

equipment were characterized by entering the sound power and/or sound pressure octave band spectrum associated with each source. Other parameters including building dimensions, frequency of use, hours of operation, and enclosure attenuation ratings also define the nature of sound emissions.

All landfill operation sources operating within the active area were modelled as a 25 m by 40 m area source, based on the active area of exposed waste. For all landfill operations except for building a berm, it was assumed the active area will be located a minimum of 20 m from the edge of the area of new waste placement to allow for the building of a working berm.

Road Traffic

The noise predictions for road traffic were carried out using CadnaA to characterize existing noise levels within the Site-vicinity Study Area. Based on past experience, using the specific algorithm outlined in Volume IV Appendix D.02 for the road traffic sources provides prediction results consistent with actual noise levels and those predicted using the MECP's Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT), which is the basis of the DOS-based STAMSON modelling software provided by the MECP. The MECP's ORNAMENT was used to verify the CadnaA noise predictions with respect to the road traffic in the Site-vicinity Study Area. Road traffic was assessed over a 16-hour daytime period (7 a.m. to 11 p.m.) and an 8-hour nighttime period (11 p.m. to 7 a.m.).

Existing noise levels due to road traffic were established using Annual Average Daily Traffic (AADT) provided by the City or, for Highway 401 and Highway 402, from published data from the Ontario Ministry of Transportation (MTO) (MTO 2016). The daytime and nighttime period percentages and total truck percentages for local roadways were provided by the City. Speed limits were provided by the City/MTO or determined from readily available public imagery.

Overall Existing Noise Levels

Existing noise levels in the Site-vicinity Study Area are influenced by vehicle traffic, existing landfill operations and operations of other facilities within the Site-vicinity Study Area. In completing a conservative assessment, these other facilities were not assessed in quantifying existing noise levels. Existing noise levels were evaluated as an average over the daytime (7 a.m. to 11 p.m.) and nighttime (11 p.m. to 7 a.m.) periods.

Existing landfill operations were predicted over the entire daytime and nighttime periods, considering normal operations, site preparation, placement of daily cover, and ancillary equipment. These landfill operating scenarios were time-weighted accordingly, based on operating hours specified above. Predicted existing landfill operations noise levels at representative PORs are presented in Table 5.2-5.

The overall existing noise levels, shown in Table 5.2-5, were calculated by combining the existing road traffic noise levels and the existing landfill operations noise levels.

ENVIRONMENTAL ASSESSMENT OF THE PROPOSED W12A LANDFILL EXPANSION CITY OF LONDON

Table 5.2-5: Predicted Existing Noise Levels

Receptor	Existing Average Road Traffic Noise Level (dBA) - Day	Existing Average Road Traffic Noise Level (dBA) - Night	Existing Average Landfill Operations Noise Level (dBA)- Day	Existing Average Landfill Operations Noise Level (dBA) - Night	Existing Overall Average Noise Level (dBA) - Day	Existing Overall Average Noise Level (dBA) - Night
R01	52	45	50	34	54	46
R02	52	45	50	35	54	45
R04	50	36	35	20	50	36
R06	50	36	46	30	51	37
R10	46	37	43	27	48	37
R15	49	35	51	37	53	39
R16	58	49	40	25	58	49
R19	65	59	30	14	65	59
R23	55	48	31	15	55	48
R25	62	56	31	14	62	56
R50	60	44	36	20	60	44

In general, the noise levels from the short-term monitoring exceeded the predicted overall existing noise levels shown in Table 5.2-5, by an average of 5 dB and up to 14 dB.

The largest differences were observed when measurements were taken near other facilities in the Site-vicinity Study Area (i.e., the aggregate pits north of the landfill and the MRF to the east). Site observations indicated these other facilities were major sources of noise for some receptors. Therefore, it is expected that the predicted overall existing noise levels shown in Table 5.2-5 are generally underestimated. This will subsequently result in a conservative assessment for landfill expansion related changes relative to existing noise levels as the predicted relative changes will be greater than what will be experienced.

Note that when establishing the applicable sound level limits to assess compliance of the landfill with MECP guidelines, the noise emissions associated with the existing landfill were not considered and therefore the MECP's most restrictive (i.e., Class 3) exclusionary sound level limits were conservatively considered in this assessment. It is also noted that Highway 401 is expected to influence the acoustical environment in parts of the Site-vicinity Study Area but was conservatively not considered in establishing the background noise levels.

5.3 Geology and Hydrogeology

This section of the EASR provides a summary of the existing hydrogeological conditions in the area underlying and surrounding the W12A Landfill site. The work to characterize existing hydrogeological conditions was carried out as described in the approved Amended ToR (Volume II) and following the Groundwater work plan (provided in Volume III Appendix B.02). The summary includes descriptions and accompanying illustrations of the geological and hydrogeological setting, overburden materials and site hydrogeology. The detailed report is contained in Volume IV Appendix D.03.

The description of existing geological and hydrogeological conditions is based on numerous previous hydrogeological investigations and groundwater monitoring programs completed for the W12A Landfill area and a supplemental investigation completed in 2019 and 2020 that focused on obtaining additional hydrogeological information related to the expansion alternatives for the W12A Landfill. In addition, to evaluate the nature of the fractures in the upper portion of the Surficial Aquitard and their potential to create a preferred pathway for leachate migration from the landfill expansion, a benched test pit measuring approximately 12 m x 12 m in plan and 5.4 m in depth was completed in November 2019 in the area between the landfill and the MRF. The test pit allowed the fracture characteristics and fracture frequency to be assessed with depth. The work plan for the supplemental investigations is detailed in the Groundwater Work Plan, dated November 2019 (refer to Volume III Appendix B.02).

The location of historical and current boreholes and the test pit at the existing landfill are shown on Figure 5.3-1.

5.3.1 Geological and Hydrogeological Setting

In terms of geological setting, the landfill is located on part of the Westminster moraine, which consists of low permeability till soils identified as the Port Stanley Till. Immediately north of the landfill site, gravel and gravelly sand were formed from the older Catfish Creek drift (located under the Port Stanley Till) or were deposited underneath the Port Stanley Till by subglacial streams.

Major hydrostratigraphic units are divided into aquitards and aquifers. An aquitard consists of low permeability soils that inhibit groundwater flow. An aquifer consists of permeable soils that can transmit large enough quantities of water such that when water wells are installed they produce usable quantities of water.

In terms of the hydrogeological setting, the Site Study Area is underlain by low permeability Port Stanley Till, which comprises most of the Westminster Moraine. The next major regional hydrogeological feature is an aquifer found beneath the Port Stanley Till, consisting of stratified sand and gravel soils, most likely part of the Catfish Creek Drift. These soil deposits comprise the White Oak Aquifer. The White Oak Aquifer extends as far north as Lambeth and extends southeast to Kettle Creek. The aquifer has an irregular vertical distribution with a maximum thickness of approximately 45 m just north of the landfill along Scotland Drive.

Some local aquifers consisting of sand and gravel soil layers occur in the Port Stanley Till and were probably formed by subglacial processes at the time that the till soils were deposited. These local aquifers are not regionally extensive and generally thinner than the White Oak Aquifer. One such local aquifer is present underneath the landfill (referred to as the Upper Aquifer) and separates the Port Stanley Till into the Surficial Aquitard and a Lower Aquitard, both of which are above the White Oak Aquifer. The Upper Aquifer has not been identified north of Scotland Drive, but is present below the W12A Landfill site and extends south of Manning Drive. The thickness of the Upper Aquifer is variable, ranging from less than 2 m to more than 8 m thick.

Geological cross-sections illustrating this sequence of overburden deposits are provided on Figure 5.3-2.

The thickness of the Surficial Aquitard varies from as much as 20 m at the northwest corner of the existing W12A Landfill site, to 15 m or greater below much of the existing landfill, and to about 8 m at the southeast corner of the landfill property along Manning Drive. A plan showing the interpreted elevation of the contact between the Surficial Aquitard and the Upper Aquifer beneath the W12A Landfill site is provided on Figure 5.3-3, while a plan showing the distribution of thickness of the Surficial Aquitard is provided on Figure 5.3-4. As illustrated on Figure 5.3-3, the elevation of the contact between the Surficial Aquitard and the underlying Upper Aquifer is relatively consistent below the landfill and adjacent area; as such, the variations in the Surficial Aquitard thickness are more related to surface topography changes than variations in the elevation of the base of the aquitard unit.

Limestone bedrock is found approximately 80 to 90 m below the landfill and slopes downwards from north-northeast.

Municipal water is available to residences near the landfill on Manning Drive, White Oak Road, Scotland Drive and Wellington Road South; however, some of the homeowners have not connected to the available municipal services. These residences, as well as residences and farms further away from the landfill area, rely on individual water supply wells, installed in either the Upper Aquifer or the White Oak Aquifer for their water supply. The annual monitoring program for the W12A Landfill includes sampling and analysis of domestic wells in the area of the landfill site. Monitoring does not indicate any effect from the landfill on the water quality in these wells.

Source water protection studies were carried out for the watersheds in which the City is located. The resulting Source Water Protection Plans delineate source protection areas with respect to municipal drinking water supplies (Wellhead Protection Areas – WHPAs and Intake Protection Zones – IPZs) as well as groundwater recharge areas, assign vulnerability to these source protection areas and describe appropriate land use planning for their protection. There are two Source Protection Regions in the area of and surrounding the W12A Landfill - the Thames-Sydenham and Region (the Upper Thames River Source Protection Area) and the Lake Erie Region Drinking Water Source Protection Region (Kettle Creek Source Protection Area). The primary source of drinking water for the City is surface water from Lake Huron and Lake Erie, with a stand-by backup supply from groundwater from the Hyde Park and Fanshawe well fields located in the northeast and west parts of the City.



Existing Groundwater Conditions

CORPORATION OF THE CITY OF LONDON
INDIVIDUAL EA OF THE PROPOSED W12A
LANDFILL EXPANSION

HISTORICAL AND CURRENT BOREHOLES AND TEST PITS

Figure 5.3-1

LEGEND

- 2019 Drilling Location
- Historical Borehole Location
- Test Pit Location

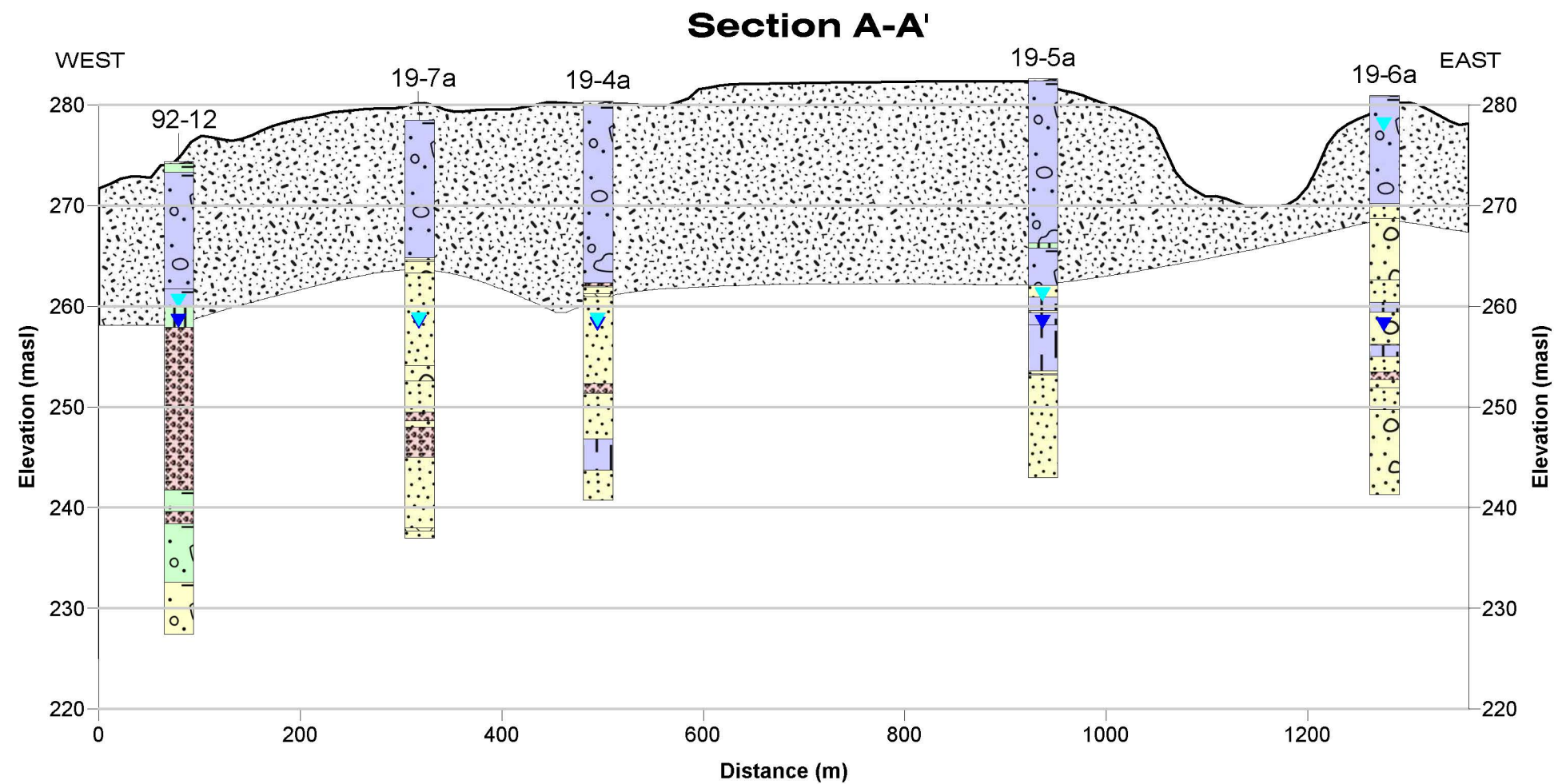
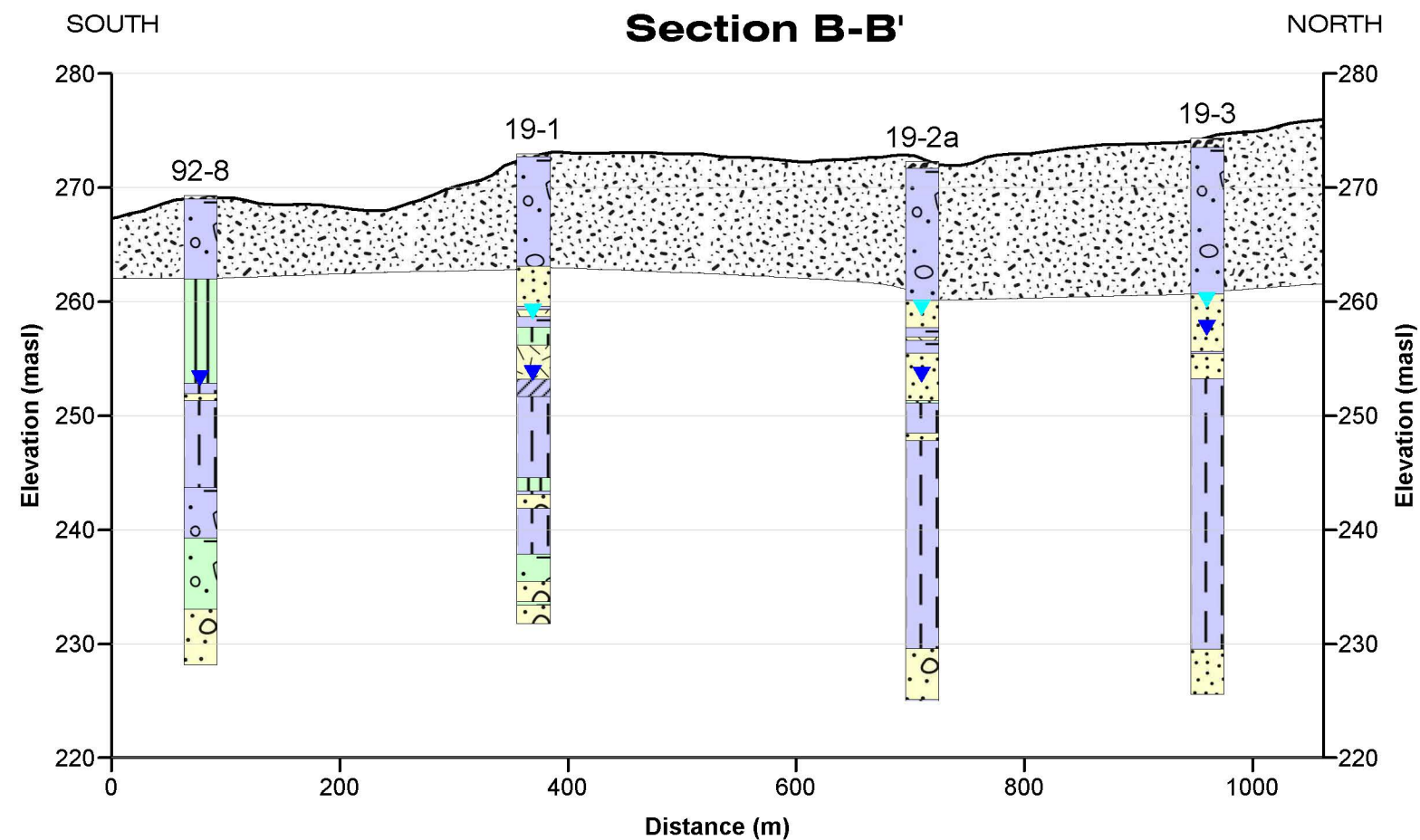
Note: See Figure 5.3-2 for Geologic Sections



MAP CREATED BY : LOM
MAP CHECKED BY: RFK
MAP PROJECTION: NAD 1983 UTM Zone 18N
2017 AIR PHOTO



PROJECT: 19-1230
STATUS: FINAL
DATE: AUGUST 2020



Existing Groundwater Conditions

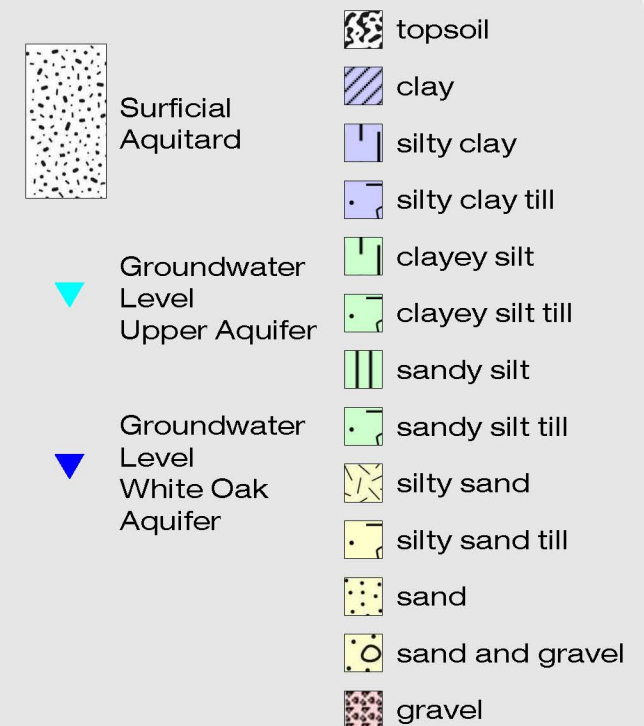
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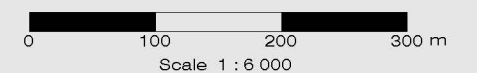
GEOLOGIC CROSS SECTIONS

Figure 5.3-2

LEGEND



Note: See Figure 5.3-1 for Geologic Section Locations



NOTE: VERTICAL SCALE EXAGGERATED 10x

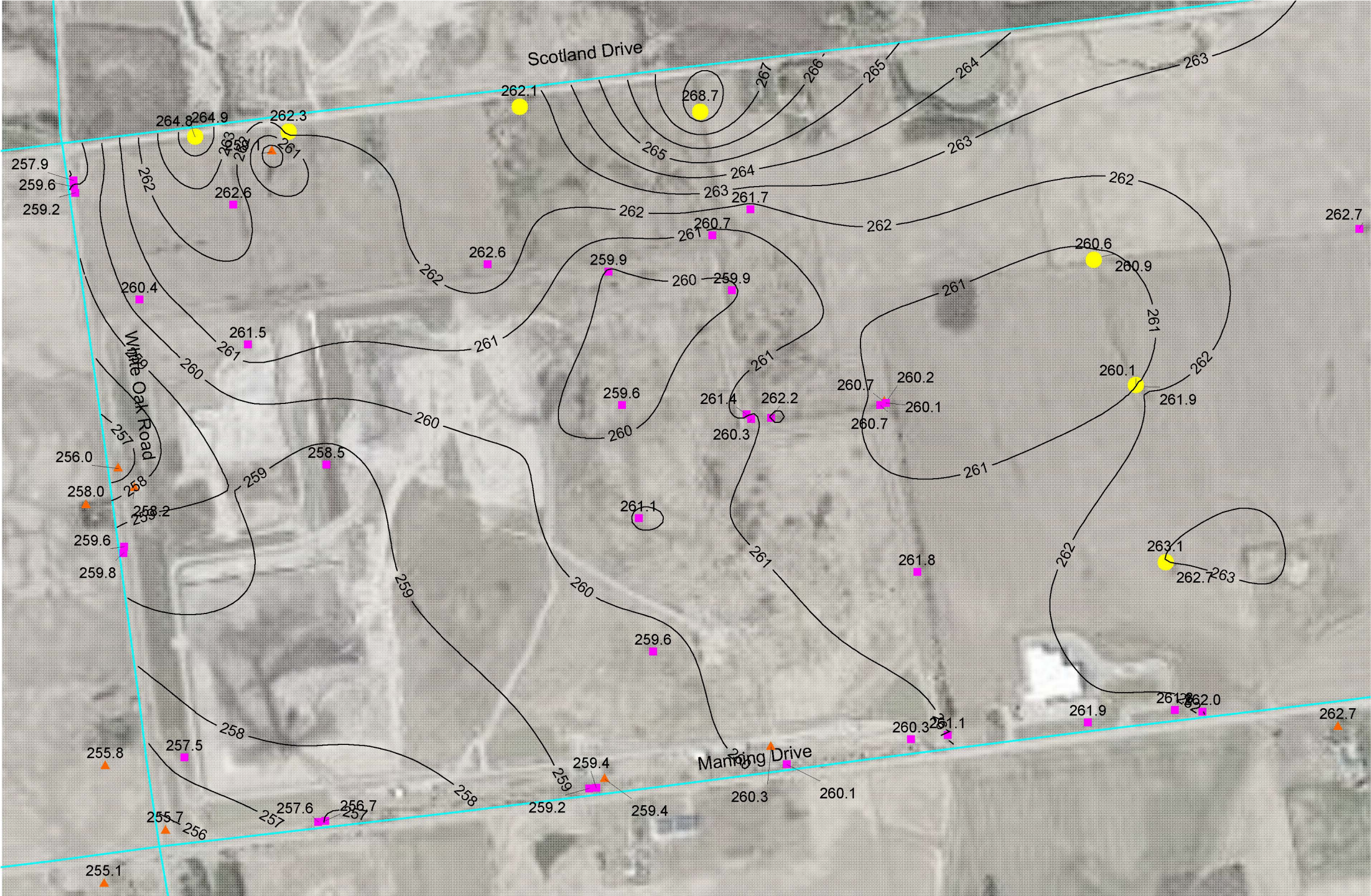
MAP CREATED BY : LOM
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DATE: JULY 2020



Existing Groundwater Conditions

CORPORATION OF THE CITY OF LONDON
INDIVIDUAL EA OF THE PROPOSED W12A
LANDFILL EXPANSION

**UPPER AQUIFER
SURFACE ELEVATION**

Figure 5.3-3

LEGEND

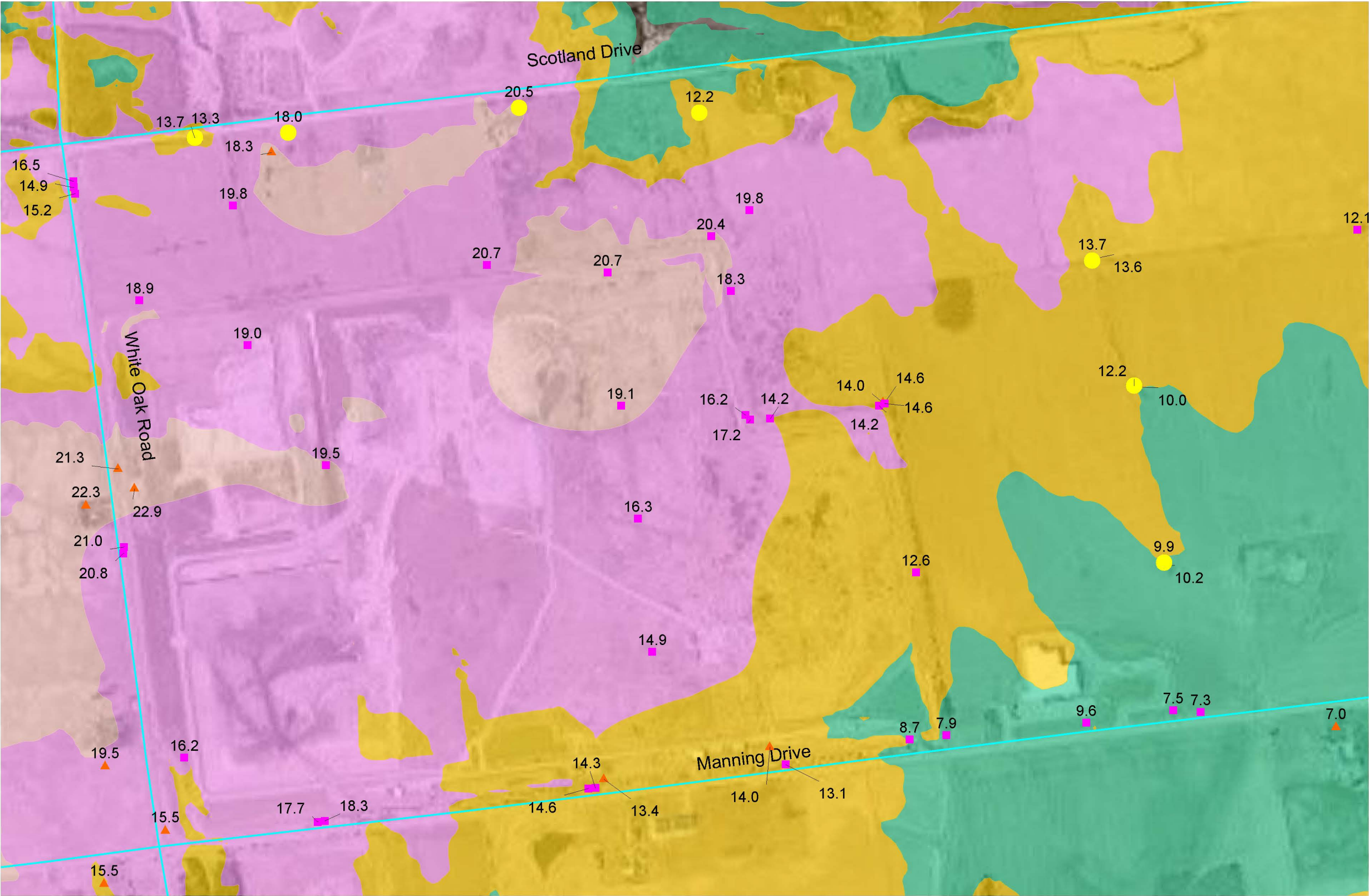
- 2019 Drilling Location
- Historical Borehole Data
- Water Well Record Data
- 260.1 Elevation of Upper Aquifer (masl)
- 260 Upper Aquifer Surface Contour (masl)



MAP CREATED BY : LOM
MAP CHECKED BY: RFK
MAP PROJECTION: NAD 1983 UTM Zone 18N
2017 AIR PHOTO



PROJECT: 19-1230
STATUS: FINAL
DATE: AUGUST 2020



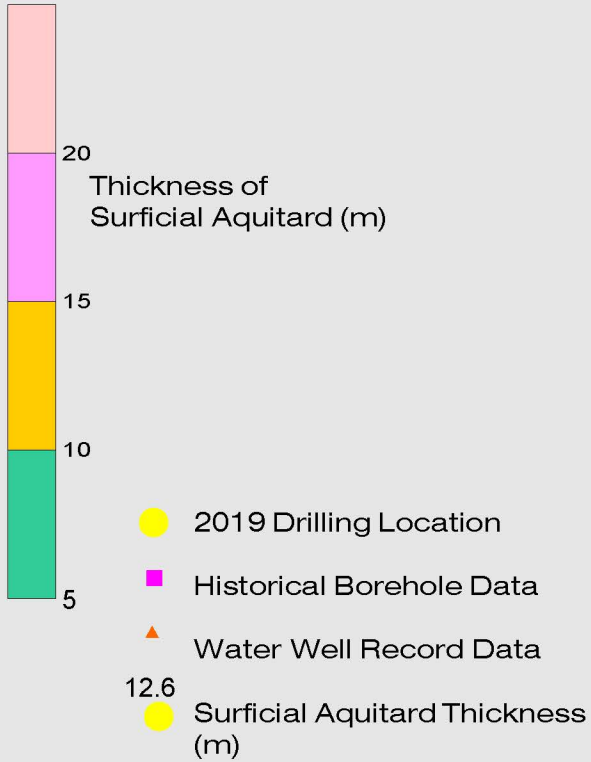
Existing Groundwater Conditions

CORPORATION OF THE CITY OF LONDON
INDIVIDUAL EA OF THE PROPOSED W12A
LANDFILL EXPANSION

SURFICIAL AQUITARD THICKNESS

Figure 5.3-4

LEGEND



MAP CREATED BY : LOM
MAP CHECKED BY: RFK
MAP PROJECTION: NAD 1983 UTM Zone 18N
2017 AIR PHOTO



PROJECT: 19-1230
STATUS: FINAL
DATE: AUGUST 2020

All of these sources are distant from the W12A Landfill. The closest municipal well field to the W12A Landfill is the Belmont well field (Kettle Creek Source Protection Area) located 10 km east of the landfill. The capture area for the Belmont well field extends to the north of Belmont and not in the direction of the landfill. There are no source water protection areas identified on or in the area of the W12A Landfill. As such, neither the existing landfill nor the proposed expansion are influenced by planning considerations or requirements related to source water protection.

5.3.2 W12A Landfill Site Hydrogeology

Groundwater flow in the Surficial Aquitard is principally vertically downward under a high vertical hydraulic gradient. The water level in the underlying Upper Aquifer is below the surface of the aquifer, which results in the high vertical gradient. The significantly weathered and fractured clay that occurs at surface and extends within the first 5 m will have a horizontal component of groundwater flow. The upper portion of the Surficial Aquitard is weathered and fractured. The degree of significant fracturing decreases with depth such that the shallower fractured till zone is more hydraulically active than the lower less fractured till soil. Generally, regional studies have indicated that the tills are highly fractured to a depth of 3-4 m, a transitional zone occurs beneath the highly weathered and fractured soil with isolated vertical fractures occurring to depths of approximately 6 m. The occurrence and pattern of fractures observed in the test pit put down in 2019 were consistent with this general description. Studies completed by the University of Western Ontario and Dillon in 2000 on Phase 1 of the landfill (where excavation depths of landfill cells were less than those in Phase 2) indicated that the depth of active fractures beneath the waste fill is less than 2 m and that desiccation fractures in till soils occurring during landfill cell construction are “self-healing” and do not create a preferential pathway for groundwater flow.

Groundwater moves downward at an estimated velocity of 1 to 2 centimetres (cm) per year in the Surficial Aquitard. The estimated travel time through the Surficial Aquitard has been estimated to be in the order of 700 years. The results of the stable isotope assessment on groundwater samples carried out as part of the current investigation program indicates that the travel time may be significantly longer than that estimated. The Surficial Aquitard provides physical separation between the base of the landfill and the Upper Aquifer and natural hydrogeologic protection of the groundwater in the Upper Aquifer from landfill leachate effects. The ongoing landfill site groundwater monitoring program shows that the Upper Aquifer groundwater has not been affected by landfill leachate.

Groundwater flow in the Upper Aquifer is shown on Figure 5.3-5. As indicated on the figure, groundwater flows from the northeast to the southwest.

Figure 5.3-6 illustrates the water level in the White Oak Aquifer. Groundwater elevations are highest in the northwest near Scotland Drive and White Oak Road and decrease to the southeast. Based on previous assessments (Dillon, 2015), the ponds in the gravel pits north of Scotland Drive are directly hydraulically connected to the White Oak Aquifer and cause an elevated groundwater elevation in this area. Groundwater elevations decrease to the southeast. Groundwater flow in the White Oak Aquifer in the area of the landfill is in a general north to south/southeast direction.



Existing Groundwater Conditions

CORPORATION OF THE CITY OF LONDON

INDIVIDUAL EA OF THE PROPOSED W12A LANDFILL EXPANSION

GROUNDWATER ELEVATION IN UPPER AQUIFER

Figure 5.3-5

LEGEND

259.46
● Fall 2019 Upper Aquifer Groundwater Elevation (masl)

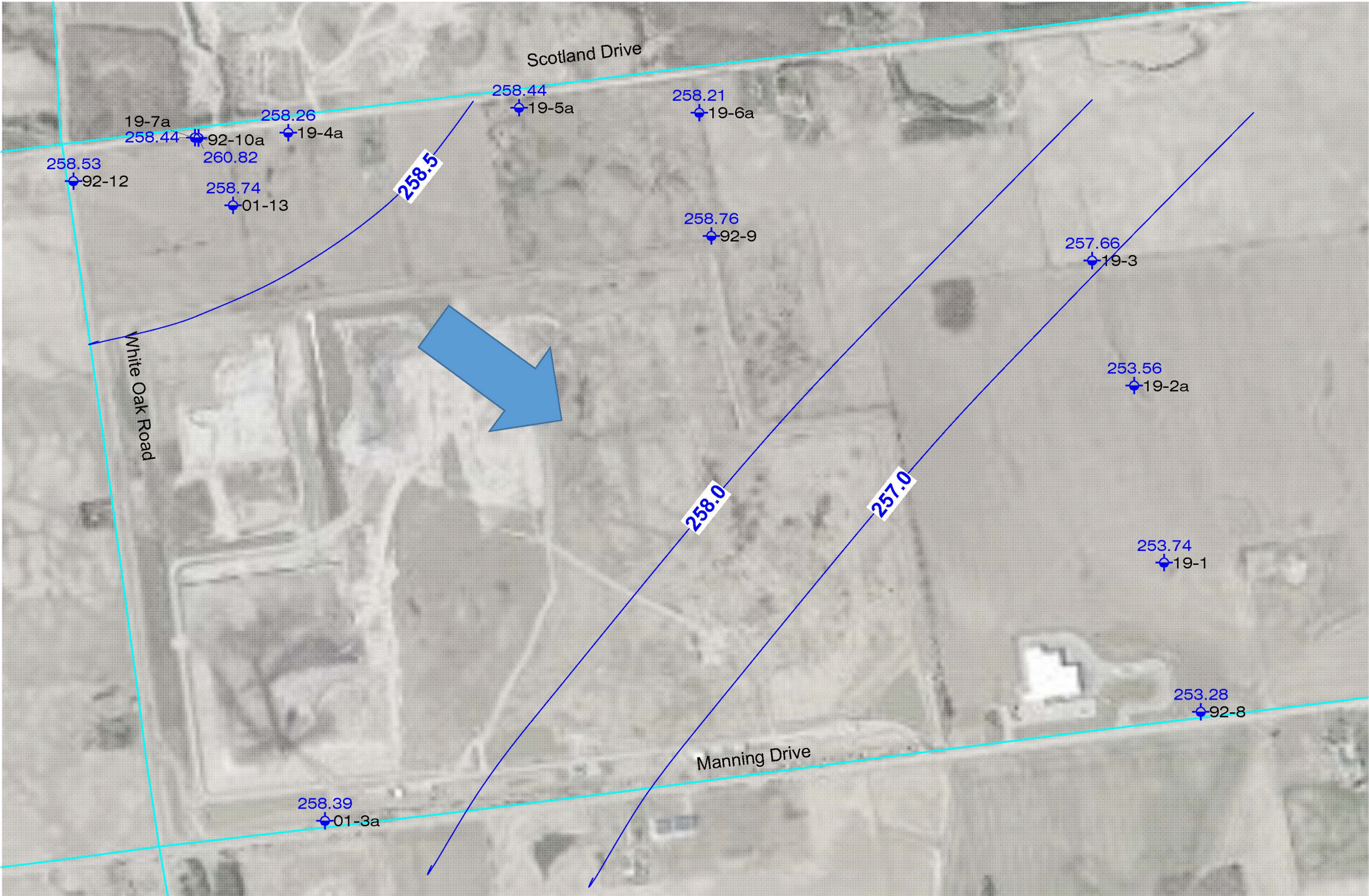
Groundwater Flow Direction



MAP CREATED BY : LOM
MAP CHECKED BY: RFK
MAP PROJECTION: NAD 1983 UTM Zone 18N
2017 AIR PHOTO



PROJECT: 19-1230
STATUS: FINAL
DATE: SEPTEMBER 2020



Existing Groundwater Conditions

CORPORATION OF THE CITY OF LONDON

INDIVIDUAL EA OF THE PROPOSED W12A LANDFILL EXPANSION

GROUNDWATER ELEVATION IN WHITE OAK AQUIFER

Figure 5.3-6

LEGEND

257.66
Fall 2019 White Oak Aquifer Groundwater Elevation (masl)

Groundwater Flow Direction



MAP CREATED BY : LOM
MAP CHECKED BY: RFK
MAP PROJECTION: NAD 1983 UTM Zone 18N
2017 AIR PHOTO



PROJECT: 19-1230

STATUS: FINAL

DATE: AUGUST 2020