW-YOANIDIS | A | 553899 | 4808353 | 283.30 | 293.79 | 12 |
| 6507603 | DW-BUTLER | A | 552938 | 4806062 | 280.02 | 282.60 | 6 |
| 1001039 | | A | 548509 | 4800206 | 303.17 | 313.76 | 5 |
| 6507862 | | A | 561448 | 4799412 | 271.88 | 280.45 | 9 |
| 6507863 | | A | 560102 | 4803069 | 292.92 | 292.46 | 9 |
| 6507865 | | A | 562473 | 4803708 | 297.48 | 294.14 | 3 |
| 6507866 | | A | 562129 | 4803742 | 297.18 | 295.35 | 3 |
| 6507867 | | A | 562192 | 4803741 | 298.40 | 295.17 | 3 |
| 6507868 | | A | 562248 | 4803811 | 300.23 | 295.34 | 3 |
| 6507869 | | A | 562555 | 4804326 | 299.93 | 296.90 | 3 |
| 6702272 | | A | 559852 | 4806897 | 297.79 | 302.64 | 7 |
| 6702305 | | A | 559859 | 4808314 | 303.19 | 303.68 | 3 |
| 6703187 | | A | 564704 | 4814103 | 324.00 | 316.18 | 11 |
| 6703262 | | A | 564614 | 4811483 | 308.76 | 310.24 | 12 |
| 6703315 | | A | 563114 | 4811203 | 315.63 | 316.76 | 7 |
| 6703347 | | A | 561994 | 4813073 | 323.09 | 306.77 | 12 |
| 6703348 | | A | 564454 | 4813643 | 328.58 | 313.19 | 12 |
| 6703354 | | A | 556994 | 4814483 | 304.80 | 306.48 | 10 |
| 6703370 | | A | 563134 | 4812083 | 316.99 | 307.36 | 12 |
| 6703371 | | A | 555214 | 4817123 | 333.18 | 322.17 | 9 |
| 6703373 | | A | 568374 | 4811563 | 314.25 | 312.45 | 4 |
| 6703385 | | A | 565574 | 4811203 | 310.89 | 310.93 | 11 |
| 6703404 | | A | 557364 | 4816573 | 329.57 | 317.34 | 9 |
| 6703426 | | A | 564254 | 4811423 | 314.25 | 317.44 | 9 |
| 6703438 | | A | 564874 | 4811673 | 315.17 | 310.98 | 12 |
| 6703451 | | A | 556224 | 4817733 | 324.78 | 316.35 | 13 |
| 6703460 | | A | 565524 | 4805583 | 300.54 | 298.19 | 9 |
| 6703467 | | A | 557614 | 4815123 | 301.77 | 306.56 | 11 |
| 6703484 | | A | 557414 | 4815163 | 305.24 | 308.40 | 11 |
| 6703492 | | A | 559594 | 4808223 | 303.89 | 303.40 | 8 |
| 6703496 | | A | 569944 | 4812433 | 309.99 | 319.55 | 9 |
| 6703535 | | A | 567884 | 4810143 | 299.92 | 310.94 | 13 |
| 6703552 | | A | 567794 | 4811613 | 306.64 | 308.74 | 11 |
| 6703590 | | A | 560804 | 4812643 | 311.14 | 305.95 | 13 |
| 6703600 | | A | 564314 | 4813613 | 326.14 | 312.48 | 12 |
| 6703601 | | A | 559894 | 4807903 | 302.73 | 303.14 | 8 |
| 6703607 | | A | 561394 | 4810963 | 309.98 | 311.49 | 9 |
| 6703614 | | A | 570804 | 4810123 | 308.15 | 318.66 | 7 |
| 6703640 | | A | 568574 | 4811553 | 306.63 | 311.63 | 13 |
| 6703648 | | A | 565134 | 4812483 | 315.46 | 321.45 | 7 |
| 6703666 | | A | 554224 | 4815923 | 313.48 | 320.02 | 10 |
| 6703671 | | A | 564224 | 4814623 | 324.92 | 321.66 | 11 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6703673 | | A | 560414 | 4813653 | 318.52 | 316.40 | 9 |
| 6703719 | | A | 554254 | 4815923 | 314.55 | 318.28 | 12 |
| 6703721 | | A | 560184 | 4807793 | 303.89 | 303.82 | 6 |
| 6703722 | | A | 558764 | 4807773 | 302.36 | 301.23 | 9 |
| 6703732 | | A | 563514 | 4813103 | 321.56 | 308.45 | 12 |
| 6703780 | | A | 556264 | 4813803 | 303.67 | 306.85 | 10 |
| 6703784 | | A | 558854 | 4807773 | 304.19 | 301.51 | 9 |
| 6703804 | | A | 563834 | 4811293 | 320.04 | 317.44 | 7 |
| 6703819 | | A | 558537 | 4806345 | 306.87 | 298.44 | 8 |
| 6703822 | | A | 560664 | 4807173 | 300.23 | 304.02 | 7 |
| 6703823 | | A | 565504 | 4811483 | 311.81 | 313.50 | 9 |
| 6703849 | | A | 566374 | 4807563 | 305.10 | 306.71 | 9 |
| 6703852 | | A | 567734 | 4811693 | 306.81 | 308.10 | 5 |
| 6703855 | | A | 570534 | 4809973 | 305.71 | 318.02 | 10 |
| 6703856 | | A | 564384 | 4811443 | 312.11 | 317.30 | 7 |
| 6703865 | | A | 565314 | 4814173 | 322.42 | 327.87 | 10 |
| 6703867 | | A | 564054 | 4813543 | 324.31 | 311.09 | 12 |
| 6703869 | | A | 565474 | 4805543 | 299.92 | 297.88 | 9 |
| 6703894 | | A | 559924 | 4808973 | 305.10 | 305.47 | 3 |
| 6703900 | | A | 565184 | 4812413 | 312.42 | 312.70 | 12 |
| 6703909 | | A | 565174 | 4812063 | 314.25 | 318.42 | 10 |
| 6703920 | | A | 557689 | 4815148 | 304.24 | 306.94 | 12 |
| 6704020 | | A | 557664 | 4815173 | 300.89 | 307.09 | 12 |
| 6704029 | | A | 557114 | 4816648 | 326.44 | 319.00 | 9 |
| 6704031 | | A | 562454 | 4810963 | 313.64 | 314.66 | 7 |
| 6704038 | | A | 569614 | 4809823 | 305.41 | 316.70 | 6 |
| 6704040 | | A | 558984 | 4812263 | 308.26 | 310.32 | 7 |
| 6704041 | | A | 567724 | 4811683 | 306.63 | 308.27 | 8 |
| 6704042 | | A | 569774 | 4809483 | 303.28 | 316.12 | 7 |
| 6704044 | | A | 560732 | 4812793 | 310.90 | 315.14 | 10 |
| 6704046 | | A | 570604 | 4810053 | 310.59 | 318.35 | 9 |
| 6704048 | | A | 559904 | 4810423 | 306.32 | 307.91 | 6 |
| 6704049 | | A | 560139 | 4806923 | 301.47 | 302.72 | 7 |
| 6704050 | | A | 560089 | 4806898 | 303.51 | 302.72 | 7 |
| 1001077 | | A | 547606 | 4803253 | 297.28 | 293.06 | 6 |
| 6704072 | | A | 561134 | 4812783 | 317.02 | 316.19 | 9 |
| 6704098 | | A | 562894 | 4811083 | 312.42 | 316.00 | 7 |
| 6704109 | | A | 557944 | 4812003 | 301.75 | 301.40 | 10 |
| 6704137 | | A | 557364 | 4811323 | 298.10 | 298.01 | 9 |
| 6704141 | | A | 563854 | 4805173 | 293.74 | 296.30 | 9 |
| 6704142 | | A | 566864 | 4805893 | 292.60 | 296.09 | 9 |
| 6704213 | | A | 560289 | 4807073 | 292.61 | 302.85 | 10 |
| 6704217 | | A | 561904 | 4809513 | 303.73 | 309.34 | 5 |
| 6704229 | | A | 559714 | 4806073 | 304.80 | 301.20 | 9 |
| 6704249 | | A | 564514 | 4814283 | 322.47 | 314.50 | 12 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6704286 | | A | 555364 | 4815798 | 322.68 | 320.27 | 9 |
| 6704296 | | A | 562334 | 4811013 | 313.94 | 314.38 | 9 |
| 6704302 | | A | 558964 | 4814398 | 309.66 | 307.55 | 9 |
| 6704314 | | A | 558439 | 4807723 | 311.20 | 300.82 | 6 |
| 6704325 | | A | 567154 | 4812093 | 312.42 | 309.76 | 9 |
| 6704326 | | A | 569014 | 4807323 | 290.30 | 293.06 | 10 |
| 6704331 | | A | 565554 | 4811323 | 309.06 | 311.96 | 9 |
| 6704332 | | A | 560439 | 4807923 | 299.31 | 304.43 | 8 |
| 6704342 | | A | 558264 | 4816173 | 309.68 | 310.79 | 10 |
| 6704352 | | A | 569574 | 4812903 | 317.60 | 313.23 | 13 |
| 6704356 | | A | 561574 | 4804633 | 298.70 | 299.63 | 6 |
| 6704389 | | A | 569634 | 4809783 | 307.24 | 316.64 | 6 |
| 6704390 | | A | 563974 | 4813563 | 326.14 | 326.27 | 7 |
| 6704391 | | A | 558939 | 4805923 | 303.98 | 300.66 | 5 |
| 6704393 | | A | 557164 | 4811273 | 298.77 | 296.91 | 8 |
| 6704398 | | A | 560164 | 4806973 | 294.51 | 302.73 | 8 |
| 6704401 | | A | 569454 | 4812703 | 313.94 | 316.05 | 10 |
| 6704421 | | A | 563154 | 4814143 | 306.33 | 307.09 | 13 |
| 6704479 | | A | 558739 | 4807798 | 290.78 | 301.21 | 8 |
| 6704486 | | A | 566574 | 4808383 | 298.40 | 307.11 | 6 |
| 6704487 | | A | 558714 | 4807823 | 300.23 | 301.26 | 6 |
| 6704500 | | A | 561604 | 4804643 | 292.61 | 299.62 | 7 |
| 6704511 | | A | 563594 | 4813983 | 326.14 | 326.27 | 10 |
| 6704518 | | A | 560694 | 4806213 | 302.21 | 302.72 | 5 |
| 6704520 | | A | 559024 | 4811573 | 303.27 | 308.17 | 8 |
| 6704531 | | A | 565164 | 4812333 | 316.99 | 320.10 | 10 |
| 6704550 | | A | 558849 | 4807833 | 303.58 | 301.28 | 9 |
| 6704558 | | A | 560225 | 4807814 | 304.50 | 304.26 | 3 |
| 6704559 | | A | 557707 | 4815081 | 301.92 | 304.83 | 10 |
| 6704562 | | A | 557329 | 4814830 | 299.77 | 306.52 | 10 |
| 6704568 | | A | 570344 | 4808403 | 296.88 | 309.38 | 8 |
| 6704576 | | A | 559257 | 4810938 | 306.93 | 306.83 | 6 |
| 1001102 | | A | 547203 | 4801170 | 301.75 | 304.74 | 6 |
| 6704628 | | A | 558177 | 4814661 | 296.57 | 299.01 | 10 |
| 6704629 | | A | 560956 | 4812703 | 313.07 | 314.95 | 10 |
| 6704635 | | A | 558953 | 4815561 | 306.33 | 304.53 | 11 |
| 6704636 | | A | 558504 | 4815789 | 308.26 | 307.52 | 10 |
| 6704656 | | A | 563554 | 4811188 | 323.70 | 317.21 | 7 |
| 6704657 | | A | 559191 | 4814515 | 312.72 | 308.20 | 9 |
| 1001113 | | A | 549456 | 4795052 | 307.25 | 311.04 | 6 |
| 6704673 | | A | 567673 | 4813039 | 314.86 | 314.50 | 7 |
| 6704686 | | A | 562751 | 4811041 | 315.73 | 315.59 | 7 |
| 6704687 | | A | 565259 | 4811693 | 315.77 | 315.88 | 8 |
| 6704692 | | A | 566810 | 4807606 | 300.22 | 307.30 | 10 |
| 1001114 | | A | 548625 | 4800224 | 303.70 | 313.90 | 6 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6704693 | | A | 568214 | 4809488 | 306.32 | 312.34 | 7 |
| 6704694 | | A | 557337 | 4811265 | 298.71 | 297.74 | 8 |
| 6704695 | | A | 557366 | 4811315 | 299.62 | 297.95 | 7 |
| 6704698 | | A | 560158 | 4806955 | 299.93 | 303.50 | 6 |
| 6704719 | | A | 568191 | 4809783 | 306.02 | 311.74 | 12 |
| 6704728 | | A | 556273 | 4817794 | 326.18 | 322.81 | 10 |
| 6704741 | | A | 557616 | 4811321 | 299.31 | 298.94 | 9 |
| 6704742 | | A | 558259 | 4812099 | 306.63 | 304.40 | 9 |
| 1001122 | | A | 550811 | 4797192 | 307.79 | 320.47 | 6 |
| 6704769 | | A | 566493 | 4808085 | 296.29 | 307.14 | 10 |
| 6704785 | | A | 557054 | 4816543 | 325.52 | 319.08 | 9 |
| 1001130 | | A | 552440 | 4796195 | 307.57 | 314.91 | 5 |
| 6704826 | | A | 568974 | 4807263 | 288.64 | 292.72 | 10 |
| 6704841 | | A | 561336 | 4806508 | 303.31 | 303.36 | 5 |
| 6704843 | | A | 566121 | 4813361 | 316.99 | 323.21 | 7 |
| 6704858 | | A | 563180 | 4811781 | 313.39 | 319.43 | 9 |
| 6704959 | | A | 561275 | 4806484 | 298.40 | 303.37 | 8 |
| 6704969 | | A | 567832 | 4813260 | 297.18 | 314.78 | 13 |
| 6704990 | | A | 560145 | 4810345 | 308.46 | 308.38 | 8 |
| 6705008 | | A | 567593 | 4812085 | 307.85 | 309.23 | 10 |
| 6705023 | | A | 562305 | 4804821 | 297.18 | 299.63 | 8 |
| 6705029 | | A | 567317 | 4812307 | 309.86 | 312.87 | 12 |
| 6705048 | | A | 564413 | 4811435 | 318.52 | 317.20 | 7 |
| 6705089 | | A | 562683 | 4811141 | 317.37 | 315.72 | 9 |
| 6705091 | | A | 565540 | 4811635 | 308.25 | 314.38 | 10 |
| 6705094 | | A | 567155 | 4807759 | 301.75 | 307.36 | 10 |
| 6705097 | | A | 568464 | 4808858 | 301.76 | 310.07 | 13 |
| 6705112 | | A | 556254 | 4814403 | 315.16 | 310.88 | 9 |
| 6705113 | | A | 563783 | 4805247 | 298.09 | 297.20 | 6 |
| 6705144 | | A | 559514 | 4808073 | 302.37 | 302.91 | 9 |
| 6705162 | | A | 557014 | 4816503 | 327.66 | 318.02 | 10 |
| 6705189 | | A | 562512 | 4810948 | 309.37 | 314.78 | 9 |
| 6705193 | | A | 566537 | 4808404 | 306.94 | 306.97 | 4 |
| 6705194 | | A | 566417 | 4808339 | 308.76 | 306.66 | 6 |
| 6705218 | | A | 562349 | 4810897 | 302.49 | 314.19 | 9 |
| 6705239 | | A | 557614 | 4815223 | 301.75 | 307.35 | 12 |
| 6705284 | | A | 564555 | 4814369 | 330.52 | 328.68 | 7 |
| 6705330 | | A | 568095 | 4809837 | 304.80 | 312.22 | 10 |
| 6705335 | | A | 558942 | 4811976 | 306.53 | 307.60 | 11 |
| 6705378 | | A | 569116 | 4808402 | 296.57 | 307.52 | 10 |
| 6705383 | | A | 559114 | 4811423 | 301.76 | 307.75 | 8 |
| 6705385 | | A | 568509 | 4808913 | 311.91 | 311.79 | 7 |
| 6705392 | | A | 557110 | 4811836 | 295.05 | 299.26 | 10 |
| 6705488 | | A | 567634 | 4811560 | 302.36 | 311.76 | 12 |
| 6705510 | | A | 570975 | 4810584 | 325.05 | 320.39 | 7 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6705521 | | A | 558164 | 4807373 | 310.04 | 299.16 | 6 |
| 6705523 | | A | 557397 | 4811887 | 280.95 | 298.99 | 10 |
| 6705550 | | A | 563505 | 4813454 | 318.82 | 324.47 | 10 |
| 6705555 | | A | 557274 | 4816803 | 325.53 | 318.72 | 9 |
| 6705566 | | A | 570354 | 4812050 | 303.53 | 318.04 | 13 |
| 6705567 | | A | 558755 | 4807743 | 300.84 | 300.92 | 9 |
| 6705611 | | A | 557734 | 4815123 | 300.44 | 306.78 | 13 |
| 6705625 | | A | 568929 | 4807315 | 277.97 | 294.37 | 11 |
| 6705682 | | A | 557514 | 4815223 | 304.70 | 308.46 | 10 |
| 6705737 | | A | 570823 | 4806883 | 286.51 | 287.68 | 10 |
| 6705773 | | A | 569305 | 4811654 | 309.38 | 315.63 | 10 |
| 6705805 | | A | 557394 | 4814923 | 300.54 | 306.76 | 10 |
| 6705826 | | A | 559129 | 4810174 | 300.18 | 305.34 | 10 |
| 6705851 | | A | 564084 | 4809205 | 303.28 | 304.81 | 6 |
| 6705870 | | A | 567138 | 4812055 | 306.79 | 309.70 | 10 |
| 6705872 | | A | 569137 | 4806966 | 287.43 | 288.67 | 10 |
| 6705876 | | A | 565508 | 4812167 | 313.34 | 318.05 | 10 |
| 6705877 | | A | 569575 | 4809782 | 306.33 | 316.53 | 7 |
| 6705884 | | A | 560287 | 4810943 | 311.81 | 309.43 | 9 |
| 6705967 | | A | 564764 | 4813647 | 323.70 | 314.19 | 12 |
| 6705970 | | A | 566865 | 4807314 | 311.81 | 306.19 | 5 |
| 6705971 | | A | 561623 | 4813258 | 325.83 | 320.23 | 10 |
| 6705988 | | A | 560231 | 4806895 | 301.75 | 303.51 | 5 |
| 6706014 | | A | 566726 | 4807791 | 307.24 | 307.83 | 5 |
| 6706027 | | A | 558518 | 4806415 | 302.21 | 297.69 | 9 |
| 6706096 | | A | 559989 | 4808071 | 300.44 | 303.56 | 9 |
| 6706097 | | A | 558608 | 4808944 | 300.93 | 302.66 | 9 |
| 6706105 | | A | 560593 | 4813731 | 287.43 | 305.86 | 13 |
| 6706106 | | A | 556534 | 4813863 | 302.97 | 305.52 | 10 |
| 6706156 | | A | 565814 | 4813543 | 324.00 | 317.39 | 11 |
| 6706160 | | A | 558614 | 4808903 | 306.94 | 302.91 | 9 |
| 6706198 | | A | 558694 | 4805803 | 295.65 | 298.72 | 9 |
| 6706220 | | A | 567034 | 4806483 | 290.17 | 300.06 | 10 |
| 6706259 | | A | 568234 | 4808223 | 301.75 | 308.89 | 7 |
| 6706261 | | A | 564574 | 4805343 | 296.67 | 294.91 | 3 |
| 6706264 | | A | 563254 | 4811703 | 309.98 | 316.80 | 11 |
| 6706296 | | A | 570762 | 4806833 | 284.99 | 287.36 | 10 |
| 6706317 | | A | 566434 | 4808123 | 303.58 | 306.97 | 6 |
| 6706318 | | A | 567774 | 4808083 | 305.41 | 308.53 | 5 |
| 6706344 | | A | 561374 | 4812843 | 317.20 | 317.65 | 10 |
| 6706346 | | A | 566434 | 4808443 | 306.31 | 306.58 | 9 |
| 6706365 | | A | 556254 | 4815843 | 317.30 | 314.33 | 10 |
| 6706431 | | A | 558154 | 4808943 | 303.58 | 301.47 | 4 |
| 6706432 | | A | 558654 | 4807683 | 304.80 | 300.54 | 8 |
| 6706444 | | A | 568514 | 4810943 | 308.76 | 311.75 | 4 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6706483 | | A | 561414 | 4810723 | 312.92 | 311.27 | 8 |
| 6706503 | | A | 561134 | 4809763 | 311.20 | 309.11 | 3 |
| 6706533 | | A | 564614 | 4814023 | 323.59 | 327.72 | 10 |
| 6706546 | | A | 558434 | 4808923 | 302.52 | 300.64 | 14 |
| 6706556 | | A | 560834 | 4812763 | 315.17 | 309.64 | 11 |
| 6706563 | | A | 556174 | 4814423 | 313.33 | 309.84 | 10 |
| 6706570 | | A | 562774 | 4811023 | 311.51 | 315.55 | 9 |
| 6706576 | | A | 570154 | 4809283 | 299.32 | 313.95 | 13 |
| 6706615 | | A | 558674 | 4807363 | 305.11 | 299.58 | 8 |
| 6706619 | | A | 567434 | 4811683 | 305.18 | 311.89 | 12 |
| 6706620 | | A | 566474 | 4812183 | 307.22 | 312.95 | 13 |
| 6706627 | | A | 569414 | 4808363 | 297.48 | 306.35 | 10 |
| 6706694 | | A | 570514 | 4812023 | 311.81 | 318.91 | 14 |
| 6706724 | | A | 566514 | 4808743 | 303.53 | 306.69 | 8 |
| 6706771 | | A | 567214 | 4812523 | 303.99 | 312.12 | 11 |
| 6706774 | | A | 564194 | 4808483 | 300.53 | 300.33 | 10 |
| 6706807 | | A | 566674 | 4808343 | 308.76 | 307.41 | 6 |
| 6706808 | TW 14 | A | 557734 | 4811403 | 302.37 | 301.34 | 12 |
| 6706821 | | A | 557714 | 4816623 | 324.00 | 315.35 | 10 |
| 6706874 | | A | 569474 | 4809943 | 305.41 | 316.56 | 6 |
| 6706875 | | A | 570534 | 4808823 | 305.56 | 310.55 | 13 |
| 6706876 | | A | 561654 | 4804643 | 289.56 | 299.58 | 9 |
| 6706881 | | A | 565094 | 4809303 | 300.23 | 304.11 | 9 |
| 6706882 | | A | 558814 | 4812243 | 310.90 | 309.45 | 9 |
| 6706885 | | A | 557434 | 4812683 | 296.26 | 297.69 | 10 |
| 6706916 | | A | 568814 | 4810343 | 311.15 | 314.38 | 10 |
| 6706947 | | A | 561534 | 4814823 | 321.52 | 320.76 | 5 |
| 6706953 | | A | 565014 | 4811643 | 309.68 | 316.41 | 9 |
| 6706982 | | A | 564994 | 4813523 | 316.74 | 314.69 | 12 |
| 6707021 | | A | 560134 | 4807843 | 302.62 | 304.13 | 3 |
| 6707041 | | A | 559934 | 4805043 | 298.86 | 297.24 | 12 |
| 6707043 | | A | 566614 | 4805963 | 293.56 | 297.83 | 10 |
| 6707091 | | A | 570294 | 4812123 | 312.54 | 321.40 | 8 |
| 6707092 | | A | 558954 | 4812043 | 306.09 | 309.52 | 6 |
| 6707200 | | A | 566294 | 4807683 | 297.26 | 306.67 | 10 |
| 6707201 | | A | 567574 | 4807883 | 304.13 | 307.75 | 5 |
| 6707202 | | A | 567294 | 4807923 | 314.04 | 307.81 | 9 |
| 6707204 | | A | 557454 | 4812683 | 297.71 | 297.79 | 10 |
| 6707208 | | A | 569534 | 4808463 | 303.16 | 308.84 | 6 |
| 6707222 | | A | 560014 | 4806243 | 302.06 | 302.42 | 3 |
| 6707241 | | A | 569494 | 4812183 | 318.49 | 316.94 | 10 |
| 6707265 | | A | 558634 | 4807723 | 300.23 | 300.00 | 9 |
| 6707266 | | A | 558854 | 4807783 | 304.29 | 301.23 | 9 |
| 6707271 | | A | 569314 | 4811663 | 309.38 | 315.65 | 10 |
| 6707273 | | A | 568954 | 4812523 | 309.18 | 308.61 | 14 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6707290 | | A | 569194 | 4812803 | 310.28 | 307.29 | 13 |
| 6707297 | | A | 563594 | 4814723 | 324.91 | 327.86 | 9 |
| 6707298 | | A | 570714 | 4812063 | 319.69 | 320.01 | 11 |
| 6707317 | TW11/16-80 | A | 565094 | 4808763 | 303.58 | 302.10 | 11 |
| 6707387 | | A | 566991 | 4806944 | 301.33 | 303.86 | 6 |
| 6707441 | | A | 564114 | 4811423 | 309.37 | 317.66 | 8 |
| 6707454 | | A | 570494 | 4806883 | 286.51 | 287.40 | 10 |
| 6707457 | | A | 567794 | 4809923 | 305.41 | 310.88 | 10 |
| 6707516 | | A | 557688 | 4815319 | 300.94 | 307.31 | 13 |
| 6707576 | | A | 570434 | 4811983 | 320.65 | 321.82 | 7 |
| 6707580 | | A | 558894 | 4808743 | 302.20 | 303.17 | 9 |
| 6707581 | | A | 568374 | 4813103 | 312.11 | 313.15 | 13 |
| 6707583 | | A | 564994 | 4805443 | 293.22 | 296.22 | 9 |
| 6707585 | | A | 569874 | 4812423 | 321.78 | 319.04 | 10 |
| 6707714 | | A | 556454 | 4816963 | 320.04 | 314.58 | 13 |
| 6707737 | | A | 565454 | 4813843 | 318.33 | 326.81 | 10 |
| 6707738 | | A | 560534 | 4807583 | 299.62 | 304.45 | 4 |
| 6707760 | | A | 560054 | 4808423 | 303.51 | 304.43 | 6 |
| 6707762 | | A | 568554 | 4810923 | 306.62 | 312.14 | 11 |
| 6707797 | | A | 568974 | 4812563 | 307.41 | 308.18 | 13 |
| 6707851 | | A | 557174 | 4810723 | 299.88 | 296.56 | 9 |
| 6707877 | | A | 556192 | 4813625 | 311.33 | 306.46 | 10 |
| 6707912 | | A | 557414 | 4811263 | 299.12 | 298.08 | 9 |
| 6707914 | | A | 558714 | 4810423 | 298.26 | 303.93 | 9 |
| 6707935 | | A | 568334 | 4812943 | 306.63 | 312.63 | 13 |
| 6707994 | | A | 559794 | 4806003 | 300.22 | 301.28 | 7 |
| 6708041 | | A | 556214 | 4815763 | 317.83 | 317.42 | 9 |
| 6708045 | | A | 557594 | 4812143 | 298.70 | 298.69 | 5 |
| 6708076 | | A | 568354 | 4812983 | 306.63 | 312.72 | 13 |
| 6708094 | | A | 568594 | 4808243 | 302.76 | 308.38 | 6 |
| 6708095 | | A | 562014 | 4810803 | 314.22 | 312.65 | 10 |
| 6708127 | | A | 566934 | 4812403 | 309.99 | 310.96 | 5 |
| 6708178 | | A | 557790 | 4815572 | 307.55 | 308.84 | 10 |
| 6708185 | | A | 558685 | 4807694 | 305.27 | 300.88 | 6 |
| 6708206 | | A | 559396 | 4812321 | 315.69 | 311.61 | 9 |
| 6708207 | | A | 557202 | 4813261 | 291.05 | 294.15 | 10 |
| 6708224 | | A | 562313 | 4810583 | 313.90 | 313.09 | 7 |
| 6708236 | | A | 560945 | 4811262 | 313.08 | 311.69 | 9 |
| 6708267 | | A | 560979 | 4811206 | 312.60 | 311.25 | 10 |
| 6708298 | | A | 556979 | 4816412 | 324.12 | 317.24 | 10 |
| 6708304 | | A | 557174 | 4811430 | 298.09 | 297.35 | 9 |
| 6708316 | | A | 564005 | 4811629 | 315.49 | 318.97 | 7 |
| 6708318 | | A | 558710 | 4807699 | 302.34 | 300.83 | 8 |
| 6708330 | | A | 557169 | 4810613 | 296.81 | 298.00 | 10 |
| 6708331 | | A | 563847 | 4810750 | 314.08 | 314.43 | 7 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6708332 | | A | 560518 | 4810649 | 309.64 | 310.02 | 9 |
| 6708334 | | A | 563722 | 4814423 | 325.06 | 327.83 | 7 |
| 6708335 | | A | 558768 | 4807878 | 305.12 | 301.66 | 6 |
| 6708337 | | A | 568654 | 4807926 | 304.94 | 305.05 | 5 |
| 6708385 | | A | 561055 | 4804537 | 288.55 | 299.37 | 8 |
| 6708408 | | A | 564837 | 4809477 | 303.79 | 305.44 | 10 |
| 6708492 | | A | 558704 | 4807771 | 303.17 | 300.91 | 9 |
| 6708511 | | A | 566614 | 4809841 | 305.26 | 307.89 | 7 |
| 6708512 | | A | 562224 | 4810532 | 309.52 | 308.44 | 11 |
| 6708515 | | A | 555134 | 4815363 | 321.87 | 319.37 | 9 |
| 6708537 | | A | 566480 | 4808321 | 303.07 | 306.90 | 7 |
| 6708538 | | A | 562117 | 4810801 | 313.90 | 310.27 | 11 |
| 6708539 | | A | 560043 | 4812496 | 308.34 | 313.40 | 7 |
| 6708573 | | A | 558533 | 4807706 | 303.29 | 299.77 | 8 |
| 6708574 | | A | 570657 | 4808699 | 299.66 | 311.91 | 10 |
| 6708588 | | A | 556675 | 4816537 | 324.53 | 319.92 | 9 |
| 6708668 | | A | 557211 | 4815602 | 314.51 | 309.43 | 13 |
| 6708696 | | A | 560291 | 4806472 | 301.31 | 302.83 | 5 |
| 1301369 | | A | 552644 | 4792223 | 264.27 | 259.36 | 7 |
| 6708697 | | A | 560251 | 4807792 | 299.65 | 304.30 | 3 |
| 6708698 | | A | 570380 | 4807250 | 285.93 | 289.64 | 10 |
| 6708732 | | A | 555853 | 4815384 | 318.90 | 317.54 | 9 |
| 6708737 | | A | 564883 | 4806660 | 301.15 | 302.99 | 5 |
| 6708738 | | A | 565623 | 4814068 | 323.46 | 328.24 | 5 |
| 6708739 | | A | 559257 | 4810429 | 303.25 | 306.19 | 6 |
| 6708761 | | A | 559029 | 4814495 | 310.90 | 306.44 | 11 |
| 6708795 | | A | 564573 | 4811089 | 317.38 | 314.60 | 9 |
| 6708859 | | A | 560922 | 4812700 | 312.99 | 315.01 | 7 |
| 6708884 | | A | 557913 | 4810060 | 294.46 | 300.18 | 10 |
| 1301386 | | A | 557214 | 4793973 | 265.48 | 265.02 | 3 |
| 6708978 | | A | 564393 | 4813685 | 324.76 | 326.98 | 8 |
| 6709102 | | A | 570456 | 4811904 | 313.14 | 321.64 | 10 |
| 6709103 | | A | 561313 | 4812744 | 315.55 | 316.82 | 9 |
| 6709104 | | A | 557395 | 4810083 | 300.79 | 298.35 | 5 |
| 1301407 | | A | 560384 | 4794593 | 257.25 | 252.05 | 5 |
| 6709134 | | A | 562652 | 4811099 | 314.33 | 315.56 | 7 |
| 1301418 | | A | 558584 | 4792773 | 263.96 | 258.13 | 4 |
| 6709136 | | A | 558693 | 4808905 | 302.32 | 302.93 | 9 |
| 6709165 | | A | 558520 | 4807954 | 303.92 | 300.81 | 9 |
| 6709166 | | A | 559976 | 4808071 | 303.42 | 303.56 | 8 |
| 6709237 | | A | 564560 | 4809542 | 303.21 | 306.41 | 8 |
| 6709239 | | A | 563936 | 4814418 | 329.72 | 328.16 | 8 |
| 6709266 | | A | 563251 | 4811449 | 319.81 | 318.14 | 9 |
| 1301423 | | A | 552504 | 4792793 | 286.82 | 271.65 | 9 |
| 6709322 | | A | 565540 | 4809717 | 301.34 | 305.14 | 10 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6709387 | | A | 561698 | 4812783 | 320.51 | 318.86 | 8 |
| 6709407 | | A | 559794 | 4804364 | 295.31 | 298.12 | 5 |
| 6709411 | | A | 562516 | 4813269 | 320.73 | 322.45 | 9 |
| 6709414 | | A | 560033 | 4807897 | 304.87 | 303.50 | 9 |
| 6709478 | | A | 570658 | 4812485 | 316.99 | 318.15 | 13 |
| 6709523 | | A | 559626 | 4808263 | 303.22 | 303.67 | 3 |
| 6709524 | | A | 558761 | 4807902 | 303.13 | 301.57 | 8 |
| 6709654 | | A | 565776 | 4810979 | 307.90 | 309.19 | 10 |
| 1301497 | | A | 553304 | 4791643 | 254.79 | 251.50 | 9 |
| 6709668 | | A | 560047 | 4808075 | 290.86 | 303.71 | 6 |
| 1301529 | | A | 549624 | 4791783 | 277.98 | 292.10 | 6 |
| 6709690 | | A | 559882 | 4810450 | 309.94 | 307.87 | 7 |
| 6709695 | | A | 557702 | 4810087 | 301.02 | 299.29 | 9 |
| 6709696 | | A | 557673 | 4810022 | 297.64 | 299.40 | 9 |
| 6709781 | | A | 570746 | 4810738 | 307.44 | 320.46 | 11 |
| 6709784 | | A | 570964 | 4810635 | 309.58 | 318.94 | 12 |
| 6709806 | | A | 562954 | 4814666 | 323.90 | 326.66 | 9 |
| 1301570 | | A | 558814 | 4794293 | 265.74 | 259.65 | 8 |
| 1301573 | | A | 553034 | 4791313 | 254.51 | 249.36 | 7 |
| 6709949 | | A | 558624 | 4807617 | 300.26 | 300.09 | 9 |
| 6710008 | | A | 569484 | 4811644 | 309.80 | 314.19 | 13 |
| 6710044 | | A | 560807 | 4812870 | 320.09 | 315.75 | 7 |
| 6710048 | | A | 570834 | 4812414 | 313.57 | 323.41 | 9 |
| 6710052 | | A | 559124 | 4804290 | 301.90 | 297.54 | 5 |
| 6710076 | | A | 556243 | 4817787 | 325.47 | 316.29 | 13 |
| 6710086 | | A | 567885 | 4807982 | 303.32 | 308.12 | 6 |
| 1301585 | | A | 558264 | 4794263 | 264.69 | 261.18 | 9 |
| 6710120 | | A | 560763 | 4812634 | 314.90 | 314.61 | 5 |
| 6710189 | | A | 559719 | 4808057 | 300.82 | 303.21 | 9 |
| 6710190 | | A | 559555 | 4808166 | 300.70 | 303.17 | 9 |
| 6710193 | | A | 560634 | 4808488 | 305.90 | 306.02 | 3 |
| 6710204 | | A | 562822 | 4808706 | 306.90 | 305.48 | 6 |
| 6710209 | | A | 557377 | 4812944 | 295.94 | 297.13 | 10 |
| 6710210 | | A | 557633 | 4811412 | 292.64 | 299.09 | 9 |
| 6710255 | | A | 564398 | 4812866 | 318.76 | 324.22 | 6 |
| 6710265 | TLR-8 | A | 558876 | 4805927 | 303.34 | 300.58 | 3 |
| 6710266 | | A | 558964 | 4810119 | 306.51 | 304.97 | 6 |
| 6710331 | | A | 557060 | 4814603 | 304.62 | 307.03 | 10 |
| 6710352 | | A | 566749 | 4808122 | 303.90 | 307.65 | 5 |
| 6710389 | | A | 560432 | 4806518 | 310.11 | 303.03 | 5 |
| 1301663 | | A | 553394 | 4791813 | 254.89 | 252.38 | 9 |
| 6710443 | | A | 570891 | 4810871 | 314.32 | 321.09 | 8 |
| 6710562 | | A | 568664 | 4809522 | 293.66 | 312.56 | 12 |
| 1301693 | | A | 553204 | 4791713 | 249.94 | 250.32 | 9 |
| 6710588 | | A | 571136 | 4806891 | 284.33 | 287.78 | 10 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6710591 | | A | 569870 | 4808773 | 308.19 | 312.51 | 10 |
| 6710679 | | A | 568227 | 4806364 | 278.44 | 289.35 | 10 |
| 6710699 | | A | 561323 | 4806150 | 301.85 | 302.84 | 5 |
| 6710707 | | A | 560305 | 4807006 | 302.93 | 303.72 | 3 |
| 6710709 | | A | 560240 | 4807004 | 302.94 | 303.68 | 3 |
| 6710710 | | A | 562260 | 4807841 | 301.21 | 304.02 | 9 |
| 1301704 | | A | 560089 | 4793003 | 237.36 | 244.50 | 7 |
| 6710760 | | A | 560624 | 4806659 | 300.28 | 303.21 | 6 |
| 6710781 | | A | 559647 | 4808247 | 303.67 | 303.46 | 9 |
| 6710782 | | A | 560027 | 4808464 | 304.43 | 304.52 | 6 |
| 6710846 | TLR-22 | A | 559118 | 4804909 | 302.59 | 299.46 | 3 |
| 6710892 | | A | 560716 | 4805296 | 295.78 | 300.88 | 5 |
| 6710903 | | A | 561448 | 4810926 | 309.51 | 311.60 | 9 |
| 6710907 | | A | 559463 | 4808180 | 303.66 | 302.95 | 9 |
| 6710911 | | A | 559602 | 4808015 | 304.73 | 303.20 | 6 |
| 6710923 | | A | 560601 | 4813308 | 314.34 | 306.22 | 12 |
| 1301819 | | A | 556834 | 4792303 | 263.35 | 267.86 | 6 |
| 6710938 | | A | 565179 | 4812165 | 316.50 | 319.52 | 8 |
| 6710945 | | A | 565588 | 4811242 | 304.33 | 310.97 | 13 |
| 6711019 | | A | 566983 | 4807820 | 306.68 | 307.73 | 4 |
| 6711020 | | A | 560511 | 4807452 | 302.67 | 304.34 | 3 |
| 6711022 | | A | 558684 | 4807356 | 304.48 | 299.58 | 9 |
| 6711023 | | A | 558637 | 4807406 | 303.48 | 299.28 | 9 |
| 6711024 | | A | 557405 | 4810154 | 300.54 | 298.21 | 5 |
| 6711025 | | A | 560192 | 4807793 | 302.87 | 304.20 | 3 |
| 6711086 | | A | 561600 | 4813188 | 322.38 | 320.33 | 9 |
| 6711096 | | A | 563365 | 4811610 | 312.02 | 318.77 | 10 |
| 6711125 | | A | 570908 | 4810689 | 308.19 | 320.32 | 11 |
| 6711134 | | A | 558137 | 4815151 | 295.04 | 305.79 | 13 |
| 6711197 | | A | 568579 | 4808241 | 307.50 | 308.38 | 8 |
| 6711217 | | A | 568976 | 4807137 | 282.60 | 293.13 | 14 |
| 6711233 | | A | 558030 | 4814444 | 296.51 | 305.04 | 12 |
| 6711245 | | A | 560786 | 4812872 | 297.53 | 308.33 | 11 |
| 6711255 | | A | 559657 | 4814716 | 312.68 | 308.11 | 11 |
| 1301933 | | A | 553084 | 4791623 | 252.68 | 248.21 | 9 |
| 6711271 | | A | 562979 | 4805237 | 301.56 | 299.94 | 6 |
| 6711314 | | A | 557659 | 4815116 | 299.08 | 305.75 | 10 |
| 6711317 | | A | 568454 | 4809354 | 302.22 | 312.80 | 7 |
| 6711321 | | A | 558753 | 4805659 | 304.17 | 299.89 | 5 |
| 6711329 | | A | 560081 | 4807881 | 304.09 | 303.58 | 9 |
| 6711367 | | A | 558153 | 4815055 | 283.84 | 305.69 | 13 |
| 6711378 | | A | 569488 | 4811604 | 310.71 | 316.88 | 10 |
| 6711394 | | A | 567617 | 4812179 | 305.65 | 312.37 | 12 |
| 6711417 | | A | 570888 | 4810595 | 310.19 | 320.29 | 10 |
| 1301990 | | A | 552687 | 4792316 | 266.40 | 273.68 | 4 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6711455 | | A | 569561 | 4811898 | 307.93 | 312.68 | 13 |
| 6711465 | | A | 562068 | 4811221 | 303.20 | 305.52 | 13 |
| 1301991 | | A | 554559 | 4792305 | 256.03 | 254.94 | 9 |
| 6711485 | | A | 558821 | 4807893 | 303.08 | 301.65 | 9 |
| 6711490 | | A | 561022 | 4806414 | 300.32 | 303.23 | 5 |
| 6711545 | | A | 570823 | 4810768 | 311.71 | 320.84 | 10 |
| 6711554 | | A | 569265 | 4808543 | 306.93 | 309.46 | 10 |
| 6711558 | | A | 557817 | 4812008 | 300.99 | 299.96 | 9 |
| 6711570 | | A | 570942 | 4810908 | 305.85 | 320.50 | 11 |
| 6711633 | | A | 559103 | 4814684 | 306.12 | 304.93 | 12 |
| 6711662 | | A | 559777 | 4810373 | 300.32 | 307.53 | 7 |
| 6711670 | | A | 568703 | 4808305 | 299.66 | 308.52 | 7 |
| 6711671 | | A | 568994 | 4807658 | 293.64 | 298.28 | 10 |
| 6711680 | | A | 566332 | 4808750 | 303.43 | 305.67 | 10 |
| 6711686 | | A | 564340 | 4814678 | 326.37 | 319.54 | 11 |
| 1302009 | | A | 552738 | 4792327 | 264.26 | 269.59 | 6 |
| 6711723 | | A | 569656 | 4811874 | 311.54 | 313.24 | 13 |
| 6711724 | | A | 569957 | 4811308 | 306.14 | 317.58 | 13 |
| 6711941 | | A | 558276 | 4816094 | 309.33 | 310.28 | 10 |
| 6711986 | | A | 560294 | 4806300 | 304.42 | 302.30 | 8 |
| 1302084 | | A | 553123 | 4791473 | 267.92 | 249.30 | 5 |
| 6712094 | | A | 557115 | 4816580 | 328.09 | 318.96 | 9 |
| 6712121 | | A | 566524 | 4808456 | 303.89 | 306.89 | 5 |
| 6806669 | | A | 566734 | 4805783 | 289.87 | 296.33 | 7 |
| 6806678 | | A | 568254 | 4806123 | 281.02 | 284.84 | 10 |
| 6806722 | | A | 567254 | 4802763 | 267.31 | 270.40 | 10 |
| 6806726 | | A | 567734 | 4805703 | 281.33 | 284.48 | 10 |
| 6806986 | | A | 570484 | 4806323 | 283.46 | 284.25 | 10 |
| 6807040 | | A | 562254 | 4795523 | 250.74 | 245.54 | 10 |
| 1302126 | | A | 552853 | 4791778 | 243.17 | 251.35 | 10 |
| 6807195 | | A | 568034 | 4801653 | 265.42 | 266.43 | 10 |
| 6807205 | | A | 561774 | 4796043 | 254.21 | 249.45 | 10 |
| 6807278 | | A | 562584 | 4794433 | 237.41 | 239.24 | 10 |
| 6807281 | | A | 562754 | 4795523 | 245.06 | 244.04 | 10 |
| 6807324 | | A | 562724 | 4795523 | 245.67 | 244.11 | 10 |
| 6807357 | | A | 566514 | 4803973 | 281.63 | 282.11 | 10 |
| 6807475 | | A | 568094 | 4801743 | 264.53 | 266.95 | 10 |
| 6807488 | | A | 567114 | 4800873 | 263.34 | 263.55 | 10 |
| 1302131 | | A | 558664 | 4792807 | 260.60 | 257.65 | 4 |
| 6807566 | | A | 566644 | 4800503 | 262.44 | 262.94 | 10 |
| 6807573 | | A | 566264 | 4800403 | 263.35 | 263.03 | 10 |
| 6807651 | | A | 566854 | 4804943 | 283.16 | 286.80 | 10 |
| 6807662 | | A | 569474 | 4805253 | 275.85 | 279.17 | 10 |
| 6807729 | | A | 561964 | 4796683 | 258.56 | 251.38 | 10 |
| 6807805 | | A | 569634 | 4803953 | 276.46 | 274.86 | 10 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6807902 | | A | 562634 | 4794433 | 238.96 | 239.00 | 10 |
| 6807903 | | A | 562679 | 4794433 | 238.08 | 238.78 | 10 |
| 6807988 | | A | 570469 | 4803413 | 275.85 | 271.69 | 10 |
| 6808030 | | A | 565834 | 4802483 | 268.53 | 269.45 | 10 |
| 6808109 | | A | 563154 | 4796023 | 245.06 | 247.52 | 10 |
| 6808151 | | A | 567794 | 4802363 | 267.92 | 269.32 | 10 |
| 6808206 | | A | 565754 | 4804503 | 287.40 | 289.89 | 9 |
| 6808297 | | A | 567934 | 4806063 | 283.14 | 288.11 | 9 |
| 6808298 | | A | 566154 | 4805633 | 298.09 | 297.86 | 6 |
| 6808337 | | A | 565154 | 4803303 | 280.60 | 281.90 | 8 |
| 6808338 | | A | 562494 | 4803903 | 295.05 | 294.71 | 9 |
| 6808383 | | A | 565580 | 4805496 | 298.40 | 297.58 | 9 |
| 6808452 | | A | 569058 | 4803260 | 272.79 | 274.73 | 10 |
| 6808535 | | A | 570886 | 4806280 | 282.33 | 284.65 | 10 |
| 6808609 | | A | 566343 | 4804674 | 282.85 | 288.75 | 6 |
| 6808650 | | A | 567782 | 4803512 | 275.23 | 276.02 | 10 |
| 6808651 | | A | 567787 | 4803488 | 275.54 | 275.87 | 10 |
| 6808652 | | A | 560834 | 4799482 | 272.18 | 282.85 | 8 |
| 6808704 | | A | 566433 | 4802621 | 267.88 | 268.94 | 10 |
| 6808744 | | A | 561288 | 4803535 | 291.72 | 295.91 | 8 |
| 6808832 | | A | 568543 | 4803954 | 275.82 | 276.42 | 10 |
| 6808846 | | A | 570019 | 4806551 | 282.68 | 285.25 | 10 |
| 6808882 | | A | 566498 | 4802646 | 267.92 | 268.99 | 10 |
| 6808892 | | A | 565007 | 4799270 | 261.82 | 261.38 | 10 |
| 6808908 | | A | 567461 | 4804911 | 281.02 | 282.16 | 10 |
| 6808930 | | A | 565168 | 4803652 | 284.07 | 286.38 | 10 |
| 6809004 | | A | 565919 | 4799961 | 263.34 | 261.98 | 10 |
| 6809006 | | A | 562593 | 4794795 | 241.40 | 240.73 | 10 |
| 6809034 | | A | 570155 | 4803124 | 273.77 | 273.98 | 10 |
| 6809036 | | A | 561333 | 4797600 | 254.26 | 265.28 | 10 |
| 6809045 | | A | 563239 | 4800994 | 268.83 | 273.75 | 9 |
| 6809048 | | A | 563813 | 4799911 | 258.47 | 263.27 | 10 |
| 6809053 | | A | 563742 | 4798423 | 253.60 | 256.47 | 10 |
| 6809089 | | A | 569256 | 4803452 | 275.54 | 275.00 | 10 |
| 6809147 | | A | 566581 | 4802685 | 266.31 | 269.09 | 10 |
| 6809170 | | A | 566590 | 4800211 | 263.05 | 261.74 | 10 |
| 6809285 | | A | 569712 | 4803505 | 272.80 | 274.84 | 10 |
| 6809288 | | A | 560734 | 4800883 | 287.43 | 287.79 | 9 |
| 6809308 | | A | 563196 | 4800192 | 264.12 | 265.48 | 10 |
| 6809317 | | A | 566800 | 4802722 | 267.00 | 269.25 | 10 |
| 6809320 | | A | 563631 | 4800548 | 262.12 | 265.83 | 10 |
| 6809381 | | A | 569972 | 4805988 | 281.02 | 282.48 | 10 |
| 6809438 | | A | 570194 | 4806583 | 282.55 | 285.14 | 10 |
| 6809442 | | A | 571614 | 4806723 | 289.87 | 286.71 | 10 |
| 6809490 | | A | 562134 | 4796023 | 250.85 | 248.57 | 10 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6809508 | DW | A | 563213 | 4799661 | 262.13 | 262.24 | 10 |
| 6809512 | | A | 562513 | 4799501 | 259.69 | 268.03 | 10 |
| 6809517 | | A | 566014 | 4799883 | 260.90 | 261.53 | 10 |
| 6809519 | | A | 566134 | 4800023 | 263.66 | 262.34 | 10 |
| 6809520 | DW | A | 564573 | 4804221 | 291.09 | 290.35 | 10 |
| 6809583 | | A | 563433 | 4799833 | 261.34 | 263.00 | 10 |
| 6809584 | | A | 563784 | 4798582 | 252.38 | 259.36 | 10 |
| 6809651 | | A | 570194 | 4805143 | 277.06 | 279.50 | 10 |
| 6809765 | | A | 564834 | 4804263 | 287.12 | 290.26 | 10 |
| 6809789 | | A | 562194 | 4796803 | 255.42 | 252.19 | 10 |
| 6809866 | | A | 562354 | 4795423 | 241.76 | 244.62 | 10 |
| 1302491 | | A | 553234 | 4791683 | 238.46 | 250.80 | 9 |
| 6809880 | | A | 562514 | 4794823 | 237.75 | 241.23 | 10 |
| 6809902 | | A | 563554 | 4798363 | 256.07 | 258.10 | 10 |
| 6809903 | | A | 563514 | 4798503 | 257.86 | 259.87 | 10 |
| 6809920 | | A | 568454 | 4802563 | 263.81 | 271.61 | 10 |
| 6809988 | DW-DETZLER | A | 561447 | 4799410 | 271.89 | 280.45 | 9 |
| 6810021 | | A | 566774 | 4805723 | 284.08 | 295.33 | 10 |
| 1302492 | | A | 553074 | 4791443 | 271.88 | 248.99 | 4 |
| 6810023 | | A | 562574 | 4797983 | 258.47 | 257.95 | 10 |
| 6810025 | | A | 567294 | 4805123 | 281.94 | 283.39 | 10 |
| 6810036 | | A | 563274 | 4797243 | 252.37 | 252.91 | 10 |
| 1302493 | | A | 552474 | 4792263 | 263.65 | 260.90 | 7 |
| 6810079 | | A | 562514 | 4794843 | 237.74 | 241.31 | 10 |
| 1302495 | | A | 553114 | 4791423 | 257.86 | 249.50 | 7 |
| 6810198 | | A | 566494 | 4805703 | 291.76 | 297.21 | 9 |
| 6810294 | | A | 565234 | 4802783 | 276.09 | 272.14 | 10 |
| 6810295 | | A | 565554 | 4804294 | 284.40 | 288.25 | 10 |
| 6810324 | | A | 567114 | 4804003 | 286.52 | 279.19 | 10 |
| 6810331 | | A | 567194 | 4805343 | 282.59 | 285.76 | 10 |
| 6810440 | | A | 569494 | 4803123 | 271.95 | 274.85 | 10 |
| 6810445 | | A | 561774 | 4796063 | 252.99 | 249.53 | 10 |
| 1302499 | | A | 552914 | 4791363 | 257.19 | 247.93 | 5 |
| 6810567 | | A | 565934 | 4800803 | 261.52 | 264.13 | 10 |
| 6810581 | | A | 567854 | 4802143 | 265.17 | 268.29 | 10 |
| 6810584 | DW-FRATHICANTELI | A | 560101 | 4803067 | 292.92 | 292.45 | 9 |
| 1302502 | | A | 552914 | 4791323 | 254.51 | 248.17 | 5 |
| 6810591 | DW-ROBERTSON | A | 562472 | 4803706 | 297.48 | 294.14 | 3 |
| 6810665 | | A | 565674 | 4804223 | 282.85 | 287.32 | 8 |
| 6810704 | | A | 566374 | 4802523 | 266.09 | 268.63 | 10 |
| 6810707 | | A | 566394 | 4802563 | 268.83 | 268.76 | 10 |
| 6810751 | DW-RUNIONS | A | 562128 | 4803740 | 297.18 | 295.35 | 3 |
| 6810754 | DW-RUNIONS CONSTRUCT | A | 562191 | 4803739 | 298.40 | 295.16 | 3 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6810755 | DW-RUNIONS CONSTRUCT | A | 562247 | 4803809 | 300.23 | 295.33 | 3 |
| 6810763 | | A | 566614 | 4802523 | 265.48 | 268.54 | 10 |
| 6810764 | | A | 567414 | 4805383 | 285.74 | 283.91 | 10 |
| 6810765 | | A | 568674 | 4804545 | 274.62 | 277.21 | 11 |
| 6810868 | | A | 565563 | 4804443 | 289.25 | 289.49 | 8 |
| 6810921 | | A | 562584 | 4795565 | 248.10 | 244.85 | 10 |
| 6811013 | | A | 565637 | 4803821 | 286.81 | 285.38 | 10 |
| 6811108 | | A | 565664 | 4804350 | 285.60 | 288.67 | 9 |
| 6811109 | | A | 565622 | 4803860 | 286.20 | 285.63 | 7 |
| 6811135 | | A | 563804 | 4798570 | 258.05 | 259.39 | 10 |
| 6811241 | | A | 569386 | 4806388 | 283.16 | 284.33 | 10 |
| 6811326 | | A | 562551 | 4794291 | 238.66 | 238.74 | 10 |
| 6811365 | | A | 561792 | 4796060 | 255.12 | 249.48 | 10 |
| 6811421 | | A | 563285 | 4797492 | 253.29 | 254.03 | 10 |
| 6811525 | | A | 561331 | 4798243 | 264.87 | 270.07 | 9 |
| 6811588 | | A | 565679 | 4803813 | 285.29 | 284.91 | 10 |
| 6811684 | | A | 567207 | 4802740 | 268.83 | 270.16 | 10 |
| 6811754 | | A | 569996 | 4804693 | 277.67 | 277.36 | 10 |
| 1302719 | | A | 551774 | 4792683 | 292.61 | 272.55 | 9 |
| 6811808 | | A | 567017 | 4804865 | 281.63 | 284.10 | 10 |
| 6811814 | | A | 568132 | 4803075 | 274.93 | 273.64 | 10 |
| 6811849 | | A | 562674 | 4795531 | 242.24 | 244.34 | 10 |
| 6811881 | | A | 562018 | 4795463 | 249.02 | 245.97 | 10 |
| 6812015 | | A | 561335 | 4798080 | 263.65 | 268.23 | 10 |
| 6812065 | | A | 563833 | 4798546 | 252.96 | 259.11 | 10 |
| 6812087 | | A | 566217 | 4804594 | 281.63 | 288.70 | 10 |
| 6812186 | | A | 565639 | 4804081 | 286.22 | 286.62 | 9 |
| 6812253 | | A | 567311 | 4802733 | 267.31 | 270.37 | 10 |
| 6812293 | | A | 566456 | 4802531 | 268.53 | 268.61 | 10 |
| 6812335 | | A | 562348 | 4798103 | 256.95 | 258.83 | 10 |
| 6812492 | | A | 561811 | 4796097 | 257.25 | 249.60 | 10 |
| 6812493 | | A | 569198 | 4803163 | 270.06 | 274.71 | 10 |
| 6812502 | | A | 568130 | 4803073 | 276.45 | 273.62 | 10 |
| 6812522 | | A | 568967 | 4802833 | 268.23 | 273.01 | 11 |
| 6812534 | | A | 566159 | 4804653 | 284.08 | 289.60 | 9 |
| 6812649 | | A | 566001 | 4804272 | 286.21 | 286.91 | 10 |
| 6812702 | | A | 565633 | 4803943 | 288.34 | 285.82 | 10 |
| 6812707 | | A | 569582 | 4805390 | 280.41 | 279.91 | 10 |
| 6812781 | | A | 570407 | 4804325 | 277.37 | 276.40 | 10 |
| 6812808 | | A | 565277 | 4804373 | 285.26 | 289.43 | 8 |
| 6812854 | | A | 565565 | 4802723 | 276.15 | 272.05 | 10 |
| 6812946 | | A | 566386 | 4800703 | 263.04 | 263.66 | 10 |
| 1302970 | | A | 552634 | 4792283 | 261.71 | 260.34 | 9 |
| 1302974 | | A | 553634 | 4791923 | 252.98 | 253.88 | 9 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 1302978 | | A | 553454 | 4791383 | 257.47 | 253.92 | 8 |
| 1302996 | | A | 552046 | 4792432 | 270.34 | 278.37 | 6 |
| 1303052 | | A | 552433 | 4792327 | 262.90 | 262.27 | 9 |
| 9200700 | | A | 548456 | 4807938 | 283.94 | 290.17 | 7 |
| 9200719 | | A | 557001 | 4810721 | 295.53 | 296.86 | 10 |
| 9200721 | | A | 557451 | 4801640 | 276.54 | 279.06 | 9 |
| 9200724 | | A | 556772 | 4810224 | 295.05 | 299.78 | 10 |
| 9200725 | | A | 551658 | 4807022 | 282.37 | 288.29 | 9 |
| 9200726 | | A | 552374 | 4807526 | 283.19 | 290.90 | 12 |
| 1303056 | | A | 553311 | 4791475 | 255.66 | 252.01 | 8 |
| 1303061 | | A | 554338 | 4791320 | 269.32 | 261.15 | 9 |
| 9200780 | | A | 548480 | 4809788 | 287.49 | 295.71 | 6 |
| 9200785 | | A | 554291 | 4812008 | 297.42 | 306.26 | 10 |
| 9200817 | | A | 548923 | 4801999 | 297.08 | 296.08 | 9 |
| 9200818 | | A | 548992 | 4803452 | 282.30 | 284.66 | 6 |
| 9200819 | | A | 547746 | 4794949 | 300.33 | 307.10 | 5 |
| 9200820 | | A | 547868 | 4793526 | 293.20 | 299.54 | 7 |
| 9200821 | | A | 553579 | 4798647 | 306.46 | 299.75 | 6 |
| 9200826 | | A | 563544 | 4799437 | 261.18 | 262.25 | 10 |
| 9200831 | | A | 549507 | 4795524 | 308.05 | 313.56 | 6 |
| 9200833 | | A | 549695 | 4798014 | 305.40 | 322.14 | 5 |
| 9200834 | | A | 548864 | 4796903 | 310.12 | 319.40 | 5 |
| 1303207 | | A | 552668 | 4792139 | 259.87 | 259.96 | 6 |
| 9200841 | | A | 559592 | 4797053 | 276.41 | 273.14 | 9 |
| 9200844 | | A | 560176 | 4802613 | 292.23 | 290.39 | 8 |
| 9200845 | | A | 560160 | 4802537 | 293.28 | 290.17 | 9 |
| 9200846 | | A | 560505 | 4802504 | 285.30 | 291.10 | 9 |
| 9200847 | | A | 561069 | 4799970 | 282.50 | 285.18 | 9 |
| 9200848 | | A | 560033 | 4801306 | 286.34 | 287.41 | 8 |
| 9200849 | | A | 560039 | 4801353 | 286.34 | 287.48 | 8 |
| 9200851 | | A | 563718 | 4803139 | 270.85 | 280.75 | 10 |
| 9200852 | | A | 563480 | 4803787 | 291.16 | 287.71 | 9 |
| 9200853 | | A | 562644 | 4803987 | 299.11 | 294.70 | 2 |
| 9200859 | | A | 549089 | 4801617 | 305.46 | 300.61 | 9 |
| 9200860 | PW1 | A | 548906 | 4802005 | 296.65 | 296.18 | 9 |
| 9200880 | | A | 550023 | 4811333 | 305.41 | 308.22 | 7 |
| 9200889 | | A | 556480 | 4797084 | 265.75 | 271.02 | 9 |
| 9200891 | | A | 560304 | 4802829 | 290.83 | 291.86 | 9 |
| 9200892 | | A | 560790 | 4800071 | 285.17 | 285.82 | 8 |
| 9200894 | | A | 555275 | 4796334 | 265.08 | 269.10 | 10 |
| 1303291 | | A | 552982 | 4790926 | 255.58 | 250.30 | 5 |
| 9200985 | | A | 552091 | 4807084 | 285.22 | 287.32 | 7 |
| 9200988 | | A | 549719 | 4807759 | 285.47 | 293.04 | 7 |
| 1303292 | | A | 553396 | 4791826 | 253.63 | 252.39 | 8 |
| 1303293 | | A | 560572 | 4793690 | 241.60 | 244.80 | 10 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 9201022 | | A | 552082 | 4807078 | 284.63 | 287.29 | 7 |
| 1303294 | | A | 553011 | 4791467 | 249.04 | 248.13 | 9 |
| 9201077 | | A | 557088 | 4810792 | 297.09 | 300.62 | 13 |
| 9201079 | | A | 558613 | 4805721 | 302.64 | 299.76 | 5 |
| 9201080 | | A | 551656 | 4810059 | 301.68 | 308.24 | 6 |
| 9201087 | | A | 560263 | 4802943 | 295.32 | 292.31 | 9 |
| 9201128 | | A | 560436 | 4799001 | 281.30 | 280.09 | 7 |
| 9201134 | | A | 551523 | 4798669 | 309.12 | 320.34 | 5 |
| 9201137 | | A | 555653 | 4797319 | 260.36 | 263.09 | 9 |
| 9201138 | | A | 550383 | 4792475 | 283.81 | 286.82 | 6 |
| 9201139 | | A | 555734 | 4798834 | 260.42 | 261.88 | 9 |
| 9201140 | | A | 563181 | 4804918 | 298.69 | 298.36 | 6 |
| 9201142 | | A | 563186 | 4801492 | 274.55 | 278.61 | 8 |
| 9201144 | | A | 549038 | 4804390 | 276.37 | 279.24 | 7 |
| 1303375 | | A | 552886 | 4791362 | 251.88 | 247.65 | 5 |
| 9201173 | | A | 547519 | 4795672 | 300.77 | 307.69 | 6 |
| 9201179 | | A | 553423 | 4807925 | 282.41 | 291.77 | 12 |
| 1303379 | | A | 553283 | 4791370 | 258.75 | 252.00 | 7 |
| 9201188 | | A | 563189 | 4803818 | 293.49 | 289.57 | 7 |
| 9201190 | | A | 560133 | 4803580 | 293.86 | 295.53 | 6 |
| 1303380 | | A | 553339 | 4791389 | 259.66 | 252.58 | 7 |
| 9201226 | | A | 549794 | 4811563 | 307.51 | 307.96 | 9 |
| 9201234 | | A | 548861 | 4801793 | 296.71 | 298.33 | 9 |
| 9201242 | | A | 552011 | 4812693 | 308.75 | 314.03 | 14 |
| 9201248 | | A | 548841 | 4801333 | 302.61 | 307.38 | 6 |
| 1303396 | | A | 552511 | 4792185 | 261.56 | 266.94 | 6 |
| 1303425 | | A | 553654 | 4791945 | 251.62 | 253.71 | 9 |
| 1303426 | | A | 556702 | 4793863 | 262.87 | 264.91 | 7 |
| 1303431 | | A | 553201 | 4791413 | 252.96 | 250.80 | 7 |
| 9201575 | | A | 560646 | 4801013 | 287.67 | 287.91 | 5 |
| 1303523 | | A | 556646 | 4792280 | 264.85 | 268.05 | 7 |
| 9201617 | | A | 555546 | 4813343 | 315.77 | 308.93 | 8 |
| 1303525 | | A | 560972 | 4793415 | 233.18 | 238.59 | 10 |
| 9201640 | | A | 550425 | 4792479 | 284.89 | 286.65 | 6 |
| 9201651 | | A | 551331 | 4806867 | 287.80 | 285.84 | 9 |
| 9201656 | | A | 563617 | 4799198 | 259.96 | 261.73 | 10 |
| 1303526 | | A | 552836 | 4791313 | 251.75 | 247.62 | 5 |
| 9201676 | | A | 549422 | 4806853 | 305.25 | 289.72 | 6 |
| 9201757 | | A | 564673 | 4800512 | 263.10 | 264.28 | 10 |
| 1303527 | | A | 556706 | 4791311 | 293.25 | 271.77 | 3 |
| 9201825 | | A | 556926 | 4795025 | 246.20 | 265.64 | 10 |
| 9201826 | | A | 556932 | 4795092 | 245.40 | 265.70 | 10 |
| 9201828 | | A | 560123 | 4803704 | 294.90 | 295.99 | 9 |
| 9201844 | | A | 549845 | 4805600 | 286.33 | 275.99 | 8 |
| 1303640 | | A | 553046 | 4791153 | 255.40 | 250.32 | 5 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 1303641 | | A | 552271 | 4792093 | 263.17 | 260.76 | 7 |
| 9201948 | | A | 564898 | 4799469 | 260.52 | 261.81 | 10 |
| 9201991 | | A | 549368 | 4799244 | 305.18 | 319.51 | 6 |
| 1303664 | | A | 551710 | 4792638 | 282.60 | 282.05 | 6 |
| 1000372 | DW-DREWREY | A | 556150 | 4808240 | 303.91 | 296.27 | 9 |
| 1303666 | | A | 560567 | 4794038 | 248.43 | 247.23 | 8 |
| 9202058 | | A | 560052 | 4795271 | 270.73 | 259.11 | 8 |
| 9202125 | | A | 548192 | 4807323 | 293.33 | 289.42 | 6 |
| 9202161 | | A | 548343 | 4808987 | 276.05 | 294.53 | 9 |
| 1303686 | | A | 553072 | 4791377 | 254.62 | 249.25 | 8 |
| 1303687 | | A | 553020 | 4791148 | 255.09 | 250.09 | 6 |
| 1303688 | | A | 553143 | 4791446 | 256.97 | 249.86 | 9 |
| 9202470 | | A | 551531 | 4800208 | 316.04 | 313.00 | 5 |
| 9202579 | | A | 549655 | 4808725 | 292.22 | 299.49 | 7 |
| 1303724 | | A | 553126 | 4791427 | 257.05 | 249.67 | 9 |
| 1303781 | | A | 560922 | 4794879 | 249.90 | 249.07 | 10 |
| 1303782 | | A | 553054 | 4791241 | 256.09 | 249.99 | 7 |
| 1303783 | | A | 553001 | 4791152 | 255.40 | 249.93 | 6 |
| 1303903 | | A | 553032 | 4791473 | 258.80 | 248.30 | 8 |
| 1303904 | | A | 553103 | 4791493 | 261.15 | 249.09 | 7 |
| 1303927 | | A | 552965 | 4791143 | 255.70 | 249.65 | 6 |
| 1303934 | | A | 553016 | 4791313 | 255.09 | 249.17 | 8 |
| 1304002 | | A | 558454 | 4792392 | 250.76 | 258.60 | 10 |
| 1304136 | | A | 552794 | 4791171 | 251.09 | 248.00 | 8 |
| 1304225 | | A | 552862 | 4791184 | 251.09 | 248.41 | 9 |
| 1304226 | | A | 552773 | 4791085 | 250.40 | 248.21 | 8 |
| 1304264 | | A | 552837 | 4791139 | 254.14 | 248.54 | 6 |
| 1304265 | | A | 552815 | 4791103 | 254.44 | 248.54 | 6 |
| 1304316 | | A | 552841 | 4791262 | 252.75 | 247.91 | 6 |
| 1304364 | | A | 552835 | 4791241 | 251.92 | 247.92 | 8 |
| 1304542 | | A | 553353 | 4791550 | 259.94 | 252.57 | 6 |
| 1304544 | | A | 552924 | 4791281 | 250.40 | 248.42 | 8 |
| 1304545 | | A | 553373 | 4791503 | 258.76 | 252.79 | 6 |
| 1304557 | | A | 556694 | 4791367 | 290.20 | 271.77 | 3 |
| 1304718 | | A | 552585 | 4792198 | 261.26 | 266.52 | 6 |
| 1304833 | | A | 554743 | 4792379 | 252.19 | 256.46 | 9 |
| 1304944 | | A | 555654 | 4791955 | 263.32 | 267.84 | 6 |
| 1304948 | | A | 552185 | 4792011 | 260.26 | 260.72 | 7 |
| 1304949 | | A | 552837 | 4790613 | 249.26 | 249.60 | 7 |
| 1304950 | | A | 552412 | 4792178 | 262.34 | 267.82 | 6 |
| 1304951 | | A | 552384 | 4792175 | 262.43 | 267.83 | 6 |
| 1304952 | | A | 552556 | 4792192 | 260.34 | 266.67 | 6 |
| 1305076 | | A | 553410 | 4791406 | 257.97 | 253.38 | 9 |
| 1305143 | | A | 551954 | 4792039 | 262.04 | 263.55 | 6 |
| 1305144 | | A | 553225 | 4792672 | 260.03 | 265.91 | 7 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 1305200 | | A | 552725 | 4791075 | 249.84 | 247.87 | 6 |
| 1000406 | DW-PIONEER SPORTSMAN | A | 547796 | 4806301 | 284.90 | 283.78 | 7 |

Table D-2 Groundwater level targets derived from Regional of Waterloo Monitoring Wells

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6500605 | G8TW | A | 558343 | 4802630 | 281.70 | 282.82 | 8 |
| 1000545 | OW57-95 | A | 558498 | 4805228 | 302.33 | 297.71 | 6 |
| 1000328 | OW1-95 | B | 554877 | 4809921 | 295.03 | 299.52 | 14 |
| 1000328 | OW1-95 | C | 554877 | 4809921 | 299.86 | 299.82 | 10 |
| 1000328 | OW1-95 | D | 554877 | 4809921 | 303.85 | 300.38 | 9 |
| 1000328 | OW1-95 | E | 554877 | 4809921 | 303.91 | 300.83 | 6 |
| 1000328 | OW1-95 | F | 554877 | 4809921 | 310.51 | 301.82 | 4 |
| 1000329 | OW2-95 | B | 556154 | 4808464 | 294.13 | 297.76 | 14 |
| 1000329 | OW2-95 | C | 556154 | 4808464 | 294.68 | 297.22 | 10 |
| 1000329 | OW2-95 | D | 556154 | 4808464 | 302.53 | 296.85 | 8 |
| 1000329 | OW2-95 | E | 556154 | 4808464 | 302.70 | 298.81 | 6 |
| 1000329 | OW2-95 | F | 556154 | 4808464 | 302.92 | 302.55 | 6 |
| 6504495 | TW4-76 | A | 550331 | 4807756 | 288.83 | 294.32 | 6 |
| 6504527 | AVE-10 | A | 558681 | 4803844 | 291.88 | 292.52 | 9 |
| 1000330 | OW3-95 | B | 555560 | 4806662 | 288.67 | 292.08 | 12 |
| 1000330 | OW3-95 | C | 555560 | 4806662 | 288.76 | 292.13 | 12 |
| 1000330 | OW3-95 | D | 555560 | 4806662 | 293.65 | 292.17 | 10 |
| 1000330 | OW3-95 | E | 555560 | 4806662 | 297.00 | 291.80 | 9 |
| 1000330 | OW3-95 | F | 555560 | 4806662 | 296.72 | 291.81 | 9 |
| 1000330 | OW3-95 | G | 555560 | 4806662 | 296.22 | 291.89 | 6 |
| 1000332 | OW5-95 | B | 553286 | 4802223 | 264.64 | 274.10 | 13 |
| 1000332 | OW5-95 | C | 553286 | 4802223 | 264.69 | 269.03 | 10 |
| 1000332 | OW5-95 | D | 553286 | 4802223 | 291.85 | 282.12 | 8 |
| 6506243 | DW-RUNIONS CONSTRUCT | A | 562286 | 4803923 | 298.71 | 295.74 | 3 |
| 1000332 | OW5-95 | E | 553286 | 4802223 | 292.45 | 283.10 | 8 |
| 6506418 | DW-RUNIONS CONSTRUCT | A | 562124 | 4803692 | 297.82 | 295.09 | 3 |
| 1000332 | OW5-95 | F | 553286 | 4802223 | 299.49 | 291.11 | 3 |
| 1000333 | OW6ABCD-95 | A | 553898 | 4803784 | 265.50 | 270.16 | 15 |
| 1000333 | OW6ABCD-95 | B | 553898 | 4803784 | 265.00 | 269.75 | 14 |
| 1000333 | OW6ABCD-95 | C | 553898 | 4803784 | 265.40 | 269.60 | 10 |
| 1000936 | C2 | A | 559342 | 4806841 | 303.57 | 302.08 | 6 |
| 1000333 | OW6ABCD-95 | D | 553898 | 4803784 | 274.10 | 275.96 | 9 |
| 1000333 | OW6ABCD-95 | E | 553898 | 4803784 | 284.04 | 281.27 | 9 |
| 6507562 | OW6-94 (TW2-91) | B | 556283 | 4804365 | 271.33 | 281.58 | 14 |
| 6507562 | OW6-94 (TW2-91) | C | 556283 | 4804365 | 271.03 | 281.41 | 13 |
| 6507562 | OW6-94 (TW2-91) | D | 556283 | 4804365 | 271.30 | 281.68 | 10 |
| 6507564 | BH2B-93 | A | 555597 | 4799776 | 253.30 | 258.07 | 13 |
| 6507564 | BH2B-93 | B | 555597 | 4799776 | 253.30 | 258.07 | 13 |
| 6507565 | BH2A-93 | A | 555589 | 4799783 | 255.70 | 258.04 | 10 |
| 6507565 | BH2A-93 | B | 555589 | 4799783 | 259.81 | 258.07 | 9 |
| 6507566 | BH1-93 | A | 555130 | 4799683 | 252.63 | 255.40 | 15 |
| 6507566 | BH1-93 | B | 555130 | 4799683 | 253.01 | 255.13 | 13 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6507566 | BH1-93 | C | 555130 | 4799683 | 251.78 | 255.00 | 10 |
| 1000335 | OW8-95 | B | 557571 | 4799770 | 271.32 | 273.03 | 14 |
| 1000335 | OW8-95 | C | 557571 | 4799770 | 271.25 | 273.17 | 11 |
| 1000335 | OW8-95 | D | 557571 | 4799770 | 271.22 | 276.89 | 10 |
| 1000335 | OW8-95 | E | 557571 | 4799770 | 277.86 | 277.24 | 9 |
| 1000335 | OW8-95 | F | 557571 | 4799770 | 277.37 | 277.56 | 6 |
| 1000335 | OW8-95 | G | 557571 | 4799770 | 277.87 | 277.81 | 3 |
| 1000336 | OW9-95 | B | 552449 | 4801218 | 300.69 | 297.23 | 13 |
| 1000336 | OW9-95 | C | 552449 | 4801218 | 300.84 | 298.80 | 12 |
| 1000336 | OW9-95 | D | 552449 | 4801218 | 304.22 | 304.23 | 9 |
| 1000336 | OW9-95 | E | 552449 | 4801218 | 304.75 | 304.37 | 8 |
| 1000336 | OW9-95 | F | 552449 | 4801218 | 303.14 | 305.08 | 6 |
| 6710783 | DW-ST.PIERRE | A | 559620 | 4808220 | 304.57 | 303.49 | 6 |
| 1000336 | OW9-95 | G | 552449 | 4801218 | 308.35 | 306.69 | 3 |
| 1000336 | OW9-95 | H | 552449 | 4801218 | 308.78 | 306.70 | 3 |
| 1000354 | BH4-94 | A | 554494 | 4799393 | 251.60 | 258.35 | 10 |
| 1000354 | BH4-94 | B | 554494 | 4799393 | 266.70 | 258.35 | 10 |
| 1000354 | BH4-94 | C | 554494 | 4799393 | 272.56 | 264.08 | 9 |
| 1000354 | BH4-94 | D | 554494 | 4799393 | 277.52 | 275.96 | 9 |
| 6810757 | DW-REYNOLDS | A | 562554 | 4804324 | 298.99 | 296.89 | 3 |
| 9070064 | OW104-90 | A | 554573 | 4800873 | 265.89 | 273.65 | 14 |
| 9070064 | OW104-90 | B | 554573 | 4800873 | 267.46 | 277.51 | 10 |
| 9070064 | OW104-90 | C | 554573 | 4800873 | 270.42 | 283.93 | 9 |
| 9070064 | OW104-90 | D | 554573 | 4800873 | 278.80 | 285.05 | 7 |
| 9200047 | MI-OW1-92 | A | 555241 | 4799600 | 259.90 | 255.66 | 9 |
| 9200047 | MI-OW1-92 | B | 555241 | 4799600 | 261.49 | 255.81 | 9 |
| 9200047 | MI-OW1-92 | C | 555241 | 4799600 | 261.47 | 255.88 | 9 |
| 9200048 | MI-OW2-92 | A | 555245 | 4799601 | 251.75 | 255.37 | 10 |
| 9200048 | MI-OW2-92 | B | 555245 | 4799601 | 252.39 | 255.44 | 9 |
| 9200048 | MI-OW2-92 | C | 555245 | 4799601 | 258.58 | 255.62 | 9 |
| 9200458 | SM3-93 | B | 557938 | 4803410 | 286.47 | 288.37 | 6 |
| 9200473 | BH6-94 | A | 555238 | 4799599 | 261.94 | 255.93 | 9 |
| 9200572 | CM-OW5ABCDEFG-94 | B | 558346 | 4806731 | 303.80 | 297.54 | 14 |
| 9200572 | CM-OW5ABCDEFG-94 | D | 558346 | 4806731 | 303.91 | 297.66 | 9 |
| 9200572 | CM-OW5ABCDEFG-94 | E | 558346 | 4806731 | 304.12 | 297.74 | 7 |
| 9200573 | SM-OW2BC-93 | B | 557822 | 4803116 | 285.09 | 286.08 | 3 |
| 1000369 | TW9-78 | A | 560267 | 4804378 | 296.96 | 298.43 | 9 |
| 1000370 | MW1-94 | A | 562785 | 4806823 | 298.78 | 301.24 | 4 |
| 1000370 | MW1-94 | B | 562785 | 4806823 | 298.98 | 300.47 | 4 |
| 9201544 | BM1SD-02 | A | 559654 | 4795434 | 269.05 | 263.27 | 9 |
| 9201544 | BM1SD-02 | B | 559654 | 4795434 | 270.53 | 263.60 | 3 |
| 9201548 | SM1-02 | A | 557344 | 4802731 | 280.95 | 280.45 | 3 |
| 1000370 | MW1-94 | C | 562785 | 4806823 | 298.65 | 300.39 | 3 |
| 9202045 | CMTW1-05 | A | 558403 | 4805357 | 300.43 | 296.03 | 15 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 9202047 | SMTW1ABC-05 | B | 558520 | 4803673 | 289.55 | 291.42 | 10 |
| 9202047 | SMTW1ABC-05 | C | 558520 | 4803673 | 286.42 | 290.73 | 9 |
| 9202049 | CMTW3ABC-05 | A | 557560 | 4805181 | 299.75 | 293.76 | 15 |
| 9202049 | CMTW3ABC-05 | C | 557560 | 4805181 | 302.81 | 294.02 | 9 |
| 9202055 | DW-REED | A | 558578 | 4806477 | 303.08 | 298.47 | 8 |
| 9202639 | CMOW3ABC-06 | A | 558916 | 4804867 | 300.33 | 296.06 | 15 |
| 9202639 | CMOW3ABC-06 | B | 558916 | 4804867 | 301.07 | 297.39 | 9 |
| 9202639 | CMOW3ABC-06 | C | 558916 | 4804867 | 301.07 | 297.98 | 9 |
| 9202642 | HPOW1AB-06 | A | 558786 | 4804395 | 298.80 | 297.14 | 5 |
| 9202643 | PBOW1ABC-06 | A | 559286 | 4806058 | 301.36 | 297.76 | 15 |
| 9202643 | PBOW1ABC-06 | B | 559286 | 4806058 | 303.26 | 299.71 | 9 |
| 9202646 | PBTW2-06 | A | 558220 | 4806227 | 302.93 | 296.76 | 15 |
| 9202647 | PLOW1AB-06 | B | 559403 | 4806775 | 304.71 | 303.05 | 2 |
| 9202664 | CMOW1D-06 | D | 558724 | 4805313 | 302.53 | 298.66 | 8 |
| 9202668 | CMOW2E-06 | E | 559588 | 4804174 | 297.22 | 297.65 | 5 |
| 9202670 | PBOW1D-06 | D | 559284 | 4806058 | 303.26 | 300.42 | 8 |
| 9202672 | PBOW1F-06 | F | 559282 | 4806059 | 303.93 | 301.55 | 3 |
| 9202673 | PBOW2ABC-06 | A | 558535 | 4806924 | 302.94 | 298.04 | 15 |
| 9202673 | PBOW2ABC-06 | B | 558535 | 4806924 | 303.07 | 298.16 | 10 |
| 9202673 | PBOW2ABC-06 | C | 558535 | 4806924 | 303.16 | 298.17 | 9 |
| 9203304 | DW-FROSCH JR | A | 558943 | 4805820 | 303.20 | 299.74 | 8 |
| 9203421 | SM3ABC-07 | A | 557938 | 4803410 | 287.67 | 287.85 | 15 |
| 9203421 | SM3ABC-07 | B | 557938 | 4803410 | 286.34 | 287.63 | 10 |
| 9203421 | SM3ABC-07 | C | 557938 | 4803410 | 286.49 | 287.64 | 9 |
| 1000381 | OW1-87 | A | 555159 | 4798045 | 258.37 | 259.88 | 8 |
| 1000382 | CM-OW1BC-92 | B | 557015 | 4805952 | 298.15 | 294.37 | 6 |
| 1000322 | TW3-94 | A | 557325 | 4802669 | 274.34 | 276.44 | 5 |
| 1000382 | CM-OW1BC-92 | C | 557015 | 4805952 | 300.75 | 296.08 | 4 |
| 1000383 | CM-OW1A-92 | A | 557019 | 4805950 | 297.25 | 292.65 | 13 |
| 1000384 | CM-OW2BC-92 | B | 558283 | 4805068 | 301.99 | 297.07 | 6 |
| 1000388 | OW3-92 | A | 557251 | 4803752 | 275.50 | 285.81 | 14 |
| 1000389 | OW4A-92 | A | 558908 | 4804870 | 301.03 | 297.96 | 9 |
| 1000390 | OW4BC-92 | B | 558911 | 4804870 | 300.94 | 298.05 | 6 |
| 1000390 | OW4BC-92 | C | 558911 | 4804870 | 301.02 | 299.01 | 4 |
| 1000384 | CM-OW2BC-92 | C | 558283 | 4805068 | 302.70 | 297.86 | 5 |
| 9203557 | PBTW3-07 | A | 557466 | 4805908 | 302.74 | 294.51 | 15 |
| 6500146 | H4 | A | 556693 | 4808882 | 302.00 | 298.99 | 12 |
| 6500132 | P10 | A | 556951 | 4806839 | 295.17 | 289.53 | 8 |
| 1000021 | P17 | A | 557129 | 4806112 | 284.30 | 289.02 | 13 |
| 6500130 | P11 | A | 557138 | 4806113 | 289.50 | 284.63 | 13 |
| 6500109 | G9 | A | 557175 | 4800261 | 260.00 | 263.32 | 11 |
| 1000388 | OW3-92 | B | 557251 | 4803752 | 276.30 | 285.80 | 13 |
| 1000018 | G38 | A | 557302 | 4802637 | 277.65 | 279.00 | 8 |
| 1000019 | G39 | A | 557324 | 4802665 | 264.00 | 272.68 | 8 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 1000013 | G18 | A | 557327 | 4804287 | 275.00 | 284.14 | 12 |
| 9200458 | SM3-93 | C | 557938 | 4803410 | 286.80 | 289.65 | 3 |
| 9203611 | NDTW1ABC-08 | A | 562367 | 4804125 | 300.85 | 297.48 | 15 |
| 9200458 | SM3-93 | A | 557938 | 4803410 | 286.80 | 287.80 | 15 |
| 9200006 | G7 | A | 558059 | 4802474 | 278.50 | 280.32 | 8 |
| 1000277 | G16 | A | 558336 | 4804722 | 285.40 | 290.32 | 13 |
| 9200007 | G8 | A | 558343 | 4802600 | 279.70 | 282.32 | 6 |
| 9203611 | NDTW1ABC-08 | B | 562367 | 4804125 | 299.79 | 297.01 | 10 |
| 9203611 | NDTW1ABC-08 | C | 562367 | 4804125 | 299.19 | 296.59 | 9 |
| 9203612 | NDTW2-08 | A | 562220 | 4804076 | 301.11 | 297.47 | 15 |
| 9203613 | NDTW1D-08 | D | 562368 | 4804123 | 298.88 | 296.57 | 6 |
| 9203614 | NDTW1E-08 | E | 562369 | 4804124 | 298.71 | 296.47 | 3 |
| 9203616 | NDOW1ABC-08 | A | 562254 | 4804736 | 301.86 | 297.61 | 15 |
| 9203616 | NDOW1ABC-08 | B | 562254 | 4804736 | 299.50 | 299.29 | 10 |
| 9203616 | NDOW1ABC-08 | C | 562254 | 4804736 | 299.54 | 299.35 | 9 |
| 9200056 | CM-OW2-92 (SW) | D | 558280 | 4805065 | 303.84 | 298.28 | 3 |
| 9203617 | NDOW1D-08 | D | 562255 | 4804733 | 299.78 | 299.74 | 6 |
| 9203618 | NDOW1E-08 | E | 562255 | 4804732 | 299.31 | 299.85 | 2 |
| 9203619 | NDOW2ABC-08 | C | 561220 | 4803776 | 300.82 | 297.10 | 9 |
| 9203619 | NDOW2ABC-08 | A | 561220 | 4803776 | 297.46 | 297.39 | 15 |
| 9203619 | NDOW2ABC-08 | B | 561220 | 4803776 | 296.88 | 297.19 | 10 |
| 9203620 | NDOW2D-08 | D | 561223 | 4803779 | 296.58 | 297.11 | 8 |
| 9203633 | NDOW2E-08 | E | 561221 | 4803779 | 297.53 | 297.46 | 2 |
| 9203634 | NDOW3A-08 | A | 562046 | 4803929 | 298.40 | 296.63 | 3 |
| 9203635 | NDOW3B-08 | B | 562045 | 4803930 | 298.07 | 296.69 | 2 |
| 9203636 | NDOW4A-08 | A | 562601 | 4803606 | 297.69 | 292.85 | 3 |
| 9200438 | TW10-79 | A | 562405 | 4806913 | 302.85 | 302.25 | 9 |
| 9203637 | NDOW4B-08 | B | 562601 | 4803608 | 297.30 | 292.89 | 2 |
| 9203638 | NDOW5-08 | A | 563380 | 4805019 | 294.82 | 297.98 | 6 |
| 9202047 | SMTW1ABC-05 | A | 558520 | 4803673 | 297.42 | 293.01 | 14 |
| 1000386 | CM-OW2A-92 | A | 558285 | 4805067 | 301.99 | 295.26 | 13 |
| 6500647 | DW-GRCA-66 | A | 558340 | 4802989 | 283.59 | 285.47 | 8 |
| 6505664 | DW-ROMEO | A | 557330 | 4803381 | 284.94 | 285.62 | 6 |
| 6708333 | DW-OLIVER | A | 559078 | 4804839 | 300.98 | 299.34 | 3 |
| 9070062 | OW102-90 | A | 556059 | 4802433 | 272.76 | 278.68 | 15 |
| 9070062 | OW102-90 | C | 556059 | 4802433 | 272.90 | 280.59 | 9 |
| 9202048 | CMTW2-05 | A | 558964 | 4804452 | 299.95 | 295.81 | 15 |
| 9200466 | SM-OW2A-93 | A | 557811 | 4803112 | 285.49 | 286.01 | 3 |
| 9200467 | SM1-93 | A | 557683 | 4802847 | 280.81 | 283.17 | 3 |
| 9200467 | SM1-93 | B | 557683 | 4802847 | 282.17 | 284.09 | 3 |
| 9200572 | CM-OW5ABCDEFG-94 | F | 558346 | 4806731 | 305.18 | 301.95 | 2 |
| 9200728 | DW-SOCCER WELL | A | 558371 | 4805241 | 302.50 | 297.17 | 8 |
| 9201413 | TW1-58 | A | 558047 | 4802475 | 280.16 | 281.08 | 8 |
| 9202046 | PBTW1-05 | A | 558317 | 4806857 | 302.92 | 297.64 | 15 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 9202637 | CMOW1ABC-06 | A | 558726 | 4805314 | 300.86 | 296.33 | 15 |
| 9202637 | CMOW1ABC-06 | B | 558726 | 4805314 | 302.74 | 297.77 | 9 |
| 9202637 | CMOW1ABC-06 | C | 558726 | 4805314 | 302.42 | 298.46 | 9 |
| 9202389 | | A | 562166 | 4804197 | 299.03 | 297.51 | 9 |
| 9202638 | CMOW2ABC-06 | A | 559589 | 4804174 | 299.82 | 296.46 | 15 |
| 9202638 | CMOW2ABC-06 | C | 559589 | 4804174 | 297.45 | 297.43 | 9 |
| 9202643 | PBOW1ABC-06 | C | 559286 | 4806058 | 303.98 | 300.17 | 9 |
| 9202647 | PLOW1AB-06 | A | 559403 | 4806775 | 304.20 | 302.85 | 3 |
| 9202648 | PLOW2ABC-06 | A | 559066 | 4806672 | 304.04 | 302.22 | 3 |
| 9202648 | PLOW2ABC-06 | B | 559066 | 4806672 | 304.69 | 302.51 | 2 |
| 9202648 | PLOW2ABC-06 | C | 559066 | 4806672 | 304.72 | 303.17 | 2 |
| 9202666 | CMOW1F-06 | F | 558725 | 4805314 | 304.44 | 299.37 | 3 |
| 9202669 | CMOW2F-06 | F | 559590 | 4804173 | 298.90 | 297.65 | 3 |
| 9202638 | CMOW2ABC-06 | B | 559589 | 4804174 | 297.66 | 296.95 | 9 |
| 9202671 | PBOW1E-06 | E | 559283 | 4806059 | 303.33 | 301.15 | 6 |
| 9202676 | PBOW2F-06 | F | 558534 | 4806922 | 304.00 | 301.79 | 3 |
| 9203305 | DW-FORD | A | 558663 | 4803841 | 291.99 | 295.91 | 3 |
| 9203307 | DW-SMALLBONE | A | 559689 | 4804281 | 297.00 | 297.89 | 5 |
| 9203308 | DW-ZIMMERMAN | A | 558603 | 4806220 | 304.43 | 301.18 | 3 |
| 9203312 | PTOW1 | A | 560024 | 4808548 | 305.26 | 304.65 | 3 |
| 9203419 | SMTW2ABC-07 | A | 557669 | 4802638 | 285.00 | 284.15 | 15 |
| 9203419 | SMTW2ABC-07 | B | 557669 | 4802638 | 281.57 | 284.12 | 13 |
| 9203419 | SMTW2ABC-07 | C | 557669 | 4802638 | 281.21 | 281.41 | 7 |
| 9203420 | SMTW3ABC-07 | A | 558418 | 4802867 | 288.60 | 288.32 | 14 |
| 9202667 | CMOW2D-06 | D | 559590 | 4804174 | 297.16 | 297.52 | 7 |
| 9203420 | SMTW3ABC-07 | B | 558418 | 4802867 | 288.49 | 284.86 | 10 |
| 9203420 | SMTW3ABC-07 | C | 558418 | 4802867 | 284.91 | 284.70 | 9 |
| 9203540 | SMOW1A-08 | A | 558970 | 4803479 | 291.65 | 291.41 | 8 |
| 9203541 | SMOW1B-08 | B | 558971 | 4803478 | 291.13 | 289.98 | 3 |
| 9203542 | SMOW1C-08 | C | 558971 | 4803480 | 291.90 | 290.11 | 2 |
| 9203543 | SMTW4ABC-08 | A | 559026 | 4803335 | 299.50 | 294.47 | 15 |
| 6505937 | P16 | A | 550347 | 4807752 | 291.00 | 293.06 | 7 |
| 6500110 | G4 | A | 553871 | 4802268 | 265.00 | 266.29 | 10 |
| 1000333 | OW6ABCD-95 | F | 553898 | 4803784 | 284.30 | 281.37 | 3 |
| 6507563 | BH3A-93 | D | 554016 | 4799651 | 295.06 | 294.54 | 9 |
| 9202674 | PBOW2D-06 | D | 558535 | 4806926 | 303.37 | 298.18 | 7 |
| 6507563 | BH3A-93 | C | 554016 | 4799651 | 293.65 | 292.32 | 9 |
| 6507563 | BH3A-93 | B | 554016 | 4799651 | 292.73 | 287.51 | 9 |
| 6507563 | BH3A-93 | A | 554016 | 4799651 | 292.62 | 281.08 | 10 |
| 1000356 | BH3B-93 | C | 554017 | 4799650 | 307.48 | 298.32 | 6 |
| 1000356 | BH3B-93 | B | 554017 | 4799650 | 296.16 | 296.48 | 6 |
| 1000356 | BH3B-93 | A | 554017 | 4799650 | 295.22 | 295.13 | 8 |
| 9200472 | BH5-94 | A | 554040 | 4799655 | 292.78 | 286.76 | 9 |
| 6501155 | P6 | A | 554159 | 4804014 | 260.40 | 264.77 | 13 |

| OBJ_NUM | CONSLT ID | Screen ID | Easting | Northing | Observed water level (masl) | Simulated water level (masl) | Model Layer |
|---|---|---|---|---|---|---|---|
| 6500129 | G5 | A | 555084 | 4806561 | 285.00 | 289.85 | 9 |
| 9200001 | G15 | A | 555170 | 4798053 | 253.00 | 259.66 | 11 |
| 9202675 | PBOW2E-06 | E | 558536 | 4806927 | 303.49 | 299.38 | 6 |
| 9200004 | G3 | A | 555183 | 4799708 | 240.00 | 251.63 | 10 |
| 9200003 | G2 | A | 555213 | 4799684 | 238.00 | 250.33 | 10 |
| 9200002 | G1 | A | 555242 | 4799693 | 246.00 | 251.90 | 13 |
| 6500142 | H3 | A | 555314 | 4808183 | 287.00 | 294.30 | 13 |
| 6500148 | H5 | A | 555327 | 4810826 | 299.39 | 301.09 | 13 |
| 9200010 | P15 | A | 555758 | 4806627 | 287.30 | 291.48 | 12 |
| 6500128 | P9 | A | 555792 | 4806582 | 284.70 | 290.99 | 12 |
| 1000017 | G17 | A | 556271 | 4804365 | 270.00 | 278.57 | 14 |
| 6500131 | G6 | A | 556355 | 4805062 | 275.00 | 279.63 | 13 |

# Appendix E

# Re-Interpretation of the Pinebush 15-day Pumping Test (October 2011)

# Re-interpretation of the Pinebush 15-day pumping test (October 2011)

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S.S. Papadopulos & Associates, Inc.
Last update: October 6, 2015

Overview

A 15-day constant-rate pumping test was conducted at the Pinebush wellfield between October 4 and October 19, 2011 (Stantec, 2013). Deep bedrock wells TW1-10 and P10A were pumped, with subsequent pumping from the Contact Aquifer well P10B. The test is particularly important because it provides insights into the response of the deep bedrock to pumping in an area that is the focus of water resource development but that has not been investigated extensively. In this technical note the analyses conducted to constrain the refinement of aquifer properties in the Cambridge East area are documented. Well P10A was pumped during a separate five-day test in May 2010 (Burnside, 2010) and the results of that test are also analyzed. The data from step tests conducted on TW1-10 and P10A have also been analyzed. These data are used to isolate the linear and nonlinear components of the drawdowns in the pumping wells. It is important to isolate these components when attempting to reproduce well performance with a numerical groundwater flow model.

The data from the testing of TW1-10 and P10A suggest that the deep bedrock aquifer in the vicinity of these wells has a complex structure. However, it is possible to develop a coherent conceptual model that is consistent with the interpreted aquifer properties. The key elements of the conceptual model are:

- TW1-10 pumps from a zone in the deep bedrock that has a transmissivity of about 520 $m^2$/d. This zone extends about 200 m from TW1-10. Beyond this distance the deep bedrock has a relatively lower transmissivity of about 150 $m^2$/d; and

- A transmissivity of 160 $m^2$/d is estimated from the P10A testing conducted in May 2010. The estimated transmissivity suggests that P10A is located close to the transition between the two zones inferred in the analysis of TW1-10.

## 1. Introduction

The constant-rate pumping test at the Pinebush well field began at 1:45 PM on October 4, 2011 and continued until 10:00 AM on October 19, 2011, a duration of 15 days. The pumping wells used for the test included TW1-10 and P10A, and the Contact Aquifer well P10B. Well P17 was also pumping cyclically during the test. The locations of the pumping wells are indicated in Figure 1.

The interpretation here is focused on the response to pumping in the deep bedrock. The drawdowns for the analysis are interpreted as the changes in water levels caused only by pumping from TW1-10 and P10A.

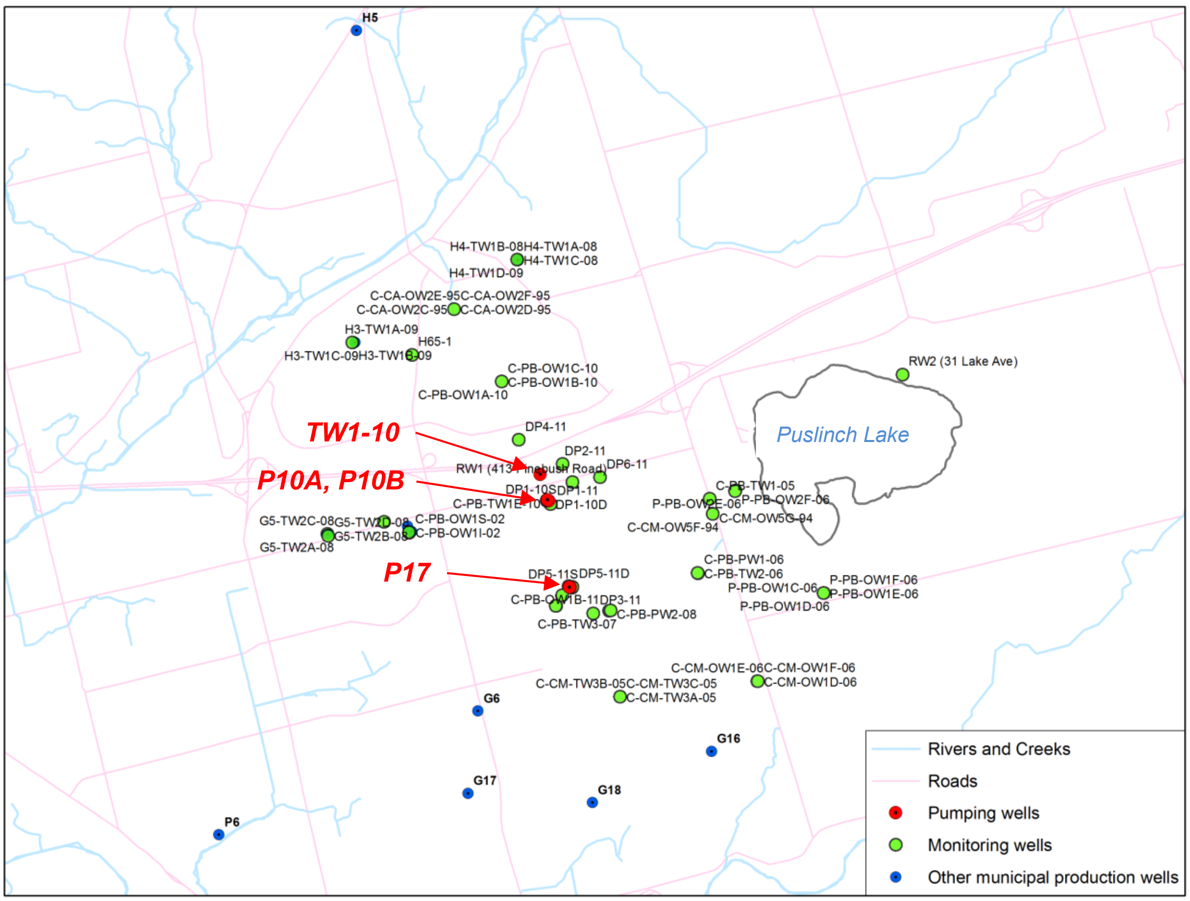


**Figure 1. Locations of the pumping wells during the Pinebush 15-day test**

## 2. Conceptual hydrogeologic model of the Pinebush area

The local hydrostratigraphic sections at the locations of test wells TW1-10 and P10A are shown in Figures 2 and 3. These sections have been extracted from the regional hydrostratigraphic model developed by S.S. Papadopulos & Associates, Inc., based on the geologic model of Frank Brunton of the Ontario Geological Survey. The blue lines in the figures denote the open intervals of the wells. The red lines in the figures denote the major flow zones inferred from borehole flowmeter proofing conducted on the wells.

The flowmeter profiling identified three major flow zones in TW1-10:

- Flow zone at 67 m Below Ground Surface (BGS), in the Reformatory Quarry Member of the Eramosa Formation: 18% of the total flow;
- Flow zone at 72 m BGS, in the Goat Island Formation: 88% of the total flow; and
- Flow zone at 97 m BGS, in the upper portion of the Gasport Formation: 18% of the total flow.

The flowmeter profiling identified three major flow zones in P10A:

- Flow zones at 70 m and 80 m BGS, in the upper portion of the Gasport Formation: 75% of the total flow; and
- Flow zone at 106 m BGS, in the middle portion of the Gasport Formation: 15% of the total flow.

The yield from a fourth flow zone at 118 m BGS was not significant.

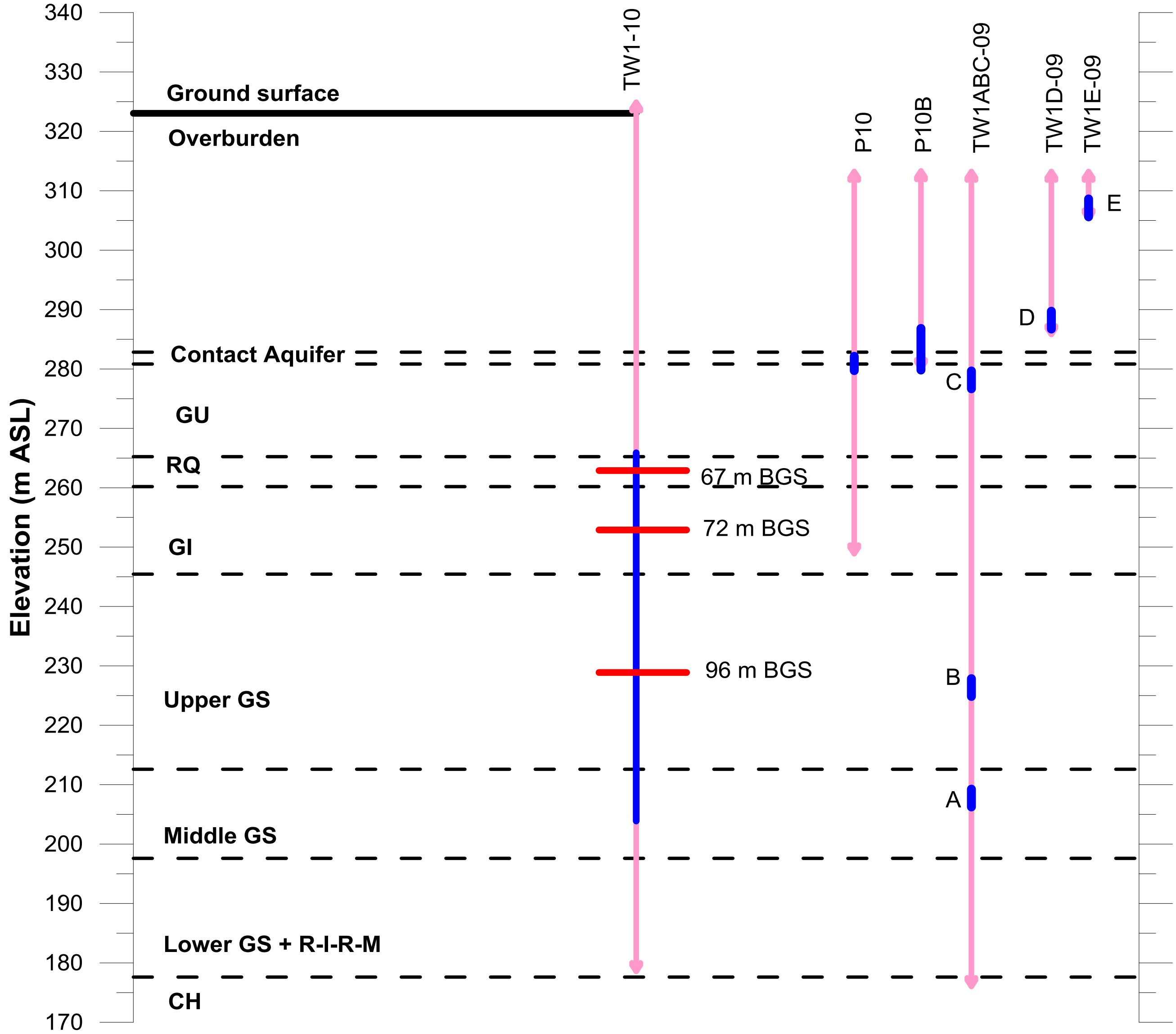


**Figure 2. Local hydrostratigraphy at TW1-10**

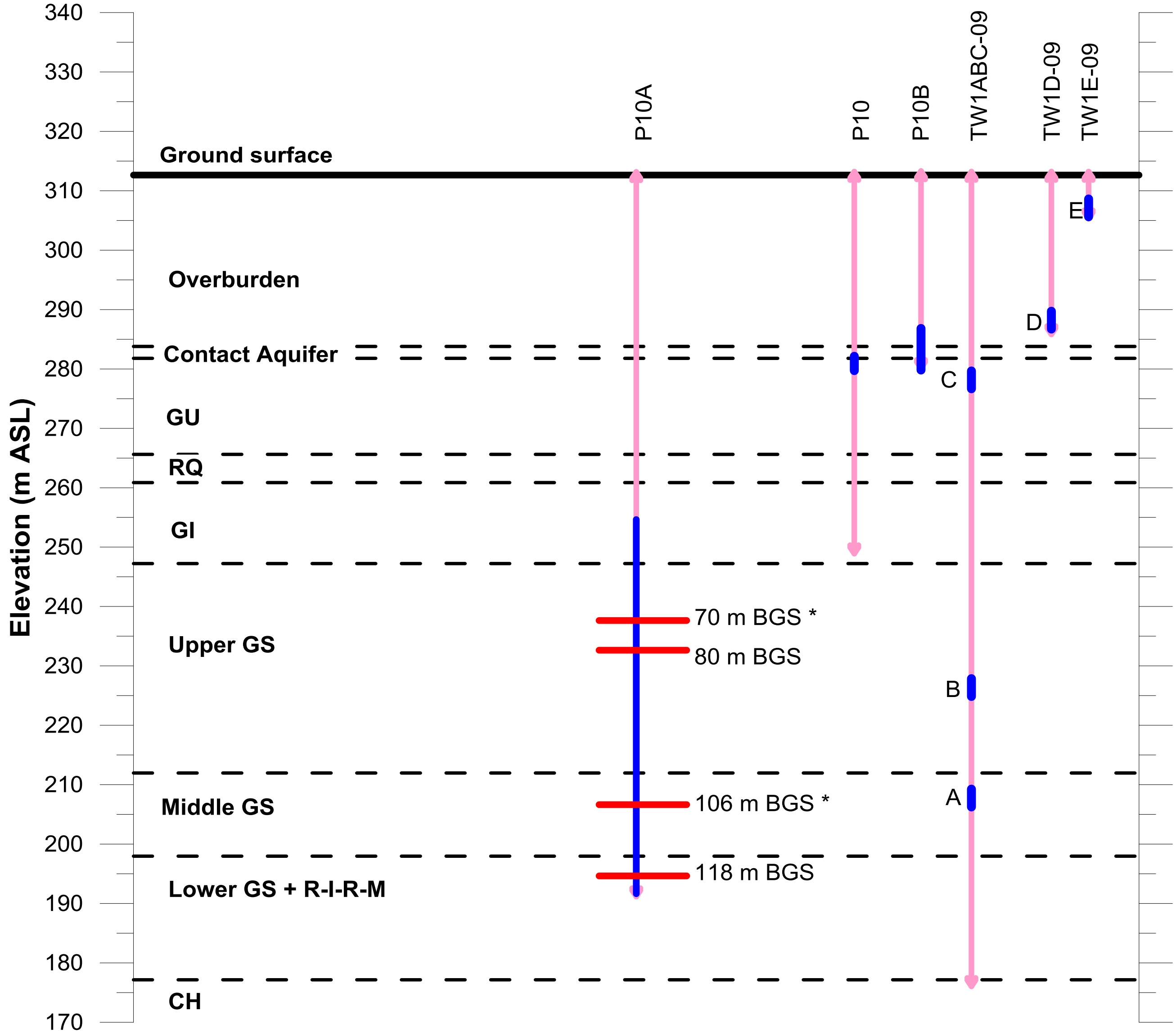


**Figure 3. Local hydrostratigraphy at P10A**

## 3. Pumping records of the Pinebush wells during the testing period

The pumping histories for TW1-10 and P10A during the Pinebush testing are summarized on Table 1. The pumping histories are plotted in Figure 4.

**Table 1 Pumping rates of the test wells during the test**

| Time | Elapsed time (days) | Pumping rate (L/s) | | |
|---|---|---|---|---|
| | | TW1-10 | P10A | Total |
| 2011-10-04 13:45 | 0.0000 | 40 | 0 | 40 |
| 2011-10-07 12:00 | 2.9271 | 35 | 0 | 35 |
| 2011-10-07 12:30 | 2.9479 | 35 | 0 | 35 |
| 2011-10-12 9:00 | 7.8021 | 0 | 0 | 0 |
| 2011-10-12 10:15 | 7.8542 | 35 | 0 | 35 |
| 2011-10-12 11:00 | 7.8854 | 35 | 70 | 105 |
| 2011-10-12 11:15 | 7.8958 | 30 | 70 | 100 |
| 2011-10-12 11:25 | 7.9028 | 25 | 70 | 95 |
| 2011-10-12 11:35 | 7.9097 | 20 | 70 | 90 |
| 2011-10-12 12:40 | 7.9549 | 15 | 70 | 85 |
| 2011-10-12 13:45 | 8.0000 | 20 | 70 | 90 |
| 2011-10-17 16:00 | 13.0938 | 0 | 70 | 70 |
| 2011-10-19 10:00 | 14.8438 | 0 | 0 | 0 |

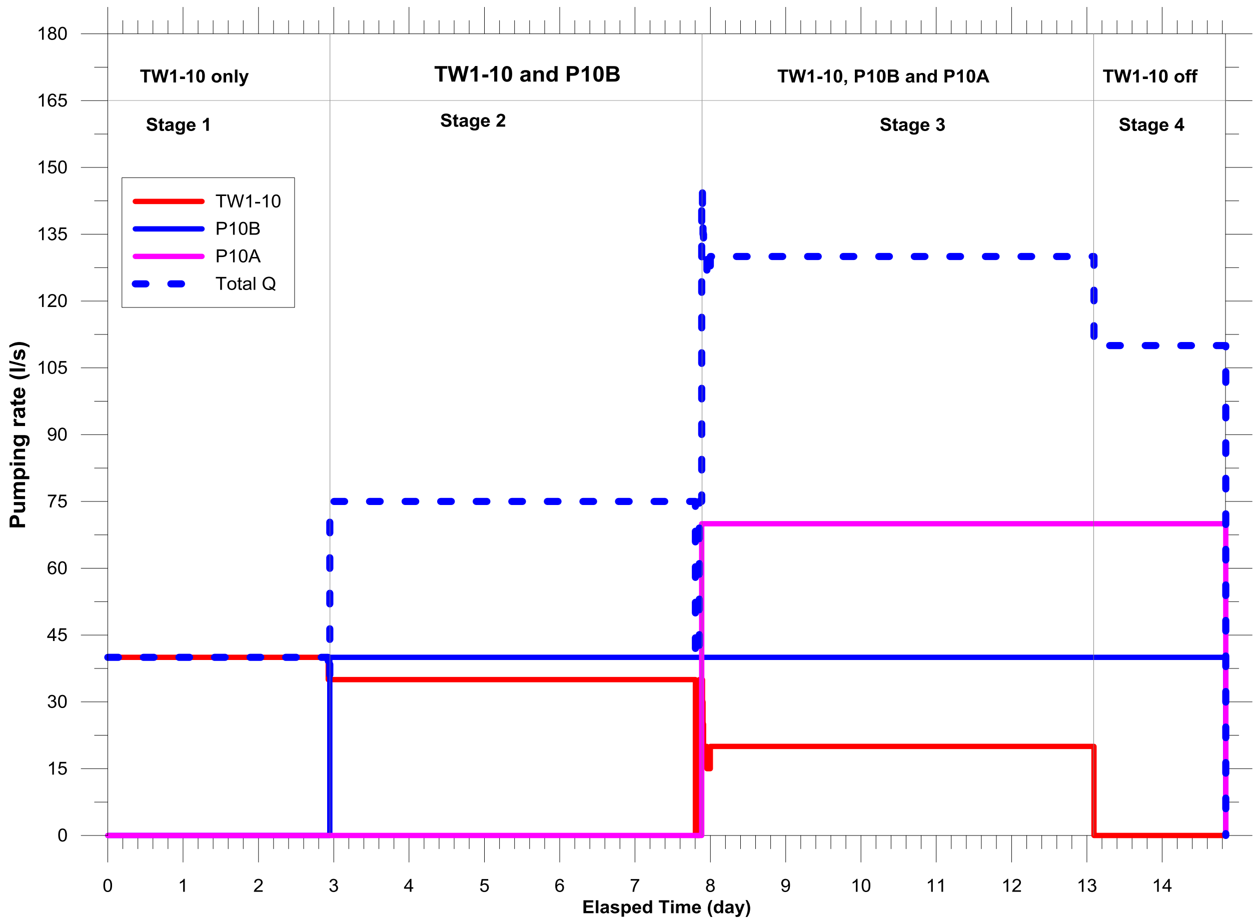


**Figure 4. Pumping records for the Pinebush wells during the testing period**

# 4. Interpretation of the response to pumping TW1-10

## 4.1 TW1-10 step test

A three-step pumping test was conducted at well TW1-10 on August 11, 2011. The steps were conducted at rates of 20 L/s, 30 L/s and 40 L/s. The durations of the first two steps were 30 minutes and the last step lasted 55 minutes. Detailed information on the test and the observed water levels during the step test are included in Stantec (2013; Appendix 1, Figure 19). The data for each step of the test are summarized on Table 2.

**Table 2 TW1-10 step test data**

| Step test # | Pumping rate, *Q* (L/s) | Drawdown at the end of each step, $s_w$ (m) |
|---|---|---|
| 1 | 20 | 7.83 |
| 2 | 30 | 12.83 |
| 3 | 40 | 18.67 |

A first-cut transmissivity at TW1-10 is estimated from the results of the step test. The transmissivity is estimated from a calculation of the specific capacity with the nonlinear well losses removed. The separation of the linear and nonlinear well losses is accomplished with the Hantush-Bierschenk analysis (Hantush, 1964; Bierschenk, 1964). It is assumed that water levels in the pumping well stabilized by the end of each step.

In the Hantush-Bierschenk analysis it is assumed that the drawdown can be approximated by the Jacob (1947) model:

$$s_w = BQ + CQ^2 \qquad (1)$$

Here $s_w$ is the drawdown, $Q$ is the pumping rate, $B$ is the linear well loss coefficient and $C$ is the nonlinear well loss coefficient. Dividing both sides of Equation (1) by $Q$ yields:

$$\frac{s_w}{Q} = B + CQ \qquad (2)$$

The values of the specific drawdowns, $s_w/Q$, are listed on Table 3.

**Table 3 TW1-10 step test results**

| Step test # | Pumping rate, *Q* (L/s) | Specific drawdown, $s_w/Q$ (m/L/s) |
|---|---|---|
| 1 | 20 | 0.392 |
| 2 | 30 | 0.428 |
| 3 | 40 | 0.467 |

The results of fitting Equation (2) to the observations are plotted in Figure 5. The step test data are approximated closely by a straight line. The specific drawdown at the end of the first interval of the 15-day pumping test, during which only TW1-10 was pumping, is also plotted in Figure 5. The specific drawdown for the constant-rate pumping test is larger than for the step test at the same pumping rate. This reflects the fact that the duration of the step test was about 2 hours, while the duration of the first interval of the constant-rate pumping test was about 3 days.

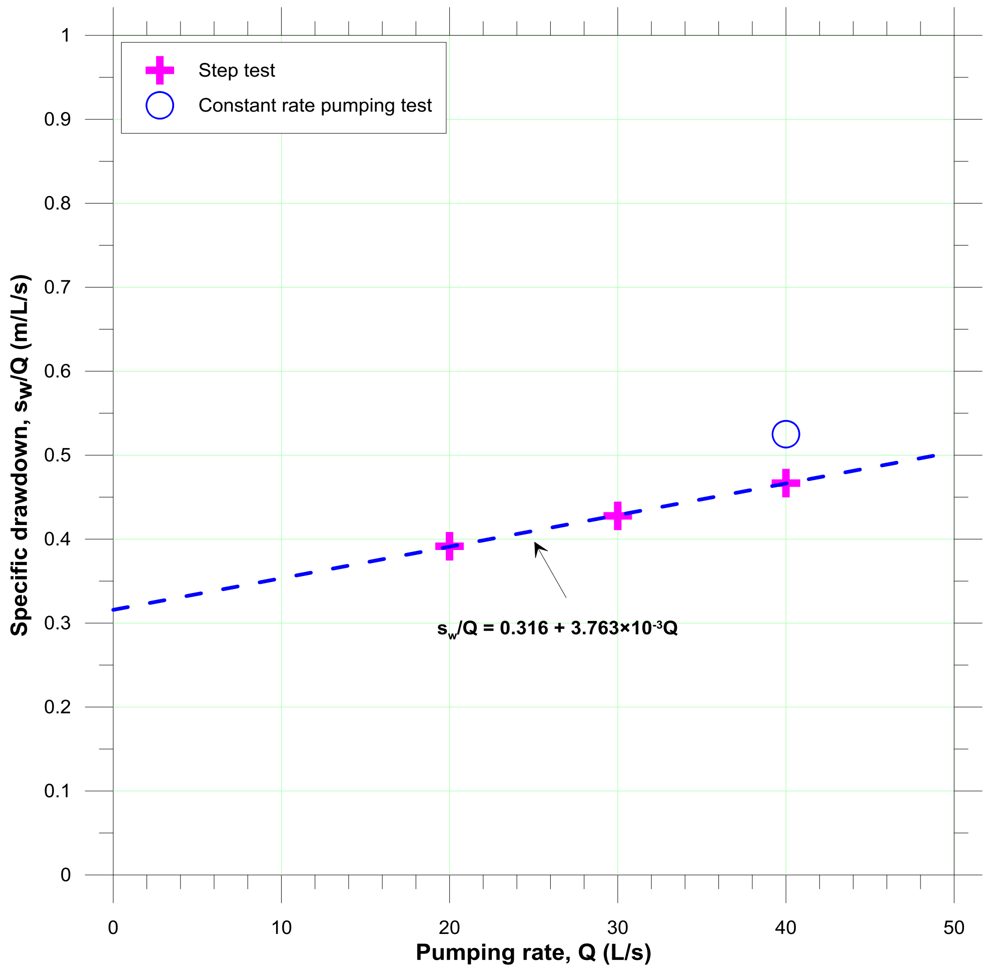


**Figure 5. TW1-10 step test results: Hantush-Bierschenk analysis**

The estimated linear and nonlinear well loss coefficients are:

- $B = 0.32$ m/L/s; and
- $C = 3.8\times10^{-3}$ m/(L/s)$^2$ = $3.8\times10^{3}$ s$^2$/m$^5$.

As a check on the fit shown in Figure 5, the pumping rates predicted with Equation (1) for a range of drawdowns are compared with the observations in Figure 6. The observations are matched closely, confirming that the line of best fit developed in Figure 5 is appropriate. For a pumping rate of 40 L/s, the Hantush-Bierschenk analysis yields the following components of the total drawdown in the pumping well:

- Linear component of drawdown: $BQ = 12.6$ m
- Nonlinear component of drawdown: $CQ^2 = 6.0$ m

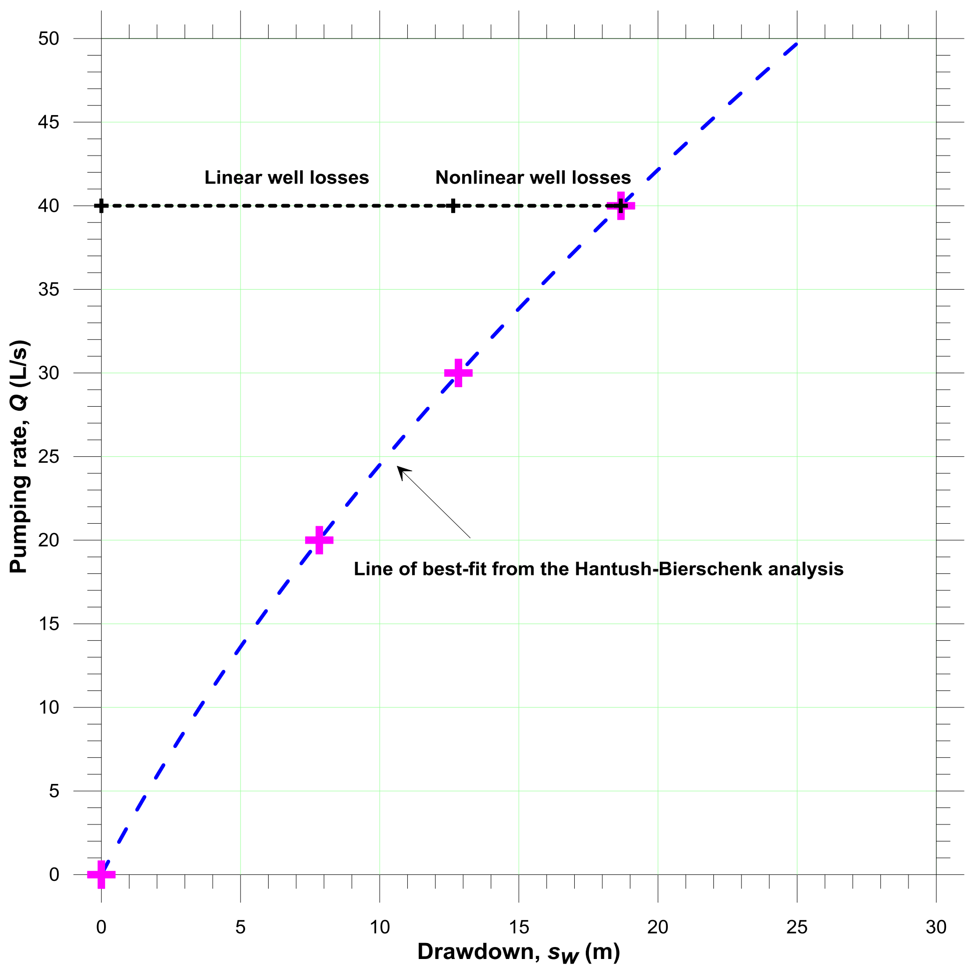


**Figure 6. TW1-10 step test results – Check on Hantush-Bierschenk analysis**

A first-cut estimate of the transmissivity in the immediate vicinity of TW1-10 is developed from the specific capacity with the nonlinear well losses removed. The adjusted specific capacity of TW1-10 is equal to the reciprocal of the linear well loss coefficient:

$$SC_{lin} = \frac{1}{B} \qquad (3)$$

Substituting the fitted value of $B$ into Equation (3) and converting units yields:

$$SC_{lin} = \frac{1}{B} = \frac{1}{0.316\ \mathrm{m/L/s}} \left|\frac{\mathrm{m}^3}{1000\ \mathrm{L}}\right| \left|\frac{86400\ \mathrm{s}}{\mathrm{d}}\right| = 270 \left(\frac{\mathrm{m}^3}{\mathrm{d}}\right)/\mathrm{m}$$

Following the approach of Theis and others (1963), Walton (1970) and Driscoll (1986), the transmissivity is estimated as:

$$T \sim 1.3 \times SC_{lin} \qquad (4)$$

The first-cut transmissivity is estimated as:

$$T \sim 1.3 \times 270 \left(\frac{\mathrm{m}^3}{\mathrm{d}}\right)/\mathrm{m} = \mathbf{350\ m^2/d}$$

## 4.2 Constant-rate pumping from TW1-10

During the first 2.9 days of the 15-day test, TW1-10 was pumped at an average rate of 40 L/s. The drawdowns observed at deep bedrock wells TW1-10, P10A, TW1A-09, TW1B-09, PB-TW2-06 and PB-OW1A-10 are assembled on a composite plot in Figure 7. The drawdowns observed at P10A, TW1A-09, TW1B-09 and TW1-10 with the nonlinear well losses removed can be matched with a single parallel line on the semi-log plot, yielding a consistent estimate of the bulk-average transmissivity of **<u>510 m$^2$/d</u>**. The drawdowns from the two more distant observation wells, PB-TW2-06 and PB-OW1A-10, are about 5 m less than would be expected for a homogenous aquifer.

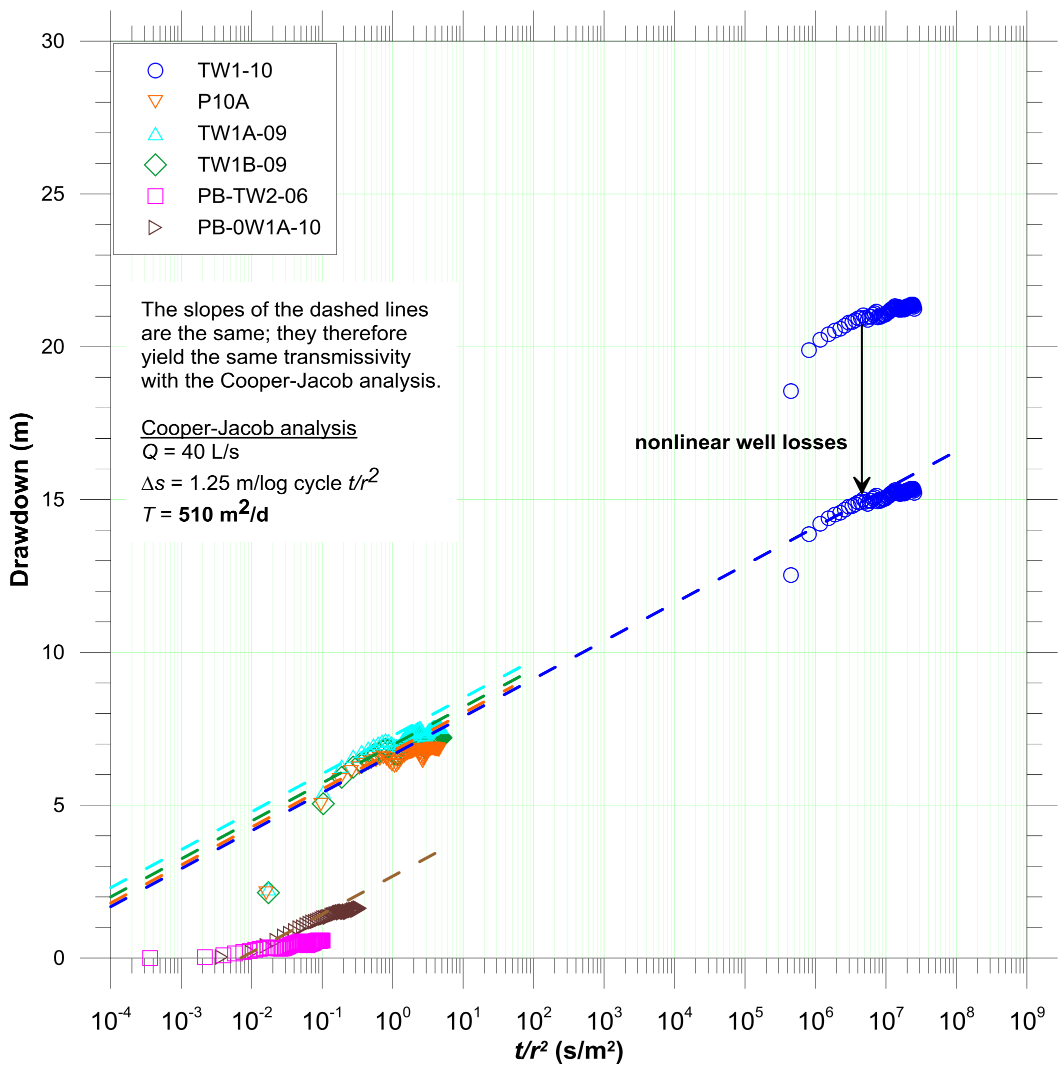


**Figure 7. Analysis of the first stress period of the 15-day pumping test**

The drawdowns observed at the end of the first 2.9 days of pumping are plotted against the distance from TW1-10 in Figure 8. The data do not appear to approximate a single straight line.

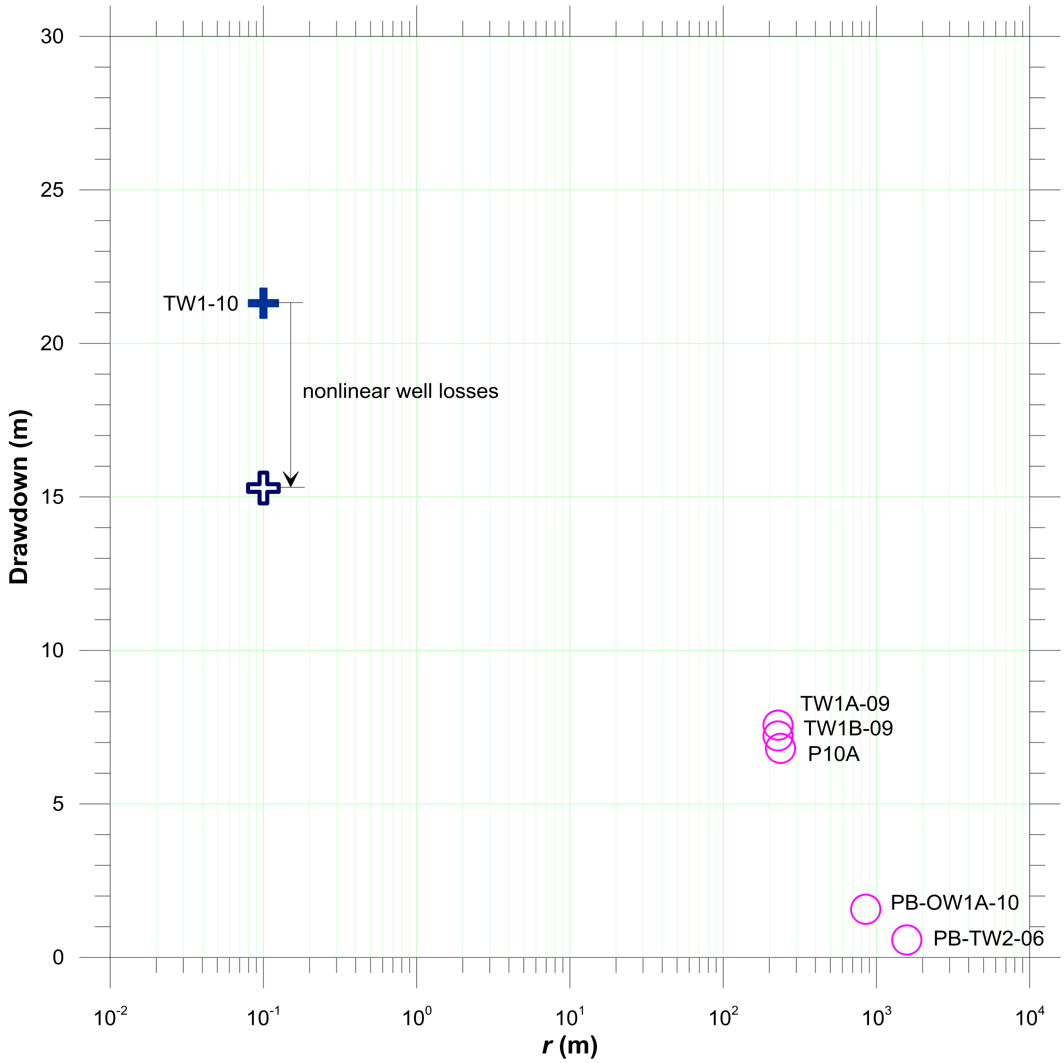


**Figure 8. TW1-10 pumping test – Distance-drawdown plot**

The distance-drawdown suggests that the pumping well and observation wells P10A, TW1A-09 and TW1B-09 might be located within an "inner" zone and that the two more distant observation wells, PB-TW2-06 and PB-OW1A-10, are located in an "outer" zone of different transmissivity. Cooper-Jacob straight-line analyses shown in Figure 9 yield transmissivities of **530 $m^2$/d** and **150 $m^2$/d** for the inner and outer zones, respectively.

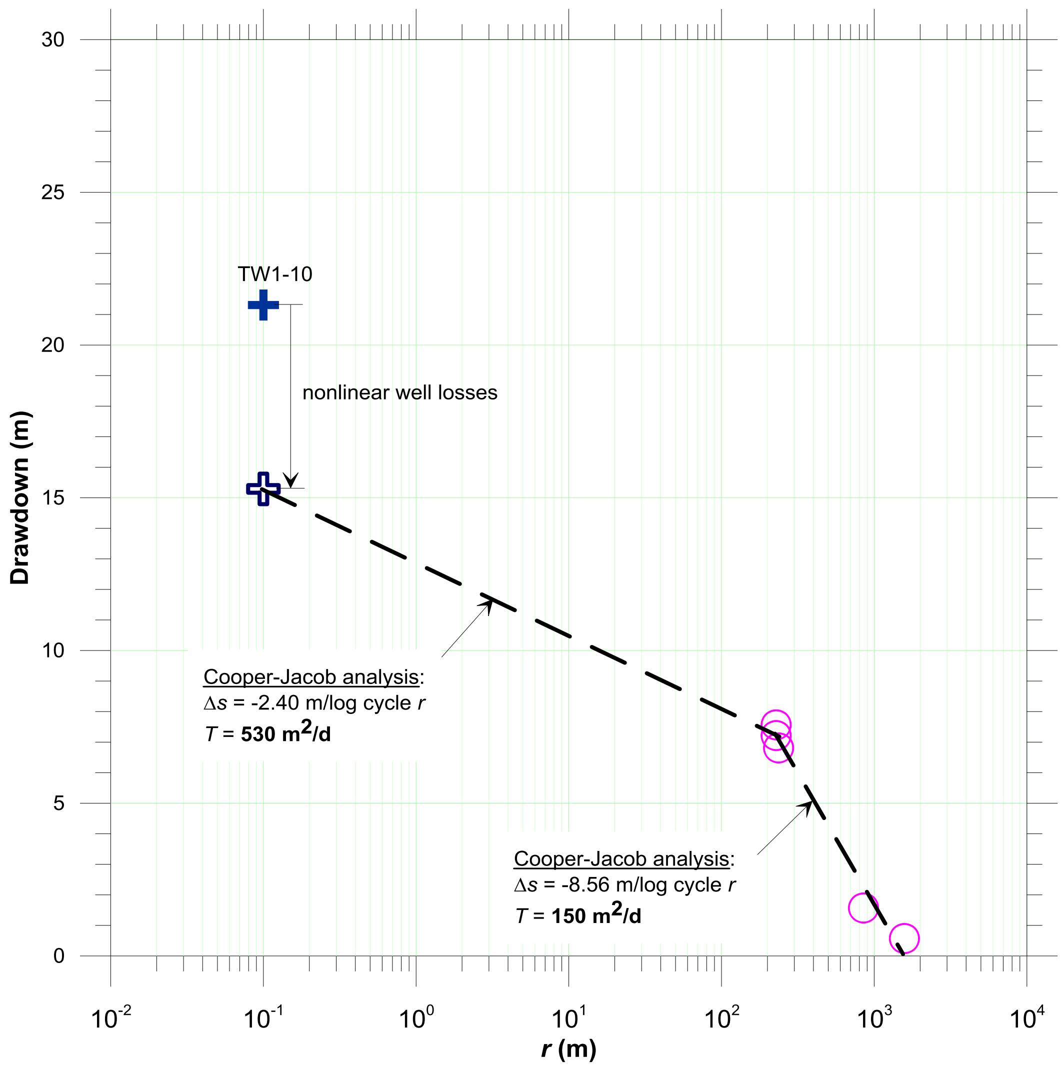


**Figure 9. TW1-10 pumping test – Distance-drawdown analysis #1**

The locations of the wells in the "inner" and "outer" zones are indicated in Figure 10. As shown in the figure, the inner zone wells are clustered around TW1-10. The "outer" zone wells, PB-TW2-06 and PB-OW1A-10, are located within similar distances from TW1-10, but in opposite directions.

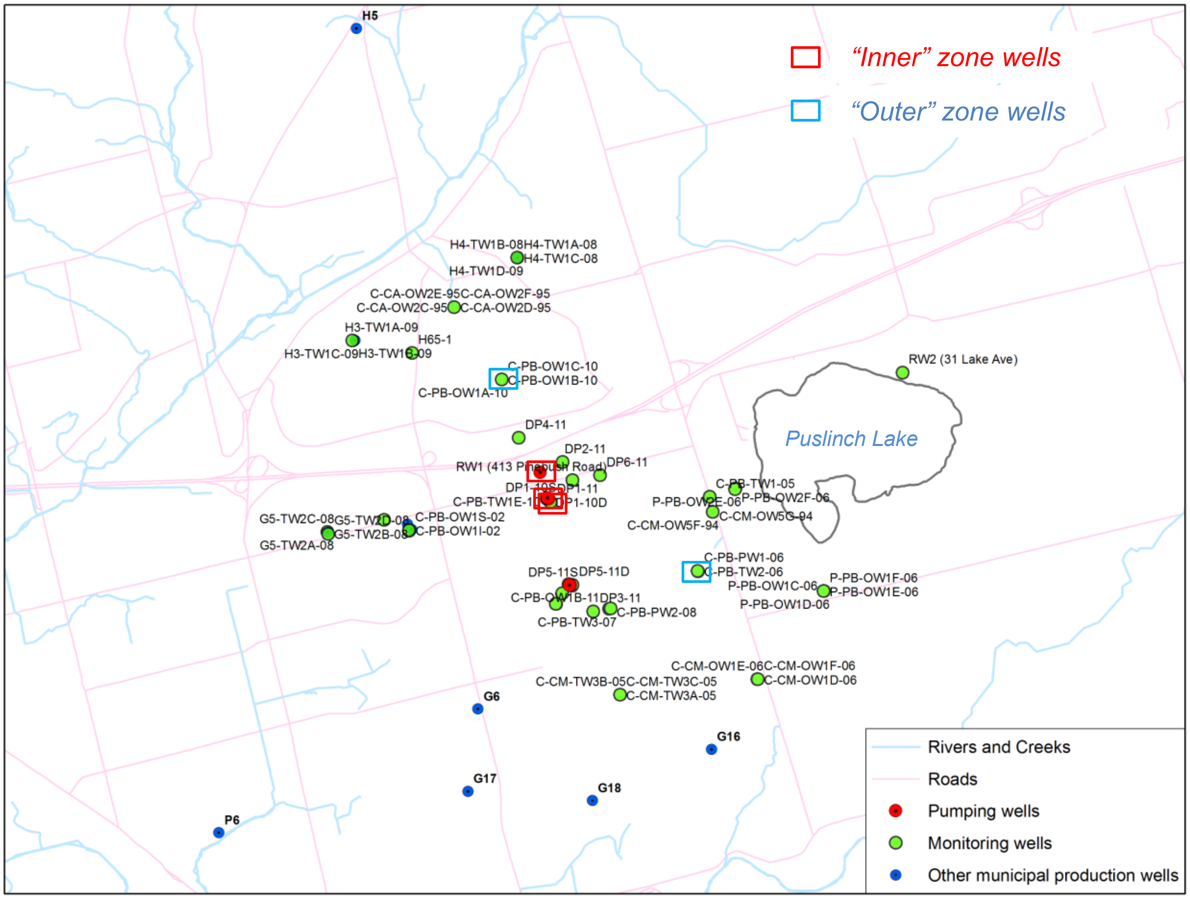


**Figure 10. Inferred "inner" and "outer" zone wells**

Only those observation wells in the deep bedrock that exhibited the clearest response to pumping have been considered in the preceding analyses. As a check on the interpretation, the responses at all of the deep observation wells monitored during that testing are incorporated in a revised distance-drawdown plot in Figure 11. The interpretation appears to be consistent with the extended set of observations.

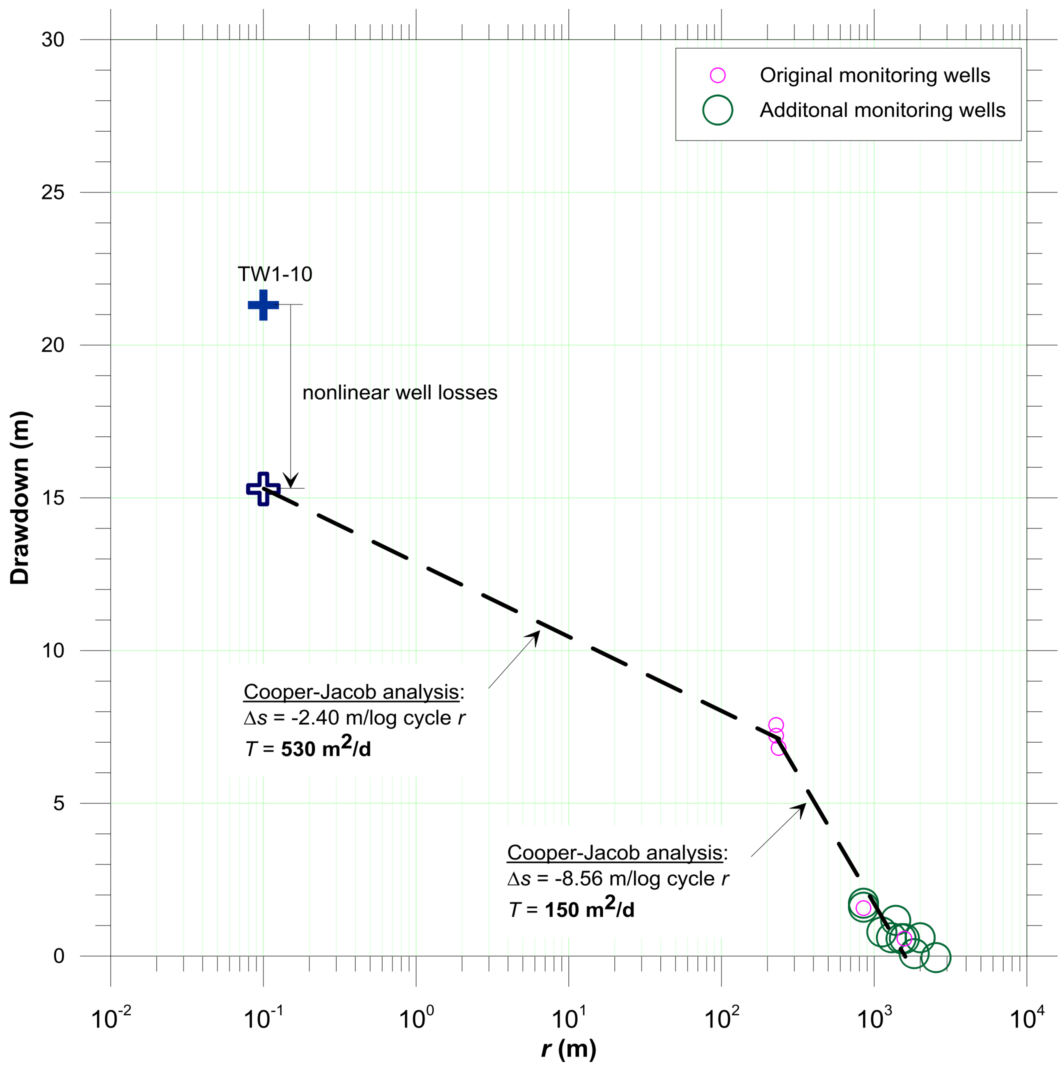


**Figure 11. TW1-10 pumping test – Distance-drawdown analysis #2**

## 5. Interpretation of previous testing at P10A

To further assess whether the interpretations of the TW1-10 testing are representative, the data collected during previous testing at P10A are revisited. Aquifer testing was conducted at well P10A in May 2010 (Burnside, 2010). P10A is about 250 m from TW1-10. A step test was conducted at the well, followed by a constant-rate pumping test.

### 5.1 P10A step test

A three-step pumping test was conducted at well P10A on May 6, 2010. The steps were conducted at rates of 25 L/s, 50 L/s and 75 L/s, with each step lasting 60 minutes. The results of the Hantush-Bierschenk analysis are shown in Figure 12.

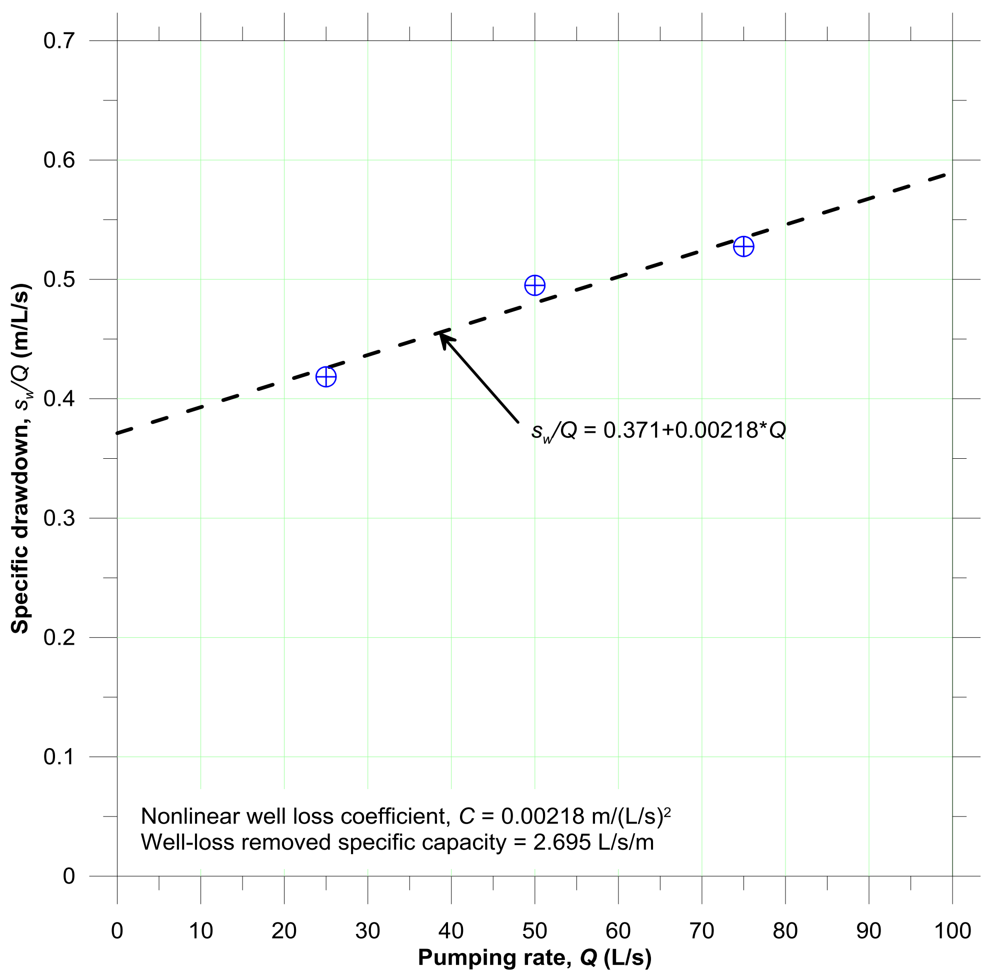


**Figure 12. P10A step test, May 2010: Hantush-Bierschenk analysis**

The results of the step test are approximated closely by a straight line of the form of Equation (2). The estimated linear and nonlinear well loss coefficients are:

- $B$ = 0.37 m/L/s; and
- $C = 2.2\times10^{-3}$ m/(L/s)$^2$ = $2.2\times10^{3}$ s$^2$/m$^5$.

The linear well loss coefficient, corresponding to the intercept of the best-fit line on the Hantush-Bierschenk plot, is 0.371 m/L/s. The specific capacity with the nonlinear well losses removed is the reciprocal of this value. Converting units yields:

$$SC_{lin} = \frac{1}{B} = \frac{1}{0.371\ \mathrm{m/L/s}}\left|\frac{\mathrm{m}^3}{1000\ \mathrm{L}}\right|\left|\frac{86400\ \mathrm{s}}{\mathrm{d}}\right| = 230\ \frac{\mathrm{m}^3/\mathrm{d}}{\mathrm{m}}$$

Therefore, the first-cut transmissivity based on Equation (4) is estimated as:

$$T \sim 1.3 \times SC_{lin} = 1.3 \times 230\left(\frac{\mathrm{m}^3}{\mathrm{d}}\right)/\mathrm{m} = \mathbf{300\ m^2/d}$$

Estimation of the linear and nonlinear sources of drawdown in P10A

The predicted pumping rates for a range of drawdowns in P10A are shown in Figure 13. For a pumping rate of 70 L/s, the linear and nonlinear components of the total drawdown in P10A are estimated as:

- Linear component of drawdown: $BQ$ = 26.0 m; and
- Nonlinear component of drawdown: $CQ^2$ = 10.7 m.

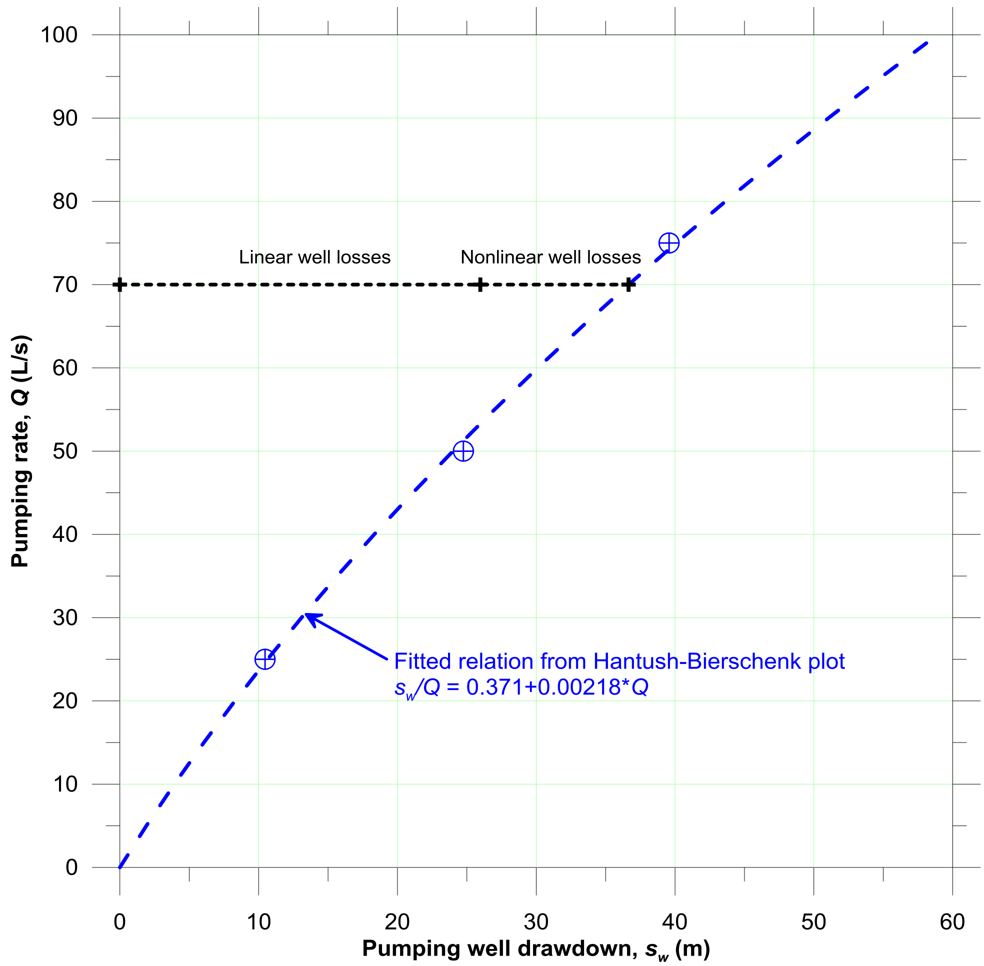


**Figure 13. P10A – Check on Hantush-Bierschenk analysis**

## 5.2 P10A constant-rate pumping test

A 5-day constant-rate pumping test was conducted at P10A on May 8, 2010. P10A was pumped at an average rate of 70 L/s.

A composite plot of the drawdowns observed at wells P10A, P10-TW1A-09 and P10-TW1B-09 is shown in Figure 14. The data from these wells can be matched by parallel lines on the semi-log composite plot, which indicates that an internally consistent, large-scale estimate of the transmissivity can be inferred from the data. The bulk-average transmissivity estimated with the Cooper-Jacob straight line analysis is about **160 $m^2$/d**.

The drawdowns for P10A plotted in Figure 14 appear to be shifted to the right with respect to the observation wells. This implies that the drawdowns observed at the pumping well are significantly smaller than would be expected for a homogeneous aquifer. The response to pumping suggests that P10A is surrounded by a zone that has an elevated transmissivity relative to the bulk properties of the deep bedrock in this area.

The inference of a zone of elevated transmissivity surrounding P10A is consistent with the other data available for this well. The results of the borehole flowmeter profiling of P10A are reproduced in Figure 15. Between depths of 70 m and 80 m, there is a major discontinuity in the flowmeter profiles, suggestive of a large cavern. It is possible that the transmissivity of this feature could be very much larger than 160 $m^2$/d; however, it is important to bear in mind that the transmissivity inferred from the pumping test is representative of the bulk-average properties of the formation outside of this feature.

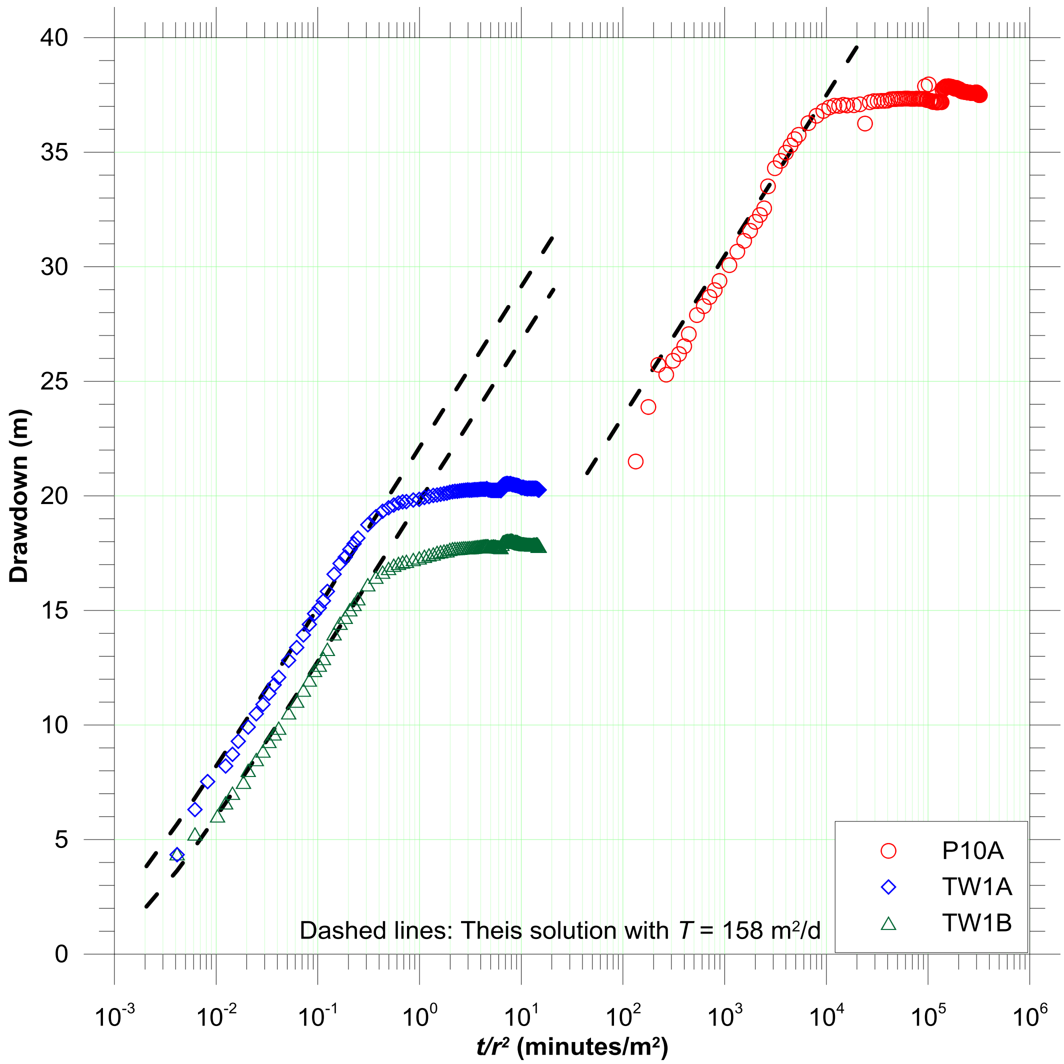


**Figure 14. P10A constant-rate pumping test, May 2010**

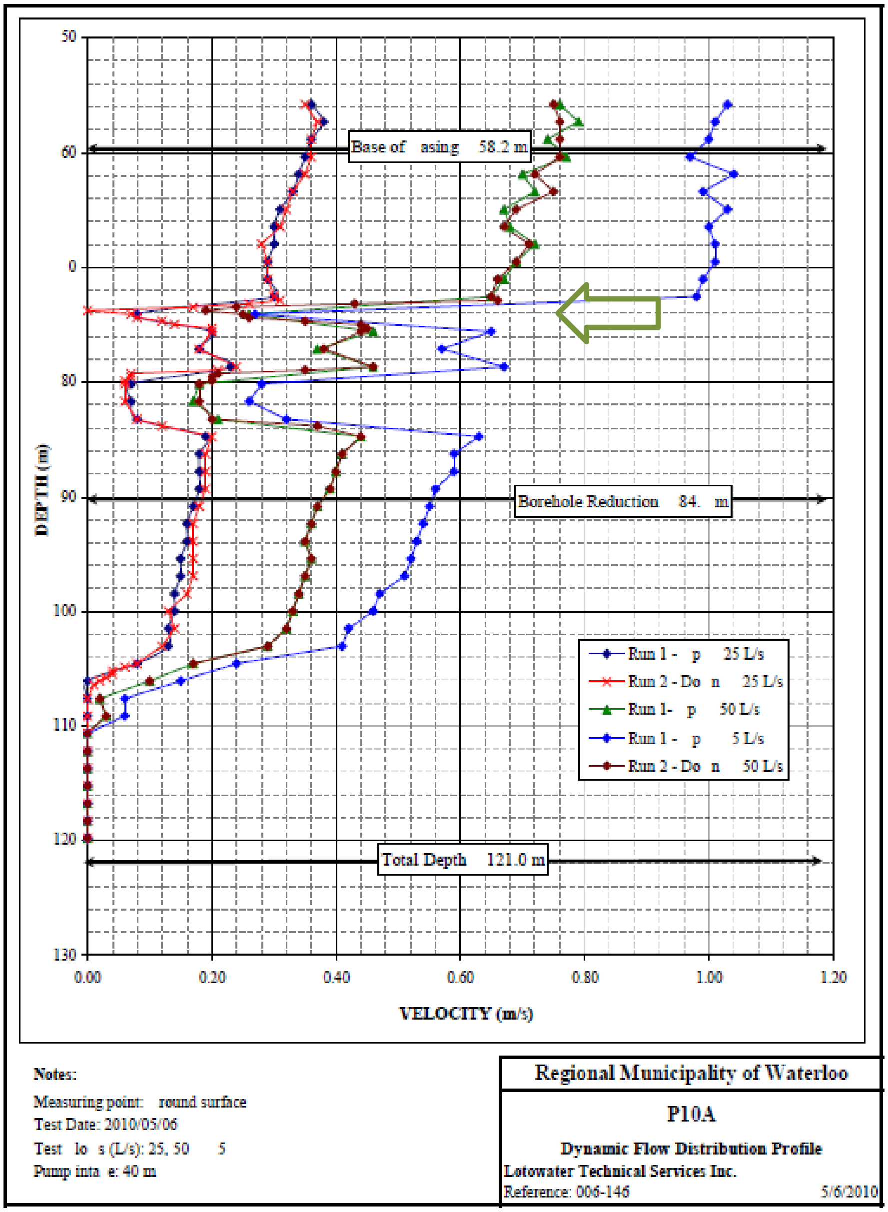


**Figure 15. Borehole flowmeter profiles for P10A**

## 6. Summary of the transmissivity estimates in the vicinity of TW1-10 and P10A

The following estimates of bulk-average transmissivity have been obtained.

Pumping TW1-10

- $T \sim 520$ m$^2$/d ("inner" zone)
- $T \sim 150$ m$^2$/d ("outer" zone)

The results of the TW1-10 constant-rate test suggested that the "inner" zone extends about 200 m from TW1-10.

Pumping P10A

- $T \sim 160$ m$^2$/d

The transmissivity of 160 m$^2$/d estimated from the P10A test is similar to the estimate obtained for the "outer" zone around TW1-10. Well P10A is located about 240 m from TW1-10. The analyses suggest that P10A is located close to the transition between the TW1-10 "inner" and "outer" transmissivity zones.

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# Appendix F

# Model Sensitivity Analysis

# Cambridge East Groundwater Model Sensitivity Analysis

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## 1 Introduction

To assist in assessing the most important aspects of the Cambridge East groundwater model, the computer assisted calibration code, PEST, was used to conduct a formal sensitivity analysis. The results of the sensitivity analysis are reported in terms of the relative change in the measure of the overall goodness of fit (the sum of the squared residuals, referred to as the objective function) versus changes in the hydraulic conductivity values from those inferred during calibration. The relative changes are referred to as the "sensitivities"'; hydraulic conductivities with the largest sensitivities are those that have the most impact on the overall match to the calibration targets.

The analysis was conducted by assigning NOPTMAX a value of -1 in the PEST control file. With a NOPTMAX value of -1, PEST terminates immediately after it has calculated the Jacobian matrix for the first time. The parameter covariance, correlation coefficient and eigenvector matrices are written to the run recorder file, and parameter sensitivities are written to the sensitivity file. The calibrated hydraulic conductivity values for the parameter zones within the Cambridge East area were specified as the baseline hydraulic conductivity values for the PEST analysis. By doing so, the sensitivities of the hydraulic conductivities calculated by PEST are based on the calibrated model. The sensitivities calculated by PEST are the composite sensitivities, sj defined as:

$$s_j = \frac{(\boldsymbol{J}^t \boldsymbol{Q}\, \boldsymbol{J})_{jj}^{1/2}}{m}$$

Here $m$ corresponds to the number of groundwater level calibration targets, $j$ denotes the $j^{th}$ parameter (the value of hydraulic conductivity specified for each zone) and $\boldsymbol{J}$ is the Jacobian matrix. $\boldsymbol{Q}$ is the 'cofactor matrix', an $m \times m$ diagonal matrix whose elements are the squared observation weights, with. Relative weights of 1.0 have been assigned for the high-quality steady-state calibration targets, and weights of 0.1 have been assigned for the targets derived from the water well records and production wells.

## 2 Results

The calculated composite sensitivities of the overall calibration with respect to changes in the calibrated hydraulic conductivity values are presented in **Figure 1**. The red bar represents the sensitivity of the horizontal hydraulic conductivity of the parameter zone, while the blue bar represents the sensitivity of the vertical hydraulic conductivity. Details on the most sensitive horizontal and vertical hydraulic conductivities are summarized on **Table 1** and **Table 2**, respectively. The locations of the most sensitive hydraulic conductivity zones are presented in **Figures 2 to 6**. Special attention is focused on the parameter zones with composite sensitivities more than 400 for the horizontal hydraulic conductivity, and 50,000 for the vertical hydraulic conductivity. These criteria are based on inspection of the distribution of sensitivities shown in **Figure 1**.

Efforts have been directed towards understanding why particular zones have the greatest impact on the calibration. These efforts have assisted in identifying areas for additional review of the conceptual model and refined calibration, and in identifying areas of the model where subsequent adjustments would not yield any significant improvement in the match to the groundwater level targets.

### 2.1 Overburden units (OB)

The PEST results show that the match to the calibration targets for 2003 average conditions are most sensitive to the hydraulic conductivity values of five parameter zones within the Overburden layers. The composite sensitivities of these zones and their hydraulic conductivity values are listed on **Table 1** and **Table 2**. The locations of the sensitive parameter zones in the overburden are presented in **Figures 2a, b, c** and discussed below.

<u>Zone 10101340</u>

As shown in **Figure 2a**, zone 10101340 is a strip that follows Mill Creek. The match to the calibration targets is affected only by the horizontal hydraulic conductivity of this zone. A low hydraulic conductivity value has been inferred for this zone during calibration, limiting the interaction between the groundwater system and Mill Creek.

<u>Zone 10101341</u>

Zone 10101314, shown in **Figure 2a**, is a small zone west of Puslinch Lake that consists of Port Stanley Till. The match to the calibration targets is sensitive to the horizontal hydraulic conductivity of this zone. A relatively low value of hydraulic conductivity is required in the model to limit the leakage from Puslinch Lake towards the west.

Zone 10202170

Zone 10202170 is shown in **Figure 2a** and represents the materials at the bottom of Puslinch Lake. The match to the calibration targets is sensitive to both the horizontal and vertical hydraulic conductivity of this zone. This parameter zone controls the leakage of Puslinch Lake to the groundwater system. The hydraulic conductivity of this zone has been critical for matching the observed lake level.

Zone 10104060

The extents of zone 10104060 are shown in **Figure 2b**. The zone represents the materials of the Port Stanley Till. The model results were sensitive to both the horizontal and vertical hydraulic conductivity of the zone. The Port Stanley Till is one of the main aquitards in the overburden that separates the overburden aquifers.

Zone 10306180

The limits of zone 10316180 are shown in **Figure 2c**. The zone includes sediments that are labeled Maryhill Till equivalents and Catfish Creek Till. It is another major aquitard in the overburden. The hydraulic conductivity of this zone has been found to exert an important influence on the differences in groundwater levels between the overburden units.

## 2.2 Bedrock units

The hydraulic conductivity zones of the bedrock units that have the greatest effect on the match to the calibration targets are primarily the Reformatory Quarry Member and the Vinemount Member of the Eramosa Formation. In general, the match to the targets is most sensitive to the vertical hydraulic conductivity of these units. Details of the sensitive parameter zones in the bedrock units are presented on **Table 1** and **Table 2**, and the locations of these zones are presented in **Figures 3 to 6**.

### 2.2.1 Reformatory Quarry Member (RQ)

Zone 41010040

The limits of zone 41010040 are shown in **Figure 3**. This zone includes the Hespeler and Shades Mills Well Fields. Mapping of estimates of transmissivity developed from the water well records suggested that these two areas had low to intermediate transmissivities. At the start of the calibration, these areas were lumped as one parameter zone along with the area in the center of Cambridge East. During the calibration of the 28-day pumping test, a separate zone for the center of the Cambridge East area was delineated to help achieve a better match to the observations from the pumping test.

Zone 41010060

As shown in **Figure 3**, this parameter zone is located at the southwest corner of the Cambridge East zone. The match to the calibration targets is more sensitive to the vertical hydraulic conductivity than to the horizontal hydraulic conductivity of this zone. The area covers the majority of the southwest of the model domain. Some multilevel monitoring data in this area, for example from OW5-95 and OW6-95, show large water level differences between the shallow and the deep bedrock aquifers in this area. The vertical hydraulic conductivity exerts the dominant control on these differences.

Zone 41010070

Parameter zone 41010070 is located in the northeastern portion of the Cambridge East area (**Figure 3**). Downward gradients from the shallow bedrock aquifer to the deep bedrock aquifer are inferred for this area. The match to the calibration targets is sensitive to the vertical hydraulic conductivity of this zone.

### 2.3 Vinemount Member (VM)

The Vinemount Member is the main aquitard that separates the shallow bedrock aquifers (the Guelph Formation and Reformatory Quarry Member of the Eramosa Formation) from the deep bedrock aquifers (the Goat Island and the Gasport Formation). The PEST results showed that the match to the calibration targets is sensitive to all the parameter zones of the Vinemount Member within the Cambridge East area. The large composite sensitivities of the hydraulic conductivity parameters representing the Vinemount Member indicate the importance of this unit.

Zone 51111010

As shown in **Figure 4**, this parameter zone extends across northeast of the Cambridge East zone. The match to the calibration targets is most sensitive to the vertical hydraulic conductivity of this zone. Golder Associates (2012) report a strong downward gradient between the shallow bedrock aquifer and the deep bedrock aquifer in this area. A low vertical hydraulic conductivity is inferred for this zone, to support the difference in water levels between the shallow and deep aquifers.

Zone 51111030

Parameter zone 51111030 covers the eastern portion of the model domain (**Figure 4)**. The match to the calibration targets is sensitive to the vertical hydraulic conductivity of this zone. Golder Associates (2012) report a strong upward gradient in the Shades Mills area. The low vertical hydraulic conductivity inferred for this zone is necessary to maintain the water level difference between the shallow and deep bedrock aquifers.

Zone 51111040

As seen in **Figure 4**, zone 51111040 is located at the center of the Cambridge East area. This zone has been delineated during calibration at the 28-day pumping test. The match to the calibration targets is sensitive to the vertical hydraulic conductivity. The low vertical hydraulic conductivity limits the propagation of the effects of pumping in the Gasport Formation to the shallow bedrock aquifer.

Zone 51111050

Parameter zone 51111050, shown in **Figure 4**, is a north-south direction strip that represents a transition zone marking the limits of the Vinemount Member. The thickness of the Vinemount Member within this zone is less than 1 m. The vertical hydraulic conductivity of this zone has been increased to reflect its thinness.

## 2.4 Gasport Formation (GS)

Only two parameter zones of the Gasport Formation, 71313090 and 81414090, have composite sensitivities higher than 400 for the horizontal hydraulic conductivity. They cover the same western portion of the model in the Upper Gasport Formation and the Middle Gasport Formation, shown in **Figures 5 and 6**. Data are relatively sparse to constrain the hydraulic conductivity value of these zones. However, the thickness of the Gasport Formation decreases sharply toward the west.

## Table 1 Horizontal conductivity zones with composite sensitivities greater than 400

| Zone ID | Description | Horizontal Hydraulic Conductivity (m/s) | Vertical Hydraulic Conductivity (m/s) | Composite Sensitivity |
|---|---|---|---|---|
| 10202170 | Bottom materials of Puslinch Lake (Layer 2) | $10^{-8}$ | $10^{-10}$ | 19860 |
| 51111050 | Vinemount Member of Eramosa Formation, thickness is less than 1 m | $10^{-7}$ | $10^{-8}$ | 1987 |
| 10101341 | Port Stanley Till at the west of Puslinch Lake (Layer 1) | $10^{-7}$ | $10^{-8}$ | 1666 |
| 51111010 | Vinemount Member of Eramosa Formation, north portion of the model domain | $10^{-7}$ | $10^{-9}$ | 1469 |
| 51111040 | Vinemount Member of Eramosa Formation, center of the Cambridge East area | $10^{-7}$ | $10^{-9}$ | 1418 |
| 41010060 | Reformatory Quarry Member of Eramosa Formation, west and southwest of the model domain | $10^{-6}$ | $5\times10^{-9}$ | 1415 |
| 10104060 | Port Stanley Till (Layer 4) | $2\times10^{-7}$ | $2\times10^{-8}$ | 945 |
| 41010040 | Reformatory Quarry Member of Eramosa Formation, transition zone at Hespeler well field and Shades Mills well field | $1.87\times10^{-7}$ | $9\times10^{-10}$ | 789 |
| 71313090 | Upper Gasport Formation, west portion of the model domain, large area with little information | $4.2\times10^{-6}$ | $4.2\times10^{-7}$ | 750 |
| 10101340 | Hydraulic conductivity zone along Mill Creek (Layers 1 to 4). | $10^{-6}$ | $10^{-7}$ | 724 |
| 81414090 | Middle Gasport Formation, west portion of the model domain, large area with little information | $2\times10^{-7}$ | $10^{-9}$ | 610 |
| 10306180 | Maryhill Till and equivalent, Catfish Creek Till (Layers 3 to 6) | $5\times10^{-7}$ | $5\times10^{-8}$ | 499 |
| 51111030 | Vinemount Member of Eramosa Formation, east central portion of the model domain | $1.5\times10^{-7}$ | $1.5\times10^{-9}$ | 416 |

## Table 2 Vertical conductivity zones with composite sensitivities greater than 50,000

| Zone ID | Description | Horizontal Hydraulic Conductivity (m/s) | Vertical Hydraulic Conductivity (m/s) | Composite sensitivity |
|---|---|---|---|---|
| 51111010 | Vinemount Member of Eramosa Formation, north portion of the model domain | $10^{-7}$ | $10^{-9}$ | 1815757 |
| 41010060 | Reformatory Quarry Member of Eramosa Formation, west and southwest of the model domain | $10^{-6}$ | $5\times10^{-9}$ | 1121633 |
| 10202170 | Bottom materials of Puslinch Lake (Layer 2) | $10^{-8}$ | $10^{-10}$ | 679415 |
| 51111030 | Vinemount Member of Eramosa Formation, east central portion of the model domain | $1.5\times10^{-7}$ | $1.5\times10^{-9}$ | 599437 |
| 51111040 | Vinemount Member of Eramosa Formation, center of the Cambridge East area | $10^{-7}$ | $10^{-9}$ | 483415 |
| 41010040 | Reformatory Quarry Member of Eramosa Formation, transition zone at Hespeler well field and Shades Mills well field | $1.87\times10^{-7}$ | $9\times10^{-10}$ | 355445 |
| 10306180 | Maryhill Till and equivalent, Catfish Creek Till (Layers 3 to 6) | $5\times10^{-7}$ | $5\times10^{-8}$ | 100265 |
| 10104060 | Port Stanley Till (Layer 4) | $2\times10^{-7}$ | $2\times10^{-8}$ | 90218 |
| 51111050 | Vinemount Member of Eramosa Formation, thickness is less than 1 m | $10^{-7}$ | $10^{-8}$ | 65040 |
| 41010070 | Reformatory Quarry Member of Eramosa Formation, thin zone, in the northeast of the model domain, close to the model boundary | $2\times10^{-6}$ | $1\times10^{-8}$ | 55568 |

## 3 Sensitivity Analyses for the Transient Simulations

For the calibration of the Cambridge East model, hydraulic conductivity estimates have been constrained relatively tightly by considering multiple calibration scenarios. The parameters about which the least data are available are the storage coefficients, in particular the specific storage. A key scenario for the model calibration is the high-quality 28-day pumping test conducted between September 5 and October 2, 2006. The storage coefficients for the transient simulations have been assigned values based on guidance in the hydrogeologic literature. Additional sensitivity analyses have been conducted to assess the significance of the storage parameters with respect to match to the transient calibration targets.

A specific storage ($S_s$) of $10^{-6}$ /m has been specified for the bedrock units of the model during the simulations of the 28-day pumping test. This is a "textbook" value (Lohman, 1972; p. 8; Boonstra, 1989; p. 17). To examine the significance of the specific storage for the bedrock layers, the following cases have been considered:

- Base Case: $S_s = 10^{-6}$/m;
- Case 1: $S_s = 10^{-5}$/m; and
- Case 2: $S_s = 10^{-7}$/m.

Scatterplots of the drawdowns calculated after 28 days for the three cases are presented in **Figures 7 to 9**. The results suggest that a specific storage of $10^{-5}$ /m yields a slightly better match to the observations. There are no obvious differences between the final drawdowns calculated for the Base Case and for Case 2. The match to the final drawdown is not the only criterion that has been considered when assessing the results of the transient calibrations. Three observation wells, CMOW1-06, CMOW2-06 and PBOW2-06, have been selected to compare the entire transient records over the duration of the test. These wells are in the immediate vicinity of the pumping wells, where the observed response to pumping is greatest. The simulated and observed hydrographs for the "A" monitoring intervals (Gasport Formation) at CMOW1-06, CMOW2-06 and PBOW2-06 are presented in **Figures 10 to 12**. The hydrographs suggest that better matches are achieved for the Base Case. For Case 1, although the final simulated drawdowns are closer to the final observed drawdowns, the results of the simulation do not match the full records as wells as for the Base Case and Case 2.

The observations suggest that the water levels at the "A" monitoring intervals are nearly stable at the end of each pumping stage. In contrast, for Case 1 the simulated water levels are still declining at the end of each pumping stage. The results for both the Base Case and Case 2 reproduce the near-stabilization by the end of each pumping stage. The results for Case 2 suggest that when a specific storage of $10^{-7}$/m is specified, the water levels in the observation wells reach their final levels almost immediately after the start of each new pumping stage. The observations suggest that this is too sudden.

Observed and simulated hydrographs for monitoring wells in the Guelph Formation and the overlying overburden are shown in **Figure 13** through **Figure 18**. The "B" monitoring intervals are open across the Guelph Formation and the “D” monitoring intervals are screened in the overburden. The “C” intervals are not discussed, as they are also open across the Guelph Formation.

The hydrographs for CMOW1-06, CMOW2-06 and PBOW2-06 are shown in **Figures 13 to 15**. At CMOW1B-06, all three analyses overestimate the final drawdowns. However, the results from both the Base Case and Case 2 closely match the drawdown of the second stage of pumping (pumping by PBPW1-06), and stable groundwater levels are predicted at the end of each stage. The drawdowns simulated for Case 1 show continuing declines in water levels at the end of each pumping stage. The simulated drawdowns for PBOW2B-06 with the Base Case and Case 2 match the observed drawdowns more closely than do the results for Case 1.

The simulated and observed hydrographs for the "D" monitoring intervals in overburden sediments at CMOW1-06, CMOW2-06 and PBOW2-06 are shown in **Figures 16 to 18**. At all three wells, the results for the Base Case and Case 2 match the observed drawdowns better than do the results for Case 1.

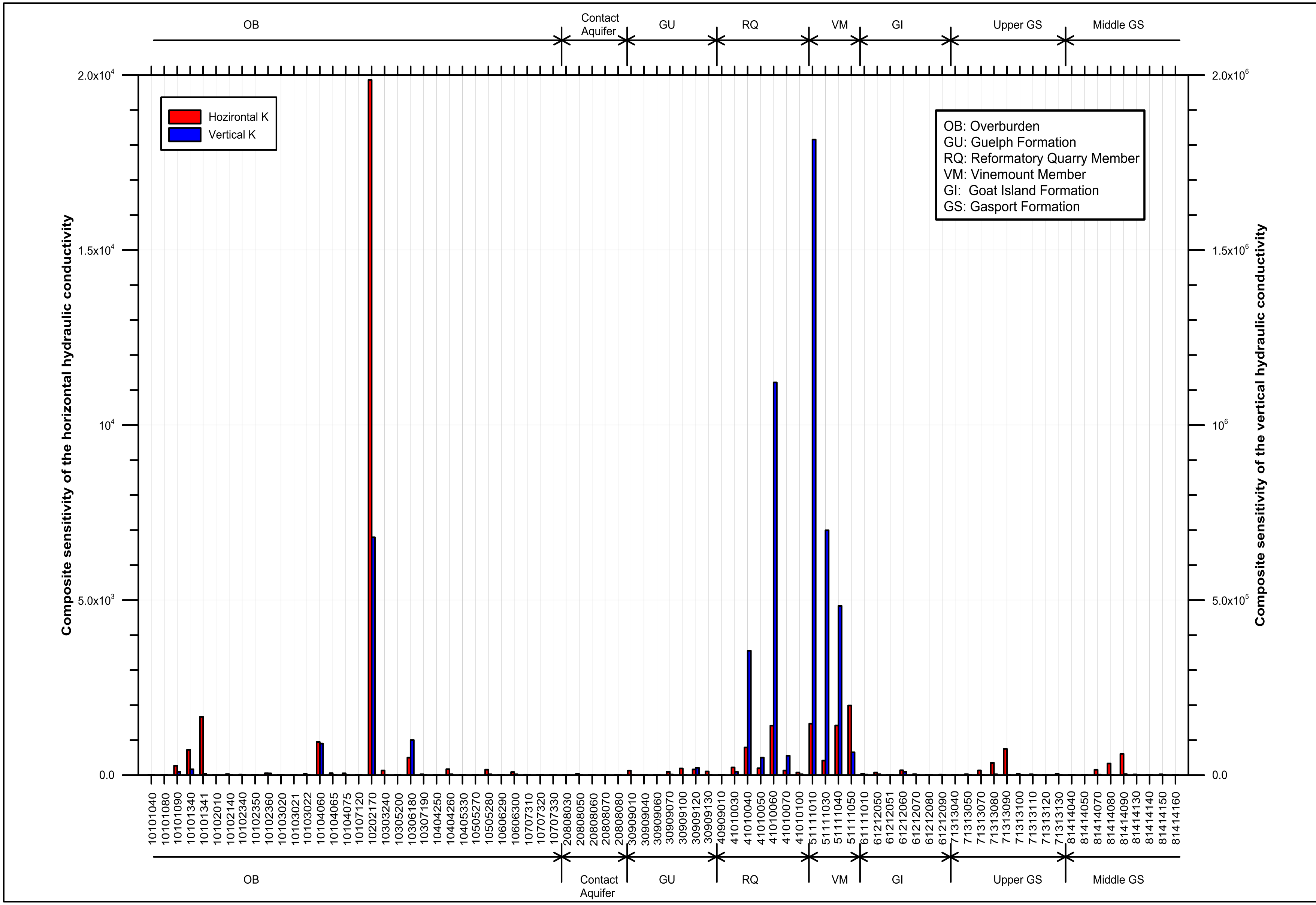
The final simulated drawdowns in the Contact Aquifer and the Middle Gasport Formation are shown for all three cases in **Figures 19 to 24**. The final simulated drawdowns are similar for specific storages of $10^{-6}$/m and $10^{-7}$/m. The differences between the simulations are more obvious for specific storages of $10^{-6}$/m and $10^{-5}$/m.

It is important to note that the pumping during the 28-day Cambridge East test was from the deeper bedrock units. Therefore, the specific storage is more significant with respect to the response in the bedrock aquifers than the overburden. It is also important to note that in the long term, the transient responses to pumping stabilize and the results do not depend on the storage coefficients.

The key finding from the sensitivity analysis are summarized below.

- The assumed specific storage value of $10^{-6}$/m for the bedrock layers is defensible. The value of $10^{-6}$/m is consistent with guidance in the literature, and yields an acceptable match to the observed trends in the drawdowns. Varying the specific storage to $10^{-7}$/m has little effect on the calibration results; however, varying the specific storage to $10^{-5}$/m yields larger differences in calculated drawdowns and produces a closer match to the final observed drawdowns. The match to the final drawdowns is improved when the specific storage is increased to $10^{-5}$ /m; however, the match to the complete drawdown record deteriorates compared to the results when specific storage is assigned a value of $10^{-6}$/m.

- For the 28-day pumping test, the drawdowns in the deep bedrock aquifer (Gasport Formation) are more sensitive to the specific storage than the shallow bedrock aquifers. This reflects the fact that the main water production zones of the deep bedrock pumping wells are within the Gasport Formation.




**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 1:** Composite Sensitivities of the Hydraulic Conductivity Zones

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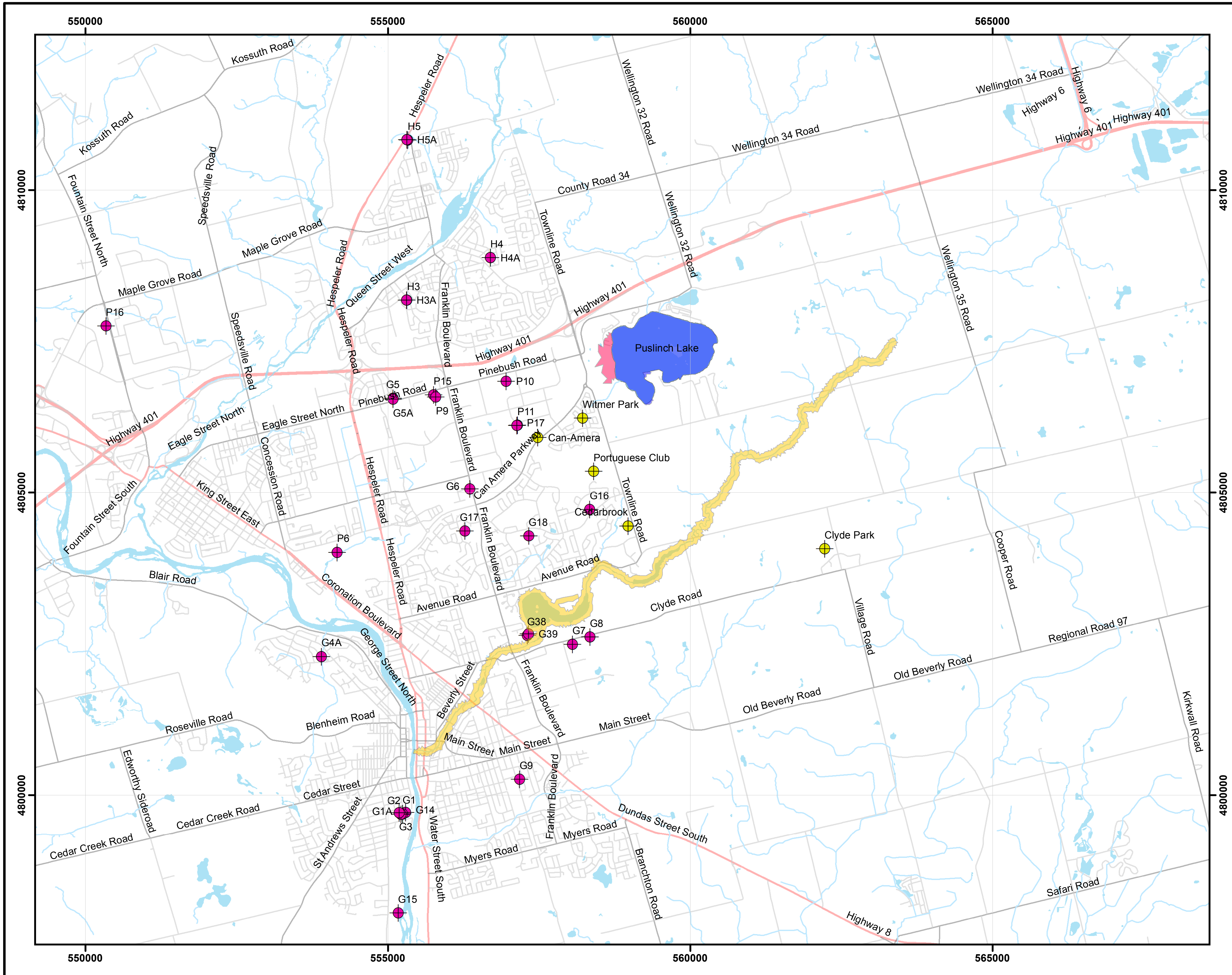
# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

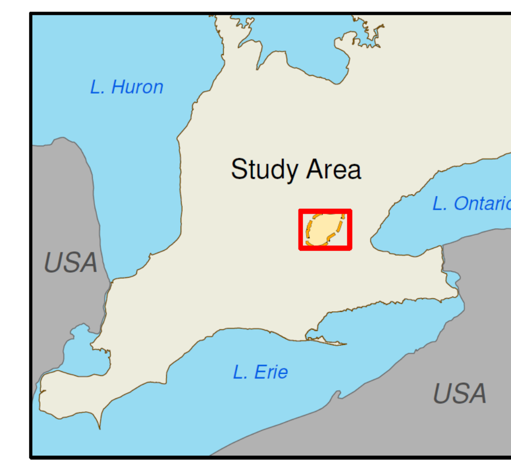
**Hydraulic conductivity zone**

- 10101340
- 10101341
- 10202170

1:60,000

1 0.5 0 1

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

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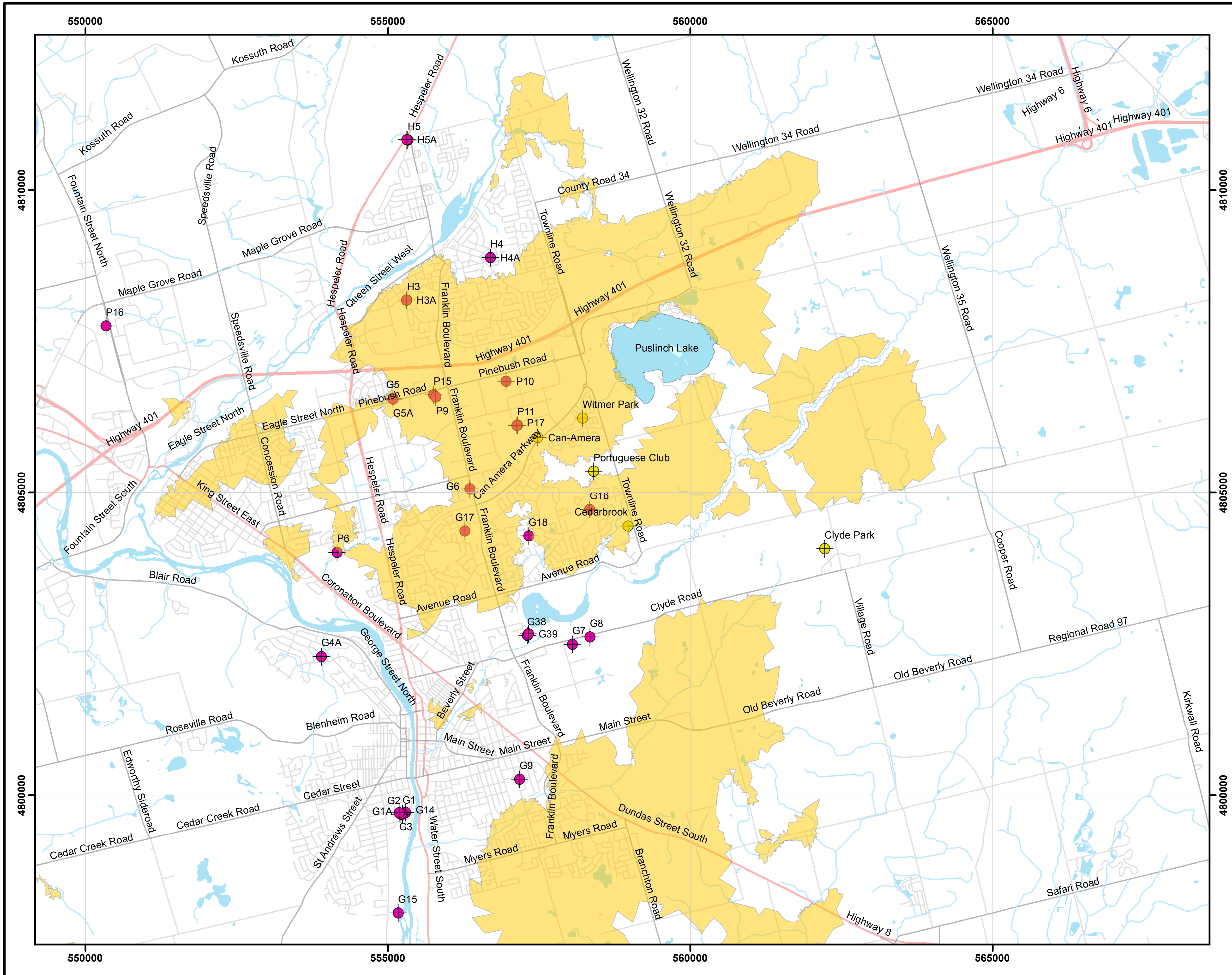
**Figure 2a**

Locations of Sensitive Hydraulic Conductivity Zones in Overburden — Map 1

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

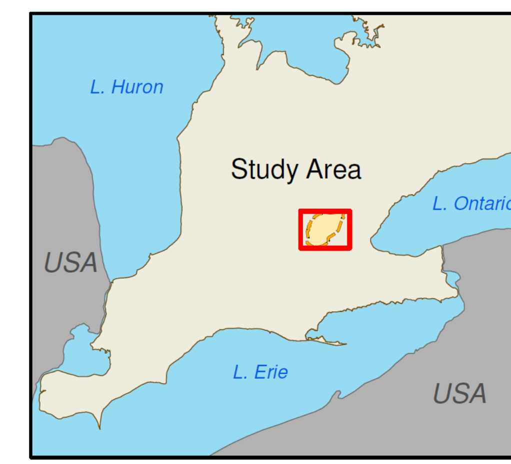
Hydraulic conductivity zone

- 10104060

1:60,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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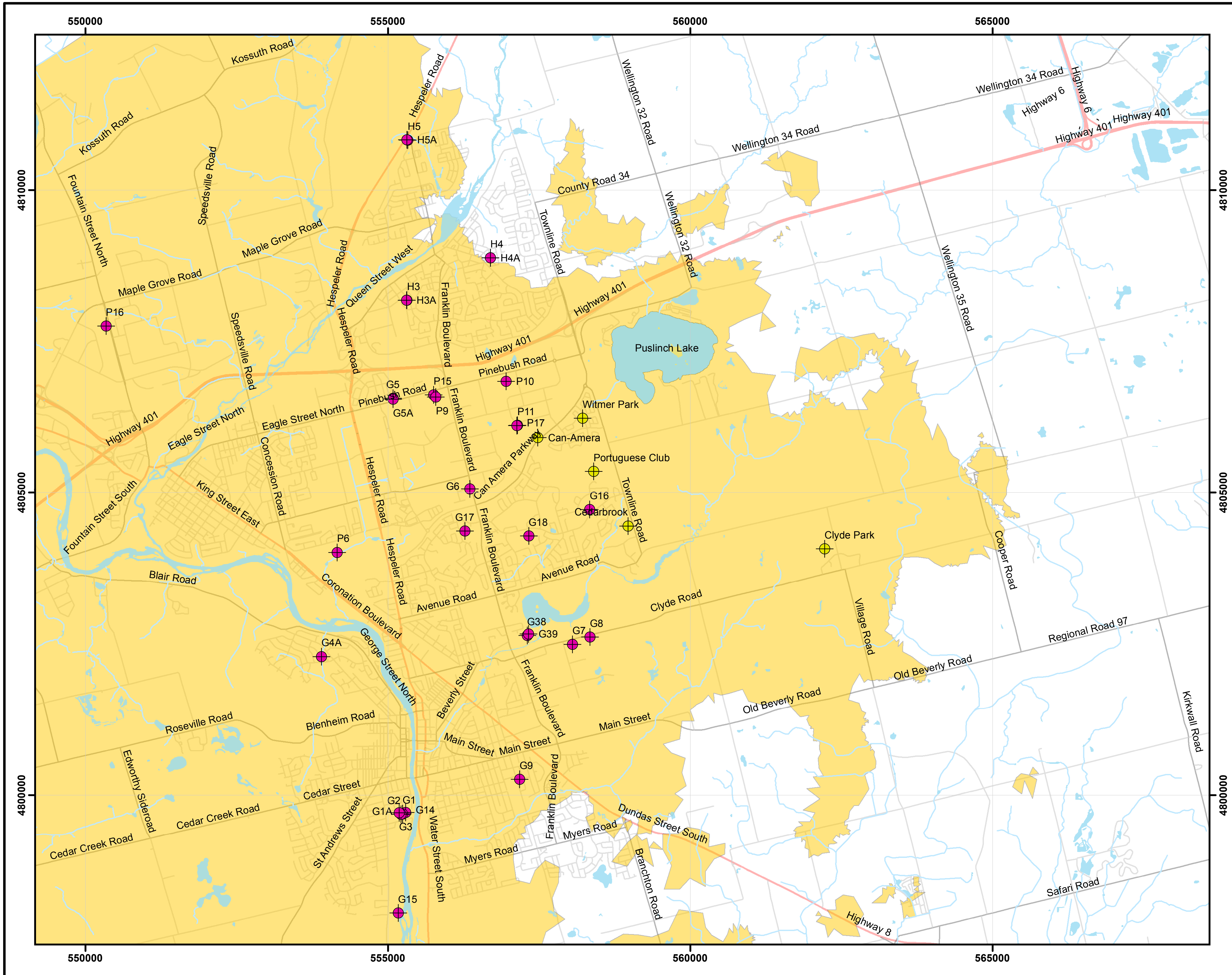
**Figure 2b**

Locations of Sensitive Hydraulic Conductivity Zones in Overburden — Map 2

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

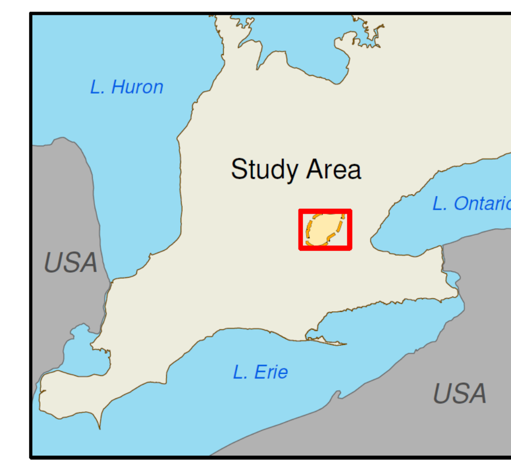
Hydraulic conductivity zone

- 10306180

1:60,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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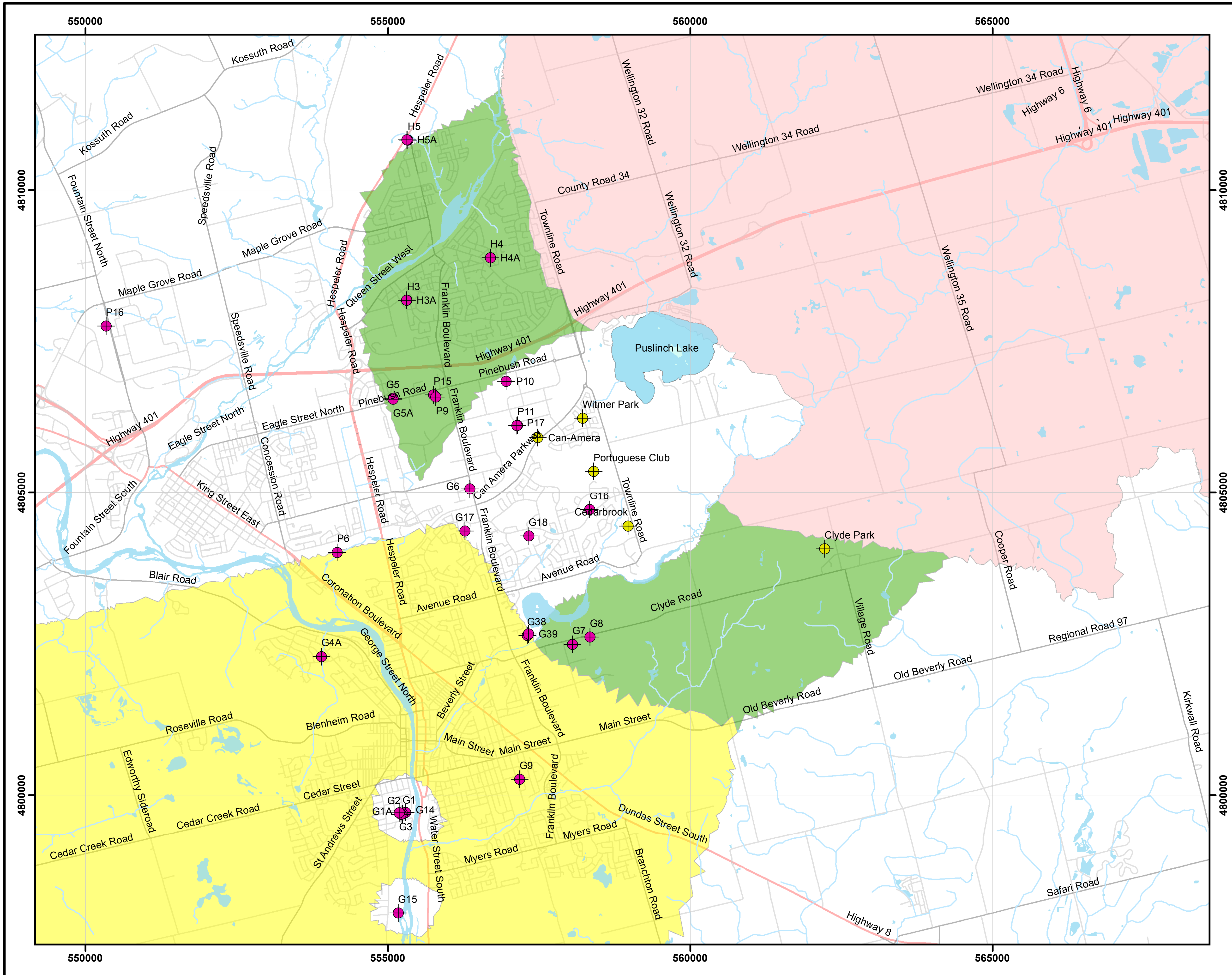
**Figure 2c**

Locations of Sensitive Hydraulic Conductivity Zones in Overburden — Map 3




**Cambridge East IUS Water Supply Class EA: Groundwater Modelling**

Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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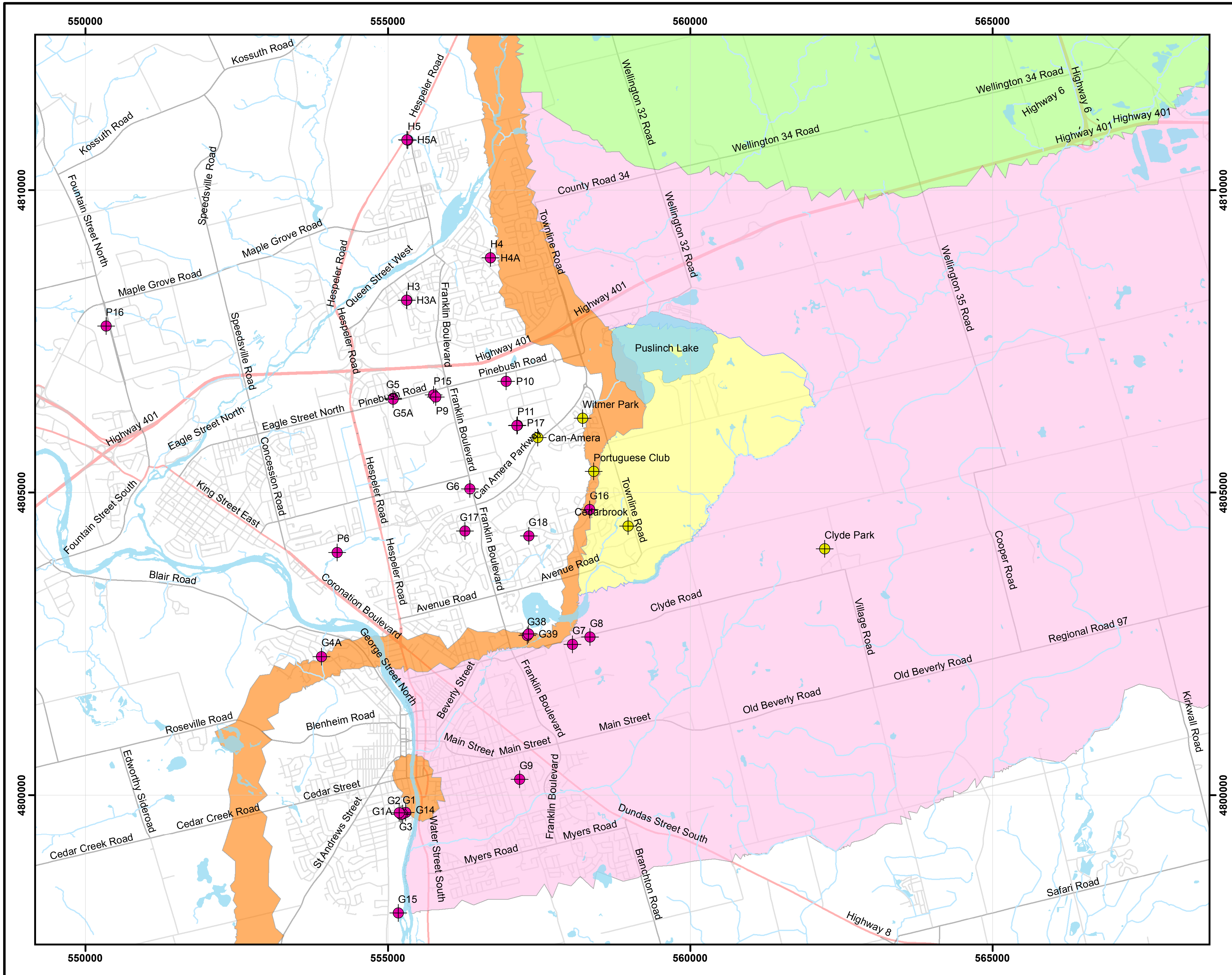
**Figure 3**

Locations of Sensitive Hydraulic Conductivity Zones in the Reformatory Quarry Member




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

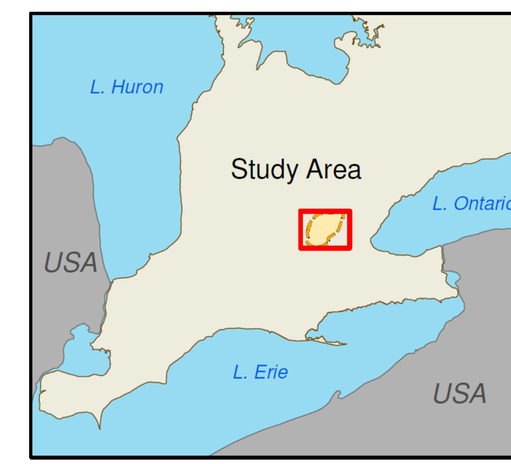
Hydraulic conductivity zone

- 51111010
- 51111030
- 51111040
- 51111050

1:60,000

1 0.5 0 1

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

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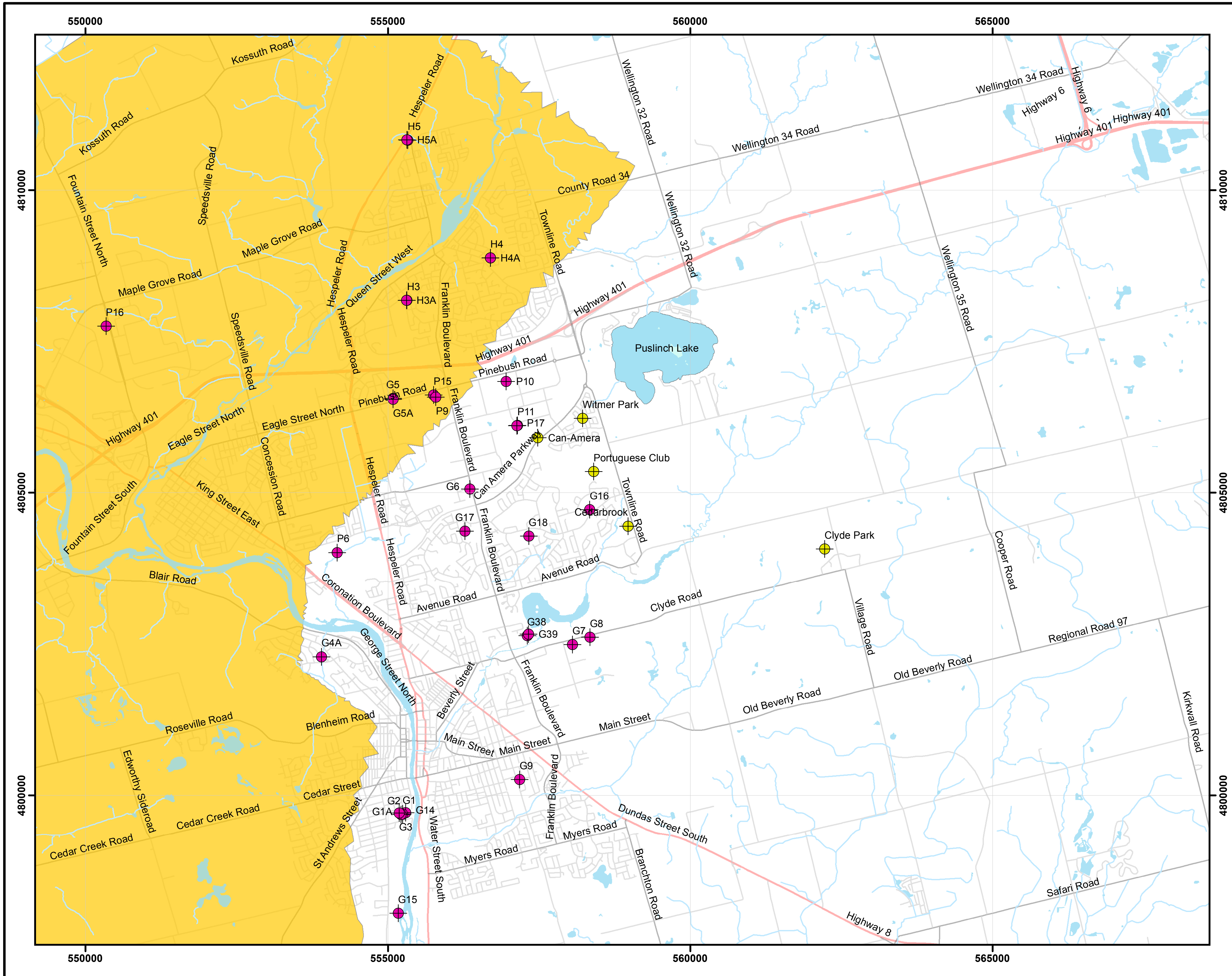
**Figure 4**

Locations of Sensitive Hydraulic Conductivity Zones in the Vinemount Member

**Cambridge East IUS Water Supply Class EA: Groundwater Modelling**




**LEGEND**

- Municipal Supply Well
- Test Production Well
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

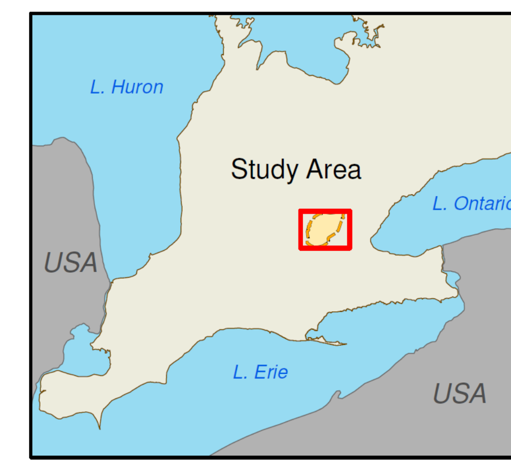
Hydraulic conductivity zone

- 71313090

1:60,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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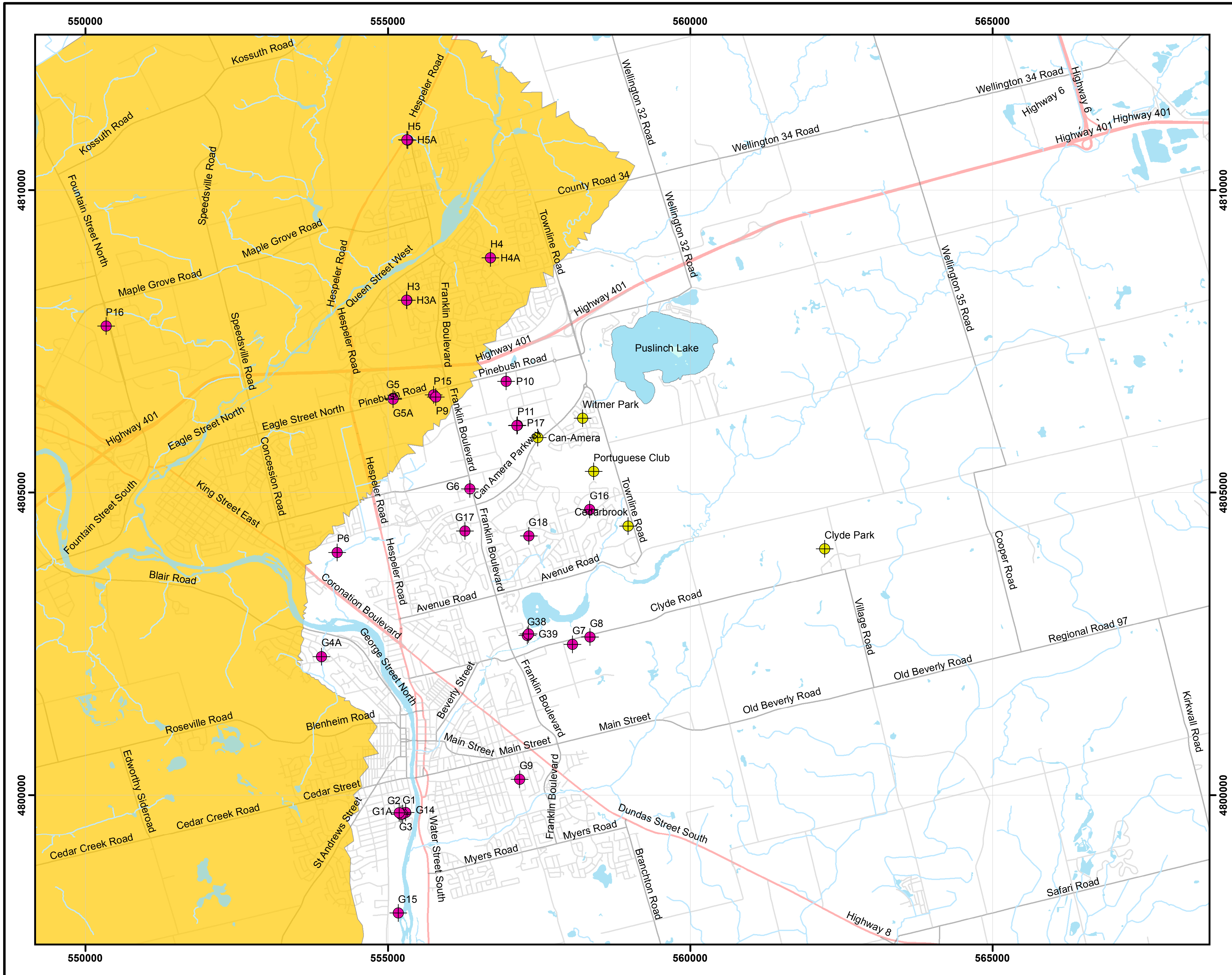
**Figure 5**

Locations of Sensitive Hydraulic Conductivity Zones in the Upper Gasport Formation




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

## Cambridge East IUS Water Supply Class EA: Groundwater Modelling

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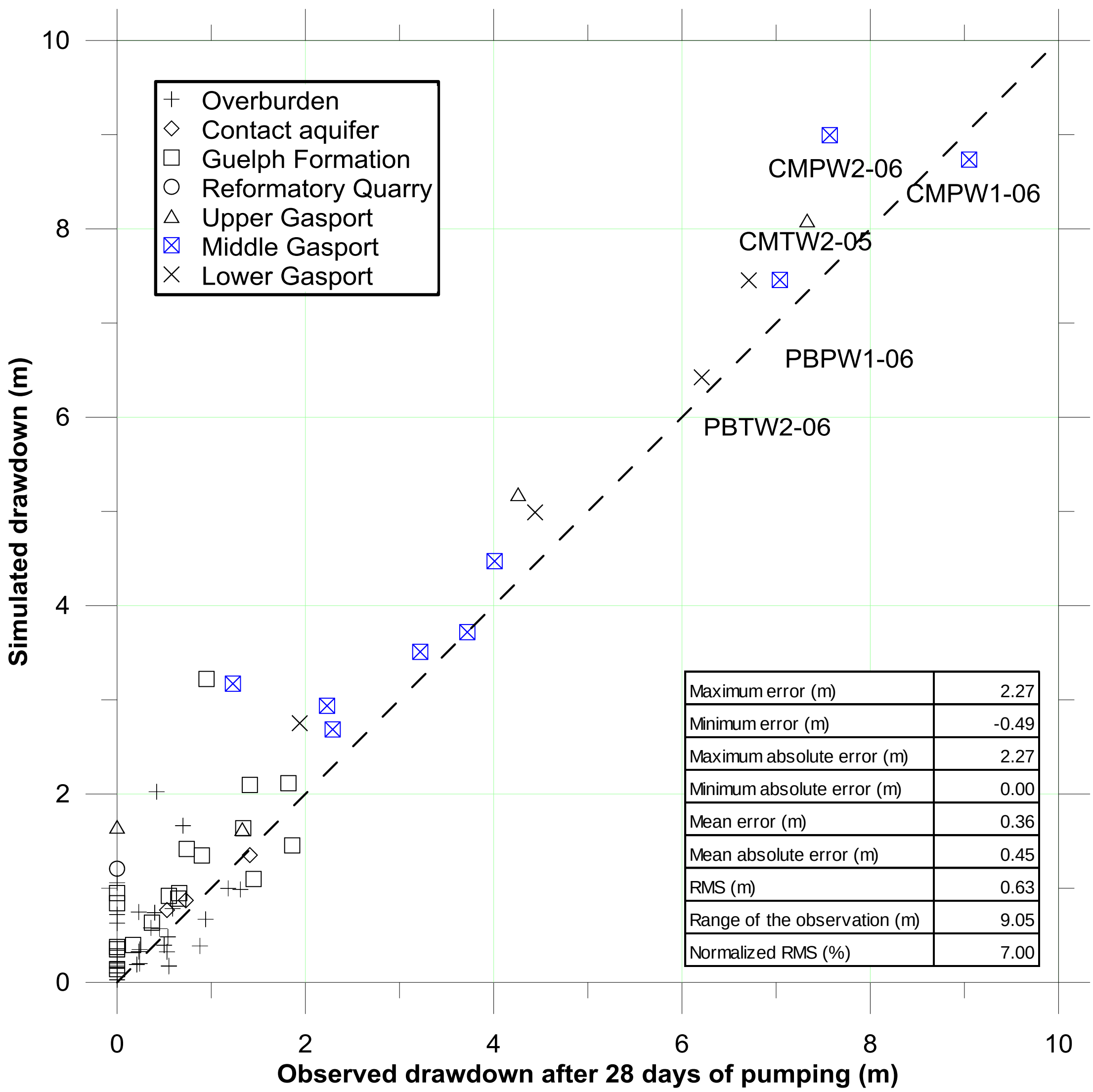
**Figure 6**

Locations of Sensitive Hydraulic Conductivity Zones in the Middle Gasport Formation




| | |
|---|---|
| Maximum error (m) | 2.27 |
| Minimum error (m) | -0.49 |
| Maximum absolute error (m) | 2.27 |
| Minimum absolute error (m) | 0.00 |
| Mean error (m) | 0.36 |
| Mean absolute error (m) | 0.45 |
| RMS (m) | 0.63 |
| Range of the observation (m) | 9.05 |
| Normalized RMS (%) | 7.00 |

**CAMBRIDGE EAST IUS WATER SUPPLY CLASS : GROUNDWATER MODELLING**

**Figure 7** Final Drawdowns for the Base Case ($S_s$=$10^{-6}$ /m)

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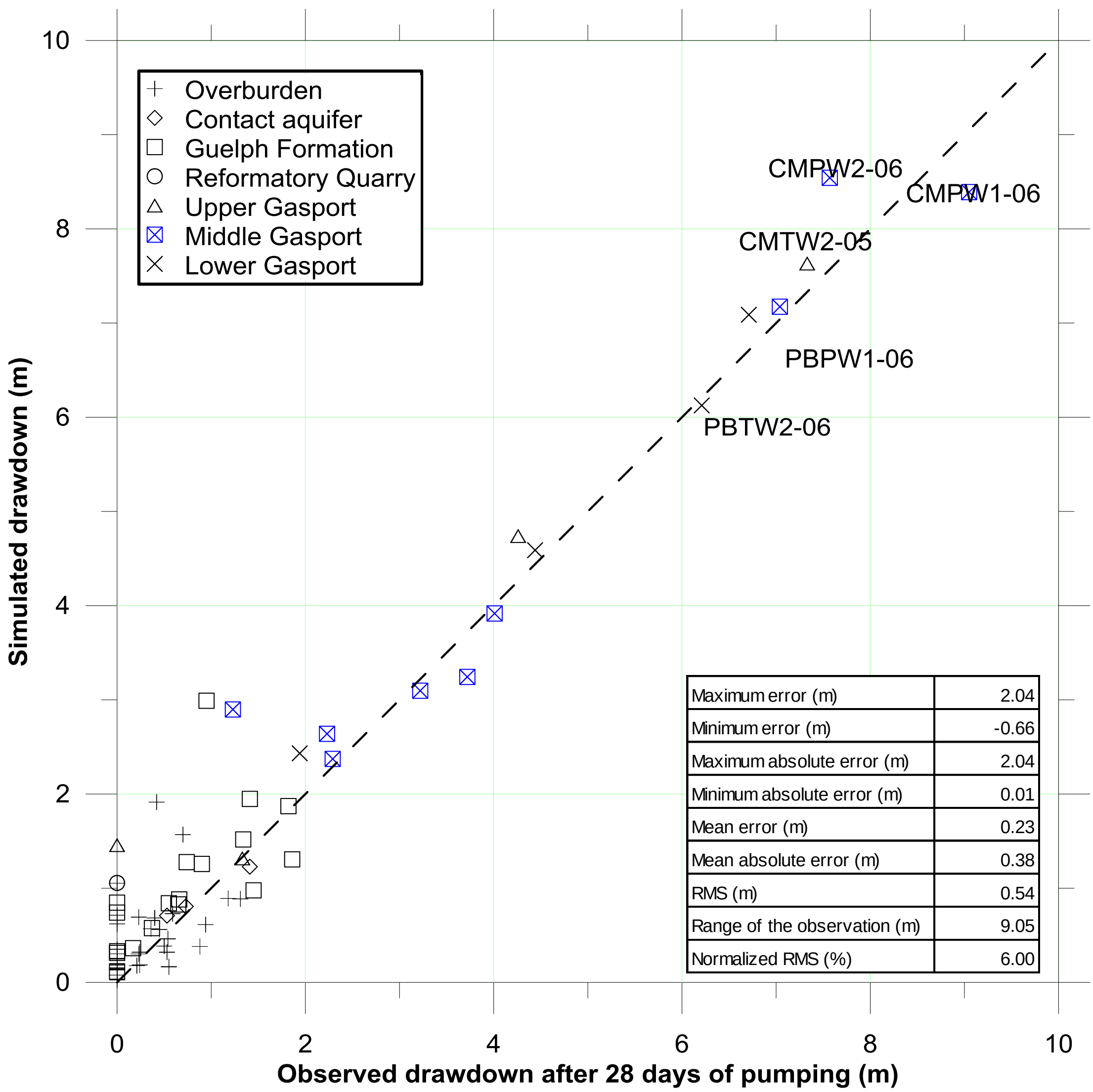


| | |
|---|---|
| Maximum error (m) | 2.04 |
| Minimum error (m) | -0.66 |
| Maximum absolute error (m) | 2.04 |
| Minimum absolute error (m) | 0.01 |
| Mean error (m) | 0.23 |
| Mean absolute error (m) | 0.38 |
| RMS (m) | 0.54 |
| Range of the observation (m) | 9.05 |
| Normalized RMS (%) | 6.00 |

**CAMBRIDGE EAST IUS WATER SUPPLY CLASS : GROUNDWATER MODELLING**

**Figure 8:** Final Drawdowns for Case 1 ($S_s$=$10^{-5}$ /m)

$\Sigma^2\Pi$

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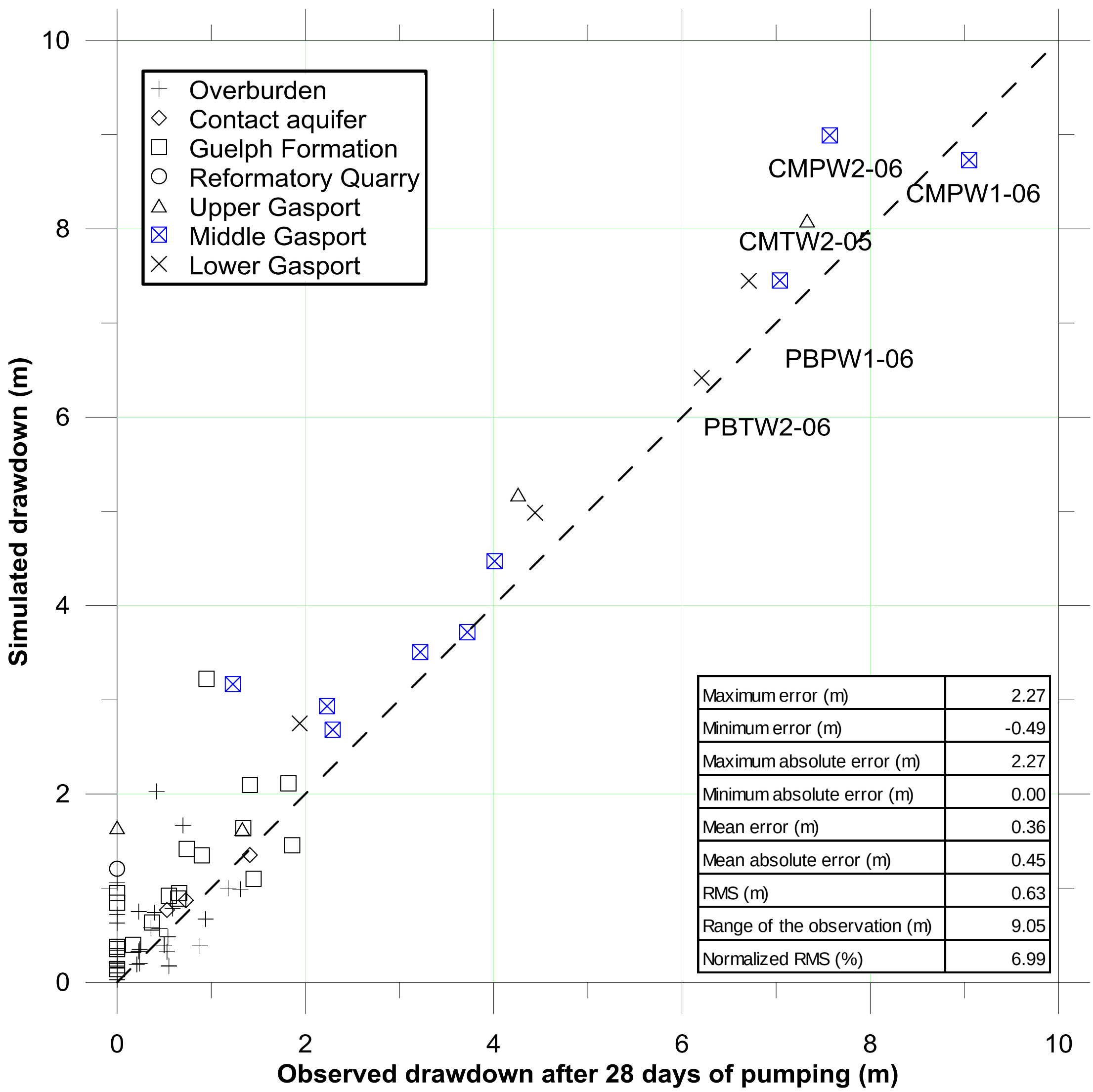


| | |
|---|---|
| Maximum error (m) | 2.27 |
| Minimum error (m) | -0.49 |
| Maximum absolute error (m) | 2.27 |
| Minimum absolute error (m) | 0.00 |
| Mean error (m) | 0.36 |
| Mean absolute error (m) | 0.45 |
| RMS (m) | 0.63 |
| Range of the observation (m) | 9.05 |
| Normalized RMS (%) | 6.99 |

**CAMBRIDGE EAST IUS WATER SUPPLY CLASS : GROUNDWATER MODELLING**

**Figure 9:** Final Drawdowns for Case 2 ($S_s$=$10^{-7}$ /m)

$\Sigma^2\Pi$

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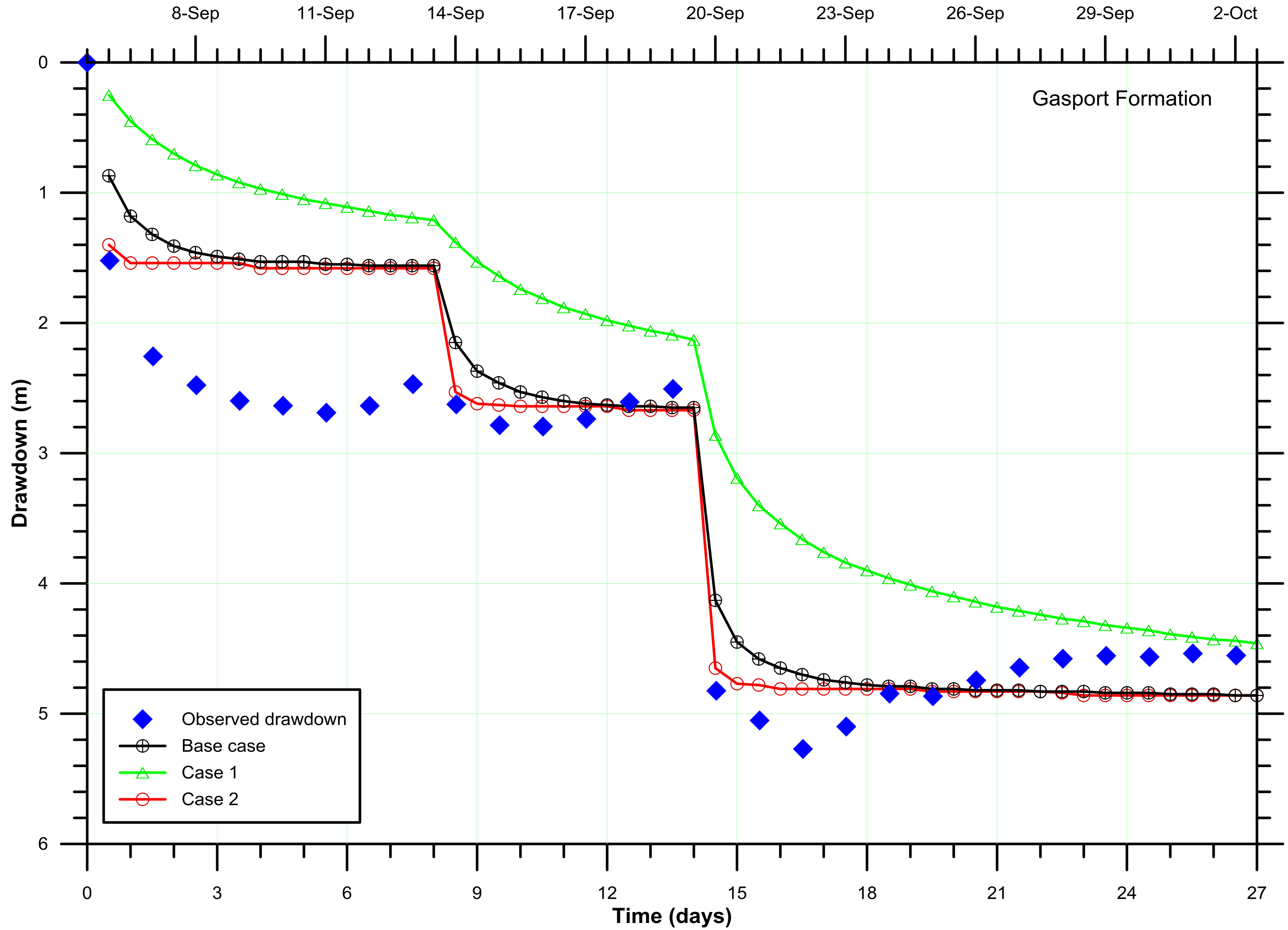


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 10** Simulated and Observed Hydrographs for CMOW1A-06

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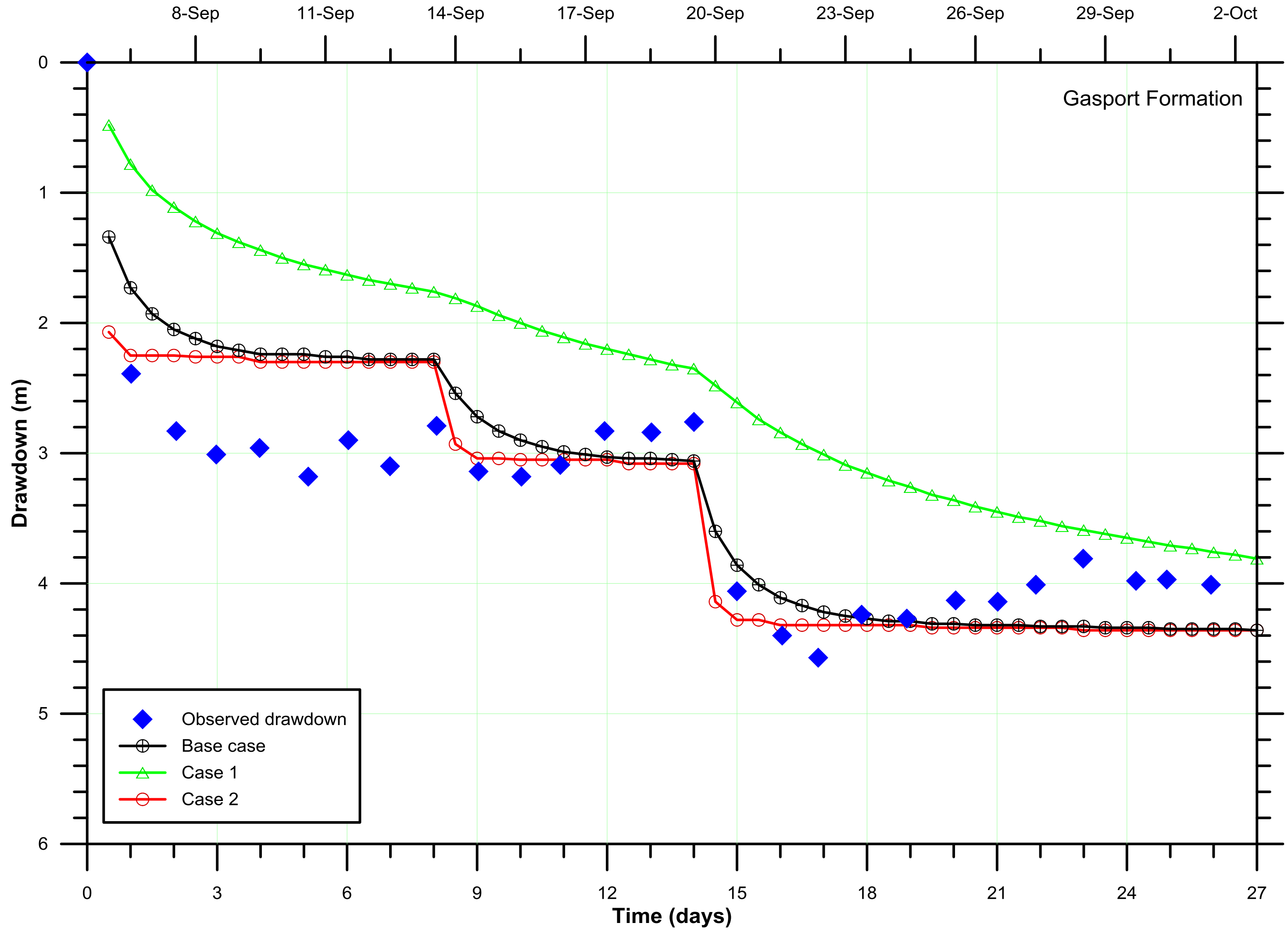


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 11** Simulated and Observed Hydrographs for CMO2A-06

Matrix Solutions Inc.
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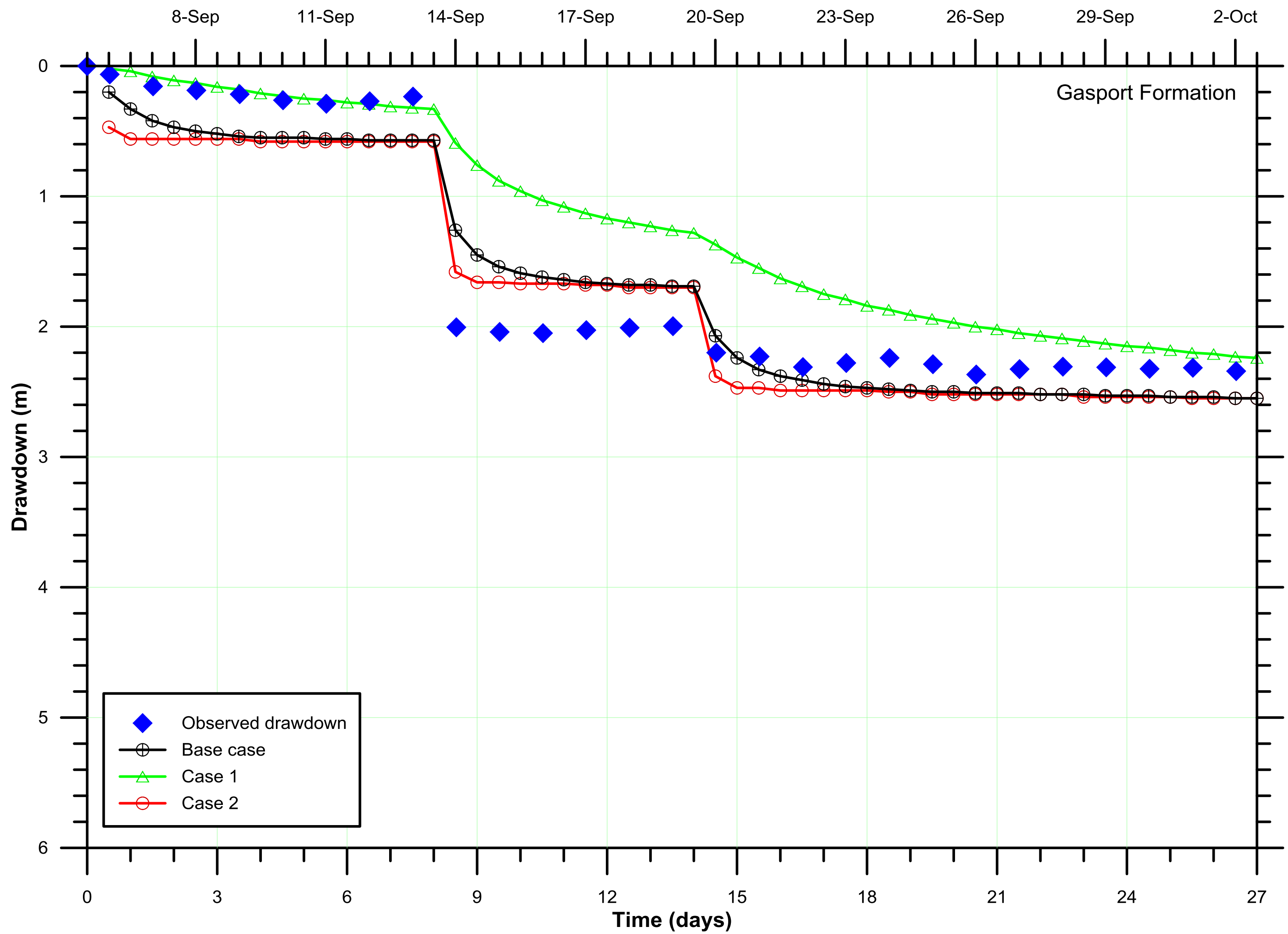
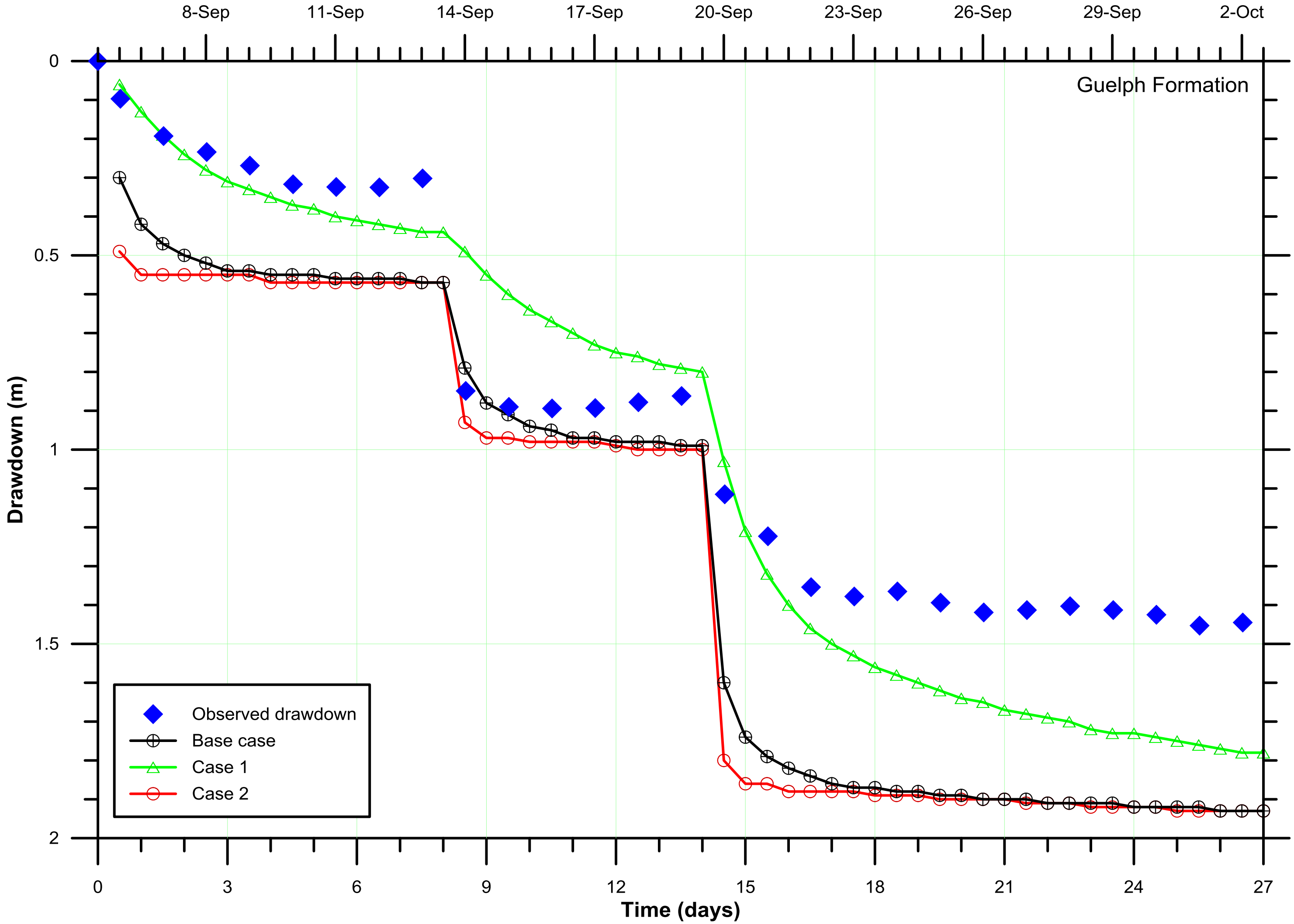



**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 12** Simulated and Observed Hydrographs for PBOW2A-06

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING




**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 13** Simulated and Observed Hydrographs for CMOW1B-06

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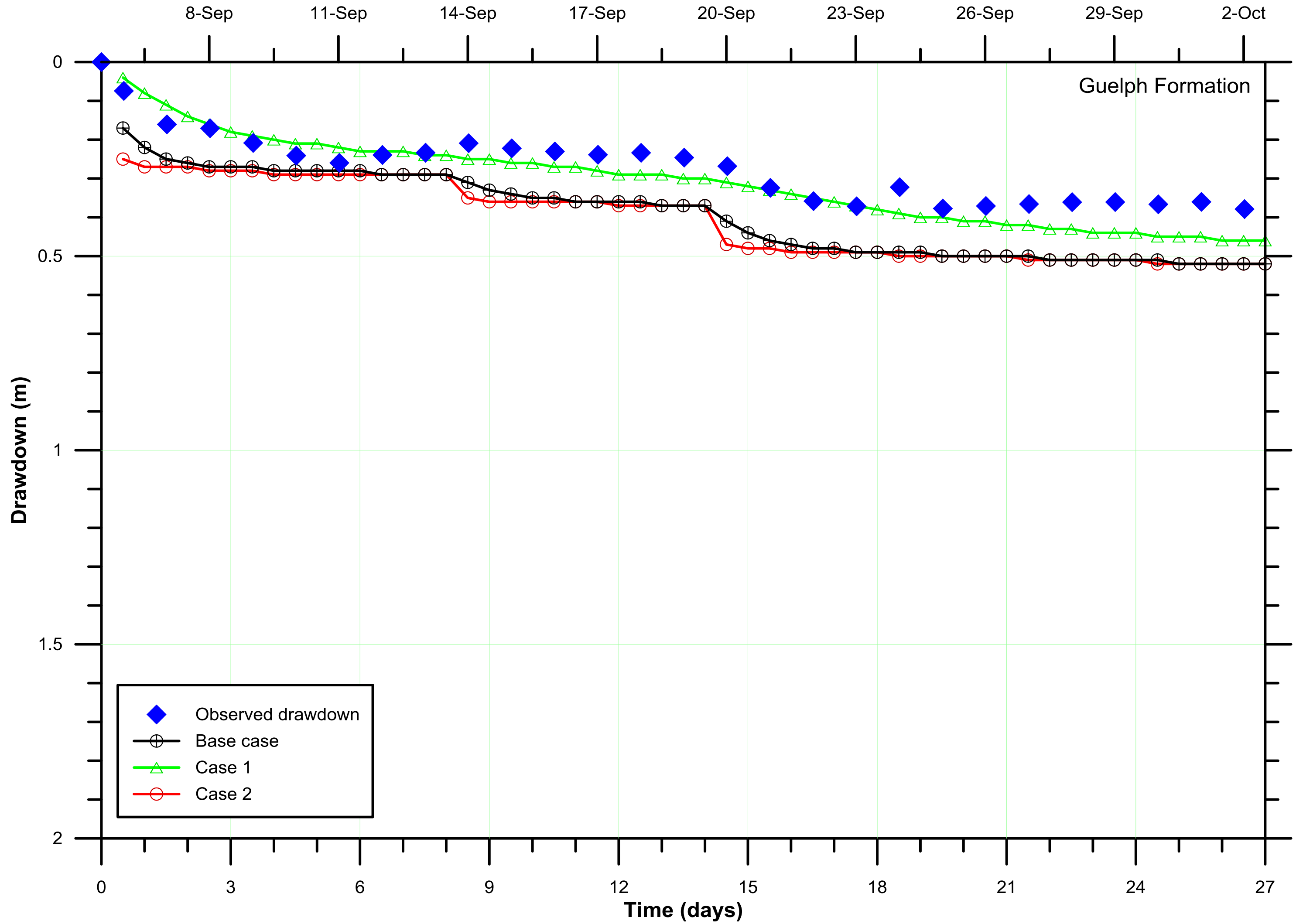


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 14** Simulated and Observed Hydrographs for CMOW2B-06

Matrix Solutions Inc.
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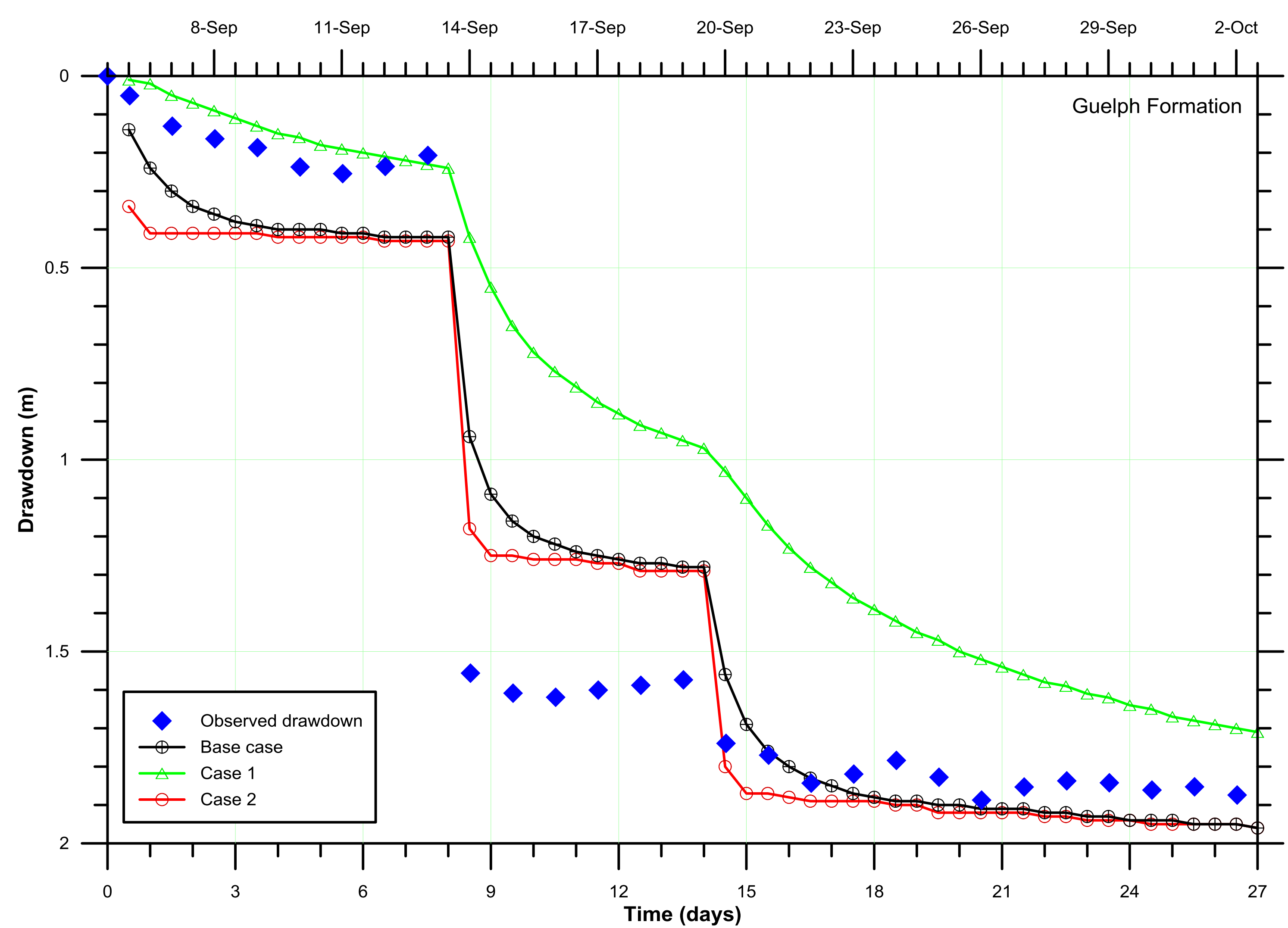


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 15** Simulated and Observed Hydrographs for PBOW2B-06

Matrix Solutions Inc.
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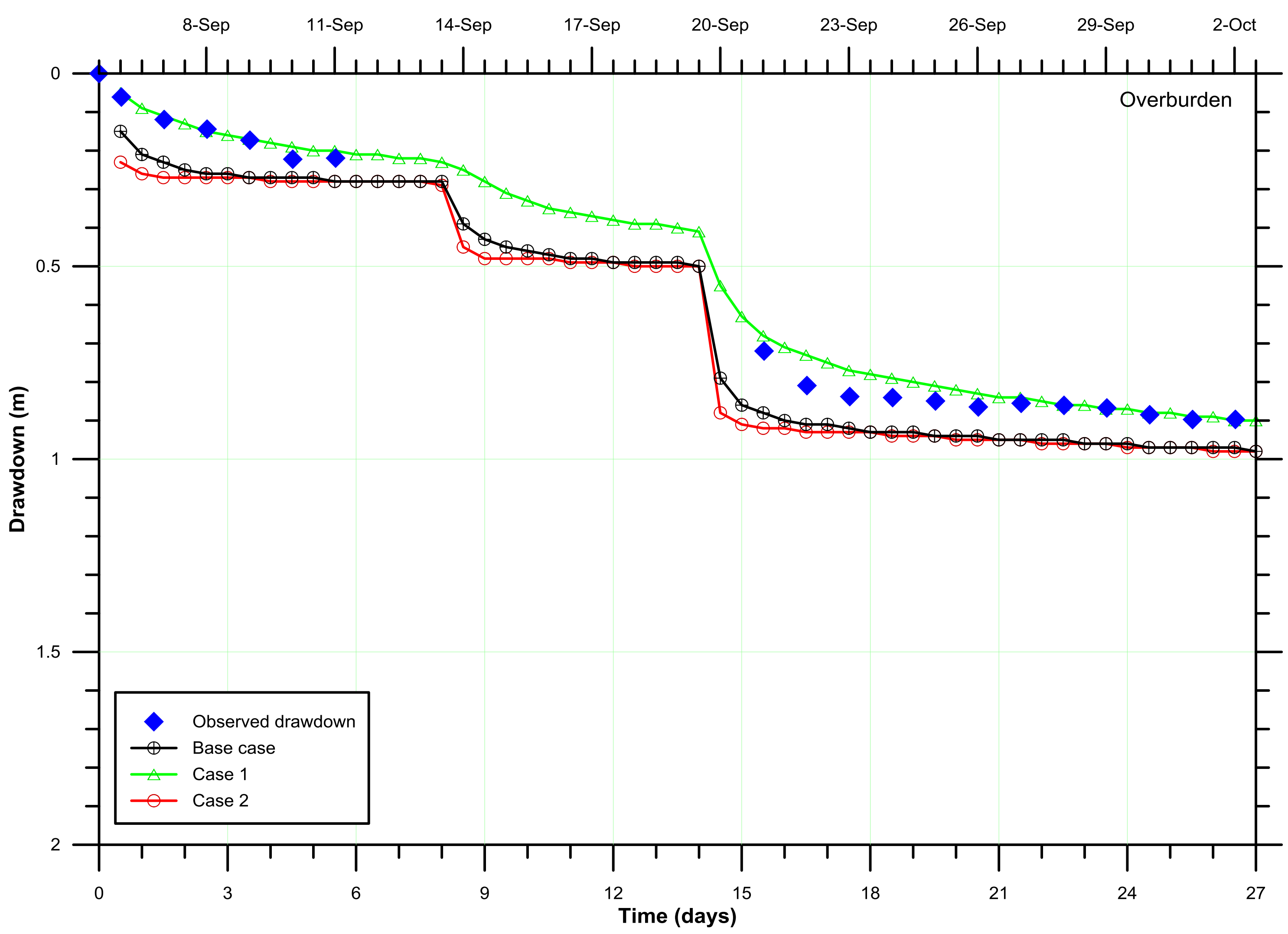


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 16** Simulated and Observed Hydrographs for CMOW1D-06

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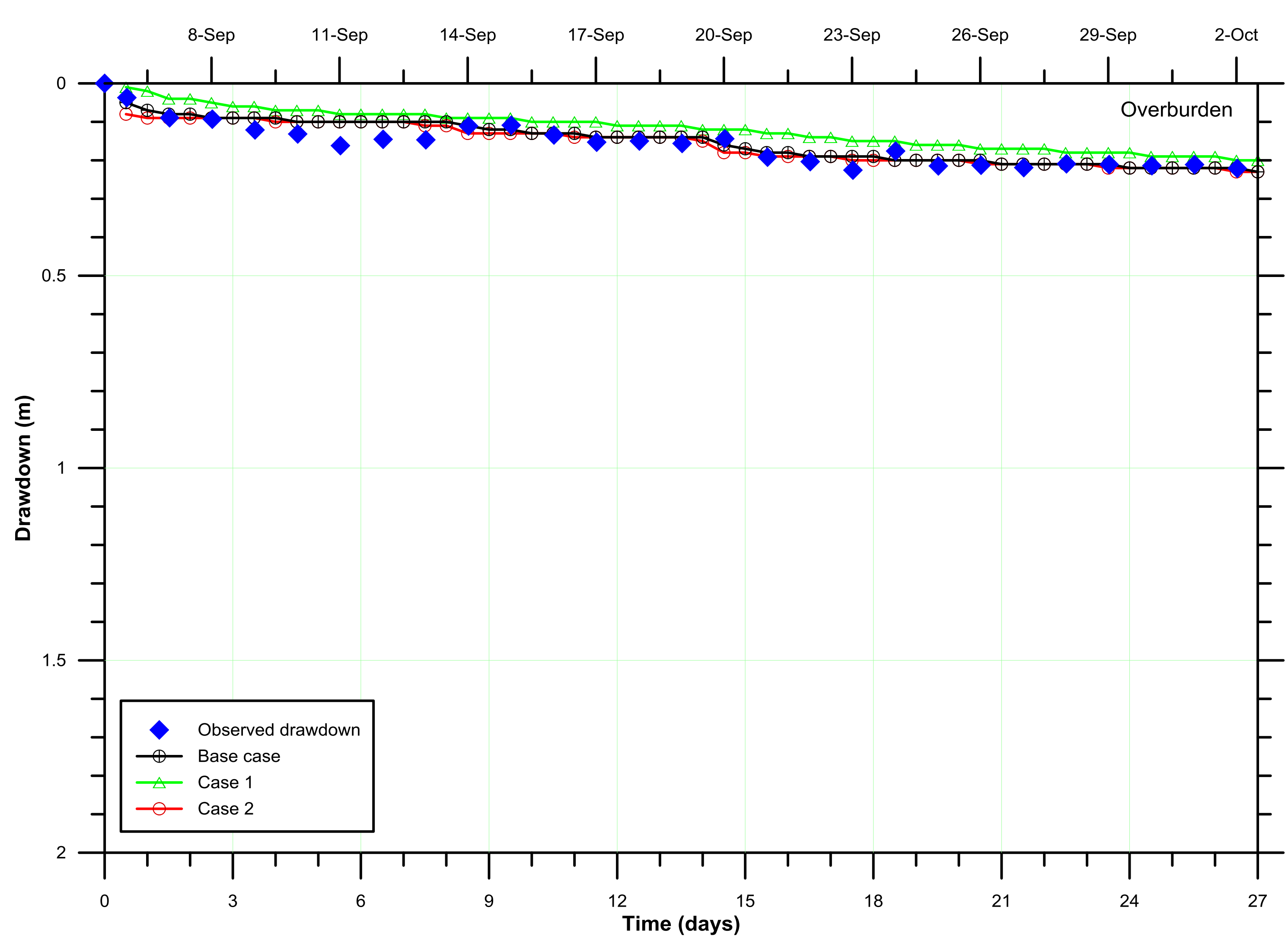
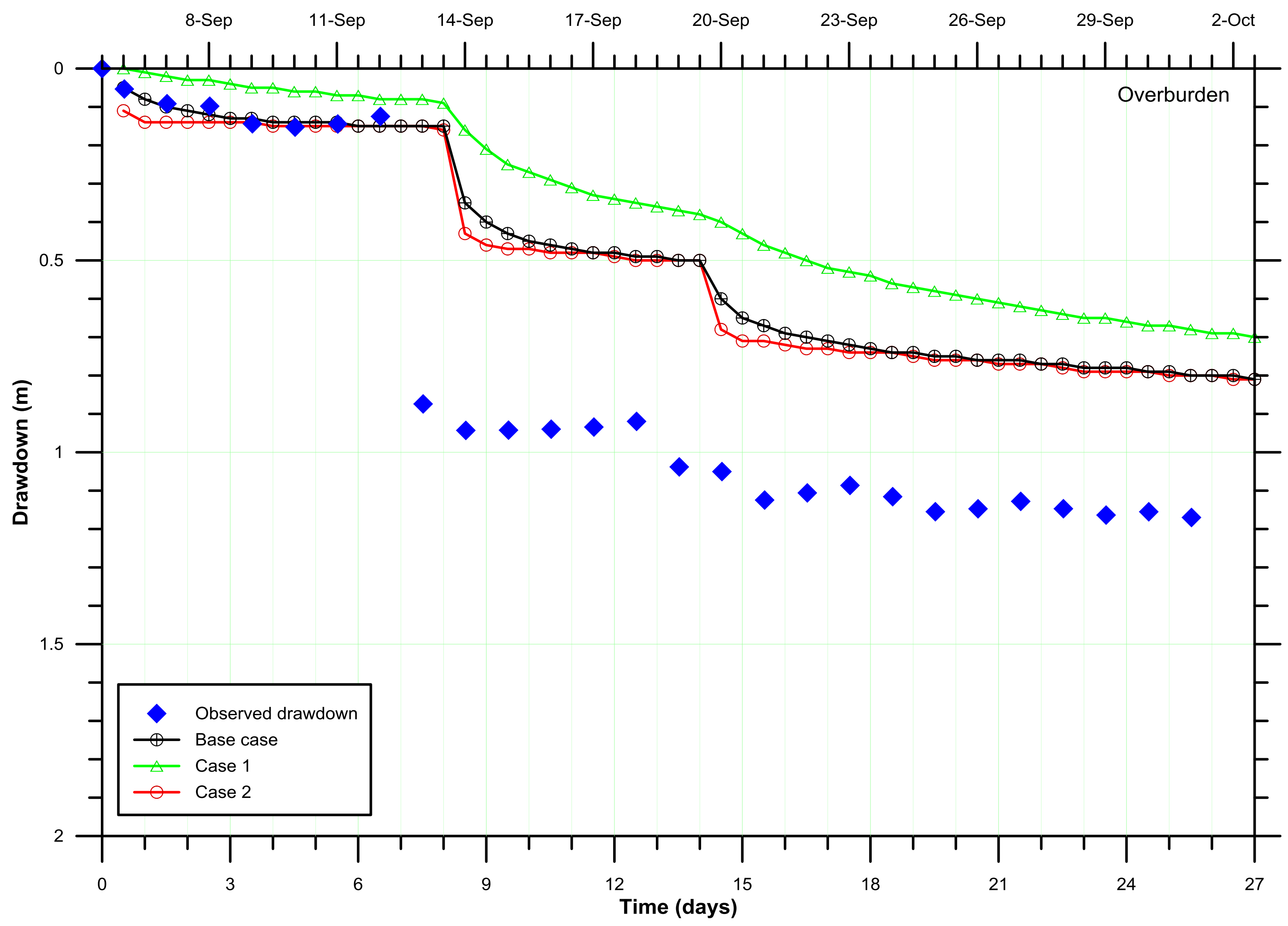



**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 17** Simulated and Observed Hydrographs for CMOW2D-06

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING




**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 18** Simulated and Observed Hydrographs for PBOW2D-06

Matrix Solutions Inc.
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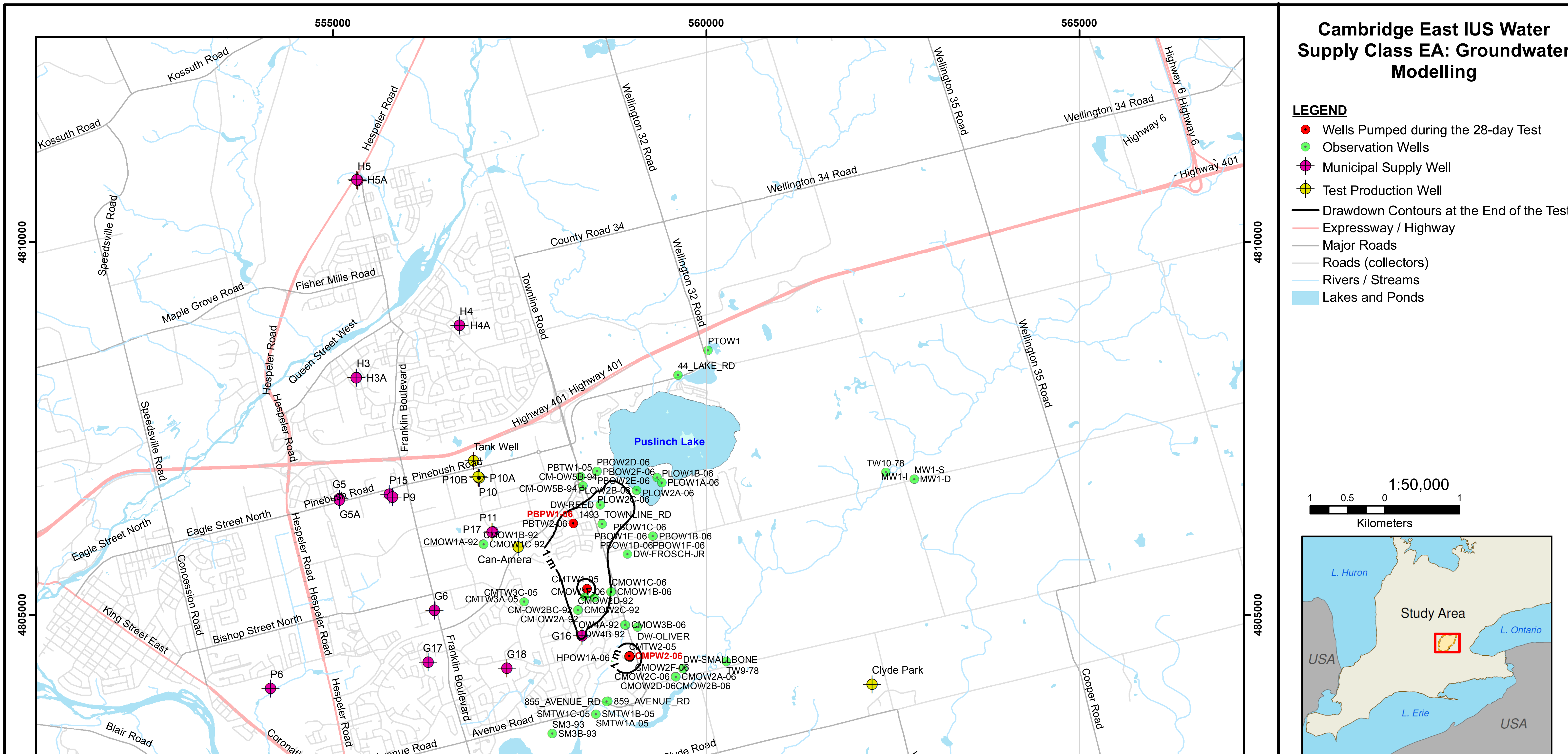



# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

**LEGEND**

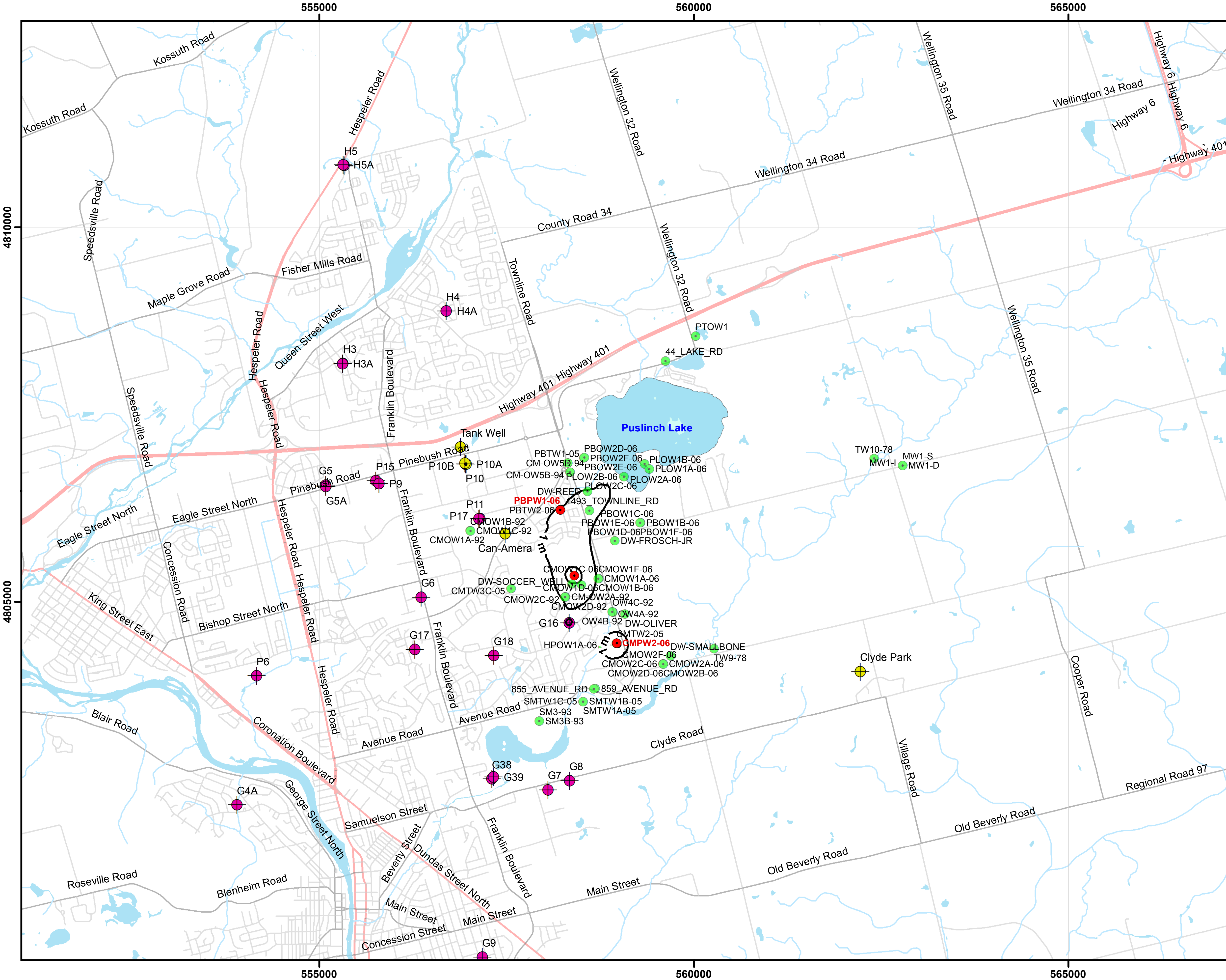
- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

$\Sigma^2\Pi$ Matrix Solutions Inc. ENVIRONMENT & ENGINEERING

**Figure 19**

Simulated Final Drawdowns in the Contact Aquifer for the Base Case ($Ss=10^{-6}$ /m)




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

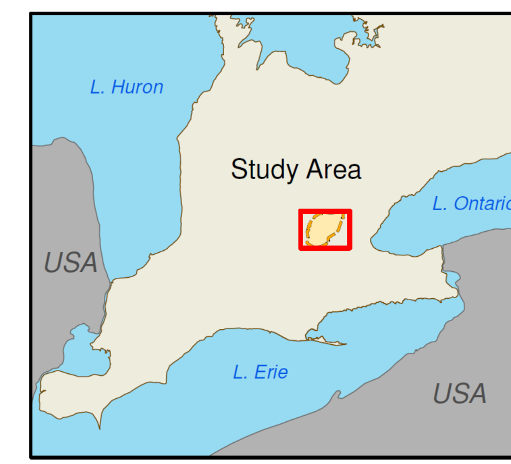
**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

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**Figure 20**

Simulated Final Drawdowns in the Contact Aquifer for Case 1 (Ss=$10^{-5}$ /m)

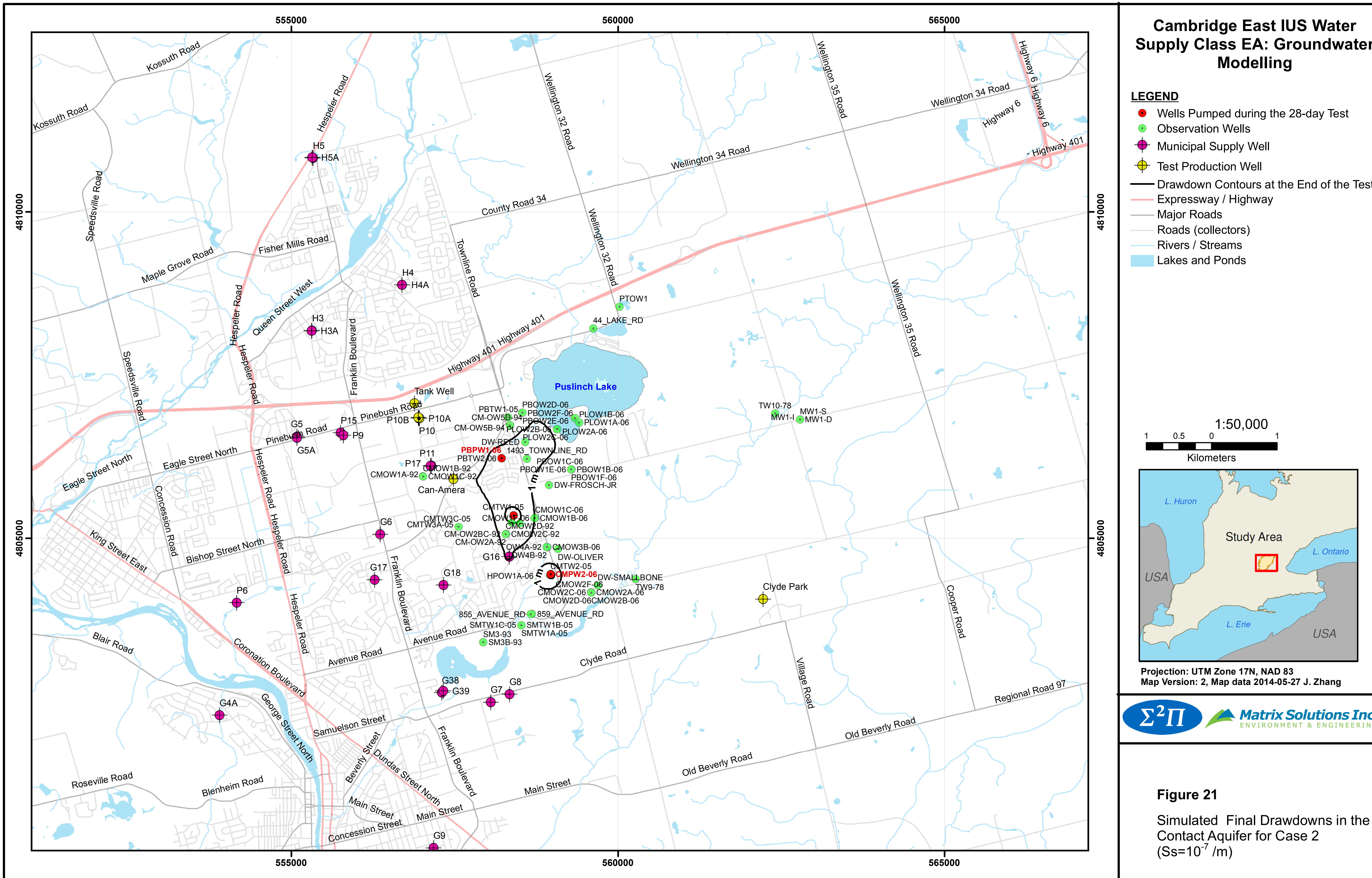

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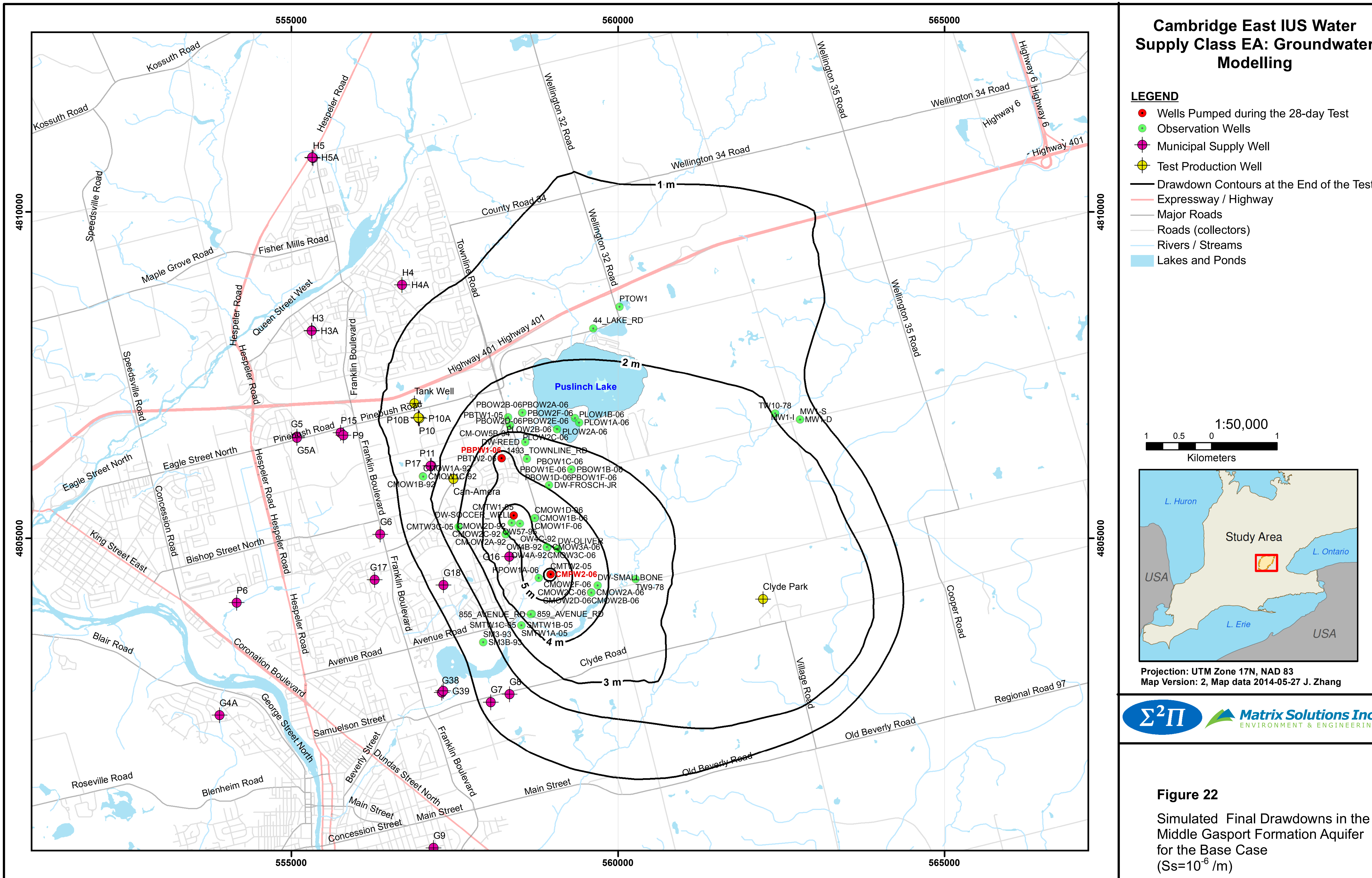
**Figure 21**

Simulated Final Drawdowns in the Contact Aquifer for Case 2 (Ss=$10^{-7}$ /m)

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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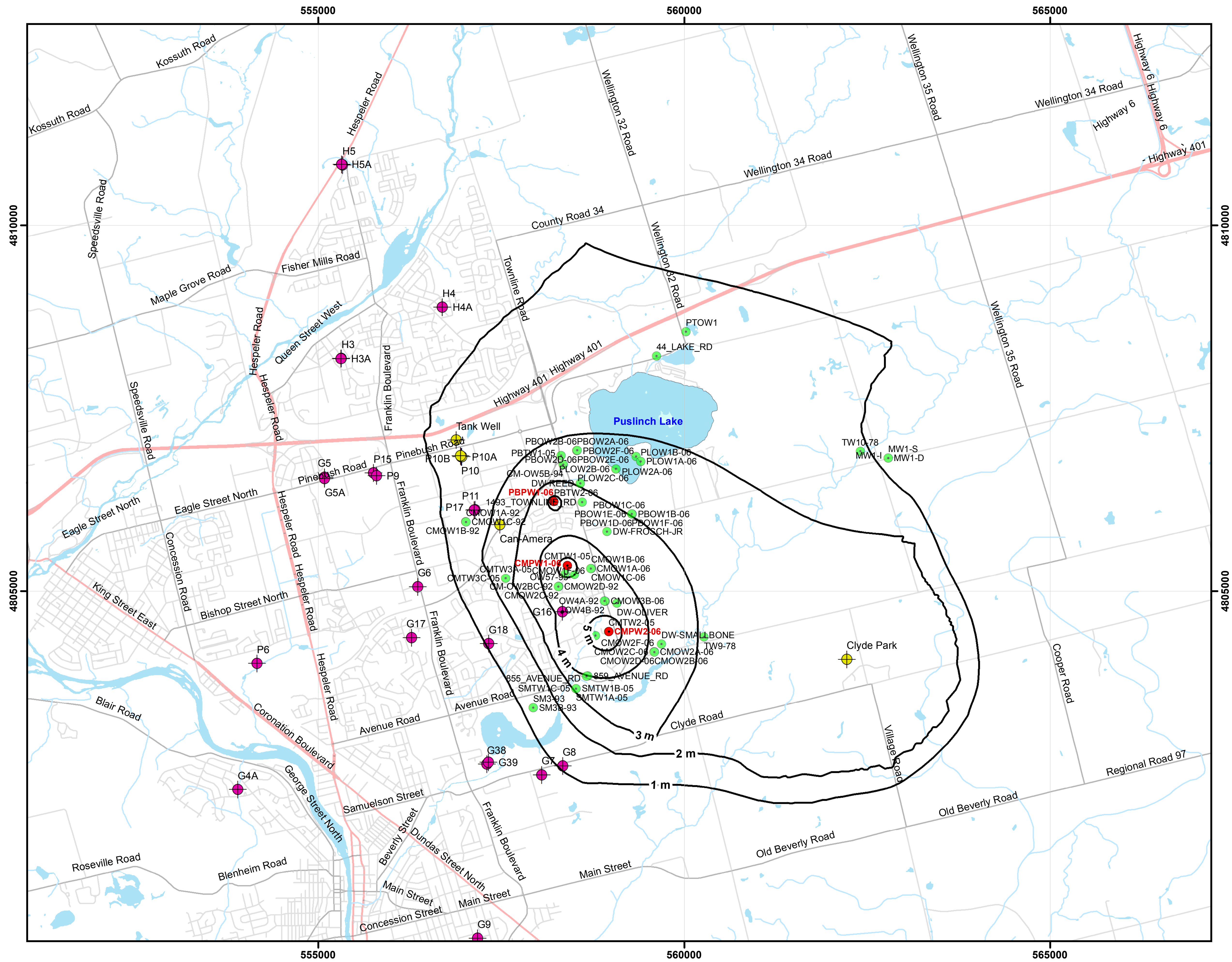
**Figure 22**

Simulated Final Drawdowns in the Middle Gasport Formation Aquifer for the Base Case ($Ss=10^{-6}$ /m)




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

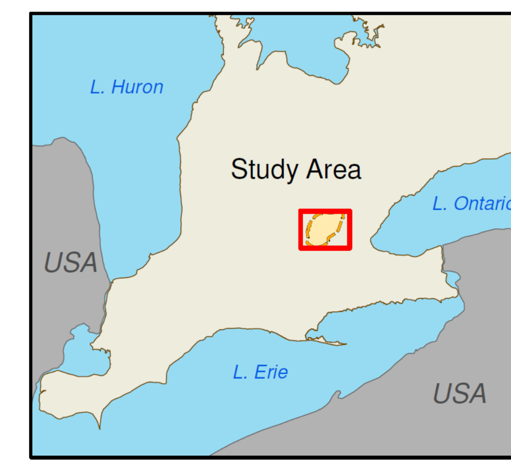
**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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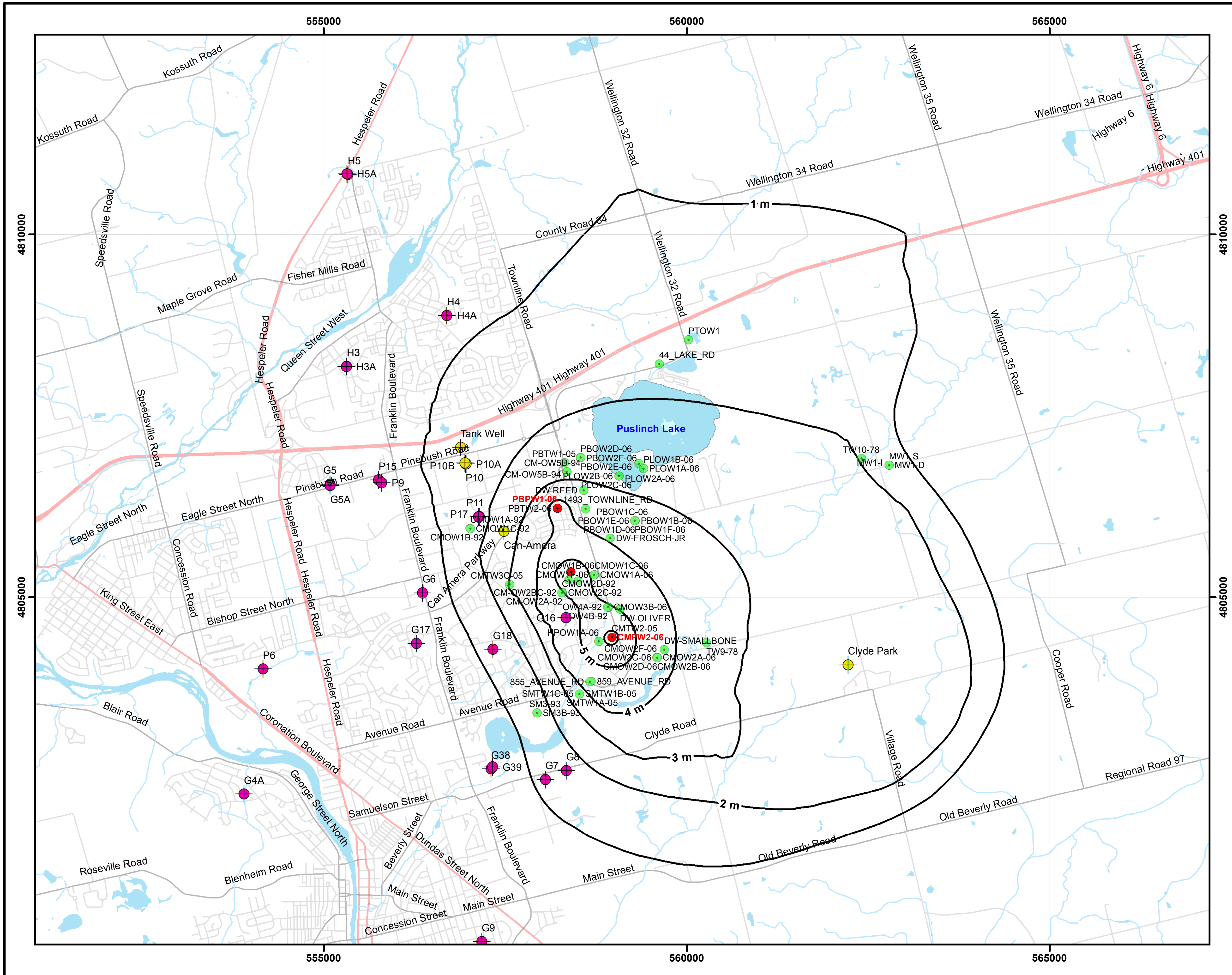
**Figure 23**

Simulated Final Drawdowns in the Middle Gasport Formation Aquifer for Case 1 (Ss=$10^{-5}$ /m)

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling



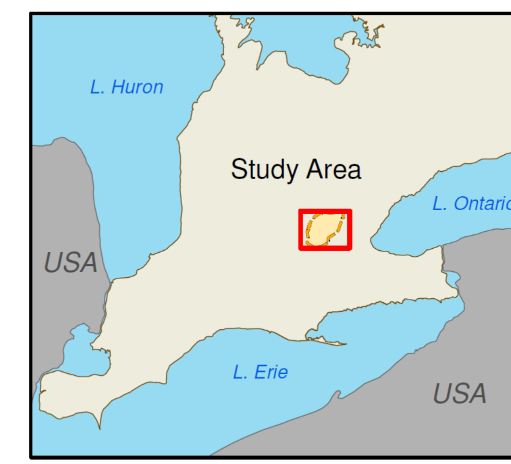

## LEGEND

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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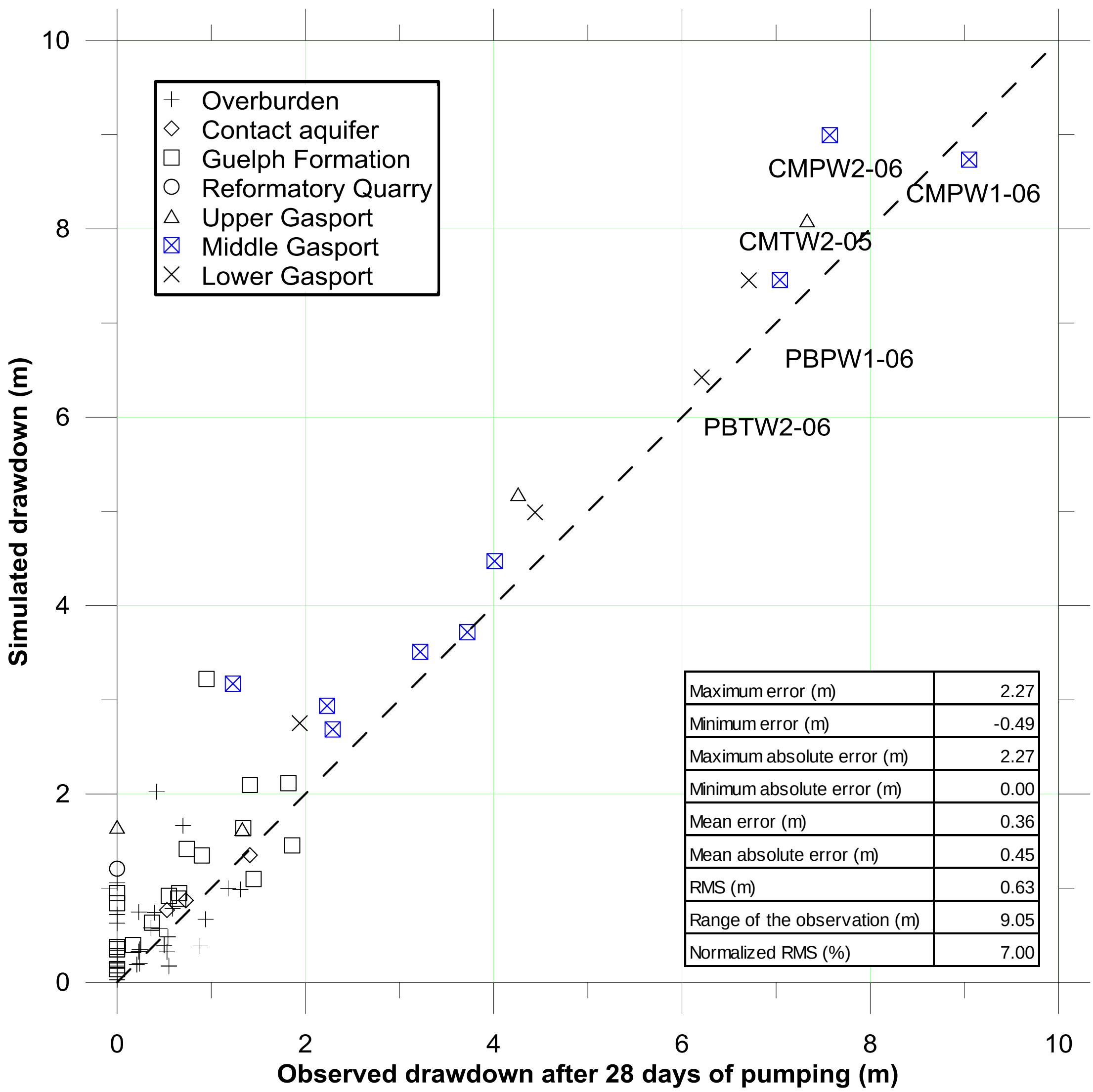
**Figure 24**

Simulated Final Drawdowns in the Middle Gasport Formation Aquifer for Case 2 (Ss=$10^{-7}$ /m)




| | |
|---|---|
| Maximum error (m) | 2.27 |
| Minimum error (m) | -0.49 |
| Maximum absolute error (m) | 2.27 |
| Minimum absolute error (m) | 0.00 |
| Mean error (m) | 0.36 |
| Mean absolute error (m) | 0.45 |
| RMS (m) | 0.63 |
| Range of the observation (m) | 9.05 |
| Normalized RMS (%) | 7.00 |

**CAMBRIDGE EAST IUS WATER SUPPLY CLASS : GROUNDWATER MODELLING**

**Figure 25** Final Drawdowns for the Base Case ($\theta_{max}$ = 0.3)

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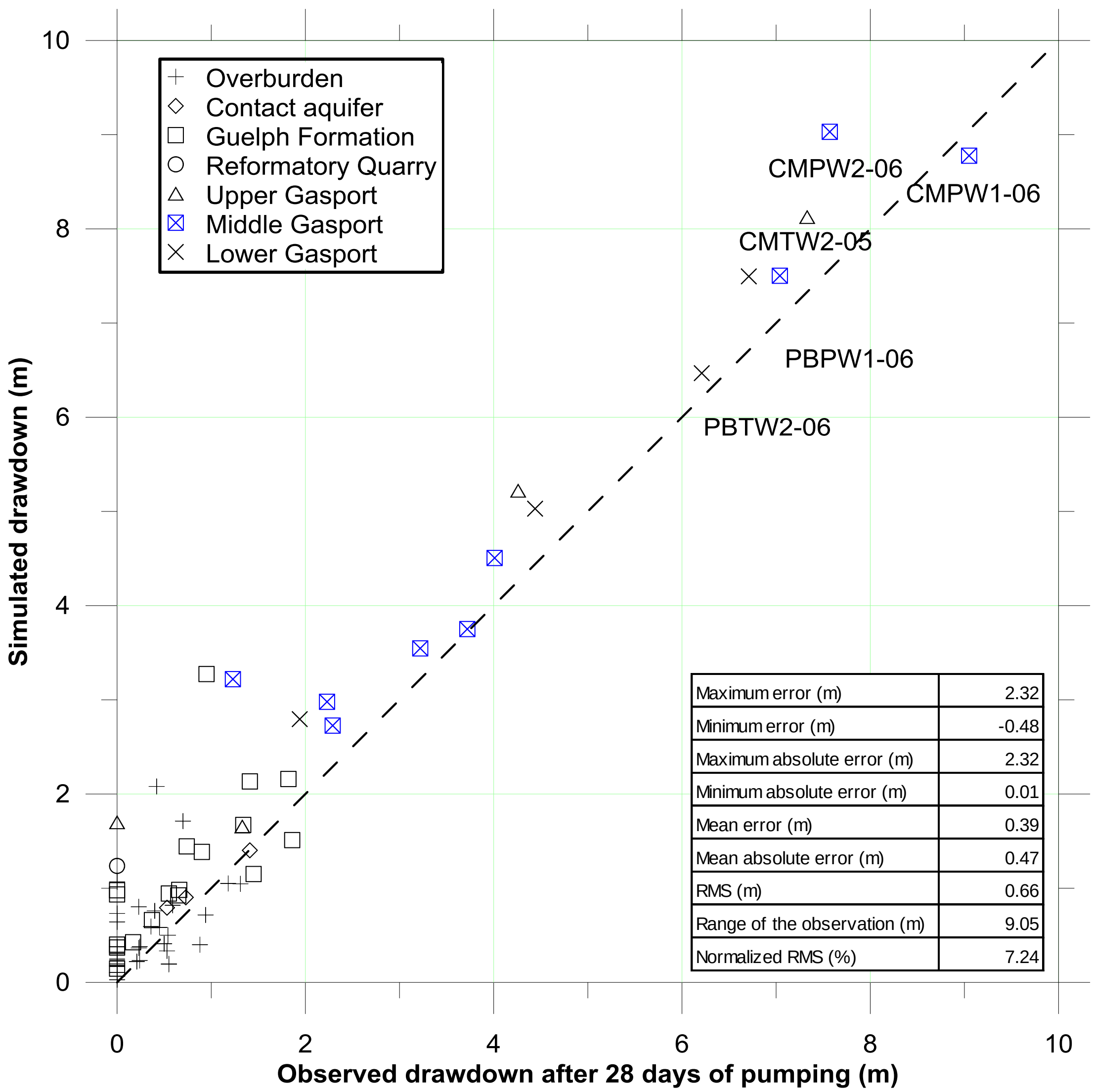


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS : GROUNDWATER MODELLING**

**Figure 26** Final Drawdowns for the Base Case ($\theta_{max}$ = 0.2)

Matrix Solutions Inc.
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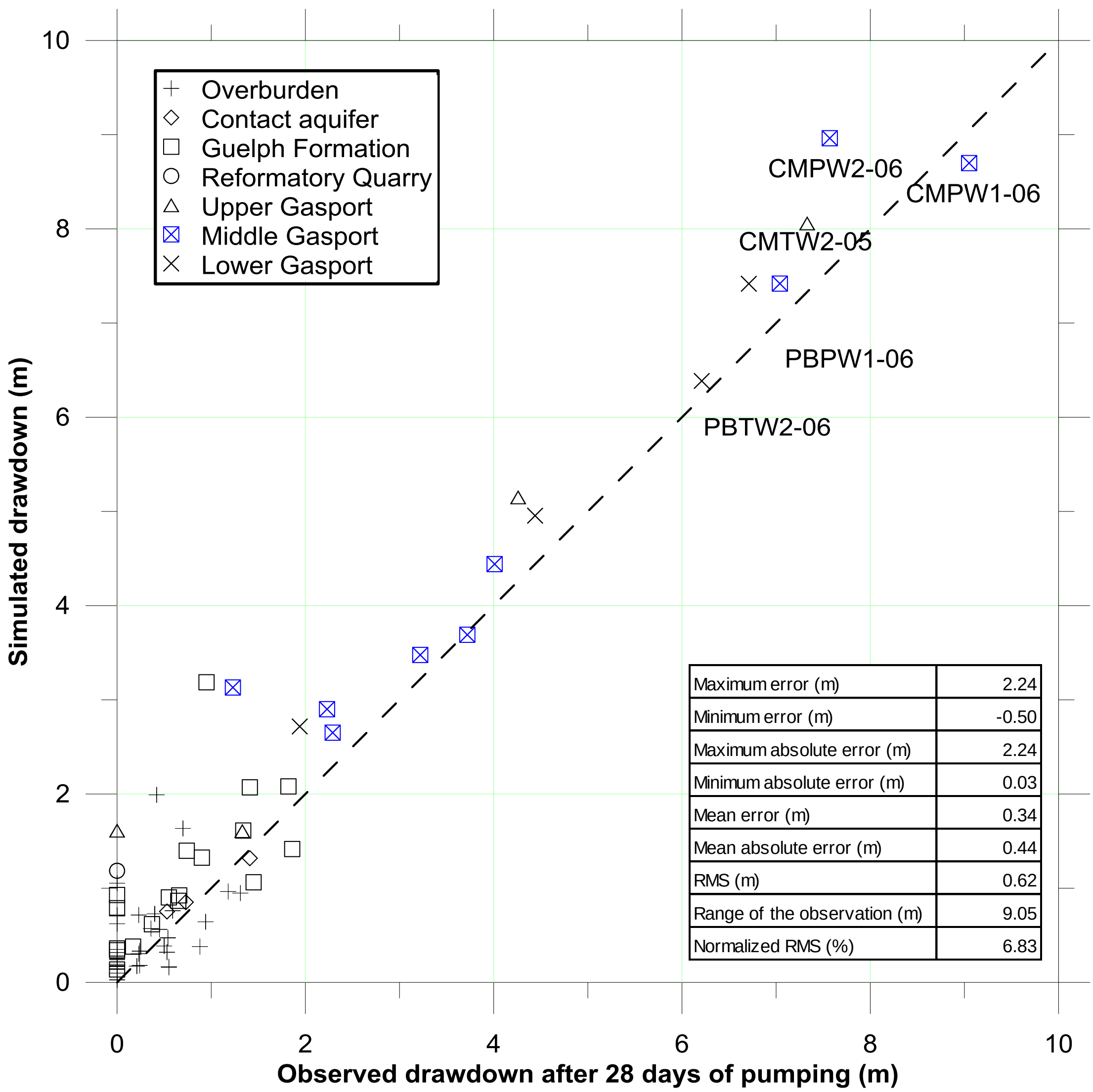


| | |
|---|---|
| Maximum error (m) | 2.24 |
| Minimum error (m) | -0.50 |
| Maximum absolute error (m) | 2.24 |
| Minimum absolute error (m) | 0.03 |
| Mean error (m) | 0.34 |
| Mean absolute error (m) | 0.44 |
| RMS (m) | 0.62 |
| Range of the observation (m) | 9.05 |
| Normalized RMS (%) | 6.83 |

**CAMBRIDGE EAST IUS WATER SUPPLY CLASS : GROUNDWATER MODELLING**

**Figure 27** Final Drawdowns for the Base Case ($\theta_{max}$ = 0.4)

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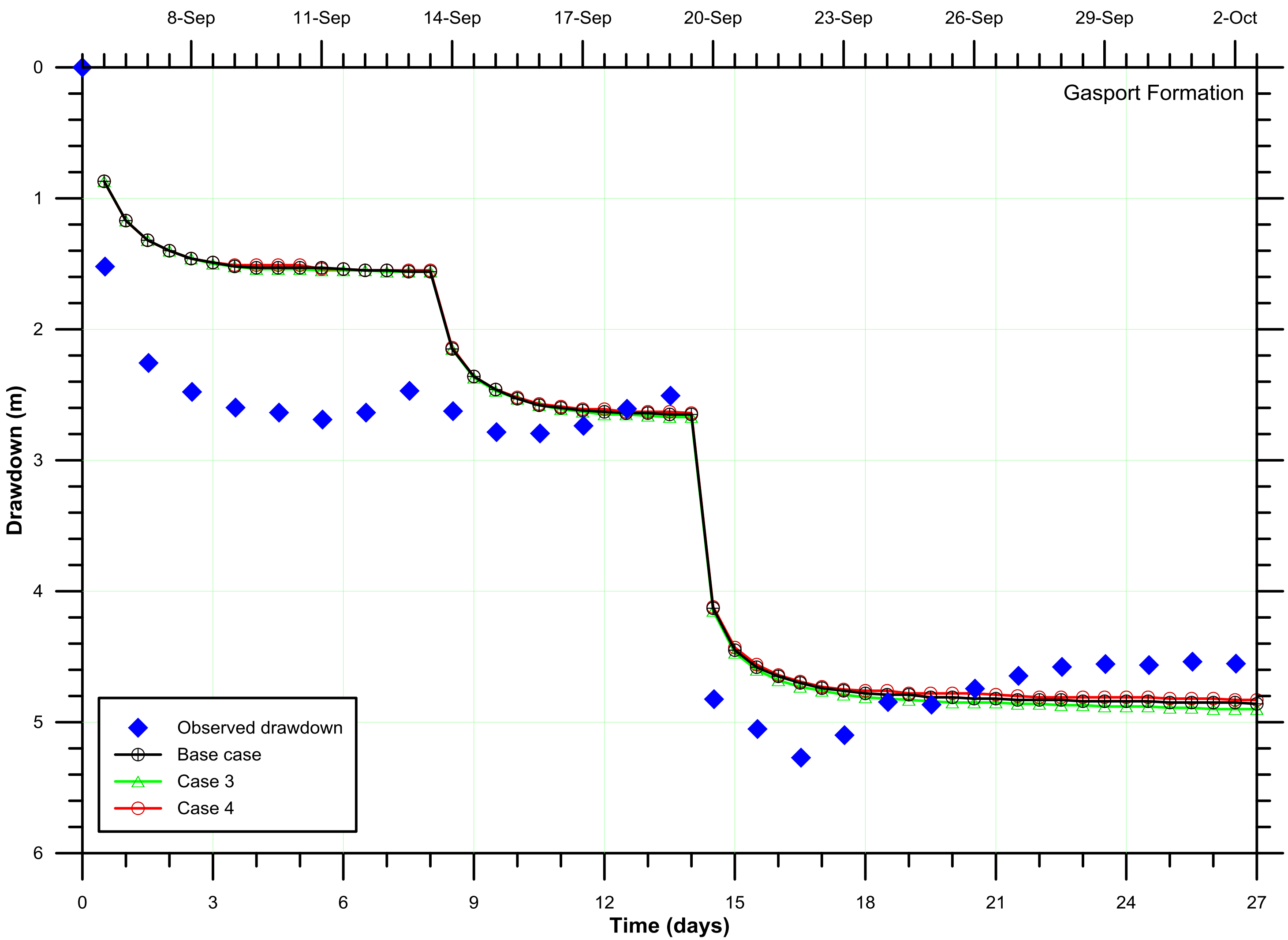


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 28** Simulated and Observed Hydrographs for CMOW1A-06 Sensitivity Analysis with Respect to the Specific Yield

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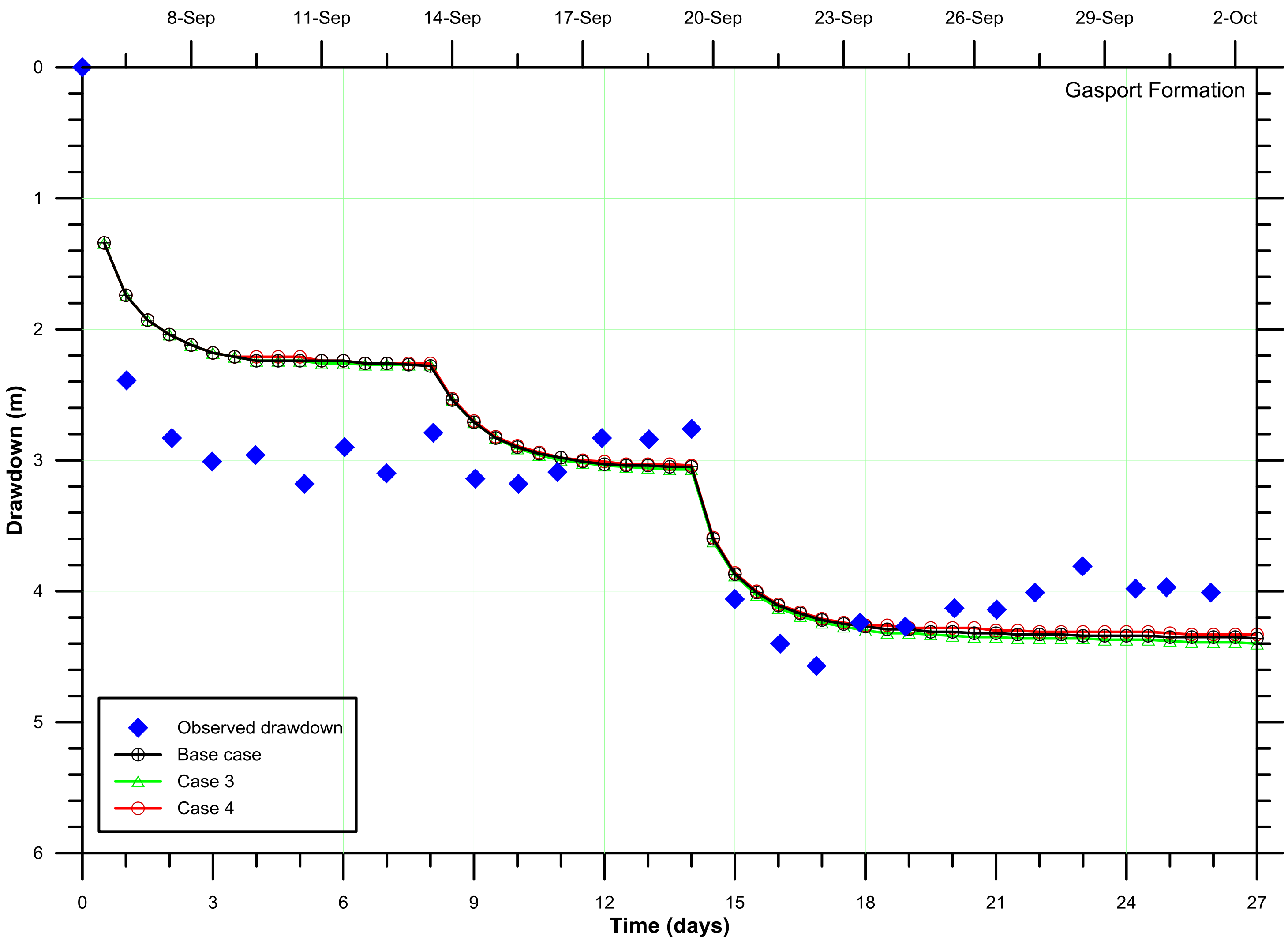
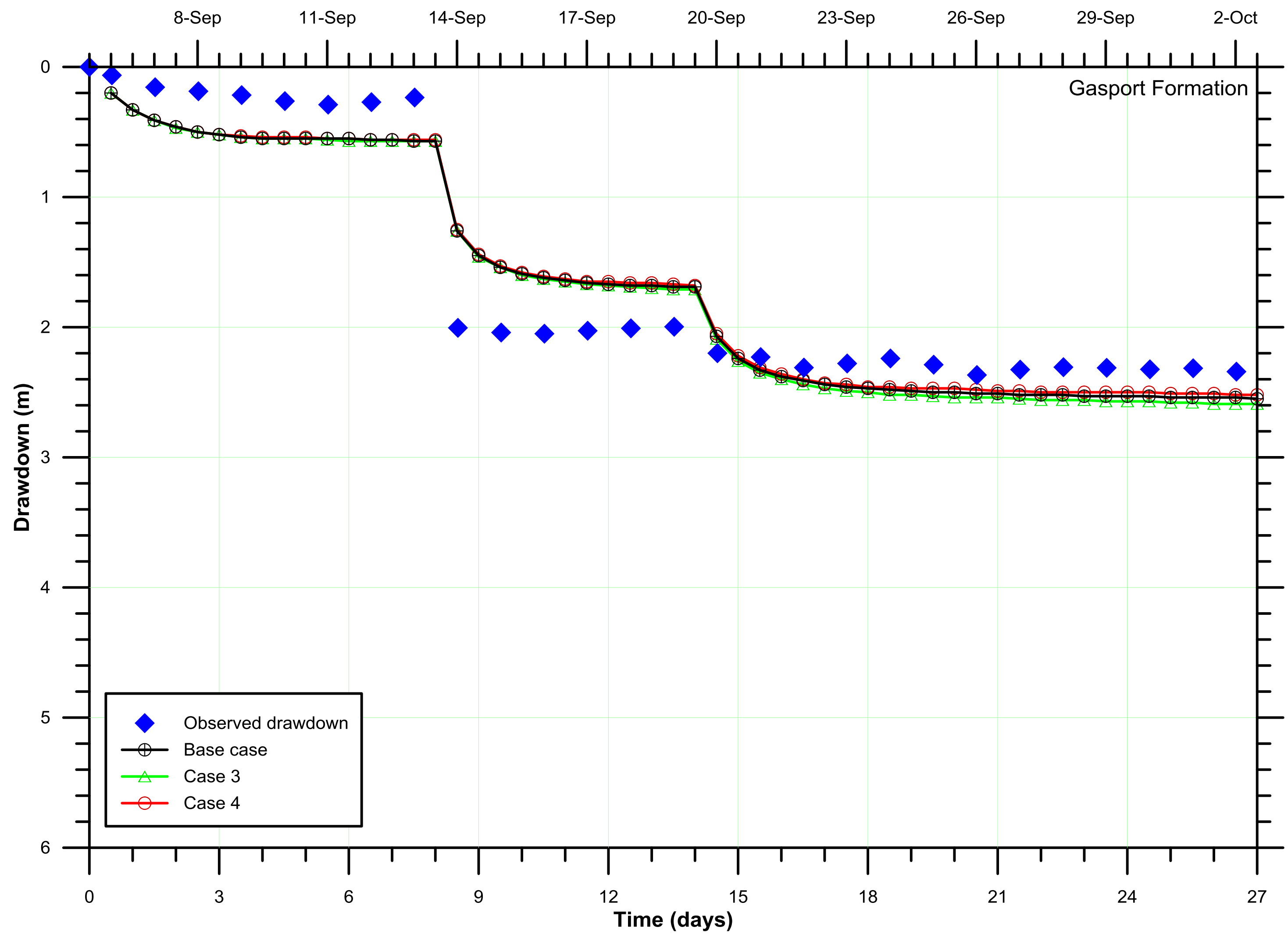



**CAMBRIDGE EAST IUS WATER SUPPLY**
**CLASS EA: GROUNDWATER MODELLING**

**Figure 29** Simulated and Observed Hydrographs for CMO2A-06 Sensitivity Analysis with Respect to the Specific Yield

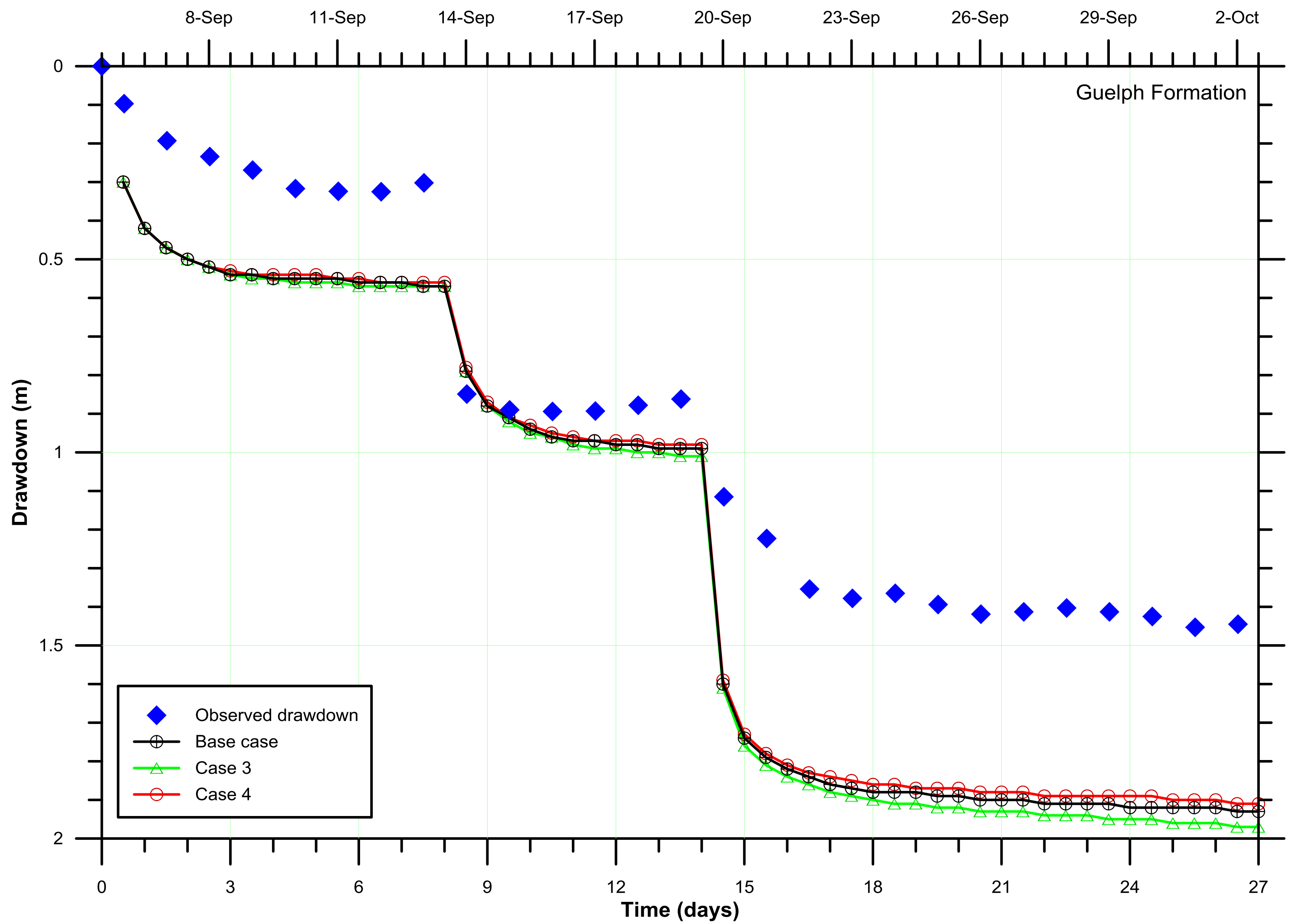
Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING




**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 30** Simulated and Observed Hydrographs for PBOW2A-06 Sensitivity Analysis with Respect to the Specific Yield

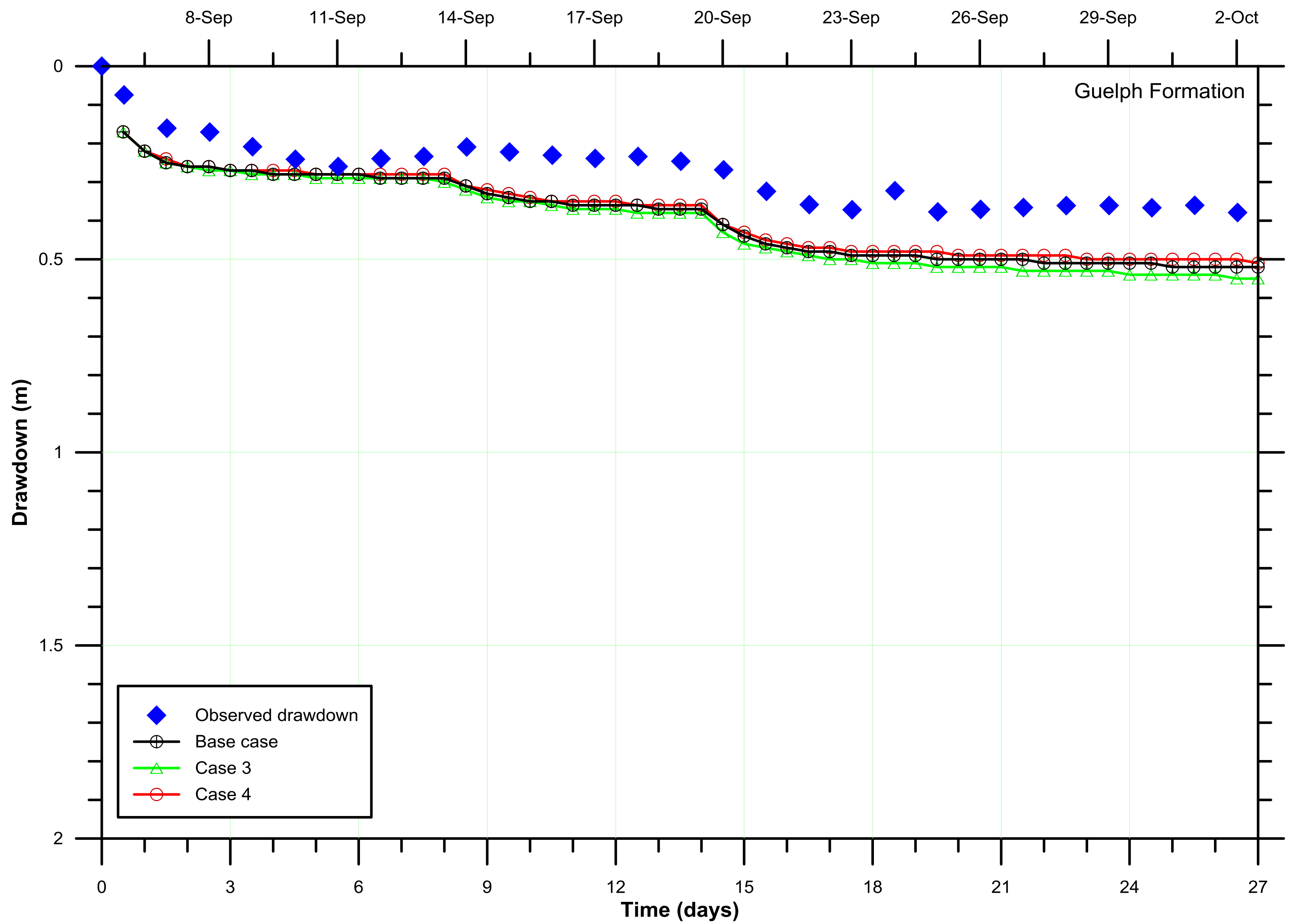
Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING




**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 31:** Simulated and Observed Hydrographs for CMOW1B-06 Sensitivity Analysis with Respect to the Specific Yield

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING




**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 32** Simulated and Observed Hydrographs for CMOW2B-06 Sensitivity Analysis with Respect to the Specific Yield

Matrix Solutions Inc.
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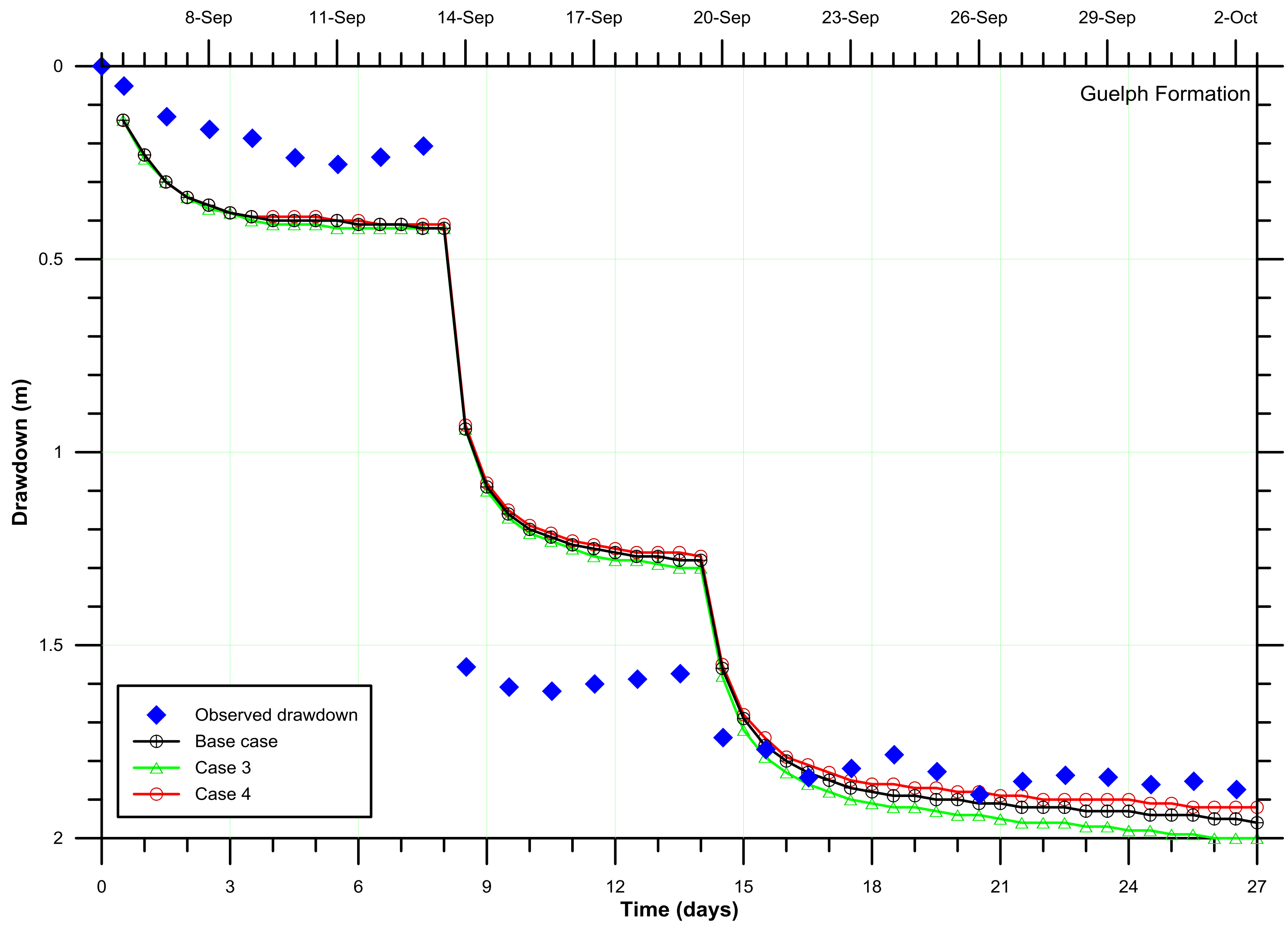


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 33** Simulated and Observed Hydrographs for PBOW2B-06 Sensitivity Analysis with Respect to the Specific Yield

Matrix Solutions Inc.
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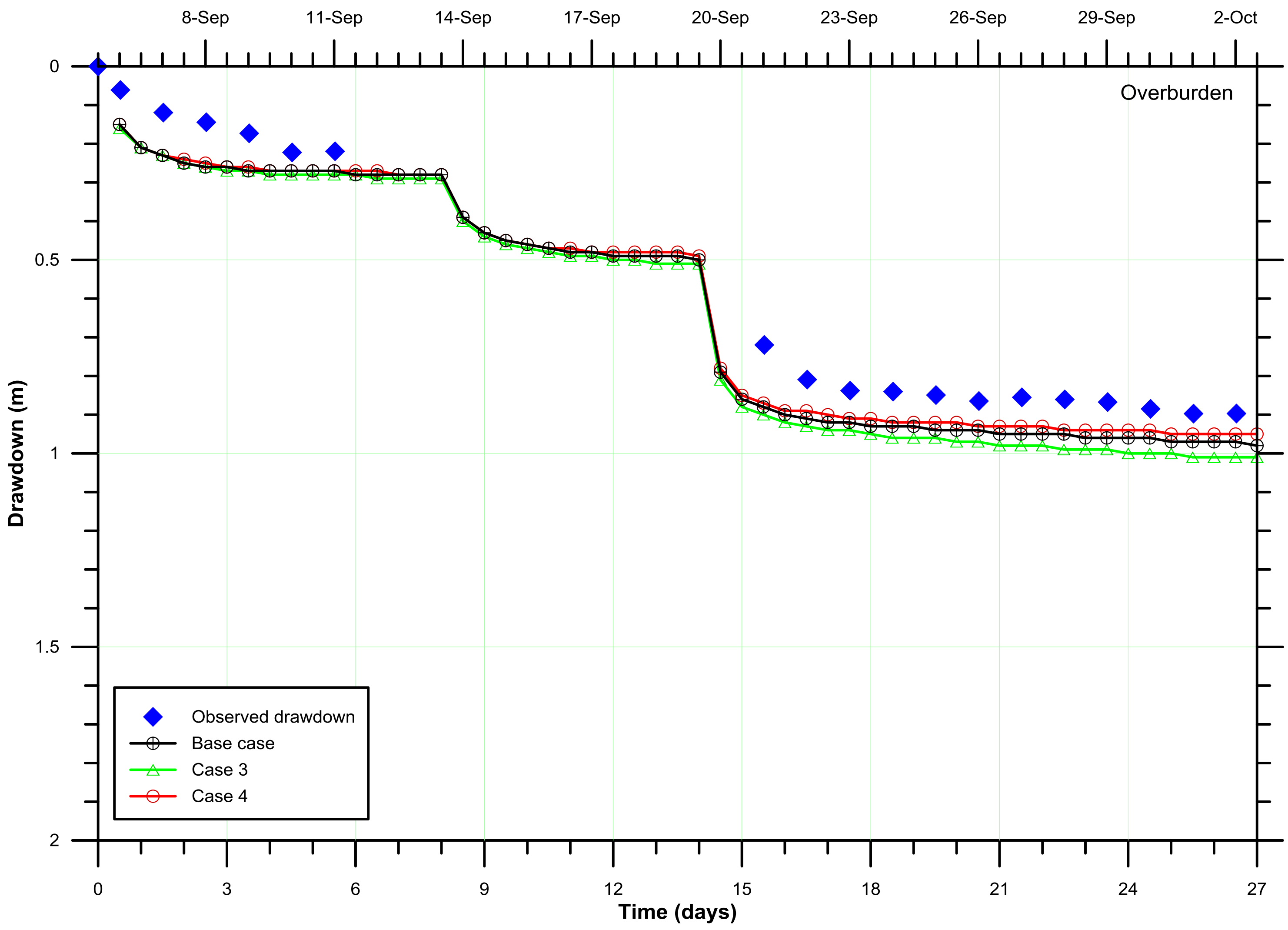


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 34** Simulated and Observed Hydrographs for CMOW1D-06 Sensitivity Analysis with Respect to the Specific Yield

Matrix Solutions Inc.
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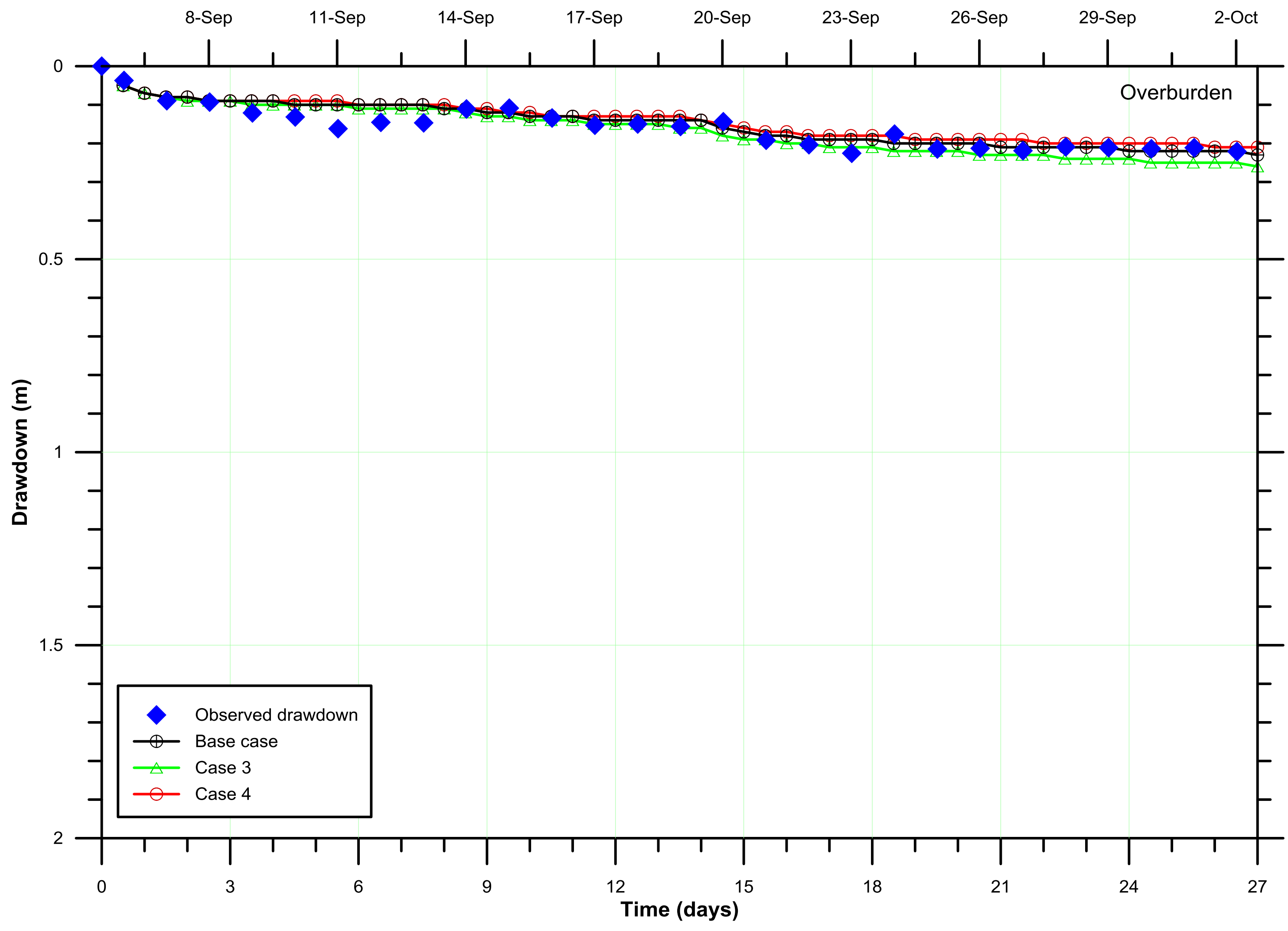


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 35** Simulated and Observed Hydrographs for CMOW2D-06 Sensitivity Analysis with Respect to the Specific Yield

Matrix Solutions Inc.
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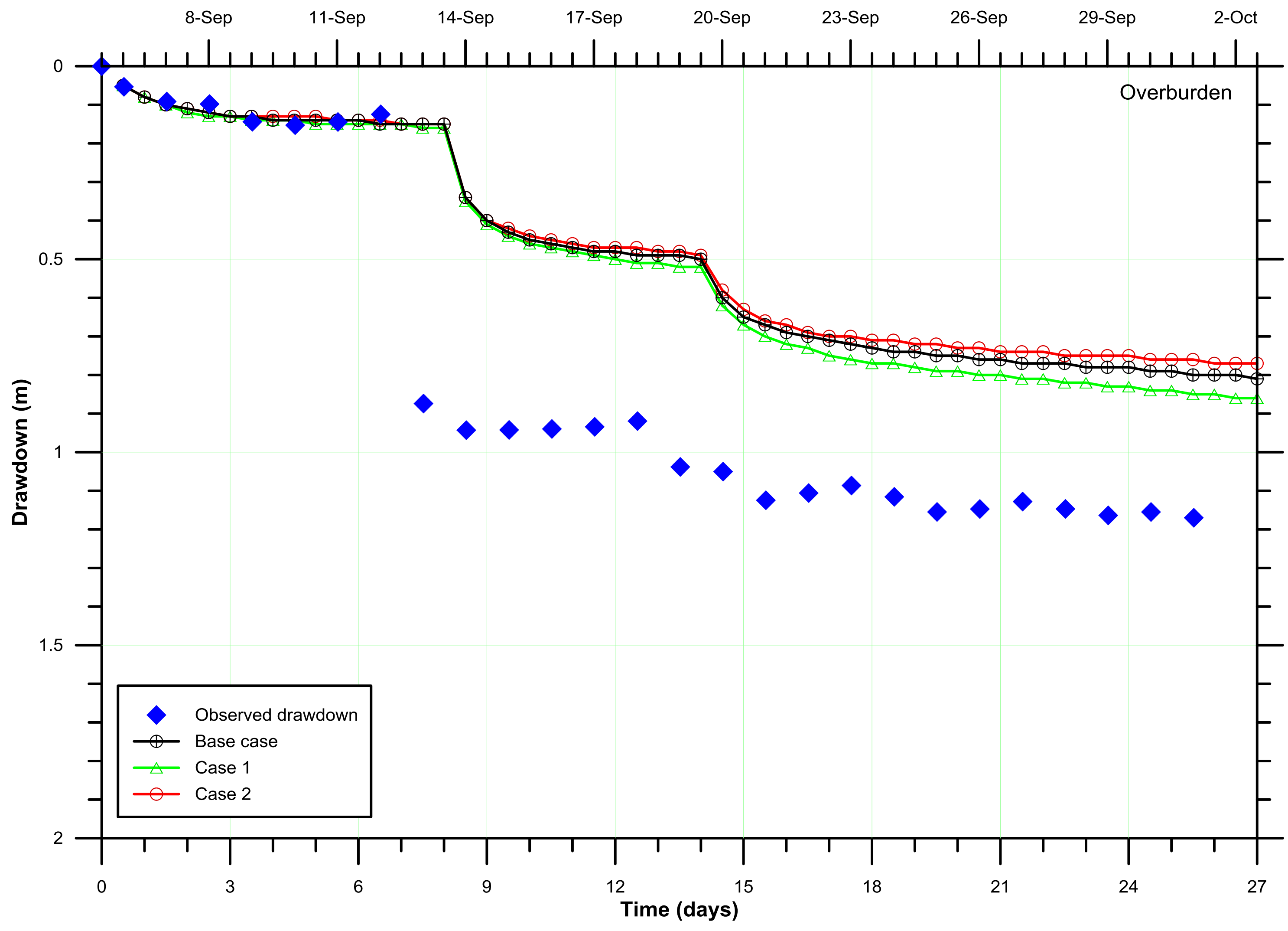


**CAMBRIDGE EAST IUS WATER SUPPLY CLASS EA: GROUNDWATER MODELLING**

**Figure 36** Simulated and Observed Hydrographs for PBOW2D-06 Sensitivity Analysis with Respect to the Specific Yield

Matrix Solutions Inc.
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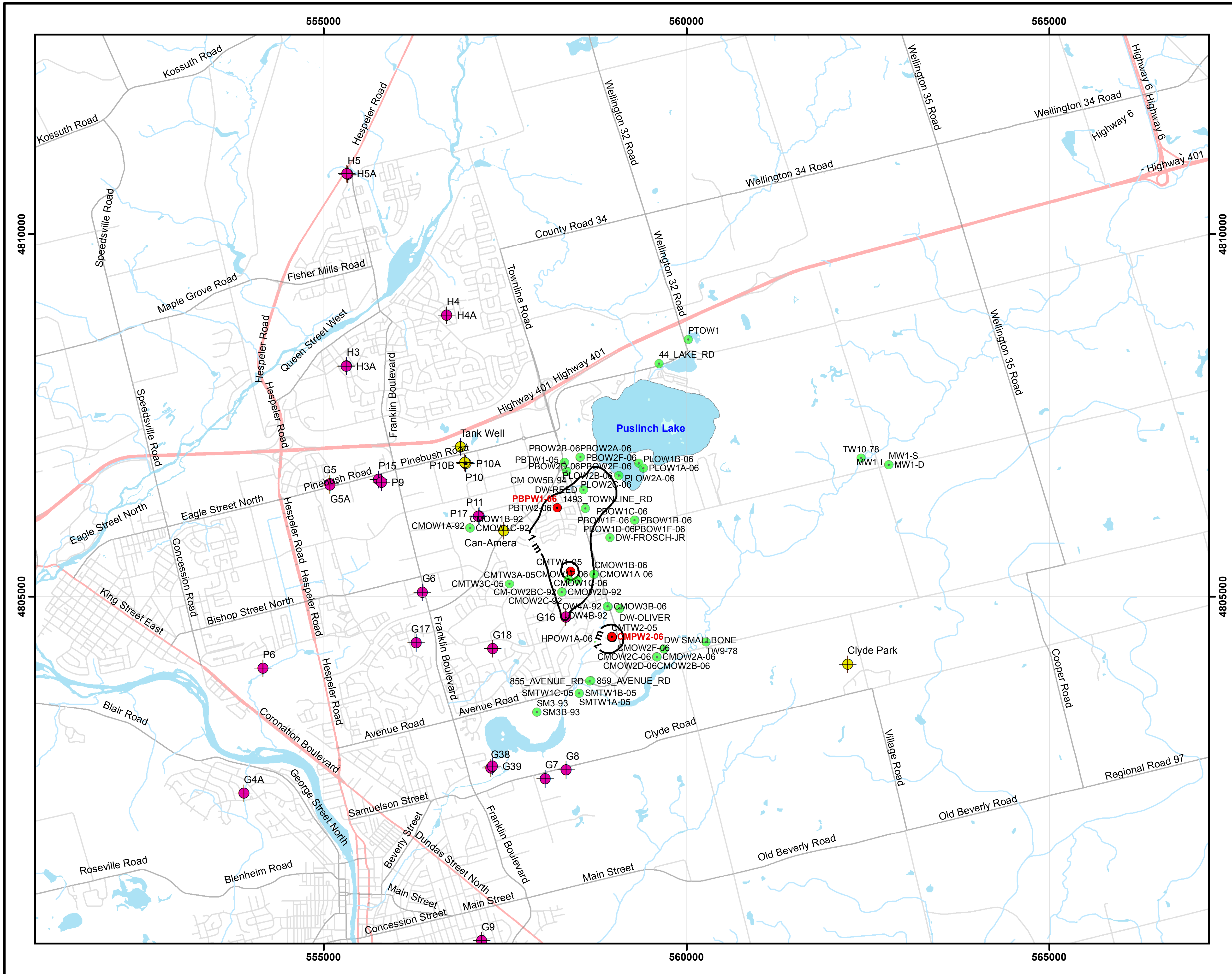

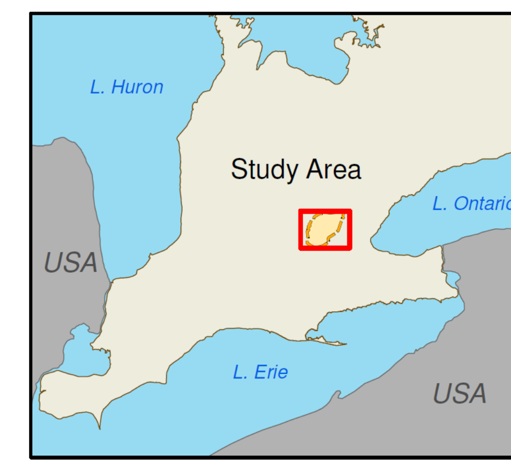


**Cambridge East IUS Water Supply Class EA: Groundwater Modelling**

**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers

**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

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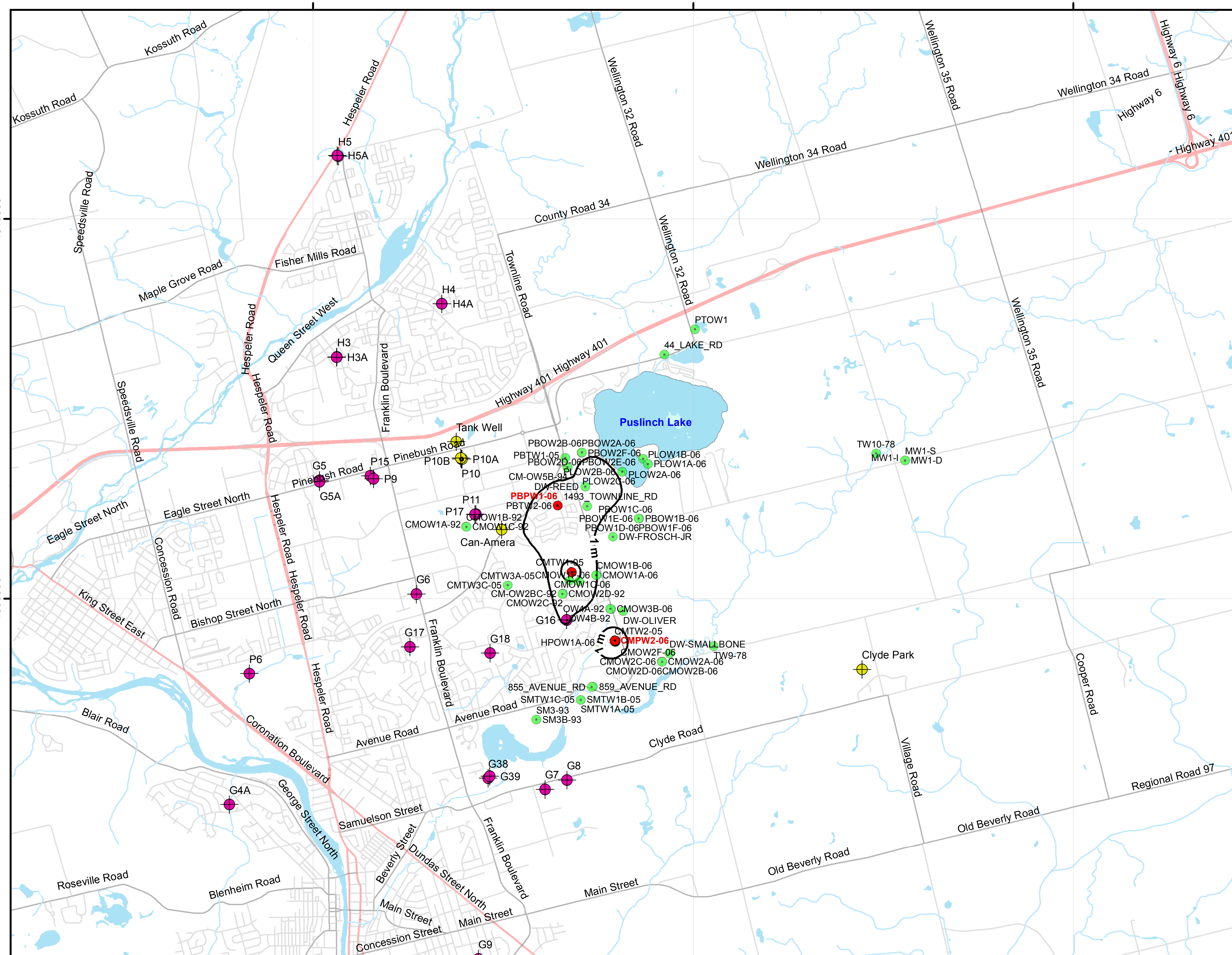
**Figure 37**

Simulated Final Drawdowns in the Contact Aquifer for the Base Case (Sy=0.3)




Cambridge East IUS Water Supply Class EA: Groundwater Modelling

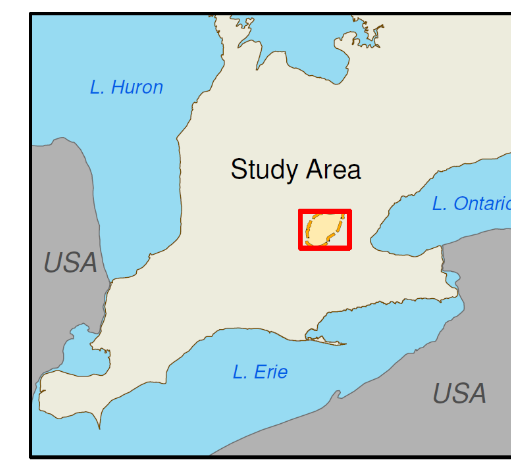
**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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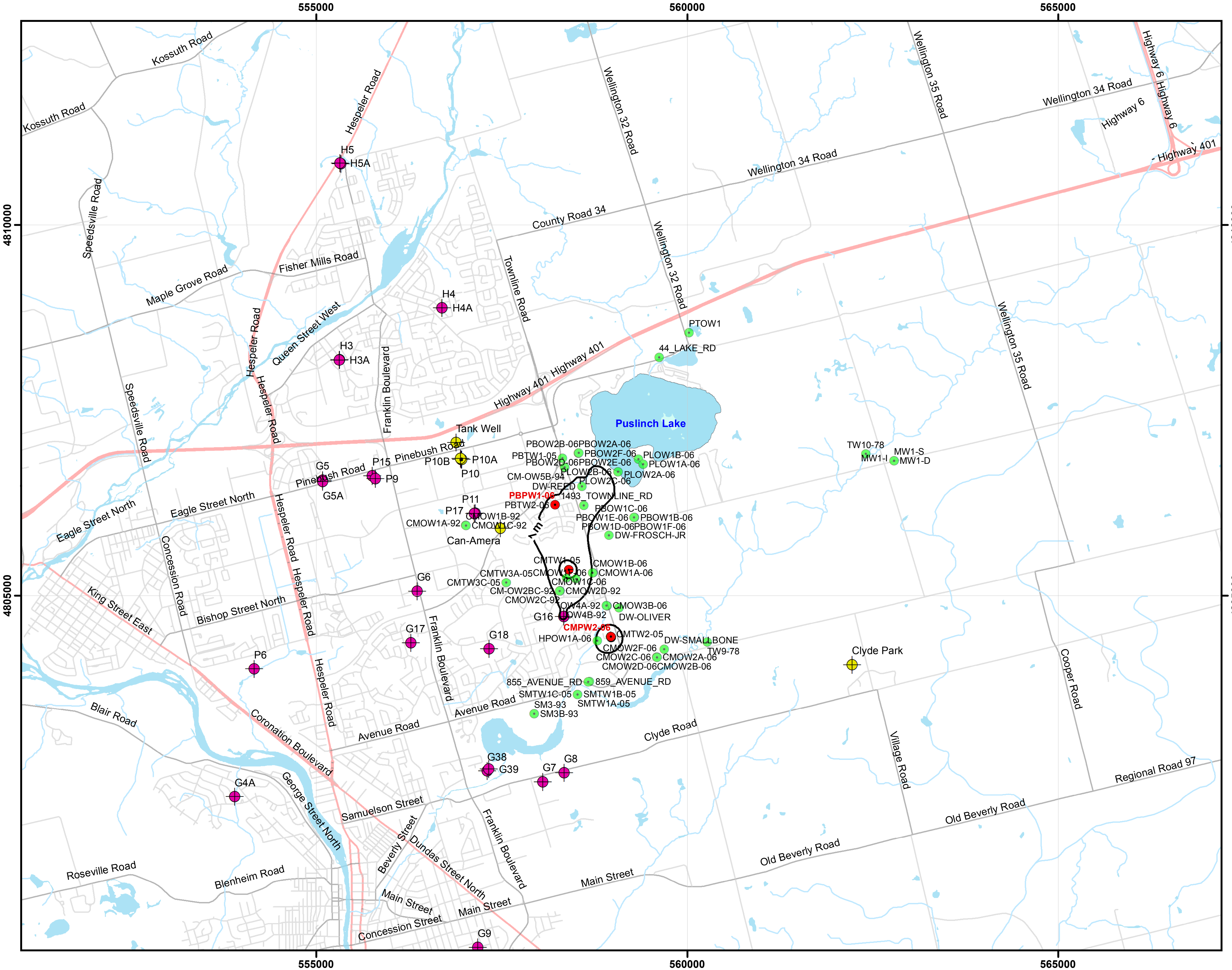
**Figure 38**

Simulated Final Drawdowns in the Contact Aquifer for Case 3 (Sy=0.2)




**Cambridge East IUS Water Supply Class EA: Groundwater Modelling**

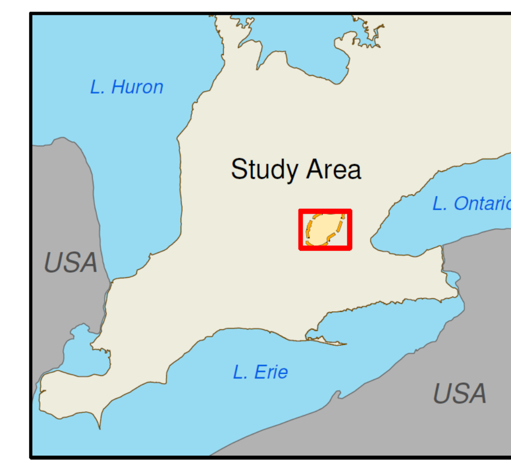
**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

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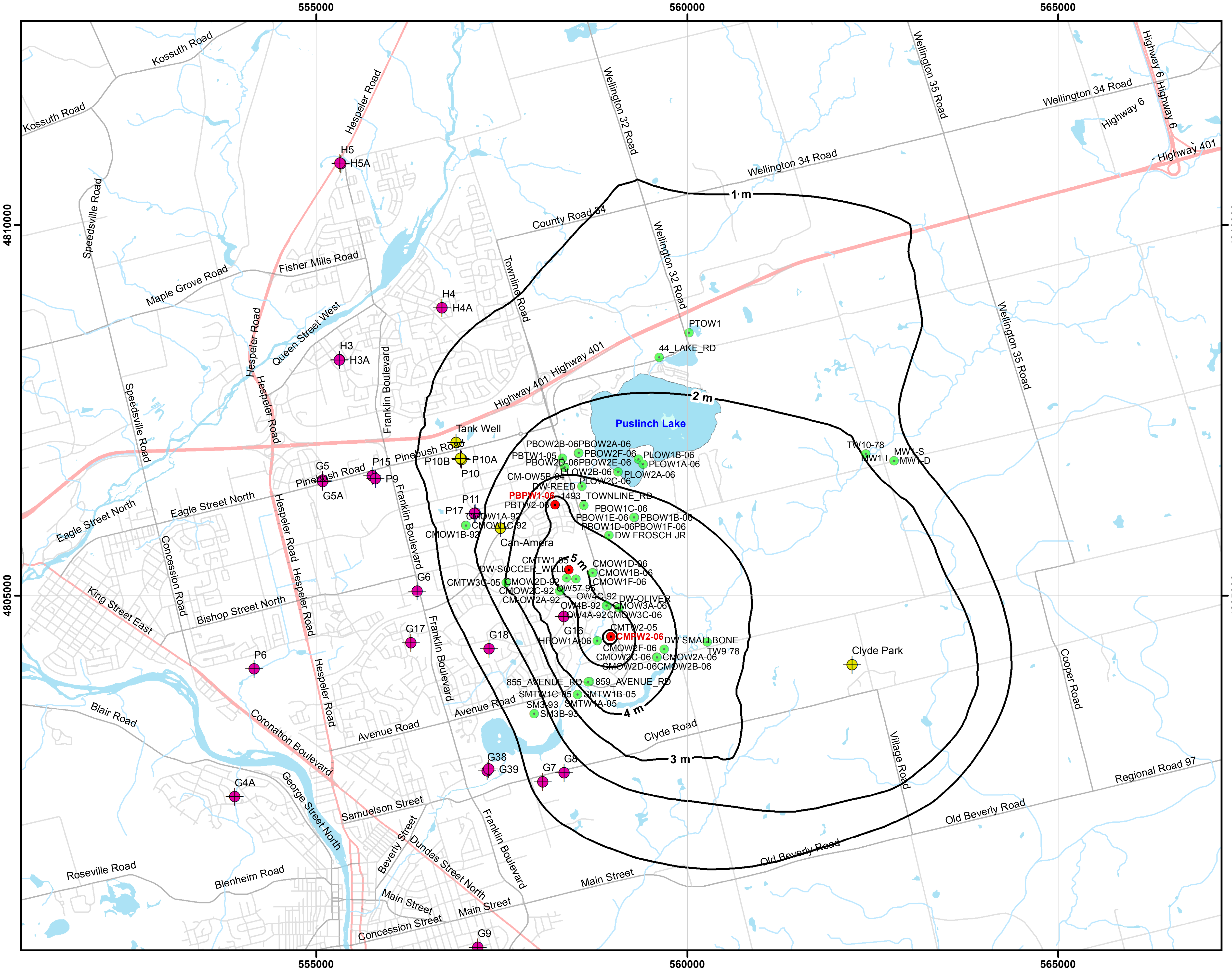
**Figure 39**

Simulated Final Drawdowns in the Contact Aquifer for Case 4 (Sy=0.4)




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

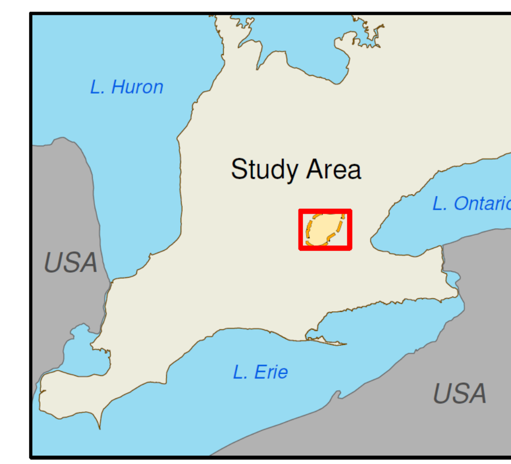
**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




**Projection: UTM Zone 17N, NAD 83**
**Map Version: 2, Map data 2014-05-27 J. Zhang**

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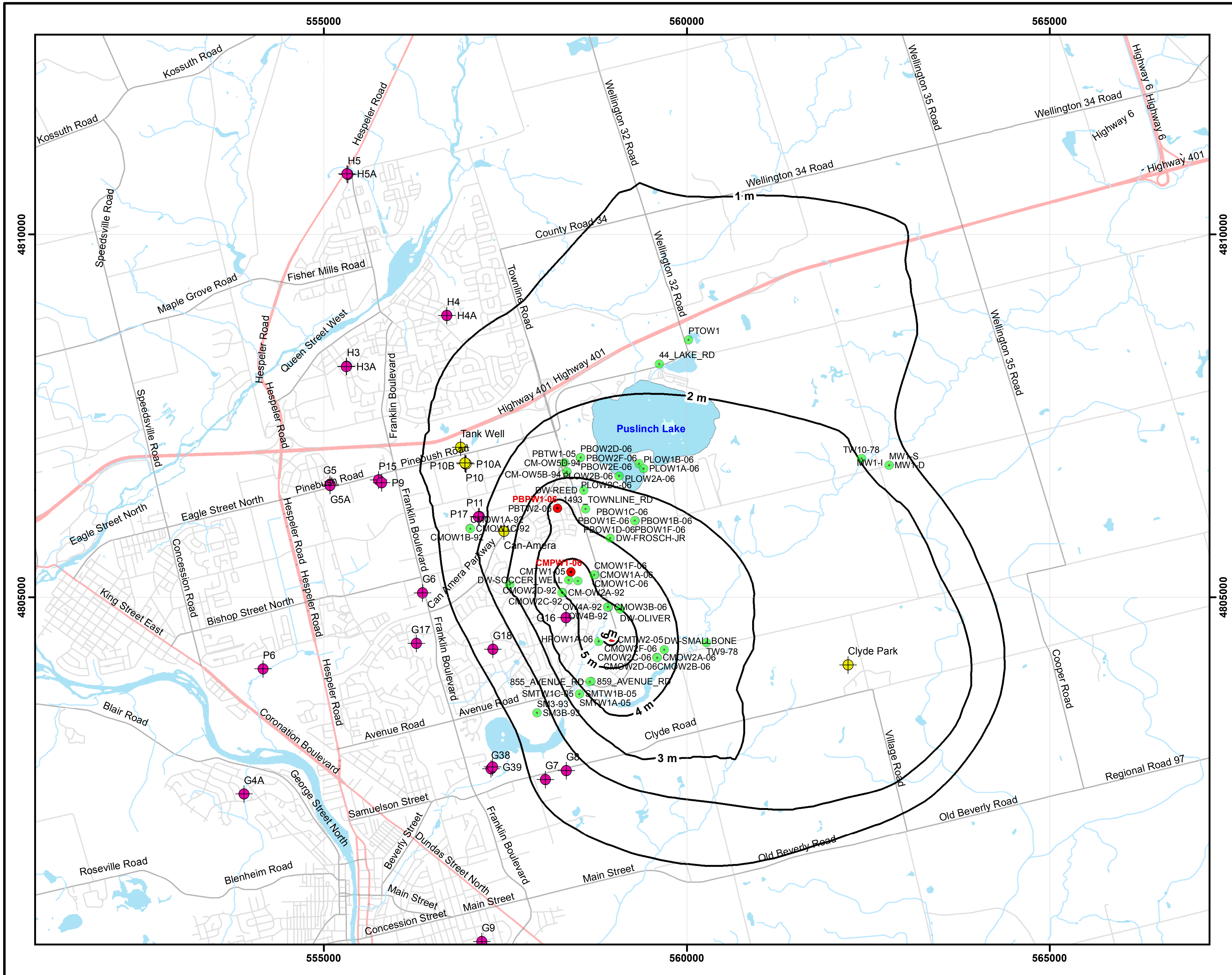
**Figure 40**

Simulated Final Drawdowns in the Middle Gasport Formation Aquifer for the Base Case (Sy=0.3)

# Cambridge East IUS Water Supply Class EA: Groundwater Modelling




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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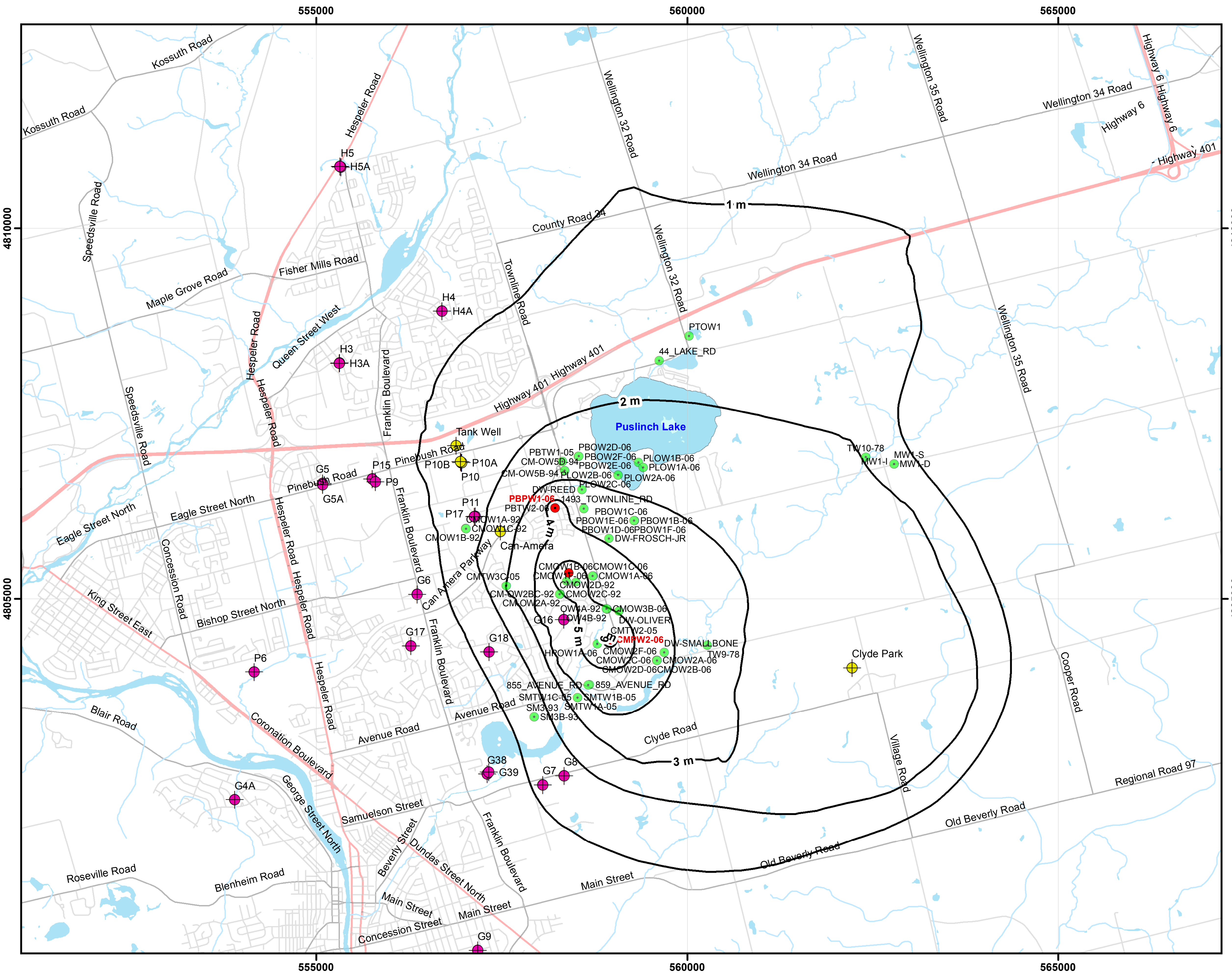
**Figure 41**

Simulated Final Drawdowns in the Middle Gasport Formation Aquifer for Case 3 (Sy=0.2)




# Cambridge East IUS Water Supply Class EA: Groundwater Modelling

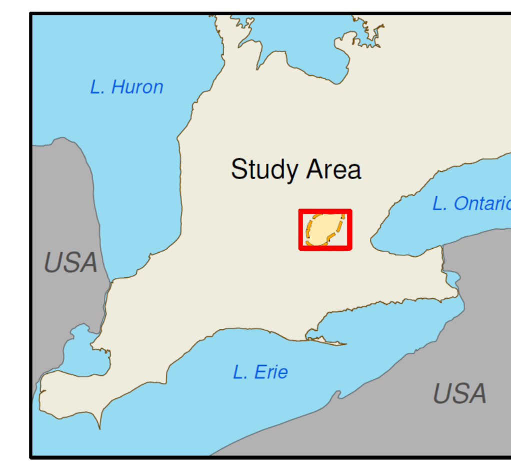
**LEGEND**

- Wells Pumped during the 28-day Test
- Observation Wells
- Municipal Supply Well
- Test Production Well
- Drawdown Contours at the End of the Test
- Expressway / Highway
- Major Roads
- Roads (collectors)
- Rivers / Streams
- Lakes and Ponds

1:50,000

1 0.5 0 1

Kilometers




Projection: UTM Zone 17N, NAD 83
Map Version: 2, Map data 2014-05-27 J. Zhang

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**Figure 42**

Simulated Final Drawdowns in the Middle Gasport Formation Aquifer for Case 4 (Sy=0.4)