Prepared By:

Annual Progress Report (2022) - Arran Landfill

Municipality of Arran-Elderslie
ECA No. 0441-4J2HV8 and No. 7585-8QKL5Q

GMBP File: M-1174

March, 2023

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1. INTRODUCTION AND BACKGROUND

The Arran landfill site is located north of Bruce County Road No.17, about 4.5 km southwest of Tara, in the south half of Lot 20, Concession 7, in the former Township of Arran, County of Bruce, where shown on Figure 1.

The original Application for a Certificate of Approval (CofA), dated July 8th, 1972, and the original Approval (i.e. CofA No. A271802), dated December 21st, 1972, considered a total useable area of 20.2 ha (49.92 acres) and a maximum theoretical capacity of 801,900 m^3. The original Application and Approval are provided in Appendix A. Between 1972 and June 2000, operations at the Arran Landfill Site occurred within a 1.73 ha footprint, which was further described in the *'Plan of Development and Operation'* (PDO: 1991, revised 1996), and referenced in the amended CofA, dated July 26, 1996.

On January 1, 1999, Arran Township amalgamated with Elderslie Township, the Villages of Tara and Paisley, and the Town of Chesley to form the Municipality of Arran-Elderslie. On April 11th, 2000, CofA No. 0441-4J2HV8 was issued by the Ministry of the Environment, Conservation and Parks (MECP) to accurately reflect the Township's name change to the Municipality of Arran-Elderslie following amalgamation (Appendix A). In June 2000, the Municipality of Arran-Elderslie consolidated its landfill operations at the Chesley Landfill Site and temporarily suspended landfill operations at the Arran Landfill. The Chesley Landfill reached final capacity in the fall of 2012. On October 1, 2012 landfilling operations for the entire Municipality resumed at the Arran Landfill Site.

In anticipation of the requirement for additional landfill capacity for the Municipality, a Hydrogeologic Investigation for the approved 20.2 ha useable area was completed by GM BluePlan Engineering Limited (GMBP, formerly Gamsby and Mannerow), dated February 2007. The report established that the site was hydrogeologically suitable within areas defined as Phase I, II and III. However, based on the anticipated life-span for each of these areas, it was recommended that details regarding the development and operation within each of these areas be addressed in separate PDO Reports that would be prepared for each Phase of development. GMBP completed a PDO for landfilling within the Phase I development area (February 2011, revised August 2012). Based on the Hydrogeological Investigation and the PDO, Phase I encompasses an area of 4.45 hectares (11.0 acre) within the northern portion of the property, and includes a large portion of the previously approved 1.73 hectares associated with Areas A, B1, B2 and C.

The landfill operates under MECP Environmental Compliance Approval (ECA) number 0441-4J2HV8, as amended on October 29, 2012 and December 6, 2017 (Appendix A). This Annual Monitoring report, for the year 2021, has been prepared to satisfy Conditions 55 and 56 of the ECA for the Arran Landfill Site.

To further support landfill development within the Phase I area, a Stormwater Management Plan was submitted to the MECP in March 2012. The stormwater management features were designed to provide quality and quantity control of stormwater runoff by attenuating runoff from storm events. The features include a south drainage ditch, north drainage ditch and a stormwater management wetland.

Stormwater management for the Site currently operates under MECP ECA No. 7585-8QKL5Q, provided in Appendix A. This Annual Monitoring report has also been prepared to satisfy Conditions 5, 6 and 7 of the ECA for Stormwater Management.

2. SITE USAGE

Landfilling operations at the Arran Landfill site were suspended on June 30, 2000 and resumed on October 1, 2012. Refuse received at the landfill site originates from full time and seasonal residents of the entire Municipality of Arran-Elderslie. The Municipality provides curb-side collection services for garbage on a weekly basis, limited to two bags per week, and recyclables every other week. Based on the landfill capacity estimates provided by others, the annual fill rate at the Chesley Landfill Site was reportedly 5,000 m^3/year during its last few years in operation. This estimate reflected waste generation and annual fill rate estimates for the entire Municipality. Based on the reported annual fill rate at the Chesley Landfill Site at that time (i.e., circa 2010/2011), it was anticipated that the total Phase I area would provide capacity for approximately 40 years.

Activities that currently occur at the Arran landfill site include landfilling of residual waste and wood waste, waste collection of blue box materials, e-waste and other waste diversion streams, and stockpiling of scrap metal, white goods and tires, as appropriate. The site includes surface water management features, an access route from the north, a waste receiving and transfer area, supervisor trailer, and a site maintenance shed. In addition, upon temporary site closure in 2000, the Municipality planted numerous trees to the east and south of the existing landfill to provide visual screening in anticipation of the future landfill development.

3. SITE LIFE EXPECTANCY

At this time landfill operations at the Arran Landfill Site are occurring within the 4.45 ha (11 acre) Phase I area situated on the northern portion of the site, where shown on Figure 2. This area generally encompasses the previously approved 1.73 ha area, with the exception of (i) a historical area of waste placement of approximately 0.25 hectares along the eastern limit of Phase I that is within the 30 m buffer area identified in the Hydrogeological Investigation between the upgradient eastern property boundary and the limit of the landfill and (ii) an area of approximately 0.33 ha in the southeast corner of Areas A and B1 which was deemed to encroach on the environmental constraints identified in consultation with the Grey Sauble Conservation Authority (i.e. the wetland). These areas are delineated on Figure 2.

Based on a maximum thickness of approximately 9 m, corresponding to an elevation of approximately 234.4 to 243.4 masl, the Phase I area has a capacity for 280,000 m^3 of waste, daily and final cover. In 2012, when landfilling operations for the Municipality resumed at the Arran Landfill site, Areas A, B1, B2 and C had been partially filled with an estimated 47,000 m^3 of waste, daily and final cover. Therefore, the total remaining capacity within the Phase I area, excluding the capacity previously utilized, was 233,000 m^3 at the time landfill operations resumed at the Site (i.e., Oct 2012). The air space capacity within each area is calculated using a differential comparison of the proposed top and bottom contours. The bottom contours and final contours for Phase I are outlined on Figures 3 and 4, respectively.

In 2022, the datum for the site was revised to reflect geodetic elevations collected with GPS systems that provide more accurate measurements. The new datum will be useful for consistent surveys moving forward at the site, and where any changes to future survey information is needed. To reflect this revised datum, new elevation data are provided within figures, tables, and appendices where applicable. Please note that there are no changes to the development plans, volumes or information, only an apparent shift in absolute elevation.

Based on the air space capacity calculations, and the assumption that the thickness for final cover and topsoil is 0.75 m, the volume of final cover and topsoil required was estimated to be 33,000 m^3. This provided for a total remaining capacity of approximately 205,000 m^3 for waste and daily cover upon the resumption of landfilling at the Site in 2012 (Note: an estimated 5,200 m^3 of final cover had previously been used). Some additional capacity may be available in areas where on-going waste placement requires the removal of previously placed final cover material.

Since landfill operations resumed at the Arran Landfill site in 2012, the remaining capacity has been determined by subtracting the estimated volumetric capacity used derived from annual surveys of the active fill areas. Using the elevation difference between the 2021 and 2022 topographical surveys, a capacity of 2,640 m^3 was calculated to have been used in 2022. Assuming 20% interim cover by volume, the amount of landfilled waste in 2022 is estimated to be approximately 2,112 m^3.

As of the end of 2022, the remaining capacity at the Arran Landfill is estimated to be 173,205 m^3 for waste and interim cover. Based on an average fill rate over the last five years of 3,006 m^3, the remaining Site life is estimated to be greater than 50 years.

It is noted that the volume for final cover of approximately 25,300 m^3 remains unused. A summary of the estimated yearly fill volumes (since 2012) is provided in Table 1.

4. EXISTING CONDITIONS

The PDO outlines a progressive waste placement plan which divides the Phase I area into ‘Stages’. Currently, the active landfill area is within Stage 2, located in the southeast portion of the landfill. Stage 2 includes a part of the previously approved area, as shown on Figure 2. As of 2012, when landfill operations resumed at the Site, waste had been placed in former Areas A, B1, B2 and C. The northern portion of Area A had been completed to the proposed final contours, however, the southern portion of former Area A remained undeveloped, as shown on Figure 2. In 2021, the active area of landfilling had transitioned from the Stage 1 area into Stage 2, and primarily occurred in the former Area C. As per the PDO, waste placement is to remain within the Phase I boundary.

In 2000, final cover was applied to the northern portion of the landfill and interim cover was applied to the remainder of the landfill mound, temporarily closing the site (Figure 3). The northern slope and a portion of the eastern slope were capped and closed out. In 2016, final cover was applied to the southern portion of Area A, completing the application of final cover along the entire eastern slope of the landfill area. The placement of cover over the majority of the former Area B was completed in December 2021.

Following the completion of waste placement within each landfill ‘Stage’, final grading and covering should be completed. The slopes along the outer edges of these landfill areas should be brought to final contours, as outlined in the existing PDO. More specifically, upon completion of landfilling within each Stage, the west slopes should be completed with a maximum 4:1 slope as they will ultimately be connected with landfill development within the following Stage of landfilling in the Phase I development area.

5. STORMWATER MANAGEMENT

A stormwater management system was developed to support landfill development within the Phase I area. The system was designed to capture water and to provide surface water quantity and quality control through the use of a perimeter swale and stormwater wetland. The intention of the stormwater management system is to separate on-site runoff that comes into contact with the landfill mound and has the potential to contain leachate, from off-site flows that cross the site through the unnamed tributary and discharge to Arkwright Creek.

Based on the separate approval process for the stormwater management, a Stormwater Management Report (March 2012) and plans for Phase I of landfill development were prepared by GMBP and submitted to the MECP. The construction, operation, maintenance and monitoring of the stormwater management facility at the Arran landfill was approved by the MECP in July 2012, as outlined in ECA No. 7585-8QKL5Q, provided in Appendix A.

5.1 Development

The development of the stormwater works was initiated in 2012 and was completed in 2015, per the Stormwater Management Plan. It is noted that Condition 8 of ECA No. 7585-8QKL5Q states:

> *Upon substantial competition of the stormwater management facility, a statement, certified by a Professional Engineer, that the works are constructed in accordance with the ECA, and a set of "as constructed" drawings shall be prepared*.

GMBP completed the "as constructed" survey and drawings in May 2016, copies of the "as-built" drawings were provided to the Municipality for their records. In order to satisfy Condition 4(2) of the ECA, it is recommended that the Municipality retain a copy of the "as constructed" drawings at the Site.

5.2 Stormwater Management Features

Initial stormwater quality treatment is provided by the grassed swales that collect stormwater runoff from the Site and discharge to the Stormwater Management Facility (Figure 2), including:

- A south drainage ditch approximately 170 m long running along the southern periphery of the approved Phase I landfill area and discharging through a sediment forebay into the stormwater management wetland.
- A north drainage ditch approximately 325 m long running along the northern and western limit of the transfer area and directly west of the approved Phase I limit. This flows through a 450 mm diameter storm sewer and discharges through a sediment forebay into the stormwater management wetland.

A stormwater management wetland/retention facility is located to the southwest of the landfill footprint, where shown on Figure 2. It is approximately 160 m in length, a typical width of 15 m, and is designed with 0.5 m deep permanent pools at the facility inlets and outlet, with varying depths of ponding throughout the remainder of the pond. The permanent pool has been designed to encourage an abundant growth of cattails to promote natural filtration and nutrient uptake, further assisting with surface water quality improvement. The pond is equipped with an outlet structure consisting of a 250 mm diameter HDPE storm sewer which discharges to the previously existing pond and swamp area which eventually reaches Arkwright Creek.

6. BURNING OPERATIONS

Condition 21 of the CofA, issued in April 2000, permitted the burning of brush and clean wood material provided that the burning was carried out in compliance with the *'MOE Guidelines for Burning at Landfill Sites in Ontario'*. However, Condition 36 of the ECA, as amended (October 2012), prohibits the burning of any type of waste, including clean wood and brush. Therefore, burning of clean wood and brush at the Arran Landfill Site no longer occurs.

7. RECYCLING/WASTE REDUCTION

The Municipality of Arran-Elderslie conducts a recycling and waste diversion program at the Arran landfill site. A blue box initiative is also promoted within the Municipality where glass, cans, newspaper, boxboard, cardboard and plastic drinking bottles are diverted from the landfill for recycling purposes. The Municipality also encourages the diversion of scrap metals, refrigeration units, tires, mattresses (when possible), polystyrene, clothing, and waste electrical and electronic equipment (WEEE) separately from the blue box program. Separate designated areas within the northern portion of the property are maintained for these waste diversion streams, where shown on Figure 2. It is noted that the Municipality provides an additional drop-off location for tires and scrap metal at the closed Chesley Landfill Site.

The Municipality of Arran-Elderslie has resolved to transition away from the blue box program to full Extended Producer Responsibility by December 31, 2025.

The Bruce Area Solid Waste Recycling Association (BASWRA) is the recycling contractor for the Municipality for both curb-side pickup and recyclables dropped off at the landfill depot. A total of 560.55 tonnes of recyclable materials were reportedly diverted from the landfill site in 2022. A table summarizing the quantity of recyclable materials diverted is provided as Table 2. In addition to recyclable materials, an estimated 391.98 tonnes of compost, wood and brush were diverted from the landfill. Continued attention should be given to the management of the tire piles located at the Arran and Chesley landfill facilities. The size of the tire pile should be monitored on a regular basis to ensure that there are fewer than 5,000 tire units onsite at any given time as per the requirements of the Environmental Protection Act (EPA). Furthermore, it is important that the Municipality continue to remove stockpiles of used tires and accumulations of other salvageable materials on a regular basis to prevent clutter and to maintain an aesthetically acceptable site.

Clean wood and brush is currently collected in a separate pile and can be used as cover material. The grinding of brush and wood waste material at the Arran Landfill Site last occurred in October 2017. This use of this material as interim cover is recommended in order to maximize the potential landfill capacity.

8. GENERAL OPERATIONS

8.1 Site Controls

Since the recommencement of landfill operations in 2012, the Site has been open to the public on Thursdays from 8:00 AM to 3:00 PM and Saturdays from 8:00 AM to 12:00 PM. The site accepts non-hazardous municipal wastes as well as various recyclables and other diversion materials. A sign at the gate notes the hours of operation. When the site is closed to the public, a locked gate across the entrance road controls access to the site.

Signs are posted at most of the waste disposal and waste diversion locations. In locations where no sign is present, the designated areas are clearly separated and are visible. The site is located in a secluded setting and is adequately screened from public view by low hills and tree cover.

8.2 Site Cleanliness

8.2.1 Landfill Operations and Management

The most important aspect of site cleanliness is to ensure that all landfilled wastes have adequate soil cover so that refuse is not exposed at the surface. Application of an appropriate soil cover immediately following waste disposal reduces blowing litter, prevents surface water infiltration into the refuse creating leachate, and discourages rodent and vector activity at the surface of the landfill mound.

We recommend that cover material be applied as per the requirements outlined in Condition 37 of the ECA, as amended. Care should be taken to ensure that the working face of the landfill is covered with a minimum thickness of 0.15 m of soil cover at the end of each working day and that litter is collected routinely to maintain an acceptable site appearance.

Another important aspect of site cleanliness is to ensure that accumulations of recyclable and re-usable materials, including tires and scrap metals, are efficiently managed. Designated areas for recyclable goods and the various other waste diversion streams at the site appear to be organized and well managed. The waste diversion areas (i.e., pile sizes) were observed to be adequate during the site inspections completed in 2022. Reportedly, in April of 2022, two complaints were received by the MECP regarding offsite blowing litter. The Municipality subsequently attended the site and placed additional cover material over the active area.

8.3 Site Operations

In 2022, the active area of landfilling at the Site continued primarily within the Stage 2 area and within the former Areas C, where shown on Figure 2. As per the PDO, it is recommended that the Municipality complete landfilling within the previously active and/or approved areas (i.e., Stages 1 and 2), so that landfilling within the previously approved landfill footprint can be completed to final contours and final cover and topsoil can be applied. Once the Stage 2 area has been filled to capacity, waste placement will be redirected to the Stage 3 area. Based on the updated PDO, it is proposed to install a perforated piping system throughout the base of Stages 3 to 5 of the landfill prior to the commencement of landfilling. The system is intended to remain in-active, unless required as part of contingency measures.

9. SUMMARY OF HYDROGEOLOGIC SETTING

The landfill site is located within the physiographic region known as the Arran Drumlin Field. The region is generally characterized by drumlins composed of glacial tills, interspersed with shallow stratified clay deposits. The overburden is about 32 m thick and overlies bedrock of the Salina Formation. Piezometric data indicate that regional groundwater flow in the bedrock aquifer is generally to the northwest.

Due to the relatively low permeability of the native soils, the depth to bedrock, and the upward gradients observed at some locations, the shallow groundwater would be the first area to indicate impacts to the subsurface from the landfill. Therefore, shallow overburden groundwater monitoring wells have been installed across the site at depths typically within the range of 2.8 to 7.6 meters below ground surface (screen elevations typically in the range of 227.13 meters above sea level (masl) to 236.57 masl), where shown on Figure 5. An intermediate overburden monitoring well (i.e., TW-25D) was installed in October 2016 to a depth of approximately 13.6 mbgs (or 221.6 masl).

Borehole logs and well construction details are provided in Appendix C and a summary of the well construction details is provided as Table C-2. Stratigraphic cross-sections for the Site are provided in Appendix D.

Groundwater levels continue to be monitored in overburden monitoring wells in conjunction with the required monitoring program. A summary of the groundwater level elevations measured at the Site is provided in Table C-1 (Appendix C) and the 2022 data is presented on Figures 6 and 7. Groundwater typically migrates in a westerly direction across the northern portion of the Site. Adjacent to the landfill area, the average water level elevation in the spring is approximately 235.5 masl, which results in an adequate soil buffer below the bottom of refuse placement (i.e., greater than the required 0.76 m, as outlined in CofA No. 271802 dated December 21, 1972).

The property is interpreted to be part of a local and regional groundwater discharge system. Upward hydraulic gradients have been observed in several areas of the northern portion of the site and are typically associated with the presence of coarser textured soils or the well sorted coarse sand unit in which artesian flow conditions have been observed. The unit of coarser textured soils are interpreted to be continuous in extent and were noted at depth in boreholes TW-17 and TW-25. In the Grey Bruce Groundwater Study (2003), upward gradients were also reported to be present in the vicinity of Arkwright Creek, upstream from the site. Upward gradients would serve to limit the downward migration of groundwater, thus limiting potential impacts to the shallow groundwater and protecting the bedrock aquifer. Furthermore, an influx of groundwater from the deeper overburden into the shallow overburden unit will enhance dilution.

Along the eastern property boundary several well couplets exist including, from north to south, TW-11/TW-11D, TW-15/TW-15D and TW-19S/D. In the area directly up-gradient of the existing fill area, slightly downward to horizontal gradients exist. Based on the existence of the centrally located wetland area and the saturated soil conditions that are often observed to the west of the fill area, it is inferred that upwards gradients become established as groundwater flows from east to west across the northern portion of the Site or, from the vicinity of the fill area, to the south towards the centrally located wetland area.

Downward gradients are typically measured at well couplet TW-19S/D located near the southeast corner of the Site, an estimated 400 meters south of the Phase I landfill area. These downward gradients are attributed to the elevated topography associated with this monitoring location. It is anticipated that upward gradients in the southern portion of the Site will become established at the depth of the intersection with a coarser soil unit, similar to that observed at TW-17 and TW-25D, or that, as the groundwater in this southern portion of the Site flows northwest towards the swampy depression, upward hydraulic gradients will become established.

Historic water level measurements at TW-9, TW-11/TW-11D, G-1, and G-2 indicate a local hydraulic gradient from the west to the southeast (i.e., a radial flow component) due to groundwater mounding within the refuse pile (Appendix C-1). However, on-going groundwater level measurements suggest that the localized radial flow has decreased since final and interim cover placement occurred along the eastern slope of the landfill mound. In 2016, final cover placement along the entire eastern slope of the landfill mound was completed. Ongoing water level monitoring will be used to assess the potential effects the placement of final cover may have on the radial flow patterns historically observed.

10. MONITORING REQUIREMENTS

10.1 Groundwater Sampling Requirements

Groundwater quality monitoring was initiated at the site in 1984. Between 1989 and 2003, groundwater quality was consistently monitored at the site by twice annual sampling from a network of monitoring wells. In 2004, the groundwater sampling was reduced to once annually in the spring. Since landfill operations at the Arran Landfill started again in 2012, after temporarily being suspended, the twice annual monitoring program (spring and fall) has been re-established. It is noted that in order to satisfy the groundwater monitoring requirements outlined in the PDO and Condition 42 of the ECA, five monitoring wells including TW-11D, TW-15D, TW-22, TW-23, and TW-24 were installed in the Fall of 2012.

Environmental monitoring at the Site currently consists of groundwater and surface water monitoring on a twice annual basis. At this time, a total of 25 monitoring wells exist. As per the PDO for Phase I and Condition 43 of ECA for waste disposal, as amended, groundwater quality monitoring is currently completed at a network of nineteen (19) monitoring wells situated between the northern property limit and the intermittent tributary that runs to the west across the central portion of the Site, where shown on Figure 2. Monitoring is completed twice annually (spring and fall), with once annual monitoring (i.e., spring only) from ten of the monitoring locations. In addition, surface water samples are collected from six (6) locations twice annually in conjunction with the groundwater monitoring program which, in order to simultaneously satisfy the requirements of the Stormwater Monitoring outlined in Condition 5 of the subject ECA, is completed following a significant rainfall event. A summary of the groundwater and surface water quality monitoring programs and required parameters, as per the Approvals, is provided in Table 3A and Table 3B, respectively (below).

It is noted that, based on the MECP correspondence dated July 29, 2016 and the agreed upon follow-up work identified in a follow-up meeting, three of the historical monitoring locations were replaced in 2016. In consideration of the acquisition of additional lands extending along the northern property boundary in 2012, monitoring wells TW-4 and TW-8 were replaced with TW-25S/D and TW-26, respectively. However, the replacement wells were moved closer to the property boundary to better reflect the revised boundary conditions (Figure 2). Well TW-9, located along the upgradient compliance limit to the east, was replaced with TW-27. Based on MECP correspondence dated July 16, 2019, monitoring well TW-11 was decommissioned. Groundwater quality continues to be monitored at this location with well TW-11D. The monitoring program has been updated to reflect these changes and is summarized below.

TABLE 3A: Summary of Groundwater Quality Monitoring Locations and Parameters

MONITORING LOCATIONS			MONITORING PARAMETERS
Sampling Location	**Spring**	**Fall**	
TW-1	X	X	Conductivity, pH, Alkalinity, Hardness, Total Dissolved Solids (TDS) Chloride, Sulphate Nitrate, Nitrite Ammonia, TKN, Organic Nitrogen Iron, Calcium, Magnesium, Potassium and Sodium
TW-2	X	X	
TW-5	X		
TW-10	X	X	
TW-11D	X		
TW-12	X	X	
TW-13	X	X	
TW-14	X		
TW-15	X	X	
TW-15D	X		
TW-16	X		
TW-17	X		
TW-22	X		
TW-23	X		
TW-24	X	X	
TW-25S	X	X	
TW-25D	X		
TW-26	X	X	
TW-27	X	X	

TABLE 3B: Summary of Surface Water Quality Monitoring Locations and Parameters

MONITORING LOCATIONS			MONITORING PARAMETERS
Sampling Location	**Spring**	**Fall**	
SW-1 (Arkwright Creek: Downgradient)	X	X	Conductivity, pH, Alkalinity, Hardness TDS, TSS, cBOD, COD, Phenols, Chloride, Sulphate, Total Phosphorus, Nitrate, Nitrite, Ammonia (Un-ionized), TKN, Metals (As, B, Ba, Ca, Co, Cd, Cr, Cu, Fe, Mg, Na, K, Pb, Hg and Zn) and Field Temperature
SW-5 (Un-named Tributary: Upgradient)	X	X	
SW-7 (Arkwright Creek: Upgradient)	X	X	
SW-8 (Un-named Tributary: Downgradient Outflow)	X	X	
SW-9 (SWM Wetland)	X	X	
SW-10 (In SWM Permanent Pool)	X	X	

10.2 Surface Water Sampling Requirements

At the site, the primary surface water feature is Arkwright Creek, which is removed from the relatively small landfill footprint by over 300 m. There is no direct surface water flow path from the existing landfill area to the Creek. The topography is relatively flat and the ground is covered with wild grasses. In conjunction with historical landfilling operations that were completed prior to June 2000 (i.e., associated with past landfilling in the 1.73 ha area), surface water sampling was completed at up to six locations. Fifteen years of surface water monitoring results completed between 1988 and 2004 did not indicate any historical landfill related impacts to Arkwright Creek or the swampy area located south to south-west of the past landfill area.

Upon resuming landfilling activities at the Site, surface water samples are collected from six (6) locations twice annually in conjunction with the groundwater monitoring program which, in order to simultaneously satisfy the requirements of the Stormwater Monitoring outlined in Condition 5 of the ECA (i.e., ECA No. 7585-8QKL5Q), is completed following a significant rainfall event. In order to satisfy the requirements of both the ECAs for the Site, surface water samples are collected from the following locations, where shown on Figure 5:

SW-1: Downgradient location in Arkwright Creek.
SW-5: Located off-site, upgradient monitoring location in unnamed tributary.
SW-7: Upgradient location in Arkwright Creek.
SW-8: Outflow from swampy area, located along western property boundary.
SW-9: Outflow from proposed stormwater management wetland located along the southwest corner of the Phase I boundary.
SW-10: Located within the permanent pool of the stormwater management wetland.

A summary of the surface water quality monitoring program and required parameters, as per the ECAs, is provided in Table 3B.

10.3 Sampling Procedures

For groundwater sampling, the static groundwater level is measured in each monitoring well prior to purging three (3) casing volumes of stagnant water from each well. GMBP personnel also check to ensure that all monitoring wells are properly secured and in compliance with O.Reg.903. After purging, monitoring wells are allowed to recharge with fresh groundwater before sampling occurs. Groundwater purging and sampling is conducted using dedicated Waterra™ tubing and inertial-type pumps. Samples are collected in laboratory supplied containers and are kept chilled following completion of the sampling program and sent within 24 hours of the sampling event to Bureau Veritas Canada Inc. (BV Labs) in Mississauga for analysis. Under the site-specific program, groundwater samples collected for the indicator metals are placed in laboratory supplied containers without preservative and are filtered and preserved by BV Labs prior to analysis. The laboratory analytical reports for 2021 are included in Appendix G.

Surface water samples are collected by submerging the appropriate sample container into the water body and removing the container when a sufficient volume of sample has been collected. During collection, contact with the bottom sediment is avoided to prevent stirring-up sediment. When collecting surface water samples, direct dipping of the sample bottle is acceptable unless the bottle contains preservative. For those samples requiring preservative, a clean unpreserved bottle is used to obtain the sample, which is then transferred into the appropriate preserved bottle. Surface water samples collected for total metals are placed in laboratory supplied containers with preservative and are not filtered prior to analysis. The surface water temperature is measured and recorded at the time of sampling.

11. DETERMINATION OF REASONABLE USE CRITERIA FOR THE SITE

11.1 Determination of Action Levels

MECP Guideline B-7 establishes the basis for determining what constitutes the reasonable use of groundwater on property adjacent to landfill sites. By applying the Reasonable Use Concept, the potential use of groundwater for domestic consumption will almost always provide the lowest allowable concentration limits. MECP Procedure B-7-1 provides technical details for the application of the reasonable use approach. A change in quality of groundwater on an adjacent property, where the reasonable use is determined to be for drinking water, will be acceptable only where:

i) Quality is not degraded by more than 50% of the difference between background concentrations and the Ontario Drinking Water Standards for non-health related parameters, and

ii) Quality is not degraded by more than 25% of the difference between background concentrations and the Ontario Drinking Water Standards for health-related parameters.

Background concentrations are considered to be the quality of the groundwater prior to any contamination from landfill activities.

11.2 Background Water Quality

Based on the hydrogeological model, water chemistry, and the EM conductivity survey, groundwater chemistry naturally varies across the site. Therefore, to determine the potential for leachate-derived contamination, individual indicator parameters are evaluated in conjunction with other parameters and concentration trends.

To be conservative, historical water quality records for monitoring wells located to the south of the previously approved landfill area (i.e., TW-1, TW-2 and TW-10) were used to establish background water quality ranges for monitored indicator parameters. All available groundwater quality results from 1984 to 2002 were used to calculate the average and 95th-percentile background concentrations for each indicator parameter. The 95th percentile concentration is used to reflect the background concentration for parameters with concentrations that exceed the Ontario Drinking Water Standards (ODWS: June 2003, revised June 2006). The background water quality locations were selected because (i) their location was cross-gradient from the landfill area and, at that time, had the least chance of impact from the landfill and (ii) historically have had the lowest concentrations of leachate indicator parameters. Historical water quality for these monitoring wells is provided in Appendix E and is summarized in Table 4.

11.3 Calculation of Objective Levels

Table 4 identifies the concentrations of groundwater quality indicator parameters used for evaluating the acceptable level of contaminant concentrations at the site boundary. Background concentrations (Cb) are the site-specific values (discussed in the previous section). The Provincial maximum concentrations (Cr) are identified in the ODWS. Acceptable concentrations at the site boundary (Cm) are calculated from MECP Procedure B-7-1 (Table 5).

Table 5 identifies background concentrations of hardness and organic nitrogen which exceed the ODWS operational guidelines (OG). These elevated background concentrations are reflected in many of the other groundwater monitoring wells across the site. Therefore, to determine if leachate is impacting groundwater, indicator parameters will be evaluated in conjunction with other indicator parameters and concentration trends. Wells with elevated and stable concentrations of the identified naturally elevated constituents, that show no increases in other leachate indicator parameters, will be deemed un-impacted by landfill leachate. Additionally, known leachate impacted groundwater will be compared to the groundwater chemistry at locations with naturally elevated concentrations to determine if leachate contributes to the elevated concentrations.

11.4 Provincial Water Quality Objectives (Surface Water)

The purpose of surface water quality management at the Site is to achieve the requirements established in the Provincial Water Quality Objectives (PWQO) set out by the MECP. The PWQO for the required list of analytical parameters is provided in Table 6. The PWQO were established to ensure that surface waters are of a quality, which is satisfactory for aquatic life and recreation. Areas that have water quality surpassing the PWQO requirements are to be maintained at or above the applicable objectives. Areas that have water quality that does not presently meet the PWQO are not to be degraded any further and are to be upgraded if practical.

12. GROUNDWATER QUALITY

12.1 Leachate Production and Plume Projection

Leachate is produced when surface water percolates down through refuse and into the groundwater. In 2001, final cover was applied to the northern portion of the landfill and an interim cover was applied to the remainder of the landfill mound, temporarily closing the site (Figure 3). Additional final cover and topsoil placement was completed within the historically landfilled areas in 2016, particularly along the eastern slope. To date, the northern slope of the old fill area and the eastern slope have been capped and closed out. It is anticipated that these measures will reduce infiltration and leachate production in these areas of the landfill.

To determine the presence of potential impacts from leachate, several indicator parameters are monitored, and a trend analysis is conducted to determine changes in existing conditions. The following Sections of this report discuss the analytical results in consideration of leachate production at the site, the potential impacts to groundwater and surface water leaving the property boundaries, and compliance with the Reasonable Use Criteria (RUC). The results of the recent and historical groundwater and surface water sampling are presented in tabular and graphical form in Appendix E and Appendix F, respectively.

The general overburden/shallow groundwater flow direction is in a south-westerly to westerly direction towards the swampy depression and Arkwright Creek. Consequently, the leachate plume from the landfill is expected to be most prevalent in these directions.

Monitoring has shown local changes to groundwater chemistry (relative to background) directly west of the landfill with the highest concentrations of indicator parameters historically found at TW-12, located approximately 100 meters downgradient of the western limit of the landfill footprint. At TW-12 and TW-13, several indicator parameters including hardness, TDS, and alkalinity have typically exceeded the objective levels and ODWS aesthetic objectives. Chloride concentrations, although still below the objective level of 126 mg/L, have typically been highest in monitoring well TW-12 (averaging approximately 45 mg/L since 1993), with slightly elevated concentrations at well TW-13. The conductivity has also been consistently higher than background at these two downgradient monitoring wells.

The EM survey conducted by the MOE in 1997 correlates with these findings, showing that leachate-impacted groundwater was limited in extent to TW-12 and, to a lesser extent, well TW-13. However, it is noted that in the memorandum describing the results of the EM Survey, the potential leachate impacts noted at TW-12 and TW-13 were attributed to potential surface transport along ditches that formerly drained the site and settled in slight depressions near these two monitoring locations.

Monitoring data reported between 2000, upon temporary site closure, and 2006 showed relatively stable concentration trends, with chloride concentrations typically ranging between 60 mg/L and 85 mg/L. Between 2006 and 2017 concentrations progressively decreased, although the migration of leachate-impacted groundwater remained evident. Consistent with active landfilling activities occurring directly upgradient of TW-12, since 2018 increased concentrations of leachate-indicator parameters have been reported. More recently, concentrations of leachate-indicator parameters at TW-12 have been generally increasing. Although earlier impacts noted by the MOE (i.e. circa 1997) were likely, in part, related to surface water run-off from the landfill, based on the temporary site closure (i.e. placement of final and interim cover over the entire fill area) that occurred between 2000 and 2012 and the groundwater concentration trends noted, the recent groundwater quality trends at TW-12 and TW-13 are interpreted to reflect groundwater quality conditions, rather than leachate-impacts resulting from surface water run-off.

Since 2019, TW-10 has seen an increase in leachate indicator parameters, and in particular a sharp increase in chloride. This response is within values expected based on the fact that TW-10 is near the toe of the active area and is situated downgradient of the landfill.

More recently, and as expected, TW-1 and TW-2 (historic shallow monitoring locations constructed in testholes) show an increasing trend in leachate indicator parameters including hardness, conductivity and chloride. There wells are located within 75 m the southwest of the landfill footprint, inferred to be downgradient of the landfill.

Well TW-1, TW-2, and TW-10 will continue to be monitored and will provide valuable information with respect leachate indicator parameters.

Monitoring well TW-24, which was installed in 2012 to monitor groundwater quality down-gradient of the northerly limit of landfilling and within 40 meters of the old fill area, suggests that, at this time, landfill-leachate derived impacts continue to be limited to non-existent in this area of the Site. It is however noted that once active landfilling is re-located to the northern limit of the approved fill area, leachate influence may become more apparent at this monitoring location.

Based on these results, it is inferred that the front of the leachate-impacted groundwater plume from the landfill will likely be stable at a distance of approximately 100 meters from the western limit of the fill area. Furthermore, the application of interim and final cover is helping to reduce leachate production at the Site allowing for greater attenuation of the existing groundwater constituents.

12.2 Background Water Quality

RUC exceedances for hardness are frequently reported and can typically be primarily attributed to natural background conditions and variability. Therefore, RUC exceedances for hardness are only discussed further where the concentration is significantly elevated, and the concentrations of other leachate indicator parameters support the potential for impacts.

At the Arran Landfill, nitrite, nitrate and organic nitrogen are frequently detected, periodically exceeding the RUC, particularly in the monitoring wells situated to the east of the landfill (i.e., TW-9, TW-11, TW-11D, TW-15 and TW-15D). However, based on a comparison to the groundwater quality in areas where leachate impacts are more evident (i.e., TW-12), concentrations of nitrate and nitrite typically remain below the detection limit suggesting these parameters should not be considered leachate indicators. Furthermore, although organic nitrogen is frequently detected at the leachate impacted monitoring location, the concentration trends do not appear to reflect the magnitude and variability of leachate impacts noted by the more prominent leachate indicator parameters (refer to TW-12 graph provided in Appendix E). Therefore, organic nitrogen alone should not be considered an indicator of leachate impacts. Elevated nitrate, nitrite and organic nitrogen concentrations are interpreted to be primarily related natural conditions in the aquifer and are consistent with the presence of organic-rich soils associated with wetland/surface water system downgradient from lands actively used for agriculture and/or livestock.

Therefore, although RUC exceedances may periodically occur at various monitoring locations, these parameters will not be discussed further unless they appear to reflect a significant change from those historically reported.

12.3 Groundwater Quality

12.3.1 East Boundary Condition (Upgradient)

Groundwater quality along the eastern boundary of the fill area is currently monitored at wells TW-11D, TW-15, TW-15D and TW-27. These wells are located to the east and along the Lot 20/21 roadway adjacent to the landfill site (Figure 5).

West of Sideroad 20

It is noted that in order to address MECP concerns, compliance well TW-27 replaced former well TW-9 in 2016. Monitoring well TW-9 was located along the west side of the municipal road allowance and within an estimated 10 meters of the eastern limit of former landfill Area A. The replacement well (i.e., TW-27) was installed an estimated 10 meters south of the former TW-9 location, and slightly closer to the road allowance.

Historically, TW-9 had shown evidence of leachate impacts although, consistent with its proximity to the fill area and the radial flow patterns identified, impacts were most notable before final and interim cover was applied to the surface of the fill area in 2000, upon temporary Site closure. As shown on the trend graph provided in Appendix E, since landfilling resumed at the Site in 2012, the concentrations of several indicator parameters exhibit a strong seasonal variation, with higher concentrations typically being measured in the fall. A similar seasonal variation trend was noted prior to temporary Site closure. Based on the combination of parameters noted, including sodium, chloride, hardness and alkalinity, it appears that this monitoring location was susceptible to groundwater quality influences from the landfilling activities.

Consistent with historical results from TW-9 and those previously reported for TW-27, in 2022 minor RUC exceedances were noted for TDS, alkalinity and hardness at well TW-27 (Table 7). While these exceedances are likely indicative of leachate-impacted groundwater at this location, they are also attributed, at least in part, to impacts from road salting along the Municipal Road (refer to Appendix E - graph).

Based on the regional groundwater flow direction in this area of the Site which is generally to the south and west (Figures 6 and 7), the location of the recently active fill area of greater than 50 meters downgradient of TW-27, and the additional separation distance of approximately 10 m from the municipal road allowance, it is expected that further migration of landfill leachate-impacted groundwater in an easterly direction will be limited. Furthermore, with the placement of final cover along the entire Phase I eastern limit of fill, which was completed in 2016, it is anticipated that a decreasing concentration trend will develop over time, ultimately decreasing the magnitude and extent of influence to the east of the landfill. Currently, the concentration trends are stable to decreasing.

East of Sideroad 20

Well TW-11 historically showed highly variable concentration trends, which were historically inferred to represent minor influence from leachate impacted groundwater. Chloride concentrations averaged approximately 40 mg/L at this location. In 2012, an additional well was installed adjacent to TW-11 (i.e., TW-11D). In contrast, the groundwater quality reported at well TW-11D generally demonstrates stable concentration trends with lower concentrations of leachate indicator parameters. Based on the inconsistent groundwater quality results noted at this well couplet, and questionable well integrity, decommissioning well TW-11 was recommended by the MECP in correspondence dated July 16, 2019 (Appendix B). Monitoring well TW-11 was decommissioned in July 2019.

Monitoring wells TW-15 and TW-15D are located further to the south along the east side of the municipal road allowance and are adjacent to the local surface water drainage and swamp area. Well TW-15 was installed in a light brown sandy layer to a depth of approximately 1.6 mbgs and TW-15D was installed in 2012 to a depth of approximately 7.6 mbgs. Based on a review of the concentration trends at TW-15, and consistent with a more radial flow pattern that was noted prior to the completion of Site's temporary closure (i.e., circa 2000), leachate impacts at TW-15 were noted in the late 1990's and early 2000's. Since that time, water quality at TW-15 has generally improved, with chloride concentrations remaining below 10 mg/L since 2003. At this time, leachate impacts in the vicinity of well couplet TW-15 and TW-15D are not evident.

Limitations and Considerations: Extent of Potential Leachate Migration to the East

Review of historical trends at these upgradient monitoring locations indicates stable to decreasing concentration trends for various leachate indicator parameters, particularly since the Municipality completed the placement of interim and final cover on the landfill mound in 2000 (refer to trend graphs provided in Appendix E). It is anticipated that water quality will continue to improve at these perimeter monitoring locations as the active landfill face moves to the west within the Stage 1 and Stage 2 area and the established cover on the landfill mound continues to promote surface water run-off and prevent infiltration, consequently limiting leachate production in the most easterly areas of the approved landfill. In order to prevent future leachate migration, it is important that the Municipality continue to maintain the final cover, particularly on the eastern portion of the landfill.

In addition, it should be noted that elevated conductivity, sodium, chloride and TDS concentrations along this eastern boundary are believed to be due to, at least in part, the increased use of road salt along Arran Sideroad 20 associated with the resumption of operations at the Arran Landfill.

Furthermore, the extent of leachate migration off-site to the east would be limited by the following factors:

i. Although mounding of groundwater within the refuse pile can create a local hydraulic gradient to the east, the regional groundwater flow is generally from east to west. The mounding effects will, therefore, be reduced with distance from the site and ultimately resume movement in a westerly direction (i.e., easterly movement is prohibited by the regional groundwater flow direction).

ii. Water level measurements at TW-11D, TW-15 and TW-15D and TW-27 indicate a local hydraulic gradient to the south along the east side of the municipal road allowance. Shallow groundwater that flows southerly is expected to re-route to the west along the path of convergence that is congruent with the centrally located stream (at the road crossing culvert location shown on Figures 6 and 7).

12.3.2 West Boundary Condition (Downgradient)

The western property boundary, from south to north, is monitored at TW-23, TW-17, TW-14, TW-5 and TW-16 in the spring only, and TW-12 and TW-13 in both the spring and fall. The TW-12 and TW-13 monitoring locations are currently located greater than 100 meters downgradient of the landfilled area, with the other four monitoring locations greater than 200 meters downgradient of the landfilled area. Since about 2010, groundwater quality trends at these downgradient monitoring locations have been relatively stable (refer to Appendix E).

Recent groundwater quality results from well TW-14 shows an increasing concentration trend, with chloride concentrations reported to be in the range of 20 to 30 mg/L since 2018. This well is located approximately 175 m from the landfill footprint and approximate 40 m from the receiving area. Based on the recent increases of salt related parameters only (i.e., the absence of other leachate indicator parameters), it is estimated that these recent increases are reflective of de-icing and or dust suppression at the gravel-surfaced receiving area. Regardless, TW-14 is located centrally on-site and is not a location that measures compliance at the property boundary. TW-14 will continue to be monitored to assess the concentration trends.

In 2022, groundwater quality at the three compliance wells TW-5, TW-16, and TW-17, generally remained within the RUC, with the exception of minor exceedance(s) for alkalinity, TDS and hardness at well TW-5. Provided that chloride concentrations remain below 5 mg/L and the concentrations of other leachate indicator parameters generally remain similar to background, groundwater quality at these monitoring locations does not indicate impacts from landfill leachate. Therefore, based on the overall comparison and review of groundwater quality concentrations and trends, it is concluded that the RUC is being met along the western compliance limit (Table 7, Table 9).

12.3.3 North Boundary Condition (Cross-gradient)

In conjunction with the resumption of operations at the Arran Landfill Site in 2012, the Municipality acquired an additional 30 meters of land extending along the northern property boundary to better facilitate landfill operations and to extend the buffer area to the north. This was equivalent to an additional area of 1.16 hectares. In order to address on-going MECP concerns pertaining to the adequacy of monitoring locations TW-4 and TW-8 (i.e., well construction), these wells were replaced in October 2016 with well couplet TW-25S/D and well TW-26, respectively. While TW-4 and TW-8 historically represented northerly compliance monitoring locations, the well replacements were installed approximately 30 to 40 meters to the north in order to more accurately and reliably access Site compliance along the adjusted northerly compliance limit, where shown on Figure 5. The borehole logs/well records are provided in Appendix C.

Based on the overall comparison and review of groundwater quality concentrations and trends, it is concluded that the RUC is being met along the northern compliance limit (Table 7). Therefore, while groundwater quality at wells TW-4 and TW-8 may have been influenced, in part, by landfill-leachate due to the radial groundwater flow patterns, it is apparent that the impacts to the north are likely limited in extent, as evidenced by the general absence of leachate indicators at these new monitoring locations.

At this time, monitoring wells TW-25S, TW-25D, TW-26, and TW-24 monitor groundwater quality to the north of the landfill footprint, with TW-25S and TW-26 serving as compliance wells. In 2022, groundwater quality at all four wells generally remained within the RUC, with the exception of a minor exceedance(s) for TDS at well TW-24. Chloride concentrations remained below 5 mg/L at all four monitoring locations. Therefore, based on the overall comparison and review of groundwater quality concentrations and trends, it is concluded that the RUC is being met along the northern compliance limit (Table 7, Table 9).

12.3.4 South Boundary Condition (Cross-gradient)

At this time, monitoring wells TW-1, TW-2, TW-10, and TW-22 monitor groundwater quality to the south of the landfill footprint between the fill area and the intermittent tributary that flows through the central portion of the Site. Although additional wells are located along the southern compliance boundary, these wells are located greater than an estimated 400 meters from the Phase I area and are therefore not sampled.

Based on (i) the separation distance between the Phase I landfill area and the southern compliance boundary, (ii) the groundwater flow direction which is generally to the west across the Site and (iii) the presence of the low-lying area identified to the south of the landfill which acts as a flow divide for the shallow groundwater re-directing the minor southerly shallow groundwater flow component noted in a westerly direction, compliance along the southern property boundary is expected.

A review of the groundwater quality trends at these locations indicates that the concentrations for the majority of the leachate indicator parameters, although variable, were relatively stable following temporary Site closure. Since landfill operations at the Site have resumed, concentrations trends at TW-22 continue to be stable and consistent with those historically reported. However, concentrations for several leachate indicator parameters at TW-1, which monitors groundwater quality in the shallow overburden, appear to have increased since active landfilling at the Site was resumed. Since 2015, chloride concentrations at TW-1 have generally ranged between 20 and 40 mg/L. Similarly, leachate indicator parameters at TW-2 have also increased in recent years.

Consistent with landfilling activities having progressed closer to monitoring well TW-10 (i.e., currently within 20 meters of the active fill area), concentrations of several leachate indicator parameters have increased significantly, with chloride concentrations more recently ranging between 120 mg/L and 130 mg/L, periodically exceeding the RUC of 126 mg/L. As shown in Table 7, slight RUC exceedances for several leachate indicator parameters are noted.

12.4 Surface Water Quality

At the site, the primary surface water feature is Arkwright Creek, which is removed from the relatively small landfill footprint by over 300 m. There is no direct surface water flow path from the existing landfill area to the Creek. The topography is relatively flat, and the ground is covered with wild grasses. Surface water monitoring results completed in conjunction with landfilling in the historical 1.73 ha landfill footprint did not indicate any historical landfill related impacts to Arkwright Creek or the swampy area located south to south-west of the past landfill footprint.

Since resuming landfilling activities at the Site, surface water samples have been collected from six (6) locations twice annually and, in order to simultaneously satisfy the requirements of the ECA for Stormwater Management, sampling is completed following a significant rainfall event. In 2022, samples were collected on May 2th and October 6t$^{h.}$ A summary of the results for 2022, compared to the PWQO, is provided in Table 8 and historical summaries, presented in tabular and graphical form, are provided in Appendix F.

It is noted that periodically phenols are detected at concentrations in exceedance of the PWQO, however as phenols are typically considered to be a normal component of natural organic carbon from the decay of vegetation, the detection of phenols in Site surface water would be expected within the highly vegetated and wetland areas that surround several of the surface water sample locations. Therefore, phenols alone are not considered to be an indicator of leachate.

Surface water quality is monitored in the unnamed tributary, located to the south of the Phase I landfill area, which flows in a westerly direction across the central portion of the Site. An upstream surface water sample (SW-5) is collected from the east side of Arran Sideroad 20, prior to influence from road salt activities and the landfill (Figure 5). This sample is considered to represent background conditions. In 2022 no exceedances of the PWQO were noted. Historically, iron and/or copper exceedances have been reported, however comparison of these periodic reported exceedances at this upgradient location to the total suspended solids (TSS) suggests that the detection of metals in exceedance of the PWQO is likely associated with the TSS. Elevated alkalinity, TDS and conductivity have also been periodically noted at this location; however, these parameters are attributed to surface water flow through the roadside ditches along Sideroad 20 that are directed into the tributary.

Two samples are collected to monitor the surface water collected by the stormwater management facility located southwest of the landfill prior to being discharged to the intermittent tributary, including one from the stormwater management wetland outlet (i.e., SW-9) and one from the pond area (i.e., SW-10) (Figure 5). Consistent with historical results, in 2022 minor exceedances of the PWQO for phosphorus, chromium, cobalt, copper and/or iron were reported at SW-9 and SW-10. While the concentrations of the majority of indicator parameters including sodium, chloride, conductivity, sulphate, hardness, and alkalinity are highly variable, there is generally a stable, to slightly increasing, concentration trend.

Since a significant separation distance from the relatively small active area of landfilling and the stormwater works exists and the stormwater works also serve to re-direct stormwater from the operational areas of the Site, these impacts are interpreted to reflect contributions from the operational area (i.e., the transfer area). It is noted that surface water quality at the pond outlet (i.e., SW-9) generally meets the PWQO, with the exception of minor exceedances for phosphorus, periodically boron, phenols, and iron. Furthermore, it is expected the use of cover (daily and final) and good waste compaction will limit the potential for leachate influenced runoff into the stormwater.

Surface water is subsequently monitored at a downgradient location in the unnamed tributary, within the swampy area and in close proximity to the outflow of the tributary into Arkwright Creek. The water quality at SW-8 is generally similar to background, however, consistent with its downgradient location from the Stormwater Management facility, shows slightly increased concentrations of sodium and chloride. The surface water quality at SW-8 continues to meet the PWQO.

Arkwright Creek is located to the west of the Site and flows in a northerly direction across the northwest corner of the Site (Figure 5). Surface water quality is monitored at an upstream and downstream location within Arkwright Creek at SW-7 and SW-1, respectively. Based on the results, indicator parameter concentrations at SW-7, which represents the water quality prior to potential influence from the landfill, are similar to concentrations downstream of the landfill (i.e., at SW-1). Therefore, there is no evidence of landfill related impacts to Arkwright Creek.

12.5 Water Quality Summary

In summary, the leachate impacted groundwater is limited to the area directly beneath the landfill, the landfill perimeter, and west (downgradient) of the landfill to approximately 100m. Based on groundwater monitoring, the predominant direction of groundwater flow is to the west and southwest towards Arkwright Creek and the swampy depression. However, historical water level monitoring has indicated that a local hydraulic gradient from the west to the southeast (i.e., a radial flow component) due to groundwater mounding within the refuse pile exists, although on-going water level measurements at these monitoring locations suggests that the localized radial flow has decreased since the final cover was applied to the eastern slope of the landfill mound (Figures 6 and 7).

Historical groundwater quality results indicated that the placement of interim and final cover, completed in 2000 when the Arran Landfill temporarily suspended operations at the Site, was effective in reducing the leachate production and groundwater mounding under the landfill. Historical groundwater quality analyses indicate that the downgradient “leachate plume” was stable and that the upgradient plume was reducing in extent following the placement of the cover over the fill area.

As would be expected, since landfill operations at the Site resumed in October 2012, groundwater quality concentration trends, which had been generally stable to decreasing during the temporary Site closure, have changed in some areas. Consistent with the location of the active area in the eastern portion of the Phase I area, the concentrations of several indicator parameters are showing an increasing trend at monitoring locations located to the south-west of the active fill area (i.e., TW-1, TW-2, TW-10, and TW-12). In addition, seasonal fluctuations for various parameters were historically observed at monitoring location TW-9, and to a lesser extent at TW-27, located to the east of the fill area and along Sideroad 20. While the results are likely indicative of leachate-impacted groundwater at this location, they are also attributed to, at least in part, impacts from road salting along the Municipal Road. It is anticipated that with the placement of final cover along the entire Phase I eastern limit of fill, which was completed in 2016, a decreasing concentration trend will develop over time, ultimately decreasing the magnitude and extent of influence to the east of the landfill.

With the recent installation of TW-25S/D and TW-26 in proximity to the northerly property boundary, groundwater quality along the compliance limit to the north can be more reliably assessed. Consistent with historical results, the water quality continues to meet the RUC and is similar to background conditions with no evidence of landfill-leachate influence. This is consistent with the inferred groundwater flow direction which is predominantly to the west.

Surface water quality monitoring suggests that the Stormwater Management Facility, including the Pond/Detention Facility and grassed swales, are successfully managing the stormwater quantity and quality for run-off from the Phase I portion of the landfill, prior to discharging to the stream courses identified at the Site, including the unnamed tributary and Arkwright Creek. On-going monitoring of surface water quality at the Site shows that the landfill has not had an unacceptable impact to the intermittent tributary/wetland area or Arkwright Creek.

13. TRIGGER MECHANISMS

A trigger mechanism and contingency plan entitled "*Arran Landfill: Trigger Mechanisms and Contingency Plan*" (the Plan) was prepared by GMBP and was provided as an Appendix in the PDO for the Site (revised August 2012). This Plan was updated in December 2017, as is recognized by the ECA amendment issued on December 6, 2017. The Plan describes the conditions (i.e., trigger levels) under which contingency measures may be required and recommends the corresponding contingency and remedial action plans for the Site. The primary goal of the Contingency Plan is to provide a course of action in the event that the monitoring program indicates a potential for off-site impacts related to the production and migration of leachate. The reader is referred to the aforementioned report for more detail pertaining to the rationale in the development of the trigger mechanisms for the Site and for a description of the contingency and remedial action plans for the Site. A brief summary and discussion is provided below.

13.1 Groundwater, Surface Water and Stormwater

Trigger locations are used to indicate potential off-site migration of landfill leachate impacts. Trigger locations at the Arran Landfill Site were established for groundwater at the perimeter of the landfill property, for surface water and for stormwater. Based on the localized and regional shallow groundwater flow directions and the location of landfill development within Phase I relative to the property boundaries, trigger locations were established for the northern, eastern, and western property boundaries and include monitoring wells TW-5, TW-11D, TW-15, TW-16, TW-17, TW-25S and TW-26 and surface water sampling locations SW-8 and SW-1. In addition, one stormwater sampling location is utilized as a trigger location to identify the potential for impacts to surface water, prior to entering the natural system (i.e., SW-9).

Tables 9 and 10 provide summaries of the trigger locations, parameters and levels approved for the Arran Landfill Site and compare the past groundwater and surface water quality data for each compliance location to the established trigger levels.

The measures outlined in the contingency plan will not be activated unless two or more groundwater parameters, or two or more surface water parameters, exceed the trigger levels at the same trigger location for *three consecutive events*. Based on the results presented in Table 9 and 10, while some parameters exceeded the trigger concentrations, based on the 2022 groundwater and surface water quality results the contingency measures are not activated at this time. Therefore, in consideration of the established trigger mechanisms for the Site, the monitoring program does not indicate a potential for off-site impacts related to the production and migration of leachate at this time.

13.2 Leachate Indicators

Although the site is intended to be a natural attenuation site where impacts beyond the property boundaries above the RUC and PWQO are not anticipated, leachate is expected to be generated within the waste mound at the site and decrease in concentration with increased distance from the active landfill mound, decreasing to below the RUC by the site's property boundaries. As a result, trigger locations were also established for groundwater adjacent to the landfill as "leachate indicators" that may predict future exceedances at the property boundary. Monitoring wells that are situated within or in proximity to the approved Phase I area and are currently considered "leachate" contingency monitoring locations include wells TW-1, TW-2, TW-10, TW-12, TW-13, TW-22, TW-23 and TW-24. A trigger exceedance for leachate is considered to occur when the chloride concentration exceeds an average of 445 mg/L over two consecutive monitoring events. Currently, chloride concentrations remain below 445 mg/L. Therefore, impacts beyond the property boundary are not expected based on current monitoring results and no contingency plan actions are considered necessary at this time.

14. LANDFILL GAS MEASUREMENT

Methane is a colorless and odourless gas formed by the decomposition of organic matter under oxygen poor (anaerobic) conditions and is commonly associated with landfills. It is produced by anaerobic bacteria, which become active only when the oxygen in the landfill has been completely consumed. The primary concern related to this parameter is that, under certain conditions, the mixture of methane in air can be explosive within a confined area. Methane gas is measured relative to the lower explosive limit (LEL) which corresponds to 5% the concentration of methane in air.

Gas sampling at the three gas monitoring locations G-1, G-2, and G-3 (located east of the Lot 20/21 roadway) has consistently indicated that there is no off-site migration of methane gas. Oxygen and methane levels as well as the Lower Explosive Limit (LEL) have been measured in each gas probe since 1993, results are summarized in Table 11.

In 2022 the oxygen levels remained greater than 19% (measured as % by volume). Historically, oxygen levels in the gas probes have ranged between 12.1% and 21.7%. It is noted that the more oxygen present in a landfill, the longer aerobic bacteria can decompose waste producing only carbon dioxide and water as by-products. LEL measurements for all gas monitoring locations produced readings of 0%. Historically, methane gas and LEL measurements from the gas probes have typically produced readings of zero (0) with the periodic detection of up to 2% methane. Based on the relatively high levels of oxygen recorded in each gas probe, it appears that the system is aerobic in the vicinity of the gas probes. In general, methane gas is not detected within the gas monitors and we expect that landfill gases being produced are readily vented to the surface through the soils.

Currently, there are no structures within several hundred metres of the landfill, where the accumulation of methane would occur (if present). Therefore, no threats are evident from the landfill due to methane gas production. New structures built at the site are to be vented or separated from the ground surface as per the approved PDO.

15. CONCLUSIONS

1. The Phase I area at the Arran Landfill site encompasses 4.45 ha (11.0 acres) on the northern portion of the property. This area generally encompasses the previously approved 1.73 ha area and, as of the Site's re-opening in 2012, provides capacity for approximately 205,000 m^3 for waste and daily cover. As of the end of 2022, the remaining capacity at the Arran Landfill is estimated to be 173,205 m^3 for waste and interim cover. Based on an average fill rate over the last five years of 3,006 m^3, the remaining Site life is greater than 50 years. It is noted that the volume for final cover of 25,300 m^3 remains unused.

2. There is no evidence of impacts to surface water above the PWQO that are directly attributable to landfilling at the Site.

3. Based on our review of groundwater results, groundwater quality generally meets the objectives of MECP Guideline B-7.

4. Based on the established trigger mechanisms for the Site, the monitoring program does not indicate a potential for off-site impacts related to the production and migration of leachate at this time.

16. RECOMMENDATIONS

1. We recommend that landfill gas production at the site continue to be monitored in conjunction with the established water quality monitoring program. The monitoring of landfill gas at the Site should include the measurement of methane and oxygen levels as well as the LEL.

2. We recommend the continuation of monitoring the northern and western property boundary utilizing a combination of indicator parameters to identify leachate impacts from the landfill, since the elevated alkalinity, hardness, sulphate, and TDS alone, are not likely due to landfill leachate.

3. We recommend that daily, intermediate and final cover be placed, as per the requirements outlined in Condition 37 the ECA for Landfilling, and that areas in which interim and final cover have been historically placed are maintained. General site maintenance including litter pick-up and the removal of waste diversion materials should continue to be completed on a regular basis.

4. We recommend a topographic survey be completed in the Fall of 2023 to allow for an estimation of landfilling rates and to ensure waste placement continues to occur within the Phase I area, as outlined in the PDO.

5. We recommend that as closure approaches in Stage 2 that preparation for completion of the base in Stage 3 (including leachate contingency piping) be considered by the Municipality.

6. We recommend that the monitoring of the groundwater and surface water locations and parameters continue twice per year, in the spring and fall, as outlined in below:

TABLE 3A: Summary of Groundwater Quality Monitoring Locations and Parameters

MONITORING LOCATIONS			MONITORING PARAMETERS
Sampling Location	**Spring**	**Fall**	
TW-1	X	X	Conductivity, pH, Alkalinity, Hardness, Total Dissolved Solids (TDS) Chloride, Sulphate Nitrate, Nitrite Ammonia, TKN, Organic Nitrogen Iron, Calcium, Magnesium, Potassium and Sodium
TW-2	X	X	
TW-5	X		
TW-10	X	X	
TW-11D	X		
TW-12	X	X	
TW-13	X	X	
TW-14	X		
TW-15	X	X	
TW-15D	X		
TW-16	X		
TW-17	X		
TW-22	X		
TW-23	X		
TW-24	X	X	
TW-25S	X	X	
TW-25D	X		
TW-26	X	X	
TW-27	X	X	

TABLE 3B: Summary of Surface Water Quality Monitoring Locations and Parameters

MONITORING LOCATIONS			MONITORING PARAMETERS
Sampling Location	**Spring**	**Fall**	
SW-1 (Arkwright Creek: Downgradient)	X	X	Conductivity, pH, Alkalinity, Hardness TDS, TSS, cBOD, COD, Phenols, Chloride, Sulphate, Total Phosphorus, Nitrate, Nitrite, Ammonia (Un-ionized), TKN, Metals (As, B, Ba, Ca, Co, Cd, Cr, Cu, Fe, Mg, Na, K, Pb, Hg and Zn) and Field Temperature
SW-5 (Un-named Tributary: Upgradient)	X	X	
SW-7 (Arkwright Creek: Upgradient)	X	X	
SW-8 (Un-named Tributary: Downgradient Outflow)	X	X	
SW-9 (SWM Wetland)	X	X	
SW-10 (In SWM Permanent Pool)	X	X	

All of which is respectfully submitted,

GM BLUEPLAN ENGINEERING LIMITED
Per:

M.D. Nelson, M.Sc., P.Eng., P.Geo.

TABLES

TABLE 1
LANDFILL VOLUME CAPACITY

Landfill Volume Capacity (m^3) - Arran Landfill												
		2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total Approved Capacity												
Total Capacity for Waste and Daily Cover		247,000	247,000	247,000	247,000	247,000	247,000	247,000	247,000	247,000	247,000	247,000
Total Capacity for Final Cover (incl Topsoil)		33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Air Space Capacity		280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000
Volume Filled at Beginning of Year												
Volume of Waste and Daily Cover		41,800	43,050	46,025	48,205	51,965	55,165	58,765	61,415	63,940	67,130	71,155
Volume of Final Cover		5,200	5,200	5,200	5,200	5,200	7,700	7,700	7,700	7,700	7,700	7,700
Total Volume Filled		47,000	48,250	51,225	53,405	57,165	62,865	66,465	69,115	71,640	74,830	78,855
Available Capacity at Beginning of Year												
Capacity for Waste and Daily Cover		205,200	203,950	200,975	198,795	195,035	191,835	188,235	185,585	183,060	179,870	175,845
Capacity for Final Cover		27,800	27,800	27,800	27,800	27,800	25,300	25,300	25,300	25,300	25,300	25,300
Total Available Capacity		233,000	231,750	228,775	226,595	222,835	217,135	213,535	210,885	208,360	205,170	201,145
Capacity Used During Year												
Capacity Used for Waste and Daily Cover		1,250	2,975	2,180	3,760	3,200	3,600	2,650	2,525	3,190	4,025	2,640
Capacity Used for Final Cover		0	0	0	0	2,500	0	0	0	0	0	0
Total Capacity Used		1,250	2,975	2,180	3,760	5,700	3,600	2,650	2,525	3,190	4,025	2,640
Volume Filled at End of Year												
Volume of Waste and Daily Cover		43,050	46,025	48,205	51,965	55,165	58,765	61,415	63,940	67,130	71,155	73,795
Volume of Final Cover		5,200	5,200	5,200	5,200	7,700	7,700	7,700	7,700	7,700	7,700	7,700
Total Volume Filled		48,250	51,225	53,405	57,165	62,865	66,465	69,115	71,640	74,830	78,855	81,495
Remaining Capacity at End of Year												
Capacity for Waste and Daily Cover		203,950	200,975	198,795	195,035	191,835	188,235	185,585	183,060	179,870	175,845	173,205
Capacity for Final Cover		27,800	27,800	27,800	27,800	25,300	25,300	25,300	25,300	25,300	25,300	25,300
Total Remaining Capacity		231,750	228,775	226,595	222,835	217,135	213,535	210,885	208,360	205,170	201,145	198,505
Remaining Site Life (Years)												
At Average Fill Rate (5-year)	3,006	67.8	66.9	66.1	64.9	63.8	62.6	61.7	60.9	59.8	58.5	57.6
At Maximum Fill Rate	6,000	34.0	33.5	33.1	32.5	32.0	31.4	30.9	30.5	30.0	29.3	28.9

Notes:

1. Landfill activities were suspended in 2002 and resumed in October of 2012 under a new PDO with expanded capacity.
2. The total approved capacity is based on that outlined in the *Plan of Development and Operation - Phase I* for the Arran Landfill (February 2011, Revised August 2012) and includes the 47,000 m^3 historically placed within Areas A, B1 and C.
3. The maximum fill rate is based on the approved maximum annual amount of 6,000 m^3, as outlined in Condition 27 of the Approval, as amended.
4. The estimated fill rates are based on topographical surveys of the active areas completed by GMBP annually in the Fall.
5. Additional capacity may be available in areas where additional waste placement requires the removal of previously placed final cover material.

TABLE 4
SUMMARY OF BACKGROUND GROUNDWATER QUALITY

Well ID	TW-1	TW-2	TW-10	TW-1, TW-2, and TW-10		
	Range of Measurements (mg/L)			Average[1]	95th Percentile[1]	Range
Parameter	*Number of Data Points Shown in Brackets – (n)*					
Conductivity (μmho/cm)	510 – 767 (28)	398 – 885 (28)	397 - 939 (31)	622 (87)	794 (87)	397 – 939
Chloride	0.82 – 13.9 (28)	0.4 – 7.4 (27)	<0.01 – 27.5 (31)	2.97 (87)	8.35 (87)	<0.01 – 27.5
Hardness	293 – 458 (27)	260 – 566 (28)	241 – 502 (30)	348 (85)	495 (85)	241 – 566
Iron	<0.01 – 0.89 (15)	<0.01 – 1.13 (17)	<0.01 – 1.59 (20)	0.27 (52)	1.04 (52)	<0.01 – 1.59
TDS	260 – 475 (11)	240 – 526 (12)	240 – 369 (12)	338 (35)	485 (35)	240 – 526
Nitrate	<0.01 – 1.2 (26)	0.01 – 0.69 (26)	<0.01 – 1.95 (29)	0.38 (81)	1.36 (81)	<0.01 – 1.95
Nitrite	0.001 – 0.07 (26)	0.005 – 0.03 (26)	0.003 – 0.41 (29)	0.06 (81)	0.20 (81)	0.001 – 0.41
Ammonia	0.017 – 2.2 (26)	0.01 – 1.0 (24)	0.01 – 2.4 (28)	0.62 (78)	1.77 (78)	0.01 – 2.4
TKN	0.33 – 6.2 (23)	0.15 – 6.7 (23)	0.41 – 8.2 (24)	1.93 (70)	6.16 (70)	0.15 – 8.2
Organic Nitrogen	0.25 – 5.78 (23)	0.14 – 6.7 (23)	0.13 – 7.17 (23)	1.35 (69)	5.70 (69)	0.13 – 7.17
Sulphate	<0.1 – 69.8 (16)	4.3 – 164 (17)	<0.1 – 33.0 (18)	19.2 (51)	68.7 (51)	<0.1 – 164
pH	6.99 – 8.33 (28)	6.99 – 7.94 (28)	7.28 – 8.26 (31)	7.59 (87)	8.05 (87)	6.99 – 8.33
Alkalinity	244 – 790 (24)	160 – 471 (24)	198 – 435 (26)	321 (74)	431 (74)	198 – 790
Sodium	<0.5 – 21 (16)	1.3 – 10.8 (17)	7.41 – 20.5 (18)	9.2 (51)	19.8 (51)	<0.5 – 20.5
Barium	<0.01 – 0.13 (4)	<0.01 – 0.14 (4)	<0.05 – 0.26 (4)	0.076 (12)	0.19 (12)	<0.01 – 0.26
Boron	0.02 – 0.04 (4)	<0.01 – 0.01 (4)	<0.05 – 0.14 (4)	0.043 (12)	0.11 (12)	<0.01 – 0.14

Notes:

1. The reported detection limit was used for calculation of average when values were reported as less than sample detection limits.
2. All available data from 1984 to 2002 was used to calculate background concentrations.
3. All data presented in mg/L = milligrams per liter unless otherwise noted.
4. μmho/cm = micromho per centimeter

TABLE 5
GROUNDWATER QUALITY INDICATOR PARAMETERS

Parameter	Background Concentration (Cb)	Maximum Concentration (Cr)	Objective Level (Cm)
Conductivity (umho/cm)	622	NV	NV
Chloride (mg/L)	2.99	250 (AO)	126
Hardness (mg/L) (as $CaCO_3$)	**495**	80 – 100 (OG)	**495**
Iron (mg/L)	0.27	0.30 (AO)	0.29
TDS (mg/L)	338	500 (AO)	419
Nitrate (mg/L) (as nitrogen)	0.38	10.0 (MAC)	2.8
Nitrite (mg/L) (as nitrogen)	0.06	1.0 (MAC)	0.3
Ammonia (mg/L)	0.62	NV	NV
TKN (mg/L)	1.93	NV	NV
Organic Nitrogen (mg/L)	**5.7**	0.15 (OG)	**5.7**
Sulphate (mg/L)	19.2	500 (AO)	260
pH	6.99 – 8.33	6.5 - 8.5 (OG)	6.5 – 8.5
Alkalinity (mg/L) (as $CaCO_3$)	321	30 - 500 (OG)	410
Sodium (mg/L)	9.2	200 (AO)	105
Barium (mg/L)	0.076	1.0 (MAC)	0.31
Boron (mg/L)	0.043	5.0 (IMAC)	1.28

Notes:

1. All available data from wells TW-1, TW-2, and TW-10 collected from 1984 to 2002 was used to calculate background concentrations. A summary of the data used for the analysis of background groundwater quality is provided in Table 4.

2. mg/L = milligrams per litre; umho/cm = micromho per centimetre; NV = No Value.

3. AO = Aesthetic Objective
   OG = Operational Guideline
   MAC = Maximum Acceptable Concentration, Parameters Related to Health
   IMAC = Interim Maximum Acceptable Concentration, Parameters Related to Health

   MOECC Procedure B-7-1: Cm = Cb + x(Cr – Cb)

   Where:
   Cm = Maximum concentration acceptable in groundwater beneath an adjacent property.
   Cb = Background concentration.
   Cr = Maximum concentration that should be present in groundwater for domestic consumption according to the Ontario Drinking Water Standards (ODWS).
   x = 0.5 for non-health related parameters and 0.25 for health related parameters.

4. As per MOECC email correspondence dated September 28, 2016, for parameters in which the background concentration (i.e. the average concentration) exceeds the ODWS, the 95th-percentile should be used to represent the RUC for the Site. These parameters are shown in **BOLD**.

TABLE 6
SURFACE WATER
PROVINCIAL WATER QUALITY OBJECTIVES (PWQO)

PARAMETER	CONCENTRATION	NOTES
Chloride	120 mg/L	4
Ammonia (un-ionized)	0.02 mg/L	
Alkalinity	NV	1
Arsenic	0.1 mg/L	
Barium (Ba)	NV	
Boron (B)	0.2 mg/L	2
Cadmium (Cd)	0.0002 mg/L	
Chromium (Cr)	0.001 mg/L	Cr(VI)
Copper (Cu)	0.005 mg/L	
Iron (Fe)	0.3 mg/L	
Lead (Pb)	0.025 mg/L	
Zinc (Zn)	0.03 mg/L	
Hardness	NV	
Total Dissolved Solids (TDS)	NV	
Specific Conductance	NV	
Field temperature	NV	
Nitrate (as N)	3 mg/L	3
Nitrite	NV	
pH	6.5 to 8.5	
Sulphate	NV	
Phenols	0.001 mg/L	
Iron	0.3 mg/L	
Total Phosphorus	0.03 mg/L	2

Notes:

1. Should not be decreased to more than 25% of the natural concentration.
2. Interim PWQO - Objective concentration currently under development
3. The Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guideline (CWQG)for long-term exposure to Nitrate (as N) is 3.0 mg/L.
4. The Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guideline (CWQG) for long-term exposure to Chloride is 120 mg/L.
5. NV = No Value

TABLE 7
SUMMARY OF GROUNDWATER QUALITY ANALYSES - 2021 and 2022

Parameter / Sample Location / Sampling Date	Background	ODWS	RUC	Upgradient (East)											
				TW-27				TW-11D		TW-15				TW-15D	
	(mg/L)	(mg/L)	(mg/L)	6-May-21	14-Nov-21	2-May-22	6-Oct-22	6-May-21	2-May-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	2-May-22
Conductivity (µS/cm)	622	NV	NV	1100	1100	1100	1100	690	680	610	650	570	590	600	610
Chloride	2.97	250	126	66	61	66	65	2.2	1.7	2.8	2.7	2.2	2.9	3.1	2.6
Hardness	495	100	495	**560**	**540**	**560**	**540**	**390**	**390**	**340**	**360**	**330**	**350**	**330**	**340**
Iron	0.27	0.30	0.29	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TDS	338	500	419	**600**	**575**	**575**	**590**	350	325	345	325	300	330	290	280
Nitrate	0.38	10.0	2.8	0.25	0.11	0.22	0.53	0.16	0.14	0.45	0.30	0.33	0.21	<0.10	<0.10
Nitrite	0.06	1.0	0.3	0.02	0.11	0.04	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Ammonia	0.62	NV	NV	0.41	1.1	0.59	0.54	<0.05	0.11	<0.05	0.26	0.13	0.17	0.23	0.32
Total Kjeldahl Nitrogen	1.93	NV	NV	0.57	1.6	0.79	0.83	<0.10	0.10	0.11	0.56	0.19	0.57	0.32	0.34
Organic Nitrogen	5.7	0.15	5.7	**0.17**	**0.51**	**0.20**	**0.30**	<0.10	<0.10	0.11	**0.30**	<0.10	**0.40**	<0.10	<0.10
Sulphate	19.2	500	260	44	37	36	43	16	13	9.4	8.7	6.2	23	24	22
pH (pH Units)	6.99 - 8.33	6.5 to 8.5		7.77	7.73	7.91	7.99	7.99	8.01	7.96	7.82	8.12	8.16	7.88	8.05
Alkalinity	321	500	410	**500**	**530**	**490**	**500**	380	370	330	360	310	340	310	310
Sodium	9.2	200	105	40	40	40	40	3.5	3.7	2.3	2.4	2.4	4.2	4.6	4.7
Calcium	NA	NV	NV	110	110	120	100	92	90	87	90	84	83	79	80
Magnesium	NA	NV	NV	66	67	67	69	39	40	30	32	29	35	32	33
Potassium	NA	NV	NV	9.0	11	9.0	11	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Parameter / Sample Location / Sampling Date	Background	ODWS	RUC	Cross-Gradient (South)													
				TW-1*				TW-2*				TW-10*				TW-22	
	(mg/L)	(mg/L)	(mg/L)	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	2-May-22
Conductivity (µS/cm)	622	NV	NV	880	900	930	920	830	1000	930		970	1100	1200	1100	550	540
Chloride	2.97	250	126	24	33	39	42	19	17	14		120	130	150	130	2.1	2.2
Hardness	495	100	495	**490**	**480**	**520**	**530**	**440**	**520**	**520**		**450**	**470**	**530**	**530**	**290**	**290**
Iron	0.27	0.30	0.29	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TDS	338	500	419	465	460	410	**585**	495	**600**	**550**		**515**	**500**	**615**	**670**	270	240
Nitrate	0.38	10.0	2.8	0.30	0.98	0.18	0.46	<0.10	<0.10	<0.10		0.67	0.18	0.14	0.82	<0.10	<0.10
Nitrite	0.06	1.0	0.3	0.05	0.02	0.05	0.32	<0.01	<0.01	<0.01		0.18	0.10	0.06	0.93	<0.01	<0.01
Ammonia	0.62	NV	NV	0.64	0.53	0.80	0.86	0.08	0.14	0.24		0.70	0.18	2.5	2.7	1.8	1.9
Total Kjeldahl Nitrogen	1.93	NV	NV	0.72	1.0	0.83	1.2	0.18	0.75	0.51	ISW	1.0	<0.20	3.0	3.7	1.9	2.1
Organic Nitrogen	5.7	0.15	5.7	<0.10	**0.49**	<0.10	**0.35**	<0.10	**0.61**	**0.27**		**0.34**	<0.10	**0.54**	**0.99**	<0.10	**0.23**
Sulphate	19.2	500	260	11	13	13	15	85	160	180		4.4	13	10	26	<1.0	<1.0
pH (pH Units)	6.99 - 8.33	6.5 to 8.5		7.82	7.90	7.98	7.9	7.67	7.63	7.81		7.82	7.88	7.88	7.90	8.09	8.08
Alkalinity	321	500	410	450	450	450	480	350	390	330		350	410	370	400	310	300
Sodium	9.2	200	105	8.1	7.2	7.7	11	21	19	18		29	46	38	41	6.6	6.9
Calcium	NA	NV	NV	120	120	130	130	130	150	150		93	98	110	110	68	67
Magnesium	NA	NV	NV	47	47	50	52	30	36	36		54	56	65	65	29	29
Potassium	NA	NV	NV	<1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0		2.0	3.0	2.0	2.0	<1.0	<1.0

Notes:
1. ODWS = Ontario Drinking Water Standards (June 2003, Revised June 2006)
2. NV = No value specified.
3. NA = Not Applicable; these compounds were measured to establish baseline concentrations, results will be compared to the ODWS.
4. Values in **bold** represent results greater than the ODWS.
5. Shaded values represent results greater than the Reasonable Use Criteria.
6. Samples analyzed by Maxxam Analytics Inc.
7. Results presented in mg/L (milligrams per litre) unless otherwise specified.
8. TDS = Total Dissolved Solids.
9. *Monitoring wells TW-1, TW-2, TW-4, TW-5, TW-8, TW-9 and TW-10 were not constructed in accordance with current standards.

TABLE 7
SUMMARY OF GROUNDWATER QUALITY ANALYSES - 2021 and 2022

Parameter / Sample Location / Sampling Date	Background	ODWS	RUC	Downgradient (West)															
				TW-5*		TW-12				TW-13				TW-14		TW-16		TW-17		TW-23	
	(mg/L)	(mg/L)	(mg/L)	6-May-21	2-May-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	2-May-22	6-May-21	2-May-22	6-May-21	2-May-22	6-May-21	2-May-22
Conductivity (µS/cm)	622	NV	NV	860	860	1200	1300	1200	1100	990	1100	1100		980	990	650	660	470	490	540	540
Chloride	2.97	250	126	3.1	2.5	63	80	67	65	21	29	42		27	31	9.1	11.0	2.5	2.5	3.7	3.2
Hardness	495	100	495	**460**	**470**	**600**	**600**	**590**	**590**	**530**	**540**	**590**		**530**	**540**	**330**	**360**	**240**	**260**	**290**	**290**
Iron	0.27	0.30	0.29	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TDS	338	500	419	450	450	**585**	**650**	**595**	**565**	**515**	**595**	**580**		**500**	**500**	310	295	235	210	295	275
Nitrate	0.38	10.0	2.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	<0.10	<0.10	0.21	0.32	0.33	0.53
Nitrite	0.06	1.0	0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	0.07	0.05	0.07	0.05
Ammonia	0.62	NV	NV	0.26	0.35	0.28	0.57	0.41	0.34	0.35	0.71	0.61		0.07	0.23	<0.05	0.10	0.31	0.33	0.27	0.33
Total Kjeldahl Nitrogen	1.93	NV	NV	0.35	0.46	0.67	1.1	0.85	0.79	0.53	0.94	1.1	NM	0.19	0.22	<0.10	0.14	0.39	0.46	0.8	1.3
Organic Nitrogen	5.7	0.15	5.7	<0.10	0.11	**0.39**	**0.48**	**0.44**	**0.45**	**0.19**	**0.23**	**0.46**		0.13	<0.10	<0.10	<0.10	<0.10	0.13	0.53	0.93
Sulphate	19.2	500	260	65	55	1.3	7.6	2.0	<1.0	<1.0	4.8	<1.0		16	13	32	28	19	19	39	39
pH (pH Units)	6.99 - 8.33	6.5 to 8.5		7.92	7.89	7.59	7.65	7.74	7.81	7.56	7.53	7.70		7.60	7.80	7.94	8.11	8.15	8.10	7.96	8.07
Alkalinity	321	500	410	420	420	**590**	**610**	**570**	**590**	**540**	**570**	**570**		**510**	**510**	330	330	240	250	250	250
Sodium	9.2	200	105	19	20	41	46	48	45	22	28	32		16	19	18	20	11	12	6.0	6.2
Calcium	NA	NV	NV	96	98	110	110	100	100	120	120	130		110	110	60	65	51	53	67	68
Magnesium	NA	NV	NV	53	54	80	79	80	80	59	59	64		63	65	43	47	27	30	29	29
Potassium	NA	NV	NV	2.0	2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	1.0	1.0	1.0	1.0	1.0	1.0

Parameter / Sample Location / Sampling Date	Background	ODWS	RUC	Cross-Gradient (North)													
				TW-25S				TW-25D		TW-26				TW-24			
	(mg/L)	(mg/L)	(mg/L)	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	2-May-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22
Conductivity (µS/cm)	622	NV	NV	710	700	730	690	520	500	630	600	620		830	820	830	810
Chloride	2.97	250	126	2.0	2.2	1.7	1.9	4.4	3.3	3.0	2.9	3.4		1.6	1.9	1.6	1.3
Hardness	495	100	495	**320**	**300**	**340**	**330**	**240**	**240**	**290**	**270**	**300**		**380**	**360**	**390**	**380**
Iron	0.27	0.30	0.29	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
TDS	338	500	419	375	350	365	360	250	240	325	300	255		425	365	430	430
Nitrate	0.38	10.0	2.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10		0.10	<0.10	<0.10	<0.10
Nitrite	0.06	1.0	0.3	<0.01	<0.01	<0.01	<0.01	0.03	0.06	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
Ammonia	0.62	NV	NV	<0.05	0.2	<0.05	<0.05	0.38	0.33	<0.05	0.14	0.09		<0.05	0.22	<0.05	<0.05
Total Kjeldahl Nitrogen	1.93	NV	NV	<0.10	0.11	<0.10	<0.10	0.92	1.4	<0.10	<0.10	<0.10	NM	<0.10	0.17	<0.10	0.11
Organic Nitrogen	5.7	0.15	5.7	<0.10	<0.10	<0.10	<0.10	**0.55**	**1.1**	<0.10	<0.10	<0.10		<0.10	<0.10	<0.10	0.11
Sulphate	19.2	500	260	57	47	56	57	14	16	49	38	48		72	67	72	72
pH (pH Units)	6.99 - 8.33	6.5 to 8.5		8.01	8.10	8.19	8.21	8.03	8.14	8.15	8.12	8.09		8.03	8.04	8.10	8.01
Alkalinity	321	500	410	340	340	340	360	260	260	300	300	290		390	400	390	410
Sodium	9.2	200	105	38	38	39	39	18	20	27	27	31		47	46	50	48
Calcium	NA	NV	NV	44	42	47	44	53	52	51	47	51		53	50	55	52
Magnesium	NA	NV	NV	51	49	53	53	27	27	40	37	41		59	57	62	62
Potassium	NA	NV	NV	2.0	2.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0

Notes:
1. ODWS = Ontario Drinking Water Standards (June 2003, Revised June 2006)
2. NV = No value specified.
3. NA = Not Applicable; these compounds were measured to establish baseline concentrations, results will be compared to the ODWS.
4. Values in **bold** represent results greater than the ODWS.
5. Shaded values represent results greater than the Reasonable Use Criteria.
6. Samples analyzed by BV Labs (formerly Maxxam Analytics Inc.)
7. Results presented in mg/L (milligrams per litre) unless otherwise specified.
8. TDS = Total Dissolved Solids.
9. *Monitoring wells TW-1, TW-2, TW-4, TW-5, TW-8, TW-9 and TW-10 were not constructed in accordance with current standards.

TABLE 8
SUMMARY OF SURFACE WATER QUALITY RESULTS AND COMPARISON TO THE PWQO (2021 and 2022)

Parameter / Sample Location	PWQO (mg/L)	SW-7 Arkwright Creek Upstream				SW-1 Arkwright Creek Downstream				SW-5 Unnamed Tributary Upstream			SW-8 Swamp Area Downstream of Tributary			SW-9 Stormwater Management Pond Outlet			SW-10 Stormwater Management Pond			
Sampling Date		6-May-21	14-Nov-21	2-May-22	6-Oct-22	6-May-21	14-Nov-21	2-May-22	6-Oct-22	6-May-21	12-Nov-21	2-May-22	6-May-21	14-Nov-21	2-May-22	6-May-21	12-Nov-21	2-May-22	6-May-21	12-Nov-21	2-May-22	6-Oct-22
Field pH (pH Units)	6.5 to 8.5	7.53	7.43	6.97	7.68	7.66	7.78	7.10	7.96	**7.56**	7.67	6.69	7.60	7.64	7.11	7.76	7.42	7.12	7.59	7.49	6.92	7.54
Field Temperature	NV	6.8	5.7	8.7	5.9	6.6	6.4	8.8	11.8	14.0	9.2	9.1	7.0	4.0	8.9	9.2	7.6	8.6	9.2	8.3	9.3	9.7
Conductivity (Field)	NV	408	NV	412	892	420	NV	412	437	561	NV	433	487	NV	418	926	NV	624	991	NV	617	791
Hardness	NV	290	310	310	380	290	310	290	280	330	280	350	320	320	320	390	400	340	400	290	320	380
Total Ammonia	NV	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.27	<0.050	3.6	1.5	0.081	4.2	0.31	<0.050	<0.050
Ammonia (un-ionized)	0.02	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Biological Oxygen Demand (BOD)	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6	<2.0	2.0	11	10	3.0	3.0
Chemical Oxygen Demand (COD)	NV	22	32	19	140	30	33	17	31	25	26	16	23	31	15	98	120	59	100	71	50	67
Conductivity	NV	550	560	610	1000	560	570	540	550	610	520	620	640	680	620	1200	1100	910	1200	900	810	1000
Total Dissolved Solids (TDS)	NV	295	300	270	765	305	305	230	360	335	245	270	365	335	285	630	630	440	655	460	380	785
Total Kjeldahl Nitrogen (TKN)	NV	0.29	0.60	0.38	0.97	0.28	0.60	0.32	0.44	0.42	0.57	0.38	0.42	1.1	0.39	5.6	8.1	2.0	6.7	2.0	1.2	0.9
pH (pH Units)	6.5 to 8.5	8.08	8.03	8.28	7.97	8.10	8.09	8.39	8.31	8.01	8.15	8.13	8.14	8.15	8.31	8.03	8	8.22	7.99	8.06	8.16	7.95
Phenols	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0029	<0.0010	<0.0010	**0.004**	0.001	<0.0010	<0.0010
Total Phosphorus	0.03	0.02	**0.03**	0.01	**0.05**	0.02	**0.03**	0.02	**0.03**	**0.03**	0.03	0.02	0.02	0.02	0.01	0.10	**1.4**	**0.15**	**0.10**	**0.07**	**0.06**	**0.37**
Total Suspended Solids (TSS)	NV	3.0	6.0	5.0	54	6.0	5.0	6.0	6.0	2.0	1.0	4.0	4.0	1.0	2.0	10	6.0	140	15	17	52	320
Sulphate	NV	<1.0	<1.0	<1.0	310	<1.0	<1.0	<1.0	37	<1.0	<1.0	<1.0	1.0	27	<1.0	37	98	50	37	64	40	310
Alkalinity	NV [2]	280	290	300	160	280	300	270	280	330	290	330	320	310	310	460	380	330	460	280	320	160
Chloride	120 [1]	12	11	19	55	12	12	14	7.9	3.9	5.3	8.6	20	30	20	93	96	68	96	78	43	56
Nitrite	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	0.02	<0.010	0.01	0.08	<0.010	0.02	0.21	<0.010	0.02
Nitrate (as N)	3.0 [1]	1.0	1.2	<0.10	<0.10	0.89	1.1	1.1	0.21	0.11	<0.10	0.16	<0.10	0.66	<0.10	0.11	1.79	0.48	<0.10	**3.49**	<0.10	<0.10
Mercury (Hg)	0.0002	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	0.1	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.001	<0.001	<0.001	<0.001	0.003	0.001	0.001	0.003	0.001	0.001	0.008
Barium (Ba)	NV	0.01	0.02	0.02	0.05	0.01	0.02	0.01	0.02	0.01	0.008	0.01	0.02	0.02	0.01	0.04	0.03	0.03	0.04	0.03	0.03	0.17
Boron (B)	0.2	0.01	0.02	0.0001	0.0004	0.02	0.02	0.00001	0.00002	0.02	0.02	0.00002	0.06	0.10	0.00005	**0.51**	**0.53**	0.0004	**0.55**	**0.50**	0.0004	0.0004
Cadmium (Cd)	0.0002	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0001	<0.0001	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	0.0002
Chromium (Cr)	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.03**
Cobalt (Co)	0.0009	<0.0005	<0.0005	<0.0005	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	**0.001**	0.0008	0.0008	**0.001**	**0.001**	**0.001**	**0.02**
Copper (Cu)	0.005	<0.0009	<0.0009	0.0009	**0.005**	<0.009	<0.009	<0.0009	<0.0009	<0.0010	<0.0010	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	**0.006**	0.002	0.001	0.002	0.002	**0.03**
Iron (Fe)	0.3	0.25	**0.39**	0.0001	**0.0003**	**0.33**	**0.33**	0.0003	0.0003	0.13	0.14	0.0001	<0.10	<0.10	<0.10	**0.58**	0.23	0.0006	**0.86**	**0.39**	0.001	0.03
Lead (Pb)	0.025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.01
Potassium (K)	NV	1.3	1.7	2.8	25	1.5	2.0	1.6	0.93	0.50	3.8	0.53	3.0	6.6	2.7	25	25	21	27	31	19	27
Sodium (Na)	NV	NV	6.0	0.01	0.04	NV	7.2	0.008	0.005	NV	2.3	0.007	NV	23	0.01	NV	83	0.06	NV	63	0.05	0.04
Zinc (Zn)	0.03	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.005	0.006	0.08

Notes:
1. There is no PWQO for Chloride or Nitrate (as N), therefore the Canadian Water Quality Guidelines for long term concentrations were used.
2. Should not be decreased to more than 25% of the natural concentration.
3. NV = No Value

Notes:
1. There is no PWQO for Chloride or Nitrate (as N), therefore the Canadian Water Quality Guidelines for long term concentrations we
2. Should not be decreased to more than 25% of the natural concentration.
3. NV = No Value

TABLE 9
GROUNDWATER QUALITY COMPARISON TO TRIGGER LEVELS

Location		Date	Chloride	Iron	Nitrate	Nitrite	Sodium	Alkalinity	Hardness	Sulphate
Trigger Levels			95	1.19	2.1	0.31	79	593	425	195
East Property Boundary	TW11D	Apr-15	4.0	<0.02	0.32	<0.01	3.9	340	400	20
	TW11D	Apr-16	3.3	<0.02	0.25	<0.01	3.8	350	380	21
	TW11D	Apr-17	3.6	0.02	0.11	<0.010	3.8	340	370	23
	TW11D	Apr-18	3.1	<0.02	0.16	<0.010	3.9	370	390	20
	TW11D	Apr-19	3.3	0.18	0.16	<0.010	3.8	380	350	18
	TW11D	Apr-20	2.6	<0.02	0.18	<0.010	3.9	370	420	17
	TW11D	May-21	2.2	<0.02	0.16	<0.010	3.5	380	390	16
	TW11D	May-22	1.7	<0.02	0.14	<0.010	3.7	370	390	13
	TW15	Apr-15	3.0	<0.02	0.43	<0.01	2.5	300	340	10
	TW15	Nov-15	2.6	<0.02	0.43	<0.01	2.9	340	380	9.3
	TW15	Apr-16	2.1	<0.02	0.44	<0.01	3.0	340	360	12
	TW15	Nov-16	2.0	<0.02	0.39	<0.01	2.8	350	380	7.7
	TW15	Apr-17	1.8	<0.02	0.42	<0.010	2.3	290	300	11
	TW15	Oct-17	1.6	<0.02	0.11	<0.010	2.4	330	330	5.6
	TW15	Apr-18	2.6	<0.02	0.36	<0.010	2.6	350	370	13
	TW15	Oct-18	2.2	<0.02	0.28	<0.010	2.4	340	340	7.2
	TW15	Apr-19	2.4	<0.02	0.41	<0.010	2.6	360	340	9.9
	TW15	Nov-19	2.4	<0.02	0.32	<0.010	2.4	350	350	6.3
	TW15	Apr-20	2.0	<0.02	0.46	<0.010	2.6	330	350	10.0
	TW15	Oct-20	2.8	<0.02	0.80	<0.010	-	340	350	7.5
	TW15	May-21	2.8	<0.02	0.45	<0.010	2.3	330	340	9.4
	TW15	Nov-21	2.7	<0.02	0.30	<0.010	2.4	360	360	8.7
	TW15	May-22	2.2	<0.02	0.33	<0.010	2.4	310	330	6.2
	TW15	Oct-22	2.9	<0.02	0.21	<0.010	4.2	340	350	23.0
West Property Boundary	TW5	Apr-15	3.0	<0.02	<0.1	0.127	23	420	***510***	82
	TW5	Apr-16	2.8	<0.02	<0.1	<0.01	21	440	***490***	76
	TW5	Apr-17	2.7	<0.02	<0.10	0.020	23	430	***490***	81
	TW5	Apr-18	3.1	<0.02	<0.10	<0.010	23	450	***500***	73
	TW5	Apr-19	2.9	<0.02	<0.10	0.01	19	450	410	64
	TW5	Apr-20	2.8	<0.02	0.17	0.05	22	420	**470**	71
	TW5	May-21	3.1	<0.02	<0.10	<0.010	19	420	**460**	65
	TW5	May-22	2.5	<0.02	<0.10	<0.010	20	420	**470**	55
	TW16	Apr-15	2.0	<0.02	<0.1	<0.01	22	310	330	35
	TW16	Apr-16	2.5	<0.02	<0.1	<0.01	23	320	340	36
	TW16	Apr-17	3.4	<0.02	0.10	<0.010	20	310	320	36
	TW16	Apr-18	5.0	<0.02	<0.10	<0.010	21	330	330	34
	TW16	Apr-19	5.1	<0.02	<0.10	<0.010	21	310	300	34
	TW16	Apr-20	6.6	<0.02	0.12	<0.010	20	320	340	33
	TW16	May-21	9.1	<0.02	<0.10	<0.010	18	330	330	32
	TW16	May-22	11.0	<0.02	<0.10	<0.010	20	330	360	28
	TW17	Apr-15	3.0	<0.02	0.20	0.097	13	250	260	17
	TW17	Apr-16	2.6	<0.02	<0.1	0.036	13	260	260	20
	TW17	Apr-17	2.2	<0.02	0.23	0.107	11	230	230	18
	TW17	Apr-18	2.5	<0.02	0.22	0.08	13	260	260	21
	TW17	Apr-19	3.0	<0.02	0.36	0.07	12	260	250	19
	TW17	Apr-20	21.0	<0.02	0.45	0.08	12	250	250	18
	TW17	May-21	2.5	<0.02	0.21	0.07	11	240	240	19
	TW17	May-22	2.5	<0.02	0.32	0.05	12	250	260	19

TABLE 9
GROUNDWATER QUALITY COMPARISON TO TRIGGER LEVELS

Location		Date	Chloride	Iron	Nitrate	Nitrite	Sodium	Alkalinity	Hardness	Sulphate
Trigger Levels			**95**	**1.19**	**2.1**	**0.31**	**79**	**593**	**425**	**195**
North Property Boundary	**TW25S**	Nov-16	7.1	<0.02	<0.1	<0.01	40	340	320	45
	TW25S	Apr-17	4.5	<0.02	0.22	<0.010	43	350	330	62
	TW25S	Oct-17	3.6	<0.02	<0.10	<0.010	46	360	320	48
	TW25S	Apr-18	2.7	<0.02	<0.10	<0.010	43	360	350	64
	TW25S	Oct-18	2.9	<0.02	<0.10	<0.010	40	360	320	48
	TW25S	Apr-19	2.3	<0.02	<0.10	<0.010	41	340	340	61
	TW25S	Nov-19	2.3	<0.02	<0.10	<0.010	39	350	310	46
	TW25S	Apr-20	1.8	<0.02	<0.10	<0.010	40	350	340	56
	TW25S	Oct-20	2.6	<0.02	<0.10	<0.010	-	350	320	47
	TW25S	May-21	2.0	<0.02	<0.10	<0.010	38	340	320	57
	TW25S	Nov-21	2.2	<0.02	<0.10	<0.010	38	340	300	47
	TW25S	May-22	1.7	<0.02	<0.10	<0.010	39	340	340	56
	TW25S	Oct-22	1.9	<0.02	<0.10	<0.010	39	360	330	57
	TW26	Nov-16	9.4	<0.02	0.45	0.012	**80**	320	220	38
	TW26	Apr-17	5.0	<0.02	<0.10	<0.010	39	310	260	38
	TW26	Oct-17	3.5	<0.02	<0.10	<0.010	36	310	280	34
	TW26	Apr-18	3.4	<0.02	<0.10	<0.010	33	310	290	45
	TW26	Oct-18	3.4	<0.02	<0.10	<0.010	30	310	280	38
	TW26	Apr-19	3.1	<0.02	<0.10	<0.010	29	280	290	42
	TW26	Nov-19	2.8	<0.02	<0.10	<0.010	29	300	280	39
	TW26	Apr-20	2.7	<0.02	<0.10	<0.010	29	300	300	42
	TW26	Oct-20	2.7	<0.02	<0.10	<0.010	-	300	280	38
	TW26	May-21	3.0	<0.02	<0.10	<0.010	27	300	290	49
	TW26	Nov-21	2.9	<0.02	<0.10	<0.010	27	300	270	38
	TW26									

Notes:

1. Trigger Levels are based on 75% of RUC or Maximum Background concentrations as outlined in the *Arran Landfill Site Trigger Mechanisms and Contingency Plan* (as amended December 2017).
2. NV = No value specified.
3. Samples analyzed by BV Labs (formerly Maxxam Analytics Inc.)
4. Results presented in mg/L (milligrams per litre).
5. Values shaded and in bold exceed the Trigger Level. Values shown in italics show a trigger level exceedence that has occurred for three or more consecutive monitoring events.
6. Contingency Plan measures are to be implemented if two or more parameters exceed the trigger levels at the same trigger location for three consecutive events.
7. Leachate indicator wells (i.e. wells within or in close proximity to the footprint), including TW-1, TW-2, TW-10, TW-12, TW-13, TW-22, TW-23 and TW-24 trigger the Contingency Plan if the chloride concentration exceeds an average of 445 mg/L over two consecutive events. To date, chloride concentrations generally remain below 100 mg/L.

TABLE 10
SURFACE WATER QUALITY COMPARISON TO TRIGGER LEVELS

Trigger Locations		SW-1 and SW-8 only		SW-1, SW-8 and SW-9				
Sample Location	**Date**	**Chloride**	**Iron**	**Boron**	**Alkalinity**	**Hardness**	**Sodium**	**Sulphate**
Trigger Level (mg/L)		90	1.19	0.2	593	425	79	195
SW-1 Arkwright Creek (Downstream)	13-Apr-15	13	0.12	0.020	220	230	6.9	3
	5-Nov-15	17	0.45	0.015	310	390	8.2	45
	11-Apr-16	15	0.13	0.015	210	230	9.4	2
	2-Nov-16	12	0.11	0.017	340	360	6.9	39
	24-Apr-17	11	0.12	0.019	240	240	6.8	<1.0
	29-Oct-17	13	0.28	0.022	380	390	6.2	<1.0
	12-Apr-18	15	0.35	0.034	230	240	NM	9.9
	30-Oct-18	12	0.22	0.017	320	350	7.6	21
	10-Apr-19	10	<0.10	0.013	200	220	NM	<1.0
	19-Nov-19	14	0.25	0.018	270	350	8.6	29
	10-Apr-20	10	0.51	0.015	230	250	NM	1.2
	26-Oct-20	17	0.20	0.021	330	310	8.3	28
	6-May-21	12	0.33	0.017	280	290	NM	<1.0
	14-Nov-21	12	0.33	0.023	300	310	7.2	<1.0
	2-May-22	14	0.26	0.014	270	290	7.6	<1.0
	6-Oct-22	7.9	0.32	0.020	280	280	4.6	37
SW-8 Swamp Area Downstream of Tributary	13-Apr-15	23	<0.1	0.039	250	280	12	<1.0
	5-Nov-15	29	0.24	0.033	300	360	15	<1.0
	11-Apr-16	17	0.10	0.018	230	240	9.3	<1.0
	2-Nov-16	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	24-Apr-17	20	0.18	0.093	270	250	14	<1.0
	29-Oct-17	22	<0.1	0.081	390	400	14	<5.0
	12-Apr-18	22	<0.01	0.076	260	260	NM	13
	30-Oct-18	19	0.11	0.055	340	350	14	<1.0
	10-Apr-19	18	**1.20**	0.021	240	250	NM	<1.0
	19-Nov-19	22	<0.10	0.093	290	350	17	29
	10-Apr-20	20	<0.10	0.061	270	290	NM	<1.0
	26-Oct-20	20	0.14	0.048	300	310	15	25
	6-May-21	20	<0.10	0.057	320	320	NM	1
	14-Nov-21	30	<0.10	0.10	310	320	23	27
	2-May-22	20	<100	0.053	310	320	14	<1.0
SW-9 Stormwater Management Pond Outlet	13-Apr-15	60	0.80	0.097	180	190	33	15
	5-Nov-15	43	0.66	0.063	280	350	20	30
	11-Apr-16	34	0.36	0.14	250	250	29	24
	2-Nov-16	34	0.35	0.059	330	370	19	56
	24-Apr-17	85	0.89	**0.50**	280	250	60	22
	29-Oct-17	19	0.37	0.025	400	390	11	<1.0
	12-Apr-18	62	0.31	**0.37**	280	280	NM	42
	30-Oct-18	17	0.77	0.023	360	360	11	<1.0
	10-Apr-19	71	**1.30**	**0.41**	370	360	NM	36
	19-Nov-19	77	0.16	**0.48**	290	390	65	89
	10-Apr-20	18	<0.10	0.020	280	300	NM	<5.0
	26-Oct-20	20	0.13	0.054	310	320	13	4.2
	6-May-21	**93**	0.58	**0.51**	460	390	NM	37
	12-Nov-21	**96**	0.23	**0.53**	380	400	**83**	98
	2-May-22	68	0.57	**0.40**	330	340	61	50

Notes:
1. The trigger levels outlined herein are to replace those initially presented in Section 6(2) of the Stormwater Management ECA No. 7585-8QKL5Q.
2. Similar to the trigger mechanism for groundwater, the measures outlined in the Contingency Plan not be activated unless two or more parameters exceed the trigger levels at the same trigger location for three consecutive monitoring events.

FIGURES

M-1174
Arran Landfill Site
Part Lot 20, Concession 7,
Municipality of Arran-Elderslie

SCALE = N.T.S.
MARCH 2023

ARRAN LANDFILL

SITE LOCATION PLAN

Figure No. 1

BluePlan ENGINEERING

FILE:C:\Carri Documents\2022 Landfills\M1174 AMR Figures.dwg LAYOUT:FIGURE 1
LAST SAVED BY:Cblue, 3/20/2023 3:56:42 PM PLOTTED BY:Carri Blue - GM BluePlan 3/20/2023 4:02:54 PM

M-1174 AMR
Arran Landfill Site
Part Lot 20, Concession 7, Municipality of Arran-Elderslie

LOT 19, CON. VII

LOT 20, CON. VII

PROPERTY OWNED BY THE MUNICIPALITY OF ARRAN-ELDERSLIE

ARKWRIGHT CREEK

UNNAMED TRIBUTARY

DIRECT FISH HABITAT ZONE

NO DEVELOPMENT ZONE

SWAMP

100m

LIMIT OF NO DEVELOPMENT ZONE

FLOODED WOODLAND RIPARIAN ZONE

LIMIT OF NO DEVELOPMENT ZONE

15m SETBACK

POND

TRANSFER SITE FOR PLANT COLONY B

SWALE

STAGE 5b

STAGE 5a

STORMWATER DETENTION FACILITY

SETBACK 15m

ACCESS ROAD

LEAF YARD WASTE

RECYCLING DIVERSION SHED

RECYCLING BINS

CP100 235.75

GARBAGE DIVERSION BINS

SCRAP METAL

CP100 236.09 ROUTE TO GOODS

CLEAN WOOD WASTE

TIRES

30.48m

STAGE 4b

PHASE I
4.45 ha

STAGE 4a

STAGE 3a

STAGE 3b

LIMIT OF WETLAND AS CONFIRMED WITH GSCA, JANUARY 2012

UNNAMED TRIBUTARY

SWALE

AREA C
STAGE 2

AREA B2
STAGE 1

AREA B1

AREA A

63m SETBACK

ACCESS

SWAMP

UPPER REACH

BRUCE COUNTY ROAD No. 17

LOT 20, CON. VII

SIDEROAD 20

LOT 21, CON. VII

LEGEND

- LIMITS OF MUNICIPALITY OWNED LANDS APPROVED FOR LANDFILLING
- HISTORIC LIMIT OF REFUSE PLACEMENT (PRIOR TO JUNE 2000)
- 234.50 EXISTING GROUND SURFACE ELEVATION CONTOUR (MASL)
- PHASE 1 LANDFILL DEVELOPMENT SEQUENCE
- HISTORICAL LANDFILL DEVELOPMENT AREAS (FOR PREVIOUS 1.73 ha LANDFILL AREA)

30 0 20 40 80

1:2000 (m)

NOTE:
1. ELEVATIONS ARE GEODETIC.

SCALE = 1:2000

MARCH 2023

ARRAN LANDFILL

SITE PLAN AND LAND DEVELOPMENT SEQUENCE

Figure No. 2

BluePlan ENGINEERING

FILE:C:\Carri Documents\2022 Landfills\M1174 AMR Figures.dwg LAYOUT:FIGURE 2
LAST SAVED BY:Cblue, 3/20/2023 3:56:42 PM PLOTTED BY:Carri Blue - GM BluePlan 3/20/2023 4:03:12 PM

M-1174 AMR
Arran Landfill Site
Part Lot 20, Concession 7,
Municipality of Arran-Elderslie

LEGEND

- LIMITS OF MUNICIPALITY OWNED LANDS APPROVED FOR LANDFILLING
- APPROVED PHASE 1 LANDFILL AREA
- HISTORIC LIMIT OF REFUSE PLACEMENT (PRIOR TO JUNE 2000)
- 234.50 — EXISTING GROUND SURFACE ELEVATION CONTOUR (MASL)
- 235.0 — APPROVED BOTTOM GROUND CONTOUR (MASL) – PHASE 1
- (1.05m) (235.97) — THICKNESS OF IMPORTED SOILS REQUIRED TO ATTAIN APPROVED BOTTOM ELEVATION.

30 0 20 40 80
1:2000 (m)

NOTE:
1. ELEVATIONS ARE GEODETIC.

SCALE = 1:2000
MARCH 2023

ARRAN LANDFILL

PHASE 1 BOTTOM CONTOURS

Figure No. 3

BluePlan ENGINEERING

M-1174 AMR
Arran Landfill Site
Part Lot 20, Concession 7, Municipality of Arran-Elderslie

LEGEND

- LIMITS OF MUNICIPALITY OWNED LANDS APPROVED FOR LANDFILLING
- APPROVED PHASE 1 LANDFILL AREA
- 236.5 FINAL ELEVATION CONTOUR (MASL)

30 0 20 40 80
1:2000 (m)

NOTE:
1. ELEVATIONS ARE GEODETIC.

SCALE = 1:2000
MARCH 2023

ARRAN LANDFILL

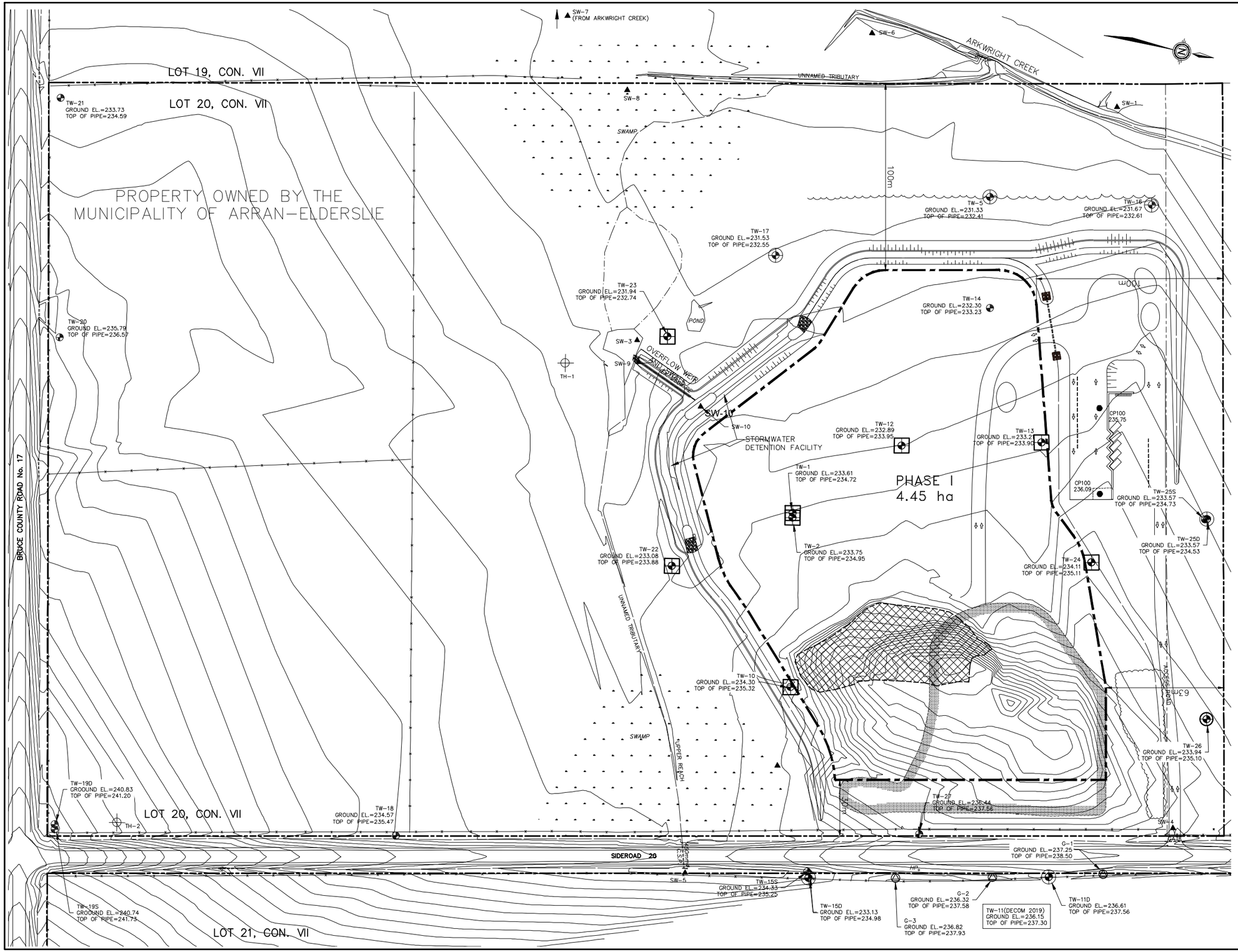
PHASE 1 FINAL TOP CONTOURS

Figure No. 4

BluePlan ENGINEERING

FILE:C:\Carri Documents\2022 Landfills\M1174 AMR Figures.dwg LAYOUT:FIGURE 4
LAST SAVED BY:Cblue, 3/21/2023 1:11:49 PM PLOTTED BY:Carri Blue - GM BluePlan 3/21/2023 1:13:52 PM

M-1174 AMR
Arran Landfill Site
Part Lot 20, Concession 7, Municipality of Arran-Elderslie



LEGEND

- RUC CONTINGENCY MONITORING LOCATION
- LEACHATE CONTINGENCY MONITORING LOCATION
- TW-1 — MONITORING WELL
- SW-1 — SURFACE WATER SAMPLING STATION
- G-1 — GAS WELL
- TH-1 — TEST HOLE LOCATION
- LIMITS OF MUNICIPALITY OWNED LANDS APPROVED FOR LANDFILLING
- APPROVED PHASE 1 LANDFILL AREA
- HISTORIC LIMIT OF REFUSE PLACEMENT (PRIOR TO JUNE 2000)
- INFERRED GROUNDWATER FLOW DIRECTION
- 234.50 — EXISTING GROUND SURFACE ELEVATION CONTOUR (MASL)
- 234 — GROUNDWATER ELEVATION CONTOUR (MASL)

NOTE:
1. ELEVATIONS ARE GEODETIC.
2. MONITORING WELLS TW1, TW2, AND TW5 WERE NOT CONSTRUCTED IN ACCORDANCE WITH CURRENT STANDARDS.

SCALE = 1:2000

MARCH 2023

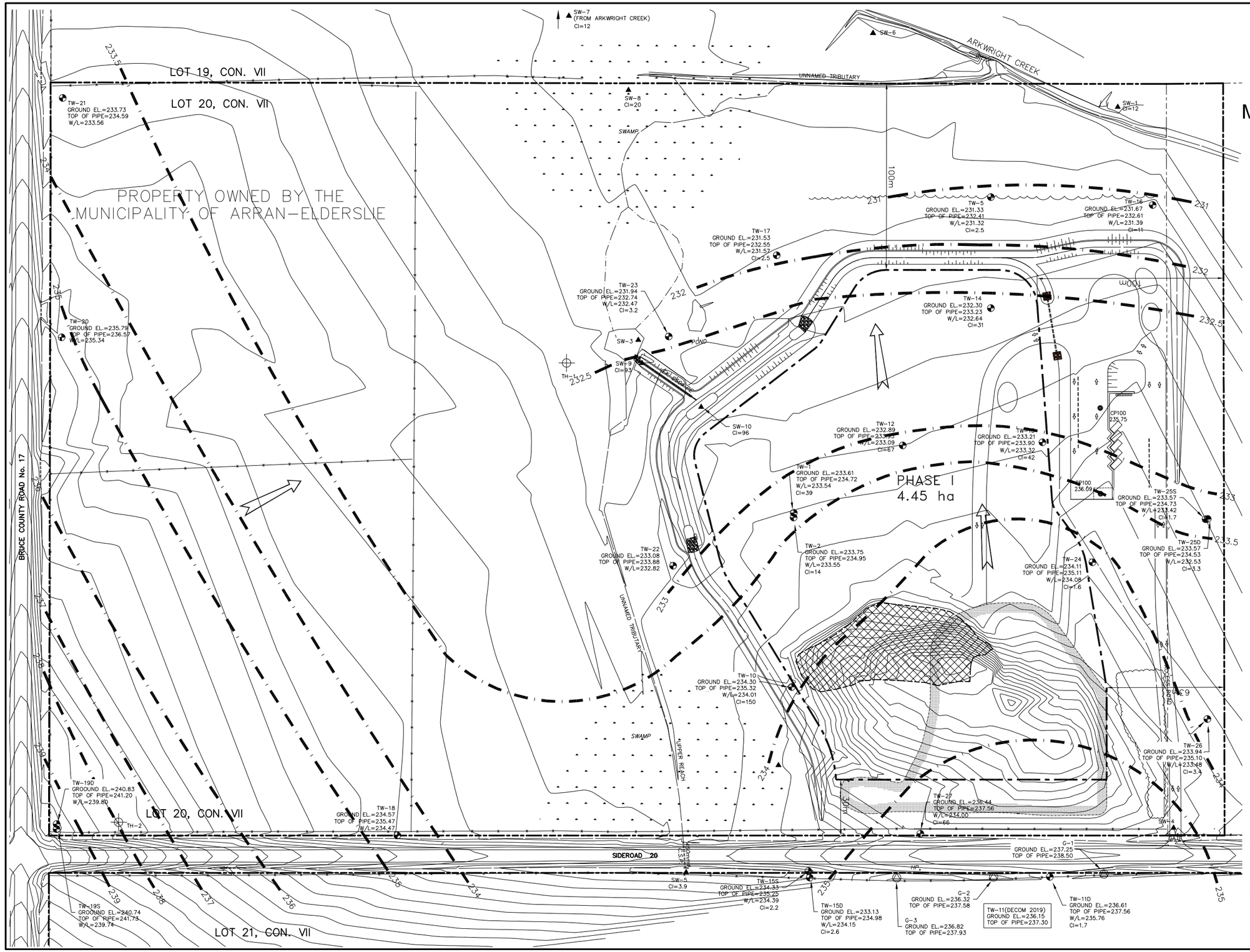
ARRAN LANDFILL

GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

Figure No. 5

BluePlan ENGINEERING

M-1174 AMR
Arran Landfill Site
Part Lot 20, Concession 7, Municipality of Arran-Elderslie



LEGEND

- TW-1 — MONITORING WELL
- SW-1 — SURFACE WATER SAMPLING STATION
- G-1 — GAS WELL
- TH-1 — TEST HOLE LOCATION
- LIMITS OF MUNICIPALITY OWNED LANDS APPROVED FOR LANDFILLING
- APPROVED PHASE 1 LANDFILL AREA
- HISTORIC LIMIT OF REFUSE PLACEMENT (PRIOR TO JUNE 2000)
- INFERRED GROUNDWATER FLOW DIRECTION
- 234.50 — EXISTING GROUND SURFACE ELEVATION CONTOUR (MASL)
- 234 — GROUNDWATER ELEVATION CONTOUR (MASL)

W/L MEASURED WATER LEVEL ELEVATION (m)
Cl = MEASURED CHLORIDE CONCENTRATION (mg/L)

NOTE:
1. ELEVATIONS ARE GEODETIC.
2. GROUNDWATER ELEVATIONS WERE MEASURED ON MAY 2, 2022.
3. MONITORING WELLS TW1, TW2, AND TW5 WERE NOT CONSTRUCTED IN ACCORDANCE WITH CURRENT STANDARDS.

SCALE = 1:2000

MARCH 2023

ARRAN LANDFILL

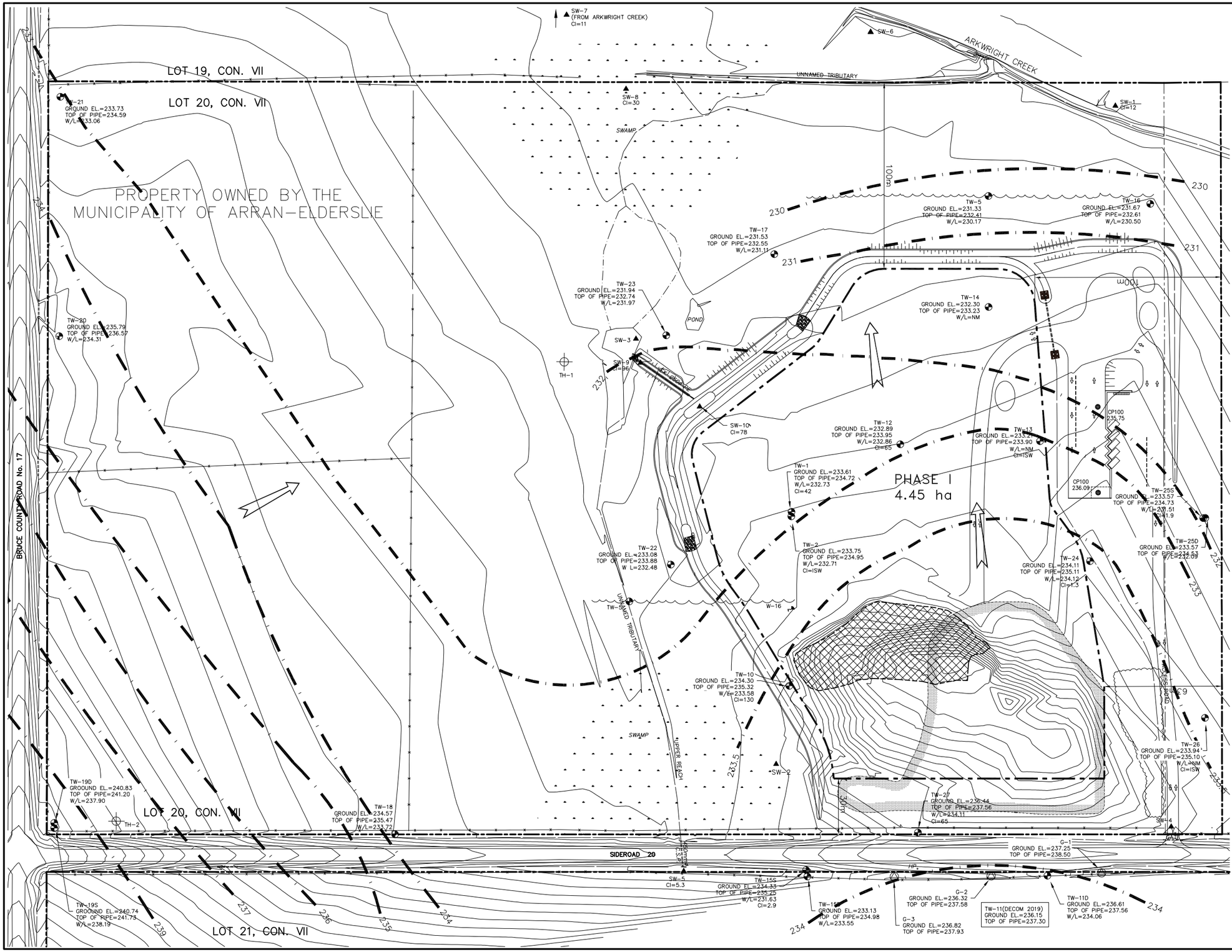
SPRING 2021 GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

Figure No. 6

BluePlan ENGINEERING

FILE:C:\Carri Documents\2022 Landfills\M1174 AMR Figures.dwg LAYOUT:FIGURE 6
LAST SAVED BY:Cblue, 3/24/2023 10:42:17 AM PLOTTED BY:Carri Blue - GM BluePlan 3/24/2023 10:42:45 AM

M-1174 AMR
Arran Landfill Site
Part Lot 20, Concession 7, Municipality of Arran-Elderslie



LEGEND

- TW-1 — MONITORING WELL
- SW-1 — SURFACE WATER SAMPLING STATION
- G-1 — GAS WELL
- TH-1 — TEST HOLE LOCATION
- LIMITS OF MUNICIPALITY OWNED LANDS APPROVED FOR LANDFILLING
- APPROVED PHASE 1 LANDFILL AREA
- HISTORIC LIMIT OF REFUSE PLACEMENT (PRIOR TO JUNE 2000)
- INFERRED GROUNDWATER FLOW DIRECTION
- 234.50 — EXISTING GROUND SURFACE ELEVATION CONTOUR (MASL)
- 234 — GROUNDWATER ELEVATION CONTOUR (MASL)

W/L MEASURED WATER LEVEL ELEVATION (m)
Cl = MEASURED CHLORIDE CONCENTRATION (mg/L)

NOTE:
1. ELEVATIONS ARE GEODETIC.
2. GROUNDWATER ELEVATIONS WERE MEASURED ON OCTOBER 6, 2022.
3. MONITORING WELLS TW1, TW2, AND TW5 WERE NOT CONSTRUCTED IN ACCORDANCE WITH CURRENT STANDARDS.

SCALE = 1:2000

MARCH 2023

ARRAN LANDFILL

FALL 2021 GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

Figure No. 7

BluePlan ENGINEERING

FILE:C:\Carri Documents\2022 Landfills\M1174 AMR Figures.dwg LAYOUT:FIGURE 7
LAST SAVED BY:Cblue, 3/24/2023 10:42:17 AM PLOTTED BY:Carri Blue - GM BluePlan 3/24/2023 10:44:44 AM

APPENDIX A:
CERTIFICATES OF APPROVAL (AND AMENDMENTS)

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

IPORTANT NOTE

HIS FORM MUST BE SUBMITTED
HROUGH THE OFFICE OF
HE REGIONAL WASTE MANAGEMENT ENGINEER

(SEE SECOND SHEET FOR INSTRUCTIONS FOR COMPLETING THIS FORM)

1. Owner (Applicant)	Under the Environmental Protection Act and the Regulations, this application is made by:—	Township of Arran (Name) ..... (Address) Dalbeattie Ontario
2. Type of disposal site	For the ~~Reissue~~ Issue of a Certificate of Approval for a	Garbage disposal site
3. Site location	Located	S½ Lot 20 Con. 7

IF APPLICATION IS FOR REISSUE, COMPLETE SECTIONS 4 AND 5 (A OR B)

4. Previous Certificate details	Certificate / Provisional Certificate of Approval:— for this site was issued on:—	No. ..... 197 .....
5. Changes.	(A) The following changes in use, operation or ownership (have occurred since the date of the original application) OR (are proposed)	
	(B) No change in use, operation or ownership of the site has occurred since the date of the original application.	☐

IF APPLICATION IS FOR ISSUE, COMPLETE SECTIONS 6, 7, 8 AND 9

6. Operator.	The site will be operated in conformity with the Environmental Protection Act and the regulations by:—	(Name) Township of Arran (Address)
7. Publication of Notice.	Notice of this application has been published in the ..... on the following dates ..... and a copy of the notice is attached.	(Name of Newspaper) ☐
8 Municipal Certificate (Non-municipal applicants only)	A certificate, that the site does not contravene any of the by-laws of the ..... Signed by ..... is attached.	Township of Arran (Municipality) G. E. Markham (Name) Clerk (Position)
9. Additional information	The required supporting information to this application is attached.	☐

Dated this 8th day of July 1972

G. E. Markham Clerk

OF A
LANDFILL DISPOSAL SITE

APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE

1. SITE DETAILS

Applicant: Township of Ashfield

Site Location: N ½ Lot 20 Con 7

Total area of Site: 24.3 ha 60 Acres
Total usable area for waste disposal: 2.0 ha 5.0 Acres
Anticipated Lifetime: 5.0 Years
Distance to nearest watercourse: 2500.00 ft
Distance to nearest potable well water supply: 1000.00 ft
Depth of well noted above: 26 ft
Distance to dwelling: 1600.00 ft
Distance to public road measured from working area: 500 ft
Distance to cemetery: 3000.00 ft
Depth from original surface to bottom of waste: 7 ft
Depth from original surface to top of fill: 3 ft
Ground conditions encountered measured from original surface
From ..... To .....
From ..... To .....
From ..... To .....
From ..... To .....
Depth to watertable below surface: 3m 10 ft
on: 197.2
General description of site (location, topography etc.)

Proposed use of land after site fully utilized

FOR REGIONAL USE

Authorities Consulted:

Health Unit	☐ Objection	☐ No Objection
O.W.R.C.	☐ Objection	☐ No Objection
A.M.B.	☐ Objection	☐ No Objection
Municipality	☐ Objection	☐ No Objection
Conservation Authority	☐ Objection	☐ No Objection

Other:

Inspection Record Forms Attached: Yes ☒ No ☐ Mar 22/72 Bowes
Number of Forms: Memo to file July 17/72 K.W.
Regional Engineer's Report Attached ☐ K.W.
Ground water monitoring: Yes ☐ No ☐
Surface water monitoring: Yes ☐ No ☐

3. Quantities

Total Tons per Day
Total Gallons per Day
Estimated ☐ or Measured ☐
Site operated ..... days from ..... to .....
Population served: 12.5.0
Names of Municipalities served
Ashfield

Official Plan ☐ Zoning Bylaw ☐

Site land zoned: A-1
Adjacent land zoned: A-1

Equipment Owned ☐ Rented ☒

2. Wastes to be Disposed of Comprise

Domestic	75 %
Commercial	%
Industrial Waste	%
Hauled Liquid Industrial Waste	%
Agricultural Waste	%
Hazardous Waste	%
Hauled Sewage	25 %
*Other	
	100%

*Describe: municipal type waste

Origin and Composition of Principal Components of Waste (other than domestic and commercial)

4. The Following Documents are Attached

Prepared by

DATED: 6th day of July 1972

Signature of Owner (Applicant)

Clerk

No Carbon Paper Required

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A WASTE DISPOSAL SITE

Provisional Certificate No. 271802

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to

Township of Arran,
Dobbinton, Ontario

for the Landfill Site

located South half of Lot 20, Concession 7,
Township of Arran

subject to the following conditions

1. That burning of domestic refuse be discontinued as a disposal technique.
2. That a soil buffer of 2½ feet in depth be retained between the bottom of the trenched and the maximum groundwater level. 0.76m
3. That an attendant be present at the site whenever it is open to receive wastes.
4. That the operation of the site be reviewed by the Regional Engineer prior to April 30th, 1973.

This Provisional Certificate expires on the 15th day of June, 19 73

Dated this 21st day of December, 19 72

Director, Waste Management Branch

MOE 14-201

Ontario

Ministry of the Environment

Southwestern Region

985 Adelaide Street South
London, Ontario
N6E 1V3
681-3600

June 11, 1980

Township of Arran
R.R. # 2
Tara, Ontario
N0H 2N0

RE: Landfilling Site
S.1/2, Lot 20, Concession 7
Township of Arran
County of Bruce

The enclosed revised Provisional Certificate of Approval contains a condition requiring it be registered on title. The reason for this condition is attached to the Certificate.

Two copies of the Certificate and reasons are on long paper to facilitate registration. Both of these should be taken to the Land Registry Office and one returned to the Director with registration particulars.

If your Certificate does not contain sufficient legal description for registration because you have not given one to the Director, you will have to provide one under Section 23(1) (e) of The Registry Act or in your application under The Land Titles Act.

In the event that the site including its buffer, is part of a larger parcel of land and you do not wish to prepare a new survey at this time, you may register the Certificate against the larger parcel of land. If you do so, the Director is prepared, if requested in the future.

1. In the case of land recorded under The Land Titles Act, to consent to an application to delete the registration from the title of lands not within the site including its buffer zone, and

2. In the case of land recorded under The Registry Act, to issue a Certificate that lands not used for the actual disposal of waste or buffer zone have not been so used.

Such documents would be issued after suitable draft documents including legal description were submitted by you or your successor. The purpose of such documents would be to assure subsequent purchasers that the lands in question were not affected by section 46 of the Environmental Protection Act.

Yours very truly

Director

Ontario

TO: Township of Arran
R.R. # 2
Tara, Ontario
N0H 2N0

You are hereby notified that Provisional Certificate o Approval No. A 271802 has been issued to you subject to th conditions outlined therein.

The reasons for the imposition of these conditions ar as follows:

The reason for the condition requiring registration of the Certificate is that Section 46 of The Environmental Protection Act, 1971 prohibits any use being made of the lands after they cease to be used for waste disposal purposes in order to protect future occupants of the site and the environment from any hazards which might occur as a result of waste being disposed of on the site. This prohibition and potential hazard should be drawn to the attention of future owners and occupants by the Certificate being registered on title.

You may by written notice served upon me and th Environmental Appeal Board within 15 days after receipt of thi Notice, require a hearing by the Board.

This Notice should be served upon:

The Secretary,
Environmental Appeal Board,
1 St. Clair Ave. West,
5th Floor,
Toronto, Ontario.
M4V 1K7

AND

The Director,
Section 39
Ministry of the Environment

DATED this 11th day of June , 1980 .

Ontario of the Environment

PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Township of Arran
R.R. # 2
Tara, Ontario
N0H 2N0

for the use and operation of a 24.3 hectare landfilling site

all in accordance with the following plans and specifications:

Located: S. 1/2 Lot 20, Concession 7
Township of Arran
County of Bruce

which includes the use of the site only for the disposal of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) Domestic, commercial and 10% other, limited to brush wood and wire.

and subject to the following conditions:

1. No operation shall be carried out at the site after sixty days from this condition becoming enforceable unless this Certificate including the reasons for this condition has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director.

Dated this 11th day of June, 1980.

Director, Section 39,
The Environmental Protection Act, 1971

NOTICE OF AMENDMENT

TO: Township of Arran
R.R. # 2
Tara, Ontario
N0H 2N0

You are hereby notified that the approval issued under Provisional Certificate of Approval for a Waste Disposal Site No. A271802, dated June 11, 1980, including all revisions, is hereby amended as follows:

1. The Site will be operated in accordance with the Plan of Development and Operation, Township of Arran Landfill Site, Revision dated April, 1996.

2. The Site will now serve both the Township of Arran and the Village of Tara.

All in accordance with the following plans and specifications:

1. The Application for a Certificate of Approval for a Waste Disposal Site (Landfill) dated March 11, 1996 and signed by Mr. S. Dolphin, Clerk-Treasurer, Township of Arran.

2. The Application for Approval of a Waste Disposal Site dated April 19, 1996 and signed by Mr. S. Dolphin, Clerk-Treasurer, Township of Arran.

3. The Plan of Development and Operation, Township of Arran Landfill Site, Revision dated April, 1996, prepared by Gamsby and Mannerow Limited, Consulting Professional Engineers.

The reasons for the imposition of these conditions are as follows:

A. The reason for condition 1 of this amendment is to ensure that the Site is operated in accordance with the most recent Plan of Development and Operation for the Site.

B. The reason for condition 2 of this amendment is to permit waste from the Village of Tara to be received at the Site, in accordance with an agreement between the Township of Arran and the Village of Tara.

You may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, R.S.O. 1990 c. E-19, as amended, provides that the Notice requiring the hearing shall state:

1. *The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;*
2. *The grounds on which you intend to rely at the hearing in relation to each portion appealed.*

In addition to these legal requirements, the Notice should also include:

3. *The name of the appellant;*
4. *The address of the appellant;*
5. *The Certificate of Approval number;*
6. *The date of the Certificate of Approval;*
7. *The name of the Director;*
8. *The municipality within which the waste disposal site is located;*

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

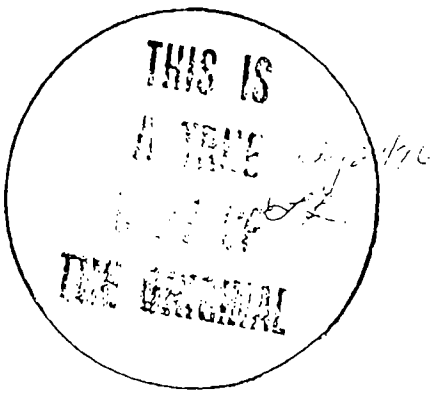
The Secretary,
Environmental Appeal Board,
Suite 502,
112 St. Clair Avenue West,
Toronto, Ontario,
M4V 1N3

AND

The Director,
Section 39, Environmental Protection Act,
Ministry of Environment and Energy,
985 Adelaide Street South
London, Ontario.
N6E 1V3

DATED AT LONDON this 26th *day of* July, 1996.

Director,
Section 39,
Environmental Protection Act



Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER 0441-4J2HV8

Municipality of Arran-Elderslie
P.O. Box 70, 1925 County Road #10
Arran-Elderslie, Ontario
N0G 1L0

Site Location: R. R. #2
Arran-Elderslie Municipality, County Of Bruce
N0H 2N0

You have applied in accordance with Section 27 of the Environmental Protection Act for approval of:

a 1.73 hectare landfill site within a total site area of 24.3 hectares

to be used for the landfilling of the following types of waste:

municipal waste

Note: Use of the site for any other type of waste is not approved under this Certificate, and requires obtaining a separate approval amending this Certificate.

For the purpose of this Provisional Certificate of Approval and the terms and conditions specified below, the following definitions apply:

(a) "Act" and "EPA" mean the **Environmental Protection Act**, R.S.O. 1990, C. E-19 as amended;

(b) "Applicant", "Owner" and "Operator" mean the Corporation of the Township of Arran-Elderslie, including its officers, employees, agents or contractors;

(c) "Certificate" means this entire Provisional Certificate of Approval including its schedules, issued in accordance with Section 27, Part V of the **Environmental Protection Act**;

(d) "Director" means a Director, Environmental Assessment and Approvals Branch, the Ontario Ministry of the Environment;

(e) "District Manager" means the District Manager of the Barrie District Office, Southwestern Region of the Ontario Ministry of the Environment;

(f) "interim closure" means an extended period of time in which the Site is not actively operating but is not

recognized as permanently closed;

(g) "Ministry" means the Ontario Ministry of the Environment (MOE);

(h) "municipal waste" means municipal waste as defined in Ontario Regulation 347, R.R.O. 1990;

(i) "Reasonable Use Guideline" means the Ministry Guideline No. B-7 entitled, "Incorporation of the Reasonable Use Concept into MOE Groundwater Management Activities", dated April 1994, or as amended;

(j) "Site" means the landfill site as described in this Certificate; and

(k) "waste fill areas" means the area on the surface of the landfilling site beneath which or above which waste is disposed by landfilling;

(l) "trained" means knowledgeable regarding the contents of this Provisional Certificate of Approval, waste management, relevant health and safety concerns, emergency procedures, and relevant Legislation and Regulations pertaining to waste management and disposal.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

A. GENERAL

1. Except as otherwise provided by these Conditions, the Site shall be operated, in accordance with the Application for a Certificate of Approval for a Waste Disposal Site, dated July 8, 1972 and Application for Approval of a Waste Disposal Site, dated February 15, 2000 and its supporting documents as listed in Schedule "A".

2. The requirements specified in this Certificate are the requirements under the **Environmental Protection Act**, R.S.O. 1990. The issuance of this Certificate in no way abrogates the Applicant's legal obligations to take all reasonable steps to avoid violating other applicable provisions of this legislation and other legislation and regulations.

3. The requirements of the Certificate are severable. If any requirement of this Provisional Certificate of Approval, or the application of any requirement of the Provisional Certificate of Approval to any circumstance, is held invalid, the application of such requirement to other circumstances and the remainder of the Provisional Certificate of Approval shall not be affected in any way.

4. The Applicant shall ensure compliance with all the terms and conditions of this Certificate. Any non-compliance constitutes a violation of the **Environmental Protection Act**, R.S.O. 1990 and

is grounds for enforcement.

5. (a) The Applicant shall, forthwith upon request of the Director, District Manager, or Provincial Officer (as defined in the Act), furnish any information requested by such persons with respect to compliance with this Certificate, including but not limited to, any records required to be kept under this Certificate; and

(b) In the event, the Applicant provides the Ministry with information, records, documentation or notification in accordance with this Certificate (for the purposes of this condition referred to as "Information"),

i. the receipt of Information by the Ministry;

ii. the acceptance by the Ministry of the Information's completeness or accuracy; or

iii. the failure of the Ministry to prosecute the Applicant, or to require the Applicant to take any action, under this Certificate or any statute or regulation in relation to the Information;

shall not be construed as an approval, excuse or justification by the Ministry of any act or omission of the Applicant relating to the Information, amounting to non-compliance with this Certificate or any statute or regulation.

6. The Applicant shall allow Ministry personnel, or a Ministry authorized representative(s), upon presentation of credentials, to:

(a) carry out any and all inspections authorized by Section 156, 157 or 158 of the **Environmental Protection Act**, R.S.O. 1990, Section 15, 16 or 17 of the **Ontario Water Resources Act**, R.S.O. 1990, or Section 19 or 20 of the **Pesticides Act**, R.S.O. 1990, as amended from time to time, of any place to which this Certificate relates; and,

without restricting the generality of the foregoing, to:

(b) i. enter upon the premises where the records required by the conditions of this Certificate are kept;

ii. have access to and copy, at reasonable times, any records required by the conditions of this Certificate;

iii. inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations required by the conditions of this Certificate; and,

iv. sample and monitor at reasonable times for the purposes of assuring compliance with the conditions of this Certificate.

7. (a) Where there is a conflict between a provision of any document referred to in Schedule "A" and the conditions of this Certificate, the conditions in this Certificate shall take precedence; and,

(b) Where there is a conflict between documents listed in Schedule "A", the document bearing the most recent date shall prevail.

8. The Applicant shall ensure that all communications/correspondence made pursuant to this Certificate includes reference to the Certificate approval number A 271802.

9. The Applicant shall notify the Director in writing of any of the following changes within thirty (30) days of the change occurring:

(a) change of Applicant or Operator of the Site or both;

(b) change of address or address of the new Applicant;

(c) change of partners where the Applicant or Operator is or at any time becomes a partnership, and a copy of the most recent declaration filed under the **Business Names Act**, 1991 shall be included in the notification to the Director;

(d) any change of name of the corporation where the Applicant or Operator is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" (form 1 or 2 of O. Reg. 182, Chapter C-39, R.R.O. 1990 as amended from time to time), filed under the **Corporations Information Act** shall be included in the notification to the Director; and,

(e) change in directors or officers of the corporation where the Applicant or Operator is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" as referred to in 9(d), supra.

10. In the event of any change in ownership of the Site, the Applicant shall notify, in writing, the succeeding owner of the existence of this Certificate, and a copy of such notice shall be forwarded to the Director.

11. Any information relating to this Certificate and contained in Ministry files may be made available to the public in accordance with the provisions of the **Freedom of Information and Protection of Privacy Act**, R.S.O. 1990, C. F-31.

12. All records and monitoring data required by the conditions of this Certificate shall be kept on the Owner's premises for a minimum period of two (2) years from the date of their creation.

13. The obligations imposed by the terms and conditions of this Certificate are obligations of due diligence.

B. PROHIBITION AND REGISTRATION ON TITLE

14. (a) Pursuant to Section 197 of the EPA, neither the Applicant nor any person having an interest in the Site shall deal with the Site in any way without first giving a copy of the Provisional Certificate of Approval to each person acquiring an interest in the Site as a result of the dealing;

(b) Within sixty (60) calendar days of the date of this Certificate of Approval, submit to the Director for the Director's signature two (2) copies of a completed Certificate of Prohibition containing a registerable description of the Site, in accordance with Form 1 of O. Reg. 14/92; and,

(c) Within ten (10) calendar days of receiving the Certificate of Prohibition, the Applicant shall register the Certificate of Prohibition in the appropriate Land Registry Office on title and immediately following registration, submit to the Director the duplicate registered copy.

C. SITE OPERATIONS

15. (a) The approved theoretical volumetric capacity of the Site is calculated to be 808 000 cubic metres;

(b) Waste fill areas A, B1, B2, and C, with total combined capacity, excluding final cover, of 60 000 cubic metres, are approved for development and use in accordance with the "Plan of Development and Operation Township of Arran Landfill Site", dated April 1996;

(c) Development and use of the remaining Site capacity shall not commence without first obtaining an approval issued by the Director for a design and operating plan for each area to be developed, and all works shall be carried out in accordance with the Director's approval.

16. The Applicant shall operate and maintain the Site in an environmentally safe manner which ensures the health and safety of all persons and the protection of the environment.

17. The Site shall be operated and maintained in accordance with the "Plan of Development and Operation Township of Arran Landfill Site", dated April 1996.

18. The Site may only receive municipal waste generated within the geographic area of the Corporation of the Township of Arran-Elderslie.

19. Delivery and removal of waste to and from the Site shall be conducted in accordance with

Ontario Regulation 347, R.R.O. 1990.

20. (a) The operating hours of this Site shall be posted on a permanent readable sign at the entrance to the Site. The sign shall include information on waste types which may be accepted at the Site, the area serviced by this Site, the license number of the Site and the name of the Applicant's contact telephone number(s) for emergencies, complaints and enquires.

(b) The Site shall only be operated under the supervision of a trained operator and shall be locked and secure at all other times.

21. Burning of brush and clean waste wood material is permitted providing the burning is continuously supervised and carried out in compliance with the Ministry of the Environment " Guidelines for Burning at Landfill Sites in Ontario".

22. If at any time problems such as dust, odour, vectors, litter, illegal dumping or other nuisances are generated at the Site, resulting in complaints received by this Ministry and validated by a Provincial Officer, then the Applicant shall, upon request of the Ministry, take appropriate and immediate remedial action. Appropriate measures may include temporary stoppage of all operations until the problem has been rectified and measures have been undertaken to prevent future occurrences.

23. Scavenging of waste is not permitted at this Site.

24. The Applicant shall ensure that personnel supervising the landfilling operation are aware of the types of waste which may be disposed at this Site; and that they are knowledgeable about the requirements of this Certificate and the Site operation.

D. SITE MONITORING

25. The Applicant shall ensure the monitoring program contained in Schedule "B" is carried out annually.

26. The Site monitoring program may be amended from time to time, as required, by the District Manager.

E. REPORT SUBMISSIONS

27. The Applicant shall submit an annual report on the operation, development and monitoring of the Site to the District Manager by March 31st of each year. The report shall cover the calendar year ending the preceding December 31st and shall include the following, where applicable:

(a) an updated site contour plan(s) showing areas that have been filled with waste, and areas to be filled with waste during the next reporting period;

(b) a summary of the number of truckloads and estimated quantities of waste received, landfilled, and the estimated quantity of cover materials used;

(c) an estimate of the remaining Site capacity and Site life;

(d) any operational or environmental problems encountered and any mitigative actions taken;

(e) the data and interpretive analyses of the data from all monitoring programs;

(f) an assessment of the need for any remedial measures;

(g) the status of compliance with all Conditions of this Certificate, including inspection and reporting requirements;

(h) any recommendations for changes to the operation, development and monitoring of the Site; and,

(i) any other information required under this Certificate or which the Director or the District Manager may require from time to time.

F. CLOSURE PLAN

28. Two (2) years prior to the time the Site reaches its approved capacity, the Applicant shall submit to the Director, for approval, a detailed Site closure plan which includes but is not limited to the following: post-closure inspection, maintenance and monitoring, and end use.

29. Six (6) months prior to interim closure of the Site, the Owner shall submit to the District Manager for approval, a detailed interim Site closure plan which includes but is not limited to the following: schedule and plans for Site inspections, maintenance and monitoring, and details regarding interim cover and Site security. The Site shall not be closed in the interim unless in accordance with an approved interim closure plan.

G. EMERGENCIES

30. In case of an emergency at this Site, the Applicant shall forthwith call the Ministry of the Environment Spills Action Centre (1-800-268-6060). All emergencies shall be recorded in the annual report described in Condition 28.

SCHEDULE "A"

This Schedule "A" forms part of Provisional Certificate of Approval No. A 271802:

1. Application for Approval of a Landfill Disposal Site from the Township of Arran, dated July 8, 1972 and supporting information.
2. Provisional Certificate of Approval No. A271802, dated December 21, 1972.
3. Provisional Certificate of Approval No. A271802, dated June 11, 1980.
4. Plan of Development and Operation Township of Arran Landfill Site, prepared by Gamsby and Mannerow Limited, dated April 1996.
5. Notice of Amendment to Certificate of Approval No. A271802, dated July 26, 1996.
6. Application for Approval of a Waste Disposal Site from the Corporation of the Municipality of Arran-Elderslie, dated February 15, 2000 and supporting information.
7. Letter from S. Ellis, MOE to J. Albright, Corporation of the Municipality of Arran-Elderslie, dated February 28, 2000 requesting additional supporting information.
8. Covering letter from P. Brodzikowski, Henderson, Paddon Environmental Inc. to S. Ellis, MOE, dated March 6, 2000 providing additional supporting information.

SCHEDULE "B"

This Schedule "B" forms part of Provisional Certificate of Approval No. A 271802:

GROUNDWATER MONITORING

Sample Location	Sample Frequency	Sample Analyses Required
TW-1, TW-2, TW-4, TW-5 TW-8, TW-9, TW-10, TW-11, TW-12, TW-13, TW-14, TW-15	Semi-annual (Spring and Fall)	Conductivity, Chloride, Alkalinity, Iron, pH, Total Ammonia, Hardness, Sodium, Nitrate, Nitrite, Total Dissolved Solids, Sulphate, Total Kjeldahl Nitrogen Water Levels

SURFACE WATER MONITORING

Sample Location	Sample Frequency	Sample Analyses Required
SW-1, SW-2, SW-3, SW-4, SW-5, SW-6	Semi-annual (Spring and Fall)	Conductivity, Chloride, Alkalinity, Iron, pH, Total Ammonia, Total Phosphorus, Phenol, Dissolved Oxygen, Temperature (field)

LANDFILL GAS MONITORING

Sample Location	Sample Frequency	Sample Analyses Required
G-1, G-2, G-3	Semi-annual (Spring and Fall)	Methane gas by volume

The reasons for the imposition of these terms and conditions are as follows:

The reason for the imposition of these changes and the replacement of the Certificate issued on June 11, 1980, and as amended July 26, 1996 with this Certificate, is to bring the Site into compliance with current operating procedures for Landfill Sites and to accommodate the service area change request by the Township.

Specific reasons for the Conditions are as follows:

1. Conditions 1, 3, 4, 5, 8, 9, 10, 11, 12 and 13 are to clarify the legal rights and obligations of this Certificate.
2. Condition 7 is to ensure that the appropriate Ministry staff have ready access to the waste Site to inspect the operations that are approved under this Certificate. The condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the ***Environmental Protection Act*** as amended.
3. Conditions 2 and 6 are to ensure that the waste disposal Site is operated in accordance with the application for this Certificate and supporting information and not in any way or under any name which the Director has not been asked to consider; and to ensure the property is cleaned up and restored to the satisfaction of the Ministry.
4. Condition 14 is required to clarify that the terms and conditions of this Certificate impose a standard of due diligence and not absolute liability.
5. Conditions 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, and 30 are to ensure that the Site is used only for the wastes and quantities specified; that the Site is properly supervised, monitored and operated in an organized and secure manner by trained persons in order to prevent environmental detriment and to ensure the safety of the general public and site personnel; that the collection, handling, and transportation of all waste materials are conducted in an environmentally acceptable manner in accordance with Provincial regulations; and that emergencies are properly recorded.
6. Conditions 28 and 29 are to ensure the Site is closed in accordance with Ministry standards and to ensure the environment and health and safety of the public are protected.

This Provisional Certificate of Approval revokes and replaces Certificate(s) of Approval No. A271802 issued on June 11, 1980, and amended July 26, 1996.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as

amended, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Appeal Board
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* **Further information on the Environmental Appeal Board's requirements for an appeal can be obtained directly from the Board at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 11th day of April, 2000

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED
ON ..... Apr. 14/00 .....
(Signed)

Andrzej Dominski, P.Eng.
Director
Section 39, *Environmental Protection Act*

SE/
c: District Manager, MOE Owen Sound

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER 0441-4J2HV8
Notice No. 1
Issue Date: October 29, 2012

The Corporation of the Municipality of Arran-Elderslie
1925 County Road 10
Post Office Box, No. 70
Arran-Elderslie, Ontario
N0G 1L0

Site Location: Arran Landfill Site
657 Sideroad 20 Arran, Part 1, Ref. Plan RP-3R9072
Lot S 1/2 Lot 20, Concession 7
Arran-Elderslie Municipality, County of Bruce

You are hereby notified that I have amended Approval No. 0441-4J2HV8 issued on April 11, 2000 for the use and operation of a 4.45 ha landfill within a total site area of 25.46 hectares , as follows:

I. The following definitions are hereby added to this Approval:

"*Approval* " means this Environmental Compliance Approval, including all items, conditions and Schedules attached to and forming part of this Approval, as amended by the Director.

"*Director* " means any *Ministry* employee appointed by the Minister pursuant to Part II.1 of the Environmental Protection Act, as amended.

II. The following conditions of this Approval are hereby amended:

REGISTRATION ON TITLE

14. (d) Within sixty (60) days of the date of this *Approval* , the *Owner* shall submit to the *Director* for the Director's signature two (2) copies of a completed Certificate of Requirement, containing a registerable description of the 1.16 hectare land to the north of the *Site* .

(e) Within ten (10) calendar days of receiving the Certificate of Requirement signed by the *Director* , the Owner shall register the Certificate of Requirement in the appropriate land registry office on title to the *Site* and submit to the *Director* a duplicate registered copy.

LANDFILL OPERATIONS

25. Site development in Phase I area, in accordance with Items 9 through 12 in Schedule "A", is hereby approved.

26. Should it become necessary to implement the contingency leachate collection system, the Owner shall submit the detailed design drawings and specifications, quality assurance / quality control program for the construction of the leachate header pipe, cleanouts, and leachate storage facility, operation and maintenance of the leachate collection system for Director's approval prior to implementation.

27. The annual amount of waste disposed of at the Site shall not exceed 6,000 cubic metres.

28. The *Owner* shall develop and implement a program to inspect waste to ensure that the waste is of a type approved for acceptance under this *Approval* .

29. All loads of waste must be properly inspected by trained site personnel prior to acceptance at the site and waste vehicles must be diverted to appropriate areas for waste disposal.

30. The Owner shall deposit waste in a manner that minimizes exposure area at the landfill working face and all waste shall be compacted before cover is applied.

31. No waste shall be deposited in groundwater or surface water at the site.

32. The *Site* shall be operated and maintained such that the vermin, vectors, dust, litter, odour, noise and traffic do not create a nuisance.

33. The Owner shall control fugitive dust emissions from on site sources including but not limited to on-site roads, stockpiled cover material and, closed landfill area prior to seeding especially during times of dry weather conditions. If necessary, major sources of dust shall be treated with water and/or dust suppression materials to minimize the overall dust emissions from the site.

34. The Owner shall take all practical steps to prevent escape of litter from the site. The Owner shall inspect and collect litter from the site on a weekly basis during the spring, summer and fall months. During winter months, litter collection shall be completed on a bi-weekly frequency. All loose, windblown litter shall be collected and disposed of at the landfill working face.

35. All buildings are to be free of any landfill gas accumulation. The Owner shall provide adequate ventilation systems to relieve landfill gas accumulations in buildings if necessary.

36. Burning of any type of waste, clean wood and brush is prohibited at this Site.

Landfill Cover

37. Cover material shall be applied as follows:
    a. Daily Cover - At the end of each working day, the entire working face shall be covered

with a minimum thickness of 150 mm of soil cover or an approved thickness of alternative cover material;

b. Intermediate Cover - In areas where landfilling has been temporarily discontinued for six months or more, a minimum thickness of 300 mm of soil cover or an approved thickness of alternative cover material shall be placed; and

c. Final Cover - In areas where landfilling has been completed to final contours, a minimum 600 mm thick layer of final cover soil having a hydraulic conductivity value of 10^{-7} m/s or less shall be placed in lifts of 150 mm or less. The final cover material shall be compacted to 95% Standard Proctor Density (SPD). A layer of 150 mm of topsoil shall be placed above the 600 mm thick soil layer. Fill areas shall be progressively completed and rehabilitated as landfill development reaches final contours.

Employees and Training

38. A training plan for all employees that operate any aspect of the site shall be developed and implemented by the *Owner* . Only *Trained Personnel* shall operate any aspect of the *Site* or carry out any activity required under this *Approval* .

Daily Inspections and Log Book

39. An inspection of the entire *Site* and all equipment on the *Site* shall be conducted each day the *Site* is in operation to ensure that: the *Site* is secure; that the operation of the *Site* is not causing any nuisances; that the operation of the *Site* is not causing any adverse effects on the environment and that the site is being operated in compliance with this *Approval* . Any deficiencies discovered as a result of the inspection shall be remedied immediately, including temporarily ceasing operations at the *Site* if needed.

40. A record of the inspections shall kept in a daily log book that includes:
    a. the name and signature of person that conducted the inspection;
    b. the date and time of the inspection;
    c. the list of any deficiencies discovered;
    d. The recommendations for remedial action; and
    e. the date, time and description of actions taken.

41. A record shall be kept in the daily log book of all refusal of waste shipments, the reason(s) for refusal, and the origin of the waste, if known.

Monitoring Program

42. By September 30, 2012, the Owner shall install two new deep monitoring wells at the east site boundary and three new monitoring wells in the vicinity of landfill footprint as described in Item 11 of Schedule "A".

43. Groundwater, surface water and landfill gas monitoring shall be carried out by the Owner in

accordance with the sampling program set out in Section 17.0 and Table 6 of Item 9 in Schedule "A", with the addition of the five new monitoring wells described in Condition 41.

44. No alterations to the groundwater or surface water monitoring programs shall be implemented prior to receiving written agreement from the District Manager or written approval from the Director.

45. (1) The Owner shall follow the trigger mechanisms for groundwater and surface water as detailed in Attachment A in Item 9 and Table 1 in Item 11 of Schedule "A".

(2) In the event a result of a monitoring test carried out under a monitoring program does not comply with the standards set out in the above condition, the *Owner* shall:

a. notify the District Manager immediately upon receipt of the result;
b. conduct confirmatory sampling within 30 days of the trigger event date;
c. conduct an investigation into the cause of the adverse result and submit a report to the *District Manager* that includes an assessment of whether contingency measures need to be carried out;
d if contingency measures are needed, submit detailed plans, specifications and descriptions for the design, operation and maintenance of the contingency measures, and a schedule as to when these measures will be implemented, to the *Director* and notify *District Manager* ; and
e implement the required contingency measures upon approval by the *Director* .

Surface Water Management

46. The Owner shall take all appropriate measures to minimize surface water from coming in contact with waste. Temporary berms and ditches shall be constructed around active waste disposal areas to prevent extraneous surface water from coming in contact with the active working face.

Complaints Procedure

47. If at any time, the *Owner* receives complaints regarding the operation of the *Site* , the *Owner* shall respond to these complaints according to the following procedure:

a) The *Owner* shall record and number each complaint, either electronically or in a log book, and shall include the following information: the nature of the complaint, the name, address and the telephone number of the complainant if the complainant will provide this information and the time and date of the complaint;
b) The Owner, upon notification of the complaint, shall initiate appropriate steps to determine all possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a formal reply to the complainant; and
c) The Owner shall complete and retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and any

recommendations for remedial measures, and managerial or operational changes to reasonably avoid the recurrence of similar incidents.

Emergency Situations

48. In the event of a fire or discharge of a contaminant to the environment, site staff shall forthwith notify the MOE Spills Action Centre (1-800-268-6060) and the District Office of the MOE.

49. The Owner shall submit to the District Manager a written report within 3 days of the spill or incident, outlining the nature of the incident, remedial measures taken and measures taken to prevent future occurrences at the Site.

50. The Owner shall prepare an Emergency Response Manual for the site within ninety (90) days of issuance of this Approval in consultation with local emergency response agencies. The Emergency Response Manual should indicate the responsibility of each of the stakeholders with respect to handling possible emergency situations.

51. The Emergency Response Manual shall be updated on a regular basis and be provided to the District Manager within one month of the revision date.

52. The Owner shall ensure that adequate fire fighting and contingency spill clean up equipment is available and that emergency response personnel are familiar with its use and location.

Closure Plan

53. At least 2 years prior to the anticipated date of closure of this *Site* , the Owner shall submit to the *Director* for approval, with copies to the *District Manager* , a detailed site closure plan pertaining to the termination of landfilling operations at this *Site* , post-closure inspection, maintenance and monitoring, and end use. The plan shall include the following:
    a. a plan showing *Site* appearance after closure;
    b. a description of the proposed end use of the *Site* ;
    c. a descriptions of the procedures for closure of the *Site,* including:
        i. advance notification of the public of the landfill closure;
        ii. posting of a sign at the Site entrance indicating the landfill is closed and identifying any alternative waste disposal arrangements;
        iii. completion, inspection and maintenance of the final cover and landscaping;
        iv. site security;
        v. removal of unnecessary landfill-related structures, buildings and facilities; and
        vi. final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas;
    d. a schedule indicating the time-period for implementing sub-conditions i) to vi) above.
    e. descriptions of the procedures for post-closure care of the Site, including:
        i. operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas;
        ii. record keeping and reporting; and

iii. complaint contact and response procedures;

f. an assessment of the adequacy of and need to implement the contingency plans for leachate and methane gas; and

g. an updated estimate of the contaminating life span of the *Site* , based on the results of the monitoring programs to date.

54. The *Site* shall be closed in accordance with the closure plan as approved by the *Director.*

Annual Report

55. A written report on the development, operation and monitoring of the *Site* , shall be completed annually. The Annual Report shall be submitted to the *District Manager* by April 30 of the year following the calendar year covered by the report.

56. The Annual Report shall include the following:

a. the results and an interpretive analysis of the results of all leachate, groundwater, surface water and landfill gas monitoring, including an assessment of the need to amend the monitoring programs and the trigger mechanisms;

b. an assessment of the operation and performance of all engineered facilities, the need to amend the design or operation of the *Site* , and the adequacy of and need to implement the contingency plans;

c. an evaluation of the horizontal and vertical extent of the leachate impact on groundwater, and an updated estimate of contaminant attenuation zone required based on the groundwater monitoring data;

d. site plans showing the existing contours of the *Site;* areas of landfilling operation during the reporting period; areas of intended operation during the next reporting period; areas of excavation during the reporting period; the progress of final cover, vegetative cover, and any intermediate cover application; previously existing site facilities; facilities installed during the reporting period; and site preparations and facilities planned for installation during the next reporting period;

e. calculations of the volume of waste, daily and intermediate cover, and final cover deposited or placed at the *Site* during the reporting period and a calculation of the total volume of Site capacity used during the reporting period;

f. a calculation of the remaining capacity of the *Site* and an estimate of the remaining *Site* life;

g. a summary of the weekly, maximum daily and total annual quantity (tonnes) of waste received at the Site.

h. a summary of any complaints received and the responses made;

i. a discussion of any operational problems encountered at the *Site* and corrective action taken;

j. any changes to the Plan of Development and Operations and the Closure Plan that have been approved by the Director since the last *Annual Report;*

k. a report on the status of all monitoring wells and a statement as to compliance with Ontario Regulation 903; and

l. any other information with respect to the *Site* which the *District Manager* may require

from time to time.

III. The following items are hereby added to Schedule "A"

9. Report entitled "Plan of Development & Operations - Phase I Arran Landfill, Municipality of Arran-Elderslie, County of Bruce" dated February 2011 (Revised August 2012) prepared by Gamsby and Mannerow Limited.

10. Report entitled "Hydrogeologic Investigation Arran Landfill Site, Municipality of Arran-Elderslie" dated February 2007 prepared by Gamsby and Mannerow Limited.

11. Letter dated January 11, 2012 addressed to Ministry of the Environment from Gamsby and Mannerow providing a response to the Ministry's review comments on the Phase I Plan of Development and Operations.

12. Report entitled "Stormwater Management Report Arran Landfill, Municipality of Arran-Elderslie, County of Bruce" dated March 2012 prepared by Gamsby and Mannerow Limited.

IV. Schedule "B" of this Approval is hereby revoked.

The reasons for this amendment to the Approval are as follows:

1. The reason for amending Condition 14 is to ensure the newly acquired land is registered on the Site's tile. This is to provide that anypersons having an interest in the Site are aware that the land has been approved and used for the purposes of waste disposal.

2. The reason for Condition 25 is to approve the Development and Operations Plan for Phase I of the Site.

3. The reason for Condition 26 is to ensure the leachate collection system if required, is properly designed, constructed, and operated.

4. The reason for Condition 27 is to specify the maximum allowable fill rate at the Site.

5. The reason for Conditions 28 and 29 is to ensure appropriate waste inspection procedures are undertaken so that waste that is disposed of at the site is in accordance with the type specified in this Approval.

6. The reasons for Conditions 30, 31, 32, 33, 34, and 35 are to ensure that the Site is operated inspected and maintained in an environmentally acceptable manner and does not result in a hazard or nuisance to the natural environment or any person.

7. The reason for Condition 36 is to ensure no waste burning is carried out at the Site for safety and air quality issues.

8. The reasons for Conditions 37 are to ensure that daily and intermediate cover is used to control potential nuisance effects, to facilitate vehicle access on the site, and to ensure an acceptable site appearance is maintained. The proper closure of a landfill site requires the application of a final cover which is aesthetically pleasing, controls infiltration, and is suitable for the end use planned for the site.

9. The reason for Condition 38 is to ensure that the Site is supervised and operated by properly trained staff in a
manner which does not result in a hazard or nuisance to the natural environment or any person.

10. The reason for Condition 39, 40 and 41 is to ensure that the Site is supervised and operated by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person.

11. The reason for Condition 42, 43, and 44 are to demonstrate that the landfill site is performing as designed and the impacts on the natural environment are acceptable. Regular monitoring allows for the analysis of trends over time and ensures that there is an early warning of potential problems so that any necessary remedial/contingency action can be taken.

12. The reason for Condition 45 is to ensure that the Owner follows a plan with an organized set of procedures for
identifying and responding to unexpected but possible problems at the Site. A remedial action / contingency plan is
necessary to ensure protection of the natural environment.

13. The reason for Condition 46 is to ensure that the surface water discharged to the environment does not have an impact on the environment.

14. The reason for Condition 47 is to ensure that any complaints regarding landfill operations at this Site are responded to in a timely and efficient manner.

15. The reason for Conditions 48, 49, 50, 51 and 52 are is to guarantee that appropriate measures are taken by the Owner to prevent future occurrences of spills or fires at the site and to protect public health and safety and the environment.

16. The reasons for Conditions 53 and 54 is to ensure that final closure of the Site is completed in accordance with Ministry standards, and to ensure the long-term protection of the health and safety of the public and the environment.

17. The reasons for Conditions 55 and 56 are to ensure that regular review of site development, operations and monitoring data is documented and any possible improvements to site design, operations or monitoring programs are identified. An annual report is an important tool used in reviewing site activities and for determining the effectiveness of site design.

This Notice shall constitute part of the approval issued under Approval No. 0441-4J2HV8 dated April

11, 2000

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 29th day of October, 2012

THIS NOTICE WAS MAILED
ON Oct. 31, 2012
SC
(Signed)

Tesfaye Gebrezghi, P.Eng.
Director
appointed for the purposes of Part II.1 of the

RL/

c: District Manager, MOE Owen Sound
Matthew Nelson, Gamsby and Mannerow Limited √

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 0441-4J2HV8
Notice No. 2
Issue Date: December 6, 2017

The Corporation of the Municipality of Arran-Elderslie
1925 Bruce County Road 10
Post Office Box, No. 70
Chesley, Ontario
N0G 1L0

Site Location: Arran Landfill Site
Lot 20, Concession 7
Arran-Elderslie Municipality, County of Bruce, N0H 2N0

You are hereby notified that I have amended Approval No. 0441-4J2HV8 issued on April 11, 2000 and amended on October 29, 2012 for the use and operation of a 4.45 ha landfill within a total site area of 25.46 hectares , as follows:

Condition 45(2) is hereby revoked.

Condition 45(1) is hereby revoked and replaced with the following:

45. (1) The *Owner* shall follow the trigger mechanisms for groundwater and surface water shall be in accordance with Item 13 of Schedule "A".

Item 13 is added to the Schedule "A":

13. Environmental Compliance Approval Application dated June 28, 2017 and signed by Scott McLeod, Public Works Manager, the Corporation of the Municipality of Arran-Elderslie, including the attached report titled "Municipality of Arran-Elderslie, Trigger Mechanism & Contingency Plan, Arran Landfill Site - Phase I" dated February 2011 (Revision 2: December 2017) prepared by GM Blue Plan Engineering.

The reason for this amendment to the Approval is to approve the revised trigger mechanisms and contingency plans.

This Notice shall constitute part of the approval issued under Approval No. 0441-4J2HV8 dated April 11, 2000

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of the Environmental Protection Act
Ministry of the Environment and Climate Change
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 6th day of December, 2017

THIS APPROVAL WAS MAILED
ON DEC 13 2017
(Signed)

Dale D. Gable

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RM/
c: District Manager, MOECC Owen Sound
Matthew Nelson, GM BluePlan Engineering Limited

Ontario

Ministry of the Environment
Ministère de l'Environnement

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 7585-8QKL5Q
Issue Date: July 17, 2012

The Corporation of the Municipality of Arran-Elderslie
1925 County Road 10
Post Office Box, No. 70
Arran-Elderslie, Ontario
N0G 1L0

Site Location: Arran Landfill Site
657 Sideroad 20 Arran, Part 1, Ref. Plan RP-3R9072
Lot S 1/2 Lot 20, Concession 7
Arran-Elderslie Municipality, County of Bruce

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

Constructing a stormwater management facility to service 7.3 ha drainage area of Phase I development of Arran Landfill Site within a total of 24.3 ha drainage area property located at Lot S1/2 Lot 20, Concession 7, Municipality of Arran-Elderslie, County of Bruce, designed to provide quality and quantity control of stormwater runoff by attenuating runoff from storm events with up to 1:100 year return frequency to pre-development levels, consisting of the following:

South Drainage Ditch

- One (1) approximately 170 m long drainage V-shaped ditch running along the southern part of the site having 3H:1V side slopes, variable depth with a minimum of 0.5 m, and a 0.90% horizontal slope, discharging through a sediment forebay to a stormwater management facility described below;

North Drainage Ditch

- One (1) approximately 325 m long drainage ditch running along the northern and western part of the site having a 1.0 m bottom width, 3H:1V side slopes, variable depth with a minimum of 0.3 m, and a horizontal slope ranging from 0.6% to 1.5%, flowing through a 450 mm diameter storm sewer, discharging through a sediment forebay to a stormwater management facility described below;

Stormwater Management Facility (Wetland)

- One (1) extended detention stormwater management facility located at the south-western part of the landfill footprint, having an approximate total length of 160 m, a typical width of 15.0 m, an average depth of 1.2 m (top at 235 m MASL, bottom at 233.8 m MASL), and side slopes of 5H:1V; equipped with one (1) 5 m wide x 10 m long x 0.5 m deep sediment forebay (east forebay), one (1) 5 m wide x 10 m long x 0.5 m deep sediment forebay (west forebay), and one (1) 5 m wide x 20 m long x 0.5 m deep permanent micro pool; providing a permanent storage capacity of 310 m^3 and an extended storage capacity of 1,625 m^3; equipped with an outlet structure consisting of one (1) 250 mm diameter HDPE storm sewer, discharging to an existing stormwater pond which discharges to an existing swamp area and eventually to Arkwright Creek;

- including all controls and associated appurtenances.

All in accordance with the supporting documentation listed in Schedule 'A'.

For the purpose of this environmental compliance approval, the following definitions apply:

"*Approval*" means this entire document and any schedules attached to it, and the application.

"*Director*" means a person appointed by the Minister pursuant to section 5 of the *EPA* for the purposes of Part II.1 of the *EPA*.

"*District Manager* " means the District Manager of the Owen Sound District Office of the Ministry.

"*EPA*" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended.

"*Ministry*" means the ministry of the government of Ontario responsible for the *EPA* and *OWRA* and includes all officials, employees or other persons acting on its behalf.

"*Owner* " means The Corporation of the Municipality of Arran-Elderslie and its successors and assignees.

"*OWRA* " means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended.

"Substantial Completion" has the same meaning as *"substantial performance* " in the Construction Lien Act.

"*Works* " means the sewage works described in the *Owner's* application and this *Approval*

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

(1) The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Works* is notified of this *Approval* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) Except as otherwise provided by these conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Approval,* and the application for approval of the Works.

(3) Where there is a conflict between a provision of any submitted document referred to in this *Approval* and the conditions of this *Approval,* the conditions in this *Approval* shall take precedence, and where there is a conflict between the listed submitted documents in the schedule, the document bearing the most recent date shall prevail.

(4) Where there is a conflict between the documents listed in the Schedule and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(5) The conditions of this *Approval* are severable. If any condition of this *Approval,* or the application of any condition of this *Approval* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Approval* shall not be affected thereby.

2. EXPIRY OF APPROVAL

The approval issued by this *Approval* will cease to apply to those parts of the *Works* which have not been constructed within five (5) years of the date of this *Approval.*

3. CHANGE OF OWNER

(1) The *Owner* shall notify the *District Manager* and the *Director,* in writing, of any of the following changes within thirty (30) days of the change occurring:

(a) change of *Owner;*
(b) change of address of the *Owner;*
(c) change of partners where the *Owner* is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the *District Manager;*
(d) change of name of the corporation where the *Owner* is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the *District Manager;*

(2) In the event of any change in Ownership of the *Works,* other than a change to a successor municipality, the *Owner* shall notify in writing the succeeding owner of the existence of this *Approval,* and a copy of such notice shall be forwarded to the *District Manager* and the *Director.*

4. UPON THE SUBSTANTIAL COMPLETION OF THE WORKS

(1) Upon the *Substantial Completion* of the *Works* , the Owner shall prepare a statement, certified by a Professional Engineer, that the Works are constructed in accordance with this *Approval,* and upon request, shall make the written statement available for inspection by Ministry personnel.

(2) Within one (1) year of the *Substantial Completion* of the *Works* , a set of as-built drawings showing the Works "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the *Works* for the operational life of the *Works.*

5. MONITORING AND RECORDING

(1) The *Owner* shall carry out the following stormwater monitoring program. Grab samples shall be collected from the designated sampling locations at a **semi-annual frequency (spring and fall)** and analysed for the following parameters listed in Table 1:

Table 1 - Stormwater Monitoring
Sampling Locations[*Note 1]: **Stormwater Management Pond Outlet**

Parameters	Parameters	Field Parameters
Alkalinity	Arsenic	Conductivity
Ammonia	Boron	pH
Chloride	Cadmium	Temperature
Conductivity	Cobalt	
Nitrate as Nitrogen	Chromium	
Nitrite as Nitrogen	Copper	
Total Kjeldahl Nitrogen	Iron	
pH	Lead	
Total Phosphorus	Mercury	
Total Suspended Solids	Zinc	
Total Dissolved Solids		
Sulphate		
Biological Oxygen Demand ($CBOD_5$)		
Chemical Oxygen Demand		
Phenol		

*** Note 1:** Stormwater sample shall be collected immediately after a rainfall event which

caused stormwater discharge from the pond.

(2) The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;

(b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions; and,

(c) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition), as amended from time to time by more recently published editions.

(3) The *Owner* shall retain for a minimum of three (3) years from the date of their creation, all records and information related to or resulting from the monitoring activities required by this *Approval* .

6. OPERATION AND MAINTENANCE

(1) Within six (6) months of the commencement of operation of the *Works* , the *Owner* shall prepare a detailed "Stormwater Contingency and Remedial Action Plan" for the *Works* and submit for approval to the *District Manager* ;

(2) The *Owner* shall compare monitoring results obtained from the *Works* under Condition 5 (1) with the trigger levels of the selected trigger parameters listed in Table 2 to identify any potential leachate impact to stormwater.

Table 2 - Stormwater Trigger Parameters

Parameter	**Trigger Levels (PWQO)** (mg/L unless otherwise indicated)
Ammonia (Un-ionized)	0.02
Boron	0.2
Cadmium	0.0002
Chromium (Hexavalent)	0.001
Lead	0.025
Phenol	0.005

(3) In the event that a monitoring result for any of the parameters listed in Table 2 exceeds its corresponding trigger level, the *Owner* shall re-sample within two weeks period to confirm the exceedence for that parameter.

(4) In the event that the presence of the parameter(s) of concern is (are) not confirmed after the

second round of sampling conducted under Condition 6 (3), then, normal stormwater and surface water monitoring shall be resumed;

(5) In the event that the presence of any parameter of concern is confirmed after the second round of sampling conducted under Condition 6 (3), the *Owner* shall implement the "Stormwater Contingency and Remedial Action Plan" approved under Condition 6(1) and notify the *District* Manager forthwith orally and in writing;

(6) Discharge of contaminated stormwater from the *Works* to storm sewer/surface water is prohibited, except where it is necessary to avoid loss of life, personal injury, danger to public health or severe property damage;

(7) After two years of monitoring in accordance with Condition 5 (1), the *Owner* may submit to the *District Manager* a request for changes to the list of trigger parameters and corresponding trigger levels stipulated under Condition 6 (2) along with supporting monitoring data and an assessment report and such changes shall be approved by the *District* Manager in writing from time to time;

(8) The *Owner* shall prepare an operations manual within six (6) months of *Substantial Completion* of the *Works* , that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the *Works* ;

(b) inspection programs, including frequency of inspection, for the *Works* and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the *Works* ;

(d) procedures for the inspection and calibration of monitoring equipment;

(e) procedures for receiving, responding and recording public complaints, including recording any follow up actions taken.

(9) The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* or operational office of the *Owner* for the operational life of the *Works* . Upon request, the *Owner* shall make the manual available to *Ministry* staff.

7. REPORTING

(1) One week prior to the start up of the operation of the *Works* , the *Owner* shall notify the *District Manager* (in writing) of the pending start up date.

(2) The *Owner* shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to *Ministry* staff.

(3) The *Owner* shall prepare and submit to the *District Manager* , a performance report, on an annual basis, before March 31st following the end of the period being reported upon. The first such report shall cover the first annual period following the commencement of operation of the *Works* and subsequent reports shall be submitted to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:

(a) a summary and interpretation of all monitoring data collected for stormwater under Condition 5, including an overview of the success and adequacy of the *Works* ;

(b) a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the *Works* ;

(c) a description of any operating problems encountered and corrective actions taken;

(d) any other information the *District Manager* requires from time to time.

Schedule 'A'

1. Application for Approval of Sewage Works submitted by The Municipality of Arran-Ederslie dated February 11, 2011, and drawings and design specifications prepared by Gamsby and Mannerow Limited, Owen Sound, Ontario.

2. "Stormwater Management Report - Arran Landfill, Municipality of Arran-Elderslie, County of Bruce" dated February 2011, Revised March 2012, prepared by Gamsby and Mannerow Limited, Consulting Professional Engineers, Owen Sound, Ontario.

3. Memorandum from Hugh Geurts, MOE Surface Water Specialist, sent on May 31, 2011, Re: Surface Water Review: Arran Landfill, Municipality of Arran-Elderslie, County of Bruce.

4. Memorandum from Helen Zhang, MOE, Hydrogeologist, SWR Technical Support Section, Re: Groundwater Review, Phase I, Arran Landfill, Municipality of Arran-Elderslie, County of Bruce.

5. Additional information request letter from Youssouf Kalogo, P.Eng., MOE, Senior Wastewater Engineer, dated April 14, 2011 Re: stormwater management facility design specifications.

6. Responses to additional information request from J. B. Slocombe, P. Eng., Gamsby and Mannerow Limited, dated April 28, 2011 and June 20, 2011 Re: stormwater management facility design specifications.

7. "Issuance of Grey Sauble Conservation Authority Permit GS11-014 for placement and grading of fill associated with berms, swales and stormwater management pond - Part of Lot 20, Concession 7; 657 Sideroad 20 Arran, Roll No. 41-03-490-002-116-00, Municipality of Arran-elderslie, formerly Arran Township" dated March, 2012, issued by Grey Sauble Conservation, Owen Sound, Ontario.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the *Approval* and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this *Approval* the existence of this *Approval.*

2. Condition 2 is included to ensure that the *Works* are constructed in a timely manner so that standards applicable at the time of Approval of the *Works* are still applicable at the time of construction, to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the *Ministry* records are kept accurate and current with respect to the approved works and to ensure that subsequent owners of the *Works* are made aware of the *Approval* and continue to operate the *Works* in compliance with it.

4. Condition 4 is included to ensure that the *Works* are constructed in accordance with the approval and that record drawings of the *Works* "as constructed" are maintained for future references.

5. Condition 5 is included to enable the *Owner* to evaluate and demonstrate the performance of the *Works* on a continual basis, so that the *Works* are properly operated and maintained at a level which is consistent with the design objectives specified in the *Approval* and that the *Works* does not cause any impairment to the receiving watercourse.

6. Condition 6 is included to require that the *Works* be properly operated and maintained such that the environment is protected .

7. Condition 7 is included to ensure that the *Ministry* is made aware of problems as they arise, and to provide a compliance record for all the terms and conditions outlined in this *Approval,* so that the *Ministry* can work with the *Owner* in resolving any problems in a timely manner.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;

2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 17th day of July, 2012

Mansoor Mahmood, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

SH/
c: District Manager, MOE Owen Sound
John Slocombe, P. Eng., Gamsby and Mannerow Limited

APPENDIX B:
CORRESPONDENCE

Ministry of the Environment and Climate Change

733 Exeter Road
London ON N6E 1L3
Tel': 519 873-5000
Fax: 519 873-5020

Ministère de l'Environnement et de l'Action en matière de changement climatique

733, rue Exeter
London ON N6E 1L3
Tél.: 519 873-5000
Fax: 519 873-5020

Ontario

MEMORANDUM

File No. SI BR AE C7 610

TO: Ian Mitchell
District Engineer
Owen Sound District Office

FROM: Simon Thuss
Hydrogeologist
Water Resources Unit – Technical Support Section

DATE: July 29, 2016

RE: 2015 Annual Monitoring Report and Trigger Mechanisms & Contingency Plan
Arran Landfill Site
Municipality of Arran-Elderslie
Reference: 1163-A8BHEM

As requested, I have reviewed the following reports:

- "Municipality of Arran-Elderslie, Annual Progress Report (2015) – Arran Landfill", dated March 2016 and prepared by GM Blueplan Engineering Limited.
- "Municipality of Arran-Elderslie, Trigger Mechanism & Contingency Plan, Arran Landfill Site – Phase I", dated February 2011 (Revised June 2016) and prepared by GM Blueplan Engineering Limited.

My review was limited to the hydrogeological aspects of the monitoring program. Review comments regarding the 2011 to 2014 annual reports were previously provided in a memorandum dated August 26, 2015.

The landfill site is located approximately 4.5 kilometres southwest of the community of Tara, within the south half of Lot 20, Concession 7 in the former Township of Arran, now in the Township of Arran-Elderslie, Bruce County. The landfill was originally operated under Provisional Certificate of Approval (C of A) No. A271802, later replaced by C of A No. 0441-4J2HV8. Landfilling was temporarily suspended in June 2000, and resumed in October 2012. The landfill currently operates under Environmental Compliance Approval (ECA) No. 0441-4J2HV8, issued on October 29, 2012.

The current groundwater monitoring network includes 19 monitoring wells, with groundwater levels

measured and samples collected twice per year (April and October). The groundwater flow direction is generally expected to be towards Arkwright Creek to the west; however, radial flow away from the fill area is also expected in some areas.

In 2015, exceedances of the Reasonable Use Guideline (RUG) criteria for alkalinity, hardness, TDS, sulphate, nitrite and/or organic nitrogen were noted at several locations. These results were generally consistent with the data presented in previous annual reports for the site.

Historically, most of the exceedances of the RUG criteria have been attributed to upwelling from a deeper groundwater flow system. In my previous August 2015 memorandum, I requested clarification on several points related to the groundwater chemistry at the site. Several of my previous concerns have not been fully addressed in the current monitoring report.

Based on a review of all available information, it appears that the exceedances of the RUG criteria along the northern and eastern property boundaries are indicative of leachate impacts originating from the landfill site. Further details are provided in the comments below:

2015 Annual Monitoring Report

1. Consistent with the data recorded in previous years, elevated concentrations (with respect to the established RUG criteria and trigger levels) of hardness, TDS, alkalinity and sulphate were measured along the northern property boundary in 2015. Historically, the Consultant has attributed these elevated concentrations to groundwater discharge from a "deeper groundwater system"; however, it appears that there is insufficient evidence to support this conclusion.

   The Consultant points to the results of an electromagnetic conductivity (EM) survey carried out in 1997 and isotopic analysis carried out in 2005 to support the "deep groundwater discharge" conceptual model. As detailed in the August 2015 memorandum, I have concerns with the interpretation of these results as presented in the various annual reports. The EM survey results are nearly 20 years old and cannot be used to evaluate the current conditions at the site.

   The current conceptual model is incompatible with the long-term groundwater quality trends observed along the northern property boundary. For example, the sulphate concentration at TW-4 and TW-8 was typically 25 to 90 mg/L in the 1990's, increasing at both locations to a maximum of approximately 350 to 385 mg/L during the 2000's. Similar increasing concentration trends were observed for conductivity, hardness and alkalinity. If the current elevated concentrations were due the discharge of water from a deep flow system, these concentrations should have remained relatively constant throughout the period of record.

   It should also be noted that the presence of a "deep groundwater flow system" has not been demonstrated at the site. A review of the borehole logs indicates that artesian conditions were

encountered in a single borehole (TW-17) which encountered a coarse sand layer at an elevation of approximately 227 masl. Unfortunately, a monitoring well was not installed at this depth and the groundwater quality within the confined unit is unknown. Furthermore, the other boreholes drilled at the site were not advanced to a sufficient depth to confirm that this sand deposit is laterally extensive.

For the reasons outlined above, the elevated concentrations of hardness, TDS, alkalinity and sulphate do not appear to be consistent with upwelling from a deeper groundwater flow system. In the absence of any other plausible sources, it is inferred that these elevated concentrations are indicative of leachate impacts originating from the landfill site.

2. The report indicates that the recent (2013-2015) increase in chloride and hardness concentrations at TW-4 may be related to the use of calcium chloride for on-site dust suppression. Given the concerns about groundwater quality along the northern property boundary, any trends at this location should be closely monitored for evidence of further degradation attributable to leachate impacts.

3. Since approximately 2012, a rough increasing trend has been observed for several parameters (including conductivity, hardness, alkalinity, TDS and chloride) in TW-9 on the eastern boundary of the landfill. The groundwater chemistry at this location has also exhibited a strong seasonal variation, with higher concentrations of most parameters measured in the fall samples.

   The Consultant has attributed these trends, in part, to road salting activities along Sideroad 20; however, I disagree with this assessment. Road salting would not contribute to an increase in hardness and alkalinity. Furthermore, if road salting was contributing to the observed sodium and chloride trends, a higher concentration should be measured in the spring following the winter salting season, and the opposite trend is observed in the samples collected from TW-9. Elevated concentrations of nitrite, ammonia, TKN and organic nitrogen at this location are also indicative of leachate impacts.

   For these reasons, it appears that the recent groundwater chemistry trends observed at TW-9 are primarily a result of landfill leachate impact. It should also be noted that the increasing trend roughly corresponds with the reopening of the landfill site in 2012.

4. The highly variable groundwater chemistry at TW-9 suggests this well may have an inadequate annular seal. The well log indicates that the seal is only approximately 0.2 metres in thickness, which would not be considered sufficient under current standards. If the well seal is compromised, surface water runoff may seep into the well and influence the quality of the samples collected from this location. The well should be inspected and any necessary maintenance or repairs should be completed in a timely manner. Since TW-9 is a key monitoring location, this well should be replaced if it cannot be adequately repaired.

5. Consistent with previous results, the hardness and/or TDS concentrations exceeded the RUG criteria at TW-11 and TW-15 in 2015. The report indicates that groundwater quality is anticipated to improve at these locations as the active landfill face moves to the south and west. However, given the apparent degradation in groundwater quality at TW-9, any trends should be closely evaluated for evidence of leachate impacts migrating towards the adjacent property.

6. The groundwater quality trends at TW-11D and TW-15D appear to be relatively stable. I agree with the Consultant's recommendation to reduce the monitoring frequency at these locations to once annually.

Revised Trigger Mechanism & Contingency Plan

7. Monitoring wells TW-1, TW-2, and TW-10 are used to characterize the background groundwater chemistry at the site; however, these wells are located downgradient of the landfill and may be potentially influenced by leachate impacts. For example, an increase in conductivity, hardness and chloride concentrations has been noted at TW-1 in 2014 and 2015.

   It is acknowledged that only data from 1984 to 2002 was used to evaluate the background groundwater chemistry, and as such, these recent trends would not influence the values used to develop the RUG criteria and trigger values. However, it should be noted that the previous 2011 version of the Trigger Mechanism & Contingency Plan indicated that "In the event that the background data appears to be influenced by leachate, new background monitoring locations should be established to ensure that conservative estimates of background groundwater quality are continually provided for on-going comparative purposes". The monitoring locations used for background characterization should be re-evaluated accordingly. Is there monitoring data available for TW-18, TW-19D, TW-20 and TW-21 that could be used to support the background groundwater quality characterization?

8. The Consultant has recommended that nitrate and nitrite be excluded from the list of trigger criteria for the landfill site, as these parameters could be related to agricultural land use in the surrounding area. However, sample results from TW-9 suggest that the landfill leachate along the eastern boundary contains elevated concentrations of several nitrogen compounds, including nitrite, ammonia, organic nitrogen and TKN. Accordingly, nitrate and nitrite should remain in the list of trigger criteria for the site.

9. The Consultant has also recommended that hardness and TDS be excluded from the list of trigger criteria. As detailed in this memorandum, it appears that the elevated hardness and TDS concentrations measured along the northern site boundary are indicative of leachate impacts and should remain in the list of trigger criteria for the site.

10. The Consultant has proposed that the Contingency Plan only be implemented in the event that the

trigger criteria are exceeded for two or more parameters for at least three consecutive sampling events. Given the semi-annual monitoring frequency, at least 1.5 years would elapse between the initial adverse sample result and the implementation of the Contingency Plan. This appears to conflict with Condition 45(2) in the ECA, which requires actions to be taken in the event a sample result exceeds the trigger criteria. These actions include immediately notifying the District Manager; conducting confirmatory sampling within 30 days; and conducting an assessment into the cause of the adverse result.

These actions are necessary to determine whether additional contingency measures are needed, and therefore should be carried out in a timely manner following receipt of an adverse result. Accordingly, the actions outlined in Condition 45(2) of the ECA should be carried out following the first trigger exceedance at any of the identified trigger locations. Additional contingency measures may not be required if the initial assessment indicates that the adverse result is not related to the landfill.

As detailed in this memorandum, the Arran Landfill site is not in compliance with the Reasonable Use Guideline with respect to groundwater quality along the northern and eastern property boundaries. Based on the decreasing trend in sulphate concentrations at TW-4 since approximately 2010, it appears that there has been some improvement in groundwater quality along the northern boundary over the past several years. However, the concentrations of several other indicator parameters (hardness, TDS and alkalinity) remain elevated relative to the RUG criteria.

It is acknowledged that the groundwater impacts do not pose an immediate risk given that there are no sensitive receptors (i.e. residences, water supply wells, etc.) immediately adjacent to the landfill; however, the exceedances of the RUG criteria represent an adverse impact to the groundwater quality on the adjacent properties.

I understand that the Municipality recently acquired an additional 30 metres of buffer lands along the northern boundary. There may be some improvement in groundwater quality within this buffer area; however, additional monitoring wells would be required to demonstrate that groundwater quality meets the RUG criteria along the northern limit of the buffer zone. Additional buffer lands or a Contaminant Attenuation Zone (CAZ) may also be required to the east of the site.

If you have any questions or require clarification on any of the points provided herein, please contact me at Simon.Thuss@ontario.ca or 519-873-5033.

Yours truly,

Simon Thuss, P.Geo.
Hydrogeologist
Technical Support Section
Southwestern Region

Limitations:
The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding subsurface conditions based on the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Drea Nelson - GM BluePlan

From: Mitchell, Ian (MOECC) <ian.mitchell@ontario.ca>
Sent: Wednesday, September 28, 2016 10:09 AM
To: Matt Nelson - GM BluePlan
Cc: Thuss, Simon (MOECC); Pietz, Kimberley (MOECC); Scott Mcleod (works@arran-elderslie.ca); Drea Nelson - GM BluePlan
Subject: RE: M-1174 Arran Landfill - Follow-up to Meeting (MOECC Ref #1163-A8BHEM)

Hello Matt

The following is our response to your email below:

1. We agree with the approach proposed. Could you please keep me informed as to the schedule for the well installations, as we may visit the site to see the new installations.
2. Our hydrogeologist generally agrees with the use of the 95-th percentile approach at this site for parameters with background concentrations that exceed the ODWS. To clarify, the average background concentration should continue to be used for parameters that have background concentrations less than the ODWS. The use of this approach on other sites would be evaluated on a case-by-case basis.
3. Please review the ECA to ensure that the updated Trigger Mechanism and Contingency Plan is submitted for the appropriate approval. An ECA amendment appears to be required to revise Schedule A to reference the updated plan. Specifically, the new Trigger Mechanism and Contingency Plan document would be added to Schedule A, and Condition 45(1) should be amended to reference the new document. Consideration should be given to removing Condition 45(2)b., since the procedure for re-sampling, etc. will be covered in the Trigger Mechanism and Contingency Plan document.

Please do not hesitate to call if you have any questions regarding this email.

Ian Mitchell
District Engineer
Ministry of the Environment and Climate Change
Owen Sound District
101-17th St E
Owen Sound ON N4K 0A5
Phone (519) 371-6191

From: Matt Nelson - GM BluePlan [mailto:matthew.nelson@gmblueplan.ca]
Sent: September 27, 2016 9:17 AM
To: Thuss, Simon (MOECC)
Cc: Mitchell, Ian (MOECC); Drea Nelson - GM BluePlan; Scott Mcleod (works@arran-elderslie.ca)
Subject: M-1174 Arran Landfill - Follow-up to Meeting (MOECC Ref #1163-A8BHEM)

Simon,

Further to our meeting on September 16, 2016 regarding outstanding concerns outlined in the July 29, 2016 MOECC correspondence related to the Arran Landfill Site, the following action items were identified:

1. **Monitoring Well Installation:** Shallow monitoring wells TW-4, TW-8 and TW-9 will be 'replaced', in that they will be decommissioned and moved closer to the respective property lines to better reflect boundary conditions. The existing wells will be decommissioned. A monitoring well nest will be installed at the location of TW-4. These wells are currently scheduled for installation the week of October 11.

2. **RUC Determination:** For the Arran Landfill Site it was generally concurred that the use of the 95-th percentile using the existing data set provided in Table 4 of the most recent AMR (i.e. Summary of Background Groundwater Quality) would be preferred. Using the 95-th percentile rather than the average, particularly for parameters in which the background concentrations are greater than the ODWS (i.e. hardness and alkalinity) will limit the number RUC exceedances highlighted during analysis, then later dismissed as being within natural variability. We understand you are assessing whether this approach be used as a general rule for RUC determination at other landfill sites?

3. **Trigger Mechanisms and Contingency Plan:**
    a. There was some discussion on whether the updated plan would meet the requirements of the ECA, namely the development of "trigger mechanism" schedule, versus notification requirement. While we believe the Revised Plan (February 2011, Revised June 2016) was developed so that it generally recognizes the conditions 45(2) of the ECA for the landfill, Condition 45(1) and Schedule A would need to be revised to reference the updated Plan. Will an ECA application to amend the Approval be required in order for the revised plan to be recognized or is concurrence from District Manager in consultation with the Technical Reviewers (i.e. the Regional Hydrogeologist and the Surface Water Specialist) be considered sufficient? i.e., will the ECA be amended through submission of the revised report and MOECC process, or will a formal ECA application (proponent driven) for administrative amendment be required?
    b. Once the process is confirmed, a conference call will be arranged to discuss and solidify the details related to the trigger parameters, locations and mechanisms.
    c. The Trigger Mechanism and Contingency Plan will be updated and re-submitted for review and approval.

We appreciate the time taken to meet with us and the Municipality in order to ensure that the concerns of all parties are satisfactorily addressed. Please correct/update any items presented herein.

Thanks,

Matt

Matthew Nelson, M.Sc., P.Eng., P.Geo.
Senior Project Manager, Partner

GM BluePlan Engineering Limited
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Ontario

September 16, 2016

Mr. Scott McLeod
Municipality of Arran-Elderslie
PO Box 70
1925 Bruce Road 10
Chesley, ON, N0G 1L0

Dear Mr. McLeod,

RE: Arran Landfill Site, Trigger Mechanisms and Contingency Plan (revised June 2016)

Further to my letter to you dated July 29, 2016, our regional surface water specialist has reviewed the Trigger Mechanism & Contingency Plan report (revised June 2016) for the Arran landfill and provides the following comments:

The report has been done in accordance with condition 6(7) of ECA 7585-8QKL5Q. This condition allows for the proponent to apply to the district manager for amendments to trigger criteria after compiling two years of monitoring data.

Currently, twice annual monitoring is required for the Stormwater Management system and anticipated water bodies that may be influenced. The monitoring requires the anticipated general chemistry and metals suites typical for landfill monitoring.

Sites SW1, SW 9 and SW8 are proposed to remain as trigger locations. On page 8, the consultant proposes to replace un-ionized ammonia as a trigger with a chloride trigger of 120 mg/l based on the CCME guideline. Although our surface water reviewer does not have an issue with chloride being substituted for un-ionized ammonia, we do not support a trigger of 120 mg/l for SW1 or SW8. The ministry's reviewer believes Awkright creek has a chloride value substantively below 120 mg/l and the buffer afforded by the 120 mg/l trigger allows substantial potential for landfill influence before the trigger is reached. Also, the text of page 8 references 120 mg/l as the trigger yet Table 3 on the same page proposes a value of 90 mg/l (which contradicts the 120 mg/l). Which value does the consultant wish to use? Chloride levels can get quite high in a near stagnant storm pond regardless of landfill waste influence so we are somewhat hesitant to apply a chloride trigger at all to SW9. And would prefer to leave chloride in as a monitoring parameter for SW9 and observe long term trending.

Section 5.0 deals with contingency actions should trigger exceedance be realized. The plan lacks specific detail for surface water but follows generally accepted steps for dealing with landfill influence; as such, we have no specific concern with the contingency as presented.

If you have any questions concerning this letter, please contact the undersigned at (519) 371-6191.

Yours truly,

Ian Mitchell , P.Eng.
District Engineer
Owen Sound District Office

File Storage Number: SI BR AE C7 610

cc. Hugh Geurts – MOECC, London
M.D. Nelson – GM BluePlan, Owen Sound
Kim Pietz – MOECC Owen Sound

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Ontario

June 29, 2017

Mr. Scott McLeod
Municipality of Arran-Elderslie
PO Box 70
1925 Bruce Road 10
Chesley, ON, N0G 1L0

Dear Mr. McLeod,

RE: Arran Landfill Site, 2016 Annual Report

The ministry received a copy of the report titled "Municipality of Arran-Elderslie, Annual Progress Report (2016) – Arran Landfill" dated March 2017 and prepared by GM BluePlan Engineering. Our regional Hydrogeologist has reviewed the 2016 report for the hydrogeological aspects of the groundwater monitoring program and provides the following comments:

1. As indicated in the report, samples collected from TW-11 continue to suggest leachate-related impacts on groundwater quality along the eastern boundary of the landfill site, with minor exceedances of the RUG criteria for hardness, alkalinity and TDS observed in Fall 2016. Although it is acknowledged that any impacts in this area are likely to be limited in extent due to the primary westerly groundwater flow direction, these continued exceedances have implications for compliance with the Reasonable Use Guideline.

   In reviewing the borehole log for TW-11, it is noted that this well was drilled in August 1993 and was completed with a bentonite annular seal placed only "at surface". The thickness/depth of the seal is unknown. In contrast, TW-11D was drilled in September 2012 and was completed with a full bentonite annular seal extending from the top of the sandpack (approximately 5.2 metres depth) to ground surface. The top of the screen interval for TW-11D is only approximately 0.6 metres below the base of TW-11; however, the analytical results for samples collected from TW-11D generally do not indicate a leachate impact on groundwater quality at this location, with the concentrations of all tested parameters below the applicable RUG criteria.

   The Consultant should comment on the integrity of monitoring well TW-11. Are samples collected from this well an accurate representation of groundwater quality along the eastern boundary of the site?

2. As discussed in our May 31, 2017 teleconference, it is understood that GM BluePlan is in the process of revising the trigger mechanism and contingency plan document, and will be submitting an ECA amendment application on behalf of the Municipality in order to formally recognize these changes. As discussed during the call, our hydrogeologist is in general agreement with the proposed approach recommended by the Consultant as summarized below:
    a. The list of trigger locations will be revised to recognize the replacement of TW-4 with TW-25S and TW-8 with TW-26.
    b. Nitrate, nitrite and hardness will be retained as trigger parameters in the revised plan.
    c. It is recognized that an increase in concentration for any of the leachate trigger parameters will also cause a corresponding increase in TDS concentration. Accordingly, TDS will not be included as a trigger parameter.
    d. The proposed approach for the trigger mechanism (exceedance of the trigger concentration for two or more parameters for three consecutive sampling events) is appropriate and consistent with the approach applied by the Ministry at other similar landfill sites.

If you have any questions concerning this letter, please contact the undersigned at (519) 371-6191.

Yours truly,

Ian Mitchell , P.Eng.
District Engineer
Owen Sound District Office

File Storage Number: SI BR AE C7 610

cc. Simon Thuss – MOECC, London
M.D. Nelson – GM BluePlan, Owen Sound
Kim Pietz –MOECC Owen Sound

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Ontario

July 4, 2017

Mr. Scott McLeod
Municipality of Arran-Elderslie
PO Box 70
1925 Bruce Road 10
Chesley, ON, N0G 1L0

Dear Mr. McLeod,

RE: Arran Landfill Site, 2016 Annual Report

Further to my letter to you dated June 29, 2017, containing groundwater comments for the Arran Landfill 2016 Monitoring Report, our regional surface water specialist has reviewed the 2016 annual report and provides the following comments:

We concur with the conclusion that the landfill is not having an off-site impact on surface water. The on-site storm water management facility sampled at SW9 and SW10 had slightly elevated concentrations of several indicator variables including upward trends in concentrations over time as shown by the appended trend graphs of monitoring data collected since 2012. Additionally, total ammonia concentrations above 1 mg/L were measured in April 2016 for these two sampling locations however total ammonia was low or non-detectable at all other sampled locations. Our surface water reviewer concurs with the report notes that daily operations at the landfill are likely responsible for the elevated concentrations. Overall, our surface water reviewer agrees with the report that the reported exceedances of PWQO's or current trigger values are not indicative of impacts or potential impacts to surface water features.

The report notes that the municipality will submit an ECA application in 2017 to revise the trigger mechanism and contingency plan primarily for groundwater concerns however the surface water component of the proposed plan should also be reviewed. For example, if the phenol detections in surface water do derive from the natural decay of vegetation then this variable is not of much use for leachate detection.

If you have any questions concerning this letter, please contact the undersigned at (519) 371-6191.

Yours truly,

Ian Mitchell , P.Eng.
District Engineer
Owen Sound District Office

File Storage Number: SI BR AE C7 610

cc. Scott Abernethy – MOECC, London
M.D. Nelson – GM BluePlan, Owen Sound
Kim Pietz –MOECC Owen Sound

Drea Nelson - GM BluePlan

From: Mitchell, Ian (MOECC) <ian.mitchell@ontario.ca>
Sent: Monday, November 06, 2017 11:50 AM
To: Drea Nelson - GM BluePlan
Cc: Matt Nelson - GM BluePlan
Subject: RE: M1562 Arran Landfill: ECA Application - Revised Trigger Mechanism and Contingency Plan

Thanks Andrea

Our surface water reviewer reviewed the proposed triggers and provided the following:

> *The proposed triggers are the same as those in the stormwater ECA minus un-ionized ammonia plus a chloride trigger (90 mg/L) for SW1 and SW8 only. The stormwater trigger for boron is acceptable to use in a revised contingency plan but I question the continued use of triggers for cadmium, chromium, lead and phenol. I would drop phenol because of elevated background concentrations. I don't see any stand-alone technical rationale for continued use of cadmium, chromium and lead other than consistency with the stormwater approval. While there is no doubt that they are high-hazard contaminants, they are not particularly soluble in water and I don't know if they are enriched in the leachate that flows in the shallow groundwater that discharges to surface. In the absence of a rational for the metals I would suggest surface water trigger parameters similar to the ones recommended for groundwater (plus boron):*
>
> *Chloride 90 mg/L*
> *Boron 0.2 mg/L*
> *Alkalinity, hardnesss, sodium, nitrate, iron (RU-based calculated water concentrations once these are finalized)*

I don't recall the reason metals were included. Can you provide comment on the above?

Thanks

Ian Mitchell
District Engineer
Ministry of the Environment and Climate Change
Owen Sound District
101-17th St E
Owen Sound ON N4K 0A5
Phone (519) 371-6191

From: Drea Nelson - GM BluePlan [mailto:Drea.Nelson@gmblueplan.ca]
Sent: November 1, 2017 9:57 AM
To: Mitchell, Ian (MOECC)
Cc: Matt Nelson - GM BluePlan
Subject: M1562 Arran Landfill: ECA Application - Revised Trigger Mechanism and Contingency Plan

Ian,

As requested, please find attached the ECA Application and the Revised Trigger Mechanism and Contingency Plan for the Arran Landfill.

Regards,
Andrea

Andrea Nelson, M.Sc.
Senior Hydrogeologist

GM BluePlan Engineering Limited
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Ontario

July 16, 2019

Mr. Scott McLeod
Municipality of Arran-Elderslie
PO Box 70
1925 Bruce Road 10
Chesley, ON, N0G 1L0

Dear Mr. McLeod,

Re: Arran Landfill Site, 2018 Annual Report
MOE File: SI BR AE C7 610

The ministry received a copy of the report titled "Municipality of Arran-Elderslie, Annual Progress Report (2018) – Arran Landfill" dated March 2019 and prepared by GM BluePlan Engineering. Our regional Hydrogeologist has reviewed the 2018 report for the hydrogeological aspects of the groundwater monitoring program and provides the following comments:

Based on the data presented in the report, the 2018 monitoring results were generally consistent with those recorded in recent years. Monitoring locations downgradient of the landfill (e.g. TW-1, TW-12, TW-14) continue to exhibit an increasing trend for several indicator parameters. The October 2018 sample collected from TW-2 indicated a sharp increase in several parameters including chloride, sulphate and sodium. The data from this location should be evaluated following future sampling events to determine if these results were anomalous or representative of a trend in groundwater quality.

We concur with the Consultant's recommendation to abandon TW-11. Going forward, it will be acceptable to rely on samples collected from TW-11D to evaluate groundwater quality at this location.

If you have any questions concerning this letter, please contact the undersigned at (519) 374-1388.

Yours truly,

Ian Mitchell
District Engineer
Owen Sound District

cc. Simon Thuss – MECP, London
M.D. Nelson – GM BluePlan, Owen Sound
Sierra Gillies –MECP Owen Sound

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Ontario

May 12, 2020

Mr. Scott McLeod
Municipality of Arran-Elderslie
PO Box 70, 1925 Bruce Road 10
Chesley, ON, N0G 1L0

Via email

Dear Mr. McLeod,

Re: Arran Landfill Site, 2019 Annual Report
MOE File: SI BR AE C7 610

The ministry received a copy of the report titled "Municipality of Arran-Elderslie, Annual Progress Report (2019) – Arran Landfill" dated March 2020 and prepared by GM BluePlan Engineering. Our regional Hydrogeologist has reviewed the 2019 report for the hydrogeological aspects of the groundwater monitoring program and provides the following comments:

The 2019 sampling results are generally consistent with those reported in previous years. Groundwater samples downgradient of the landfill continue to indicate elevated concentrations of several parameters including chloride, hardness, alkalinity and TDS. Several onsite monitoring wells near the active landfilling area have recently started to show an increasing trend in leachate related parameters; however, the site remains in compliance with the Reasonable Use Guideline criteria at the property boundaries.

As previously agreed, monitoring was discontinued at TW-11 in 2019 and the well was abandoned. Groundwater quality will continue to be monitored at this location using TW-11D. We have no further groundwater comments or concerns at this time.

If you have any questions concerning this letter, please contact the undersigned at (519) 374-1388.

Yours truly,

Ian Mitchell
District Engineer
Owen Sound District

cc. Simon Thuss – MECP, London
M.D. Nelson – GM BluePlan, Owen Sound
Sierra Gillies –MECP Owen Sound

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Ontario

June 29, 2020

Mr. Scott McLeod
Municipality of Arran-Elderslie
PO Box 70, 1925 Bruce Road 10
Chesley, ON, N0G 1L0

Via email: works@arran-elderslie.ca

Dear Mr. McLeod,

Re: Arran Landfill Site, 2019 Annual Report
MOE File: SI BR AE C7 610

Further to my letter to you dated May 12, 2020, containing groundwater comments for the Arran Landfill Site 2019 Monitoring Report, our regional surface water specialist has reviewed the 2019 annual report and provides the following comments:

Stormwater management consists of a stormwater perimeter swale system that collects to a stormwater wetland. Page 16 makes the following observations:

Two samples are collected to monitor the surface water collected by the stormwater management facility located southwest of the landfill prior to being discharged to the intermittent tributary, including one from the stormwater management wetland outlet (i.e. SW-9) and one from the pond area (i.e. SW-10) (Figure 5). Since monitoring began at these locations in 2012, indicator parameters have been generally slightly increasing. In 2019, indicator parameters conductivity, sodium, and sulphate were all slightly elevated at both monitoring locations, with hardness and alkalinity slightly elevated at SW-10 only, as compared to recent years. Minor exceedances of the PWQO of some metals as well as phenols, phosphorus, and unionized ammonia were also reported in 2019. Future sampling and reporting will monitor if a trend is developing.

Accordingly, the Municipality should provide comment on SW 9 and SW 10 with respect to whether landfill influence is resulting in increasing trends. We understand from the consultant however that SW9 discharges to a small pond (SW 3) that generally has little to no discharge overland to the downgradient wetland that leads to Arkwright Creek.

Page 18 of the report notes that trigger criteria at SW1, SW8, and SW9 were not exceeded for the 2019 monitoring year. However; from our reading of Table 10, it appears boron exceeded its trigger at SW9 (stormwater pond outlet) for both sample events in 2019. If this is correct and the Spring 2020 boron sample at SW 9 exceeds the boron trigger again, we believe that will be three exceedances and the "Trigger mechanisms and contingency plan" will be activated.

Except for SW9 and SW10 as noted above, no impact is noted in Arkwright Creek in an upstream to downstream analysis and all other surface water sample points remain within

historical norms. As such, our surface water reviewer does not believe the landfill is having unacceptable impact for 2019.

The report does not recommend any other changes to the current surface water monitoring program. Please confirm our understanding of the boron trigger for SW9 and whether or it has been initiated.

If you have any questions concerning this letter, please contact the undersigned at (519) 374-1388.

Yours truly,

Ian Mitchell
District Engineer
Owen Sound District

cc. Hugh Geurts – MECP, London
M.D. Nelson – GM BluePlan, Owen Sound
Sierra Gillies –MECP Owen Sound

July 23, 2020
Our File: M-1174

Via Email: Works@arran-elderslie.ca

Municipality of Arran-Elderslie
PO Box 70, 1925 Bruce Road 10
Chesley, ON, N0G 1L0

Attention: Mr. Scott McLeod

Re: Arran Landfill Site – Surface Water Contingency Review
Response to MECP Comments
Annual Progress Report (2019)
ECA No. 0441-4J2HV8 (Landfill)

Dear Mr. Mcleod:

In response to correspondence from the Ministry of the Environment, Parks, and Conservation (MECP) dated June 29, 2020 we have reviewed the surface water quality results from the Spring 2020 sampling event. A copy of the MECP correspondence is included with this letter. In particular the MECP provided the following comment:

"*Please confirm our understanding of the boron trigger for SW9 and whether or it has been initiated.*"

The surface water quality results in comparison to trigger levels and the contingency plan trigger mechanisms are discussed below. Other comments provided in the letter, primarily around expanded explanation, will be dealt with in future Annual Monitoring Reports.

The spring surface water sampling event was carried out April 10, 2020. The Boron concentration at sampling location SW-9 was recorded as 0.020 mg/L. This is below the trigger level of 0.20 mg/L. All other monitoring parameters at SW-9 were also below the trigger levels. All monitoring parameters at both SW-1 and SW-8 were also below the trigger levels. See attached Table 1.

As detailed in the Trigger Mechanism and Contingency Plan (GM BluePlan, Revision 2, December 2017), the Contingency Plan is not to be activated unless 2 or more trigger parameters exceed the surface water trigger levels at the same trigger location for 3 consecutive events.

As only one (1) parameter exceeded the trigger level during the 2019 fall sampling event, and zero (0) parameters exceeded the trigger levels during the 2020 spring sampling event, it is our opinion that the Contingency Plan has not yet been activated.

We will continue to monitor per the established program and identify any concerns if they are encountered.

By way of this letter, we are also providing a copy to Ian Mitchell of the MECP.

Yours truly,

GM BLUEPLAN ENGINEERING LIMITED
Per:

J. L. Swiger, B.E.Sc., E.I.T.

Encl. Table 1
MECP Correspondence dated June 29, 2020

Cc Matthew Nelson, GMBP
Ian Mitchell, MECP – District Engineer, Owen Sound

APPENDIX C:
BOREHOLE LOGS AND MONITORING WELL INSTALLATION DETAILS

TABLE C-1
SUMMARY OF HISTORICAL GROUNDWATER LEVEL DATA

Well No.	Ground Elevation (m)	Original Well Depth from GS (m)	Measuring Point Top of Casing (m)	Feb-84	May-85	Aug-88	Oct-88	Nov-90	Mar-91	Sep-91	Apr-92	Nov-92	May-93	May-94	Nov-94	May-95	Oct-95
TW-1	95.74	3.7	96.87	95.62	95.04	94.12	95.52	NM	95.60	93.70	95.56	95.45	95.00	95.56	95.60	95.61	95.25
TW-2	95.79	2.3	96.86	95.67	95.04	94.00	95.55	95.67	95.70	93.70	NM	95.50	94.98	95.51	95.49	95.50	95.05
TW-3	97.65	3.4	98.71	97.69	97.08	94.75	97.58	97.45	97.60	97.28	97.18	97.71	ABANDONED				
TW-4	95.99	5.0	97.05	95.96	95.23	94.30	NM	95.89	95.88	93.58	95.75	95.73	95.33	95.75	95.75	95.75	94.70
TW-5	93.49	4.8	94.46	93.58	92.85	91.61	93.32	93.40	93.44	91.17	93.49	93.54	93.11	93.54	93.56	93.54	93.09
TW-6	95.33	2.3	NA	95.44	95.01	94.25	95.31	ABANDONED									
TW-7	97.87	6.0	NA	97.72	97.06	96.59	97.44	ABANDONED									
TW-8	96.98	4.3	98.14	96.71	96.44	95.54	96.96	96.81	96.88	95.15	96.93	96.84	96.64	96.97	96.97	96.98	96.20
TW-9	99.38	4.1	100.54	98.24	97.26	96.83	97.71	97.48	97.86	NM	98.29	97.51	97.85	98.34	98.17	97.81	97.14
TW-10	96.14	4.1	97.37	96.09	95.41	95.01	96.21	98.48	96.07	94.32	95.80	95.89	95.47	96.30	95.91	95.93	95.47
TW-11	98.70	3.8	99.35	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	98.30	98.18	97.32	96.32
TW-12	95.02	4.6	96.00	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	95.00	95.04	95.01	94.85
TW-13	95.21	4.0	95.95	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	95.19	95.20	95.21	94.75
TW-14	94.38	4.6	95.38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	94.33	94.35	94.34	93.43
TW-15	96.50	1.63	97.63	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
G-1	99.33	3.3	100.70	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	99.15	NM	NM	99.06
G-2	98.28	3.32	99.63	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	98.02	NM	NM	97.93
G-3	98.85	3.34	100.19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	96.89	NM	NM	97.01

Well No.	Ground Elevation (m)	Original Well Depth from GS (m)	Measuring Point Top of Casing (m)	May-96	Sep-96	Apr-97	Sep-97	May-98	Sep-98	May-99	Oct-99	May-00	Oct-00	May-01	Nov-01	May-02	Nov-02
TW-1	95.74	3.7	96.87	95.47	94.53	95.57	95.18	95.37	93.85	94.89	92.77	95.59	95.36	95.27	95.58	95.57	94.61
TW-2	95.79	2.3	96.86	95.26	94.30	95.38	94.97	95.15	93.61	94.75	DRY	95.44	95.14	95.04	95.37	95.37	94.37
TW-4	95.99	5.0	97.05	95.62	94.04	95.72	94.77	95.47	92.27	95.00	91.93	95.71	94.10	95.26	95.63	95.61	91.75
TW-5	93.49	4.8	94.46	93.33	92.45	93.42	93.22	93.26	88.40	92.93	89.89	92.46	93.06	93.16	93.51	93.44	89.88
TW-8	96.98	4.3	98.14	96.79	94.46	96.84	95.91	96.72	92.57	96.20	DRY	96.94	94.16	96.65	96.84	96.86	DRY
TW-9	99.38	4.1	100.54	97.98	97.14	97.46	96.88	97.31	95.95	96.91	95.93	97.66	96.74	97.49	97.40	97.43	96.01
TW-10	96.14	4.1	97.37	95.83	94.95	95.87	95.39	95.69	94.06	94.29	93.89	95.57	95.42	95.57	95.82	95.78	94.75
TW-11	98.70	3.8	99.35	97.55	96.65	97.43	96.72	97.21	95.63	96.72	95.67	97.77	96.57	97.33	97.4	96.03	95.77
TW-12	95.02	4.6	96.00	94.94	94.22	94.98	94.92	94.32	92.15	94.27	91.95	95.02	94.96	94.69	95.01	95.06	92.87
TW-13	95.21	4.0	95.95	95.17	94.26	95.20	95.07	95.13	93.43	94.32	91.95	95.22	95.15	95.00	95.21	95.29	93.75
TW-14	94.38	4.6	95.38	94.26	93.30	94.31	94.17	95.15	91.63	93.47	90.03	94.35	94.25	94.04	94.35	94.46	91.08
TW-15	96.50	1.63	97.63	NI	NI	NI	96.61	96.73	95.68	96.43	95.73	96.77	96.36	96.66	96.67	96.98	95.88
G-1	99.33	3.3	100.70	98.83	97.17	98.67	97.46	98.19	96.14	97.27	96.19	98.82	97.11	98.14	98.88	98.62	DRY
G-2	98.28	3.32	99.63	97.40	96.64	97.35	96.74	97.19	95.63	96.71	95.65	95.33	96.59	97.28	97.41	95.92	95.78
G-3	98.85	3.34	100.19	97.39	96.31	96.78	96.75	96.71	95.73	96.53	95.78	97.41	96.30	96.73	96.82	96.79	DRY

Notes:

1. Elevations measured relative to a benchmark established by GMBP (formerly Gamsby and Mannerow) and comprised of a nail in a hydro pole located to the east of the site along Arran Sideroad 25.
2. NI = Not Installed; NM = Not Measured; NA = Not Applicable
3. GS = Ground Surface
4. Ground elevations and subsequent measuring point (top of casing) adjusted in 2022 to suit UTM derived coordinates. Elevations across the site lowered by 1.6 m

TABLE C-1
SUMMARY OF HISTORICAL GROUNDWATER LEVEL DATA

Well No.	Ground Elevation (m)	Original Well Depth from GS (m)	Measuring Point Top of Casing (m)	May-03	May-04	May-05	Apr-06	Sep-06	May-07	Apr-08	May-09	May-10	Apr-11	Apr-12	Nov-12	Apr-13	Nov-13
TW-1	235.21	3.7	236.32	235.11	235.05	234.98	235.13	234.10	235.11	234.80	235.15	235.11	235.27	235.15	235.12	235.11	235.22
TW-2	235.35	2.3	236.55	235.20	235.10	235.00	235.17	234.11	235.12	234.82	235.17	235.13	235.30	235.17	235.14	235.17	235.11
TW-4	235.58	5.0	236.60	235.32	235.26	235.06	235.16	232.27	235.18	234.80	235.31	235.14	235.42	235.30	235.39	235.71	235.73
TW-5	232.93	NA	234.01	233.09	233.04	NM	232.91	231.45	233.16	232.51	233.26	233.21	233.30	233.26	234.01	233.23	232.95
TW-8	236.64	4.3	237.69	236.51	236.49	236.38	236.42	232.83	236.48	236.24	236.56	236.57	236.63	236.54	236.44	236.64	236.49
TW-9	239.17	4.1	240.09	238.79	237.73	237.64	237.88	236.62	236.64	237.55	237.80	237.14	237.82	237.40	237.29	238.25	237.79
TW-10	235.90	4.1	236.92	235.51	235.43	235.40	235.50	234.56	235.37	235.20	235.49	235.34	235.44	235.42	235.36	235.49	235.48
TW-11	237.75	3.8	238.90	237.76	237.40	237.16	237.45	235.79	237.11	236.97	237.52	236.65	237.47	236.97	236.86	238.06	237.75
TW-11D	238.21	NM	239.16	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	236.99	237.99	237.72
TW-12	234.49	4.6	235.55	234.58	234.57	234.58	234.61	233.81	234.58	234.35	234.64	234.65	234.67	234.65	234.55	234.46	234.64
TW-13	234.81	4.0	235.50	234.81	234.80	234.83	234.84	234.37	234.84	234.61	234.88	234.88	234.83	234.88	234.8	234.89	234.88
TW-14	233.90	4.6	234.83	233.85	233.83	233.76	233.77	232.84	233.85	233.59	233.91	233.92	233.65	233.91	234.1	234.28	234.11
TW-15	235.93	1.63	236.85	235.91	235.95	235.94	235.98	235.51	235.94	235.91	236.01	235.86	236.02	235.94	235.94	236.07	236.02
TW-15D	234.73	NM	236.58	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	235.63	235.82	235.73
TW-16	233.27	5.03	234.21	NI	NI	NI	NI	230.14	232.96	232.70	232.99	232.92	233.11	232.96	232.99	233.08	233.04
TW-17	233.13	4.57	234.15	NI	NI	NI	NI	232.94	233.56	233.22	233.35	233.35	233.42	233.51	233.3	233.40	233.45
TW-18	236.17	4.15	237.07	NI	NI	NI	NI	235.44	235.99	236.04	236.13	235.77	NM	NM	235.87	236.23	236.09
TW-19S	242.34	5.90	243.33	NI	NI	NI	NI	240.73	241.33	241.28	241.50	241.17	NM	NM	NM	243.33	241.69
TW-19D	242.43	12.2	242.80	NI	NI	NI	NI	240.21	241.22	241.02	241.43	240.83	NM	NM	241.05	241.78	241.45
TW-20	237.39	6.25	238.17	NI	NI	NI	NI	235.98	236.88	236.74	237.01	236.83	NM	NM	237.05	237.24	237.17
TW-21	235.33	4.57	236.19	NI	NI	NI	NI	235.03	235.20	235.14	235.27	235.26	NM	NM	235.26	235.30	235.27
TW-22	234.68	NM	235.48	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	234.44	234.53	234.46
TW-23	233.54	NM	234.34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	234.20	234.29	234.26
TW-24	235.71	NM	236.71	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	235.56	235.63	235.63
G-1	238.85	3.3	240.10	238.49	238.20	237.95	238.35	NM	237.93	237.57	NM	NM	NM	NM	NM	NM	NM
G-2	237.92	3.32	239.18	237.57	237.28	237.07	237.34	NM	237.08	236.91	NM	NM	NM	NM	NM	NM	NM
G-3	238.42	3.34	239.53	236.15	DRY	236.09	236.13	NM	236.17	236.03	NM	NM	NM	NM	NM	NM	NM

Notes:

1. Elevations measured relative to a benchmark established by GMBP (formerly Gamsby and Mannerow) and comprised of a nail in a hydro pole located to the east of the site along Arran Sideroad 25.
2. NI = Not Installed; NM = Not Measured; NA = Not Applicable
3. GS = Ground Surface
4. Ground elevations and subsequent measuring point (top of casing) adjusted in 2022 to suit UTM derived coordinates. Elevations across the site lowered by 1.6 m

TABLE C-1
SUMMARY OF HISTORICAL GROUNDWATER LEVEL DATA

Well No.	*Ground Elevation (m)*	*Original Well Depth from GS (m)*	*Measuring Point Top of Casing (m)*	*Apr-14*	*Oct-14*	*Apr-15*	*Nov-15*	*Apr-16*	*Nov-16*	*Jan-17*	*Apr-17*	*Oct-17*	*Apr-18*	*Oct-18*	*Apr-19*	*Nov-19*
TW-1	235.21	3.7	236.32	235.29	235.12	235.09	234.99	235.14	234.89	NM	235.22	234.90	235.30	235.09	235.26	235.19
TW-2	235.35	2.3	236.55	235.31	235.16	235.25	235.01	235.22	234.69	NM	235.24	235.10	235.37	235.11	235.29	235.21
TW-4	235.58	5.0	236.60	235.91	235.55	235.55	235.53	235.66	Decom	Decom	Decom	Decom	Decom	Decom	Decom	Decom
TW-5	232.93	NA	234.01	233.30	NM	233.00	233.11	233.30	232.42	NM	233.19	232.34	233.09	233.12	232.76	233.14
TW-8	236.64	4.3	237.69	236.69	236.54	236.66	236.52	236.72	Decom	Decom	Decom	Decom	Decom	Decom	Decom	Decom
TW-9	239.17	4.1	240.09	238.07	237.16	238.06	236.86	237.78	Decom	Decom	Decom	Decom	Decom	Decom	Decom	Decom
TW-10	235.90	4.1	236.92	235.61	235.44	235.48	235.43	235.65	235.22	NM	235.55	235.30	235.70	235.46	235.64	235.59
TW-11	237.75	3.8	238.90	238.06	236.80	237.83	236.51	237.78	236.03	237.05	237.55	236.22	237.53	236.42	237.63	Decom
TW-11D	238.21	NM	239.16	237.99	236.84	237.81	236.54	237.75	235.99	236.95	237.56	236.68	237.53	236.43	237.60	236.71
TW-12	234.49	4.6	235.55	234.67	234.63	234.65	234.55	234.58	234.44	NM	234.55	234.72	234.75	234.66	234.72	234.68
TW-13	234.81	4.0	235.50	234.89	234.88	234.90	234.80	234.93	234.80	234.92	234.91	234.89	234.96	234.89	234.92	234.91
TW-14	233.90	4.6	234.83	234.31	NM	234.16	234.22	234.27	234.14	NM	234.22	NM	234.26	NM	NM	234.26
TW-15	235.93	1.63	236.85	236.10	235.89	236.03	235.83	236.05	235.62	NM	236.03	235.81	236.04	235.88	236.05	235.94
TW-15D	234.73	NM	236.58	235.85	235.57	235.77	235.52	235.82	235.29	NM	235.75	235.46	235.75	235.54	235.76	235.63
TW-16	233.27	5.03	234.21	233.11	232.95	233.05	232.92	233.15	232.87	NM	233.08	232.84	233.17	232.94	233.08	233.02
TW-17	233.13	4.57	234.15	233.51	233.42	233.55	233.40	233.51	233.25	NM	233.33	233.18	233.35	233.16	233.49	233.30
TW-18	236.17	4.15	237.07	236.23	235.79	236.18	235.59	236.26	236.02	NM	236.12	235.70	236.16	235.82	236.15	235.92
TW-19S	242.34	5.90	243.33	241.68	241.33	241.66	241.18	241.74	241.79	NM	241.51	240.69	241.69	241.02	241.54	241.29
TW-19D	242.43	12.2	242.80	241.60	240.99	241.54	240.73	241.72	241.05	NM	241.40	240.32	241.51	240.70	241.52	240.94
TW-20	237.39	6.25	238.17	237.17	237.02	237.21	236.91	237.22	237.07	NM	237.06	236.45	237.23	236.82	237.13	237.11
TW-21	235.33	4.57	236.19	235.31	235.25	235.25	235.19	235.29	235.17	NM	235.24	235.18	235.29	235.12	235.21	235.18
TW-22	234.68	NM	235.48	234.45	234.41	234.46	234.42	234.56	234.33	NM	234.47	234.44	234.55	234.42	234.51	234.45
TW-23	233.54	NM	234.34	234.24	234.14	234.24	234.11	234.31	233.99	NM	234.23	234.12	234.24	234.14	234.22	234.17
TW-24	235.71	NM	236.71	235.63	235.49	235.63	235.54	235.69	234.79	235.68	235.65	234.46	235.73	235.73	235.71	235.70
TW-25S	235.17	5.2	236.33	NI	NI	NI	NI	NI	232.69	234.56	235.05	233.99	235.14	234.81	235.09	235.01
TW-25D	235.17	13.6	236.13	NI	NI	NI	NI	NI	234.00	234.91	234.38	234.17	234.41	234.21	234.41	234.28
TW-26	235.54	5.7	236.70	NI	NI	NI	NI	NI	234.96	235.42	235.27	235.09	235.46	235.22	235.33	235.28
TW-27	238.04	6.5	239.16	NI	NI	NI	NI	NI	235.31	236.86	235.90	235.50	235.85	235.62	235.93	235.71
G-1	238.85	3.3	240.10	NM	NM	NM	NM	238.49	NM	238.72	238.43	NM	NM	NM	NM	NM
G-2	237.92	3.32	239.18	NM	NM	NM	NM	237.58	NM	237.91	NM	NM	NM	NM	NM	NM
G-3	238.42	3.34	239.53	NM	NM	NM	NM	236.34	NM	236.38	236.25	NM	NM	NM	NM	NM

Notes:

1. Elevations measured relative to a benchmark established by GMBP (formerly Gamsby and Mannerow) and comprised of a nail in a hydro pole located to the east of the site along Arran Sideroad 25.
2. NI = Not Installed; NM = Not Measured; NA = Not Applicable
3. GS = Ground Surface
4. Ground elevations and subsequent measuring point (top of casing) adjusted in 2022 to suit UTM derived coordinates. Elevations across the site lowered by 1.6 m

TABLE C-1
SUMMARY OF HISTORICAL GROUNDWATER LEVEL DATA

Well No.	*Ground Elevation (m)*	*Ground Elevation (adjusted 2022)*	*Original Well Depth from GS (m)*	*Measuring Point Top of Casing (m) Adjusted 2022*	*Apr-20*	*Oct-20*	*May-21*	*Nov-21*	*May-22*	*Oct-22*
TW-1	235.21	233.61	3.7	234.72	233.6	233.62	233.13	233.65	233.54	232.73
TW-2	235.35	233.75	2.3	234.95	233.63	233.68	233.46	233.69	233.55	232.71
TW-5	232.93	231.33	NA	232.41	231.57	231.64	NM	231.68	231.32	230.17
TW-10	235.90	234.30	4.1	235.32	234.01	234.00	233.65	234.10	234.01	233.58
TW-11D	238.21	236.61	NM	237.56	235.74	NM	235.58	235.52	235.76	234.06
TW-12	234.49	232.89	4.6	233.95	233.08	233.13	233.11	233.13	233.09	232.86
TW-13	234.81	233.21	4.0	233.90	233.33	233.23	233.33	233.41	233.32	NM
TW-14	233.90	232.30	4.6	233.23	232.67	232.63	232.64	232.67	232.64	NM
TW-15S	235.93	234.33	1.63	233.13	232.29	232.21	232.27	232.32	232.31	231.63
TW-15D	234.73	233.13	NM	234.98	234.13	234.01	234.12	234.13	234.15	233.55
TW-16	233.27	231.67	5.03	232.61	231.45	231.47	231.49	231.52	231.39	230.50
TW-17	233.13	231.53	4.57	232.55	231.69	231.61	231.69	231.51	231.57	231.11
TW-18	236.17	234.57	4.15	235.47	234.57	234.20	234.48	234.51	234.48	233.72
TW-19S	242.34	240.74	5.90	241.73	239.84	239.68	239.70	239.77	239.74	238.19
TW-19D	242.43	240.83	12.2	241.20	239.78	239.13	239.58	239.62	239.80	237.90
TW-20	237.39	235.79	6.25	236.57	235.39	235.39	235.29	235.38	235.34	234.31
TW-21	235.33	233.73	4.57	234.59	233.61	233.55	233.59	233.60	233.56	233.06
TW-22	234.68	233.08	NM	233.88	232.86	232.86	232.82	232.94	232.82	232.48
TW-23	233.54	231.94	NM	232.74	232.64	232.58	232.64	232.47	232.47	231.97
TW-24	235.71	234.11	NM	235.11	234.01	234.13	234.13	234.12	234.08	234.12
TW-25S	235.17	233.57	5.2	234.73	233.48	233.48	233.47	233.47	233.42	231.51
TW-25D	235.17	233.57	13.6	234.53	232.8	232.69	232.71	232.43	232.53	232.09
TW-26	235.54	233.94	5.7	235.10	233.58	233.84	233.60	233.74	233.48	NM
TW-27	238.04	236.44	6.5	237.56	234.27	234.10	234.71	234.22	234.00	234.11

Notes:

1. Elevations measured relative to a benchmark established by GMBP (formerly Gamsby and Mannerow) and comprised of a nail in a hydro pole located to the east of the site along Arran Sideroad 25.
2. NI = Not Installed; NM = Not Measured; NA = Not Applicable
3. GS = Ground Surface
4. Ground elevations and subsequent measuring point (top of casing) adjusted in 2022 to suit UTM derived coordinates. Elevations across the site lowered by 1.6 m

TABLE C-2
SUMMARY OF TEST WELL DATA

Well Number	Top of PVC Pipe (masl)	Ground Elevation (masl)	Well Depth From Ground Level (m)	Screen Length (m)	Well Screen Elevation Depth (masl)
TW-1	236.32	235.21	3.7	0.9	232.41 – 231.51
TW-2	236.55	235.35	2.3	1.2	234.25 – 233.05
TW-3	238.26	237.5	3.4	0.9	235.00 – 234.10
TW-4	236.6	235.58	5	1.2	231.78 – 230.58
TW-5	234.01	232.93	4.8	1.2	229.33 – 228.13
TW-6	235.75	234.88	2.3	0.9	233.48 – 232.58
TW-7	238.49	237.42	6	1.2	232.62 – 231.42
TW-8	237.69	236.64	4.3	0.9	233.24 – 232.34
TW-9	240.09	239.17	4.1	1.5	236.57 – 235.07
TW-10	236.92	235.9	4.1	1.8	233.60 – 231.80
TW-11	238.9	237.75	3.8	1.5	235.45 – 233.95
TW-11D	239.16	238.21	7.0	3	232.71 - 231.21
TW-12	235.55	234.49	4.6	1.5	231.44 – 229.92
TW-13	235.5	234.81	4	1.5	232.37 – 230.85
TW-14	234.83	233.9	4.6	1.5	230.85 – 229.33
TW-15	236.85	235.93	1.63	1.5	235.80 - 234.30
TW-15D	236.58	234.73	7.60	3	228.63 - 227.13
TW-16	234.21	233.27	5.03	3	231.24 - 228.24
TW-17S	234.15	233.13	4.57	3	231.56 – 228.56
TW-17D	NA	NA	6.55	Artesian Conditions	Well not installed
TW-18	237.07	236.17	4.15	3	235.02 – 232.02
TW-19S	243.33	242.34	5.9	3	239.44 - 236.44
TW-19D	242.8	242.43	12.2	3	233.23 - 230.23
TW-20	238.17	237.39	6.25	3	234.14 - 231.14
TW-21	236.19	235.33	4.57	3	233.76 - 230.76
TW-22	235.48	234.68	5.20	3	232.48 - 229.48
TW-23	234.34	233.54	5.20	3	231.34 - 228.34
TW-24	236.71	235.71	6.70	3	232.01 - 229.01
TW-25S	236.33	235.17	5.18	1.5	231.51 - 229.99
TW-25D	236.13	235.17	13.56	3	224.65 - 221.61
TW-26	236.70	235.54	5.69	1.5	232.37 - 230.85
TW-27	239.16	238.04	6.50	1.5	234.17 - 232.65
G-1	240.1	238.85	3.3	3.05	238.60 – 235.55
G-2	239.18	237.92	3.32	3.05	237.63 – 234.58
G-3	239.53	238.42	3.34	3.05	238.13 – 235.08

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TW-1	0.0 - 0.2	Topsoil	235.21	1 @ .2-1.1	0.9	2.8 - 3.7	0.3 - 2.1	1.11
	0.2 - 1.1	Silty TILL, grey-brown mottled, minor stones		2 @ 1.1-1.8				
	1.1 - 1.8	Fine SAND, silty (TILL) minor gravel and clay, brown		3 @ 1.8-2.3				
	1.8 - 2.3	Fine SAND, silty, grey minor gravel and stones		4 @ 2.3-3.2				
	2.3 - 3.7	Silty fine SAND/GRAVEL, grey						
TW-2	same as above	same as above	235.35	same as above	1.2	1.1 - 2.3	Silt Seal 0.0 - 0.6	1.2

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TW-3	0.0 - 0.25	Topsoil	237.50	1 @ 1.25-1.7	0.9	2.50 - 3.40	Native sand 2.0 - 3.40	0.76
	0.25 - 1.6	Brown sandy silt TILL		2 @ 2.0-2.4				
	1.6 - 2.5	Silty SAND TILL		3 @ 2.75-3.2				
	2.5 - 4.25	SAND medium to coarse, minor gravel, grey brown		4 @ 3.50-4.0 5@4.25-4.75				
	4.25 - 4.75	Grey sandy silt TILL		6@5.80-6.20				
	4.75 - 5.20	Grey silty TILL						
	5.20 - 6.20	Grey sandy silt TILL						
TW-4	0.0 - 0.25	Topsoil	235.58	1 @ .25-2.0	1.2	3.8 - 5.0	0 - 3.0	1.02
	0.25 - 3.6	SILT TILL, sandy reddish brown and grey mottled		2 @ 2.0-3.4 3 @ 3.5-5.0				
	3.6 - 5.0	SILT TILL, minor clay, and sand grey brown						

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TW-5	0.0 - 0.35	Topsoil	232.93	1 @ .35-1.2	1.2	3.6 - 4.8	Silt Seal 0.3 - 6.0	1.08
	0.35 - 1.2	SILT TILL, sandy reddish-brown and grey mottled		2 @ 1.2-3.4				
				3 @ 3.4-4.3				
	1.2 - 3.4	SILT TILL, sandy reddish-brown		4 @ 4.3-5.2				
	3.4 - 4.3	SILT TILL grey-brown mottled, minor clay						
	4.3 - 5.15	SILT clay grey-brown mottled						
TW-6	0.0 - 0.3	Topsoil	234.88	1 @ 1.3 -2.3	0.9	1.4 - 2.3	Silt till seal 0 - 1.2	0.87
	0.3 - 1.0	SILT TILL, sandy, grey-brown mottled						
	1.0 - 1.3	Fine SAND, silty, brown						
	1.3 - 2.3	Fine SAND, silty, grey						

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TW-7	0.0 - 0.25	Topsoil	237.42	1 @ 1.25-1.7	1.2	4.8 - 6.0	Partial Peltonite 4.35 - 4.70	1.07
	0.25 - 1.6	Brown sandy TILL		2 @ 2.0-2.4				
	1.6 - 2.5	Silty SAND TILL		3 @ 2.75-3.2				
	2.5 - 4.25	SAND medium to coarse, minor gravel, grey brown		4 @ 3.50-4.0 5@4.25-4.75			Silica Sand Packing 4.70 - 6.0	
	4.25-4.75	Grey sandy SILT TILL		6@5.80-6.20			4.35 - 4.70	
	4.75-5.20	Grey silty SAND						
	5.20-6.20	Grey sandy SILT TILL						

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TW-8	0.0 - 0.3 0.3 - 3.6 3.6 - 4.7 3.4 - 4.3 4.3 - 5.15	Topsoil SILT TILL, minor gravel and clay, brown SILT TILL, minor gravel and clay, grey-brown	236.64	1 @ 0.5-1.9 2 @ 1.2-1.7 3 @ 2.0-2.4 4 @ 2.7-3.2 5 @ 3.5-4.0 6 @ 4.3-4.7	0.9	3.4 - 4.3	1.0 - 1.2	1.05
TW-9	0.0 - 0.3 0.3 - 2.1 2.1 - 4.1 4.1 - 4.6	Topsoil SILT TILL, sandy, brown SILT TILL, grey	239.17	1 @ 0.3-0.8 2 @ 1.1-1.5 3 @ 1.8-2.3 4 @ 2.6-3.1 5 @ 3.4-3.8 6 @ 4.1-4.6	1.5	2.6 - 4.1	1.3 - 1.5	0.92

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TW-10	0.0 - 0.3	Topsoil	235.90	1 @ 0.3-0.8	1.8	2.3 - 4.1	0.6 - 0.8	1.02
	0.3 - 2.4	SAND, silty minor gravel brown		2 @ 1.1-1.5				
				3 @ 1.8-2.3				
	2.4 - 3.2	Silty gravelly, SAND grey		4 @ 2.6-3.1				
	3.2 - 4.6	SILT TILL, grey		5 @ 3.4-3.8				
				6 @ 4.1-4.6				
TH-1	0.0 - 0.25	Topsoil	-	1 @ 0.3-1.4	N/A	N/A	N/A	N/A
	0.25 - 1.4	Sandy SILT TILL, reddish-brown mottled		2 @ 1.4-2.2				
				3 @ 2.2-3.4				
	1.4 - 2.2	SILT TILL, brownish-grey, minor stones and boulders						
	2.2 - 3.4	SAND/GRAVEL silty grey						

BOREHOLE LOGS TW-1 THROUGH TW-10, TH-1, AND TH-2

Testwell No.	Testwell Log (m below ground surface[mbgs])		Ground Elevation (masl)	Sample No. and Depth (mbgs)	Completion (mbgs)			
					Screen Length	Screen Interval	Depth of Seal	Standpipe Height Above Ground
TH-2	0.0 - 0.25	Topsoil	-	1 @ 0.3-2.1	N/A	N/A	N/A	N/A
	0.25 - 2.1	Fine SAND TILL, silty brown minor stones and cobbles		2 @ 2.1-2.8				
	2.1 - 2.8	SAND TILL, very silty, grey, minor gravel						

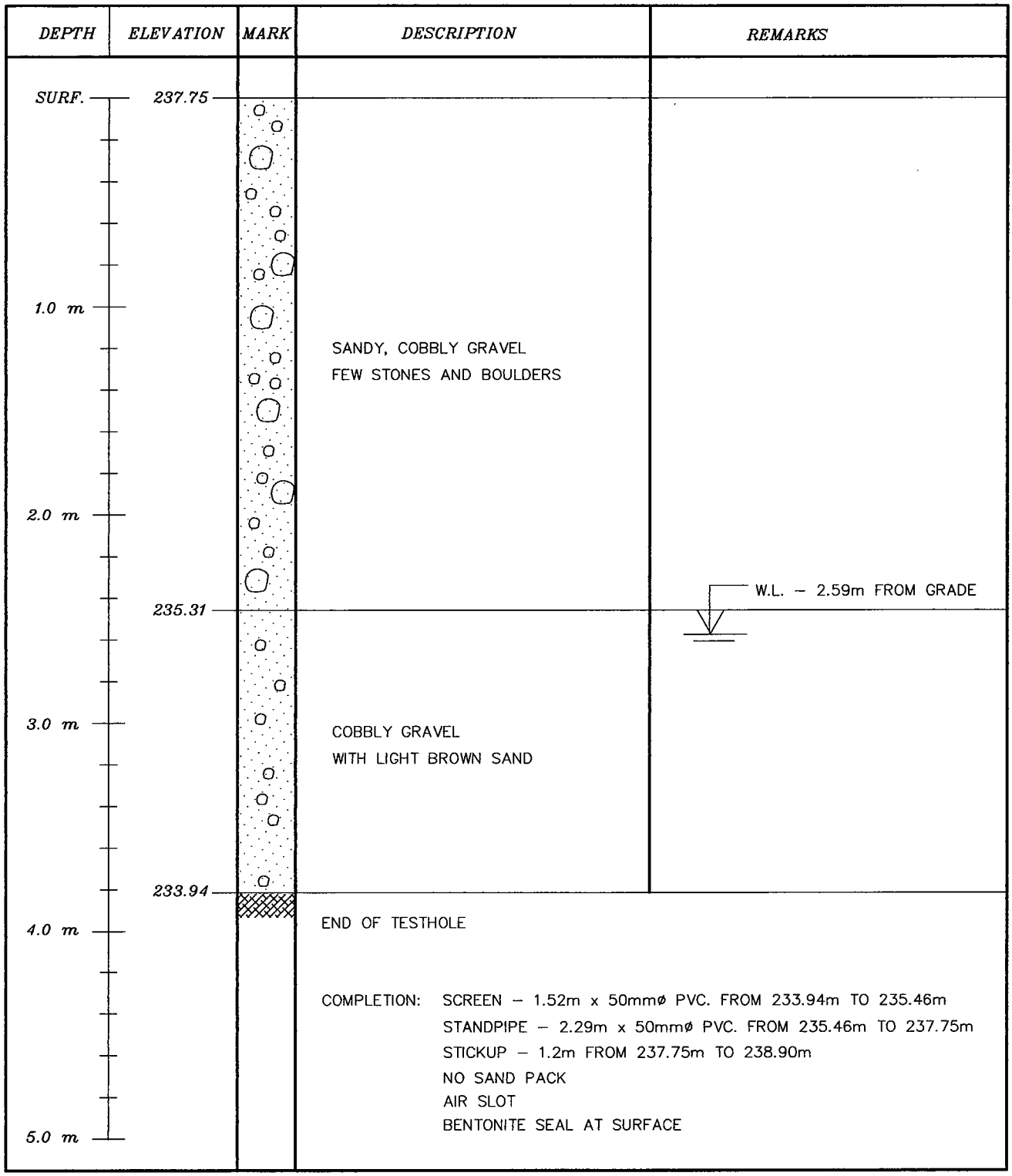
RECORD OF TESTHOLE NO. TW–11

PROJECT : ARRAN LANDFILL — PROJECT NO. : M–1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7



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1260 Second Avenue East, Owen Sound, ON N4K 2J3
519-376-1805 Fax 519-376-8977 www.gamsby.com

MONITORING WELL ID: TW-11D

CLIENT Municipality of Arran-Elderslie
PROJECT NAME Arran Landfill Contigency Plan
PROJECT NUMBER M-1562
PROJECT LOCATION Arran Landfill
DATE COMPLETED 09/12/2012
CONTRACTOR Aardvark Drilling Inc.
LOGGED BY ALE
METHOD Hollow Stem Auger
WELL CONSTRUCTION 0.05 m Ø PVC
NOTES Third Attempt. Auger refusal on boulders in first two attempts.

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
								0.00 Topsoil with rootlets	Concrete
			SS 1	95	1-2-4-5 (6)			0.30 Reddish Brown Silty Sand with cobbles and boulders. Becoming wet at 2 m	
			SS 2	45	5-6-4-4 (10)				
			SS 3	50	8-21-37-38 (58)				Bentonite Seal
			SS 4	10	50-50-50-50 (100)				
			SS 5	92	8-12-19-20 (31)			5.30 Grey Brown dense silty sand with gravel, wet.	
			SS 6	83	14-20-22-24 (42)			6.40 Grey stiff silty clayey sand. Hard and fractured with low moisture.	Silica Sand Pack

Borehole Terminated at 7.00 m.

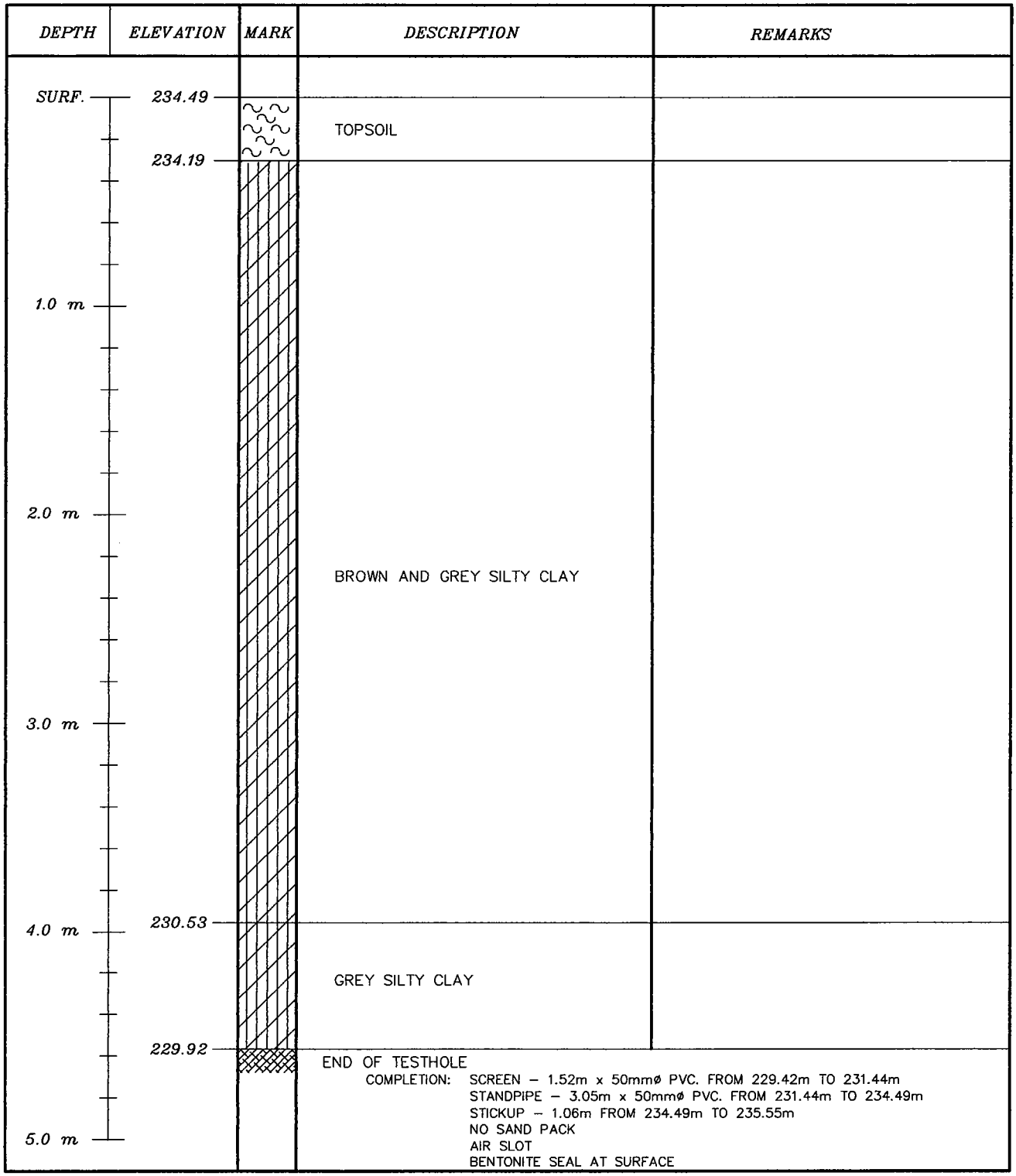
RECORD OF TESTHOLE NO. TW–12

PROJECT : ARRAN LANDFILL — PROJECT NO. : M–1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7



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RECORD OF TESTHOLE NO. TW–13

PROJECT : ARRAN LANDFILL — PROJECT NO. : M–1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7

DEPTH	ELEVATION	MARK	DESCRIPTION	REMARKS
SURF.	234.81			
			TOPSOIL	
	234.51			
			REDDISH–GREY SILTY CLAY	
	233.90			
1.0 m			BROWN AND GREY SILTY CLAY	
2.0 m				
3.0 m				
	230.85			
4.0 m			END OF TESTHOLE	
5.0 m				

COMPLETION: SCREEN – 1.52m x 50mmø PVC. FROM 230.85m TO 232.37m
STANDPIPE – 2.44m x 50mmø PVC. FROM 232.37m TO 234.81m
STICKUP – 0.69m FROM 234.81m TO 235.50m
NO SAND PACK
AIR SLOT
BENTONITE SEAL AT SURFACE

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RECORD OF TESTHOLE NO. TW–14

PROJECT : ARRAN LANDFILL — PROJECT NO. : M–1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7

DEPTH	ELEVATION	MARK	DESCRIPTION	REMARKS
SURF.	233.90			
			TOPSOIL	
	233.60			
1.0 m				
2.0 m			BROWN AND GREY CLAY	
3.0 m				
4.0 m	229.94		GREY CLAY	
	229.33		END OF TESTHOLE	
5.0 m			COMPLETION: SCREEN – 1.52m x 50mmø PVC. FROM 229.33m TO 230.85m STANDPIPE – 3.05m x 50mm ø PVC. FROM 230.85m TO 233.90m STICKUP – 0.93m FROM 233.90m TO 234.83m NO SAND PACK AIR SLOT BENTONITE SEAL AT SURFACE	

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MONITORING WELL ID: TW-15D

CLIENT Municipality of Arran-Elderslie
PROJECT NAME Arran Landfill Contigency Plan
PROJECT NUMBER M-1562
PROJECT LOCATION Arran Landfill
DATE COMPLETED 09/12/2012
CONTRACTOR Aardvark Drilling Inc.
LOGGED BY ALE
METHOD Hollow Stem Auger
WELL CONSTRUCTION 0.05 m Ø PVC
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION
								0.00 Topsoil with rootlets
								0.24 Brown silt with Grey clay some sand and stones
1	1		SS 1	80	1-2-2-3 (4)			
	2							
	3							
	4							
	5							1.50
2	6		SS 2	95	2-4-8-13 (12)			Light brown coarse sand and gravel with some silt. Becoming wet at 3.5 m.
	7							
	8							
	9							
3	10		SS 3	100	2-2-3-8 (5)			
	11							
	12							
4	13		SS 4	100	3-5-8-5 (13)			
	14							
	15							
5	16		SS 5	20	1-2-6-3 (8)			
	17							
	18		SS 6	80	3-13-6-3 (19)			
	19							
6	20							
	21		SS 7	30	1-1-1-1 (2)			
	22							6.70
7	23		SS 8	100	2-3-5-4 (8)			Grey silty sand with some gravel.
	24							

Borehole Terminated at 7.60 m.

Project No: M-1562

Project: Arran Landfill

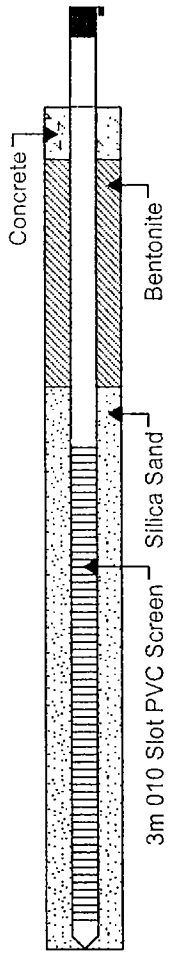
Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Log of Borehole: TW-16

Eng./Tech.: M. Nelson

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details
		Ground Surface					
0		Organic topsoil.					
1		Brown and mottled grey, stiff silty clay with some sand, moist, becoming wet with depth.					
3 / 1			1	SS	3,4,5		
5			2	SS	6,9,14		
7 / 2							
8		Clayey silt till (clayey silt and silty clay), wet, becoming very wet and soft ("sloppy") with depth.	3	SS	7,14,15		
10 / 3			4	SS	6,10,11		
13 / 4							
16 / 5			5	SS	3,3,5		
17		End of Borehole					
19							



Drill Method: HSA with Split Spoon Sampler

Drill Date: June 27, 2006

Drilling Contractor: London Soil Test

Hole Diameter (m): 0.16

Hole Depth (m): 5.03

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Ground Elevation (masl): 233.27

TOC Elevation (masl): 234.21

Stickup (m): 0.94

Notes: NW Corner of Site

Sheet: 1 of 1

Project No: M-1562

Project: Arran Landfill

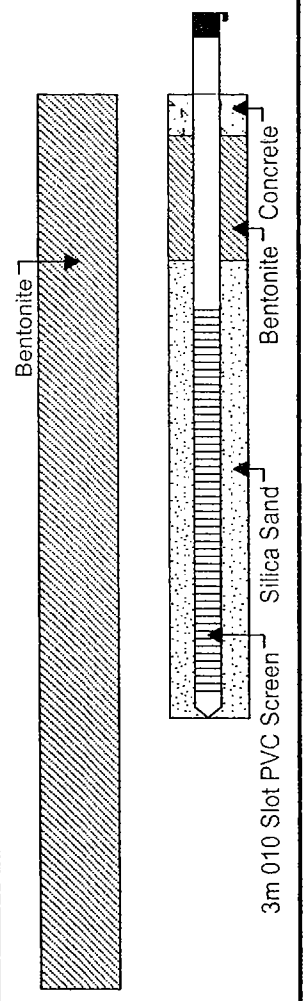
Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Eng./Tech.: M. Nelson

Log of Borehole: TW-17S/D

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details TW-17D TW-17S
0 / 0		Ground Surface					
0 – 3 / 0 – 1		Light brown silty clay, slightly moist.					
3 – 10 / 1 – 3		Brown silty clay with some gravel, moist becoming wet with depth.	1	SS	4,9,10		
			2	SS	5,11,13		
10 – 20 / 3 – 6		Brown, stiff clay, wet. Clay becoming grey, increasingly plastic and soft with depth. Two 1-mm scale silt lenses 4.57 to 6.10m.	3	SS	5,8,8		
			4	SS	1,1,1		
20 – 21.5 / 6 – 6.55		Coarse sand. Artesian flow in borehole. Head in augers 0.40m above ground surface, well could not be installed, borehole was capped with bentonite.	5	SS	3,1,1		
21.5 / 6.55		End of Borehole					



Drill Method: HSA with Split Spoon Sampler
Drill Date: June 27, 2006
Drilling Contractor: London Soil Test
Hole Diameter (m): 0.16
Hole Depth (m): 6.55

Gamsby and Mannerow Limited
People Engineering Environments
Guelph - Owen Sound - Listowel

Ground Elevation (masl): 233.13
TOC Elevation (masl): 234.15
Stickup (m): 1.02
Notes: Central West Property
Sheet: 1 of 1

Project No: M-1562

Project: Arran Landfill

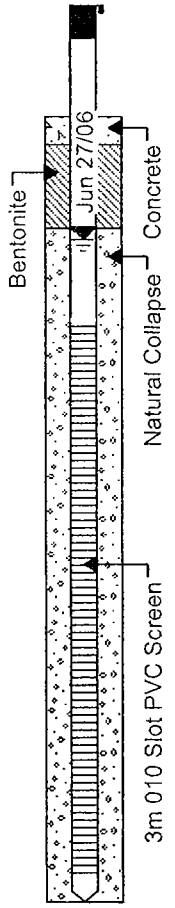
Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Log of Borehole: TW-18

Eng./Tech.: M. Nelson

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details
		Ground Surface					
0 / 0		Sandy silt, moist to wet. Brown sandy silt with some clay 0.76 to 1.52m, wet (sand coarsening with depth).	1	SS	4,5,7		
5 / 1		Brown silty sand with clay, very wet and high pore water pressure (sand coarsening with depth).	2	SS	2,5,8		
10 / 3			3	SS	3,4,4		
11 / 3		Gravel with sand and silt, wet (very high pore water pressure).	4	SS	13,13,11		
13 / 4		Gravel till, wet. Notes: Difficult drilling.					
14 / 4		End of Borehole					
17 / 5							



Drill Method: HSA with Split Spoon Sampler

Drill Date: June 27, 2006

Drilling Contractor: London Soil Test

Hole Diameter (m): 0.16

Hole Depth (m): 4.15

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People Engineering Environments
Guelph - Owen Sound - Listowel

Ground Elevation (masl): 236.17

TOC Elevation (masl): 237.07

Stickup (m): 0.90

Notes:

Sheet: 1 of 1

Project No: M-1562

Project: Arran Landfill

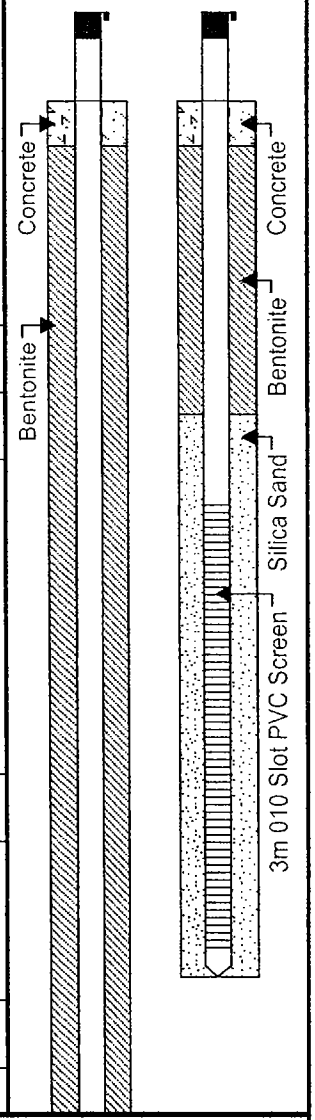
Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Log of Borehole: TW-19S/D

Eng./Tech.: A. Bringleson

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details TW-19D / TW19-S
0		Ground Surface					
0		Light brown silty sand and gravel, dry.					
1		Light brown silt till with gravel stones and cobbles, moist.					
6			1	SS	16,28,18		
7		Light brown silt till with stones and cobbles, moist becoming wet at 2.74m. Angular stones and cobbles 2.74 to 5.03m.	2	SS	37,17,19		
16			3	SS	50,x,x		
17		Light brown, dense silt till, wet.					
20			4	SS	39,50,x		
22		Grey/brown silt till with stones.	5	SS	47,50,x		



Drill Method: HSA with Split Spoon Sampler

Drill Date: June 26 and 27, 2006

Drilling Contractor: London Soil Test

Hole Diameter (m): 0.16

Hole Depth (m): 12.65

Gamsby and Mannerow Limited
People Engineering Environments
Guelph - Owen Sound - Listowel

Ground Elevation (masl): 242.43 (D), 242.34 (S)

TOC Elevation (masl): 242.80 (D), 243.33 (S)

Stickup (m): 0.37 (D), 0.99 (S)

Notes:

Project No: M-1562

Project: Arran Landfill

Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Log of Borehole: TW-19S/D

Eng./Tech.: A. Bringleson

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details
23 7							
24		Grey, hard silt till, moist.	6	SS	45,50,x		
25							
26 8							
27							
28							
29							
30 9							
31							
32							
33 10							
34							
35							
36 11			7	SS	26,50,x		
37							
38							
39							
40 12		Notes: Overall difficult drilling due to presence of rocks and dense till 1.98m to 12.64m.	8	SS	34,50,x		
41							
42		End of Borehole					
43 13							
44							
45							
46 14							
47							

Silica Sand

3m 010 Slot PVC Screen

Drill Method: HSA with Split Spoon Sampler

Drill Date: June 26 and 27, 2006

Drilling Contractor: London Soil Test

Hole Diameter (m): 0.16

Hole Depth (m): 12.65

Gamsby and Mannerow Limited
People Engineering Environments
Guelph - Owen Sound - Listowel

Ground Elevation (masl): 242.43 (D), 242.34 (S)

TOC Elevation (masl): 242.80 (D), 243.33 (S)

Stickup (m): 0.37 (D), 0.99 (S)

Notes:

Sheet: 2 of 2

Project No: M-1562

Project: Arran Landfill

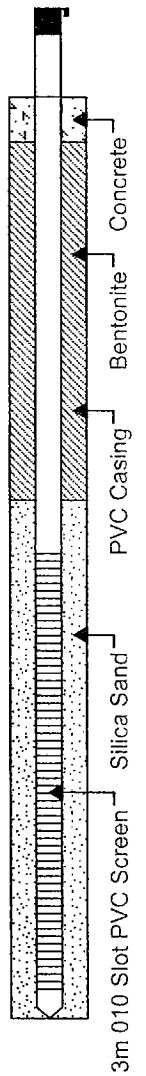
Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Log of Borehole: TW-20

Eng./Tech.: A. Bringleson

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details
		Ground Surface					
0		Brown silty sand with stones and organics 0 to 0.76m, moist.					
1		Light brown, dense silty sand with angular stones 0.76 to 1.23m.	1	SS	10,10,12		
2		Light brown, dense silt with clay and stones with iron oxidation staining throughout, moist to wet.	2	SS	17,18,21		
3		Grey/brown, dense silt with stones layered with medium coarse sand, wet.	3	SS	13,18,20		
4			4	SS	18,15,14		
5		Grey silty sand and gravel, wet.	5	SS	10,17,17		
6		Grey, dense silt with clay, dry.					
		Grey silt till with seams of medium to coarse sand and gravel, wet.	6	SS	5,12,34		
		Grey, dense, uniform silt till. Split spoon refusal at 6.32m.	7	SS	36,50,x		
		End of Borehole					



Drill Method: HSA with Split Spoon Sampler
Drill Date: June 26, 2006
Drilling Contractor: London Soil Test
Hole Diameter (m): 0.16
Hole Depth (m): 6.55

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Ground Elevation (masl): 237.39
TOC Elevation (masl): 238.17
Stickup (m): 0.78
Notes:
Sheet: 1 of 1

Project No: M-1562

Project: Arran Landfill

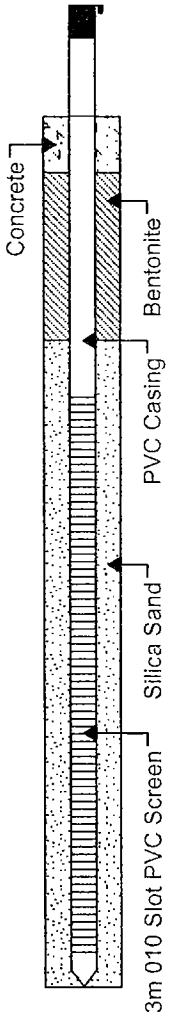
Client: Municipality of Arran Elderslie

Location: Lot 20, Concession 7, Township of Arran, County of Bruce

Log of Borehole: TW-21

Eng./Tech.: A. Bringleson

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description	Number	Type	Blow Counts	Recovery %	Well Completion Details
		Ground Surface					
0		Light brown silt with organics, moist.					
1		Light brown silt till, moist.					
2		Grey/brown to grey silt till with seams of coarse sand and gravel, moist, becoming wet and grey at 1.98m. Occasional stones 1.98 to 2.74m.	1	SS	9,6,9		
			2	SS	4,10,15		
3		Grey silt with sand and gravel, wet.	3	SS	5,3,3		
			4	SS	7,12,16		
4							
			5	SS	9,13,19		
5		End of Borehole					



Drill Method: HSA with Split Spoon Sampler
Drill Date: June 26, 2006
Drilling Contractor: London Soil Test
Hole Diameter (m): 0.16
Hole Depth (m): 5.03

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People Engineering Environments
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Ground Elevation (masl): 235.33
TOC Elevation (masl): 236.19
Stickup (m): 0.86
Notes:
Sheet: 1 of 1

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MONITORING WELL ID: TW-22

CLIENT Municipality of Arran-Elderslie
PROJECT NAME Arran Landfill Contigency Plan
PROJECT NUMBER M-1562
PROJECT LOCATION Arran Landfill
DATE COMPLETED 09/11/2012
CONTRACTOR Aardvark Drilling Inc.
LOGGED BY ALE
METHOD Hollow Stem Auger
WELL CONSTRUCTION 0.05 m Ø PVC
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
			SS 1	80	1-2-3-4 (5)				0.00 Topsoil 0.40 Brown sandy silt. Hard and dry.
			SS 2	50	1-1-2-3 (3)		Wet at 1.8 m bgs		1.50 Grey silty sandy clay with stones. Moist.
			SS 3	80	8-12-13-18 (25)				
			SS 4	75	10-19-24-35 (43)				

WELL DIAGRAM: Concrete; Bentonite Seal; Silica Sand Pack; Native Material Slough

Borehole Terminated at 5.20 m.

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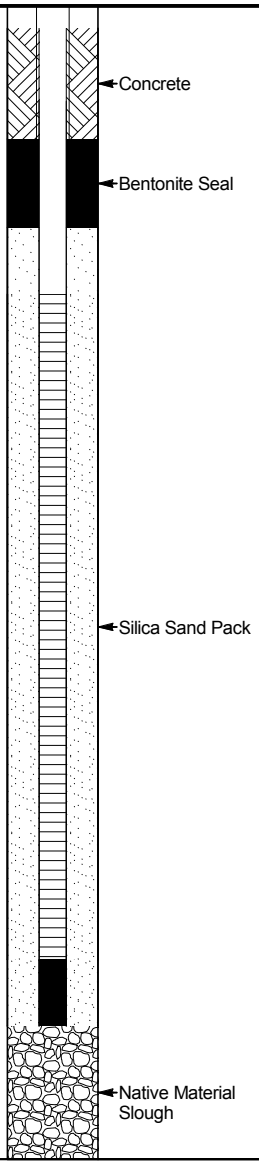
MONITORING WELL ID: TW-23

CLIENT Municipality of Arran-Elderslie
PROJECT NAME Arran Landfill Contigency Plan
PROJECT NUMBER M-1562
PROJECT LOCATION Arran Landfill
DATE COMPLETED 09/11/2012
CONTRACTOR Aardvark Drilling Inc.
LOGGED BY ALE
METHOD Hollow Stem Auger
WELL CONSTRUCTION 0.05 m Ø PVC
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION
								0.00 Mucky organic topsoil. Wet.
	1		SS 1	75				0.50 Grey Clay, soft and wet.
	2							
1	3							
	4							
	5							1.50 Grey silty clayey sand with seams of gravel approximately 9 cm thick. Wet.
	6		SS 2	50	2-2-3-4 (5)			
2	7							
	8							
	9							
3	10							
	11		SS 3	80	5-9-9-8 (18)			
	12							
4	13							
	14							
	15							
	16		SS 4	100	5-9-7-6 (16)			
5	17							

Borehole Terminated at 5.20 m.



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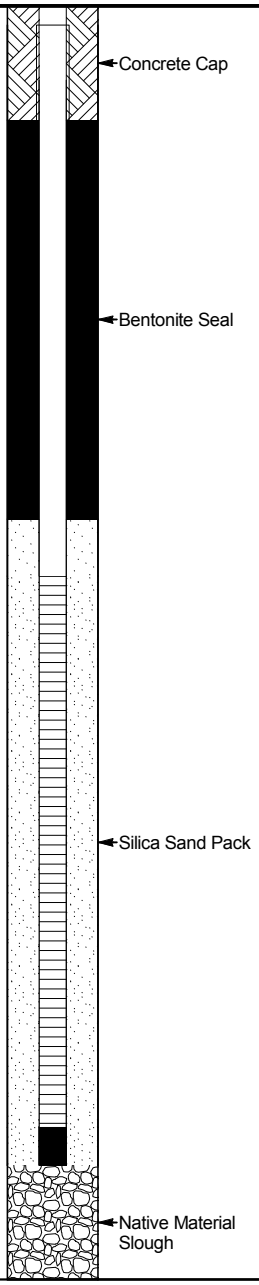
MONITORING WELL ID: TW-24

CLIENT Municipality of Arran-Elderslie
PROJECT NAME Arran Landfill Contigency Plan
PROJECT NUMBER M-1562
PROJECT LOCATION Arran Landfill
DATE COMPLETED 09/11/2012
CONTRACTOR Aardvark Drilling Inc.
LOGGED BY ALE
METHOD Hollow Stem Auger
WELL CONSTRUCTION 0.05 m Ø PVC
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION
			SS 1	100				0.00 Topsoil with rootlets. 0.30 Light brown clayey silt with some stones. Dense and dry.
			SS 2	100				
			SS 3	100	6-10-13-15 (23)			3.00 Grey silty clay with some stones. Plastic and moist.
			SS 4	100	2-4-5-5 (9)			
			SS 5	100	1-2-5-4 (7)			



Borehole Terminated at 6.70 m.

Borehole ID: TW-25S

CLIENT Municipality of Arran Elderslie
PROJECT NAME Arran Landfill
PROJECT NUMBER M-1174
PROJECT LOCATION Arran Elderslie
DATE COMPLETED 2016/10/24
CONTRACTOR London Soil Test
LOGGED BY AN
METHOD Hollow Stem Auger
WELL CONSTRUCTION 2" PVC
NOTES Lithology and sample information taken from TW-25 D

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
								0.00 Ground Surface 235.17	T.O.P = 236.33
								TOPSOIL 0.30 234.87	
								Reddish brown, SILT and CLAY 1.52 233.65	BENTONITE SEAL
			SS 1	95	3-9-9-14 (18)			Reddish brown, SILT and CLAY with trace coarse sand and fine gravel, moist at 1.5 mbgs 3.05 232.12	
			SS 2	90	6-10-11-13 (21)			Greyish brown, SILT and CLAY with trace coarse sand and fine gravel, wet at 4.57 mbgs	CAPPED RISER SILICA SAND PACK 10' SLOTTED SCREEN
			SS 3	100	3-7-7-8 (14)				BOTTOM CAP

Borehole Terminated at 6.27 m.

Borehole ID: TW-25D

CLIENT Municipality of Arran Elderslie
PROJECT NAME Arran Landfill
PROJECT NUMBER M-1174
PROJECT LOCATION Arran Elderslie
DATE COMPLETED 2016/10/24
CONTRACTOR London Soil Test
LOGGED BY AN
METHOD Hollow Stem Auger
WELL CONSTRUCTION 2" PVC
NOTES 30 metres towards Sideroad 20 from North property line.

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
	-2	236								T.O.P = 236.13
0	0							0.00 Ground Surface	235.17	
	2							0.30 TOPSOIL	234.87	
	4	234						Reddish brown, SILT and CLAY		
2	6		SS 1	95 (100)	3-9-9-14 (18)			1.52	233.65	
	8							Reddish brown, SILT and CLAY with trace coarse sand and fine gravel, moist at 1.5 mbgs		
	10	232						3.05	232.12	
	12		SS 2	90 (100)	6-10-11-13 (21)			Grey brown, SILT and CLAY with trace coarse sand and fine gravel, wet at 4.57 mbgs		
4	14									
	16		SS 3	100 (100)	3-7-7-8 (14)					BENTONITE SEAL
	18	230						5.18	229.99	
6	20							Grey brown, SILT and CLAY with trace coarse sand		
	22		SS 4	29 (100)	3-5-5-6 (10)			6.71	228.47	
	24	228						Reddish brown, SILT and CLAY with trace coarse sand		
8	26		SS 5	100 (100)	0-0-0-3 (0)					
	28									
	30	226								
	32		SS 6	75 (100)	1-2-2-3 (4)			9.75	225.42	
10	34							Reddish brown, clayey SILT		CAPPED RISER
	36		SS 7	96 (100)	0-0-0-0 (0)					
	38	224								
12	40									SILICA SAND PACK
	42		SS 8	100 (100)	0-0-0-0 (0)			12.19	222.98	
	44	222						12.34 Grey, fine SAND	222.83	10' SLOTTED SCREEN
14	46							Grey, clayey SILT		
								13.72	221.45	BOTTOM CAP
								Grey, fine to medium SAND with some silt (based on material brought to surface from auger cuttings). Estimated to occur at approximately 13.7 mbgs		

Borehole Terminated at 14.60 m.

Borehole ID: TW-26

CLIENT Municipality of Arran Elderslie
PROJECT NAME Arran Landfill
PROJECT NUMBER M-1174
PROJECT LOCATION Arran Elderslie
DATE COMPLETED 2016/10/24
CONTRACTOR London Soil Test
LOGGED BY AN
METHOD Hollow Stem Auger
WELL CONSTRUCTION 2" PVC
NOTES Replaced TW-8

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
									T.O.P = 236.70
0	0	236						0.00 Ground Surface 235.54	
								TOPSOIL	
	1							0.30 235.24	
	2	235						Reddish brown, SILT and CLAY with trace sand and gravel	
1	3								
	4								
	5	234	SS 1	83 (100)	6-11-13-18 (24)				BENTONITE SEAL
2	6								
	7							2.13 233.41	
	8	233						Grey to brown, SILT and CLAY with trace medium to coarse sand and gravel	
	9								
3	10								CAPPED RISER
	11		SS 2	83 (100)	5-7-9-10 (16)				
	12	232							
4	13								SILICA SAND PACK
	14								
	15	231							10' SLOTTED SCREEN
	16		SS 3	100 (100)	4-5-6-8 (11)				
5	17								
	18	230							BOTTOM CAP

Borehole Terminated at 5.69 m.

Borehole ID: TW-27

CLIENT Municipality of Arran Elderslie
PROJECT NAME Arran Landfill
PROJECT NUMBER M-1174
PROJECT LOCATION Arran Elderslie
DATE COMPLETED 2016/10/24
CONTRACTOR London Soil Test
LOGGED BY AN
METHOD Hollow Stem Auger
WELL CONSTRUCTION 2" PVC
NOTES Replaced TW-9

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	SPT N VALUE 20 40 60 80	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
								0.00 Ground Surface	238.04	T.O.P = 239.16
								TOPSOIL		
								0.30	237.74	
								Reddish brown, SILT and CLAY		
								1.52	236.52	BENTONITE SEAL
			SS 1	75 (100)	9-24-16-13 (40)			Tan, fine to medium SAND with some fine to coarse gravel and cobbles, dry		
								2.13	235.91	
								Reddish brown, clayey SILT with trace fine to coarse gravel and cobbles		
			SS 2	100 (100)	7-5-8-7 (13)			3.48	234.56	CAPPED RISER
								3.66 Brown, fine SAND and trace fine gravel, becoming wet at 3.47 mbgs	234.38	SILICA SAND PACK
								Grey, SILT and SAND with little gravel, cobbles noted.		
			SS 3	54 (100)	7-13-14-13 (27)					10' SLOTTED SCREEN
										BOTTOM CAP

Borehole Terminated at 6.50 m.

RECORD OF TESTHOLE NO. G-1

PROJECT : ARRAN LANDFILL — PROJECT NO. : M-1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7

DEPTH	ELEVATION	MARK	DESCRIPTION	REMARKS
SURF.	238.85			
			TOPSOIL	
	238.55			
1.0 m			LIGHT BROWN CLAY	MOIST
2.0 m				
3.0 m				
	235.55		END OF TESTHOLE	
4.0 m				
5.0 m				

GAS WELL COMPLETION:
SCREEN – 3.05m x 50mmø PVC. FROM 235.55m TO 238.60m
STANDPIPE – 0.25m x 50mmø PVC. FROM 238.60m TO 238.85m
STICKUP – 1.25m FROM 238.85m TO 240.10m
NO SAND PACK
NO AIR SLOT
BENTONITE SEAL AT SURFACE

GAMSBY AND MANNEROW LIMITED

RECORD OF TESTHOLE NO. G-2

PROJECT : ARRAN LANDFILL — PROJECT NO. : M-1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7

DEPTH	ELEVATION	MARK	DESCRIPTION	REMARKS
SURF.	237.92			
			TOPSOIL	
	237.62			
			VERY COBBLY AND STONY	
	237.31			
1.0 m				
			LIGHT BROWN SAND, SMALL BOULDERS AND LARGE ROCKS	
2.0 m				W.L. – 2.59m FROM GRADE
3.0 m				
	234.58		END OF TESTHOLE	
4.0 m				
5.0 m				

GAS WELL COMPLETION:
SCREEN – 3.05m x 50mmø PVC. FROM 234.58m TO 237.63m
STANDPIPE – 0.29m x 50mmø PVC. FROM 237.63m TO 237.92m
STICKUP – 1.26m FROM 237.92m TO 239.18m
NO SAND PACK
NO AIR SLOT
BENTONITE SEAL AT SURFACE

GAMSBY AND MANNEROW LIMITED

RECORD OF TESTHOLE NO. G-3

PROJECT : ARRAN LANDFILL — PROJECT NO. : M-1174

CLIENT : TOWNSHIP OF ARRAN — SUPERVISOR : P. QUINLAN

TEST HOLE TYPE : TRACTOR BACKHOE — DATE : AUGUST 6, 1993

LOCATION : SOUTH HALF OF LOT 20, CONCESSION 7

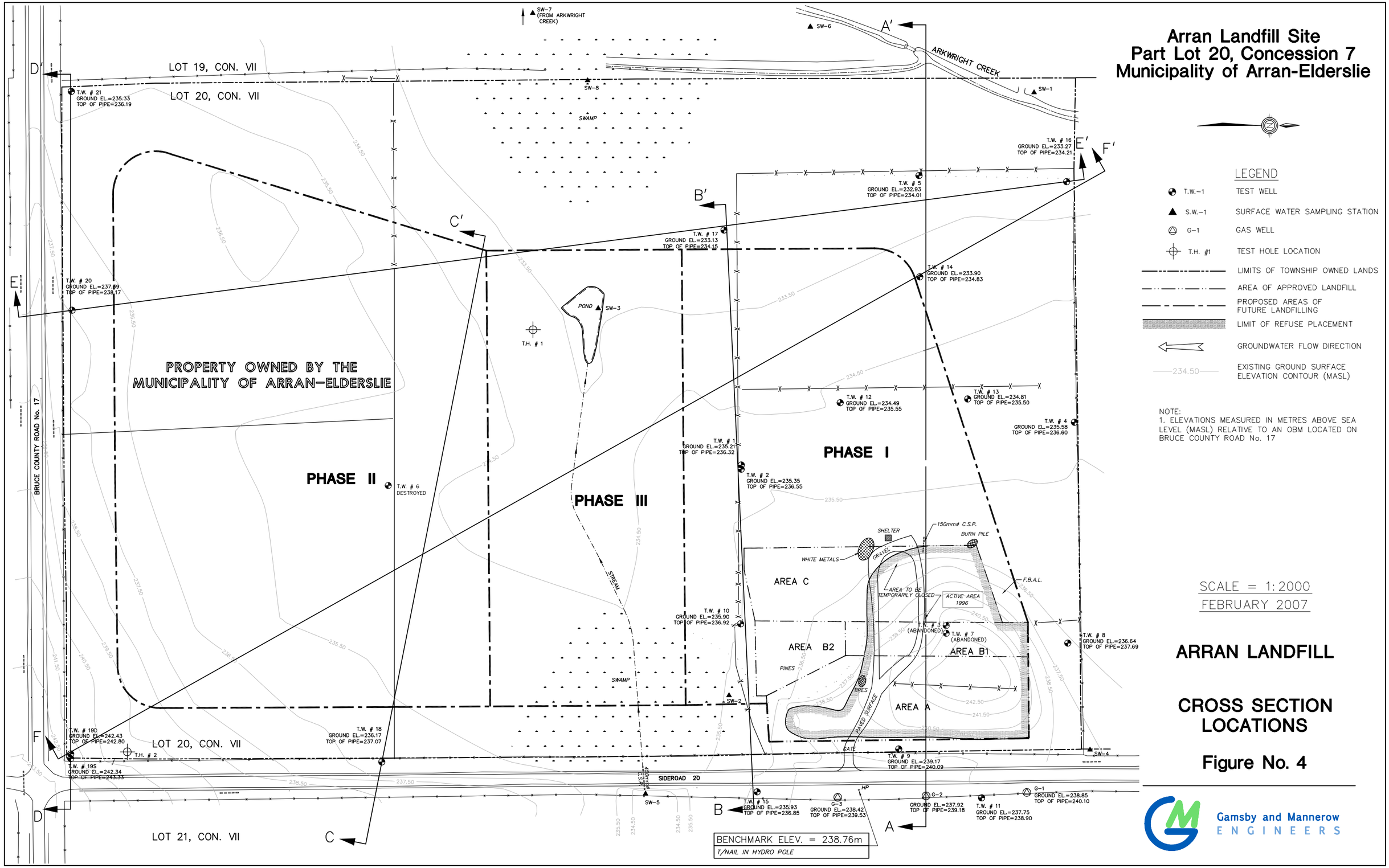
DEPTH	ELEVATION	MARK	DESCRIPTION	REMARKS
SURF.	238.42		TOPSOIL LARGE ROCKS	
1.0 m				
2.0 m				W.L. – 2.44m FROM GRADE
3.0 m				
	235.08		END OF TESTHOLE	
4.0 m				
5.0 m				

GAS WELL COMPLETION:
SCREEN – 3.05m x 50mmø PVC. FROM 235.08m TO 238.13m
STANDPIPE – 0.29m x 50mmø PVC. FROM 238.13m TO 238.42m
STICKUP – 1.11m FROM 238.42m TO 239.55m
NO SAND PACK
NO AIR SLOT
BENTONITE SEAL AT SURFACE

GAMSBY AND MANNEROW LIMITED

APPENDIX D:
CROSS-SECTIONS

Arran Landfill Site
Part Lot 20, Concession 7
Municipality of Arran-Elderslie



LEGEND

T.W.–1	TEST WELL
S.W.–1	SURFACE WATER SAMPLING STATION
G–1	GAS WELL
T.H. #1	TEST HOLE LOCATION
	LIMITS OF TOWNSHIP OWNED LANDS
	AREA OF APPROVED LANDFILL
	PROPOSED AREAS OF FUTURE LANDFILLING
	LIMIT OF REFUSE PLACEMENT
	GROUNDWATER FLOW DIRECTION
234.50	EXISTING GROUND SURFACE ELEVATION CONTOUR (MASL)

NOTE:
1. ELEVATIONS MEASURED IN METRES ABOVE SEA LEVEL (MASL) RELATIVE TO AN OBM LOCATED ON BRUCE COUNTY ROAD No. 17

SCALE = 1:2000
FEBRUARY 2007

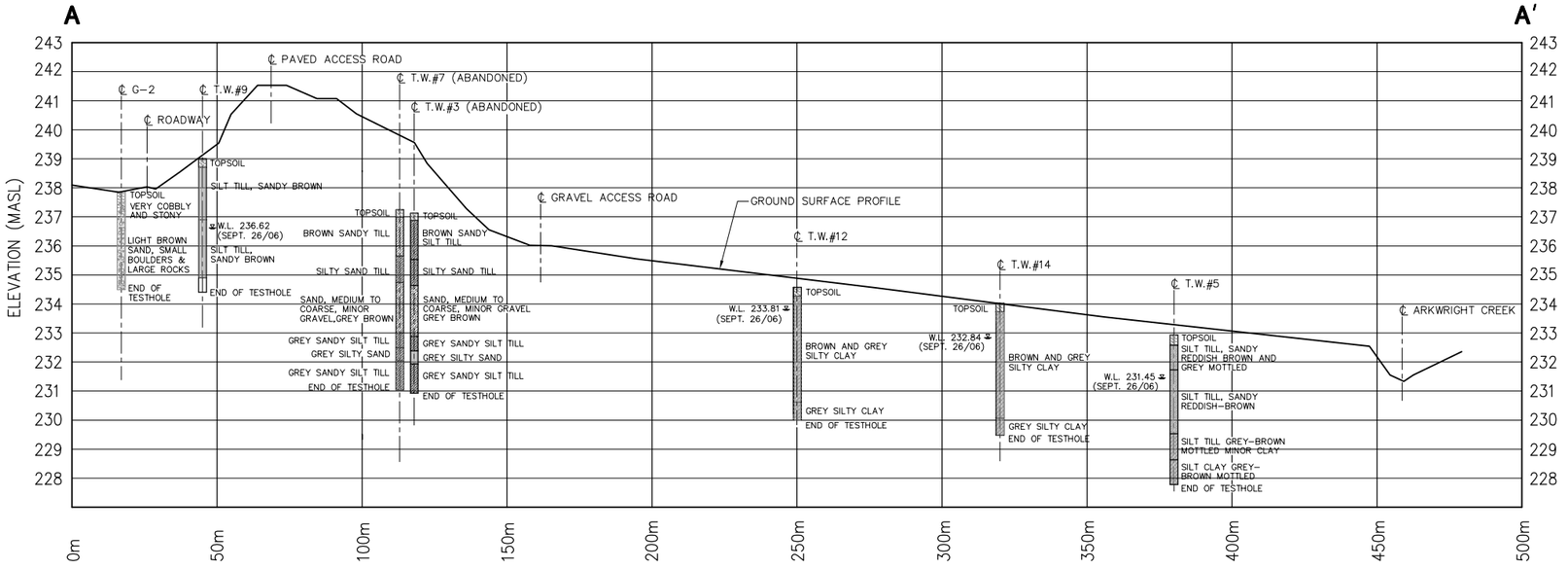
ARRAN LANDFILL

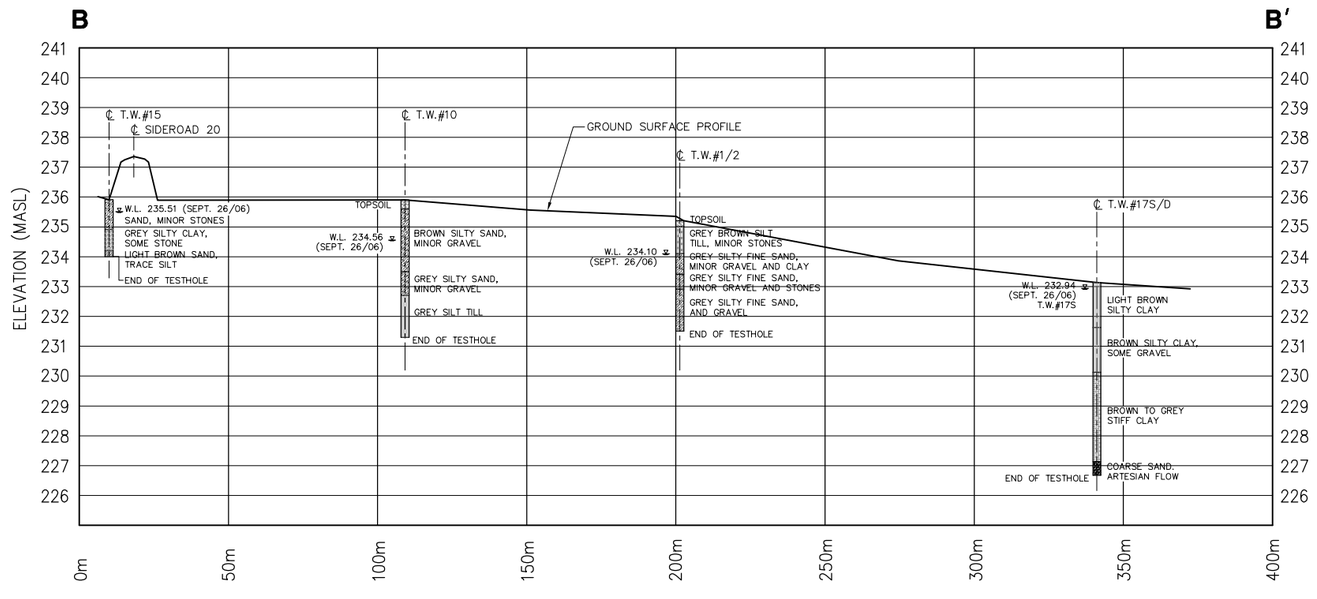
CROSS SECTION LOCATIONS

Figure No. 4

Gamsby and Mannerow
ENGINEERS

Arran Landfill Site
Part Lot 20, Concession 7
Municipality of Arran-Elderslie





NOTES:

1. ELEVATIONS MEASURED IN METERS ABOVE SEA LEVEL (MASL) RELATIVE TO AN OBM LOCATED ON COUNTY ROAD 17.

2. 10 X VERTICAL EXAGGERATION.

3. WATER LEVELS (W.L.) WERE MEASURED ON SEPTEMBER 26, 2006.

SCALE = 1:2000 HORIZ.
1:200 VERT.

FEBRUARY 2007

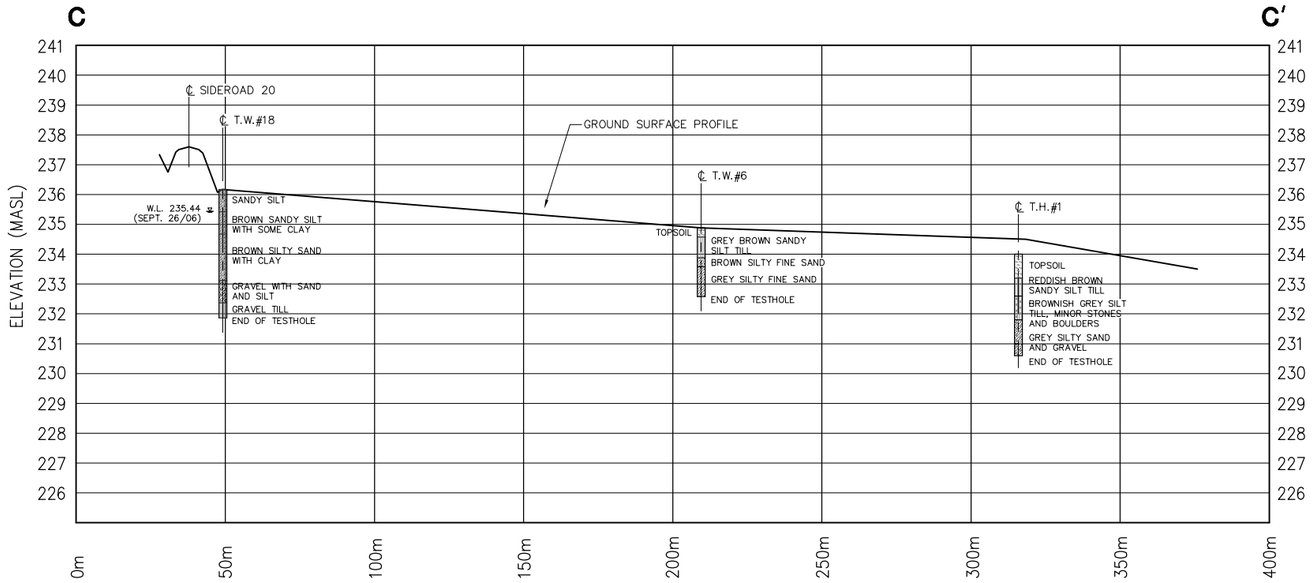
ARRAN LANDFILL

CROSS SECTIONS A-A′ AND B-B′

Figure No. 4A

Gamsby and Mannerow
ENGINEERS

Arran Landfill Site
Part Lot 20, Concession 7
Municipality of Arran-Elderslie

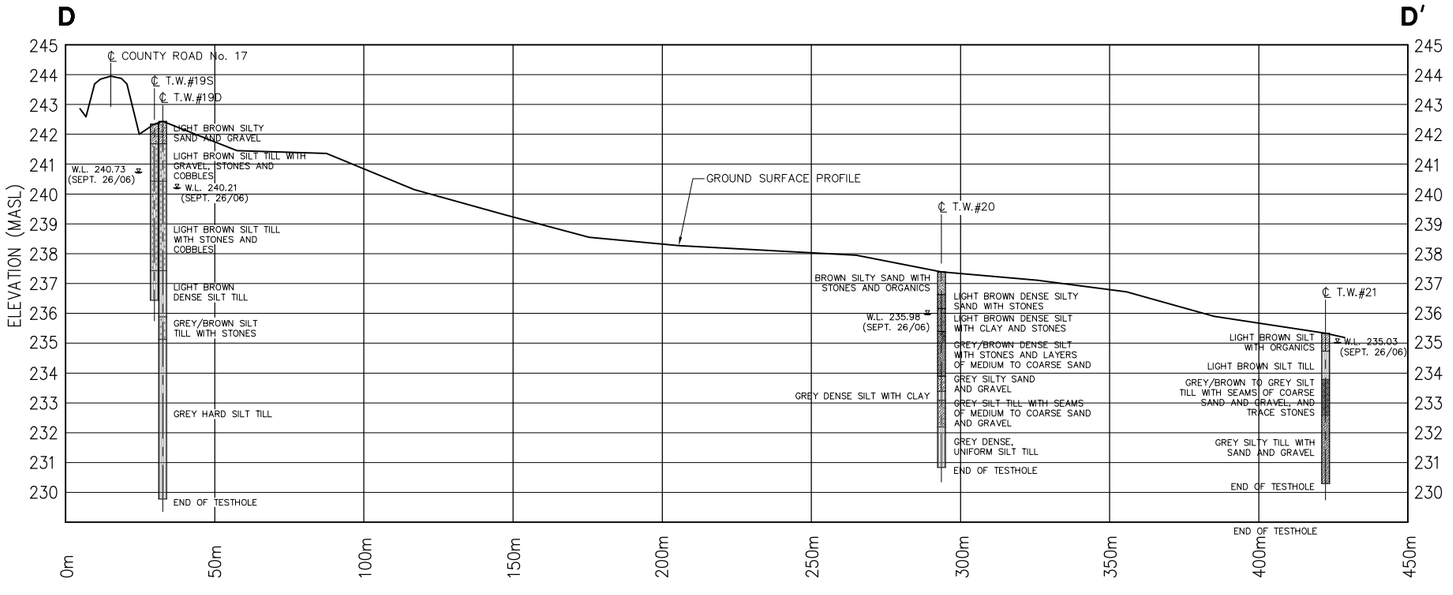


NOTES:

1. ELEVATIONS MEASURED IN METERS ABOVE SEA LEVEL (MASL) RELATIVE TO AN OBM LOCATED ON COUNTY ROAD 17.

2. 10 X VERTICAL EXAGGERATION.

3. WATER LEVELS (W.L.) WERE MEASURED ON SEPTEMBER 26, 2006.



SCALE = 1:2000 HORIZ.
1:200 VERT.

FEBRUARY 2007

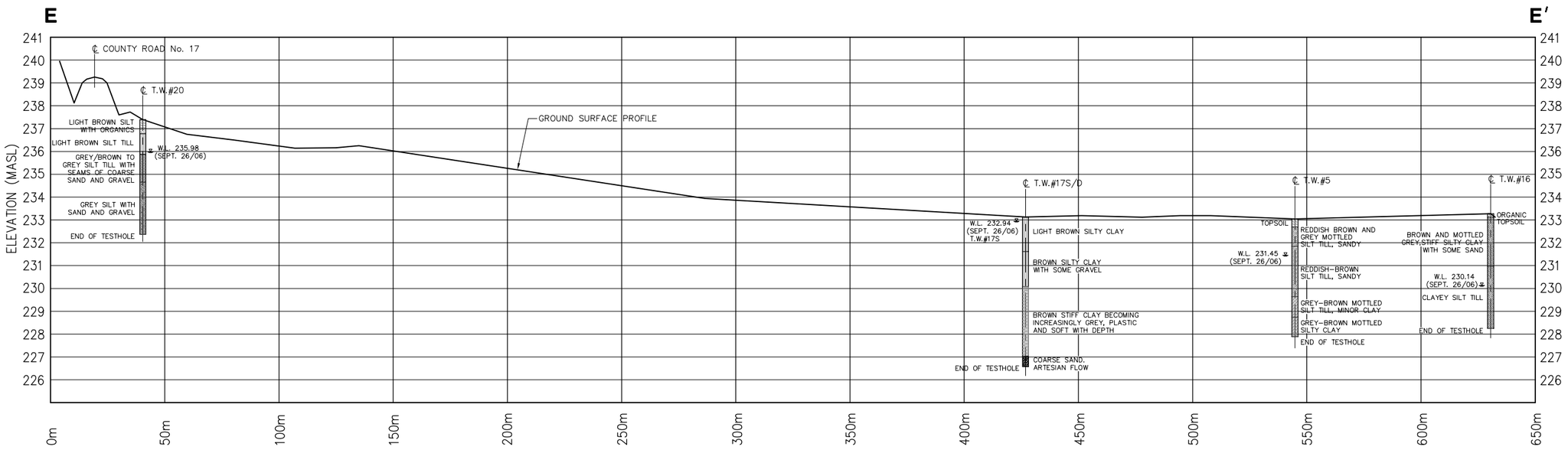
ARRAN LANDFILL

CROSS SECTIONS C-C′ AND D-D′

Figure No. 4B

Gamsby and Mannerow
ENGINEERS

Arran Landfill Site
Part Lot 20, Concession 7
Municipality of Arran-Elderslie



NOTES:

1. ELEVATIONS MEASURED IN METERS ABOVE SEA LEVEL (MASL) RELATIVE TO AN OBM LOCATED ON COUNTY ROAD 17.

2. 10 X VERTICAL EXAGGERATION.

3. WATER LEVELS (W.L.) WERE MEASURED ON SEPTEMBER 26, 2006.

SCALE = 1:2000 HORIZ.
1:200 VERT.

FEBRUARY 2007

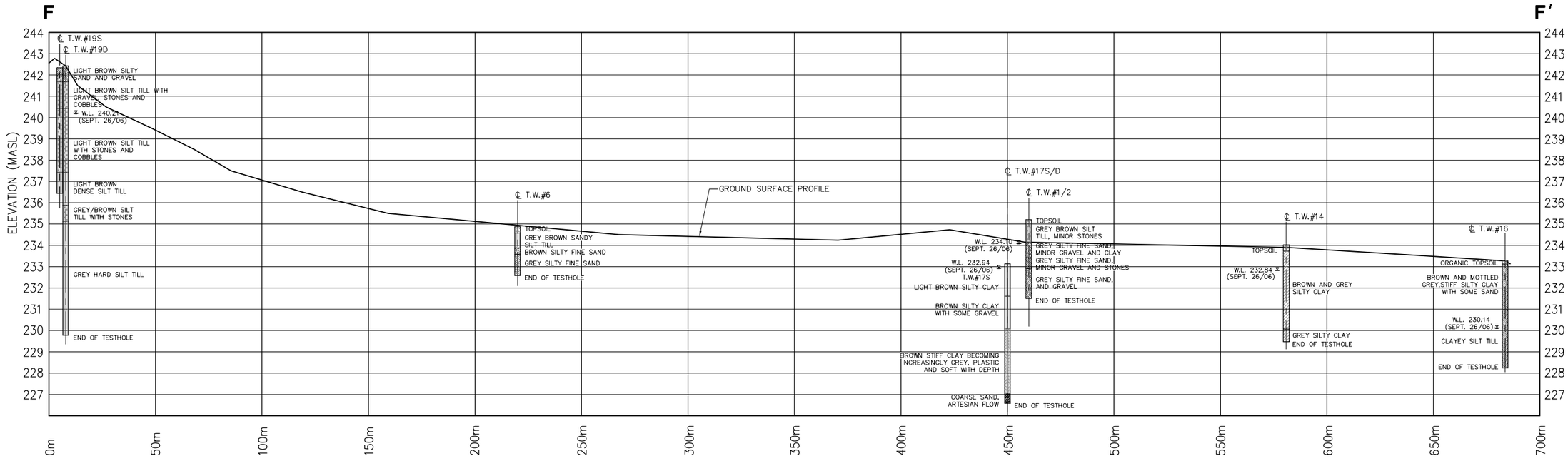
ARRAN LANDFILL

CROSS SECTION E-E'

Figure No. 4C

Gamsby and Mannerow
ENGINEERS

Arran Landfill Site
Part Lot 20, Concession 7
Municipality of Arran-Elderslie



NOTES:

1. ELEVATIONS MEASURED IN METERS ABOVE SEA LEVEL (MASL) RELATIVE TO AN OBM LOCATED ON COUNTY ROAD 17.

2. 10 X VERTICAL EXAGGERATION.

3. WATER LEVELS (W.L.) WERE MEASURED ON SEPTEMBER 26, 2006.

SCALE = 1:2000 HORIZ.
1:200 VERT.

FEBRUARY 2007

ARRAN LANDFILL

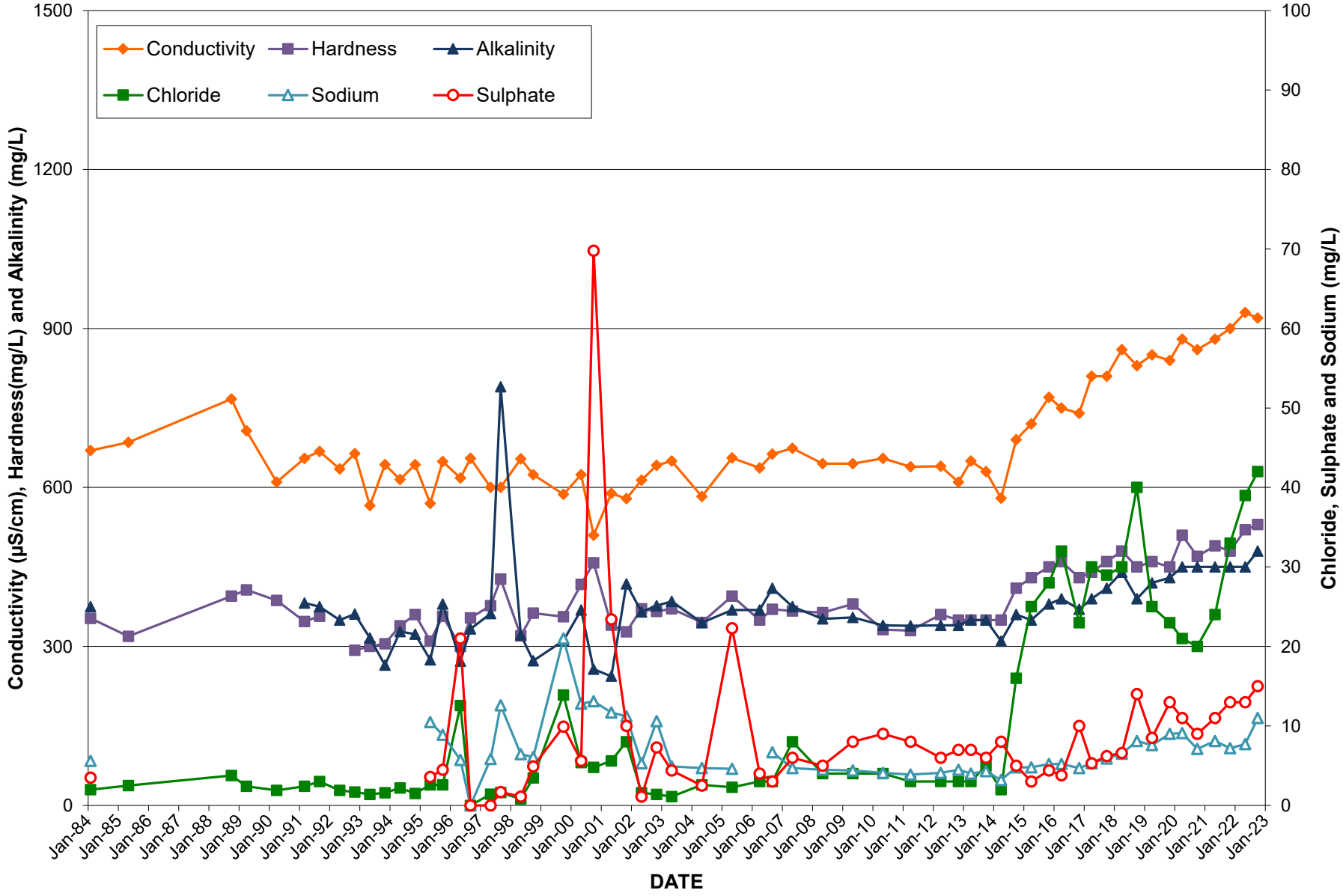
CROSS SECTION F-F'

Figure No. 4D

Gamsby and Mannerow
ENGINEERS

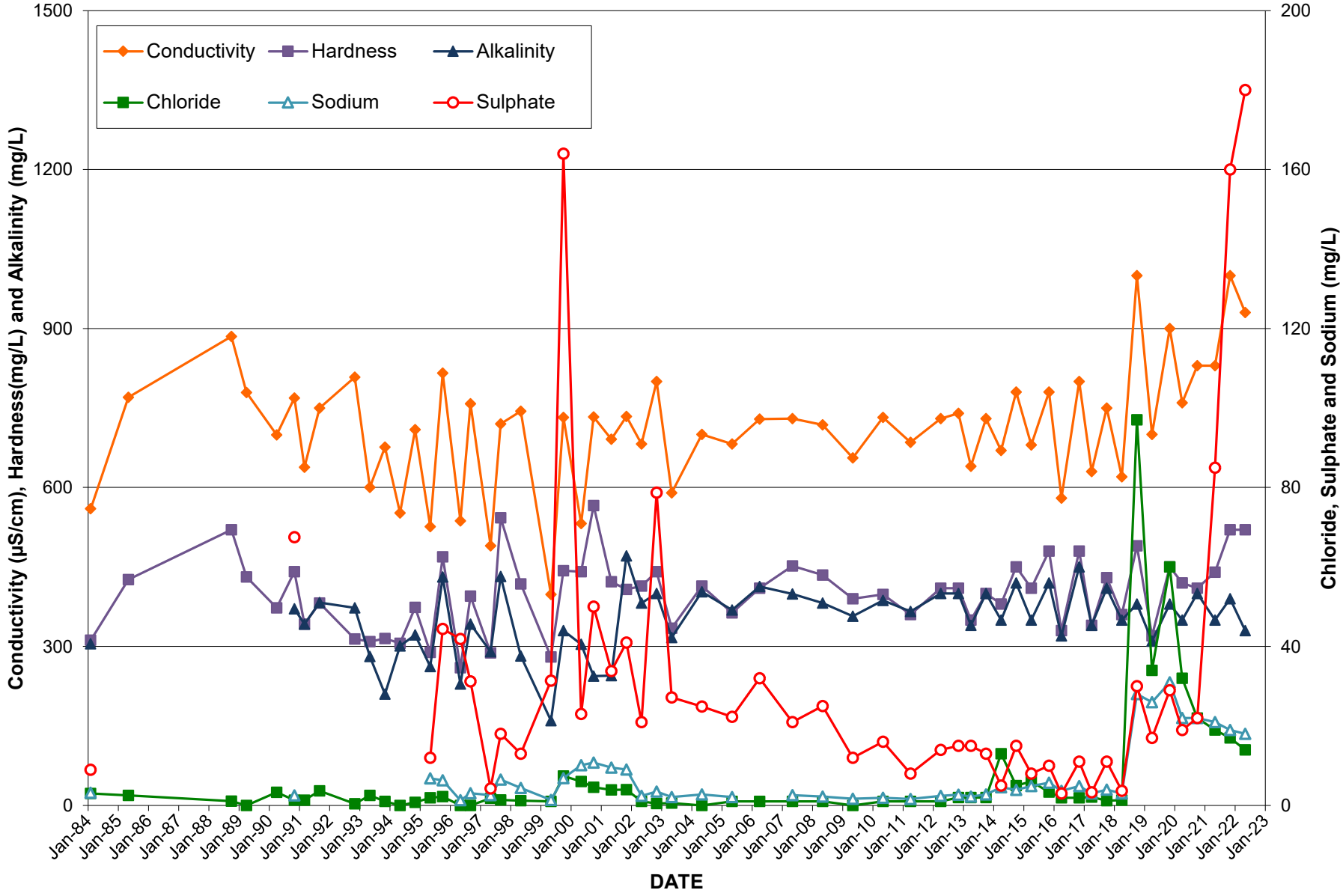
APPENDIX E:
HISTORIC GROUNDWATER QUALITY ANALYTICAL RESULTS (TABLES AND GRAPHS)

GROUNDWATER SAMPLING LOCATION: TW-1



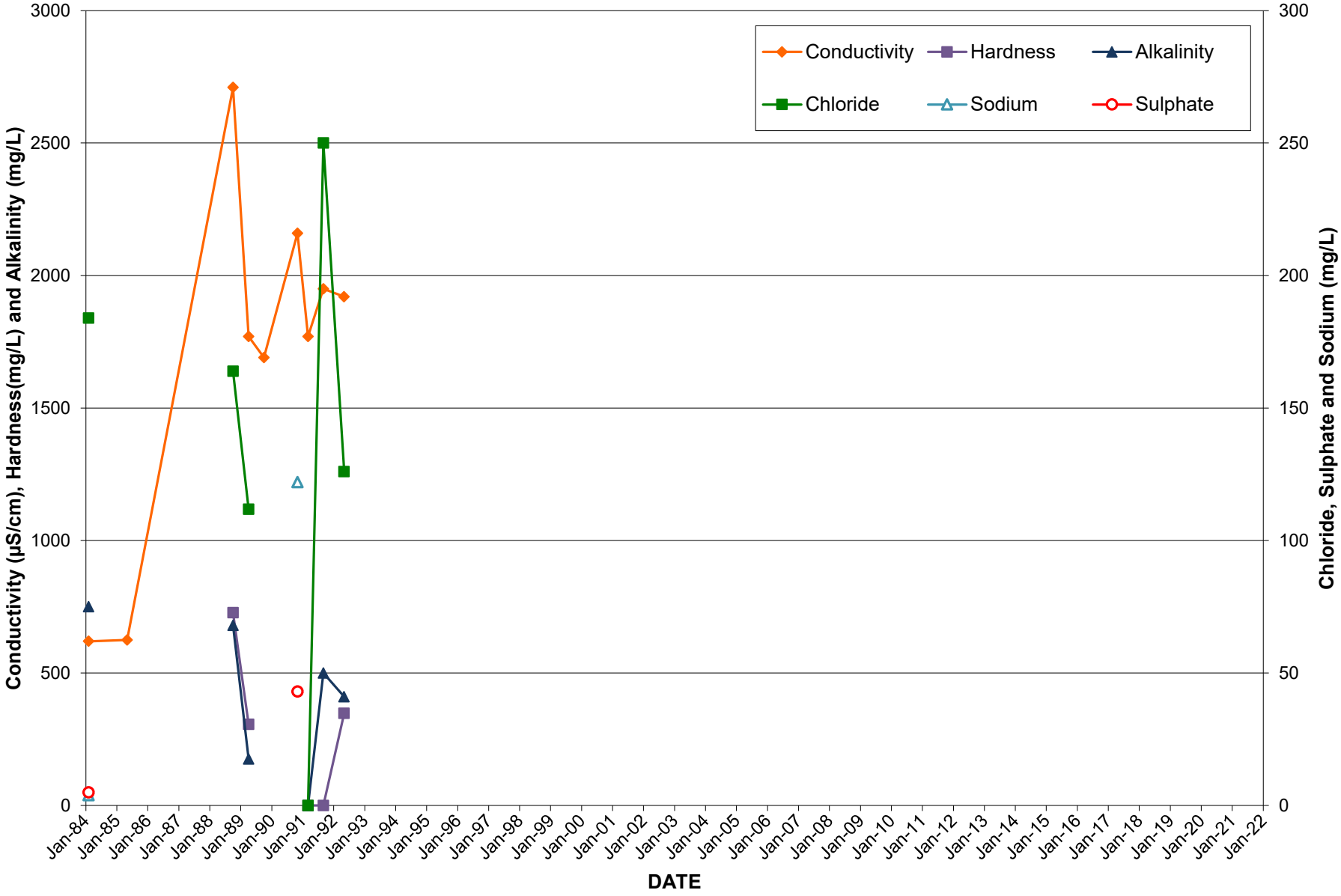
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-2



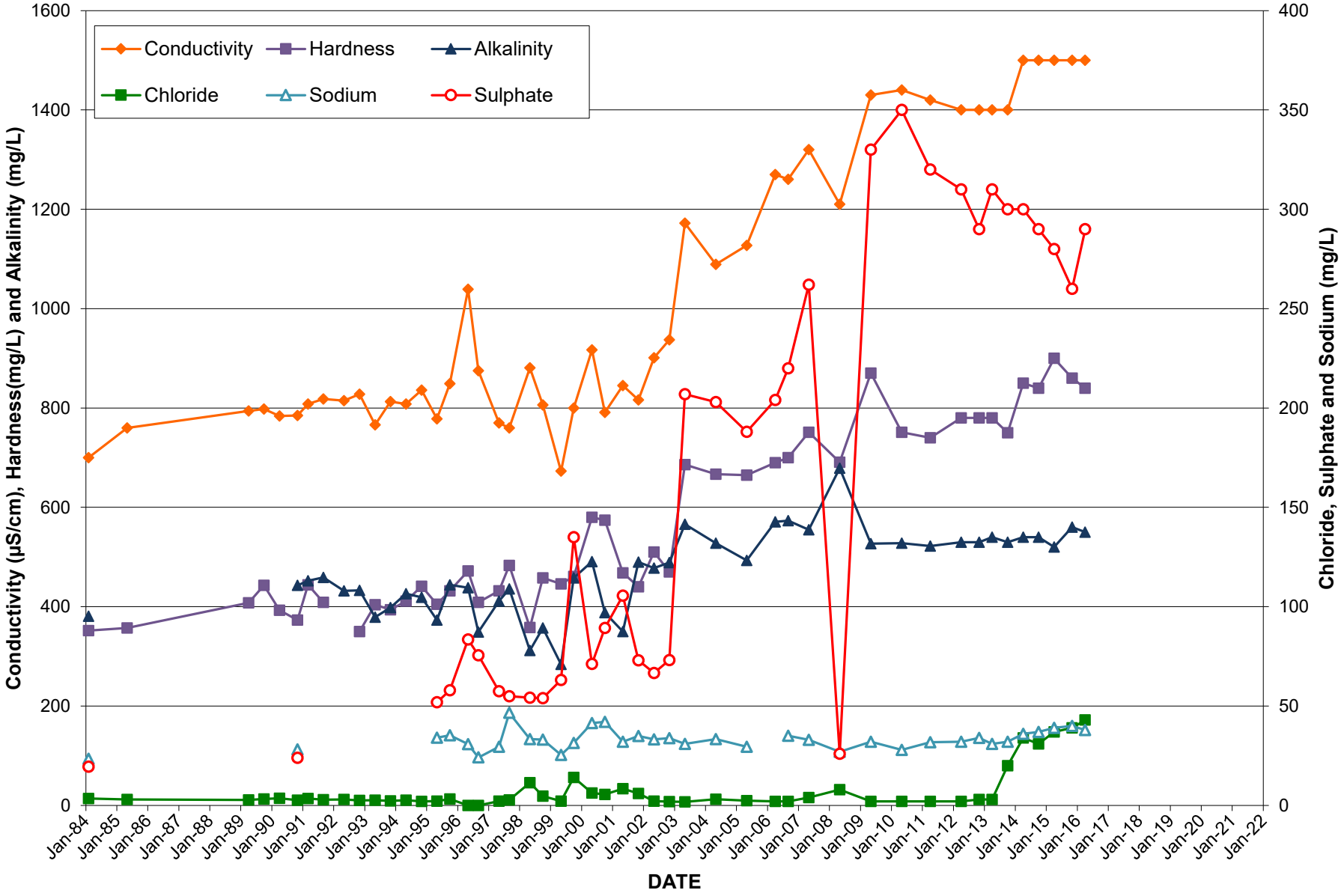
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-3



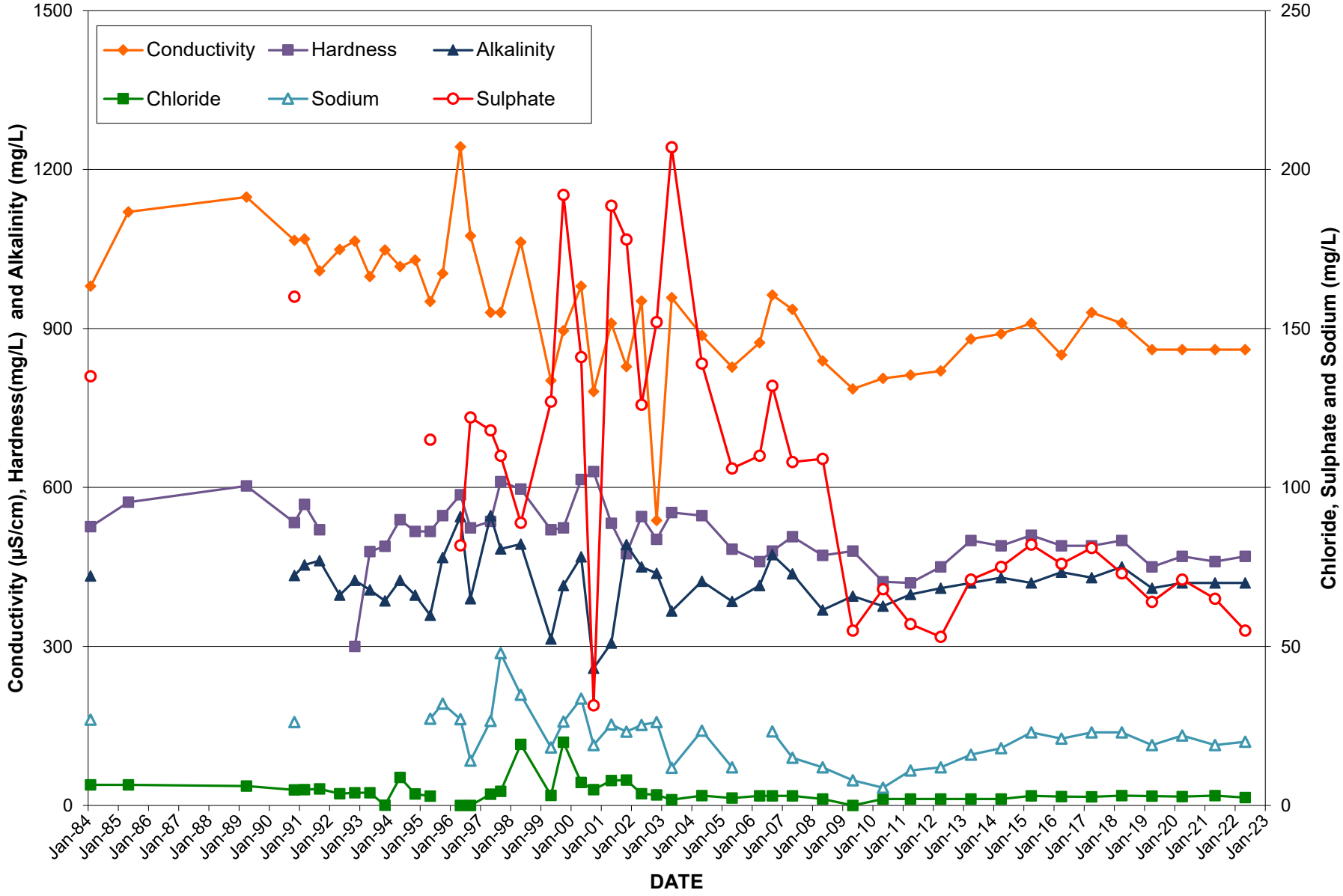
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-4



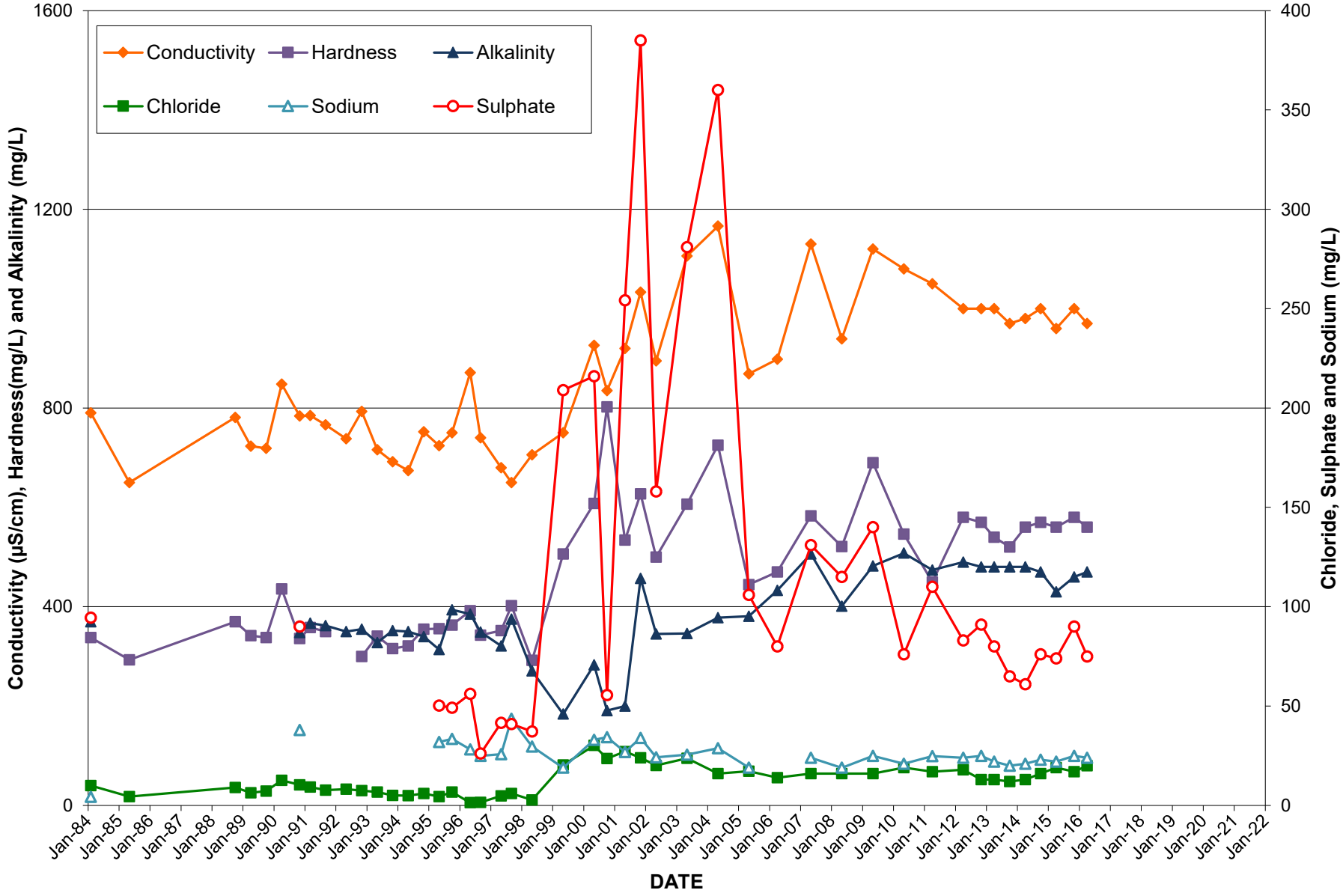
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-5



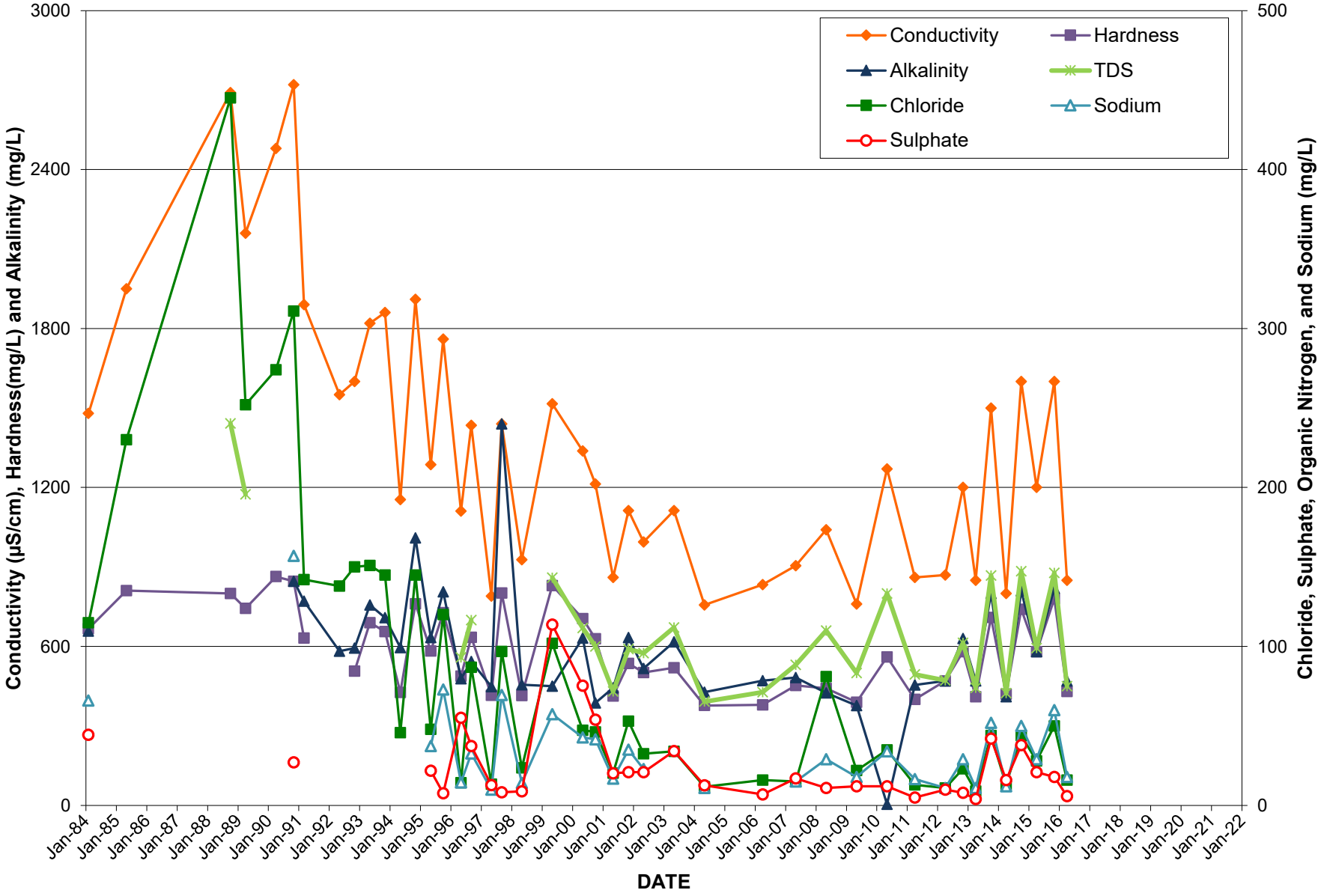
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-8



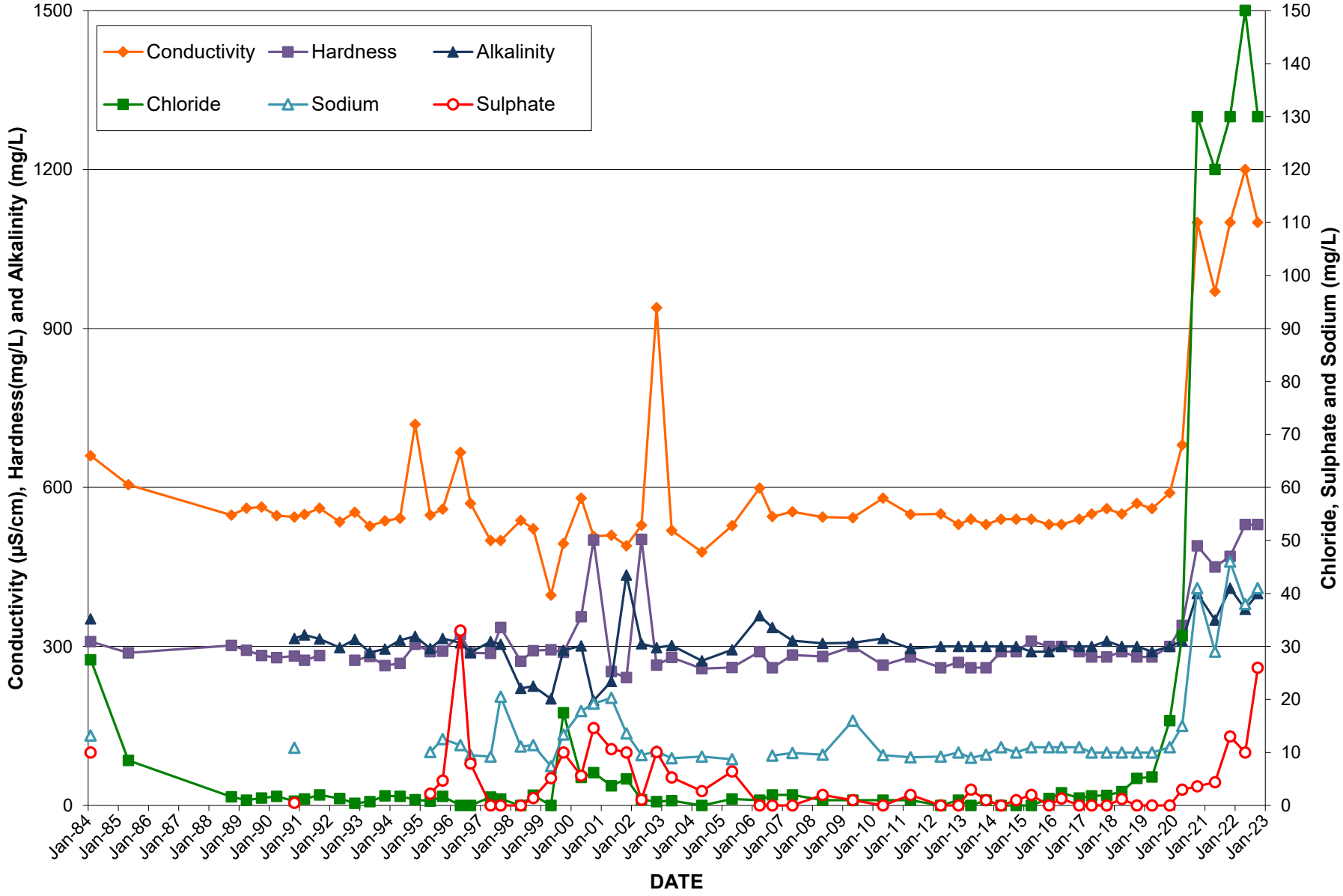
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-9



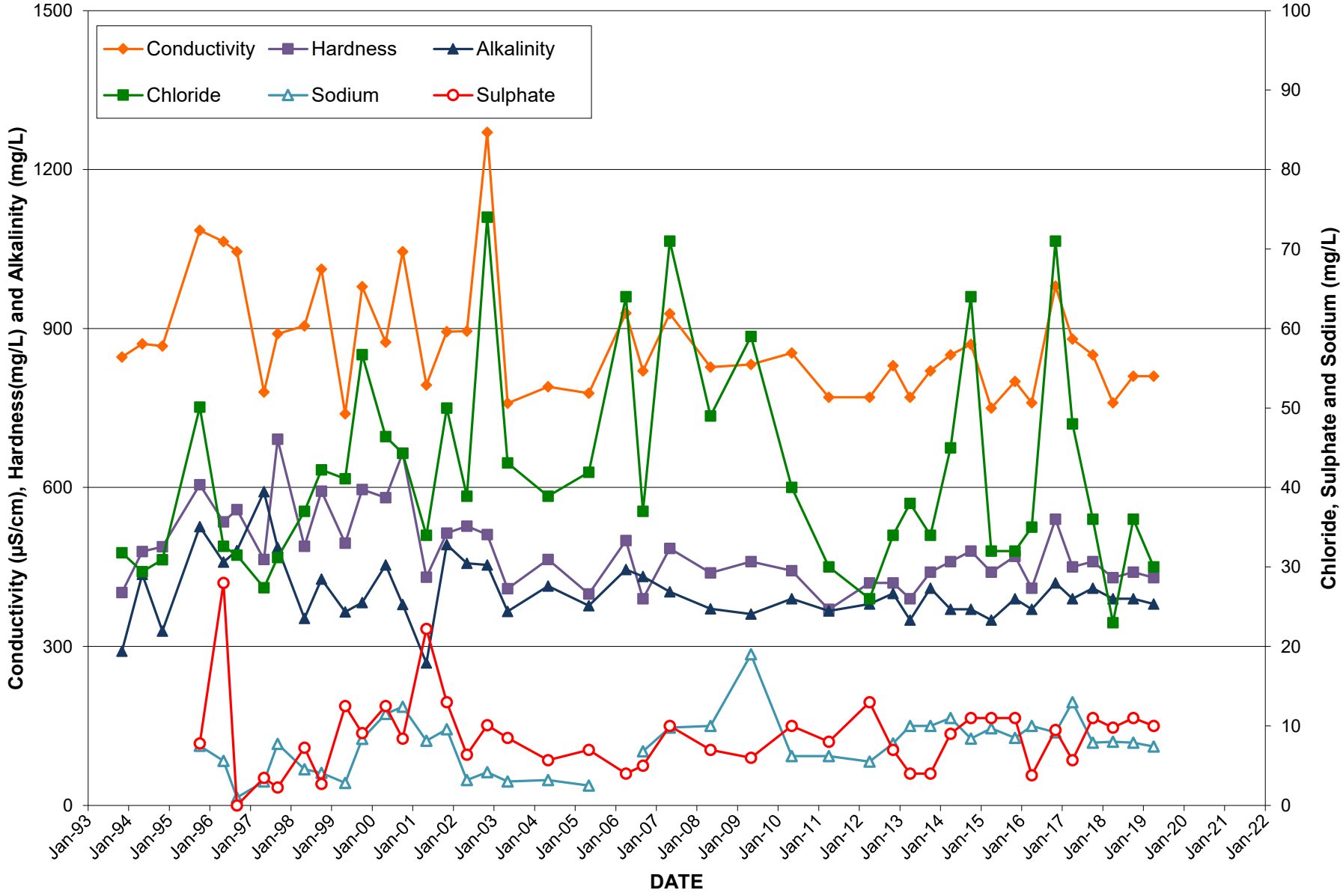
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-10



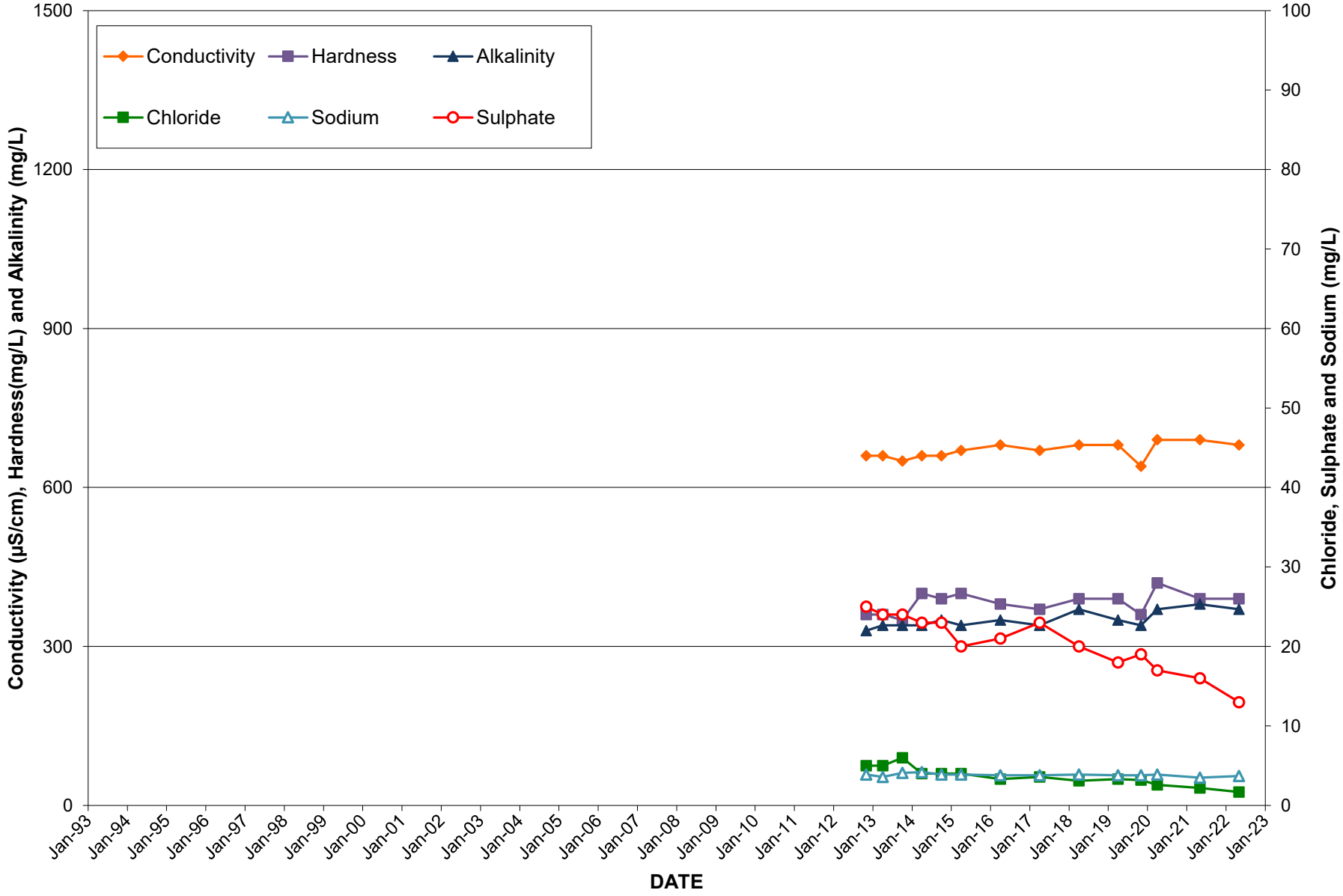
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-11



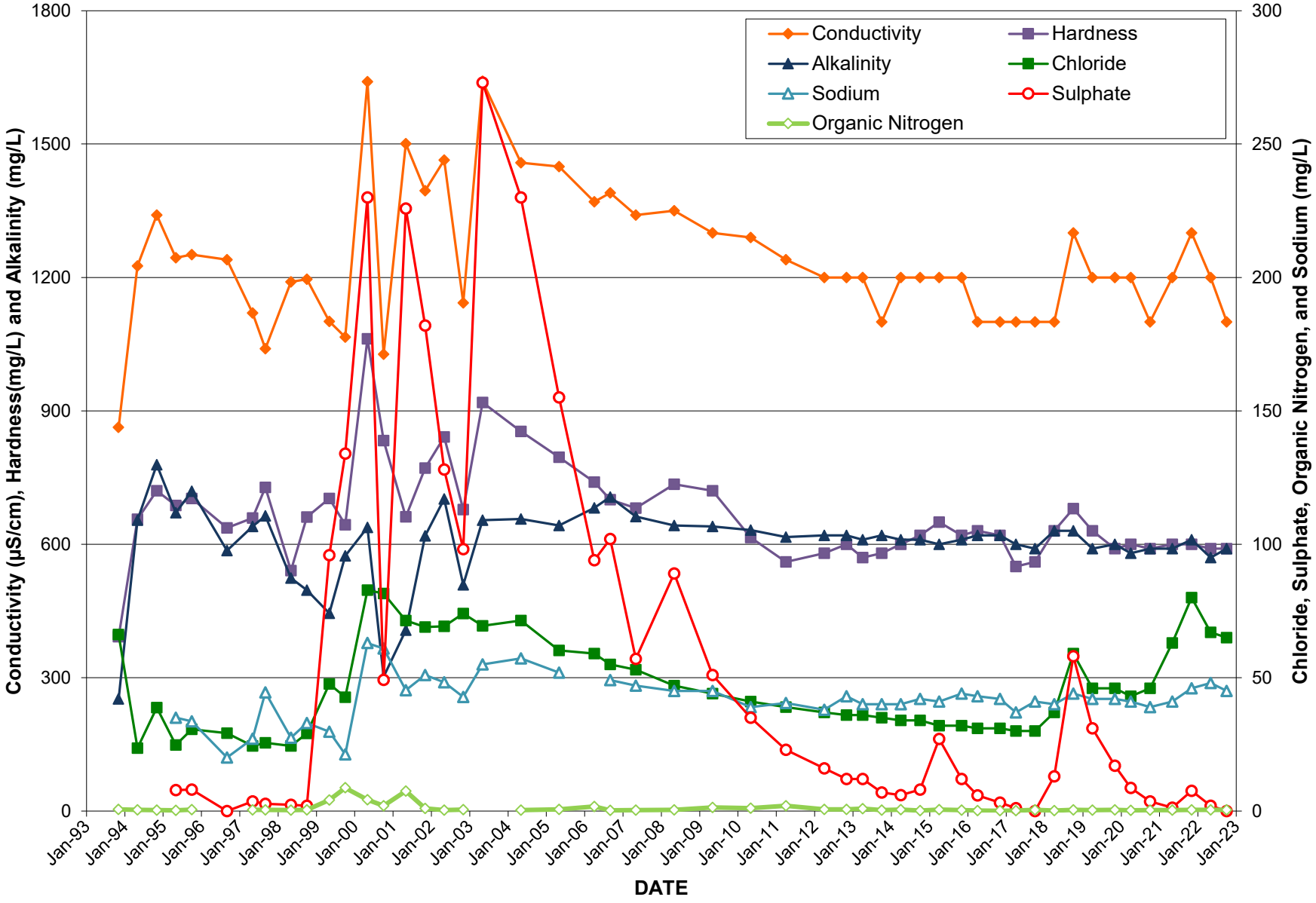
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-11D



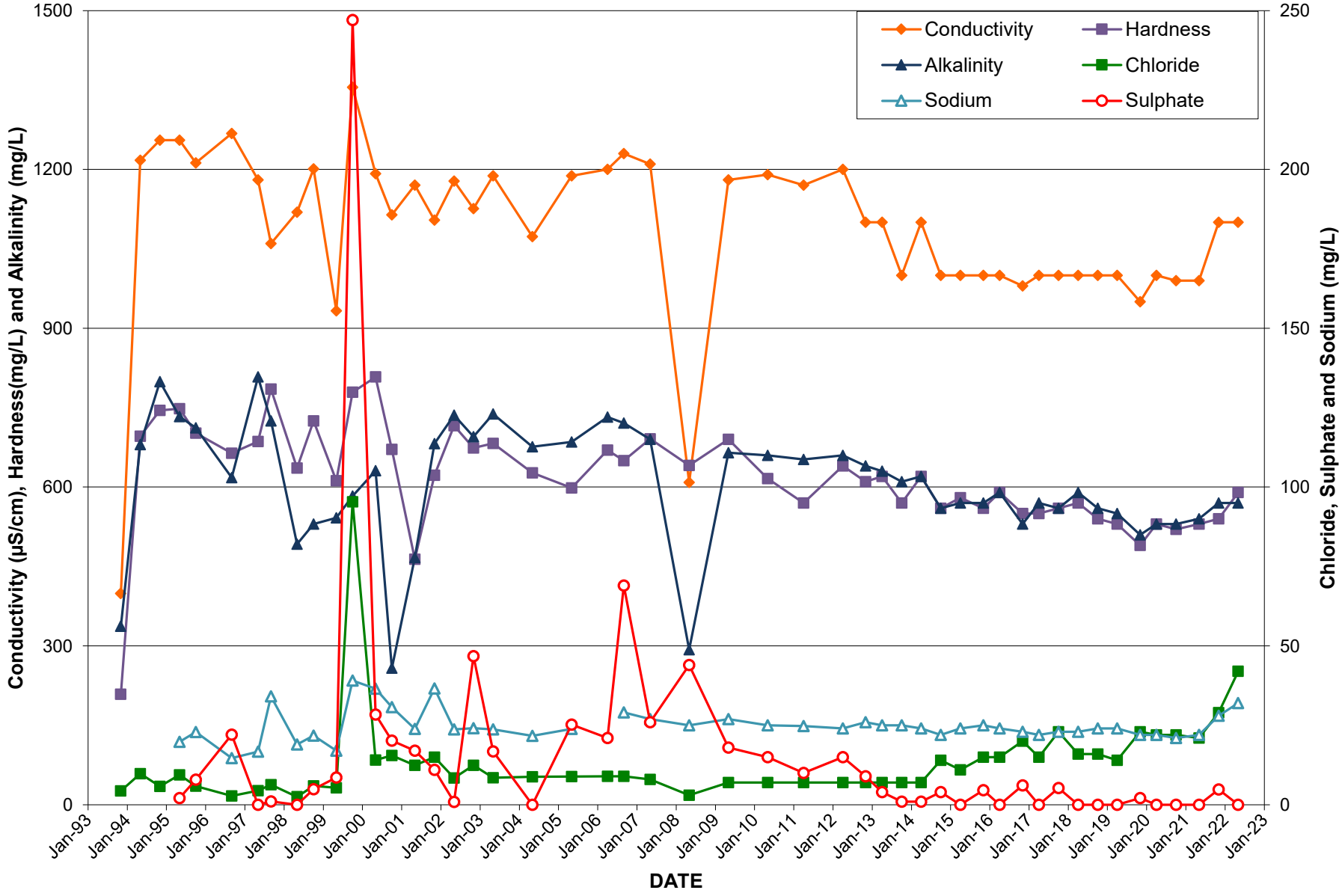
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-12



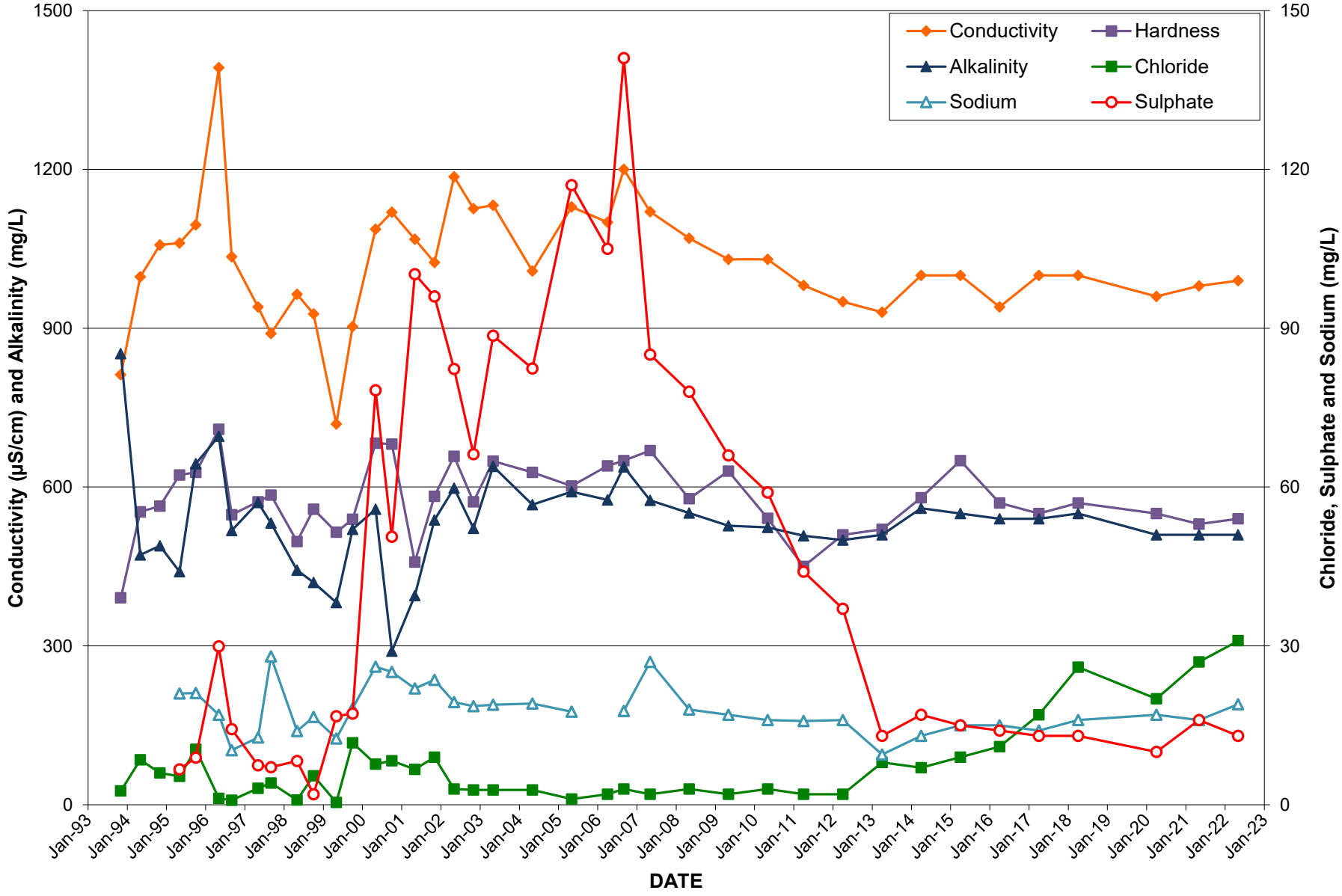
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-13



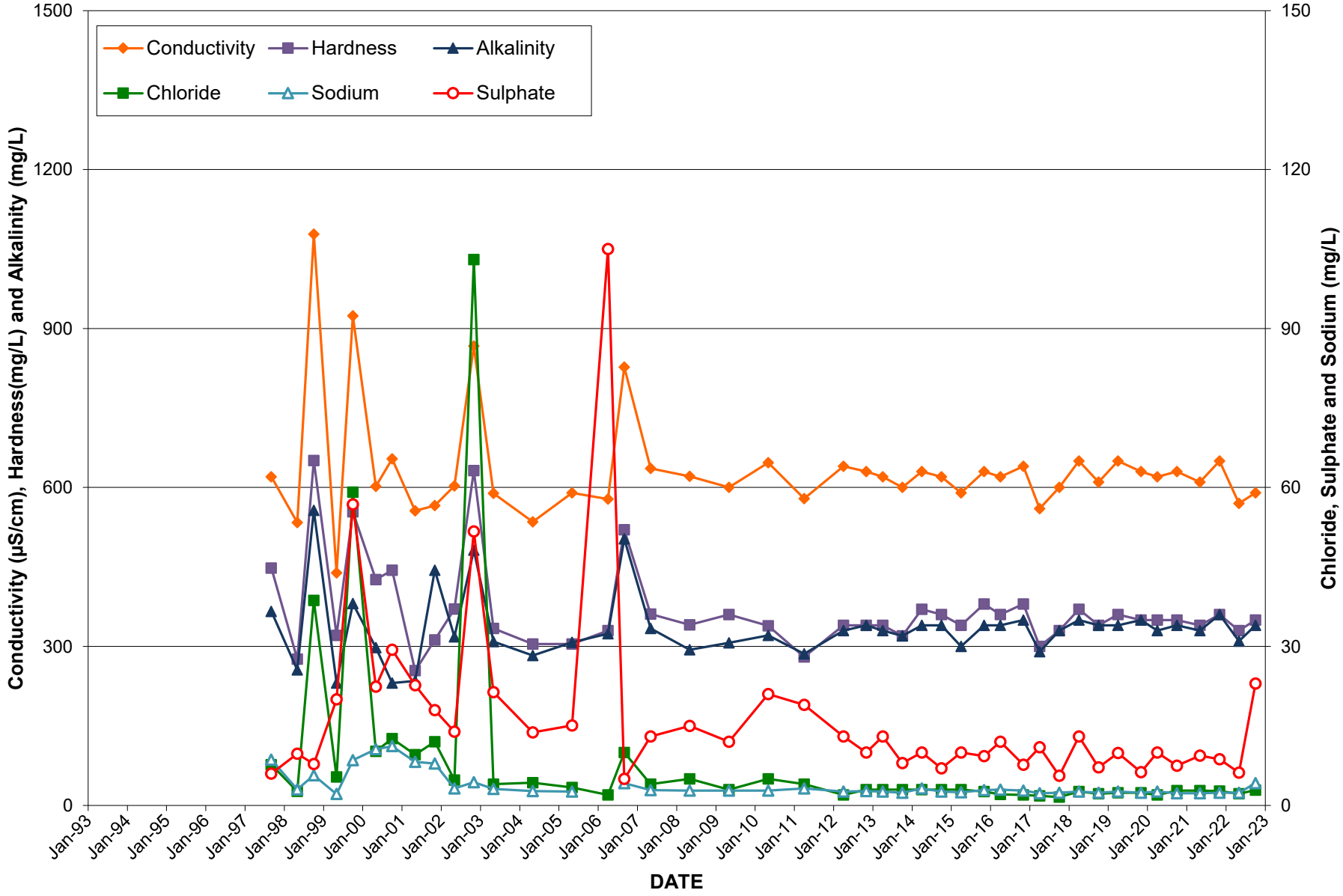
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-14



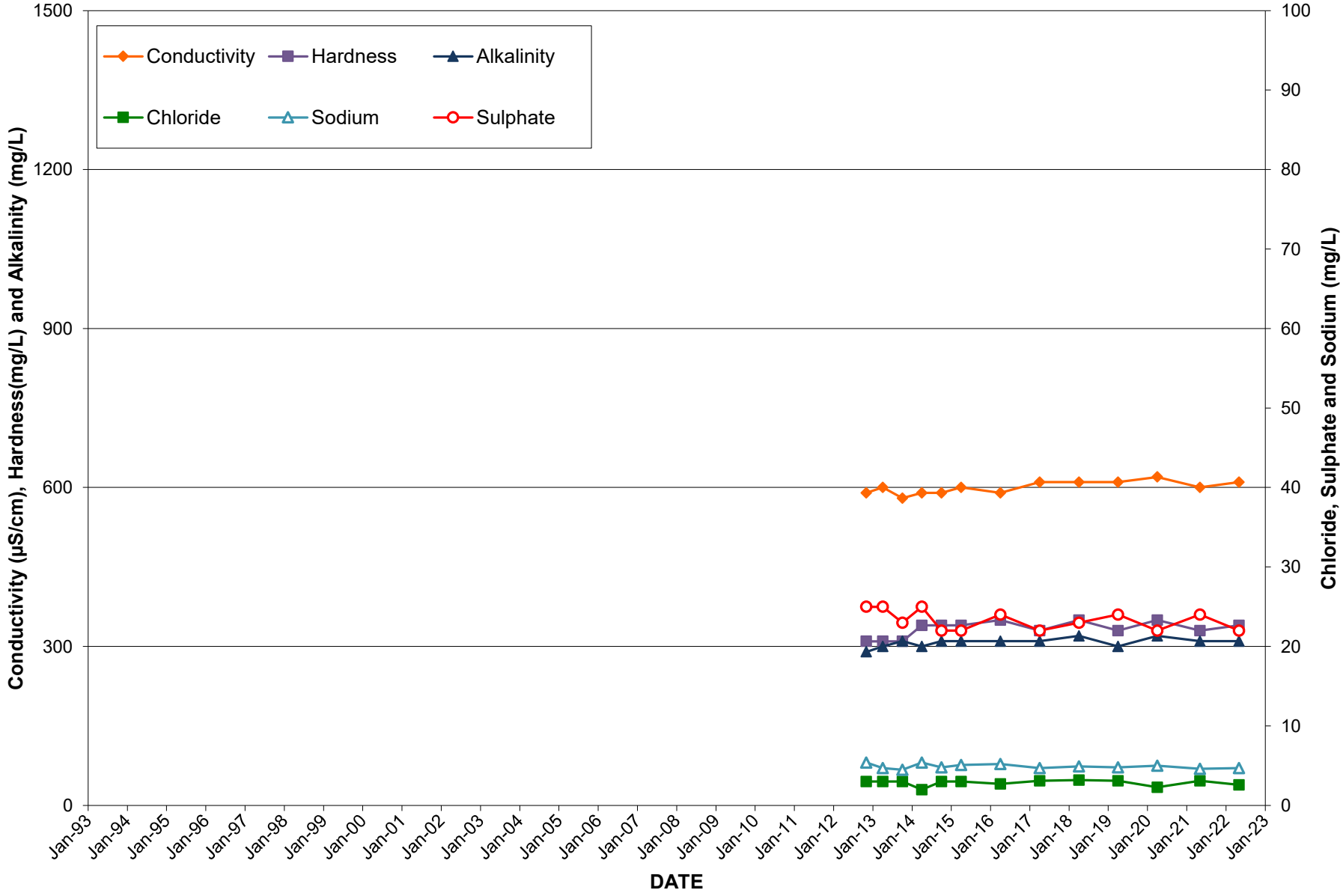
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-15



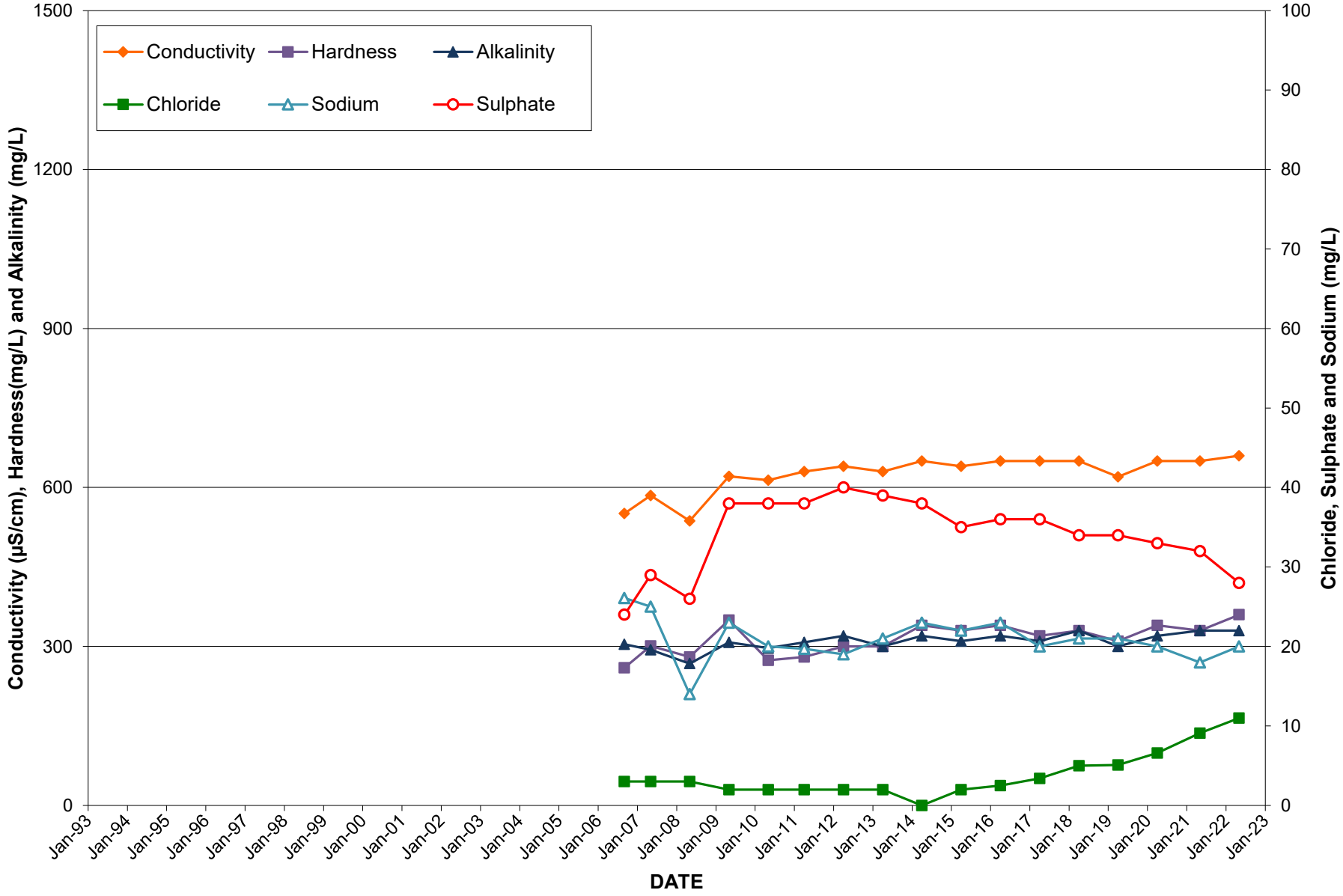
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-15D



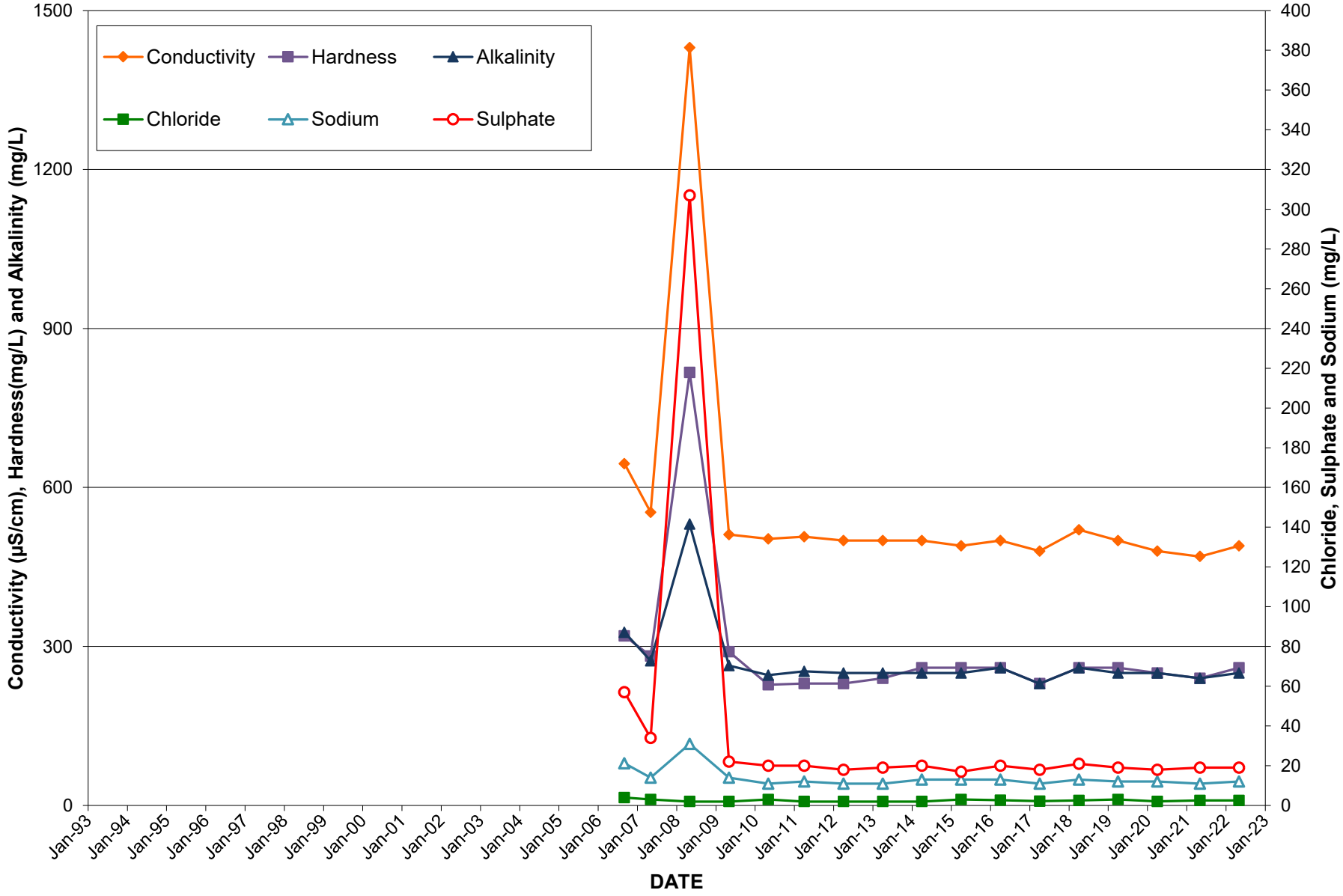
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-16



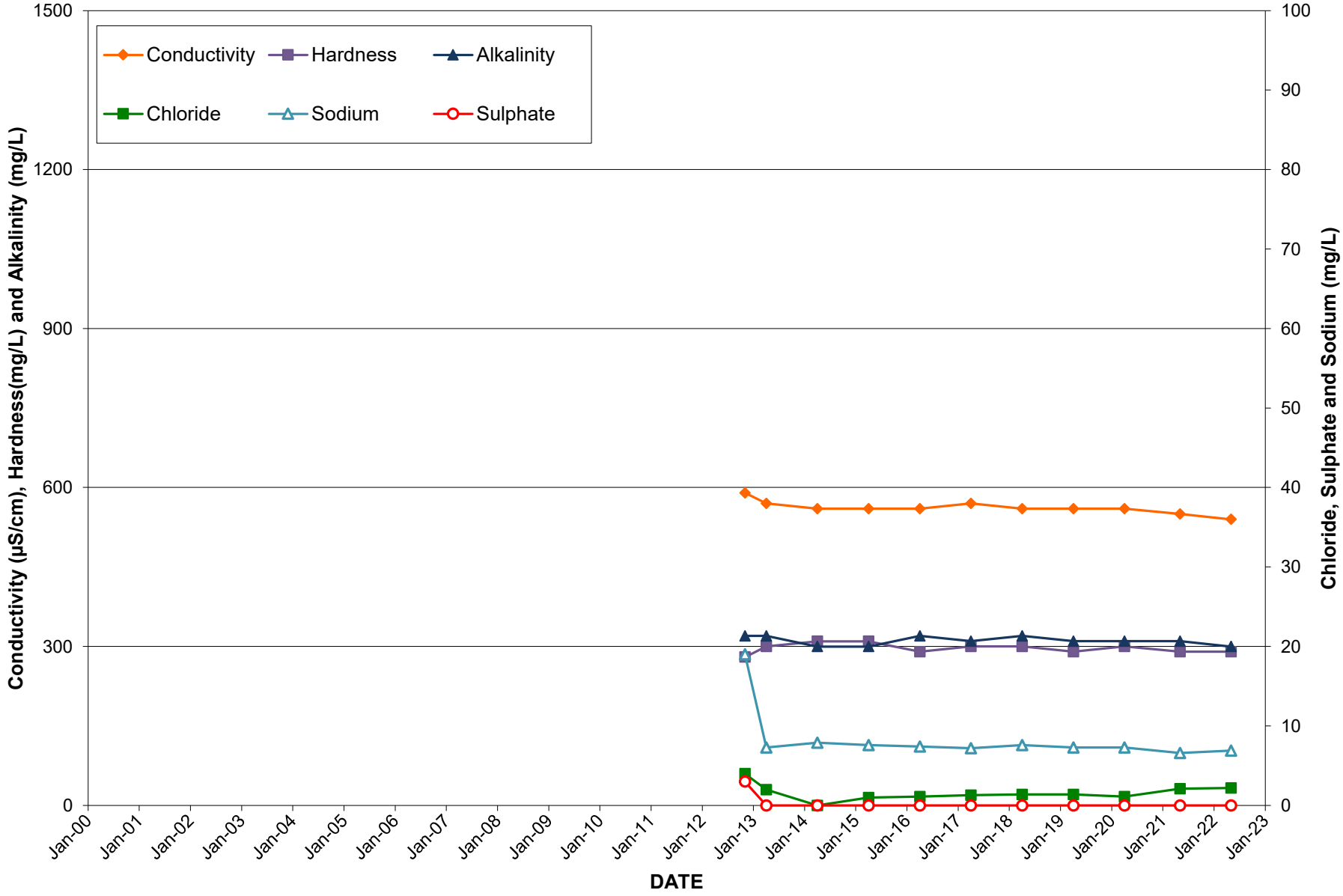
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-17



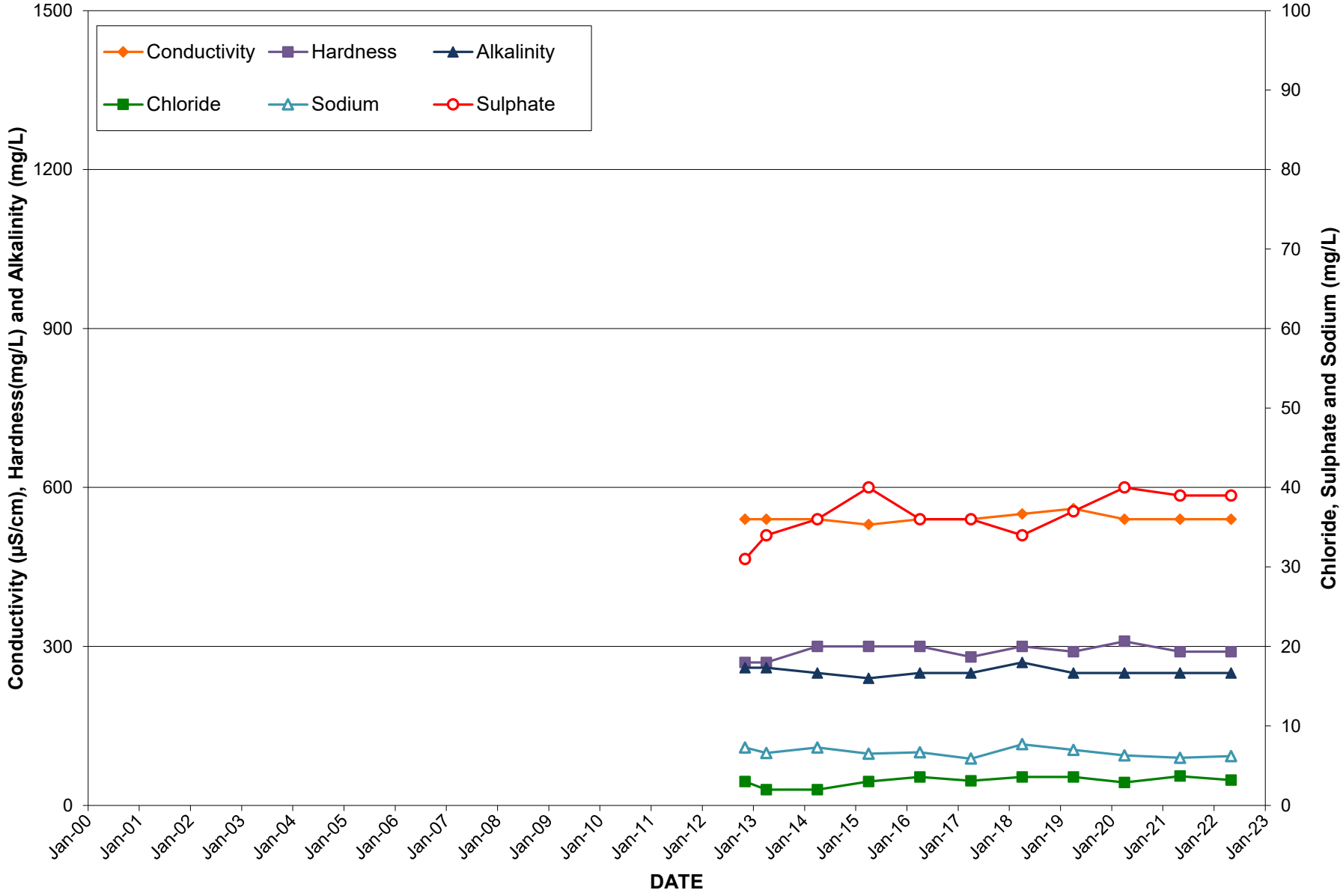
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-22



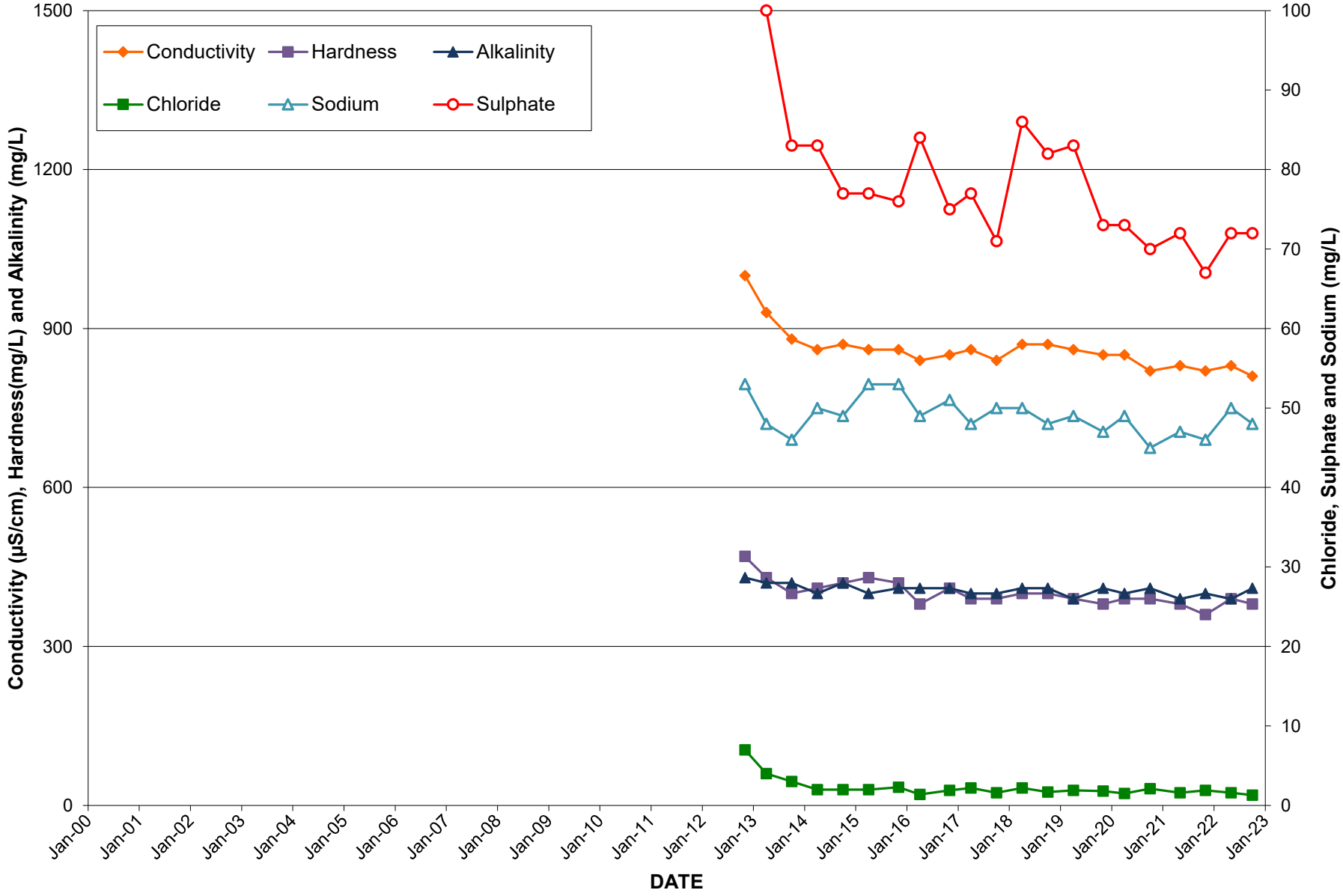
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-23



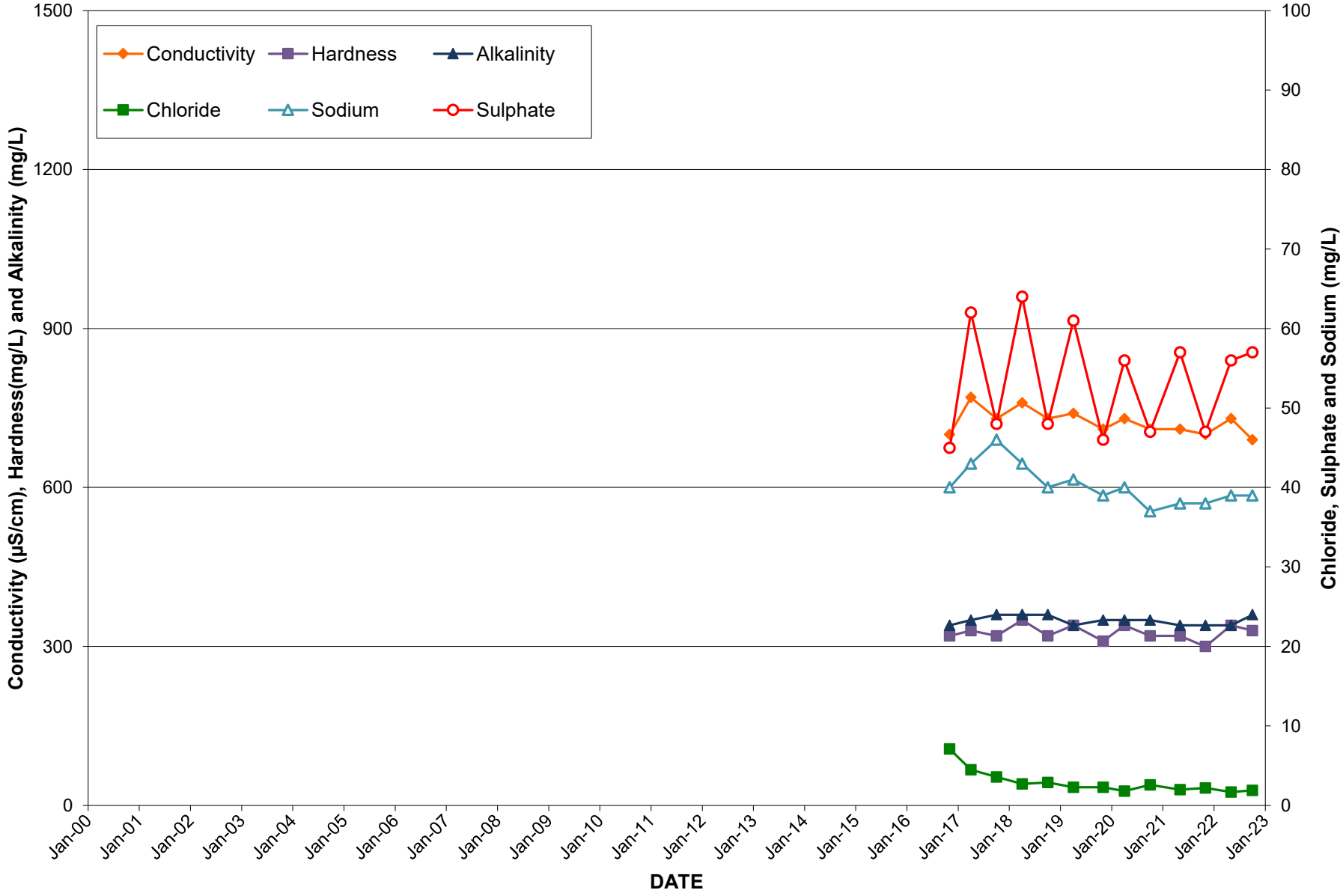
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-24



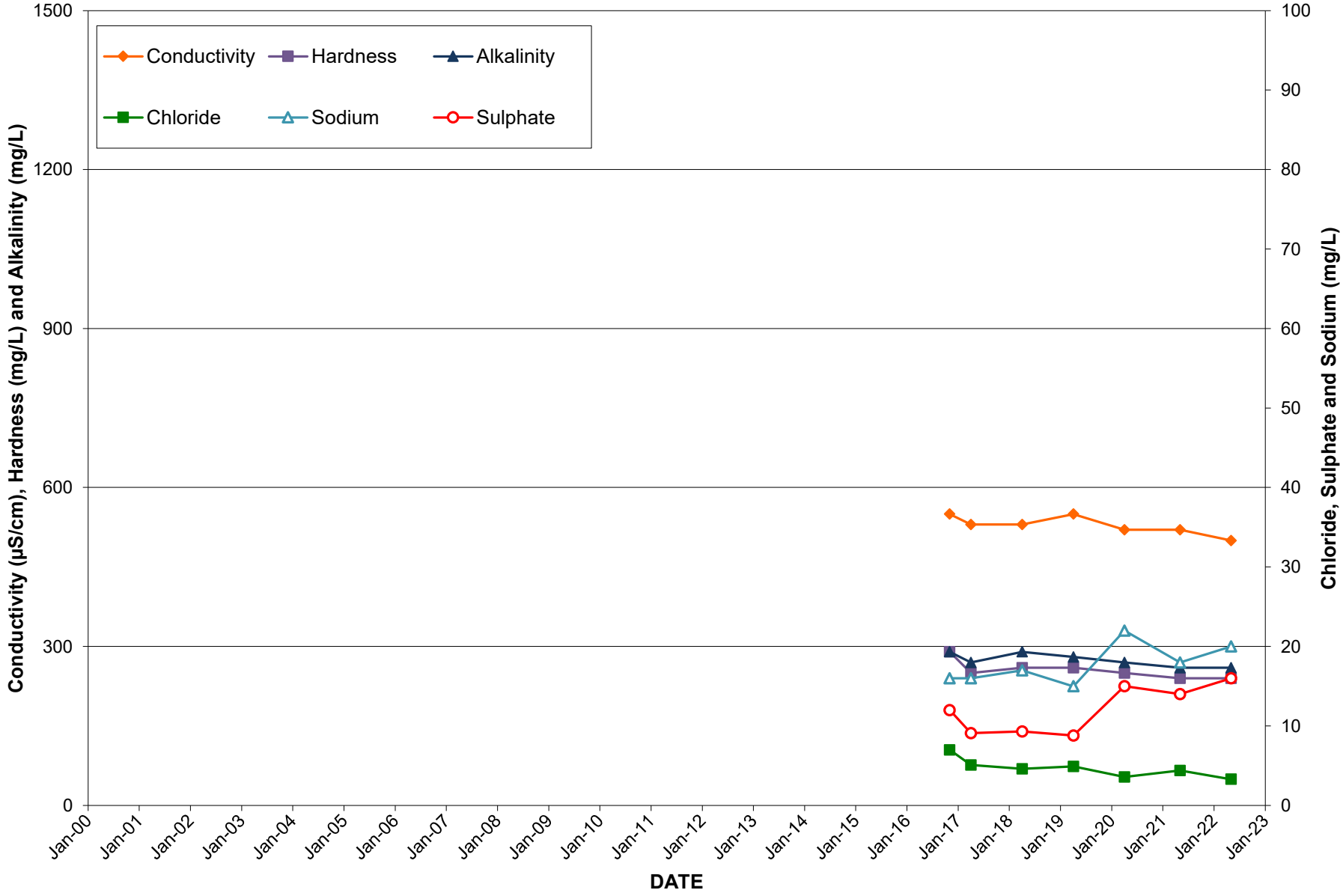
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-25S



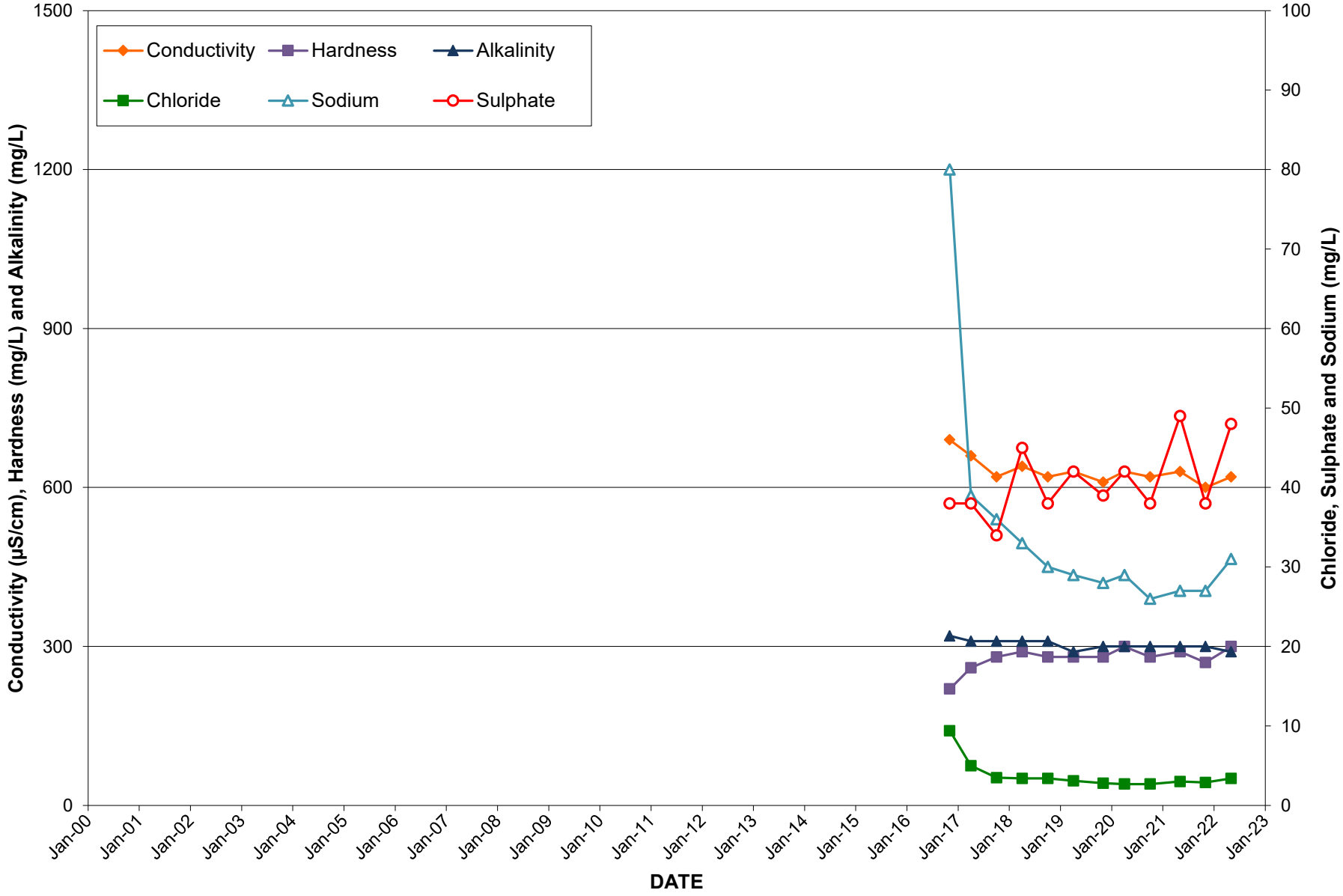
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-25D



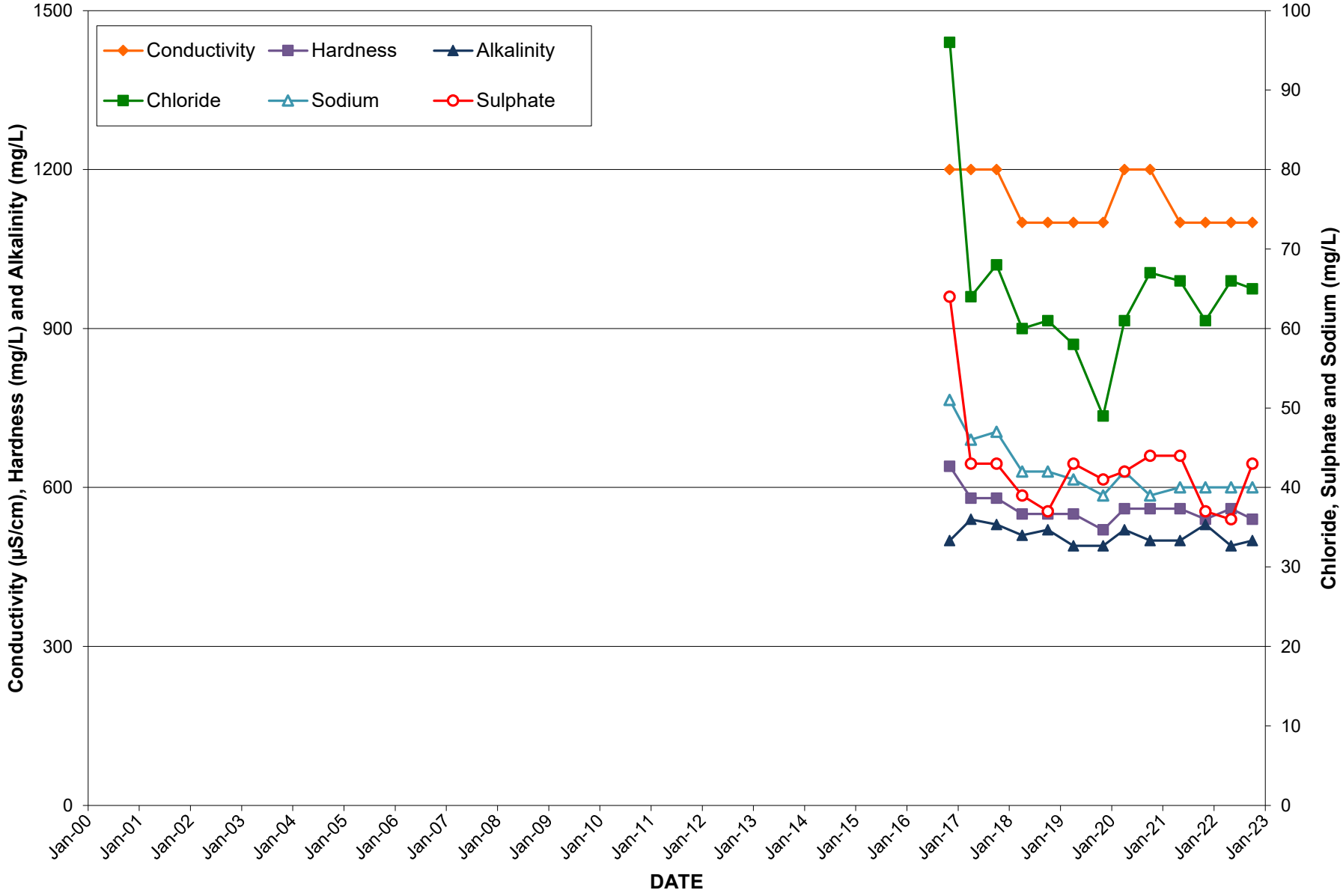
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-26



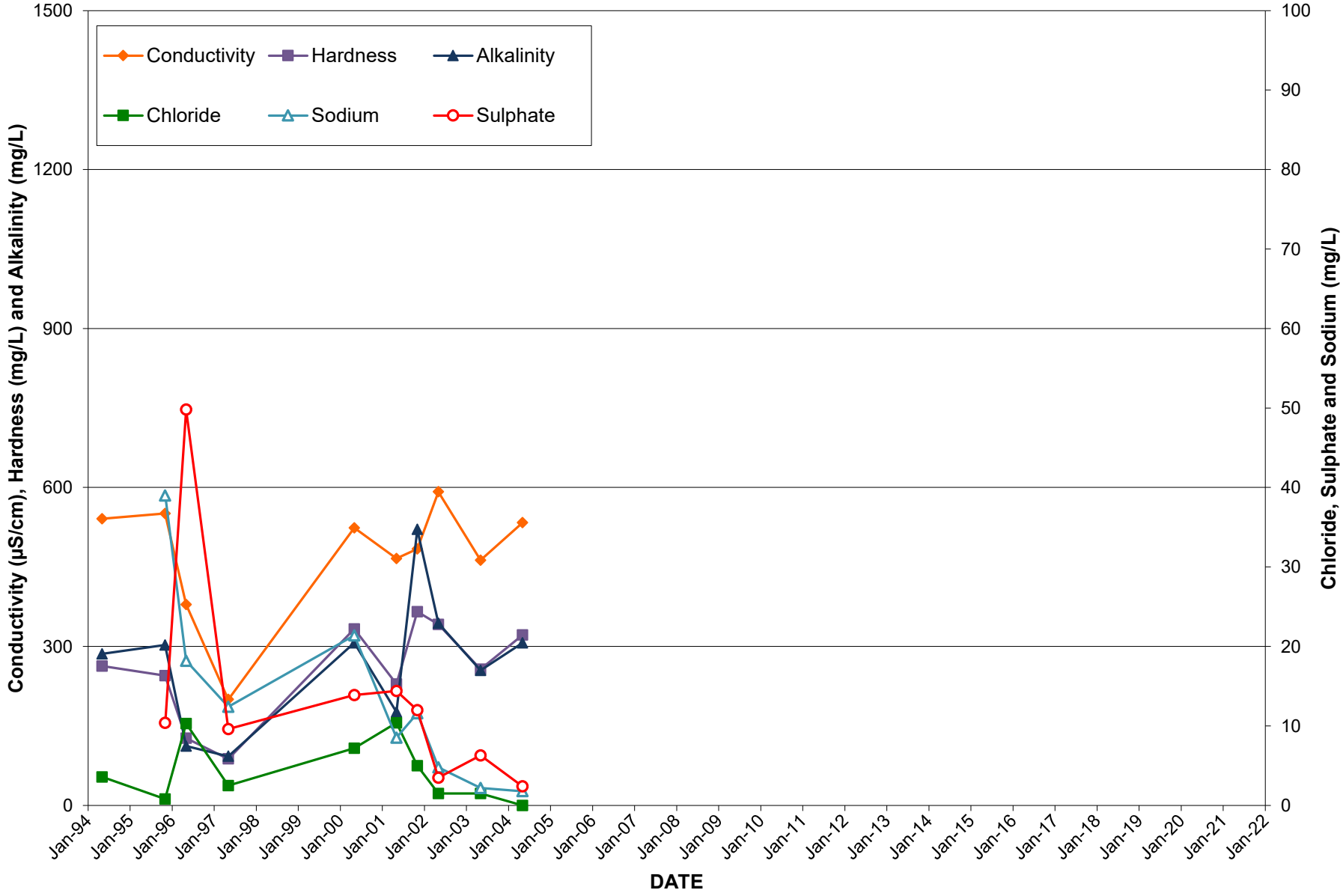
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: TW-27



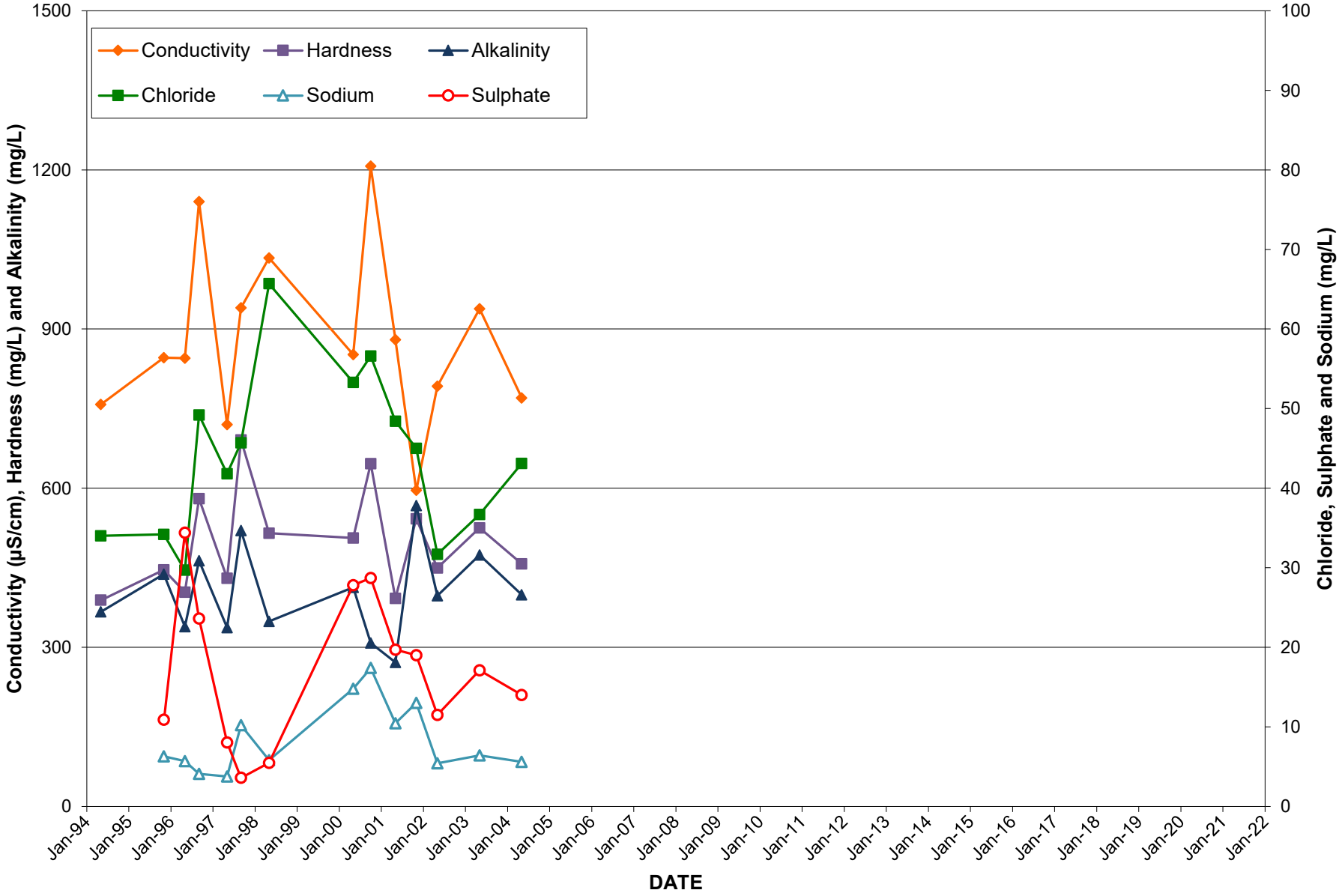
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: G-1



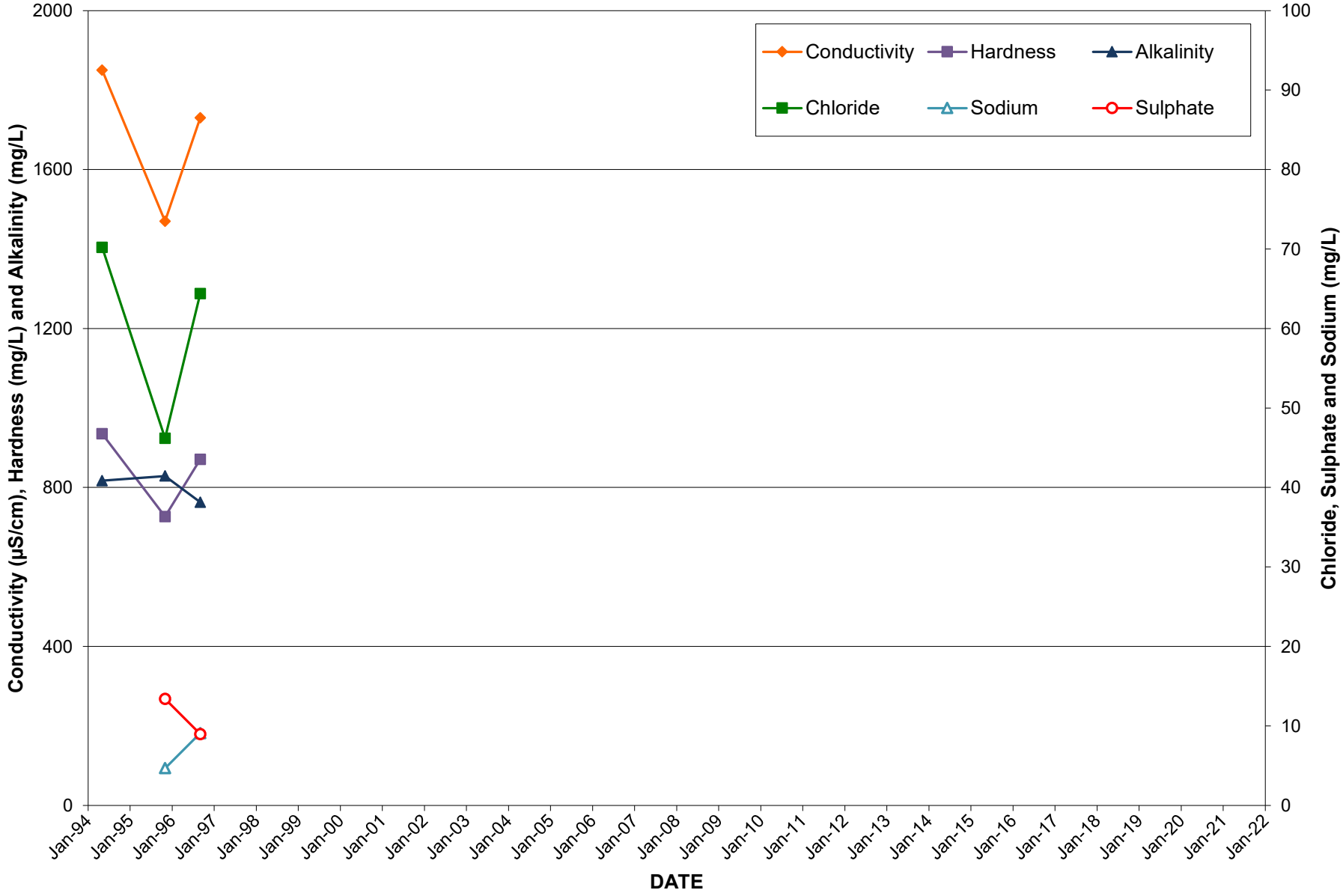
Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: G-2



Arran Landfill: M-1174
GM BluePlan Engineering Limited

GROUNDWATER SAMPLING LOCATION: G-3



Arran Landfill: M-1174
GM BluePlan Engineering Limited

HISTORICAL GROUNDWATER QUALITY DATA: TW-1

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	670	2.0	353	0.89		<0.01	0.001	0.515	0.79	0.28	3.5	7.66	375	5.6					
May-85	685	2.5	319									7.50							
Oct-88	767	3.8	395		424							6.99							
Apr-89	707	2.4	407	1.24	460	<0.1	0.04	2.2				7.31							
Apr-90	610	1.9	387	2.4		0.4	0.02	0.017	0.33	0.31		7.21							
Mar-91	655	2.4	347	0.30		0.1	<0.01	1.2	1.53	0.33		7.64	382						
Sep-91	668	3.0	357	0.08		<0.1	0.02	1.4	2.1	0.70		7.80	375						
May-92	635	1.9				0.3	0.02	0.748	1.06	0.31		7.58	350						
Nov-92	664	1.7	293	8.00		<0.1	0.05	1.1	2.64	1.54		7.70	361						
May-93	566	1.4	300	0.85		0.2	0.02	0.6	1.55	0.95		7.61	316						
Nov-93	643	1.6	305	0.08		<0.1	<0.01	0.42	1.31	0.89		7.60	265						
May-94	615	2.2	339	0.14		0.2	<0.01	0.78	1.51	0.73		8.05	328						
Nov-94	643	1.5	360	0.12		<0.1	0.01	0.58	1.37	0.79		7.67	323						
May-95	570	2.6	310			0.6	0.04	0.43	0.91	0.48	3.6	7.87	275	10.5					
Oct-95	649	2.6	357			0.4	0.07	0.43	1.53	1.10	4.5	7.90	380	8.9					
May-96	618	12.6	300	<0.02	309	<0.05	<0.05	<0.05			21.0	7.40	272	5.7					
Sep-96	655	<1.0	354	<0.02	340	<0.05	<0.05	<0.05			<1.0	7.72	333	<0.5					
May-97	600	1.42	377			<0.1	<0.1	0.729	1.02	0.29	<0.1	7.60	362	5.9					
Sep-97	600	1.64	427			0.34	<0.1	0.940	1.19	0.25	1.69	7.30	790	12.6					
May-98	654	0.82	320			1.12	<0.05	0.17	0.72	0.55	1.1	7.03	322	6.4					
Oct-98	624	3.45	363			0.57	<0.05	0.59	0.9	0.31	4.9	7.00	273	6.1					
Oct-99	587	13.9	356	<0.01	300	1.16	<0.05	0.42	6.2	5.78	9.9	7.27	311	21.0					
May-00	624	5.4	417	0.44	320	1.15	<0.05	0.16	4.5	4.34	5.6	7.82	369	12.8					
Oct-00	510	4.8	458	<0.01	260	0.45	<0.05	1.20	3.7	2.50	69.8	8.33	257	13.1					
May-01	589	5.6	340	0.93	280	0.57	<0.05	0.21	5.8	5.59	23.4	7.24	244	11.7				0.13	0.04
Nov-01	579	8.0	328	0.34	320	0.45	<0.05	0.48	0.92	0.44	10	7.39	418	11.2				<0.01	0.04
May-02	614	1.6	371	<0.01	351	<0.2	<0.2	1.08	1.36	0.28	1.1	7.90	365	5.3				0.055	0.02
Nov-02	642	1.4	366	0.06	475	1.2	<0.2	1.33	1.59	0.26	7.3	7.70	377	10.6				0.06	0.03
May-03	650	1.1	371	<0.01	366	0.5	<0.2	1.14			4.4	7.81	385	4.9				0.055	0.03
May-04	583	2.6	345	<0.01	356	1.1	<0.2	1.03	1.25	0.22	2.5	7.51	345	4.7				0.049	0.03
May-05	656	2.3	395	<0.01	402	1.0	<0.2	1.23	1.74	0.51	22.3	7.71	369	4.6				0.05	0.03
Apr-06	637	3	350	<0.02	390	0.6	0.06	1.09	1.2	0.11	4	8.1	369						
Sep-06	663	3	370	0.56	385	<0.1	0.02	1.66	1.7	<0.1	3	8.2	410	6.7					0.04
May-07	674	8	367	<0.05	371	<0.1	0.04	1.01	1.6	0.59	6	8.0	375	4.7				0.049	0.02
May-08	645	4	364	<0.1	370	<0.1	0.04	1.3	2.4	1.1	5	8.2	352	4.5				0.046	0.03
May-09	645	4	380	<0.1	425	0.1	0.06	1.2	5	3.8	8	7.9	355	4.4					
May-10	655	4	332	<0.1	424	0.6	0.07	1.0	5	4.0	9	8.0	340	4.1				0.056	0.029
Apr-11	639	3	330	<0.02	398	1	<0.01	0.9	3	2.5	8	8.17	339	3.9					
Apr-12	640	3	360	<0.1	342	0.11	0.035	0.97	1.8	0.9	6	7.97	340	4.1	84	37		0.054	0.03
Nov-12	610	3	350	<0.1	330	0.67	0.031	0.3	1.8	1.6	7	8.15	340	4.5	77	37		0.054	0.03
Apr-13	650	3	350	<0.1	326	0.21	0.042	1.2	6.4	5.2	7	8.04	350	4.0	80	35			
Oct-13	630	5	350	<0.10	362	0.37		0.23	1.0	0.8	6	7.90	350	4.3	80	36			
Apr-14	580	2	350	<0.02	322	<0.1	<0.01	0.11	0.52	0.4	8	7.71	310	3.2					
Oct-14	690	16	410	<0.02	394	0.38	0.1	0.68	1.0	0.3	5	7.95	360	4.8					
Apr-15	720	25	430	<0.02	328	0.88	0.070	0.70	1.3	0.6	3	7.69	350	4.8					
Nov-15	770	28	450	<0.02	416	1.15	0.018	0.72	0.98	0.26	4.4	7.91	380	5.2	110	45	1		
Apr-16	750	32	460	<0.02	426	0.46	0.043	0.79	0.93	0.13	3.8	8.07	390	5.2	110	46	1		
Nov-16	740	23	430	<0.02	428	0.61	<0.010	<0.050	0.21	0.21	10	8.17	370	4.7	100	41	1	Note**	
Apr-17	810	30	440	<0.02	452	0.53	0.064	0.90	1.1	0.17	5.3	8.08	390	5.3	100	45	1		
Oct-17	810	29	460	<0.02	435	0.51	0.041	0.96	1.4	0.49	6.2	8.08	410	5.9	110	47			
Apr-18	860	30	480	<0.02	420	0.44	0.043	0.55	0.69	0.14	6.6	7.95	440	6.5	110	47	1		
Oct-18	830	40	450	<0.02	485	0.80	0.026	0.10	0.27	0.17	14	8.02	390	8.1					
Apr-19	850	25	460	<0.02	420	0.38	0.053	0.63	0.68	<0.10	8.5	7.97	420	7.6	110	46	1		
Nov-19	840	23	450	<0.02	510	0.96	<0.010	<0.050	<0.10	<0.10	13	8.08	430	9.0	110	46	1		
Apr-20	880	21	510	<0.02	480	0.75	0.087	0.70	0.85	0.15	11	7.83	450	9.1	120	51	1		
Oct-20	860	20	470	<0.02	485	0.87	0.027	0.062	0.16	<0.10	9	7.94	450	7.1	110	48	1		
May-21	880	24	490	<0.02	465	0.30	0.047	0.64	0.72	<0.10	11	7.82	450	8.1	120	47	<1		
Nov-21	900	33	480	<0.02	460	0.98	0.015	0.53	1.0	0.49	13	7.90	450	7.2	120	47	1		
May-22	930	39	520	<0.02	410	0.18	0.053	0.80	0.8	<0.10	13	7.98	450	7.7	130	50	<1		
Oct-22	920	42	530	<0.02	585	0.46	0.322	0.86	1.2	0.35	15	7.90	480	11	130	52	1		
Average	687	10.59	388	0.33	396	0.461	0.045	0.773	1.74	1.13	9.25	7.78	372	7.12	106.2	44.6	1.0	0.060	0.031
Std. Dev.	101.9	12.17	60.3	1.17	68.0	0.370	0.047	0.433	1.52	1.52	10.5	0.32	77.6	3.42	16.5	5.20	0.0	0.024	0.007

HISTORICAL GROUNDWATER QUALITY DATA: TW-2

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	560	3.0	312	0.15		0.01	0.005	0.01	0.15	0.14	9	7.43	305	3.2					
May-85	770	2.5	426									7.34							
Oct-88	885	1.1	520		526							7.02							
Apr-89	779	1..3	431	1.21	506	<0.01	0.03	0.037	0.29	0.25		7.21							
Apr-90	699	3.3	373	2.8		0.1	0.02		2.74	2.74		7.18							
Nov-90	769	1.3	441	0.14		0.1	<0.01	0.046	0.29	0.24	67.5	7.31	371	2.5					
Mar-91	638	1.3	342	0.04		<0.1	<0.01	0.068	0.3	0.23		7.48	342						
Sep-91	750	3.7	382	0.06		<0.1	0.02	1.0	1.18	0.18		7.88	383						
Nov-92	808	0.4	314	6.47		<0.1	0.01	0.108	0.76	0.65		7.43	373						
May-93	600	2.5	309	0.37		0.1	<0.01	0.139	0.54	0.40		7.63	281						
Nov-93	676	1.0	315	1.13		<0.1	<0.01	0.034	0.46	0.43		7.52	210						
May-94	552	<0.5	306	0.01		0.2	<0.01	0.076	0.43	0.35		7.91	301						
Nov-94	709	0.8	374	0.19		<0.1	0.01	0.17	0.35	0.18		7.42	322						
May-95	526	1.9	289			0.4	0.02	0.22	0.57	0.35	12	7.69	262	6.8					
Oct-95	816	2.2	469			0.4	0.01	0.34	0.93	0.59	44.4	7.54	431	6.3					
May-96	537	<1.0	260	<0.02	278	<0.05	<0.05	<0.05			41.9	7.10	229	1.3					
Sep-96	758	<1.0	395	<0.02	390	<0.05	<0.05	<0.05			31.2	7.80	342	3.1					
May-97	490	1.83	288			<0.1	<0.1	0.106	0.65	0.54	4.3	7.5	290	2.6					
Sep-97	720	1.37	543			<0.1	<0.1	0.182	0.44	0.26	18.0	7.10	432	6.5					
May-98	744	1.21	418			0.62	<0.05	0.03	0.56	0.53	13.0	7.04	282	4.4					
May-99	398	1.05	280	0.04	240	<0.05	<0.05	<0.05	6.7	6.7	31.4	7.94	160	1.4					
Oct-99	732	7.4	443	<0.01	390	0.54	<0.05	3.86	10.3	6.44	164	6.99	330	6.9					
May-00	532	6.0	441	0.36	260	0.69	<0.05	<0.05	3.5	3.5	23	7.82	304	10.1					
Oct-00	733	4.6	566	0.26	360	0.32	<0.05	0.11	2.4	2.29	50	7.87	244	10.8					
May-01	691	3.9	422	1.45	320	0.33	<0.05	<0.05	6.1	6.1	33.8	7.48	245	9.6				0.14	0.01
Nov-01	734	4.0	408	0.16	390	0.13	<0.05	0.1	0.64	0.54	41	7.03	471	9.0				<0.01	0.01
May-02	682	1.0	414	0.02	340	<0.2	<0.2	0.06	0.28	0.22	21	7.59	382	2.4				0.034	<0.01
Nov-02	800	0.5	441	<0.01	475	0.4	<0.2	<0.03	0.25	0.25	78.7	7.51	400	3.5				0.042	0.01
May-03	590	0.6	335	<0.01	339	<0.2	<0.2	<0.03			27.2	7.60	317	2.1				0.025	<0.01
May-04	700	<0.5	414	<0.01	424	<0.2	<0.2	0.21	0.33	0.12	24.9	7.27	403	2.8				0.034	<0.01
May-05	682	1	363	<0.01	402	<0.2	<0.2	0.1	1.35	1.25	22.3	7.52	369	2.1				0.021	<0.01
Apr-06	729	1	410	<0.02	420	<0.1	<0.01	<0.05	0.3	0.30	32	8.10	413						
May-07	730	1	452	<0.05	406	<0.1	<0.01	0.08	1.5	1.42	21	8.00	399	2.6				0.031	<0.01
May-08	718	1	435	<0.1	490	<0.1	<0.01	0.07	1.6	1.53	25	8.00	382	2.2				0.029	<0.01
May-09	656	<1	390	<0.1	450	<0.1	<0.01	<0.05	2.1	2.1	12	7.70	357	1.7					
May-10	732	1	398	<0.1	450	<0.1	<0.01	0.050	0.7	0.7	16	7.80	387	1.9				0.030	<0.01
Apr-11	685	1	360	<0.02	390	<0.1	<0.01	0.100	3.0	3.0	8	7.96	366	1.6					
Apr-12	730	1	410	<0.1	390	<0.1	<0.01	0.094	1.5	1.4	14	7.71	400	2.4	110	33		0.028	<0.01
Nov-12	740	2	410	<0.1	406	<0.1	<0.01	0.094	1.1	1.0	15	7.81	400	2.7	110	34		0.030	<0.01
Apr-13	640	2	350	<0.1	320	<0.10	<0.010	0.078	3.1	3.0	15	7.79	340	2.2	95	27			
Oct-13	730	2	400	<0.10	414	<0.10		0.088	2.7	2.7	13	7.58	400	2.8	110	32			
Apr-14	670	13	380	<0.02	372	0.26	0.07	0.81	2.1	1.3	5	8.07	350	4.6					
Oct-14	780	5	450	<0.02	450	<0.10	<0.010	0.062	0.29	0.2	15	7.55	420	3.9					
Apr-15	680	6	410	<0.02	324	<0.50	<0.050	<0.050	1.3	1.3	8	7.57	350	4.9					
Nov-15	780	3.4	480	<0.02	472	<0.10	<0.010	0.20	0.79	0.58	10	7.71	420	5.7	130	36	<1		
Apr-16	580	1.9	330	<0.02	318	<0.10	<0.010	0.12	0.25	0.13	3	7.97	320	3.7	95	24	<1		
Nov-16	800	1.9	480	<0.02	468	<0.10	<0.010	<0.050	0.26	0.26	11	7.84	450	4.9	140	33	<1	Note**	
Apr-17	630	2.1	340	<0.02	294	<0.10	<0.010	<0.050	0.18	0.18	3.3	7.96	340	3.0	96	24	<1		
Oct-17	750	1.2	430	<0.02	415	<0.10	0.016	<0.050	0.53	0.53	11	8.04	410	4.0	120	32			
Apr-18	620	1.3	360	<0.02	325	<0.10	<0.010	0.17	0.3	0.14	3.7	7.75	350	3	100	27	<1		
Oct-18	1000	97	490	<0.02	590	<0.10	<0.010	0.34	0.56	0.22	30	7.65	380	28					
Apr-19	700	34	320	<0.02	345	<0.10	<0.010	0.066	0.21	0.14	17	7.95	310	26	92	23	<1		
Nov-19	900	60	450	<0.02	510	<0.10	<0.010	0.077	0.22	0.14	29	7.77	380	31	130	32	<1		
Apr-20	760	32	420	<0.02	390	0.11	<0.010	0.074	0.29	0.22	19	7.67	350	22	120	32	<1		
Oct-20	830	22	410	<0.02	485	<0.10	<0.010	<0.050	0.24	0.24	22	7.68	400	22	110	31	<1		
May-21	830	19	440	<0.02	495	<0.10	<0.010	0.078	0.18	<0.10	85	7.67	350	21	130	30	<1		
Nov-21	1000	17	520	<0.02	600	<0.10	<0.010	0.14	0.75	0.61	160	7.63	390	19	150	36	<1		
May-22	930	14	520	<0.02	550	<0.10	<0.010	0.24	0.51	0.27	180	7.81	330	18	150	36	<1		
Average	714	7.74	401	0.30	409	0.125	0.022	0.192	1.30	1.14	32.8	7.62	350	7.44	117	30.7	<1	0.040	0.006
Std. Dev.	115	16.51	68.7	1.00	85.4	0.155	0.028	0.537	1.86	1.58	40.1	0.29	62.6	7.94	19.0	4.25	NA	0.033	0.002

HISTORICAL GROUNDWATER QUALITY DATA: TW-3

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	620	2.5	344	0.38		<0.01	0.001	0.11	0.22	0.11	5	7.42	345	3.9					
May-85	625	3.0	306									7.55							
Oct-88	2710	377	1283		1918							7.23							
Apr-89	1770	182	864	12.4	924	0.1	0.01	3.1	6.51	3.41		7.03							
Oct-89	1690	173	754	8.6		0.1	0.01	3.94	6.5	2.56		7.04	653						
Nov-90	2160	207	770	2.42		<0.1	0.03	11.0	13.8	2.8	43	7.12	847	122					
Mar-91	1770	173	754	7.10		<0.1	0.02	5.8	7.7	1.9		7.11	760						
Sep-91	1950	174	744	4.88		<0.1	0.05	10.8	12.4	1.6		7.06	725						
May-92	1920	184				0.2	0.01	3.8	5.8	2.0		7.14	750						
ABANDONED																			
Average	1691	164	727	6.0	1421	0.08	0.02	5.5	7.6	2.1	24.0	7.2	680	63					
Std. Dev.	678	112	306	4.3	703	0.06	0.02	4.1	4.5	1.1	26.9	0.2	176	84					

HISTORICAL GROUNDWATER QUALITY DATA: TW-4

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	700	3.5	352	0.10		0.06	0.003	0.055	0.23	0.18	19.5	7.56	381	23.5					
May-85	760	3.0	357									7.54							
Apr-89	794	2.8	408	1.19	516	<0.1	0.01	0.159	0.45	0.29		7.44							
Oct-89	798	3.3	443	4.6		0.1	0.02	0.229	0.74	0.51		7.42							
Apr-90	784	3.6	393	1.78		0.1	0.02	0.164	0.42	0.26		7.33							
Nov-90	785	2.7	373	0.52		0.1	<0.01	0.214	0.47	0.26	24	7.68	443	28.2					
Mar-91	808	3.5	444	0.18		0.1	0.01	0.248	0.7	0.45		7.64	452						
Sep-91	818	2.9	409	0.10		<0.1	0.02	0.222	0.61	0.39		7.54	459						
May-92	815	3.0				0.2	0.01	0.265	0.58	0.32		7.66	432						
Nov-92	828	2.5	350	3.96		<0.1	0.01	0.193	0.23	0.04		7.75	433						
May-93	766	2.6	404	1.08		0.1	0.01	0.252	0.74	0.49		7.56	379						
Nov-93	813	2.3	394	0.54		0.1	0.01	0.071	0.53	0.46		7.57	398						
May-94	808	2.7	411	0.01		0.2	<0.01	0.201	0.49	0.29		8.00	426						
Nov-94	836	2.0	441	0.40		<0.1	0.02	0.24	0.51	0.27		7.67	419						
May-95	778	2.2	405			<0.1	0.02	0.1	0.63	0.53	52	7.68	373	34.1					
Oct-95	849	3.3	432			0.4	0.01	0.26	0.74	0.48	58	7.71	444	35.3					
May-96	1039	<1.0	472	<0.02	525	<0.05	<0.05	<0.05			83.5	7.50	438	30.9					
Sep-96	875	<1.0	409	<0.02	450	<0.05	<0.05	<0.05			75.6	7.24	349	24.2					
May-97	770	2.12	432			<0.1	<0.1	0.161	0.49	0.33	57.5	7.60	411	29.5					
Sep-97	760	2.81	483			<0.1	<0.1	0.228	1.25	1.02	55.0	7.30	436	46.6					
May-98	881	11.4	358			0.32	<0.05	0.30	0.82	0.52	54.2	7.35	312	33.4					
Oct-98	806	4.73	458			<0.05	<0.05	0.58	0.9	0.32	54.0	7.38	357	33.2					
May-99	673	2.15	446	<0.01	410	<0.05	<0.05	0.14	4.1	3.96	63.2	7.98	284	25.4					
Oct-99	800	14.1	461	<0.01	450	0.55	<0.05	0.49	8.8	8.31	135	7.17	458	31.5					
May-00	917	6.3	580	2.47	460	0.11	<0.05	0.03	3.8	3.77	71.2	7.43	491	41.5					
Oct-00	791	5.6	574	0.5	380	0.26	<0.05	0.46	1.0	0.54	89.3	8.25	388	42.1					
May-01	845	8.4	468	2.22	420	0.26	<0.05	<0.05	6.3	6.3	105.6	7.95	350	32.1				0.16	0.41
Nov-01	816	6.0	440	0.09	430	0.54	<0.05	0.12	0.73	0.61	73.0	7.55	490	35.0				<0.01	0.37
May-02	901	2.2	510	<0.01	543	<0.2	<0.2	0.16	0.44	0.28	66.7	7.73	478	33.3				0.049	0.37
Nov-02	937	1.9	470	<0.01	699	0.4	<0.2	0.35	0.64	0.29	73.1	7.45	489	33.9				0.051	0.41
May-03	1172	1.8	686	0.03	791	0.2	<0.2	0.17			207	7.55	566	31.0				0.067	0.33
May-04	1089	3.1	667	<0.01	790	0.2	<0.2	0.2	0.46	0.26	203	7.32	528	33.4				0.077	0.36
May-05	1127	2.4	665	<0.01	724	0.3	<0.2	0.19	0.62	0.43	188	7.61	493	29.5				0.056	0.28
Apr-06	1270	2	690	<0.02	753	<0.1	0.01	0.23	0.50	0.27	204	8.00	571						
Sep-06	1260	2	700	4.35	821	0.2	0.03	0.44	0.80	0.4	220	8.10	573	35.1					0.40
May-07	1320	4	751	<0.05	847	<0.1	<0.01	0.18	0.60	0.4	262	7.90	555	33				0.075	0.31
May-08	1210	8	691	<0.1	890	<0.1	<0.01	0.22	0.60	0.4	26	8.00	679	27				0.022	0.09
May-09	1430	2	870	<0.1	915	<0.1	<0.01	0.2	2.1	1.9	330	7.70	527	32					
May-10	1440	2	751	<0.1	890	<0.1	<0.01	0.14	1.0	0.9	350	7.80	528	28				0.071	0.29
Apr-11	1420	2	740		842	<0.1	<0.01	0.22	0.50	0.2	320	7.66	522	32					
Apr-12	1400	2	780	<0.1	934	<0.1	<0.01	0.095	0.47	0.4	310	7.75	530	32	120	120		0.076	0.37
Nov-12	1400	3	780	<0.1	874	<0.1	<0.01	0.18	0.53	0.4	290	7.74	530	34	110	120		0.071	0.38
Apr-13	1400	3	780	<0.1	946	<0.10	<0.010	0.18	0.69	0.5	310	7.83	540	31	120	120			
Oct-13	1400	20	750	<0.10	892	<0.10		0.18	0.46	0.3	300	7.55	530	32	120	110			
Apr-14	1500	34	850	0.09	962	0.10	0.01	0.22	0.41	0.2	300	7.70	540	36					
Oct-14	1500	31	840	<0.02	974	<0.10	<0.010	0.55	0.65	0.1	290	7.79	540	37					
Apr-15	1500	37	900	<0.02	896	<0.10	0.057	0.21	0.48	0.3	280	7.69	520	39					
Nov-15	1500	39	860	<0.02	962	<0.10	<0.010	2.7	3.1	0.32	260	7.63	560	40	140	130	3		
Apr-16	1500	43	840	<0.02	914	<0.10	0.02	0.81	0.98	0.17	290	7.93	550	38	130	120	2		
Average	1028	7.55	566	0.62	730	0.128	0.026	0.026	1.16	0.87	166	7.65	470	33.2	123	120	2.50	0.070	0.336
Std. Dev.	284	10.84	177	1.22	208	0.131	0.029	0.029	1.64	1.62	112	0.23	81.4	4.92	10.3	6.32	0.71	0.034	0.087

HISTORICAL GROUNDWATER QUALITY DATA: TW-5

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	980	6.5	526	0.23		0.01	0.002	0.155	0.32	0.17	135	7.47	433	27.0					
May-85	1120	6.5	572									7.27							
Apr-89	1148	6.1	603	1.66	694	0.4	0.01	0.022	1.27	1.25		7.33							
Nov-90	1066	4.9	534	0.37		0.1	<0.01	0.323	0.53	0.21	160	7.42	434	26.2					
Mar-91	1069	5.0	568	0.02		0.1	0.01	0.303	0.65	0.35		7.41	454						
Sep-91	1009	5.2	520	0.03		0.1	0.02	0.269	0.83	0.56		7.45	462						
May-92	1049	3.7				0.4	0.03	0.101	0.91	0.81		7.79	397						
Nov-92	1065	4.0	300	1.06		0.3	<0.01	0.019	0.23	0.21		7.60	425						
May-93	998	4.0	479	0.15		0.5	0.01	0.094	0.69	0.60		7.77	407						
Nov-93	1048	0.1	489	0.38		0.4	<0.01	0.114	0.41	0.30		7.56	386						
May-94	1017	8.8	539	<0.01		0.3	0.01	0.187	0.41	0.22		7.88	425						
Nov-94	1029	3.6	517	0.09		<0.1	0.01	0.11	0.24	0.13		7.64	397						
May-95	951	2.9	517			0.2	<0.01	0.04	0.59	0.55	115	7.33	359	27.3					
Oct-95	1004		547						0.85	0.85		8.25	468	32.0					
May-96	1243	<1.0	586	<0.02	630	<0.05	<0.05	<0.05			82	7.50	545	27.1					
Sep-96	1075	<1.0	524	<0.02	555	<0.05	<0.05	<0.05			122	6.89	390	14.1					
May-97	930	3.52	536			<0.1	<0.1	0.175	0.7	0.53	118	7.30	547	26.6					
Sep-97	930	4.48	611			0.59	<0.1	2.66	2.95	0.29	110	7.40	484	47.9					
May-98	1063	19.2	597			0.23	<0.05	0.24	0.79	0.55	89	7.15	493	34.8					
May-99	802	3.18	520	0.46	480	<0.05	<0.05	0.16	5.7	5.54	127	7.63	314	18.2					
Oct-99	896	19.9	524	<0.01	480	0.78	<0.05	0.55	5.9	5.35	192	7.26	415	26.4					
May-00	980	7.2	615	0.81	500	0.35	<0.05	0.09	4.3	4.21	141	7.74	469	33.6					
Oct-00	781	5.0	630	<0.01	400	0.47	<0.05	0.22	0.9	0.68	31.5	7.89	259	19.0					
May-01	910	7.8	532	0.51	430	0.21	<0.05	<0.05	5.0	5.0	189	7.17	306	25.4				0.11	0.39
Nov-01	828	8.0	475	0.21	430	0.29	<0.05	0.12	0.75	0.63	178	7.21	492	23.2				<0.01	0.31
May-02	952	3.7	545	<0.01	602	<0.2	<0.2	0.29	0.5	0.21	126	7.60	450	25.3				0.041	0.39
Nov-02	538	3.3	502	<0.01	767	0.3	<0.2	0.69	1.64	0.95	152	7.61	438	26.2				0.057	0.41
May-03	958	1.8	553	<0.01	626	<0.2	<0.2	<0.03			207	7.60	367	11.8				0.042	0.16
May-04	887	3.1	547	<0.01	606	0.2	<0.2	0.23	0.35	0.12	139	7.38	423	23.5				0.043	0.34
May-05	827	2.3	484	<0.01	526	<0.2	<0.2	0.14	0.58	0.44	106	7.59	385	12.0				0.025	0.17
Apr-06	873	3	460	<0.02	548	<0.1	0.02	0.13	0.4	0.27	110	8.10	415						
Sep-06	963	3	480	<0.02	638	<0.1	<0.01	0.47	0.6	0.2	132	8.10	473	23.3					
May-07	936	3	507	<0.05	574	<0.1	<0.01	0.34	3.0	2.7	108	7.90	437	15				0.036	0.21
May-08	839	2	472	<0.1	600	<0.1	0.01	0.42	4.0	3.6	109	8.10	369	12				0.033	0.19
May-09	786	<1	480	<0.1	505	<0.1	<0.01	0.11	1.0	0.9	55	7.70	395	8					
May-10	806	2	422	<0.1	508	<0.1	<0.01	0.16	<2	1.8	68	7.80	376	5.6				0.030	0.092
Apr-11	812	2	420	<0.02	478	<0.1	0.01	0.26	3.0	2.5	57	7.99	398	11					
Apr-12	820	2	450	<0.1	458	<0.1	<0.01	0.081	1.5	1.4	53	7.84	410	12	100	48		0.029	0.20
Apr-13	880	2	500	<0.1	466	<0.10	<0.010	0.14	0.95	0.8	71	7.85	420	16	110	57			
Apr-14	890	2	490	<0.02	476	<0.1	<0.01	0.21	0.97	0.8	75	7.83	430	18					
Apr-15	910	3	510	<0.02	430	<0.10	0.127	0.34	0.74	0.4	82	7.75	420	23					
Apr-16	850	2.8	490	<0.02	498	<0.10	<0.010	0.25	0.51	0.26	76	7.96	440	21	100	58	2		
Apr-17	930	2.7	490	<0.02	506	<0.10	0.02	0.25	0.41	0.16	81	7.99	430	23	98	58	2		
Apr-18	910	3.1	500	<0.02	465	<0.10	<0.010	0.52	0.53	<0.10	73	7.86	450	23	100	60	2		
Apr-19	860	2.9	450	<0.02	455	<0.10	0.012	0.06	0.18	0.12	64	7.86	410	19	94	52	2		
Apr-20	860	2.8	470	<0.02	465	0.17	0.045	0.31	0.35	<0.10	71	7.80	420	22	96	56	2		
May-21	860	3.1	460	<0.02	450	<0.10	<0.010	0.26	0.35	<0.10	65	7.92	420	19	96	53	2		
May-22	860	2.5	470	<0.02	450	<0.10	<0.010	0.35	0.46	0.11	55	7.89	420	20	98	54	2		
Average	933	4.49	511	0.16	522	0.168	0.027	0.262	1.32	1.14	106	7.65	421	21.58	99	55	2.0	0.041	0.260
Std. Dev.	119	3.81	58.5	0.33	85.7	0.177	0.033	0.392	1.52	1.50	43.5	0.30	53.2	8.25	4.59	3.72	0.0	0.026	0.111

HISTORICAL GROUNDWATER QUALITY DATA: TW-6

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	860	20.5	432	0.62		<0.01	0.001	0.395	0.59	0.20	5.0	7.29	454	14.7					
May-85	845	18.0	435									7.08							
Oct-88	715	14.0	396		422							7.02							
Apr-89	782	19.0	464	7.0	508	0.1	0.10	0.044	0.50	0.46		7.15							
Average	801	18	432	3.8	465	0.05	0.05	0.22	0.55	0.33	5	7.14	454	15					
Std. Dev.	66.3	2.8	28.0	4.5	60.8	0.07	0.07	0.25	0.06	0.18	NA	0.12	NA	NA					

HISTORICAL GROUNDWATER QUALITY DATA: TW-7

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	675	8.5	343	0.22		<0.01	0.001	0.045	0.11	0.065	19.5	7..57	361	7.3					
May-85	635	2.5	297									7.59							
Oct-88	800	36.5	419		404							7.40							
Apr-90	1930	198	803	13.8		<0.1	0.06	8.0	10.7	2.7		6.92							
Average	1010	61.4	466	7.0	404	<0.1	0.03	4.02	5.41	1.38	19.5	7.30	361	7					
Std. Dev.	617	92.3	231	9.6	NA	NA	0.04	5.63	7.49	1.86	NA	0.35	NA	NA					

HISTORICAL GROUNDWATER QUALITY DATA: TW-8

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	790	10.0	338	0.34		0.07	0.039	0.01	0.18	0.17	94.5	7.73	370	4.3					
May-85	650	4.5	293									7.72							
Oct-88	781	9.1	370		436							7.50							
Apr-89	723	6.4	342	0.87	470	0.02	0.01	0.016	0.18	0.16		7.52							
Oct-89	719	7.2	338	0.96		0.1	0.03	0.381	0.30	0.00		7.58							
Apr-90	848	12.6	436	0.61		0.1	0.03	0.057	0.2	0.14		7.43							
Nov-90	784	10.4	336	0.38		0.1	0.02	0.148	0.37	0.22	90	7.61	348	38.0					
Mar-91	785	9.3	358	0.03		0.1	0.01	0.153	0.42	0.27		7.75	367						
Sep-91	766	7.7	350	0.01		<0.1	0.02	0.287	0.67	0.38		7.78	362						
May-92	738	8.2				0.3	0.02	0.096	0.4	0.30		7.81	350						
Nov-92	793	7.5	300	0.39		0.2	0.01	0.046	0.24	0.19		7.90	355						
May-93	716	6.8	341	0.12		0.2	<0.01	0.154	0.59	0.44		7.77	328						
Nov-93	692	5.1	316	0.49		0.2	<0.01	0.136	0.33	0.19		7.71	352						
May-94	674	4.9	321	0.02		0.2	<0.01	0.093	0.39	0.30		8.13	350						
Nov-94	752	6.0	355	0.11		0.2	0.01	0.33	0.35	0.02		7.68	340						
May-95	724	4.4	356			<0.1	<0.01	0.04	0.23	0.19	50.2	7.63	314	31.9					
Oct-95	750	6.8	363			0.4	0.01	0.34	0.78	0.44	49.2	7.90	394	33.5					
May-96	871	1.4	392	<0.02	442	<0.05	<0.05	<0.05			56.2	7.50	385	28.2					
Sep-96	740	1.6	343	<0.02	390	<0.05	<0.05	<0.05			26.1	7.45	349	25.0					
May-97	680	4.8	352			<0.1	<0.1	0.071	0.41	0.34	41.6	7.40	321	25.8					
Sep-97	650	6.1	402			0.27	<0.1	0.198	0.42	0.22	41.0	7.30	375	43.6					
May-98	706	2.8	292			0.62	<0.05	0.24	0.75	0.51	37.3	7.34	271	29.6					
May-99	750	20.4	506	0.05	450	0.28	<0.05	0.08	2.7	2.62	209	7.96	184	19.0					
May-00	926	30.2	608	0.54	460	0.68	<0.05	<0.05	3.8	3.8	216	7.68	283	33.0					
Oct-00	835	23.6	802	<0.01	440	0.8	<0.05	<0.05	3.9	3.9	55.6	8.01	191	34.3					
May-01	920	27.1	534	0.63	470	0.43	<0.05	<0.05	2.7	2.7	254	7.35	200	26.9				0.11	0.19
Nov-01	1033	24.0	627	0.03	560	0.99	<0.05	<0.05	0.5	0.5	385	7.54	457	34.0				<0.5	0.20
May-02	895	20.1	500	<0.01	572	<0.2	<0.2	0.09	0.24	0.15	158	7.84	345	24.2				0.032	0.10
May-03	1106	23.8	606	<0.01	736	<0.2	<0.2	<0.03			281	7.78	346	25.5				0.02	0.10
May-04	1166	16.0	725	<0.01	740	1.2	<0.2	0.04	0.18	0.14	360	7.39	378	28.8				0.034	0.15
May-05	869	17.2	444	<0.01	548	<0.2	<0.2	0.34	12.70	12.36	106	7.68	381	19.1				0.038	0.05
Apr-06	898	14	470	<0.02	543	<0.1	<0.01	0.06	0.30	0.24	80	8.10	433						
May-07	1130	16	583	<0.05	648	<0.1	<0.01	0.29	6.00	5.71	131	7.90	506	24				0.041	0.09
May-08	939	16	521	<0.1	630	<0.1	<0.01	0.18	5.00	4.82	115	8.10	401	19				0.033	0.07
May-09	1120	16	690	<0.1	695	<0.1	<0.01	0.05	1.80	1.75	140	7.70	482	25					
May-10	1080	19	546	<0.1	686	<0.1	<0.01	0.08	1.10	1.02	76	7.80	508	21				0.051	0.075
Apr-11	1050	17	450		592	<0.1	<0.01	0.23	5.00	5.10	110	7.95	474	25					
Apr-12	1000	18	580	<0.1	608	<0.1	<0.01	<0.05	0.56	0.60	83	7.85	490	24	110	74		0.040	0.11
Nov-12	1000	13	570	<0.1	624	<0.1	<0.01	0.29	13.00	12.20	91	7.87	480	25	110	74		0.034	0.12
Apr-13	1000	13	540	<0.1	566	<0.10	<0.01	0.22	5.60	5.40	80	7.90	480	22	110	67			
Oct-13	970	12	520	<0.1	574	<0.10		0.09	0.89	0.80	65	7.60	480	20	100	63			
Apr-14	980	13	560	<0.02	576	<0.1	<0.01	0.19	5.30	5.10	61	7.72	480	21					
Oct-14	1000	16	570	<0.02	592	0.59	0.011	0.20	0.32	0.10	76	7.86	470	23					
Apr-15	960	19	560	<0.02	586	<0.10	<0.01	0.057	0.36	0.30	74	7.75	430	22					
Nov-15	1000	17	580	<0.02	624	<0.10	<0.01	0.17	0.71	0.54	90	7.76	460	25	120	72	3		
Apr-16	970	20	560	<0.02	576	<0.10	<0.010	0.061	0.41	0.35	75	7.91	470	24	110	70	2		
Average	868	12.71	465	0.16	566	0.210	0.023	0.134	1.96	1.82	117	7.72	384	25.8	110	70	2.5	0.043	0.113
Std. Dev.	146	7.11	129	0.26	93.2	0.273	0.028	0.108	3.05	2.97	90.0	0.21	84.5	6.99	6.32	4.3	0.7	0.025	0.049

HISTORICAL GROUNDWATER QUALITY DATA: TW-9

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	1480	115	667	0.26		<0.01	0.004	1.68	2.25	0.57	44.5	7.39	658	66					
May-85	1950	230	811									7.37							
Oct-88	2690	445	800		1442							7.36							
Apr-89	2160	252	744	7.8	1174	0.1	0.05	7.2	7.96	0.76		7.41							
Apr-90	2480	274	864	2.2		0.1	0.05	9.0	10.0	1.00		7.35							
Nov-90	2720	311	846	0.30		<0.1	0.01	9.9	11.2	1.30	27.1	7.53	846	157					
Mar-91	1890	142	632	0.01		0.1	0.01	6.8	8.32	1.52		7.70	771						
May-92	1550	138				0.4	0.01	2.7	4	1.30		7.58	582						
Nov-92	1600	150	507	0.32		<0.1	0.01	2.9	5.05	2.15		8.12	594						
May-93	1820	151	690	0.08		0.1	<0.01	6.0	9.6	3.60		8.02	757						
Nov-93	1860	145	656	0.18		<0.1	<0.01	5.4	8.8	3.40		7.56	709						
May-94	1154	45.8	427	0.11		0.2	<0.01	5.3	6.6	1.30		8.05	596						
Nov-94	1910	145	761	0.69		0.1	0.01	6.55	11.2	4.65		7.66	1010						
May-95	1286	47.9	583			<0.1	0.02	2.53	4.79	2.26	21.9	7.71	634	37.4					
Oct-95	1760	120	728			0.4	0.01	5.13	7.85	2.72	7.7	7.83	806	72.9					
May-96	1111	14.3	488	<0.02	559	<0.05	<0.05	<0.05			55.1	7.40	478	14.4					
Sep-96	1435	86.9	635	<0.02	700	<0.05	<0.05	<0.05			37.4	6.69	543	32.7					
May-97	790	13.4	416			<0.1	<0.1	1.49	1.77	0.28	12.8	7.30	448	9.9					
Sep-97	1440	96.8	802			<0.1	<0.1	5.61	6.12	0.51	8.2	7.40	1440	69.4					
May-98	927	23.6	415			0.19	<0.05	2.02	4.11	2.09	8.9	7.50	456	14.2					
May-99	1516	102.1	830	0.09	860	<0.05	<0.05	0.52	4.6	4.08	114	7.98	450	57.4					
May-00	1338	47.3	705	6.06	670	0.29	<0.05	3.22	6.1	2.88	75.4	7.39	632	42.8					
Oct-00	1213	46.3	629	0.61	600	5.03	<0.05	<0.05	1.4	1.4	54.0	8.13	387	41.6					
May-01	861	20.3	413	4.25	430	1.94	<0.05	0.06	5.2	5.14	20.2	7.65	444	16.9				0.25	0.38
Nov-01	1113	53.0	536	1.64	590	0.92	<0.05	2.15	4.92	2.77	21.0	7.46	634	35.1				0.6	0.60
May-02	994	32.6	502	<0.01	575	0.4	<0.2	0.17	0.86	0.69	20.9	7.78	517	22.9				0.109	0.39
May-03	1113	34.0	520	<0.01	672	2.4	<0.2	3.64			34.2	7.62	617						
May-04	757	11.8	377	0.1	392	<0.2	<0.2	1.6	1.89	0.29	12.6	7.19	428	11.0				<0.005	0.22
Apr-06	833	16	380	<0.02	428	0.1	0.04	3.25	3.5	0.25	7	8.20	471						
May-07	905	15	453	<0.05	531	<0.1	<0.01	2.4	4	1.60	17	8.00	483	15				0.029	0.28
May-08	1040	81	442	<0.1	660	0.20	0.030	3.3	4.2	0.90	11	8.20	425	29				0.039	0.40
May-09	760	22	390	<0.1	500	0.30	0.030	0.98	2.2	1.22	12	8.00	377	18					
May-10	1270	35	560	<0.1	800	0.20	0.080	4.8	6	1.2	12	8.00	4.8	34				0.061	0.74
Apr-11	861	13	400		494	1.20	0.030	1.3	2.7	1.4	5	8.08	455	17					
Apr-12	870	11	470	<0.1	472	0.11	0.021	0.75	2	1.3	10	7.86	470	11	96	57		0.027	0.21
Nov-12	1200	23	580	<0.1	614	0.11	0.057	6.6	8.8	2.2	8	7.79	630	29	64	100		0.04	0.74
Apr-13	850	9	410	<0.1	444	1.40	0.096	2.3	4.7	2.4	4	7.95	470	11	71	57			
Oct-13	1500	44	710	<0.10	868	0.15		8.8	12	3.7	42	7.91	800	52	76	130			
Apr-14	800	13	420	<0.02	424	0.29	0.070	2.1	4.2	2.1	16	7.92	410	12					
Oct-14	1600	44	740	<0.02	884	<0.10	0.028	10	10	0.3	38	7.99	810	50					
Apr-15	1200	28	580	<0.02	594	2.35	1.11	3.7	19	15.6	21	7.91	580	29					
Nov-15	1600	50	780	<0.02	878	1.36	1.39	11	12	0.98	18	8.10	820	60	72	150	52		
Apr-16	850	16	430	<0.02	450	0.28	0.037	3.1	3.4	0.30	5.8	7.79	470	18	69	63	22		
Average	1373	86.4	589	0.73	656	0.52	0.096	3.82	6.14	2.16	25.1	7.72	593	36.2	74.7	92.8	37.0	0.144	0.440
Std. Dev.	516	95.1	155	1.79	243	0.95	0.272	3.02	3.84	2.57	23.6	0.33	226	29.8	11.2	40.4	21.2	0.199	0.206

HISTORICAL GROUNDWATER QUALITY DATA: TW-10

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Feb-84	660	27.5	309	0.60		<0.01	0.003	1.45	1.8	0.35	10	7.75	352	13.2					
May-85	605	8.5	288									7.82							
Oct-88	548	1.6	302		264							7.95							
Apr-89	561	1.0	293	1.2	365	1.60	0.07	0.01	0.74	0.73		7.67							
Oct-89	563	1.4	283	1.29		0.10	0.41	1.74				7.74							
Apr-90	547	1.7	279	0.26		0.10	0.02	0.29	1.9	1.61		7.62							
Nov-90	544	0.8	282	0.96		0.10	0.09				0.5	7.87	315	10.9					
Mar-91	549	1.2	274	0.02		0.10	0.01	1.60				7.87	322						
Sep-91	561	2.0	283	0.01		<0.1	0.01	2.40	2.7	0.30		7.98	314						
May-92	535	1.3				0.40	0.02	1.00	1.69	0.69		7.82	298						
Nov-92	553	0.4	274	0.54		0.10	0.15	0.70	1.66	0.96		8.04	313						
May-93	527	0.7	281	0.22		0.30	0.03	1.30	2.15	0.85		7.77	289						
Nov-93	537	1.8	264	1.59		0.90	0.06	0.01	0.84	0.84		7.71	295						
May-94	542	1.7	268	0.09		0.30	0.03	0.91	1.85	0.94		8.16	312						
Nov-94	719	1.1	304	0.28		0.40	0.09	0.81	1.94	1.13		7.48	319						
May-95	548	0.8	290			<0.1	0.04	1.08	0.41	0.67	2.2	7.72	296	10.1					
Oct-95	559	1.7	291			0.40	0.01	0.96	2.46	1.50	4.7	8.01	315	12.5					
May-96	666	<1.0	323	<0.02	336	<0.05	<0.05	<0.05			33	7.50	307	11.4					
Sep-96	570	<1.0	288	<0.02	300	<0.05	<0.05	<0.05			7.9	7.57	289	9.5					
May-97	500	1.6	287			<0.1	<0.1	1.53	1.93	0.40	<0.1	7.70	309	9.2					
Sep-97	500	1.2	336			<0.1	<0.1	1.94	2.07	0.13	<0.1	7.60	304	20.5					
May-98	538	<0.1	272			1.95	<0.05	0.11	0.61	0.50	<0.5	7.32	221	11.1					
Oct-98	522	1.9	292			0.62	<0.05	2.32	3.4	1.08	1.4	7.38	225	11.4					
May-99	397	<0.01	294	0.01	260	0.66	<0.05	0.06	3.5	3.44	5.2	8.09	201	7.4					
Oct-99	494	17.5	289	<0.01	280	1.44	<0.05	1.02	6.2	5.18	10.0	7.57	293	13.4					
May-00	580	5.3	356	0.69	260	0.91	<0.05	1.07	5.5	4.43	5.6	7.73	301	17.8					
Oct-00	508	6.2	501	0.77	240	1.36	<0.05	1.23	3.6	2.37	14.6	8.26	198	19.2					
May-01	510	3.7	252	5.63	260	0.91	<0.05	1.03	8.2	7.17	10.6	7.50	234	20.3				0.26	0.14
Nov-01	490	5.0	241	0.03	280	0.40	<0.05	<0.05	0.61	0.61	10.0	7.58	435	13.6				<0.05	<0.05
May-02	529	1.1	502	0.03	287	<0.2	<0.2	1.34	2.18	0.84	1.1	7.97	305	9.5				0.061	0.07
Nov-02	939	0.7	265	<0.01	369	1.40	<0.2	1.73	2.07	0.34	10.1	7.28	298	10.2				0.058	0.09
May-03	519	0.9	279	<0.01	287	1.10	<0.2	0.95			5.3	7.90	302	8.9				0.052	0.07
May-04	478	<0.5	258	<0.01	273	1.00	<0.2	2.10	2.36	0.26	2.7	7.66	273	9.2				0.051	0.08
May-05	528	1.2	260	<0.01	276	1.80	<0.2	2.12	6.23	4.11	6.4	7.79	294	8.7				0.061	0.06
Apr-06	599	1	290	0.1	328	<0.1	<0.01	4.13	110	105.9	<1	8.00	358						
Sep-06	545	2	260	<0.02	321	0.10	0.04	2.82	2.8	<0.1	<1	8.20	336	9.4					
May-07	554	2	284	<0.05	305	<0.1	0.02	2.42	5	2.58	<1	8.10	311	9.9				0.055	0.07
May-08	544	1	281	<0.1	360	<0.1	0.01	2.8	6	3.2	2	8.20	306	9.6				0.057	0.09
May-09	543	1	300	<0.1	350	0.10	0.03	2.5	7	4.5	1	7.90	307	16					
May-10	580	1	265	<0.1	370	<0.1	<0.01	9.7	33	23.3	<1	8.20	315	9.5				0.14	0.091
Apr-11	549	1	280		312	<0.1	0.01	3.4	7	3.8	2	7.89	296	9.1					
Apr-12	550	<1	260	<0.1	290	<0.1	<0.01	2.7	12	9.6	<1	8.03	300	9.2	51	33		0.07	0.086
Nov-12	530	1	270	<0.1	240	0.11	0.02	2.6	30	27.5	<1	8.12	300	10	50	35		0.092	0.093
Apr-13	540	<1	260	<0.1	250	<0.10	<0.010	2.8	8.2	5.4	3	8.15	300	9.0	50	32			
Oct-13	530	1	260	<0.10	388	0.42		1.6	10	8.4	1	7.99	300	9.6	51	33			
Apr-14	540	<1	290	<0.02	284	<0.1	0.03	2.5	6.2	3.6	<1	8.00	300	11					
Oct-14	540	<1	290	<0.02	312	0.28	0.034	2.6	5.9	3.3	1	7.99	300	10					
Apr-15	540	<1	310	<0.02	436	0.93	0.52	1.0	1.8	0.8	2	7.87	290	11					
Nov-15	530	1	300	<0.02	306	1.11	0.14	2.2	2.5	0.37	<1.0	8.02	290	11	61	36	2		
Apr-16	530	2.4	300	<0.02	278	0.76	0.09	0.81	0.97	0.15	1.3	8.15	300	11	60	36	2		
Nov-16	540	1.4	290	<0.02	304	1.01	0.22	1.3	1.6	0.35	<1.0	8.08	300	11	59	34	2		
Apr-17	550	1.8	280	<0.02	268	0.15	0.012	0.98	1.0	<0.10	<1.0	8.08	300	10	56	34	2		
Oct-17	560	1.9	280	<0.02	270	0.12	0.044	3.5	4.3	0.78	<1.0	8.07	310	10	57	34			
Apr-18	550	2.6	290	<0.02	265	0.81	0.090	0.88	1.1	0.18	1.2	7.97	300	10	59	36	2		
Oct-18	570	5.1	280	<0.02	295	<0.10	0.016	3.9	3.8	<0.10	<1.0	7.86	300	10					
Apr-19	560	5.4	280	<0.02	305	1.01	0.064	0.78	0.98	0.2	<1.0	8.04	290	10	57	34	2		
Nov-19	590	16	300	<0.02	350	1.54	<0.010	0.15	0.11	<0.10	<1.0	8.03	300	11	60	36	2		
Apr-20	680	32	340	<0.02	355	0.66	0.153	0.64	0.9	0.26	3.0	7.89	310	15	69	41	2		
Oct-20	1100	130	490	<0.02	465	0.27	0.021	1.1	1.7	0.59	3.6	7.84	400	41	99	60	2		
May-21	970	120	450	<0.02	515	0.67	0.179	0.70	1.0	0.34	4.4	7.82	350	29	93	54	2		
Nov-21	1100	130	470	<0.02	500	0.18	0.095	0.18	<0.20	<0.10	13	7.88	410	46	98	56	3		
May-22	1200	150	530	<0.02	615	0.14	0.061	2.50	3	0.54	10	7.88	370	38	110	65	2		
Oct-22	1100	130	530	<0.02	670	0.82	0.934	2.70	3.7	0.99	26	7.9	400	41	110	65	2		
Average	599	13.09	309	0.33	333	0.46	0.093	1.65	6.30	4.96	3.90	7.87	307	14.2	69.4	41.9	2.1	0.087	0.085
Std. Dev.	162.5	35.7	70.8	0.85	93.9	0.51	0.169	1.49	15.6	15.4	5.75	0.23	42.5	9.12	21.6	11.97	NA	0.063	0.021

HISTORICAL GROUNDWATER QUALITY DATA: TW-11

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-93	846	31.8	402	0.78		<0.1	<0.01	0.047	0.55	0.50		7.38	291						
May-94	871	29.4	479	0.33		0.20	<0.01	0.077	0.44	0.36		7.73	436						
Nov-94	867	30.9	488	0.82		0.10	0.01	0.260	0.4	0.14		7.30	329						
Oct-95	1085	50.1	605			0.40	0.01	0.690	1.83	1.14	7.8	7.35	526	7.5					
May-96	1064	32.6	535	<0.02	527	<0.05	<0.05	<0.05			28.0	7.00	459	5.6					
Sep-96	1045	31.5	558	<0.02	520	<0.05	<0.05	<0.05			<1.0	7.35	481	1.0					
May-97	780	27.4	464			<0.1	<0.1	0.318	0.7	0.38	3.45	7.20	592	3.0					
Sep-97	890	31.2	691			<0.1	<0.1	0.368	0.82	0.45	2.27	6.80	487	7.8					
May-98	905	37.0	489			0.29	<0.05	0.26	0.72	0.46	7.25	6.90	353	4.5					
Oct-98	1012	42.2	593			<0.05	<0.05	1.26	2.3	1.04	2.7	6.93	427	4.1					
May-99	739	41.1	495	0.02	430	<0.05	<0.05	0.75	5.8	5.05	12.5	7.48	365	2.8					
Oct-99	979	56.7	596	<0.01	500	0.29	<0.05	1.16	7.3	6.14	9.1	7.33	383	8.4					
May-00	874	46.4	581	4.43	410	0.35	<0.05	0.25	4.8	4.55	12.5	7.17	454	11.5					
Oct-00	1045	44.3	665	<0.01	510	0.60	<0.05	0.54	0.8	0.26	8.4	7.51	379	12.4					
May-01	793	34.0	431	2.55	380	0.27	<0.05	0.16	7.9	7.74	22.2	7.37	269	8.1				0.16	0.01
Nov-01	894	50.0	514	1.57	480	0.19	<0.05	0.51	0.93	0.42	13.0	7.17	492	9.6				<0.5	<0.5
May-02	895	38.9	527	<0.01	502	<0.2	<0.2	0.52	1.11	0.59	6.4	7.56	457	3.2				0.024	0.01
Nov-02	1270	74.0	511	<0.01	710	0.30	0.4	0.73	1.08	0.35	10.1	7.39	454	4.2				0.03	<0.01
May-03	759	43.1	409	<0.01	415	<0.2	<0.2	0.40			8.5	7.42	366	3.0				0.02	<0.01
May-04	790	38.9	464	<0.01	498	0.40	<0.2	0.43	0.65	0.22	5.7	7.26	414	3.2				0.021	<0.01
May-05	778	41.9	399	<0.01	494	0.40	<0.2	0.50	2.48	1.98	7.0	7.46	377	2.5				0.019	0.01
Apr-06	929	64	500	<0.02	589	<0.1	0.05	0.53	1.1	0.57	4	8.00	445						
Sep-06	820	37	390	0.04	495	<0.1	<0.01	0.6	0.7	0.1	5	8.00	432	6.8					0.02
May-07	928	71	485	<0.05	509	<0.1	<0.01	0.6	3	2.4	10	7.90	403	9.8				0.022	0.011
May-08	827	49	439	<0.1	540	<0.1	<0.01	0.7	3	2.3	7	8.00	371	10				0.019	<0.01
May-09	832	59	460	<0.1	542	<0.1	0.02	0.4	1.9	1.6	6	7.90	361	19					
May-10	854	40	443	<0.1	540	<0.1	0.04	0.56	1.1	0.5	10	7.90	390	6.2				0.019	0.011
Apr-11	770	30	370		482	0.20	0.1	0.60	4	3.1	8	7.95	367	6.2					
Apr-12	770	26	420	<0.1	456	<0.1	<0.01	0.28	11	10.8	13	7.96	380	5.5	100	41		0.017	0.011
Nov-12	830	34	420	<0.1	514	<0.10	<0.010	0.59	2.3	1.7	7	7.92	400	7.8	100	42		0.021	<0.01
Apr-13	770	38	390	<0.1	432	<0.10	<0.010	0.54	2.2	1.6	4	7.77	350	10	98	35			
Oct-13	820	34	440	<0.10	448	<0.10		0.42	1.3	0.9	4	7.51	410	10	110	38			
Apr-14	850	45	460	<0.02	458	<0.10	0.012	0.46	1.8	1.3	9	7.75	370	11					
Oct-14	870	64	480	<0.02	548	<0.10	0.012	0.40	0.6	0.2	11	7.77	370	8.4					
Apr-15	750	32	440	<0.02	350	0.21	<0.010	0.40	0.8	0.4	11	7.69	350	10					
Nov-15	800	32	470	<0.02	492	0.15	0.011	0.46	0.8	0.33	11	7.75	390	8.5	120	44	1		
Apr-16	760	35	410	<0.02	410	<0.10	<0.010	0.40	0.57	0.17	3.8	7.98	370	10	100	38	<1		
Nov-16	980	71	540	<0.02	534	<0.10	<0.010	0.62	0.73	0.10	9.5	7.86	420	9.2	130	51	1		
Apr-17	880	48	450	<0.02	458	<0.10	<0.010	0.60	0.84	0.24	5.7	7.98	390	13	110	41	<1		
Oct-17	850	36	460	<0.02	465	<0.10	<0.010	0.58	0.76	0.19	11	7.87	410	7.9	110	45			
Apr-18	760	23	430	<0.02	390	<0.10	<0.010	0.39	0.45	<0.10	9.8	7.77	390	8.0	100	41	<1		
Oct-18	810	36	440	<0.02	460	0.26	0.035	0.60	0.67	<0.10	11	7.85	390	7.9					
Apr-19	810	30	430	<0.02	435	<0.10	<0.010	0.35	0.55	0.20	10	7.83	380	7.4	100	42	<1		
Average	871	41.6	481	0.30	484	0.14	0.036	0.49	2.02	1.59	8.91	7.58	403	7.56	107	41.6	<1.0	0.034	0.010
Std. Dev.	110	12.76	73.1	0.86	66.5	0.14	0.065	0.23	2.33	2.35	4.88	0.34	58.9	3.52	10.25	4.20	NA	0.042	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-11D

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-12	660	5	360	<0.1	254	0.15	<0.010	0.21	3.4	3.2	25	7.82	330	3.9	81	39		0.022	<0.01
Apr-13	660	5	360	<0.1	378	0.44	<0.010	0.21	2.1	1.9	24	7.98	340	3.6	82	37			
Oct-13	650	6	350	<0.1	362	0.2		<0.050	0.55	0.5	24	7.92	340	4.1	80	36			
Apr-14	660	4	400	<0.02	366	0.35	<0.01	0.11	1.1	1	23	7.95	340	4.2					
Oct-14	660	4	390	<0.02	384	0.22	<0.010	0.074	<1.0	<0.1	23	7.96	350	3.9					
Apr-15	670	4	400	<0.02	368	0.32	<0.010	<0.050	0.31	0.3	20	7.82	340	3.9					
Apr-16	680	3.3	380	<0.02	356	0.25	<0.010	<0.050	0.11	0.11	21	7.87	350	3.8	89	38	<1		
Apr-17	670	3.6	370	0.02	342	0.11	<0.010	<0.050	0.10	0.10	23	8.04	340	3.8	85	37	<1		
Apr-18	680	3.1	390	<0.02	350	0.16	<0.010	0.13	0.13	<0.10	20	8.03	370	3.9	92	40	<1		
Apr-19	680	3.3	390	0.18	380	0.16	<0.010	<0.050	0.12	0.12	18	8	350	3.8	88	39	<1		
Nov-19	640	3.2	360	<0.02	385	0.15	<0.010	<0.050	0.12	0.12	19	8.07	340	3.8	83	38	<1		
Apr-20	690	2.6	420	<0.02	365	0.18	<0.010	0.08	0.13	<0.10	17	7.85	370	3.9	97	42	<1		
May-21	690	2.2	390	<0.02	350	0.16	<0.010	<0.050	<0.10	<0.10	16	7.99	380	3.5	92	39	<1		
May-22	680	1.7	390	<0.02	325	0.14	<0.010	0.11	0.1	<0.10	13	8.01	370	3.7	90	40	<1		
Average	669	3.64	382	0.03	355	0.214	<0.01	0.079	0.69	0.82	20.4	7.95	351	3.84	87.2	38.6	NA	0.022	<0.01
Std. Dev.	14.92	1.15	19.7	0.08	33.6	0.095	NA	0.068	1.04	1.07	3.52	0.083	15.42	0.18	5.42	1.69	NA	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-12

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-93	863	66.2	392	0.07		<0.1	<0.01	<0.005	0.6	0.6		7.61	252						
May-94	1226	23.6	656	7.45		0.20	<0.01	0.05	0.5	0.45		7.40	654						
Nov-94	1340	38.8	720	3.48		0.10	0.01	0.28	0.67	0.39		7.19	779						
May-95	1244	24.8	687			0.10	0.02	0.25	0.56	0.31	7.9	7.23	671	35.0					
Oct-95	1251	30.6	703			0.40	0.01	0.26	0.77	0.51	8.0	7.29	719	33.6					
Sep-96	1240	29.2	637	<0.02	620	<0.05	<0.05	<0.05			<1.0	6.69	586	20.1					
May-97	1120	24.4	659			<0.1	<0.1	0.45	0.86	0.41	3.63	6.90	640	27.1					
Sep-97	1040	25.6	728			<0.1	<0.1	0.187	0.64	0.45	2.72	6.90	664	44.5					
May-98	1190	24.4	541			<0.05	<0.05	0.18	0.5	0.32	2.38	6.75	524	27.5					
Oct-98	1196	29.1	661			<0.05	<0.05	0.15	0.6	0.45	2.0	6.71	497	33.0					
May-99	1101	47.6	703	<0.01	620	<0.05	<0.05	0.18	4.3	4.12	95.9	7.39	445	29.7					
Oct-99	1066	42.7	644	<0.01	580	0.81	<0.05	0.46	9.2	8.74	134	6.72	574	21.2					
May-00	1640	82.8	1062	7.32	810	<0.05	<0.05	0.13	4.4	4.27	230	7.06	638	63.0					
Oct-00	1027	81.5	833	<0.01	710	0.72	<0.05	<0.05	2.0	2.0	49.2	7.80	302	60.9					
May-01	1501	71.4	662	0.14	730	0.20	<0.05	<0.05	7.5	7.5	226	7.10	407	45.3				0.12	0.21
Nov-01	1395	69.0	772	2.45	750	0.13	<0.05	0.18	1.13	0.95	182	6.94	619	51.0				<0.5	0.2
May-02	1464	69.2	841	<0.01	933	<0.2	<0.2	0.30	0.68	0.38	128	7.33	702	48.3				0.04	0.16
Nov-02	1143	74.0	678	<0.01	1032	<0.2	<0.2	0.26	0.78	0.52	98.2	7.43	509	42.8				0.036	0.19
May-03	1641	69.4	919	<0.01	1080	<0.2	<0.2	0.34			273	7.29	654	55.0				0.042	0.16
May-04	1458	71.4	854	<0.01	1100	<0.2	<0.2	0.29	0.62	0.33	230	7.08	657	57.2				0.041	0.17
May-05	1449	60.2	796	<0.01	934	<0.2	<0.2	0.32	0.91	0.59	155	7.15	642	51.9				0.032	0.15
Apr-06	1370	59	740	<0.02	886	<0.1	0.01	0.31	2	1.69	94	8.10	682						
Sep-06	1390	55	700	4.74	858	<0.1	<0.01	0.22	0.5	0.3	102	8.00	706	49.1					0.23
May-07	1340	53	681	<0.05	756	<0.1	<0.01	0.31	0.7	0.4	57	7.80	662	47				0.033	0.17
May-08	1350	47	735	<0.1	850	<0.1	<0.01	0.37	0.8	0.4	89	8.10	642	45				0.032	0.2
May-09	1300	44	720	<0.1	825	<0.1	0.01	0.25	1.6	1.4	51	7.70	640	45					
May-10	1290	41	615	<0.1	820	<0.1	0.01	0.34	1.4	1.1	35	7.70	632	39				0.034	0.18
Apr-11	1240	39	560		758	<0.1	0.03	0.37	2	2.0	23	7.87	616	40.5					
Apr-12	1200	37	580	<0.1	682	<0.1	<0.01	0.18	0.77	0.6	16	7.75	620	38	100	79		0.025	0.19
Nov-12	1200	36	600	<0.1	640	<0.1	<0.01	0.29	0.88	0.6	12	7.69	620	43	100	84		0.024	0.20
Apr-13	1200	36	570	<0.1	650	<0.1	<0.01	0.34	1.3	0.9	12	7.74	610	40	100	79			
Oct-13	1100	35	580	<0.10	632	<0.1		0.25	0.66	0.4	7	7.53	620	40	100	79			
Apr-14	1200	34	600	<0.02	614	<0.1	<0.01	0.41	0.92	0.5	6	7.74	610	40					
Oct-14	1200	34	620	<0.02	666	<0.1	<0.01	0.38	0.56	0.2	8	7.76	610	42					
Apr-15	1200	32	650	0.13	592	<0.1	0.023	0.39	0.85	0.5	27	7.67	600	41					
Nov-15	1200	32	620	<0.02	676	<0.1	0.070	0.42	0.75	0.34	12	7.58	610	44	110	83	<1		
Apr-16	1100	31	630	<0.02	606	<0.10	<0.010	0.35	0.5	0.15	5.9	7.92	620	43	110	84	<1		
Nov-16	1100	31	620	<0.02	652	<0.10	<0.010	0.37	0.51	0.14	3.2	7.84	620	42	110	81	<1		
Apr-17	1100	30	550	<0.02	584	<0.10	<0.010	0.31	0.48	0.17	1.1	7.85	600	37	97	74	<1		
Oct-17	1100	30	560	<0.02	470	<0.10	<0.010	0.47	0.9	0.43	<1.0	7.86	590	41	99	75			
Apr-18	1100	37	630	<0.02	610	<0.10	<0.010	0.50	0.68	0.19	13	7.63	630	40	110	84	<1		
Oct-18	1300	59	680	<0.02	730	<0.10	<0.010	0.45	0.92	0.47	58	7.65	630	44					
Apr-19	1200	46	630	<0.02	660	<0.10	<0.010	0.38	0.73	0.35	31	7.67	590	42	110	85	<1		
Nov-19	1200	46	590	<0.02	675	<0.10	<0.010	0.41	0.82	0.41	17	7.76	600	42	100	79	<1		
Apr-20	1200	43	600	<0.02	615	<0.10	<0.010	0.40	0.71	0.31	8.7	7.61	580	41	110	81	<1		
Oct-20	1100	46	590	<0.02	645	<0.10	<0.010	0.30	0.63	0.33	3.6	7.87	590	39	100	81	<1		
May-21	1200	63	600	<0.02	585	<0.10	<0.010	0.28	0.67	0.39	1.3	7.59	590	41	110	80	<1		
Nov-21	1300	80	600	<0.02	650	<0.10	<0.010	0.57	1.1	0.48	7.6	7.65	610	46	110	79	<1		
May-22	1200	67	590	<0.02	595	<0.10	<0.010	0.41	0.85	0.44	2	7.74	570	48	100	80	<1		
Oct-22	1100	65	590	<0.02	565	<0.10	<0.010	0.34	0.79	0.45	<1.0	7.81	590	45	100	80	<1		
Average	1234	46.9	664	0.61	718	0.098	0.023	0.318	1.32	1.03	57.5	7.50	600	42.0	104.2	80.4	<1	0.042	0.185
Std. Dev.	151	17.5	108	1.78	146	0.150	0.030	0.106	1.69	1.72	74.7	0.382	91.4	8.66	5.36	2.95	NA	0.027	0.023

HISTORICAL GROUNDWATER QUALITY DATA: TW-13

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-93	399	4.4	209	0.07		<0.1	<0.01	0.032	0.66	0.63		7.70	337						
May-94	1217	9.8	696	20.8		0.20	<0.01	0.075	0.78	0.71		7.29	680						
Nov-94	1255	5.8	745	10.3		0.10	0.01	0.310	1.3	0.99		7.00	799						
May-95	1255	9.4	748			<0.1	0.02	0.190	0.95	0.76	2.1	7.08	733	19.8					
Oct-95	1212	5.9	702			0.40	0.01	0.270	1.06	0.79	7.9	6.70	712	22.9					
Sep-96	1268	2.8	664	<0.02	645	<0.05	<0.05	<0.05			22.1	7.45	618	14.7					
May-97	1180	4.5	686			<0.1	<0.1	0.302	0.76	0.46	<0.1	6.70	808	16.7					
Sep-97	1060	6.3	785			<0.1	<0.1	0.185	0.68	0.50	1.04	6.70	725	34.1					
May-98	1119	2.5	636			<0.05	<0.05	0.30	0.51	0.21	<0.5	6.61	492	19.0					
Oct-98	1201	5.9	725			<0.05	<0.05	0.20	0.8	0.60	4.9	6.59	530	21.8					
May-99	933	5.4	612	0.01	550	<0.05	<0.05	0.13	5.2	5.07	8.6	7.26	542	17.0					
Oct-99	1355	95.4	779	<0.01	720	0.37	<0.05	0.67	5.8	5.13	247	6.89	583	39.1					
May-00	1192	14.1	808	13	600	0.20	<0.05	<0.05	3.1	3.1	28.4	7.02	631	36.5					
Oct-00	1114	15.5	671	0.51	530	0.92	<0.05	<0.05	4.2	4.2	20.2	7.35	258	30.7					
May-01	1170	12.4	464	0.1	590	0.15	<0.05	<0.05	7.2	7.2	17	6.80	467	23.9				0.09	0.11
Nov-01	1104	15.0	623	1.53	590	0.16	<0.05	0.28	1.42	1.14	11	6.80	682	36.6				<0.5	0.1
May-02	1178	8.4	716	<0.01	711	<0.2	<0.2	0.40	0.75	0.35	0.9	7.27	736	23.7				0.021	0.06
Nov-02	1126	12.4	674	0.03	926	<0.2	<0.2	0.34	0.73	0.39	46.8	7.29	695	24.1				0.028	0.08
May-03	1188	8.5	683	<0.01	716	<0.2	<0.2	0.36			16.8	7.36	738	23.7				0.019	0.06
May-04	1073	8.8	627	<0.01	694	<0.2	<0.2	0.40	0.7	0.30	<0.5	7.03	676	21.7				0.022	0.06
May-05	1188	8.9	598	0.020	710	<0.2	<0.2	0.51	1.08	0.57	25.2	7.15	685	23.9				0.027	0.07
Apr-06	1200	9	670	<0.02	728	<0.1	<0.01	0.38	0.7	0.32	21	7.8	732						
Sep-06	1230	9	650	<0.02	724	<0.1	<0.01	0.33	0.7	0.4	69	7.8	721	29.1					
May-07	1210	8	691	<0.05	697	<0.1	<0.01	0.40	0.9	0.5	26	7.7	690	27				0.022	0.08
May-08	609	3	641	<0.1	780	0.40	<0.01	0.50	2.2	1.7	44	8.2	293	25				0.022	0.08
May-09	1180	7	690	<0.1	745	<0.1	<0.01	0.42	1.1	0.7	18	7.5	665	27					
May-10	1190	7	616	<0.1	740	<0.1	<0.01	0.41	0.9	0.5	15	7.6	660	25				0.018	0.08
Apr-11	1170	7	570		698	<0.1	<0.01	0.60	5	4.2	10	7.5	652	24.8					
Apr-12	1200	7	640	<0.1	630	<0.1	<0.01	0.2	1.2	1	15	7.63	660	24	140	72		0.02	0.089
Nov-12	1100	7	610	<0.1	576	<0.1	<0.01	0.54	1.9	1.3	9	7.7	640	26	120	72		0.018	0.097
Apr-13	1100	7	620	<0.1	632	<0.10	<0.010	0.47	1.3	0.8	4	7.62	630	25	130	71			
Oct-13	1000	7	570	<0.10	596	<0.10		0.39	1.3	0.9	1	7.45	610	25	120	66			
Apr-14	1100	7	620	<0.02	592	<0.10	<0.01	0.41	1.3	0.9	1	7.55	620	24					
Oct-14	1000	14	560	<0.02	546	<0.10	<0.010	0.46	0.93	0.5	4	7.65	560	22					
Apr-15	1000	11	580	<0.02	514	<0.10	<0.010	0.48	0.93	0.4	<1	7.56	570	24					
Nov-15	1000	15	560	<0.02	576	<0.10	0.013	0.56	0.92	0.36	4.6	7.48	570	25	120	62	<1		
Apr-16	1000	15	590	0.13	540	<0.10	<0.010	0.44	0.68	0.25	<1.0	7.87	590	24	130	66	<1		
Nov-16	980	20	550	<0.02	520	<0.10	<0.010	0.57	0.82	0.24	6.1	7.79	530	23	120	60	<1		
Apr-17	1000	15	550	<0.02	554	<0.10	<0.010	0.39	0.82	0.43	<1.0	7.82	570	22	120	62	<1		
Oct-17	1000	23	560	<0.02	460	<0.10	<0.010	0.42	0.63	0.21	5.3	7.74	560	23	120	61			
Apr-18	1000	16	570	<0.02	525	<0.10	<0.010	0.89	1.0	0.12	<1.0	7.70	590	23	120	63	<1		
Oct-18	1000	16	540	<0.02	545	<0.10	<0.010	0.58	0.76	0.18	<1.0	7.66	560	24					
Apr-19	1000	14	530	<0.02	495	<0.10	<0.010	0.38	0.54	0.16	<1.0	7.59	550	24	110	59	<1		
Nov-19	950	23	490	0.1	500	<0.10	<0.010	0.55	0.73	0.18	2.1	7.70	510	22	110	55	<1		
Apr-20	1000	22	530	<0.02	525	<0.10	<0.010	0.76	0.99	0.23	<1.0	7.53	530	22	120	59	<1		
Oct-20	990	22	520	<0.02	490	<0.10	<0.010	0.30	0.49	0.19	<1.0	7.59	530	21	110	60	<1		
May-21	990	21	530	<0.02	515	<0.10	<0.010	0.35	0.53	0.19	<1.0	7.56	540	22	120	59	<1		
Nov-21	1100	29	540	<0.02	595	<0.10	<0.010	0.71	0.94	0.23	4.8	7.53	570	28	120	59	<1		
May-22	1100	42	590	<0.02	580	<0.10	<0.010	0.61	1.1	0.46	<1.0	7.7	570	32	130	64	<1		
Average	1085	13.6	617	1.12	615	0.10	0.021	0.410	1.47	1.08	21.8	7.40	604	24.7	121	62.9	<1	0.028	0.081
Std. Dev.	159	14.1	99	4.00	100.3	0.15	0.029	0.175	1.51	1.55	43.2	0.383	113	4.94	7.81	4.98	NA	0.021	0.016

HISTORICAL GROUNDWATER QUALITY DATA: TW-14

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-93	812	2.6	391	0.47		<0.1	<0.01	<0.005	0.59	0.59		7.36	852						
May-94	997	8.5	553	0.74		1.00	0.02	0.07	0.31	0.24		7.67	472						
Nov-94	1057	6.0	564	0.13		0.10	0.01	0.41	0.35	-0.06		7.24	489						
May-95	1061	5.4	623			<0.1	0.03	0.09	0.42	0.33	6.7	7.38	440	21.0					
Oct-95	1095	10.5	628			0.40	0.01	0.47	0.89	0.42	8.9	7.36	644	21.1					
May-96	1392	1.23	709	<0.02	697	<0.05	<0.05	<0.05			29.9	6.90	696	17.0					
Sep-96	1035	0.87	548	<0.02	530	<0.05	<0.05	<0.05			14.3	6.80	518	10.3					
May-97	940	3.1	572			<0.1	<0.1	<0.04	0.26	0.26	7.45	6.90	571	12.7					
Sep-97	890	4.1	585			<0.1	<0.1	0.024	0.24	0.22	7.08	7.20	532	28.0					
May-98	964	0.9	497			0.40	<0.05	0.13	0.7	0.57	8.26	6.83	443	13.9					
Oct-98	927	5.5	558			<0.05	<0.05	0.04	0.5	0.46	2.0	6.98	420	16.6					
May-99	719	0.46	515	0.01	450	<0.05	<0.05	0.06	3.1	3.04	16.7	7.66	382	12.5					
Oct-99	903	11.7	539	<0.01	490	0.53	<0.05	0.32	5.8	5.48	17.2	7.02	520	18.2					
May-00	1087	7.7	683	0.15	530	0.20	<0.05	<0.05	3.5	3.5	78.3	7.12	558	26.1					
Oct-00	1119	8.3	681	0.17	530	2.72	<0.05	<0.05	1.2	1.2	50.6	7.21	290	25.1					
May-01	1068	6.7	458	0.06	530	0.27	<0.05	<0.05	4.8	4.8	100.2	6.97	395	22.0				0.1	0.16
Nov-01	1024	9.0	582	0.55	550	0.20	<0.05	<0.05	0.71	0.71	96	7.00	538	23.6				<0.5	0.1
May-02	1186	3.0	658	<0.01	676	<0.2	<0.2	0.08	0.22	0.14	82.3	7.45	598	19.4				0.025	0.1
Nov-02	1126	2.8	572	<0.01	759	0.20	<0.2	0.04	0.19	0.15	66.2	7.45	522	18.6				0.021	0.12
May-03	1132	2.8	649	<0.01	702	0.20	<0.2	0.15			88.6	7.32	639	18.9				0.028	0.09
May-04	1008	2.8	628	<0.01	662	<0.2	<0.2	0.07	0.21	0.14	82.4	7.19	567	19.1				0.027	0.09
May-05	1129	1.1	602	<0.01	702	<0.2	<0.2	0.05	0.42	0.37	117	7.57	591	17.6				0.025	0.09
Apr-06	1100	2	640	<0.02	703	<0.1	<0.01	0.07	0.2	0.13	105	8.10	576						
Sep-06	1200	3	650	<0.02	762	<0.1	<0.01	<0.05	0.2	0.2	141	8.00	638	17.7					
May-07	1120	2	669	<0.05	698	<0.1	<0.01	0.16	0.7	0.5	85	7.80	575	27				0.022	0.08
May-08	1070	3	578	<0.1	700	<0.1	<0.01	0.16	0.8	0.6	78	8.10	551	18				0.024	0.11
May-09	1030	2	630	<0.1	665	<0.1	0.01	0.10	1.5	1.4	66	7.60	527	17					
May-10	1030	3	541	<0.1	654	<0.1	<0.01	0.10	0.5	0.4	59	7.80	524	16				0.021	0.1
Apr-11	981	2	450		612	<0.1	<0.01	0.13	3	2.6	44	7.89	508	15.8					
Apr-12	950	2	510	<0.1	530	<0.1	<0.01	<0.05	0.28	0.3	37	7.73	500	16	100	63		0.018	0.12
Apr-13	930	8	520	<0.1	502	<0.1	<0.01	0.13	0.7	0.6	13	7.92	510	9.5	110	62			
Apr-14	1000	7	580	<0.02	534	<0.1	<0.01	0.16	0.46	0.3	17	7.68	560	13					
Apr-15	1000	9	650	<0.02	500	<0.1	0.012	0.12	0.43	0.3	15	7.66	550	15					
Apr-16	940	11	570	<0.02	522	<0.10	<0.010	0.12	0.13	<0.10	14	7.89	540	15	120	68	<1		
Apr-17	1000	17	550	<0.02	534	<0.10	<0.010	0.076	0.24	0.16	13	7.82	540	14	110	67	<1		
Apr-18	1000	26	570	<0.02	535	<0.10	<0.010	0.17	0.22	<0.10	13	7.73	550	16	120	68	<1		
Apr-20	960	20	550	0.05	510	<0.10	<0.010	0.19	0.23	<0.10	10	7.72	510	17	110	67	<1		
May-21	980	27	530	<0.02	500	<0.10	<0.010	0.065	0.19	0.13	16	7.60	510	16	110	63	<1		
May-22	990	31	540	<0.02	500	<0.10	<0.010	0.23	0.22	<0.10	13	7.80	510	19	110	65	<1		
Average	1024	7.18	578	0.08	592	0.20	0.026	0.108	0.96	0.95	45.0	7.47	535	17.8	111	65.4	<1	0.031	0.105
Std. Dev.	114	7.51	68.4	0.17	93.8	0.45	0.031	0.104	1.35	1.39	39.2	0.375	92	4.40	6.41	2.45	NA	0.024	0.022

HISTORICAL GROUNDWATER QUALITY DATA: TW-15

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sep-97	620	7.7	448			0.43	0.16	0.237	0.49	0.25	6.0	7.00	366	8.6					
May-98	534	2.7	276			2.7	<0.05	0.18	0.71	0.53	9.8	6.97	256	3.0					
Oct-98	1078	38.7	651			<0.05	<0.05	1.24	2.4	1.16	7.8	6.75	557	5.7					
May-99	439	5.4	321	0.02	270	0.35	<0.05	<0.05	5.2	5.20	20.0	7.42	231	2.2					
Oct-99	924	59.1	554	<0.01	520	0.41	<0.05	1.75	7.7	5.95	56.8	6.78	381	8.5					
May-00	602	10.2	426	5.27	300	4.1	<0.05	<0.05	2.8	2.8	22.4	7.50	298	10.6					
Oct-00	654	12.6	444	<0.01	330	4.4	<0.05	<0.05	1.4	1.4	29.4	7.53	231	11.2					
May-01	556	9.6	254	1.17	280	2.19	<0.05	<0.05	5.2	5.2	22.7	7.54	235	8.2				0.090	0.01
Nov-01	566	12.0	312	0.72	300	1.98	<0.05	<0.05	0.69	0.69	18.0	7.31	444	7.9				<0.5	<0.5
May-02	603	4.8	370	0.02	340	2.8	<0.2	<0.03	0.44	0.44	13.9	7.86	318	3.2				0.014	0.01
Nov-02	867	103	632	<0.01		<0.2	<0.2	<0.03	0.34	0.34	51.7	7.49	482	4.4				0.026	<0.01
May-03	589	4.0	334	<0.01	328	2.6	<0.2	0.03			21.4	7.68	309	3.1				0.012	0.01
May-04	535	4.3	305	<0.01	350	3.2	<0.2	0.03	0.5	0.47	13.8	7.54	283	2.7				0.012	<0.01
May-05	590	3.4	305	<0.01	366	2.2	<0.2	0.04	0.61	0.57	15.1	7.80	308	2.6				0.010	<0.01
Apr-06	578	2	330	0.05	703	<0.1	<0.01	0.07	0.7	0.63	105	8.30	324						
Sep-06	827	10	520	0.61	494	<0.1	<0.01	0.17	0.4	0.2	5	8.00	503	4.2					<0.02
May-07	636	4	361	<0.05	422	1.9	<0.01	<0.05	0.7	0.7	13	8.10	334	2.9				0.012	0.011
May-08	621	5	341	<0.1	410	7.8	<0.01	0.12	1.3	1.18	15	8.20	294	2.8				0.012	0.012
May-09	600	3	360	<0.1	395	3.7	0.01	<0.05	0.8	0.8	12	8.00	307	2.8					
May-10	647	5	339	<0.1	420	2.0	<0.01	0.06	1.4	1.3	21	8.00	321	2.8				0.012	0.013
Apr-11	579	4	280		386	1.3	<0.01	0.06	1.4	1.4	19	8.13	286	3.2					
Apr-12	640	2	340	<0.1	342	0.86	<0.01	<0.05	1.3	1.3	13	7.95	330	2.6	82	33		0.0100	0.1
Nov-12	630	3	340	<0.1	348	0.64	<0.010	0.05	2.4	2.4	10	8.08	340	2.7	79	34		0.0085	0.074
Apr-13	620	3	340	<0.1	344	0.79	<0.010	<0.050	0.83	0.8	13	8.06	330	2.6	82	32			
Oct-13	600	3	320	<0.10	342	0.44		<0.050	1.0	1.0	8	7.73	320	2.4	79	31			
Apr-14	630	3	370	<0.02	324	0.64	<0.01	<0.05	<0.05	<0.1	10	7.90	340	3.2					
Oct-14	620	3	360	<0.02	338	0.51	<0.01	<0.050	0.29	0.3	7	7.97	340	2.6					
Apr-15	590	3	340	<0.02	278	0.43	<0.01	<0.050	0.44	0.4	10	7.74	300	2.5					
Nov-15	630	2.6	380	<0.02	368	0.43	<0.01	<0.050	0.22	0.22	9.3	7.84	340	2.9	95	34	<1		
Apr-16	620	2.1	360	<0.02	334	0.44	<0.010	<0.050	0.2	0.20	12	8.03	340	3.0	90	33	<1		
Nov-16	640	2.0	380	<0.02	342	0.39	<0.010	<0.050	0.22	0.22	7.7	7.98	350	2.8	95	34	<1		
Apr-17	560	1.8	300	<0.02	292	0.42	<0.010	<0.050	0.22	0.22	11	8.03	290	2.3	74	28	<1		
Oct-17	600	1.6	330	<0.02	245	0.11	<0.010	0.065	0.32	0.25	6	8.00	330	2.4	84	30			
Apr-18	650	2.6	370	<0.02	300	0.36	<0.010	0.067	0.16	<0.10	13	7.95	350	2.6	93	34	<1		
Oct-18	610	2.2	340	<0.02	340	0.28	<0.010	<0.050	0.14	0.14	7.2	7.86	340	2.4					
Apr-19	650	2.4	360	0.02	345	0.41	<0.010	0.07	0.13	<0.10	9.9	7.93	340	2.6	90	33	<1		
Nov-19	630	2.4	350	<0.02	360	0.32	<0.010	<0.050	<0.10	<0.10	6.3	7.9	350	2.4	87	31	<1		
Apr-20	620	2.0	350	<0.02	310	0.46	<0.010	<0.050	0.15	0.15	10	7.78	330	2.6	88	32	<1		
Oct-20	630	2.8	350	<0.02	350	0.80	<0.010	<0.050	<0.10	<0.10	7.5	7.87	340	2.3	86	32	<1		
May-21	610	2.8	340	<0.02	345	0.45	<0.010	<0.050	0.11	0.11	9.4	7.96	330	2.3	87	30	<1		
Nov-21	650	2.7	360	<0.02	325	0.30	<0.010	0.26	0.56	0.30	8.7	7.82	360	2.4	90	32	<1		
May-22	570	2.2	330	<0.02	300	0.33	<0.010	0.13	0.19	<0.10	6.2	8.12	310	2.4	84	29	<1		
Oct-22	590	2.9	350	<0.02	330	0.21	<0.010	0.17	0.57	0.40	23	8.16	340	4.2	83	35	<1		
Average	633	8.5	368	0.22	354	1.26	0.02	0.13	1.14	1.10	16.7	7.78	335	3.78	86.0	32.1	<1	0.020	0.010
Std. Dev.	106	17.9	82.5	0.86	79.0	1.57	0.04	0.32	1.60	1.47	17.4	0.37	63.4	2.37	5.72	1.92	NA	0.024	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-15D

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-12	590	3	310	<0.1	324	<0.10	<0.010	0.40	1.30	0.9	25	7.84	290	5.4	68	34		0.047	0.030
Apr-13	600	3	310	<0.1	332	<0.10	0.042	0.40	0.75	0.3	25	8.15	300	4.7	73	32			
Oct-13	580	3	310	<0.10	320	<0.10		0.29	0.40	0.1	23	8.11	310	4.5	71	32			
Apr-14	590	2	340	<0.02	312	<0.10	<0.01	0.32	1.30	1.0	25	7.97	300	5.4					
Oct-14	590	3	340	<0.02	346	<0.10	<0.010	0.31	0.34	<0.1	22	8.00	310	4.8					
Apr-15	600	3	340	<0.02	148	<0.10	0.055	0.27	0.38	0.1	22	7.90	310	5.1					
Apr-16	590	2.7	350	<0.02	308	<0.10	<0.010	0.26	0.35	<0.10	24	8.11	310	5.2	81	35	1		
Apr-17	610	3.1	330	<0.02	318	<0.10	0.019	0.20	0.30	<0.10	22	8.12	310	4.7	78	33	<1		
Apr-18	610	3.2	350	<0.02	280	<0.10	0.010	0.27	0.30	<0.10	23	8.04	320	4.9	82	35	1		
Apr-19	610	3.1	330	<0.02	325	<0.10	<0.010	0.25	0.29	<0.10	24	8.02	300	4.8	77	33	<1		
Apr-20	620	2.3	350	<0.02	320	<0.10	0.035	0.30	0.31	<0.10	22	7.99	320	5.0	82	35	1		
May-21	600	3.1	330	<0.02	290	<0.10	0.012	0.23	0.32	<0.10	24	7.88	310	4.6	79	32	<1		
May-22	610	2.6	340	<0.02	280	<0.10	<0.010	0.32	0.34	<0.10	22	8.05	310	4.7	80	33	<1		
Average	600	2.85	333	<0.1	300	<0.1	0.017	0.29	0.51	0.21	23.3	8.01	308	4.91	77.1	33.4	1.0	0.047	0.030
Std. Dev.	11.55	0.36	14.9	NA	49.7	NA	0.017	0.06	0.37	0.34	1.25	0.10	8.32	0.29	4.86	1.26	0.0	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-16

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sep-06	551	3	260	0.12	360	<0.1	<0.01	0.25	0.3	<0.1	24	8.2	304	26.1					0.47
May-07	585	3	301	<0.05	352	<0.1	<0.01	<0.05	<0.5	<0.5	29	8.1	294	25				0.033	0.36
May-08	537	3	280	<0.1	410	0.2	0.07	0.17	0.6	0.4	26	8.2	268	14				0.044	0.089
May-09	621	2	350	<0.1	400	0.4	<0.01	<0.05	1.8	1.8	38	8.0	308	23					
May-10	614	2	274	<0.1	390	0.2	<0.01	0.07	0.9	0.8	38	8.1	297	20				0.036	0.35
Apr-11	630	2	280		388	0.2	<0.01	0.05	3.0	2.8	38	7.98	308	20					
Apr-12	640	2	300	<0.1	352	0.2	<0.01	<0.05	1.4	1.4	40	8.07	320	19	54	41		0.031	0.32
Apr-13	630	2	300	<0.1	334	0.1	<0.010	0.08	3.0	2.9	39	8.14	300	21	53	41			
Apr-14	650	<1	340	<0.02	358	<0.1	0.02	0.08	1.1	1.0	38	8.03	320	23					
Apr-15	640	2	330	<0.02	276	<0.10	<0.010	0.09	0.16	<0.1	35	7.93	310	22					
Apr-16	650	2.5	340	<0.02	346	<0.10	<0.010	0.06	0.14	<0.10	36	7.88	320	23	62	45	2		
Apr-17	650	3.4	320	<0.02	332	0.1	<0.010	<0.050	0.13	0.13	36	8.20	310	20	57	43	1		
Apr-18	650	5.0	330	<0.02	300	<0.10	<0.010	0.10	<0.10	<0.10	34	8.09	330	21	60	45	1		
Apr-19	620	5.1	310	<0.02	375	<0.10	<0.010	<0.050	<0.10	<0.10	34	8.21	300	21	56	42	1		
Apr-20	650	6.6	340	<0.02	340	0.12	<0.010	<0.050	<0.10	<0.10	33	8.00	320	20	61	46	2		
May-21	650	9.1	330	<0.02	310	<0.10	<0.010	<0.050	<0.10	<0.10	32	7.94	330	18	60	43	1		
May-22	660	11.0	360	<0.02	295	<0.10	<0.010	0.10	0.14	<0.10	28	8.11	330	20	65	47	1		
Average	625	3.98	314	0.03	348	0.12	0.010	0.072	0.77	0.74	34.0	8.07	310	20.9	58.7	43.7	1.29	0.036	0.318
Std. Dev.	35.8	2.75	29.2	0.03	38.1	0.10	0.016	0.061	0.99	0.99	4.77	0.103	15.9	2.77	3.94	2.18	0.49	0.006	0.140

HISTORICAL GROUNDWATER QUALITY DATA: TW-17

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sep-06	645	4	320	0.20	404	<0.1	<0.01	1.26	1.2	<0.1	57	8.2	327	21.2					0.11
May-07	553	3	282	<0.05	360	0.30	0.02	0.58	1.0	0.42	34	8.1	273	14				0.044	0.08
May-08	1430	2	817	<0.1	360	<0.1	<0.01	0.55	1.1	0.6	307	8.1	531	31				0.087	0.36
May-09	511	2	290	<0.1	335	0.3	0.16	0.75	2.1	1.4	22	7.9	264	14					
May-10	503	3	228	<0.1	330	0.4	0.24	0.71	1.1	0.4	20	8.1	246	11				0.039	0.077
Apr-11	507	2	230		298	0.5	<0.01	0.54	4.0	3.2	20	8.19	253	12					
Apr-12	500	2	230	<0.1	274	<0.1	0.041	0.40	0.72	0.3	18	8.11	250	11	48	28		0.037	0.08
Apr-13	500	2	240	<0.1	174	0.2	0.16	0.56	1.1	0.6	19	8.17	250	11	49	29			
Apr-14	500	2	260	<0.02	262	<0.1	0.047	0.57	0.64	<0.1	20	8.01	250	13					
Apr-15	490	3	260	<0.02	222	0.2	0.097	0.40	0.62	0.2	17	7.83	250	13					
Apr-16	500	2.6	260	<0.02	260	<0.10	0.036	0.35	0.40	<0.10	20	8.10	260	13	54	31	1		
Apr-17	480	2.2	230	<0.02	260	0.23	0.107	0.25	0.35	<0.10	18	8.14	230	11	48	27	1		
Apr-18	520	2.5	260	<0.02	240	0.22	0.083	0.49	0.47	<0.10	21	8.03	260	13	54	30	1		
Apr-19	500	3.0	260	<0.02	245	0.36	0.066	0.46	0.57	0.11	19	8.24	250	12	53	30	1		
Apr-20	480	2.1	250	<0.02	255	0.45	0.079	0.36	0.44	<0.10	18	7.99	250	12	53	29	1		
May-21	470	2.5	240	<0.02	235	0.21	0.066	0.31	0.39	<0.10	19	8.15	240	11	51	27	1		
May-22	490	2.5	260	<0.02	210	0.32	0.047	0.33	0.46	0.13	19	8.1	250	12	53	30	1		
Average	563	2.49	289	<0.1	278	0.22	0.074	0.522	0.98	0.73	39.3	8.09	273	13.8	51.4	29.0	1.0	0.052	0.141
Std. Dev.	227	0.56	138	NA	61.3	0.15	0.064	0.235	0.90	0.94	69.7	0.11	69.7	5.03	2.51	1.41	0.00	0.024	0.123

SUMMARY OF GROUNDWATER QUALITY DATA: WELLS TW-18 THROUGH TW-21 (SEPTEMBER 2006)

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TW-18	804	74	380	<0.02	473	2.6	<0.01	0.12	0.4	0.20	11	7.9	333	23.6					<0.02
TW-19S	2230	424	550	0.04	1370	0.1	<0.01	0.17	0.3	0.10	28	8.0	456	252					0.03
TW-19D	1620	247	600	0.86	1010	<0.1	<0.01	0.50	0.6	<0.1	49	8.0	482	105					0.04
TW-20	817	43	390	<0.02	482	0.6	0.02	0.56	0.8	0.2	29	8.2	392	13.0					0.04
TW-21	1540	244	530	0.16	969	<0.1	<0.01	2.99	3.1	0.2	14	8.1	423	108					0.07

HISTORICAL GROUNDWATER QUALITY DATA: TW-22

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-12	590	4	280	<0.1	316	<0.10	<0.010	2.1	2.8	0.8	3	8.13	320	19	61	32		0.086	0.063
Apr-13	570	2	300	<0.1	266	<0.10	<0.010	1.9	2.1	0.2	<1	8.10	320	7.3	67	31			
Apr-14	560	<1	310	<0.02	294	<0.1	0.014	1.8	5.9	4.1	<1	7.99	300	7.9					
Apr-15	560	1	310	<0.02	306	0.75	0.293	1.8	2.3	0.5	<1	7.93	300	7.6					
Apr-16	560	1.1	290	<0.02	282	<0.10	<0.010	1.7	2.3	0.51	<1.0	8.14	320	7.4	68	30	<1		
Apr-17	570	1.3	300	<0.02	260	<0.10	<0.010	1.7	1.8	0.12	<1.0	8.12	310	7.2	68	31	<1		
Apr-18	560	1.4	300	<0.02	265	<0.10	<0.010	1.8	1.9	<0.10	<1.0	8.07	320	7.6	70	31	<1		
Apr-19	560	1.4	290	<0.02	285	<0.10	<0.010	1.7	2.0	0.34	<1.0	8.05	310	7.3	67	30	1		
Apr-20	560	1.1	300	<0.02	285	<0.10	0.073	1.8	2.1	0.30	<1.0	7.97	310	7.3	69	31	1		
May-21	550	2.1	290	<0.02	270	<0.10	<0.010	1.8	1.9	<0.10	<1.0	8.09	310	6.6	68	29	<1		
May-22	540	2.2	290	<0.02	240	<0.10	<0.010	1.9	2.1	0.23	<1.0	8.08	300	6.9	67	29	<1		
Average	562	1.64	296	<0.1	279	0.11	0.044	1.82	2.47	0.79	0.73	8.06	311	8.4	67.2	30.4	1.0	0.086	0.063
Std. Dev.	12.5	0.94	9.2	NA	21.8	0.21	0.087	0.12	1.17	1.26	0.75	0.069	8.3	3.54	2.54	1.01	0.0	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-23

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-12	540	3	270	<0.1	288	<0.10	<0.010	1.4	30	28.8	31	8.12	260	7.3	59	30		0.062	0.045
Apr-13	540	2	270	<0.1	306	<0.10	<0.010	1.2	6.4	5.2	34	8.14	260	6.6	61	29			
Apr-14	540	2	300	<0.02	288	<0.10	0.023	1.2	7.9	6.7	36	8.05	250	7.3					
Apr-15	530	3	300	<0.02	440	0.54	0.154	0.88	1.3	0.4	40	7.82	240	6.5					
Apr-16	540	3.6	300	<0.02	284	<0.10	0.034	0.25	1.4	1.2	36	8.08	250	6.7	69	31	1		
Apr-17	540	3.1	280	<0.02	282	0.15	0.036	0.73	0.74	<0.10	36	8.14	250	5.9	64	29	1		
Apr-18	550	3.6	300	<0.02	285	<0.10	0.011	0.43	1.1	0.71	34	8.14	270	7.7	69	31	1		
Apr-19	560	3.6	290	<0.02	305	0.26	0.042	0.22	1.1	0.84	37	8.06	250	7.0	66	30	1		
Apr-20	540	2.9	310	<0.02	280	0.51	0.125	0.65	0.73	<0.10	40	7.98	250	6.3	71	31	1		
May-21	540	3.7	290	<0.02	295	0.33	0.065	0.27	0.80	0.53	39	7.96	250	6.0	67	29	1		
May-22	540	3.2	290	<0.02	275	0.53	0.048	0.33	1.30	0.93	39	8.07	250	6.2	68	29	1		
Average	542	3.06	291	<0.1	303	0.25	0.050	0.69	4.80	5.03	36.5	8.05	253	6.68	66.0	29.9	1.0	0.062	0.045

HISTORICAL GROUNDWATER QUALITY: TW-24

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-12	1000	7	470	<0.1	630	<0.10	<0.010	0.33	1.6	1.2	140	7.95	430	53	64	74		0.062	0.45
Apr-13	930	4	430	<0.1	538	<0.10	0.016	0.17	0.58	0.4	100	8.02	420	48	59	68			
Oct-13	880	3	400	<0.10	504	<0.10		0.11	0.34	0.2	83	7.85	420	46	55	64			
Apr-14	860	2	410	<0.02	460	<0.10	0.011	0.18	0.61	0.4	83	8.06	400	50					
Oct-14	870	2	420	<0.02	508	<0.10	0.015	0.14	0.18	<0.1	77	8.02	420	49					
Apr-15	860	2	430	<0.02	430	<0.10	0.024	0.057	0.25	0.2	77	8.02	400	53					
Nov-15	860	2.3	420	<0.02	508	<0.10	0.018	0.12	0.25	0.13	76	7.92	410	53	59	66	3		
Apr-16	840	1.4	380	<0.02	462	<0.10	0.013	<0.050	0.12	0.12	84	8.20	410	49	53	61	2		
Nov-16	850	1.9	410	<0.02	482	<0.10	0.02	0.069	0.21	0.15	75	8.14	410	51	57	64	3		
Apr-17	860	2.2	390	<0.02	460	<0.10	<0.010	<0.050	0.11	0.11	77	8.24	400	48	53	61	2		
Oct-17	840	1.6	390	<0.02	440	<0.10	0.015	0.087	0.14	<0.10	71	8.13	400	50	54	61			
Apr-18	870	2.2	400	<0.02	425	<0.10	<0.010	0.075	<0.10	<0.10	86	8.04	410	50	56	64	2		
Oct-18	870	1.7	400	<0.02	495	<0.10	<0.010	0.060	0.14	<0.10	82	7.98	410	48					
Apr-19	860	1.9	390	<0.02	460	<0.10	<0.010	0.068	<0.10	<0.10	83	8.18	390	49	54	62	2		
Nov-19	850	1.8	380	<0.02	510	<0.10	<0.010	<0.050	<0.10	<0.10	73	8.10	410	47	52	61	2		
Apr-20	850	1.5	390	<0.02	475	<0.10	<0.010	<0.050	<0.10	<0.10	73	7.99	400	49	54	62	2		
Oct-20	820	2.1	390	<0.02	480	<0.10	<0.010	<0.050	<0.10	<0.10	70	7.99	410	45	50	63	2		
May-21	830	1.6	380	<0.02	425	0.1	<0.010	<0.050	<0.10	<0.10	72	8.03	390	47	53	59	2		
Nov-21	820	1.9	360	<0.02	365	<0.10	<0.010	0.22	0.17	<0.10	67	8.04	400	46	50	57	2		
May-22	830	1.6	390	<0.02	430	<0.10	<0.010	<0.050	<0.10	<0.10	72	8.1	390	50	55	62	2		
Oct-22	810	1.3	380	<0.02	430	<0.10	<0.010	<0.050	0.11	0.11	72	8.01	410	48	52	62	2		
Average	860	2.24	400	<0.1	472	<0.10	0.012	0.13	0.25	0.16	80.6	8.05	407	49.0	54.7	63.0	2	0.062	0.45
Std. Dev.	41.1	1.24	24.0	NA	53.8	NA	0.005	0.08	0.35	0.27	15.5	0.095	10.6	2.26	3.53	3.79	0.38	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-25S

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-16	700	7.1	320	<0.02	400	<0.10	<0.010	0.10	0.22	0.12	45	8.16	340	40	46	49	7		
Apr-17	770	4.5	330	<0.02	394	0.22	<0.010	<0.050	0.21	0.21	62	8.23	350	43	45	54	4		
Oct-17	730	3.6	320	<0.02	285	<0.10	<0.010	0.072	0.18	0.11	48	8.29	360	46	44	52			
Apr-18	760	2.7	350	<0.02	335	<0.10	<0.010	0.076	<0.10	<0.10	64	8.08	360	43	48	56	3		
Oct-18	730	2.9	320	<0.02	395	<0.10	<0.010	<0.050	<0.10	<0.10	48	8.10	360	40					
Apr-19	740	2.3	340	<0.02	410	<0.10	<0.010	<0.050	<0.10	<0.10	61	8.13	340	41	46	54	3		
Nov-19	710	2.3	310	<0.02	405	<0.10	<0.010	<0.050	<0.10	<0.10	46	8.12	350	39	43	50	2		
Apr-20	730	1.8	340	<0.02	405	<0.10	<0.010	<0.050	<0.10	<0.10	56	8.02	350	40	47	54	2		
Oct-20	710	2.6	320	<0.02	430	<0.10	<0.010	<0.050	<0.10	<0.10	47	8.06	350	37	42	53	2		
May-21	710	2.0	320	<0.02	375	<0.10	<0.010	<0.050	<0.10	<0.10	57	8.01	340	38	44	51	2		
Nov-21	700	2.2	300	<0.02	350	<0.10	<0.010	0.20	0.11	<0.10	47	8.10	340	38	42	49	2		
May-22	730	1.7	340	<0.02	365	<0.10	<0.010	<0.050	<0.10	<0.10	56	8.19	340	39	47	53	2		
Oct-22	690	1.9	330	<0.02	360	<0.10	<0.010	<0.050	<0.10	<0.10	57	8.21	360	39	44	53	2		
Average	724	2.89	326	<0.02	378	0.06	<0.010	0.079	0.06	0.09	53.4	8.13	349	40.2	44.8	52.3	2.82	NA	NA
Std. Dev.	23.6	1.49	13.87	NA	38.73	0.05	NA	0.074	0.02	0.07	6.8	0.083	8.62	2.49	1.99	2.19	1.54	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-25D

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-16	550	7.0	290	<0.02	306	<0.10	<0.010	0.95	1.7	0.7	12	8.17	290	16	62	32	2		
Apr-17	530	5.1	250	<0.02	214	<0.10	<0.010	0.78	0.81	<0.10	9.1	8.26	270	16	52	29	1		
Apr-18	530	4.6	260	<0.02	265	<0.10	<0.010	0.98	1.1	<0.10	9.3	8.08	290	17	55	30	2		
Apr-19	550	4.9	260	<0.02	410	<0.10	<0.010	0.91	1.3	0.37	8.8	8.10	280	15	56	30	2		
Apr-20	520	3.6	250	<0.02	275	<0.10	0.103	0.23	1.3	1.1	15	8.03	270	22	52	28	2		
May-21	520	4.4	240	<0.02	250	<0.10	0.033	0.38	0.92	0.55	14	8.03	260	18	53	27	1		
May-22	500	3.3	240	<0.02	240	<0.10	0.056	0.33	1.4	1.1	16	8.14	260	20	52	27	1		
Average	529	4.70	256	<0.02	280	<0.10	0.037	0.65	1.22	0.57	12.0	8.12	274	17.7	54.6	29.0	1.57	NA	NA
Std. Dev.	17.7	1.21	17.2	NA	64.1	NA	NA	0.33	0.30	0.44	3.03	0.082	12.7	2.50	3.64	1.83	0.53	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-26

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-16	690	9.4	220	<0.02	394	0.45	0.012	0.12	0.31	0.19	38	8.14	320	80	43	28	5		
Apr-17	660	5.0	260	<0.02	334	<0.10	<0.010	<0.050	0.10	0.10	38	8.25	310	39	45	36	3		
Oct-17	620	3.5	280	<0.02	315	<0.10	<0.010	0.08	<0.10	<0.10	34	8.17	310	36	48	38			
Apr-18	640	3.4	290	<0.02	290	<0.10	<0.010	0.10	<0.10	<0.10	45	8.09	310	33	51	40	2		
Oct-18	620	3.4	280	<0.02	365	<0.10	<0.010	<0.050	<0.10	<0.10	38	8.09	310	30					
Apr-19	630	3.1	280	<0.02	330	<0.10	<0.010	<0.050	<0.10	<0.10	42	8.10	290	29	49	40	2		
Nov-19	610	2.8	280	<0.02	375	<0.10	<0.010	<0.050	<0.10	<0.10	39	8.12	300	28	48	38	2		
Apr-20	630	2.7	300	<0.02	325	<0.10	<0.010	<0.050	<0.10	<0.10	42	7.99	300	29	52	42	2		
Oct-20	620	2.7	280	<0.02	365	<0.10	<0.010	<0.050	<0.10	<0.10	38	8.01	300	26	47	40	2		
May-21	630	3.0	290	<0.02	325	<0.10	<0.010	<0.050	<0.10	<0.10	49	8.15	300	27	51	40	2		
Nov-21	600	2.9	270	<0.02	300	<0.10	<0.010	0.14	<0.10	<0.10	38	8.12	300	27	47	37	2		
May-22	620	3.4	300	<0.02	255	<0.10	<0.010	0.09	<0.10	<0.10	48	8.09	290	31	51	41	2		
Average	631	3.78	278	<0.02	331	0.08	0.006	0.054	0.08	0.066	40.8	8.11	303	34.6	48.4	38.2	2.40	NA	NA
Std. Dev.	23.9	1.88	21.4	NA	39.3	0.12	0.002	0.045	0.08	0.042	4.56	0.068	8.88	14.8	2.80	3.82	0.97	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: TW-27

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Nov-16	1200	96	640	<0.02	744	<0.10	<0.010	0.60	0.98	0.38	64	7.90	500	51	130	76	12		
Apr-17	1200	64	580	<0.02	664	0.37	0.062	0.40	1.0	0.63	43	7.96	540	46	110	74	10		
Oct-17	1200	68	580	<0.02	640	<0.10	0.023	0.73	1.1	0.36	43	7.95	530	47	110	73			
Apr-18	1100	60	550	<0.02	610	0.24	<0.010	0.14	0.25	0.11	39	7.95	510	42	110	69	9		
Oct-18	1100	61	550	<0.02	610	0.35	0.094	0.46	0.57	0.11	37	7.90	520	42					
Apr-19	1100	58	550	<0.02	615	0.26	0.045	0.23	0.51	0.28	43	7.92	490	41	110	67	9		
Nov-19	1100	49	520	<0.02	605	0.34	0.011	0.45	0.64	0.19	41	7.93	490	39	100	65	9		
Apr-20	1200	61	560	<0.02	645	0.50	<0.010	0.22	0.36	0.15	42	7.78	520	42	110	69	10		
Oct-20	1200	67	560	<0.02	650	0.21	<0.010	0.48	0.63	0.15	44	7.86	500	39	110	71	11		
May-21	1100	66	560	<0.02	600	0.25	0.022	0.41	0.57	0.17	44	7.77	500	40	110	66	9		
Nov-21	1100	61	540	<0.02	575	0.11	0.11	1.1	1.6	0.51	37	7.73	530	40	110	67	11		
May-22	1100	66	560	<0.02	575	0.22	0.039	0.6	0.79	0.2	36	7.91	490	40	120	67	9		
Oct-22	1100	65	540	<0.02	590	0.53	0.059	0.5	0.83	0.3	43	7.99	500	40	100	69	11		
Average	1138	64.8	561	<0.02	625	0.27	0.037	0.49	0.76	0.27	42.8	7.89	509	42.2	111	69.4	10.0	NA	NA
Std. Dev.	50.6	10.6	28.7	NA	45.4	0.15	0.035	0.25	0.36	0.16	7.0	0.081	17.1	3.61	7.9	3.42	1.10	NA	NA

HISTORICAL GROUNDWATER QUALITY DATA: G-1

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
May-94	541	3.6	263	0.50		1.00		0.18	0.55	0.37		7.95	286						
Nov-95	551	0.8	245	0.021		0.30	<0.01	0.11	0.43	0.32	10.4	7.85	303	39.0				0.009	<0.03
May-96	379	10.3	127	<0.02	201	<0.05	<0.05	<0.05			49.8	7.60	112	18.2					
May-97	200	2.5	88			<0.1	<0.1	0.11	0.77	0.66	9.62	7.60	93	12.4					
May-00	524	7.2	333	0.07	260	0.52	<0.05	<0.05	2.5	2.5	13.9	8.18	307	21.4					
May-01	466	10.4	229	0.04	240	0.31	<0.05	<0.05	1.9	1.9	14.4	7.77	176	8.5				0.09	<0.01
Nov-01	484	5.0	366	0.05	340	0.24	<0.05	0.20	1.04	0.84	12.0	7.15	521	11.6				<0.5	<0.5
May-02	592	1.5	342	<0.01	334	<0.2	<0.2	<0.03	0.18	0.18	3.5	7.75	344	4.8				0.024	<0.01
May-03	463	1.5	257	<0.01	253	<0.2	<0.2	<0.03			6.3	7.80	255	2.2				0.018	0.01
May-04	534	<0.5	322	<0.01	336	<0.2	<0.2	0.05	0.27	0.22	2.4	7.50	307	1.8				0.015	<0.01
Average	473	4.76	257	0.078	281	0.275	0.048	0.076	0.96	0.87	13.6	7.72	270	13.3	NA	NA	NA	0.031	<0.01
Std. Dev.	113	3.74	91.5	0.160	55.7	0.297	0.038	0.070	0.83	0.86	14.2	0.28	124	11.7	NA	NA	NA	0.033	NA

HISTORICAL GROUNDWATER QUALITY DATA: G-2

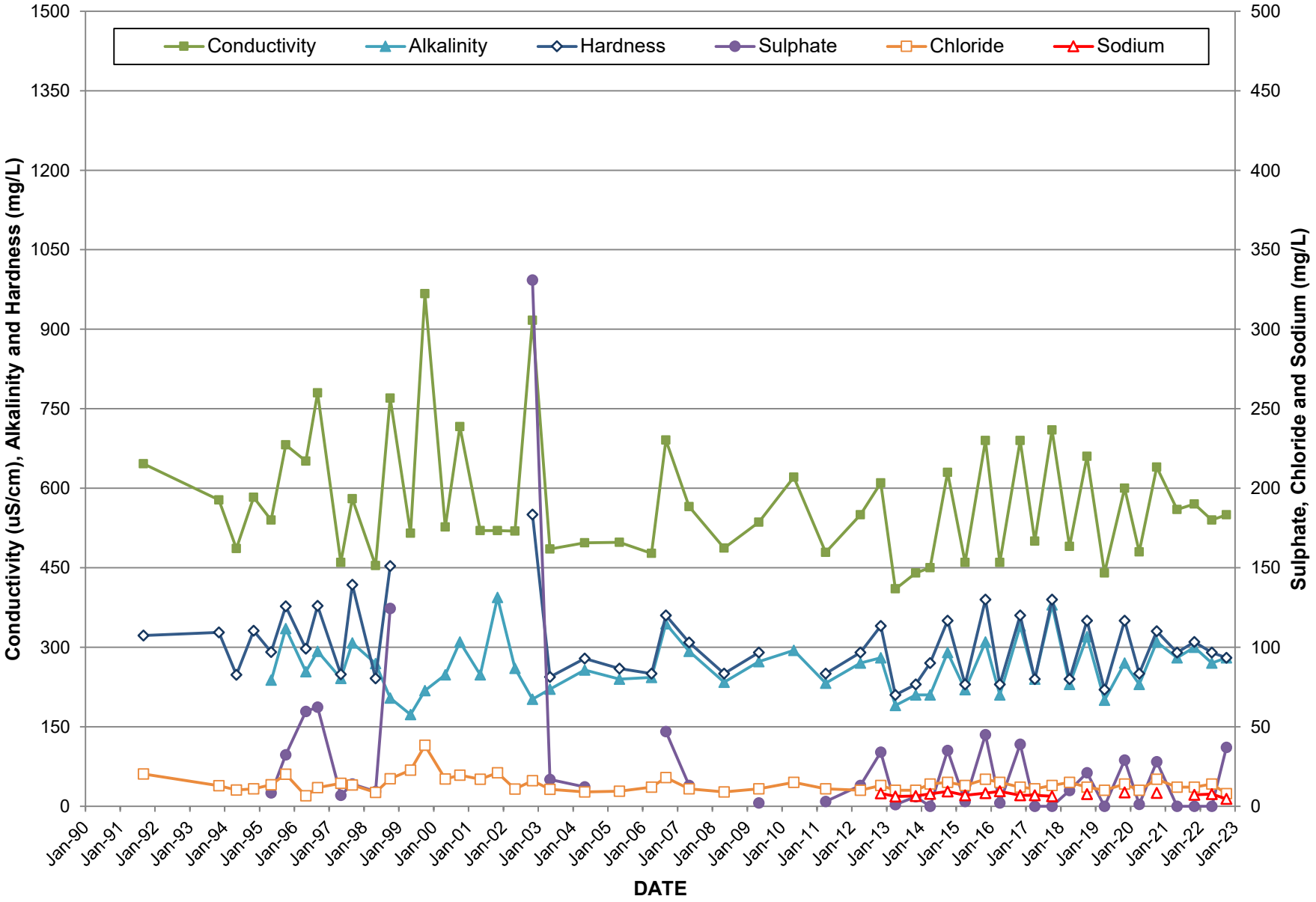
Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
May-94	758	34.0	389	0.21		0.30	0.03	0.27	0.77	0.50		7.68	367						
Nov-95	846	34.2	446	0.146		0.20	<0.01	0.13	0.53	0.40	10.9	7.46	438	6.3				0.018	<0.03
May-96	845	29.7	404	<0.02	424	<0.05	<0.05	<0.05			34.4	7.0	339	5.7					
Sep-96	1140	49.2	580	<0.02	570	<0.05	<0.05	<0.05			23.6	6.7	463	4.1					
May-97	720	41.8	430			<0.1	<0.1	0.31	0.67	0.36	8.05	7.1	337	3.8					
Sep-97	940	45.7	691			<0.1	<0.1	0.728	1.39	0.66	3.6	6.6	520	10.2					
May-98	1034	65.7	515			0.26	<0.05	1.05	2.11	1.06	5.47	6.63	349	5.8					
May-00	852	53.3	506	0.04	460	0.36	<0.05	<0.05	3.0	3.0	27.8	7.00	413	14.8					
Oct-00	1207	56.6	646	<0.01	590	2.74	<0.05	0.35	3.6	3.25	28.7	7.33	308	17.4					
May-01	880	48.4	392	0.48	440	0.14	<0.05	<0.05	2.0	2.0	19.7	7.20	272	10.4				0.09	0.09
Nov-01	596	45.0	542	0.19	310	0.13	<0.05	0.35	1.37	1.02	19	7.01	567	13.0				<0.5	<0.5
May-02	792	31.7	450	<0.01	444	<0.2	<0.2	0.14	0.47	0.33	11.5	7.63	397	5.4				0.016	0.01
May-03	938	36.7	525	<0.01	527	<0.2	<0.2	0.19			17.1	7.30	474	6.4				0.025	0.02
May-04	770	43.1	457	<0.01	498	<0.2	<0.2	0.50	0.8	0.30	14.0	7.39	399	5.6				0.02	<0.01
Average	880	43.9	498	0.101	474	0.327	0.047	0.294	1.52	1.17	17.2	7.15	403	8.38	NA	NA	NA	0.034	0.065
Std. Dev.	164	10.3	92.9	0.149	84.9	0.702	0.031	0.299	1.05	1.09	9.49	0.35	83	4.38	NA	NA	NA	0.032	0.096

HISTORICAL GROUNDWATER QUALITY DATA: G-3

Parameter	Conductivity	Chloride	Hardness	Iron	TDS	Nitrate	Nitrite	Ammonia	TKN	Organic Nitrogen	Sulphate	pH	Alkalinity	Sodium	Calcium	Magnesium	Potassium	Barium	Boron
ODWS	NV	250	80-100	0.30	500	10	1.0	NV	NV	0.15	500	6.5-8.5	500	200	NV	NV	NV	1.0	5.0
RUC	NV	126	348	0.29	419	2.8	0.3	NV	NV	1.35	260	6.5-8.5	410	105	NV	NV	NV	0.31	1.28
UNITS	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
May-94	1850	70.2	935	46.6		0.4	0.01	14.6	28	13.4		7.39	817						
Nov-95	1470	46.2	727	48.0		0.2	0.01	12.0	19	7.0	13.4	7.16	829	4.7				0.115	0.03
Sep-96	1730	64.4	871	<0.02	570	<0.05	<0.05	<0.05			9.0	6.61	763	9.1					
Average	1683	60	844	31.5	570	0.21	0.015	8.88	23.5	10.2	11.2	7.05	803	6.90	NA	NA	NA	0.115	0.030
Std. Dev.	194	12.5	107	27.3	NA	0.19	0.009	7.77	6.36	4.53	3.13	0.40	35.2	3.11	NA	NA	NA	NA	NA

APPENDIX F:
HISTORIC SURFACE WATER QUALITY ANALYTICAL RESULTS (TABLES AND GRAPHS)

SW-1 TREND GRAPH



Arran Landfill: M-1174
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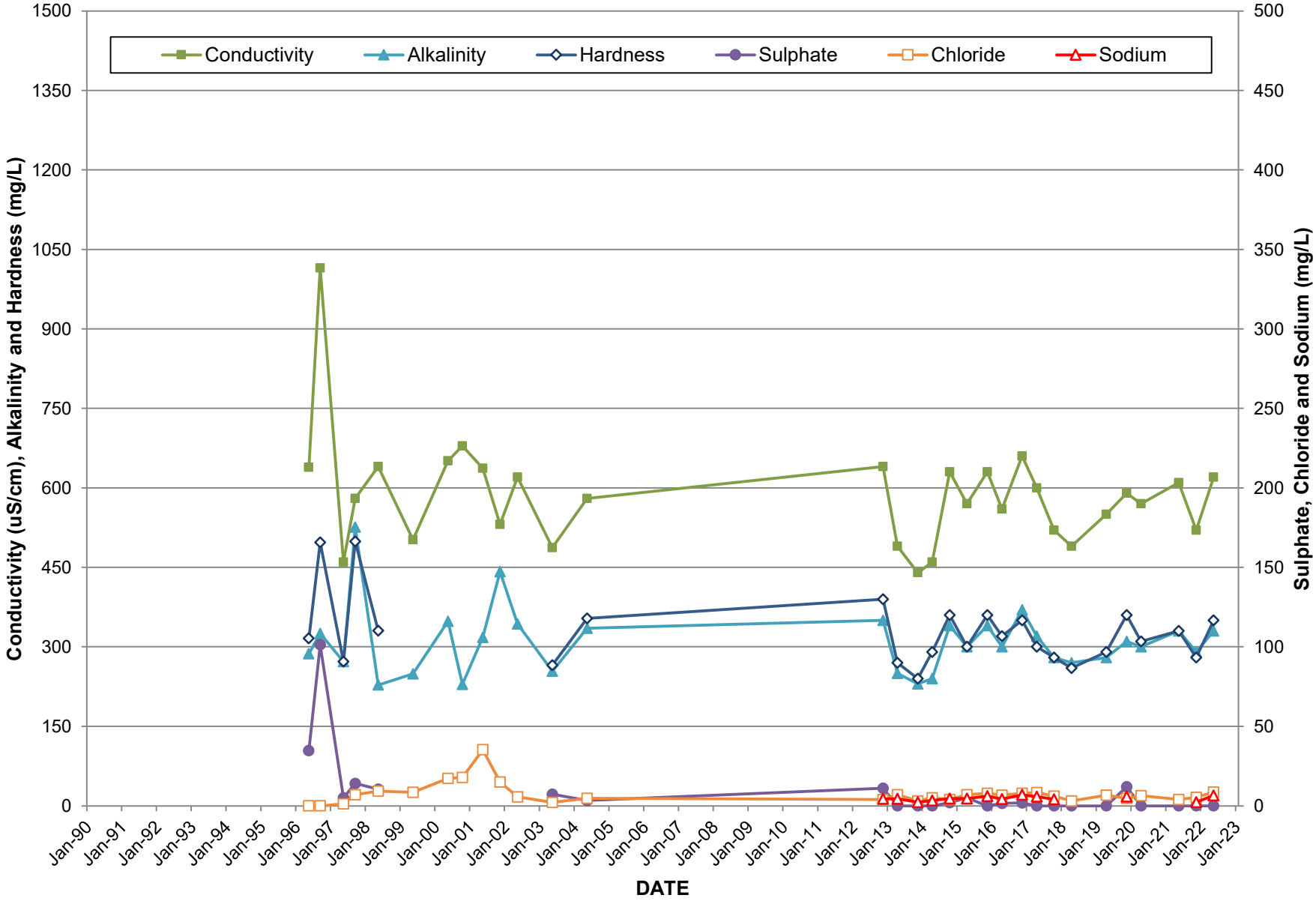
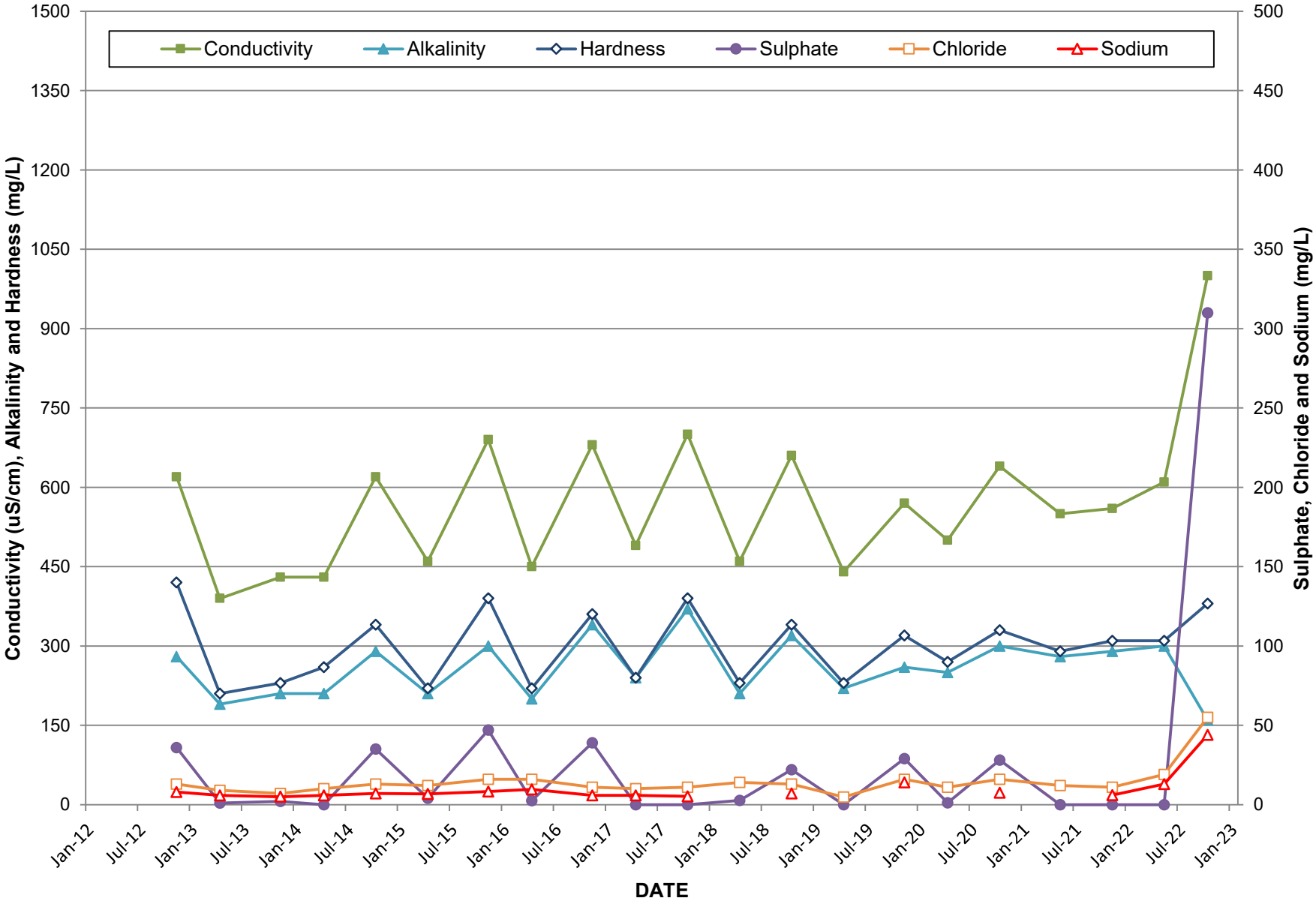
SW-5 TREND GRAPH



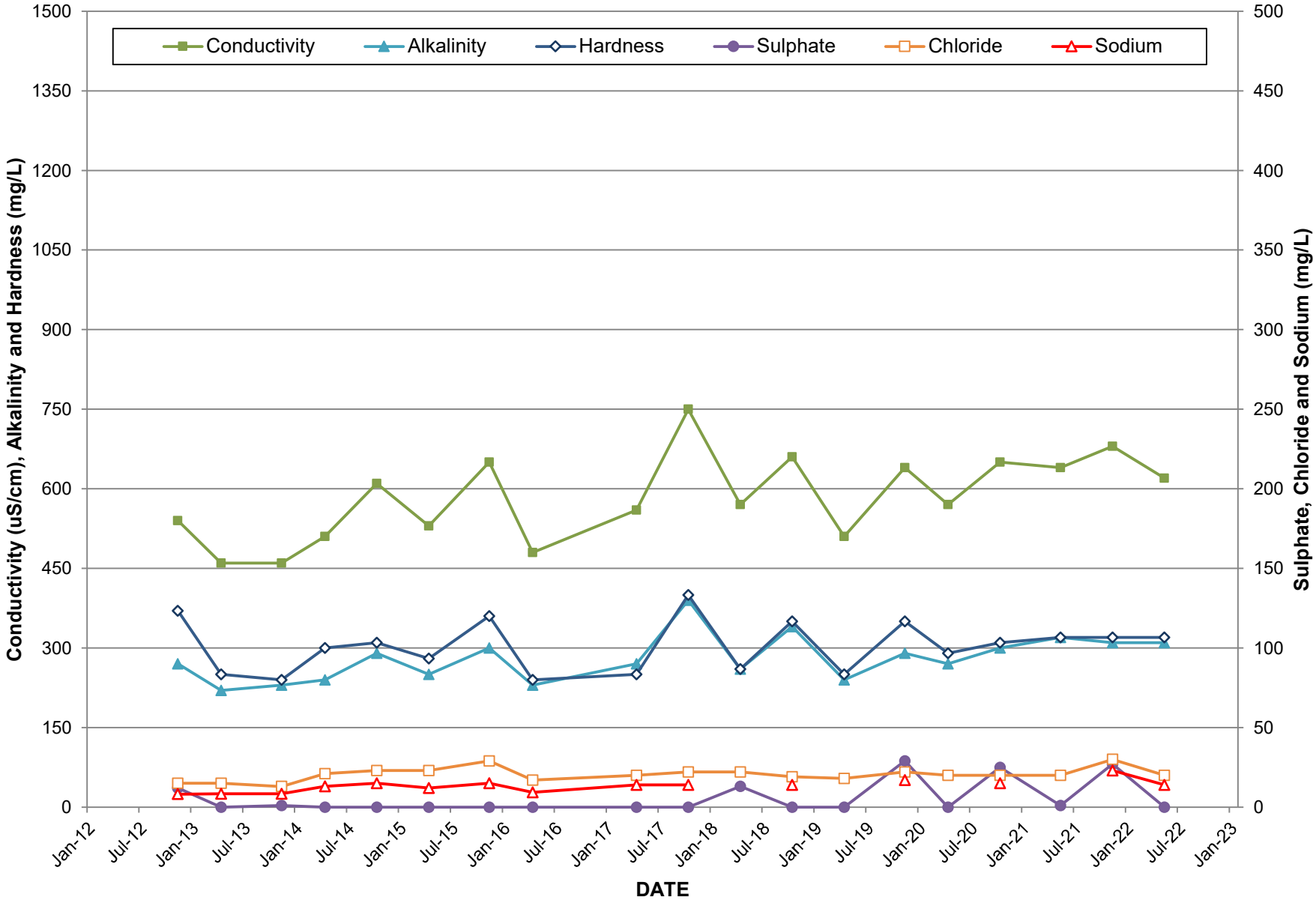
Arran Landfill: M-1174
GM BluePlan Engineering Limited

SW-7 TREND GRAPH



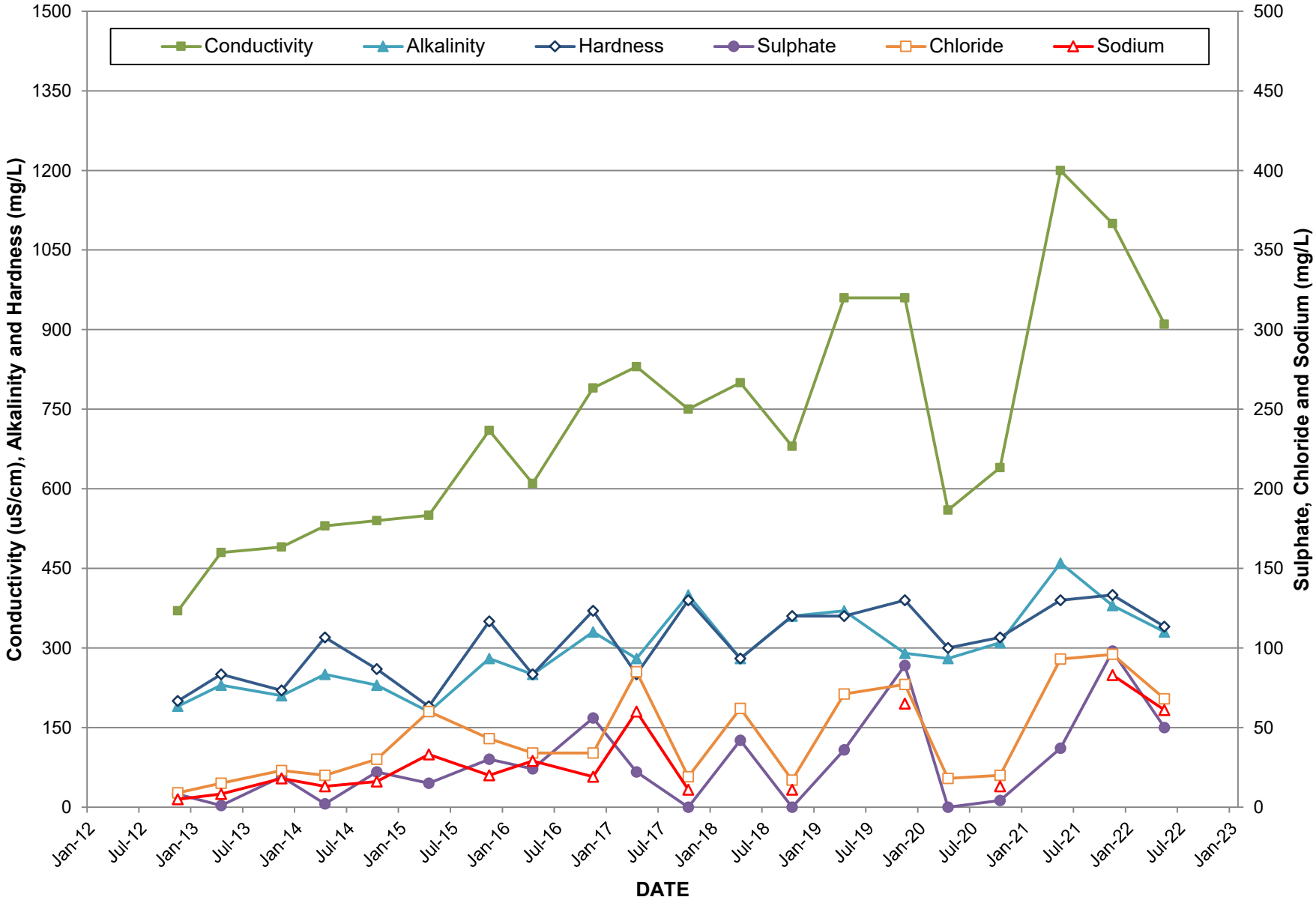
Arran Landfill: M-1174
GM BluePlan Engineering Limited

SW-8 TREND GRAPH



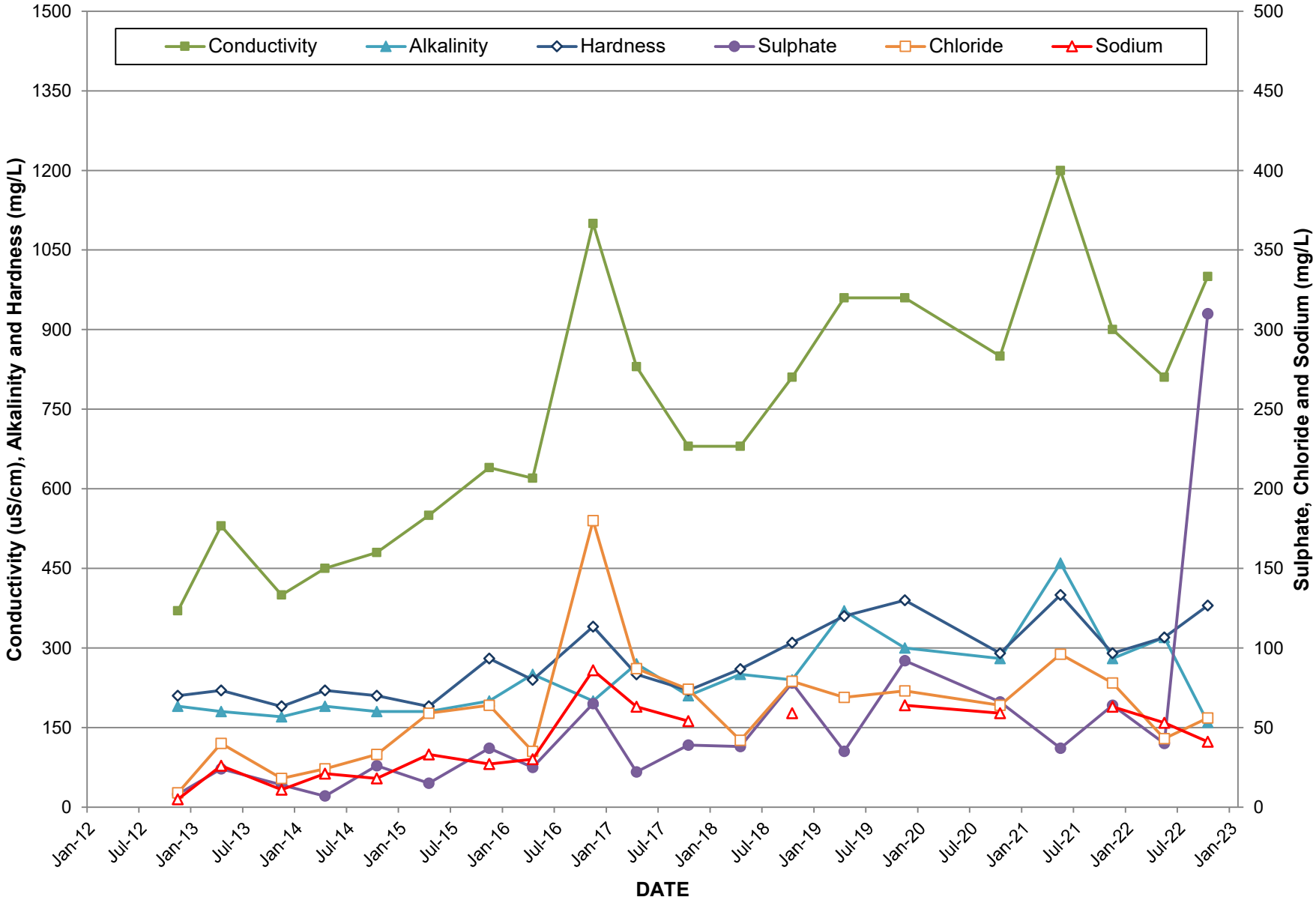
Arran Landfill: M-1174
GM BluePlan Engineering Limited

SW-9 TREND GRAPH



Arran Landfill: M-1174
GM BluePlan Engineering Limited

SW-10 TREND GRAPH



Arran Landfill: M-1174
GM BluePlan Engineering Limited

HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1
		18-Sep-91	2-Nov-93	17-May-94	9-Nov-94	24-May-95	17-Oct-95	21-May-96	18-Sep-96	6-May-97	24-Sep-97	4-May-98	20-Oct-98	17-May-99	1-Oct-99	24-May-00	11-Oct-00	4-May-01	26-Nov-01	7-May-02	14-Nov-02	13-May-03	11-May-04	5-May-05	19-Apr-06	27-Sep-06	16-May-07
Field pH (pH Units)	pH Units																									
Field Temperature	Celcius																									
Conductivity (Field)	umho/cm																									
Hardness (CaCO3)	mg/L	322	328	248	331	291	377	297	378	249	418	241	453								551	244	279	260	250	360	309
Total Ammonia-N	mg/L	0.096	0.011	0.038	0.16	0.030	0.39	<0.05	<0.05	0.021	0.059	0.18	0.08	<0.05	0.49	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	0.04	0.04	0.04	<0.05	0.21	0.15
Unionized Ammonia	mg/L																										
BOD	mg/L																										
COD	mg/L																										
Conductivity	umho/cm	646	578	486	583	540	682	651	780	460	580	454	770	515	967	527	716	520	520	519	917	485	497	498	477	691	565
Total Dissolved Solids	mg/L							334	400												671	253	298	280	302	442	313
Total Kjeldahl Nitrogen	mg/L																										
pH	pH Units	8.03	7.82	8.21	7.92	7.77	7.92	7.50	8.02	7.70	7.70	7.70	7.52	7.95	7.68	7.83	7.85	7.74	7.41	8.15	7.88	7.93	7.85	8.66	8.30	8.3	8.3
Phenols-4AAP	mg/L																										
Total Phosphorus	mg/L																										
Total Suspended Solids	mg/L																										
Sulphate	mg/L					8.4	32.3	59.5	62.3	6.8	13.9	9.2	124.3								331	16.8	12.2			47	13
Alkalinity	mg/L					238	335	254	292	241	308	269	204	173	218	248	310	248	394	260	202	221	257	240	243	344	292
Chloride (Cl)	mg/L	20.2	12.9	10.1	10.9	13.5	20.1	6.5	11.7	14.4	13.4	8.7	17.3	22.7	38.3	17.1	19.5	17.0	21.0	10.8	16.1	10.6	8.9	9.4	12	18	11
Nitrite (N)	mg/L	0.04	<0.01	<0.01	0.01	<0.01	0.01	<0.05	<0.05	<0.1	<0.1	<0.05	<0.05								<0.2	<0.2	<0.2	<0.2	<0.01	0.01	<0.01
Nitrate (N)	mg/L	<0.1	<0.1	0.2	0.5	<0.1	0.4	<0.05	<0.05	<0.1	0.22	0.35	<0.05								0.8	0.2	0.2	0.2	<0.1	<0.1	<0.1
Mercury (Hg)	mg/L																										
Total Arsenic (As)	mg/L																										
Total Barium (Ba)	mg/L																										
Total Boron (B)	mg/L																										
Total Cadmium (Cd)	mg/L																										
Total Chromium (Cr)	mg/L																										
Total Cobalt (Co)	mg/L																										
Total Copper (Cu)	mg/L																										
Total Iron (Fe)	mg/L																										
Total Lead (Pb)	mg/L																										
Total Potassium (K)	mg/L																										
Total Sodium (Na)	mg/L																										
Total Zinc (Zn)	mg/L																										

Notes:
COD = Chemical Oxygen Demand
BOD = Biological Oxygen Demand

HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1
		1-May-08	4-May-09	1-May-10	18-Apr-11	18-Apr-12	20-Nov-12	17-Apr-13	7-Nov-13	30-Apr-14	14-Oct-14	13-Apr-15	5-Nov-15	11-Apr-16	2-Nov-16	24-Apr-17	26-Oct-17	12-Apr-18	30-Oct-18	10-Apr-19	19-Nov-19	10-Apr-20	26-Oct-20	6-May-21	14-Nov-21	2-May-22	6-Oct-22
Field pH (pH Units)	pH Units						7.87					6.67	7.31	7.37	7.67	7.57	7.22	8.00	7.61	7.68	7.77	7.00	7.67	7.66	7.78	7.10	7.96
Field Temperature	Celcius						2					6.13	10.81	1.29	9.92	9.90	10.6	4.89	10.5	3.1	3.4	4.2	8.0	6.6	6.4	8.8	11.8
Conductivity (Field)	umho/cm											461	494	247	482	541	506	292	454		369	487	394	420		430	437
Hardness (CaCO3)	mg/L	250	290		250	290	340	210	230	270	350	230	390	230	360	240	390	240	350	220	350	250	330	290	310	290	280
Total Ammonia-N	mg/L	0.07	<0.05	<0.05	<0.05	<0.050	<0.05	<0.05	<0.05	0.063	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.087	0.059	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia	mg/L						<0.02					<0.001	<0.001	<0.0005	<0.0005	<0.001	<0.0005	0.0013	<0.001	<0.00061							
BOD	mg/L									<2	<2.0	<2	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
COD	mg/L									19	32	19	56	18	41	24	41	14	35	20	18	13	30	30	33	17	31
Conductivity	umho/cm	487	536	621	479	550	610	410	440	450	630	460	690	460	690	500	710	490	660	440	600	480	640	560	570	540	550
Total Dissolved Solids	mg/L	320	350	400	318	310	322	222	238	286	406	230	430	236	434	236	450	240	400	255	365	230	460	305	305	230	360
Total Kjeldahl Nitrogen	mg/L									0.48	0.83	0.68	0.81	0.28	0.67	0.54	0.73	0.40	0.64	0.29	0.55	0.37	0.48	0.28	0.60	0.32	0.44
pH	pH Units	8.2	8.0	8.2	8.05	8.13	7.88	8.11	7.83	8.11	8.04	7.84	8.12	8.01	8.20	8.29	8.17	8.14	8.03	8.10	8.01	8.04	8.11	8.10	8.09	8.39	8.31
Phenols-4AAP	mg/L									<0.001	0.0016	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.002	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L									0.012	0.014	0.014	0.077	0.009	0.009	0.010	0.023	0.034	0.012	0.005	0.017	0.019	0.018	0.018	0.03	0.015	0.034
Total Suspended Solids	mg/L									1	<1	3	21	3	5	1	2	11	7	1	16	8	3	6	5	6	6
Sulphate	mg/L		2		3	13	34	1	6	<1	35	3	45	2	39	<1.0	<1.0	9.9	21	<1.0	29	1.2	28	<1.0	<1.0	<1.0	37
Alkalinity	mg/L	234	273	294	232	270	280	190	210	210	290	220	310	210	340	240	380	230	320	200	270	230	310	280	300	270	280
Chloride (Cl)	mg/L	9	11	15	11	10	13	10	10	14	15	13	17	15	12	11	13	15	12	10	14	10	17	12	12	14	7.9
Nitrite (N)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1.09	0.21
Nitrate (N)	mg/L	<0.1	0.1	1.0	0.8	<0.10	1.8	0.72	0.17	0.35	0.60	1.13	2.45	0.67	1.24	1.23	0.68	0.64	1.27	0.62	3.75	0.91	1.15	0.89	1.13	<0.010	0.011
Mercury (Hg)	mg/L									<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L							<0.2		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0013	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	<0.001	<0.001
Total Barium (Ba)	mg/L							0.011		0.014	0.018	0.011	0.021	0.011	0.020	0.012	0.021	0.013	0.017	0.011	0.016	0.013	0.018	0.014	0.015	0.014	0.018
Total Boron (B)	mg/L							<0.02		0.018	0.029	0.02	0.015	0.015	0.017	0.019	0.022	0.034	0.017	0.013	0.018	0.015	0.021	0.017	0.023	0.014	0.020
Total Cadmium (Cd)	mg/L							<0.005		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009
Total Chromium (Cr)	mg/L							<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt (Co)	mg/L									<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Copper (Cu)	mg/L							<0.02		0.0011	0.001	0.001	0.0019	<0.001	<0.001	<0.001	0.0011	0.0014	0.0011	<0.001	0.0026	0.0011	0.0012	<0.009	<0.009	<0.0009	<0.0009
Total Iron (Fe)	mg/L							0.07	0.22	<0.1	0.12	0.12	0.45	0.13	0.11	0.12	0.28	0.35	0.22	<0.1	0.25	0.51	0.20	0.33	0.33	0.26	0.32
Total Lead (Pb)	mg/L							<0.05		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Potassium (K)	mg/L													1.7	1.5	1.7	2.4	2.3		1.6	1.7	1.6	1.6	1.5	2.0	1.6	0.9
Total Sodium (Na)	mg/L						8.0	6.1	6.4	7.8	9.2	6.9	8.2	9.4	6.9	6.8	6.2		7.6		8.6		8.3		7.2	7.6	4.6
Total Zinc (Zn)	mg/L							<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
COD = Chemical Oxygen Demand
BOD = Biological Oxygen Demand

HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5
		21-May-96	18-Sep-96	6-May-97	24-Sep-97	4-May-98	17-May-99	24-May-00	11-Oct-00	4-May-01	26-Nov-01	7-May-02	13-May-03	11-May-04	20-Nov-12	17-Apr-13	7-Nov-13	30-Apr-14	14-Oct-14	13-Apr-15	5-Nov-15	11-Apr-16	2-Nov-16	24-Apr-17
Field pH (pH Units)	pH Units														8.06					7.34	7.48	6.53	7.51	7.11
Field Temperature	Celcius														2					10.70	9.68	0.54	8.44	9.50
Conductivity (Field)	umho/cm																			562	629	306	422	651
Hardness (CaCO3)	mg/L	316	497	272	499	330							266	354	390	270	240	290	360	300	360	320	350	300
Total Ammonia-N	mg/L	<0.05	<0.05	<0.004	1.88	0.17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	0.04	<0.05	<0.05	<0.05	0.075	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia	mg/L														<0.02					<0.001	<0.001	<0.0005	<0.0005	<0.001
BOD	mg/L																	<2	<2.0	<2	<2.0	<2	<2	<2
COD	mg/L																	28	29	10	30	16	23	16
Conductivity	umho/cm	639	1015	460	580	640	502	651	679	637	531	620	487	580	640	490	440	460	630	570	630	560	660	600
Total Dissolved Solids	mg/L	325	490										258	366	342	260	226	254	380	170	380	302	392	304
Total Kjeldahl Nitrogen	mg/L																	0.87	0.51	0.51	0.67	0.26	0.58	0.44
pH	pH Units	7.80	7.34	8.00	7.50	7.34	8.17	7.77	8.24	7.86	7.49	7.94	7.85	7.69	8.06	8.16	7.85	7.91	8.01	7.92	7.97	8.05	8.23	8.16
Phenols-4AAP	mg/L																	<0.001	0.0026	0.0014	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L																	0.032	0.034	0.016	0.085	0.012	0.038	0.026
Total Suspended Solids	mg/L																	1	3	1	7	<1	9	2
Sulphate	mg/L	34.7	101.4	4.98	14.0	10.5							7.2	3.4	11	<1	<1.0	<1	2	5	<1.0	1.6	1.8	<1.0
Alkalinity	mg/L	287	325	272	526	228	249	348	229	318	442	343	254	335	350	250	230	240	340	300	340	300	370	320
Chloride (Cl)	mg/L	<1.0	<1.0	1.2	7.0	9.27	8.5	17.2	17.9	35.3	15	5.6	2.1	4.7	4	7	3	5	4	7	7.9	6.7	7.9	8.3
Nitrite (N)	mg/L	<0.05	<0.05	<0.1	<0.1	<0.05							<0.2	<0.2	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	<0.05	<0.05	<0.1	<0.1	0.49							<0.2	0.6	<0.1	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Mercury (Hg)	mg/L																	<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0001	<0.0001
Total Arsenic (As)	mg/L															<0.2		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Barium (Ba)	mg/L															0.011		0.0096	0.014	0.013	0.016	0.010	0.021	0.010
Total Boron (B)	mg/L															<0.02		0.014	0.029	0.019	0.019	<0.01	0.033	0.018
Total Cadmium (Cd)	mg/L															<0.005		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Chromium (Cr)	mg/L															<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt (Co)	mg/L																	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Copper (Cu)	mg/L															<0.02		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Iron (Fe)	mg/L															0.15	0.12	0.24	0.28	0.15	0.62	<0.1	0.87	0.28
Total Lead (Pb)	mg/L															<0.05		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005
Total Potassium (K)	mg/L																					1.4	3.1	0.93
Total Sodium (Na)	mg/L														4.4	4.4	2.3	3.3	4.5	4.6	6.0	4.2	6.9	5.7
Total Zinc (Zn)	mg/L															<0.01		<0.005	0.0054	<0.005	0.013	<0.005	<0.005	<0.005

Notes:
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HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5
		26-Oct-17	12-Apr-18	10-Apr-19	19-Nov-19	10-Apr-20	6-May-21	12-Nov-21	2-May-22
Field pH (pH Units)	pH Units	7.41	8.07	7.33	7.60	6.47	7.56	7.67	6.69
Field Temperature	Celcius	10.5	5.5	2.2	2.2	5.3	14.0	9.2	9.1
Conductivity (Field)	umho/cm	378	294		362	608	561	830	433
Hardness (CaCO3)	mg/L	280	260	290	360	310	330	280	350
Total Ammonia-N	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia	mg/L	<0.0005	<0.001	<0.00061					
BOD	mg/L	<2	<2	<2	<2	<2	<2	<2	<2
COD	mg/L	48	12	16	15	30	25	26	16
Conductivity	umho/cm	520	490	550	590	570	610	520	620
Total Dissolved Solids	mg/L	315	245	305	380	295	335	245	270
Total Kjeldahl Nitrogen	mg/L	0.95	0.38	0.43	0.46	0.62	0.42	0.57	0.38
pH	pH Units	8.09	8.13	8.01	8.03	7.97	8.01	8.15	8.13
Phenols-4AAP	mg/L	<0.002	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.092	0.014	0.010	0.052	0.041	0.025	0.034	0.023
Total Suspended Solids	mg/L	4	<1	<1	5	12	2	1	4
Sulphate	mg/L	<1.0	<1.0	<1.0	12	<1.0	<1.0	<1.0	<1.0
Alkalinity	mg/L	280	270	280	310	300	330	290	330
Chloride (Cl)	mg/L	6.1	3.1	6.7	4.7	6.4	3.9	5.3	8.6
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.16
Nitrate (N)	mg/L	<0.10	<0.10	0.22	<0.10	0.41	0.11	<0.10	<0.010
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.001
Total Barium (Ba)	mg/L	0.012	0.008	0.009	0.010	0.009	0.010	0.008	0.012
Total Boron (B)	mg/L	0.027	<0.01	0.013	0.013	0.012	0.017	0.015	0.015
Total Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0009
Total Chromium (Cr)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt (Co)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Copper (Cu)	mg/L	0.0092	<0.001	<0.001	0.0017	<0.0010	<0.0010	<0.0010	<0.0009
Total Iron (Fe)	mg/L	0.27	<0.010	<0.010	<0.010	0.18	0.13	0.14	0.12
Total Lead (Pb)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Potassium (K)	mg/L	7.3	2.4	2.3	4.3	2.0	0.5	3.8	0.5
Total Sodium (Na)	mg/L	4.1			5.8			2.3	6.5
Total Zinc (Zn)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<5.0

Notes:
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HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7
		20-Nov-12	17-Apr-13	7-Nov-13	30-Apr-14	14-Oct-14	13-Apr-15	5-Nov-15	11-Apr-16	2-Nov-16	24-Apr-17	26-Oct-17	12-Apr-18	30-Oct-18	10-Apr-19	19-Nov-19	10-Apr-20	26-Oct-20	6-May-21	14-Nov-21	2-May-22	6-Oct-22
Field pH (pH Units)	pH Units	7.95					7.30	7.44	7.46	7.63	7.63	6.96	7.89	7.47	7.27	7.80	6.96	7.57	7.53	7.43	6.97	7.68
Field Temperature	Celcius	2					6.97	10.63	2.10	9.69	12.8	11.0	3.5	9.8	5.1	1.6	4.5	8.2	6.8	5.7	8.7	5.9
Conductivity (Field)	umho/cm						453	488	249	468	506	559	259	447		340	505	398	408		412	892
Hardness (CaCO3)	mg/L	420	210	230	260	340	220	390	220	360	240	390	230	340	230	320	270	330	290	310	310	380
Total Ammonia-N	mg/L	<0.05	<0.05	<0.05	0.063	<0.050	<0.050	0.062	<0.050	<0.050	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia	mg/L	<0.02					<0.001	0.001	<0.0005	<0.0005	<0.001	<0.0005	0.00055	<0.001	<0.050							
BOD	mg/L				<2	<2.0	<2	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
COD	mg/L				19	32	16	44	23	36	24	42	15	37	10	13	17	30	22	32	19	140
Conductivity	umho/cm	620	390	430	430	620	460	690	450	680	490	700	460	660	440	570	500	640	550	560	610	1000
Total Dissolved Solids	mg/L	358	208	248	272	396	234	438	234	424	238	380	250	405	245	350	270	420	295	300	270	765
Total Kjeldahl Nitrogen	mg/L				0.58	0.64	0.66	0.92	0.25	0.63	0.40	0.67	0.31	0.67	0.23	0.47	0.29	0.52	0.29	0.60	0.38	0.97
pH	pH Units	7.95	8.18	7.76	7.98	8.07	7.70	8.07	7.84	8.23	8.25	8.16	8.09	8.05	8.14	8.12	8.00	8.13	8.08	8.03	8.28	7.97
Phenols-4AAP	mg/L				<0.001	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.002	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L				0.012	0.013	0.013	0.046	0.019	0.008	0.008	0.030	0.053	0.007	0.029	0.009	0.011	0.023	0.015	0.034	0.013	0.049
Total Suspended Solids	mg/L				2	2	2	11	8	<1	1	<2	15	4	31	5	6	3	3	6	5	54
Sulphate	mg/L	36	1	2	<1	35	4	47	2.5	39	<1.0	<1.0	2.6	22	<1.0	29	1.2	28	<1.0	<1.0	<1.0	310
Alkalinity	mg/L	280	190	210	210	290	210	300	200	340	240	370	210	320	220	260	250	300	280	290	300	160
Chloride (Cl)	mg/L	13	9	7	10	13	12	16	16	11	10	11	14	13	4.8	16	11	16	12	11	19	55
Nitrite (N)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Nitrate (N)	mg/L	2.3	1.1	0.94	0.57	0.92	1.28	2.71	1.32	1.37	1.48	0.79	1.07	1.62	<0.10	<0.10	<0.10	1.28	1.03	1.22	<0.010	<0.010
Mercury (Hg)	mg/L				<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L		<0.2		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0016	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	<0.001	0.001
Total Barium (Ba)	mg/L		0.011		0.012	0.017	0.012	0.021	0.011	0.019	0.011	0.021	0.014	0.016	0.015	0.016	0.015	0.016	0.013	0.015	0.015	0.048
Total Boron (B)	mg/L		<0.02		0.011	0.019	0.016	0.013	<0.01	0.014	0.014	0.015	<0.01	0.012	0.013	0.053	0.016	0.015	0.010	0.016	0.052	0.420
Total Cadmium (Cd)	mg/L		<0.005		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009
Total Chromium (Cr)	mg/L		<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt (Co)	mg/L				<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001
Total Copper (Cu)	mg/L		<0.02		0.0011	<0.001	0.0011	0.0015	<0.001	<0.001	<0.001	<0.001	0.0015	<0.001	0.0017	0.0021	0.0033	0.0011	<0.0009	<0.0009	0.0009	0.0045
Total Iron (Fe)	mg/L		0.10	0.16	<0.1	0.14	0.14	0.37	0.27	<0.1	0.10	0.32	0.63	0.12	0.38	<0.1	0.14	0.22	0.25	0.39	0.13	0.33
Total Lead (Pb)	mg/L		<0.05		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Potassium (K)	mg/L								1.6	1.4	1.7	2.3	2.1		0.6	2.4	1.1	1.4	1.3	1.7	2.8	25.0
Total Sodium (Na)	mg/L	8.0	5.8	5.0	5.9	7.0	6.7	8.2	9.6	5.8	5.9	5.3		7.0		14.0		7.5		6.0	13.0	44.0
Total Zinc (Zn)	mg/L		<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
COD = Chemical Oxygen Demand
BOD = Biological Oxygen Demand

HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8
		20-Nov-12	17-Apr-13	7-Nov-13	30-Apr-14	14-Oct-14	13-Apr-15	5-Nov-15	11-Apr-16	24-Apr-17	26-Oct-17	12-Apr-18	30-Oct-18	10-Apr-19	19-Nov-19	10-Apr-20	26-Oct-20	6-May-21	14-Nov-21	2-May-22
Field pH (pH Units)	pH Units	7.91					7.20	7.36	7.87	7.49	7.28	7.96	7.46	7.57	6.87	7.38	7.68	7.60	7.64	7.11
Field Temperature	Celcius	2					10.69	11.78	0.27	16.6	10.2	6.4	9.7	7.7	1.6	5.4	7.3	7.0	4.0	8.9
Conductivity (Field)	umho/cm						526	487	245	630	529	241	440		363	586	398	487		418
Hardness (CaCO3)	mg/L	370	250	240	300	310	280	360	240	250	400	260	350	250	350	290	310	320	320	320
Total Ammonia-N	mg/L	<0.05	<0.05	<0.05	0.067	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.26	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.27	<0.050
Unionized Ammonia	mg/L	<0.02					<0.001	<0.001	<0.0005	<0.001	<0.0005	0.004	<0.001	<0.00061						
BOD	mg/L				<2	<2.0	<2	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
COD	mg/L				36	35	12	41	15	22	31	14	32	29	18	11	27	23	31	15
Conductivity	umho/cm	540	460	460	510	610	530	650	480	560	750	570	660	510	640	570	650	640	680	620
Total Dissolved Solids	mg/L	248	232	248	270	362	246	392	258	292	445	285	395	275	365	300	395	365	335	285
Total Kjeldahl Nitrogen	mg/L				1.3	0.63	0.49	0.67	0.21	0.52	0.59	0.60	0.71	0.33	0.44	0.36	0.55	0.42	1.1	0.39
pH	pH Units	7.91	8.13	7.91	8.05	7.95	7.97	8.03	8.11	8.22	8.12	8.23	7.96	8.04	8.04	8.04	7.92	8.14	8.15	8.31
Phenols-4AAP	mg/L				<0.001	0.0043	<0.0010	<0.0010	<0.0010	<0.0010	<0.002	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L				0.05	0.019	0.014	0.048	0.009	0.020	0.013	0.015	0.009	0.070	0.016	0.008	0.015	0.016	0.021	0.012
Total Suspended Solids	mg/L				4	1	2	12	1	30	2	9	1	24	2	9	6	4	1	2
Sulphate	mg/L	12	<1	1	<1	<1	<1	<1.0	<1.0	<1.0	<5.0	13	<1.0	<1.0	29	<1.0	25	1	27	<1.0
Alkalinity	mg/L	270	220	230	240	290	250	300	230	270	390	260	340	240	290	270	300	320	310	310
Chloride (Cl)	mg/L	15	15	13	21	23	23	29	17	20	22	22	19	18	22	20	20	20	30	20
Nitrite (N)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.024	<0.10
Nitrate (N)	mg/L	<0.1	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	<0.10	<0.10	0.17	<0.10	<0.10	<0.10	0.66	<0.010
Mercury (Hg)	mg/L				<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L		<0.2		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	<0.001
Total Barium (Ba)	mg/L		0.013		0.016	0.017	0.016	0.018	0.010	0.017	0.022	0.013	0.017	0.016	0.015	0.016	0.020	0.016	0.015	0.014
Total Boron (B)	mg/L		<0.02		0.030	0.039	0.039	0.033	0.018	0.093	0.081	0.076	0.055	0.021	0.093	0.061	0.048	0.057	0.100	0.053
Total Cadmium (Cd)	mg/L		<0.005		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0009	<0.0009	<0.0009	<0.0009
Total Chromium (Cr)	mg/L		<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt (Co)	mg/L				<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Copper (Cu)	mg/L		<0.02		0.0018	0.001	0.0016	0.0015	<0.001	0.0014	0.0016	<0.001	0.0088	0.0015	0.0018	0.0010	0.0017	<0.0009	<0.0009	<0.0009
Total Iron (Fe)	mg/L		0.03	0.09	0.39	<0.1	<0.1	0.24	0.10	0.18	<0.1	<0.010	0.11	1.2	<0.1	<0.10	0.14	<0.10	<0.10	<0.1
Total Lead (Pb)	mg/L		<0.05		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Potassium (K)	mg/L								1.4	2.9	2.7	3.3		15.0	3.9	3.2	2.4	3.0	6.6	2.7
Total Sodium (Na)	mg/L	8.2	8.4	8.4	13	15	12	15	9	14	14		14		17		15		23	14
Total Zinc (Zn)	mg/L		<0.01		<0.005	0.0064	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
COD = Chemical Oxygen Demand
BOD = Biological Oxygen Demand

HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9	SW-9
		20-Nov-12	17-Apr-13	7-Nov-13	30-Apr-14	14-Oct-14	13-Apr-15	5-Nov-15	11-Apr-16	2-Nov-16	24-Apr-17	26-Oct-17	12-Apr-18	30-Oct-18	10-Apr-19	19-Nov-19	10-Apr-20	26-Oct-20	6-May-21	12-Nov-21	2-May-22
Field pH (pH Units)	pH Units	8.12					7.36	7.51	6.66	7.55	7.44	7.40	7.93	7.44	7.61	7.67	7.23	7.65	7.76	7.42	7.12
Field Temperature	Celcius	2.5					10.26	11.49	2.49	10.35	14.4	9.9	5.2	9.7	7.6	1.8	4.8	6.5	9.2	7.6	8.6
Conductivity (Field)	umho/cm						547	503	345	543	890	525	473	456		564	578	376	926		624
Hardness (CaCO3)	mg/L	200	250	220	320	260	190	350	250	370	250	390	280	360	360	390	300	320	390	400	340
Total Ammonia-N	mg/L	<0.05	<0.05	1.0	0.073	<0.050	0.065	<0.050	1.2	<0.050	2.2	<0.050	2.2	0.061	3.6	1.2	<0.050	0.15	3.6	1.5	0.081
Unionized Ammonia	mg/L	<0.02					0.001	<0.001	0.0007	<0.0005	0.016	<0.0005	0.029	<0.001	0.027						
BOD	mg/L				<2	<2.0	5	<2.0	7	<2	2	<2	<2	<2	7	<2	<2	<2	6	<2	2
COD	mg/L				20	25	33	37	46	35	55	35	34	33	64	33	12	27	98	120	59
Conductivity	umho/cm	370	480	490	530	540	550	710	610	790	830	750	800	680	960	960	560	640	1200	1100	910
Total Dissolved Solids	mg/L	210	256	268	292	326	278	424	342	508	436	430	460	390	520	585	285	385	630	630	440
Total Kjeldahl Nitrogen	mg/L				0.63	0.60	0.92	0.77	2.2	0.69	3.9	0.72	3.0	0.60	4.9	2.1	0.32	0.65	5.6	8.1	2
pH	pH Units	8.13	8.17	7.79	8.01	8.11	7.86	8.01	8.08	8.17	8.31	8.13	8.14	8.02	7.97	7.89	8.11	8.15	8.03	8.00	8.22
Phenols-4AAP	mg/L				<0.001	0.0029	0.0054	<0.0010	0.0012	<0.0010	0.0012	<0.002	0.0013	<0.0010	0.014	<0.0010	<0.0010	<0.0010	0.0029	<0.0010	<0.0010
Total Phosphorus	mg/L				0.016	0.032	0.042	0.075	0.031	0.036	0.090	0.043	0.036	0.097	0.059	0.039	0.016	0.027	0.1	1.4	0.15
Total Suspended Solids	mg/L				1	4	11	3	<1	20	24	6	3	5	10	4	14	1	10	6	140
Sulphate	mg/L	8	1	19	2	22	15	30	24	56	22	<1.0	42	<1.0	36	89	<5.0	4.2	37	98	50
Alkalinity	mg/L	190	230	210	250	230	180	280	250	330	280	400	280	360	370	290	280	310	460	380	330
Chloride (Cl)	mg/L	9	15	23	20	30	60	43	34	34	85	19	62	17	71	77	18	20	93	96	68
Nitrite (N)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	0.038	<0.010	<0.010	0.013	0.078	0.48
Nitrate (N)	mg/L	<0.1	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.72	<0.10	<0.10	0.73	<0.10	0.15	0.11	1.79	<0.010
Mercury (Hg)	mg/L				<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L		<0.2		<0.001	<0.001	<0.001	<0.001	0.0012	<0.001	0.002	<0.001	<0.001	<0.001	0.0031	<0.001	<0.0010	<0.001	0.0031	0.0012	0.0011
Total Barium (Ba)	mg/L		0.013		0.013	0.018	0.018	0.029	0.017	0.027	0.022	0.019	0.024	0.036	0.047	0.032	0.012	0.015	0.038	0.033	0.030
Total Boron (B)	mg/L		<0.02		0.022	0.075	0.097	0.063	0.14	0.059	0.50	0.025	0.37	0.023	0.410	0.480	0.022	0.054	0.510	0.530	0.400
Total Cadmium (Cd)	mg/L		<0.005		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.10	<0.00010	<0.0001	<0.0009	<0.0009	<0.0009	<0.0009
Total Chromium (Cr)	mg/L		<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<5.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt (Co)	mg/L				<0.0005	<0.0005	0.00064	<0.0005	0.001	<0.0005	0.0009	<0.0005	<0.0005	0.001	0.001	<0.0005	<0.0005	<0.0005	0.001	0.001	0.001
Total Copper (Cu)	mg/L		<0.02		<0.001	0.002	0.0023	0.0024	0.0010	0.0016	0.0019	0.0026	0.0017	0.0017	<0.0010	0.0016	<0.0010	<0.0009	<0.0009	0.0057	0.0017
Total Iron (Fe)	mg/L		<0.02	1.2	<0.1	0.34	0.80	0.66	0.36	0.35	0.89	0.37	0.31	0.77	1.3	0.16	<0.10	0.13	0.58	0.23	0.57
Total Lead (Pb)	mg/L		<0.05		<0.0005	<0.0005	0.00067	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Potassium (K)	mg/L								9.1	1.9	12	2.2	13		15.0	14.0	1.7	3.3	25.0	25.0	21.0
Total Sodium (Na)	mg/L	4.9	8.2	18	13	16	33	20	29	19	60	11		11		65		13		83	61
Total Zinc (Zn)	mg/L		<0.01		<0.005	0.0055	<0.005	0.005	<0.005	<0.005	0.007	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.006

Notes:
COD = Chemical Oxygen Demand
BOD = Biological Oxygen Demand

HISTORICAL SURFACE WATER QUALITY SUMMARY

	Units	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10	SW-10
		20-Nov-12	17-Apr-13	7-Nov-13	30-Apr-14	14-Oct-14	13-Apr-15	5-Nov-15	11-Apr-16	2-Nov-16	24-Apr-17	26-Oct-17	12-Apr-18	30-Oct-18	10-Apr-19	19-Nov-19	26-Oct-20	6-May-21	12-Nov-21	2-May-22	6-Oct-22
Field pH (pH Units)	pH Units	8.21					8.09	7.75	6.79	8.23	7.41	8.01	8.12	7.53	7.67	7.68	7.79	7.59	7.49	6.92	7.54
Field Temperature	Celcius	2					12.42	11.22	3.10	9.75	15.8	10.5	5.6	10.1	6.5	1.4	9.1	9.2	8.3	9.3	9.7
Conductivity (Field)	umho/cm						543	477	357	778	880	491	455	568		566	1248	991		617	791
Hardness (CaCO3)	mg/L	210	220	190	220	210	190	280	240	340	250	220	260	310	360	390	290	400	290	320	380
Total Ammonia-N	mg/L	<0.05	0.59	0.54	0.94	<0.050	0.075	0.05	1.3	<0.050	2.2	0.058	1.8	<0.050	3.6	0.53	2.6	4.2	0.31	<0.050	<0.050
Unionized Ammonia	mg/L	<0.02					0.002	0.001	0.001	<0.0015	0.016	0.0014	0.037	<0.001	0.028						
BOD	mg/L				8	<2.0	6	<2.0	7	<2	<2	<2	<2	<2	7	4	2	11	10	3	3
COD	mg/L				57	24	31	37	51	35	51	30	28	36	62	45	48	100	71	50	67
Conductivity	umho/cm	370	530	400	450	480	550	640	620	1100	830	680	680	810	960	960	850	1200	900	810	1000
Total Dissolved Solids	mg/L	72	340	234	286	306	236	418	350	640	452	390	360	515	480	565	680	655	460	380	785
Total Kjeldahl Nitrogen	mg/L				2.5	0.63	0.95	0.86	2.3	0.70	3.8	0.95	2.5	0.9	4.8	1.6	3.9	6.7	2.0	1.2	0.9
pH	pH Units	8.22	8.02	7.71	7.96	8.28	7.83	7.99	8.05	8.23	8.30	8.28	8.15	8.04	7.98	7.97	8.18	7.99	8.06	8.16	7.95
Phenols-4AAP	mg/L				0.0046	0.0035	0.005	<0.0010	0.0016	<0.0010	0.0014	<0.001	0.0016	<0.0010	0.014	<0.0010	<0.0010	0.0041	0.0013	<0.0010	<0.0010
Total Phosphorus	mg/L				0.08	0.030	0.049	0.051	0.031	0.024	0.059	0.045	0.021	0.026	0.069	0.078	0.056	0.1	0.072	0.064	0.370
Total Suspended Solids	mg/L				20	6	17	18	<1	5	24	14	1	6	12	23	8	15	17	52	320
Sulphate	mg/L	8	24	14	7	26	15	37	25	65	22	39	38	78	35	92	66	37	64	40	310
Alkalinity	mg/L	190	180	170	190	180	180	200	250	200	270	210	250	240	370	300	280	460	280	320	160
Chloride (Cl)	mg/L	9	40	18	24	33	59	64	35	180	87	74	42	79	69	73	64	96	78	43	56
Nitrite (N)	mg/L	<0.01	0.012	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.023	0.039	0.016	0.211	<0.10	<0.10
Nitrate (N)	mg/L	<0.1	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.75	<0.10	<0.10	1.32	0.26	<0.10	3.49	<0.010	0.016
Mercury (Hg)	mg/L				<0.0001	<0.00010	<0.00010	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L		<0.2		0.0018	<0.001	<0.001	<0.001	0.0013	<0.001	0.0019	0.0015	<0.001	0.0011	0.0034	<0.001	0.0017	0.0034	0.0013	0.0011	0.0075
Total Barium (Ba)	mg/L		0.027		0.022	0.018	0.018	0.029	0.018	0.035	0.024	0.038	0.020	0.031	0.045	0.037	0.033	0.041	0.029	0.033	0.170
Total Boron (B)	mg/L		<0.02		0.12	0.095	0.094	0.088	0.14	0.22	0.52	0.49	0.29	0.53	0.40	0.54	0.41	0.55	0.50	0.38	0.41
Total Cadmium (Cd)	mg/L		<0.005		0.00013	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00011	<0.0009	<0.0009	<0.0009	<0.0009	0.000
Total Chromium (Cr)	mg/L		<0.01		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.013	<0.005	<0.005	<0.005	<0.005	0.032
Total Cobalt (Co)	mg/L				0.0009	<0.0005	0.00063	<0.0005	0.001	<0.0005	0.0009	<0.0005	<0.0005	<0.0005	0.001	0.001	0.001	0.001	0.001	0.001	0.016
Total Copper (Cu)	mg/L		<0.02		0.0025	0.002	0.0024	0.0029	0.0010	0.0014	0.0019	0.0014	0.0012	0.0015	<0.0010	0.0150	0.0027	0.0010	0.0021	0.0019	0.0320
Total Iron (Fe)	mg/L		1.6	1.2	1.1	0.55	0.92	0.96	0.38	0.43	0.93	0.71	0.12	0.48	1.3	0.47	0.50	0.86	0.39	1.10	33.00
Total Lead (Pb)	mg/L		<0.05		0.00067	<0.0005	0.00071	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006		0.001	<0.0005	<0.0005	<0.0005	0.012
Total Potassium (K)	mg/L								9.7	6.8	13	14	10		15	15	21	27	31	19	27
Total Sodium (Na)	mg/L	4.9	26	11	21	18	33	27	30	86	63	54		59		64	59		63	53	41
Total Zinc (Zn)	mg/L		0.02		0.0059	<0.005	0.0053	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0058	0.0053	<0.005	0.0054	0.006	0.075

Notes:
COD = Chemical Oxygen Demand
BOD = Biological Oxygen Demand

APPENDIX G:
LABORATORY CERTIFICATES OF ANALYSES

Your Project #: Arran (M1174)
Your C.O.C. #: 874216-01-01

Attention: Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2022/05/31
Report #: R7145222
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2B9349
Received: 2022/05/04, 09:00

Sample Matrix: Surface Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	6	N/A	2022/05/07	CAM SOP-00448	SM 23 2320 B m
Carbonaceous BOD	6	2022/05/05	2022/05/10	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	6	N/A	2022/05/06	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	6	N/A	2022/05/09	CAM SOP-00416	SM 23 5220 D m
Conductivity	6	N/A	2022/05/07	CAM SOP-00414	SM 23 2510 m
Hardness (calculated as CaCO3)	6	N/A	2022/05/11	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	6	2022/05/06	2022/05/06	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	6	N/A	2022/05/10	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	6	N/A	2022/05/10	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (1)	6	N/A	2022/05/06	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	6	2022/05/05	2022/05/07	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	6	N/A	2022/05/06	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	6	N/A	2022/05/11	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	1	2022/05/06	2022/05/09	CAM SOP-00428	SM 23 2540C m
Total Dissolved Solids	5	2022/05/07	2022/05/09	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	6	2022/05/06	2022/05/09	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	6	2022/05/06	2022/05/06	CAM SOP-00407	SM 23 4500 P B H m
Low Level Total Suspended Solids	6	2022/05/06	2022/05/09	CAM SOP-00428	SM 23 2540D m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or

Your Project #: Arran (M1174)
Your C.O.C. #: 874216-01-01

Attention: Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2022/05/31
Report #: R7145222
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2B9349

Received: 2022/05/04, 09:00

implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bureauveritas.com
Phone# (905)817-5765
==========
This report has been generated and distributed using a secure automated process.
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For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C2B9349
Report Date: 2022/05/31

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF SURFACE WATER

Bureau Veritas ID		SNJ799		SNJ800		SNJ801		
Sampling Date		2022/05/02 09:15		2022/05/02 08:15		2022/05/02 10:05		
COC Number		874216-01-01		874216-01-01		874216-01-01		
	UNITS	SW-1	QC Batch	SW-5	QC Batch	SW-7	RDL	QC Batch
Calculated Parameters								
Hardness (CaCO3)	mg/L	290	7975062	350	7975062	310	1.0	7975062
Inorganics								
Total Ammonia-N	mg/L	<0.050	7980755	<0.050	7980749	<0.050	0.050	7980749
Total Carbonaceous BOD	mg/L	<2	7978185	<2	7978185	<2	2	7978185
Total Chemical Oxygen Demand (COD)	mg/L	17	7980360	16	7980360	19	4.0	7980360
Conductivity	umho/cm	540	7979144	620	7979144	610	1.0	7979144
Total Dissolved Solids	mg/L	230	7981611	270	7981611	270	10	7981611
Total Kjeldahl Nitrogen (TKN)	mg/L	0.32	7980312	0.38	7980312	0.38	0.10	7980312
pH	pH	8.39	7979140	8.13	7979140	8.28		7979140
Phenols-4AAP	mg/L	<0.0010	7979897	<0.0010	7979897	<0.0010	0.0010	7979897
Total Phosphorus	mg/L	0.015	7980169	0.023	7980169	0.013	0.004	7980169
Total Suspended Solids	mg/L	6	7980514	4	7980514	5	1	7980514
Dissolved Sulphate (SO4)	mg/L	<1.0	7979198	<1.0	7979198	<1.0	1.0	7979198
Alkalinity (Total as CaCO3)	mg/L	270	7979129	330	7979129	300	1.0	7979129
Dissolved Chloride (Cl-)	mg/L	14	7979201	8.6	7979201	19	1.0	7979201
Nitrite (N)	mg/L	<0.010	7979226	<0.010	7979226	<0.010	0.010	7979204
Nitrate (N)	mg/L	1.09	7979226	0.16	7979226	<0.10	0.10	7979204
Nitrate + Nitrite (N)	mg/L	1.09	7979226	0.16	7979226	<0.10	0.10	7979204

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C2B9349
Report Date: 2022/05/31

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF SURFACE WATER

Bureau Veritas ID		SNJ801			SNJ802			SNJ803		
Sampling Date		2022/05/02 10:05			2022/05/02 10:10			2022/05/02 10:15		
COC Number		874216-01-01			874216-01-01			874216-01-01		
	UNITS	SW-7 Lab-Dup	RDL	QC Batch	SW-8	RDL	QC Batch	SW-9	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L				320	1.0	7975062	340	1.0	7975062
Inorganics										
Total Ammonia-N	mg/L				<0.050	0.050	7980749	0.081	0.050	7980749
Total Carbonaceous BOD	mg/L				<2	2	7978185	2	2	7978185
Total Chemical Oxygen Demand (COD)	mg/L				15	4.0	7980360	59	4.0	7980360
Conductivity	umho/cm				620	1.0	7979144	910	1.0	7979144
Total Dissolved Solids	mg/L	280	10	7981611	285	10	7980729	440	10	7981611
Total Kjeldahl Nitrogen (TKN)	mg/L				0.39	0.10	7980312	2.0	0.10	7980312
pH	pH				8.31		7979140	8.22		7979140
Phenols-4AAP	mg/L				<0.0010	0.0010	7979999	<0.0010	0.0010	7979951
Total Phosphorus	mg/L				0.012	0.004	7980169	0.15	0.02	7980169
Total Suspended Solids	mg/L				2	1	7980514	140	3	7980514
Dissolved Sulphate (SO4)	mg/L				<1.0	1.0	7979198	50	1.0	7979198
Alkalinity (Total as CaCO3)	mg/L				310	1.0	7979129	330	1.0	7979129
Dissolved Chloride (Cl-)	mg/L				20	1.0	7979201	68	1.0	7979201
Nitrite (N)	mg/L				<0.010	0.010	7979204	<0.010	0.010	7979226
Nitrate (N)	mg/L				<0.10	0.10	7979204	0.48	0.10	7979226
Nitrate + Nitrite (N)	mg/L				<0.10	0.10	7979204	0.48	0.10	7979226

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Report Date: 2022/05/31

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF SURFACE WATER

Bureau Veritas ID		SNJ803			SNJ804		
Sampling Date		2022/05/02 10:15			2022/05/02 10:20		
COC Number		874216-01-01			874216-01-01		
	UNITS	SW-9 Lab-Dup	RDL	QC Batch	SW-10	RDL	QC Batch
Calculated Parameters							
Hardness (CaCO3)	mg/L				320	1.0	7975062
Inorganics							
Total Ammonia-N	mg/L				<0.050	0.050	7980749
Total Carbonaceous BOD	mg/L				3	2	7978185
Total Chemical Oxygen Demand (COD)	mg/L				50	4.0	7980360
Conductivity	umho/cm				810	1.0	7979144
Total Dissolved Solids	mg/L				380	10	7981611
Total Kjeldahl Nitrogen (TKN)	mg/L				1.2	0.10	7980312
pH	pH				8.16		7979140
Phenols-4AAP	mg/L	<0.0010	0.0010	7979951	<0.0010	0.0010	7979951
Total Phosphorus	mg/L				0.064	0.004	7980169
Total Suspended Solids	mg/L				52	1	7980514
Dissolved Sulphate (SO4)	mg/L				40	1.0	7979198
Alkalinity (Total as CaCO3)	mg/L				320	1.0	7979129
Dissolved Chloride (Cl-)	mg/L				43	1.0	7979201
Nitrite (N)	mg/L				<0.010	0.010	7979204
Nitrate (N)	mg/L				<0.10	0.10	7979204
Nitrate + Nitrite (N)	mg/L				<0.10	0.10	7979204

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
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Bureau Veritas Job #: C2B9349
Report Date: 2022/05/31

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

ELEMENTS BY ATOMIC SPECTROSCOPY (SURFACE WATER)

Bureau Veritas ID		SNJ799	SNJ800	SNJ801	SNJ802	SNJ803	SNJ804		
Sampling Date		2022/05/02 09:15	2022/05/02 08:15	2022/05/02 10:05	2022/05/02 10:10	2022/05/02 10:15	2022/05/02 10:20		
COC Number		874216-01-01	874216-01-01	874216-01-01	874216-01-01	874216-01-01	874216-01-01		
	UNITS	SW-1	SW-5	SW-7	SW-8	SW-9	SW-10	RDL	QC Batch
Metals									
Mercury (Hg)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	7979803
Total Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	1.1	1.1	1.0	7983699
Total Barium (Ba)	ug/L	14	12	15	14	30	33	2.0	7983699
Total Boron (B)	ug/L	14	15	52	53	400	380	10	7983699
Total Cadmium (Cd)	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	0.090	7983699
Total Calcium (Ca)	ug/L	76000	86000	82000	84000	78000	76000	200	7983699
Total Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7983699
Total Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	0.82	1.1	0.50	7983699
Total Copper (Cu)	ug/L	<0.90	<0.90	0.91	<0.90	1.7	1.9	0.90	7983699
Total Iron (Fe)	ug/L	260	120	130	<100	570	1100	100	7983699
Total Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7983699
Total Magnesium (Mg)	ug/L	25000	33000	28000	28000	33000	33000	50	7983699
Total Potassium (K)	ug/L	1600	530	2800	2700	21000	19000	200	7983699
Total Sodium (Na)	ug/L	7600	6500	13000	14000	61000	53000	100	7983699
Total Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.8	5.7	5.0	7983699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C2B9349
Report Date: 2022/05/31

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

TEST SUMMARY

Bureau Veritas ID: SNJ799
Sample ID: SW-1
Matrix: Surface Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Carbonaceous BOD	DO	7978185	2022/05/05	2022/05/10	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Chemical Oxygen Demand	SPEC	7980360	N/A	2022/05/09	Prgya Panchal
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Mercury in Water by CVAA	CV/AA	7979803	2022/05/06	2022/05/06	Rupinder Gill
Total Metals Analysis by ICPMS	ICP/MS	7983699	N/A	2022/05/10	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7980755	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979226	N/A	2022/05/06	Samuel Law
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7979897	N/A	2022/05/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7981611	2022/05/07	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980312	2022/05/06	2022/05/09	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7980169	2022/05/06	2022/05/06	Shivani Shivani
Low Level Total Suspended Solids	BAL	7980514	2022/05/06	2022/05/09	Shaneil Hall

Bureau Veritas ID: SNJ800
Sample ID: SW-5
Matrix: Surface Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Carbonaceous BOD	DO	7978185	2022/05/05	2022/05/10	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Chemical Oxygen Demand	SPEC	7980360	N/A	2022/05/09	Prgya Panchal
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Mercury in Water by CVAA	CV/AA	7979803	2022/05/06	2022/05/06	Rupinder Gill
Total Metals Analysis by ICPMS	ICP/MS	7983699	N/A	2022/05/10	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7980749	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979226	N/A	2022/05/06	Samuel Law
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7979897	N/A	2022/05/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7981611	2022/05/07	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980312	2022/05/06	2022/05/09	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7980169	2022/05/06	2022/05/06	Shivani Shivani
Low Level Total Suspended Solids	BAL	7980514	2022/05/06	2022/05/09	Shaneil Hall

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TEST SUMMARY

Bureau Veritas ID: SNJ801 **Collected:** 2022/05/02
Sample ID: SW-7 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Carbonaceous BOD	DO	7978185	2022/05/05	2022/05/10	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Chemical Oxygen Demand	SPEC	7980360	N/A	2022/05/09	Prgya Panchal
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Mercury in Water by CVAA	CV/AA	7979803	2022/05/06	2022/05/06	Rupinder Gill
Total Metals Analysis by ICPMS	ICP/MS	7983699	N/A	2022/05/10	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7980749	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979204	N/A	2022/05/06	Samuel Law
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7979897	N/A	2022/05/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7981611	2022/05/07	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980312	2022/05/06	2022/05/09	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7980169	2022/05/06	2022/05/06	Shivani Shivani
Low Level Total Suspended Solids	BAL	7980514	2022/05/06	2022/05/09	Shaneil Hall

Bureau Veritas ID: SNJ801 Dup **Collected:** 2022/05/02
Sample ID: SW-7 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids	BAL	7981611	2022/05/07	2022/05/09	Kristen Chan

Bureau Veritas ID: SNJ802 **Collected:** 2022/05/02
Sample ID: SW-8 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Carbonaceous BOD	DO	7978185	2022/05/05	2022/05/10	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Chemical Oxygen Demand	SPEC	7980360	N/A	2022/05/09	Prgya Panchal
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Mercury in Water by CVAA	CV/AA	7979803	2022/05/06	2022/05/06	Rupinder Gill
Total Metals Analysis by ICPMS	ICP/MS	7983699	N/A	2022/05/10	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7980749	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979204	N/A	2022/05/06	Samuel Law
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7979999	N/A	2022/05/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980312	2022/05/06	2022/05/09	Rajni Tyagi

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TEST SUMMARY

Bureau Veritas ID: SNJ802 **Collected:** 2022/05/02
Sample ID: SW-8 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	7980169	2022/05/06	2022/05/06	Shivani Shivani
Low Level Total Suspended Solids	BAL	7980514	2022/05/06	2022/05/09	Shaneil Hall

Bureau Veritas ID: SNJ803 **Collected:** 2022/05/02
Sample ID: SW-9 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Carbonaceous BOD	DO	7978185	2022/05/05	2022/05/10	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Chemical Oxygen Demand	SPEC	7980360	N/A	2022/05/09	Prgya Panchal
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Mercury in Water by CVAA	CV/AA	7979803	2022/05/06	2022/05/06	Rupinder Gill
Total Metals Analysis by ICPMS	ICP/MS	7983699	N/A	2022/05/10	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7980749	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979226	N/A	2022/05/06	Samuel Law
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7979951	N/A	2022/05/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7981611	2022/05/07	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980312	2022/05/06	2022/05/09	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7980169	2022/05/06	2022/05/06	Shivani Shivani
Low Level Total Suspended Solids	BAL	7980514	2022/05/06	2022/05/09	Shaneil Hall

Bureau Veritas ID: SNJ803 Dup **Collected:** 2022/05/02
Sample ID: SW-9 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	7979951	N/A	2022/05/06	Louise Harding

Bureau Veritas ID: SNJ804 **Collected:** 2022/05/02
Sample ID: SW-10 **Shipped:**
Matrix: Surface Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Carbonaceous BOD	DO	7978185	2022/05/05	2022/05/10	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Chemical Oxygen Demand	SPEC	7980360	N/A	2022/05/09	Prgya Panchal
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Mercury in Water by CVAA	CV/AA	7979803	2022/05/06	2022/05/06	Rupinder Gill

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Bureau Veritas Job #: C2B9349
Report Date: 2022/05/31

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

TEST SUMMARY

Bureau Veritas ID: SNJ804
Sample ID: SW-10
Matrix: Surface Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	7983699	N/A	2022/05/10	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7980749	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979204	N/A	2022/05/06	Samuel Law
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7979951	N/A	2022/05/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7981611	2022/05/07	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980312	2022/05/06	2022/05/09	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7980169	2022/05/06	2022/05/06	Shivani Shivani
Low Level Total Suspended Solids	BAL	7980514	2022/05/06	2022/05/09	Shaneil Hall

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7978185	Total Carbonaceous BOD	2022/05/10					<2	mg/L	0.25	30	98	85 - 115
7979129	Alkalinity (Total as CaCO3)	2022/05/06			93	85 - 115	<1.0	mg/L	1.2	20		
7979140	pH	2022/05/06			102	98 - 103			1.2	N/A		
7979144	Conductivity	2022/05/06			100	85 - 115	<1.0	umho/cm	0	25		
7979198	Dissolved Sulphate (SO4)	2022/05/11	NC	75 - 125	97	80 - 120	<1.0	mg/L	3.7	20		
7979201	Dissolved Chloride (Cl-)	2022/05/06	110	80 - 120	104	80 - 120	<1.0	mg/L	1.5	20		
7979204	Nitrate (N)	2022/05/06	NC	80 - 120	97	80 - 120	<0.10	mg/L	0.83	20		
7979204	Nitrite (N)	2022/05/06	103	80 - 120	100	80 - 120	<0.010	mg/L	NC	20		
7979226	Nitrate (N)	2022/05/06	NC	80 - 120	101	80 - 120	<0.10	mg/L	0.34	20		
7979226	Nitrite (N)	2022/05/06	98	80 - 120	102	80 - 120	<0.010	mg/L	0.12	20		
7979803	Mercury (Hg)	2022/05/06	93	75 - 125	95	80 - 120	<0.00010	mg/L	NC	20		
7979897	Phenols-4AAP	2022/05/06	103	80 - 120	104	80 - 120	<0.0010	mg/L	NC	20		
7979951	Phenols-4AAP	2022/05/06	105	80 - 120	104	80 - 120	<0.0010	mg/L	NC	20		
7979999	Phenols-4AAP	2022/05/06	NC	80 - 120	104	80 - 120	<0.0010	mg/L	0.58	20		
7980169	Total Phosphorus	2022/05/06	NC	80 - 120	95	80 - 120	<0.004	mg/L	0.45	20	90	80 - 120
7980312	Total Kjeldahl Nitrogen (TKN)	2022/05/10	98	80 - 120	101	80 - 120	<0.10	mg/L	NC	20	104	80 - 120
7980360	Total Chemical Oxygen Demand (COD)	2022/05/09	97	80 - 120	95	80 - 120	<4.0	mg/L	NC	20		
7980514	Total Suspended Solids	2022/05/09					<1	mg/L	NC	25	97	85 - 115
7980729	Total Dissolved Solids	2022/05/09					<10	mg/L	0	25	97	90 - 110
7980749	Total Ammonia-N	2022/05/10	104	75 - 125	99	80 - 120	<0.050	mg/L	16	20		
7980755	Total Ammonia-N	2022/05/10	94	75 - 125	99	80 - 120	<0.050	mg/L	8.9	20		
7981611	Total Dissolved Solids	2022/05/09					<10	mg/L	3.6	25	95	90 - 110
7983699	Total Arsenic (As)	2022/05/10	99	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
7983699	Total Barium (Ba)	2022/05/10	92	80 - 120	97	80 - 120	<2.0	ug/L	1.7	20		
7983699	Total Boron (B)	2022/05/10	96	80 - 120	89	80 - 120	<10	ug/L	6.9	20		
7983699	Total Cadmium (Cd)	2022/05/10	98	80 - 120	96	80 - 120	<0.090	ug/L	NC	20		
7983699	Total Calcium (Ca)	2022/05/10	NC	80 - 120	101	80 - 120	<200	ug/L	3.1	20		
7983699	Total Chromium (Cr)	2022/05/10	98	80 - 120	100	80 - 120	<5.0	ug/L	NC	20		
7983699	Total Cobalt (Co)	2022/05/10	95	80 - 120	99	80 - 120	<0.50	ug/L	NC	20		
7983699	Total Copper (Cu)	2022/05/10	100	80 - 120	96	80 - 120	<0.90	ug/L	7.1	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7983699	Total Iron (Fe)	2022/05/10	100	80 - 120	102	80 - 120	<100	ug/L	3.4	20		
7983699	Total Lead (Pb)	2022/05/10	93	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
7983699	Total Magnesium (Mg)	2022/05/10	NC	80 - 120	102	80 - 120	<50	ug/L	4.5	20		
7983699	Total Potassium (K)	2022/05/10	102	80 - 120	102	80 - 120	<200	ug/L	2.5	20		
7983699	Total Sodium (Na)	2022/05/10	NC	80 - 120	101	80 - 120	<100	ug/L	3.9	20		
7983699	Total Zinc (Zn)	2022/05/10	95	80 - 120	100	80 - 120	<5.0	ug/L	10	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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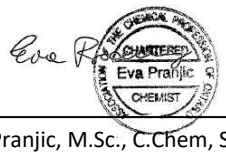
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

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Your Project #: Arran (M1174)
Your C.O.C. #: 874211-01-01, 874211-02-01

Attention: Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2022/05/11
Report #: R7120990
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2B9361
Received: 2022/05/04, 09:00

Sample Matrix: Ground Water
Samples Received: 19

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	18	N/A	2022/05/06	CAM SOP-00448	SM 23 2320 B m
Alkalinity	1	N/A	2022/05/07	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	19	N/A	2022/05/06	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	18	N/A	2022/05/06	CAM SOP-00414	SM 23 2510 m
Conductivity	1	N/A	2022/05/07	CAM SOP-00414	SM 23 2510 m
Hardness (calculated as CaCO3)	9	N/A	2022/05/11	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	5	N/A	2022/05/06	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	5	N/A	2022/05/09	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP	5	2022/05/05	2022/05/06	CAM SOP-00408	EPA 6010D m
Lab Filtered Metals Analysis by ICP	9	2022/05/07	2022/05/10	CAM SOP-00408	EPA 6010D m
Lab Filtered Metals Analysis by ICP	5	2022/05/07	2022/05/09	CAM SOP-00408	EPA 6010D m
Total Ammonia-N	19	N/A	2022/05/10	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (1)	19	N/A	2022/05/06	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Organic Nitrogen	19	N/A	2022/05/11	Auto Calc.	
pH	18	2022/05/05	2022/05/06	CAM SOP-00413	SM 4500H+ B m
pH	1	2022/05/05	2022/05/07	CAM SOP-00413	SM 4500H+ B m
Sulphate by Automated Colourimetry	19	N/A	2022/05/11	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	19	2022/05/06	2022/05/09	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	2	2022/05/06	2022/05/10	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	17	2022/05/06	2022/05/09	CAM SOP-00938	OMOE E3516 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are

Your Project #: Arran (M1174)
Your C.O.C. #: 874211-01-01, 874211-02-01

Attention: Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2022/05/11
Report #: R7120990
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2B9361

Received: 2022/05/04, 09:00

reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bureauveritas.com
Phone# (905)817-5765
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For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SNJ838		SNJ839	SNJ840			SNJ841		
Sampling Date		2022/05/02 10:40		2022/05/02 10:45	2022/05/02 09:00			2022/05/02 10:30		
COC Number		874211-01-01		874211-01-01	874211-01-01			874211-01-01		
	UNITS	TW-1	QC Batch	TW-2	TW-5	RDL	QC Batch	TW-10	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	520	7975062	520	470	1.0	7975062	530	1.0	7975062
Total Organic Nitrogen	mg/L	<0.10	7975798	0.27	0.11	0.10	7975798	0.54	0.10	7975798
Inorganics										
Total Ammonia-N	mg/L	0.80	7981280	0.24	0.35	0.050	7981280	2.5	0.050	7981280
Conductivity	umho/cm	930	7979144	930	860	1.0	7978754	1200	1.0	7978754
Total Dissolved Solids	mg/L	410	7980729	550	450	10	7980729	615	10	7980729
Total Kjeldahl Nitrogen (TKN)	mg/L	0.83	7980300	0.51	0.46	0.10	7980300	3.0	0.10	7980300
pH	pH	7.98	7979140	7.81	7.89		7978756	7.88		7978756
Dissolved Sulphate (SO4)	mg/L	13	7978805	180	55	1.0	7979175	10	1.0	7979198
Alkalinity (Total as CaCO3)	mg/L	450	7979129	330	420	1.0	7978741	370	1.0	7978741
Dissolved Chloride (Cl-)	mg/L	39	7978802	14	2.5	1.0	7979183	150	2.0	7979201
Nitrite (N)	mg/L	0.053	7979226	<0.010	<0.010	0.010	7979214	0.061	0.010	7979214
Nitrate (N)	mg/L	0.18	7979226	<0.10	<0.10	0.10	7979214	0.14	0.10	7979214
Nitrate + Nitrite (N)	mg/L	0.24	7979226	<0.10	<0.10	0.10	7979214	0.21	0.10	7979214

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SNJ842		SNJ843	SNJ844	SNJ845	SNJ846		
Sampling Date		2022/05/02 08:10		2022/05/02 09:50	2022/05/02 09:40	2022/05/02 09:30	2022/05/02 08:00		
COC Number		874211-01-01		874211-01-01	874211-01-01	874211-01-01	874211-01-01		
	UNITS	TW-11D	QC Batch	TW-12	TW-13	TW-14	TW-15	RDL	QC Batch
Calculated Parameters									
Hardness (CaCO3)	mg/L	390	7975062	590	590	540	330	1.0	7975062
Total Organic Nitrogen	mg/L	<0.10	7975798	0.44	0.46	<0.10	<0.10	0.10	7975798
Inorganics									
Total Ammonia-N	mg/L	0.11 (1)	7981280	0.41	0.61	0.23 (1)	0.13	0.050	7981280
Conductivity	umho/cm	680	7978754	1200	1100	990	570	1.0	7978754
Total Dissolved Solids	mg/L	325	7980729	595	580	500	300	10	7980729
Total Kjeldahl Nitrogen (TKN)	mg/L	0.10 (1)	7980300	0.85	1.1	0.22 (1)	0.19	0.10	7980300
pH	pH	8.01	7978756	7.74	7.70	7.80	8.12		7978756
Dissolved Sulphate (SO4)	mg/L	13	7979198	2.0	<1.0	13	6.2	1.0	7979175
Alkalinity (Total as CaCO3)	mg/L	370	7978741	570	570	510	310	1.0	7978741
Dissolved Chloride (Cl-)	mg/L	1.7	7979201	67	42	31	2.2	1.0	7979183
Nitrite (N)	mg/L	<0.010	7979214	<0.010	<0.010	<0.010	<0.010	0.010	7979214
Nitrate (N)	mg/L	0.14	7979214	<0.10	<0.10	<0.10	0.33	0.10	7979214
Nitrate + Nitrite (N)	mg/L	0.14	7979214	<0.10	<0.10	<0.10	0.33	0.10	7979214

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SNJ847			SNJ847			SNJ899		
Sampling Date		2022/05/02 09:10			2022/05/02 09:10			2022/05/02 10:00		
COC Number		874211-01-01			874211-01-01			874211-02-01		
	UNITS	TW-16	RDL	QC Batch	TW-16 Lab-Dup	RDL	QC Batch	TW-17	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	360	1.0	7975062				260	1.0	7975062
Total Organic Nitrogen	mg/L	<0.10	0.10	7975798				0.13	0.10	7975798
Inorganics										
Total Ammonia-N	mg/L	0.10	0.050	7981280				0.33	0.050	7981280
Conductivity	umho/cm	660	1.0	7978754				490	1.0	7978754
Total Dissolved Solids	mg/L	295	10	7980729				210	10	7980729
Total Kjeldahl Nitrogen (TKN)	mg/L	0.14	0.10	7980300				0.46	0.10	7980300
pH	pH	8.11		7978756				8.10		7978756
Dissolved Sulphate (SO4)	mg/L	28	1.0	7979198	27	1.0	7979198	19	1.0	7979175
Alkalinity (Total as CaCO3)	mg/L	330	1.0	7978741				250	1.0	7978741
Dissolved Chloride (Cl-)	mg/L	11	1.0	7979201	11	1.0	7979201	2.5	1.0	7979183
Nitrite (N)	mg/L	<0.010	0.010	7979214				0.047	0.010	7979214
Nitrate (N)	mg/L	<0.10	0.10	7979214				0.32	0.10	7979214
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	7979214				0.36	0.10	7979214

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SNJ900		SNJ901		SNJ902			SNJ902		
Sampling Date		2022/05/02 10:20		2022/05/02 10:10		2022/05/02 08:50			2022/05/02 08:50		
COC Number		874211-02-01		874211-02-01		874211-02-01			874211-02-01		
	UNITS	TW-22	RDL	TW-23	RDL	TW-24	RDL	QC Batch	TW-24 Lab-Dup	RDL	QC Batch
Calculated Parameters											
Hardness (CaCO3)	mg/L	290	1.0	290	1.0	390	1.0	7975062			
Total Organic Nitrogen	mg/L	0.23	0.10	0.93	0.10	<0.10	0.10	7975798			
Inorganics											
Total Ammonia-N	mg/L	1.9	0.050	0.33	0.050	<0.050	0.050	7981280			
Conductivity	umho/cm	540	1.0	540	1.0	830	1.0	7978754			
Total Dissolved Solids	mg/L	240	10	275	10	430	10	7980729	430	10	7980729
Total Kjeldahl Nitrogen (TKN)	mg/L	2.1	0.10	1.3	0.20	<0.10	0.10	7980300			
pH	pH	8.08		8.07		8.10		7978756			
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	39	1.0	72	1.0	7979175			
Alkalinity (Total as CaCO3)	mg/L	300	1.0	250	1.0	390	1.0	7978741			
Dissolved Chloride (Cl-)	mg/L	2.2	1.0	3.2	1.0	1.6	1.0	7979183			
Nitrite (N)	mg/L	<0.010	0.010	0.048	0.010	<0.010	0.010	7979214			
Nitrate (N)	mg/L	<0.10	0.10	0.53	0.10	<0.10	0.10	7979214			
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	0.57	0.10	<0.10	0.10	7979214			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SNJ903			SNJ903			SNJ904		
Sampling Date		2022/05/02 08:40			2022/05/02 08:40			2022/05/02 08:45		
COC Number		874211-02-01			874211-02-01			874211-02-01		
	UNITS	TW-25S	RDL	QC Batch	TW-25S Lab-Dup	RDL	QC Batch	TW-25D	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	340	1.0	7975062				240	1.0	7975062
Total Organic Nitrogen	mg/L	<0.10	0.10	7975798				1.1	0.10	7975798
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	7981280	<0.050	0.050	7981280	0.33	0.050	7981280
Conductivity	umho/cm	730	1.0	7978754				500	1.0	7978754
Total Dissolved Solids	mg/L	365	10	7980729				240	10	7980729
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	7980300	<0.10	0.10	7980300	1.4	0.20	7980300
pH	pH	8.19		7978756				8.14		7978756
Dissolved Sulphate (SO4)	mg/L	56	1.0	7979175				16	1.0	7979198
Alkalinity (Total as CaCO3)	mg/L	340	1.0	7978741				260	1.0	7978741
Dissolved Chloride (Cl-)	mg/L	1.7	1.0	7979183				3.3	1.0	7979201
Nitrite (N)	mg/L	<0.010	0.010	7979214				0.056	0.010	7979226
Nitrate (N)	mg/L	<0.10	0.10	7979214				<0.10	0.10	7979226
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	7979214				<0.10	0.10	7979226

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SNJ905	SNJ906	SNJ907		
Sampling Date		2022/05/02 08:30	2022/05/02 08:20	2022/05/02 08:05		
COC Number		874211-02-01	874211-02-01	874211-02-01		
	UNITS	TW-26	TW-27	TW-15D	RDL	QC Batch
Calculated Parameters						
Hardness (CaCO3)	mg/L	300	560	340	1.0	7975062
Total Organic Nitrogen	mg/L	<0.10	0.20	<0.10	0.10	7975798
Inorganics						
Total Ammonia-N	mg/L	0.092	0.59	0.32	0.050	7981280
Conductivity	umho/cm	620	1100	610	1.0	7978754
Total Dissolved Solids	mg/L	255	575	280	10	7980729
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.79	0.34	0.10	7980300
pH	pH	8.09	7.91	8.05		7978756
Dissolved Sulphate (SO4)	mg/L	48	36	22	1.0	7979175
Alkalinity (Total as CaCO3)	mg/L	290	490	310	1.0	7978741
Dissolved Chloride (Cl-)	mg/L	3.4	66	2.6	1.0	7979183
Nitrite (N)	mg/L	<0.010	0.039	<0.010	0.010	7979214
Nitrate (N)	mg/L	<0.10	0.22	<0.10	0.10	7979214
Nitrate + Nitrite (N)	mg/L	<0.10	0.26	<0.10	0.10	7979214

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C2B9361
Report Date: 2022/05/11

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

ELEMENTS BY ATOMIC SPECTROSCOPY (GROUND WATER)

Bureau Veritas ID		SNJ838	SNJ839		SNJ840		SNJ841	SNJ842		
Sampling Date		2022/05/02 10:40	2022/05/02 10:45		2022/05/02 09:00		2022/05/02 10:30	2022/05/02 08:10		
COC Number		874211-01-01	874211-01-01		874211-01-01		874211-01-01	874211-01-01		
	UNITS	TW-1	TW-2	QC Batch	TW-5	QC Batch	TW-10	TW-11D	RDL	QC Batch
Metals										
Dissolved Calcium (Ca)	mg/L	130	150	7979327	98	7982340	110	90	0.05	7982462
Dissolved Iron (Fe)	mg/L	<0.02	<0.02	7979327	<0.02	7982340	<0.02	<0.02	0.02	7982462
Dissolved Magnesium (Mg)	mg/L	50	36	7979327	54	7982340	65	40	0.05	7982462
Dissolved Potassium (K)	mg/L	<1	<1	7979327	2	7982340	2	<1	1	7982462
Dissolved Sodium (Na)	mg/L	7.7	18	7979327	20	7982340	38	3.7	0.5	7982462

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas ID		SNJ842	SNJ843		SNJ844		SNJ845		
Sampling Date		2022/05/02 08:10	2022/05/02 09:50		2022/05/02 09:40		2022/05/02 09:30		
COC Number		874211-01-01	874211-01-01		874211-01-01		874211-01-01		
	UNITS	TW-11D Lab-Dup	TW-12	QC Batch	TW-13	QC Batch	TW-14	RDL	QC Batch
Metals									
Dissolved Calcium (Ca)	mg/L	96	100	7982462	130	7982340	110	0.05	7982462
Dissolved Iron (Fe)	mg/L	<0.02	<0.02	7982462	<0.02	7982340	<0.02	0.02	7982462
Dissolved Magnesium (Mg)	mg/L	42	80	7982462	64	7982340	65	0.05	7982462
Dissolved Potassium (K)	mg/L	<1	<1	7982462	<1	7982340	<1	1	7982462
Dissolved Sodium (Na)	mg/L	3.9	48	7982462	32	7982340	19	0.5	7982462

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas ID		SNJ846		SNJ847		SNJ899		SNJ900		
Sampling Date		2022/05/02 08:00		2022/05/02 09:10		2022/05/02 10:00		2022/05/02 10:20		
COC Number		874211-01-01		874211-01-01		874211-02-01		874211-02-01		
	UNITS	TW-15	QC Batch	TW-16	QC Batch	TW-17	QC Batch	TW-22	RDL	QC Batch
Metals										
Dissolved Calcium (Ca)	mg/L	84	7979327	65	7982340	53	7979327	67	0.05	7982340
Dissolved Iron (Fe)	mg/L	<0.02	7979327	<0.02	7982340	<0.02	7979327	<0.02	0.02	7982340
Dissolved Magnesium (Mg)	mg/L	29	7979327	47	7982340	30	7979327	29	0.05	7982340
Dissolved Potassium (K)	mg/L	<1	7979327	1	7982340	1	7979327	<1	1	7982340
Dissolved Sodium (Na)	mg/L	2.4	7979327	20	7982340	12	7979327	6.9	0.5	7982340

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (GROUND WATER)

Bureau Veritas ID		SNJ901	SNJ902	SNJ903	SNJ904		SNJ905		
Sampling Date		2022/05/02 10:10	2022/05/02 08:50	2022/05/02 08:40	2022/05/02 08:45		2022/05/02 08:30		
COC Number		874211-02-01	874211-02-01	874211-02-01	874211-02-01		874211-02-01		
	UNITS	TW-23	TW-24	TW-25S	TW-25D	QC Batch	TW-26	RDL	QC Batch
Metals									
Dissolved Calcium (Ca)	mg/L	68	55	47	52	7982340	51	0.05	7982462
Dissolved Iron (Fe)	mg/L	<0.02	<0.02	<0.02	<0.02	7982340	<0.02	0.02	7982462
Dissolved Magnesium (Mg)	mg/L	29	62	53	27	7982340	41	0.05	7982462
Dissolved Potassium (K)	mg/L	1	2	2	1	7982340	2	1	7982462
Dissolved Sodium (Na)	mg/L	6.2	50	39	20	7982340	31	0.5	7982462

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas ID		SNJ906		SNJ907		
Sampling Date		2022/05/02 08:20		2022/05/02 08:05		
COC Number		874211-02-01		874211-02-01		
	UNITS	TW-27	QC Batch	TW-15D	RDL	QC Batch
Metals						
Dissolved Calcium (Ca)	mg/L	120	7979327	80	0.05	7982340
Dissolved Iron (Fe)	mg/L	<0.02	7979327	<0.02	0.02	7982340
Dissolved Magnesium (Mg)	mg/L	67	7979327	33	0.05	7982340
Dissolved Potassium (K)	mg/L	9	7979327	<1	1	7982340
Dissolved Sodium (Na)	mg/L	40	7979327	4.7	0.5	7982340

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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TEST SUMMARY

Bureau Veritas ID: SNJ838 **Collected:** 2022/05/02
Sample ID: TW-1 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7979129	N/A	2022/05/07	Surinder Rai
Chloride by Automated Colourimetry	KONE	7978802	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7979144	N/A	2022/05/07	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/06	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7979327	2022/05/05	2022/05/06	Medhat Nasr
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979226	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7979140	2022/05/05	2022/05/07	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7978805	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ839 **Collected:** 2022/05/02
Sample ID: TW-2 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/06	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7979327	2022/05/05	2022/05/06	Medhat Nasr
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ840 **Collected:** 2022/05/02
Sample ID: TW-5 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai

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TEST SUMMARY

Bureau Veritas ID: SNJ840
Sample ID: TW-5
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ841
Sample ID: TW-10
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/09	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982462	2022/05/07	2022/05/09	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ842
Sample ID: TW-11D
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/09	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982462	2022/05/07	2022/05/09	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

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TEST SUMMARY

Bureau Veritas ID: SNJ842 Dup
Sample ID: TW-11D
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Lab Filtered Metals Analysis by ICP	ICP	7982462	2022/05/07	2022/05/09	Suban Kanapathippllai

Bureau Veritas ID: SNJ843
Sample ID: TW-12
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/09	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982462	2022/05/07	2022/05/09	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ844
Sample ID: TW-13
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ845
Sample ID: TW-14
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif

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TEST SUMMARY

Bureau Veritas ID: SNJ845
Sample ID: TW-14
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/09	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982462	2022/05/07	2022/05/09	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ846
Sample ID: TW-15
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/06	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7979327	2022/05/05	2022/05/06	Medhat Nasr
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ847
Sample ID: TW-16
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan

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TEST SUMMARY

Bureau Veritas ID: SNJ847 **Collected:** 2022/05/02
Sample ID: TW-16 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ847 Dup **Collected:** 2022/05/02
Sample ID: TW-16 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal

Bureau Veritas ID: SNJ899 **Collected:** 2022/05/02
Sample ID: TW-17 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/06	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7979327	2022/05/05	2022/05/06	Medhat Nasr
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ900 **Collected:** 2022/05/02
Sample ID: TW-22 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

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TEST SUMMARY

Bureau Veritas ID: SNJ901 **Collected:** 2022/05/02
Sample ID: TW-23 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/10	Rajni Tyagi

Bureau Veritas ID: SNJ902 **Collected:** 2022/05/02
Sample ID: TW-24 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ902 Dup **Collected:** 2022/05/02
Sample ID: TW-24 **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan

Bureau Veritas ID: SNJ903 **Collected:** 2022/05/02
Sample ID: TW-25S **Shipped:**
Matrix: Ground Water **Received:** 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif

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TEST SUMMARY

Bureau Veritas ID: SNJ903
Sample ID: TW-25S
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ903 Dup
Sample ID: TW-25S
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ904
Sample ID: TW-25D
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979201	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979226	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979198	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/10	Rajni Tyagi

Bureau Veritas ID: SNJ905
Sample ID: TW-26
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai

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TEST SUMMARY

Bureau Veritas ID: SNJ905
Sample ID: TW-26
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/09	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982462	2022/05/07	2022/05/09	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ906
Sample ID: TW-27
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/06	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7979327	2022/05/05	2022/05/06	Medhat Nasr
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

Bureau Veritas ID: SNJ907
Sample ID: TW-15D
Matrix: Ground Water

Collected: 2022/05/02
Shipped:
Received: 2022/05/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7978741	N/A	2022/05/06	Surinder Rai
Chloride by Automated Colourimetry	KONE	7979183	N/A	2022/05/06	Raiq Kashif
Conductivity	AT	7978754	N/A	2022/05/06	Surinder Rai
Hardness (calculated as CaCO3)		7975062	N/A	2022/05/11	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7982340	2022/05/07	2022/05/10	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7981280	N/A	2022/05/10	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7979214	N/A	2022/05/06	Samuel Law
Organic Nitrogen	CALC	7975798	N/A	2022/05/11	Automated Statchk
pH	AT	7978756	2022/05/05	2022/05/06	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7979175	N/A	2022/05/11	Chandra Nandlal
Total Dissolved Solids	BAL	7980729	2022/05/06	2022/05/09	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7980300	2022/05/06	2022/05/09	Rajni Tyagi

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GENERAL COMMENTS

Sample SNJ842 [TW-11D] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample SNJ845 [TW-14] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7978741	Alkalinity (Total as CaCO3)	2022/05/06			95	85 - 115	<1.0	mg/L	1.5	20		
7978754	Conductivity	2022/05/06			101	85 - 115	<1.0	umho/cm	0.10	25		
7978756	pH	2022/05/06			102	98 - 103			0.47	N/A		
7978802	Dissolved Chloride (Cl-)	2022/05/06	112	80 - 120	104	80 - 120	<1.0	mg/L	0.85	20		
7978805	Dissolved Sulphate (SO4)	2022/05/11	NC	75 - 125	99	80 - 120	<1.0	mg/L	1.2	20		
7979129	Alkalinity (Total as CaCO3)	2022/05/06			93	85 - 115	<1.0	mg/L	1.2	20		
7979140	pH	2022/05/06			102	98 - 103			1.2	N/A		
7979144	Conductivity	2022/05/06			100	85 - 115	<1.0	umho/cm	0	25		
7979175	Dissolved Sulphate (SO4)	2022/05/11	283 (1)	75 - 125	97	80 - 120	<1.0	mg/L	18	20		
7979183	Dissolved Chloride (Cl-)	2022/05/06	NC	80 - 120	107	80 - 120	<1.0	mg/L	0.52	20		
7979198	Dissolved Sulphate (SO4)	2022/05/11	NC	75 - 125	97	80 - 120	<1.0	mg/L	3.7	20		
7979201	Dissolved Chloride (Cl-)	2022/05/06	110	80 - 120	104	80 - 120	<1.0	mg/L	1.5	20		
7979214	Nitrate (N)	2022/05/06	NC	80 - 120	99	80 - 120	<0.10	mg/L	0.033	20		
7979214	Nitrite (N)	2022/05/06	97	80 - 120	101	80 - 120	<0.010	mg/L	NC	20		
7979226	Nitrate (N)	2022/05/06	NC	80 - 120	101	80 - 120	<0.10	mg/L	0.34	20		
7979226	Nitrite (N)	2022/05/06	98	80 - 120	102	80 - 120	<0.010	mg/L	0.12	20		
7979327	Dissolved Calcium (Ca)	2022/05/06	98	80 - 120	101	80 - 120	<0.05	mg/L				
7979327	Dissolved Iron (Fe)	2022/05/06	103	80 - 120	101	80 - 120	<0.02	mg/L	NC	25		
7979327	Dissolved Magnesium (Mg)	2022/05/06	99	80 - 120	97	80 - 120	<0.05	mg/L				
7979327	Dissolved Potassium (K)	2022/05/06	102	80 - 120	102	80 - 120	<1	mg/L				
7979327	Dissolved Sodium (Na)	2022/05/06	103	80 - 120	103	80 - 120	<0.5	mg/L	2.6	25		
7980300	Total Kjeldahl Nitrogen (TKN)	2022/05/09	105	80 - 120	99	80 - 120	<0.10	mg/L	NC	20	102	80 - 120
7980729	Total Dissolved Solids	2022/05/09					<10	mg/L	0	25	97	90 - 110
7981280	Total Ammonia-N	2022/05/10	93	75 - 125	99	80 - 120	<0.050	mg/L	NC	20		
7982340	Dissolved Calcium (Ca)	2022/05/10	NC	80 - 120	100	80 - 120	<0.05	mg/L	3.9	25		
7982340	Dissolved Iron (Fe)	2022/05/10	95	80 - 120	98	80 - 120	<0.02	mg/L				
7982340	Dissolved Magnesium (Mg)	2022/05/10	NC	80 - 120	96	80 - 120	<0.05	mg/L	4.1	25		
7982340	Dissolved Potassium (K)	2022/05/10	96	80 - 120	99	80 - 120	<1	mg/L				
7982340	Dissolved Sodium (Na)	2022/05/10	NC	80 - 120	99	80 - 120	<0.5	mg/L	2.7	25		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7982462	Dissolved Calcium (Ca)	2022/05/09	NC	80 - 120	93	80 - 120	<0.05	mg/L	5.8	25		
7982462	Dissolved Iron (Fe)	2022/05/09	102	80 - 120	101	80 - 120	<0.02	mg/L	NC	25		
7982462	Dissolved Magnesium (Mg)	2022/05/09	NC	80 - 120	93	80 - 120	<0.05	mg/L	5.6	25		
7982462	Dissolved Potassium (K)	2022/05/09	100	80 - 120	95	80 - 120	<1	mg/L	NC	25		
7982462	Dissolved Sodium (Na)	2022/05/09	104	80 - 120	100	80 - 120	<0.5	mg/L	5.3	25		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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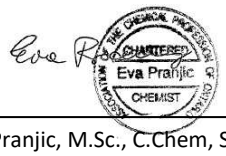
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

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Your Project #: Arran (M1174)
Your C.O.C. #: 900142-01-01

Attention: Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2022/11/17
Report #: R7391860
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2T2017
Received: 2022/10/07, 09:22

Sample Matrix: Water
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	7	N/A	2022/10/14	CAM SOP-00448	SM 23 2320 B m
Alkalinity	3	N/A	2022/10/15	CAM SOP-00448	SM 23 2320 B m
Carbonaceous BOD	3	2022/10/08	2022/10/13	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	9	N/A	2022/10/14	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	1	N/A	2022/10/19	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	3	N/A	2022/10/14	CAM SOP-00416	SM 23 5220 D m
Conductivity	7	N/A	2022/10/14	CAM SOP-00414	SM 23 2510 m
Conductivity	3	N/A	2022/10/15	CAM SOP-00414	SM 23 2510 m
Hardness (calculated as CaCO3)	7	N/A	2022/10/14	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	3	N/A	2022/10/17	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	3	2022/10/13	2022/10/13	CAM SOP-00453	EPA 7470A m
Lab Filtered Metals Analysis by ICP	7	2022/10/12	2022/10/14	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS	2	N/A	2022/10/13	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2022/10/14	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	10	N/A	2022/10/17	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (1)	1	N/A	2022/10/14	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate & Nitrite as Nitrogen in Water (1)	8	N/A	2022/10/15	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate & Nitrite as Nitrogen in Water (1)	1	N/A	2022/10/17	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Organic Nitrogen	7	N/A	2022/10/18	Auto Calc.	
pH	7	2022/10/12	2022/10/14	CAM SOP-00413	SM 4500H+ B m
pH	2	2022/10/13	2022/10/15	CAM SOP-00413	SM 4500H+ B m
pH	1	2022/10/14	2022/10/15	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	3	N/A	2022/10/14	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	10	N/A	2022/10/17	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	10	2022/10/12	2022/10/13	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	3	2022/10/12	2022/10/13	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	7	2022/10/12	2022/10/14	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	3	2022/10/12	2022/10/14	CAM SOP-00407	SM 23 4500-P I

Your Project #: Arran (M1174)
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CANADA N4K 2J3

Report Date: 2022/11/17
Report #: R7391860
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2T2017
Received: 2022/10/07, 09:22

Sample Matrix: Water
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Low Level Total Suspended Solids	3	2022/10/12	2022/10/13	CAM SOP-00428	SM 23 2540D m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

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Your Project #: Arran (M1174)
Your C.O.C. #: 900142-01-01

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Report Date: 2022/11/17
Report #: R7391860
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2T2017
Received: 2022/10/07, 09:22

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bureauveritas.com
Phone# (905)817-5765

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Bureau Veritas Job #: C2T2017
Report Date: 2022/11/17

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TYK429			TYK429			TYK430		
Sampling Date		2022/10/06			2022/10/06			2022/10/06		
COC Number		900142-01-01			900142-01-01			900142-01-01		
	UNITS	TW-1	RDL	QC Batch	TW-1 Lab-Dup	RDL	QC Batch	TW-10	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	530	1.0	8271103				530	1.0	8271103
Total Organic Nitrogen	mg/L	0.35	0.10	8271933				0.99	0.10	8271933
Inorganics										
Total Ammonia-N	mg/L	0.86	0.050	8280677				2.7	0.050	8280677
Conductivity	umho/cm	920	1.0	8281671				1100	1.0	8279765
Total Dissolved Solids	mg/L	585	10	8278411	565	10	8278411	670	10	8278411
Total Kjeldahl Nitrogen (TKN)	mg/L	1.2	0.10	8279523				3.7	0.10	8279523
pH	pH	7.90		8281665				7.90		8279760
Dissolved Sulphate (SO4)	mg/L	15	1.0	8280765				26	1.0	8279734
Alkalinity (Total as CaCO3)	mg/L	480	1.0	8281669				400	1.0	8279770
Dissolved Chloride (Cl-)	mg/L	42	1.0	8280753				130	2.0	8279724
Nitrite (N)	mg/L	0.322	0.010	8279836				0.934	0.010	8279163
Nitrate (N)	mg/L	0.46	0.10	8279836				0.82	0.10	8279163
Nitrate + Nitrite (N)	mg/L	0.78	0.10	8279836				1.75	0.10	8279163

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2T2017
Report Date: 2022/11/17

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TYK431			TYK431			TYK432		
Sampling Date		2022/10/06			2022/10/06			2022/10/06		
COC Number		900142-01-01			900142-01-01			900142-01-01		
	UNITS	TW-12	RDL	QC Batch	TW-12 Lab-Dup	RDL	QC Batch	TW-15	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	590	1.0	8271103				350	1.0	8271103
Total Organic Nitrogen	mg/L	0.45	0.10	8271933				0.40	0.10	8271933
Inorganics										
Total Ammonia-N	mg/L	0.34	0.050	8280677				0.17	0.050	8280677
Conductivity	umho/cm	1100	1.0	8279765				590	1.0	8279765
Total Dissolved Solids	mg/L	565	10	8278411				330	10	8278411
Total Kjeldahl Nitrogen (TKN)	mg/L	0.79	0.10	8279523				0.57	0.10	8279523
pH	pH	7.81		8279760				8.16		8279760
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	8279734	<1.0	1.0	8279734	23	1.0	8279734
Alkalinity (Total as CaCO3)	mg/L	590	1.0	8279770				340	1.0	8279770
Dissolved Chloride (Cl-)	mg/L	65	1.0	8279724	66	1.0	8279724	2.9	1.0	8279724
Nitrite (N)	mg/L	<0.010	0.010	8279163				<0.010	0.010	8279163
Nitrate (N)	mg/L	<0.10	0.10	8279163				0.21	0.10	8279163
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8279163				0.21	0.10	8279163

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2T2017
Report Date: 2022/11/17

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TYK433		TYK434		TYK435		
Sampling Date		2022/10/06		2022/10/06		2022/10/06		
COC Number		900142-01-01		900142-01-01		900142-01-01		
	UNITS	TW-24	QC Batch	TW-25S	QC Batch	TW-27	RDL	QC Batch
Calculated Parameters								
Hardness (CaCO3)	mg/L	380	8271103	330	8271103	540	1.0	8271103
Total Organic Nitrogen	mg/L	0.11	8271933	<0.10	8271933	0.30	0.10	8271933
Inorganics								
Total Ammonia-N	mg/L	<0.050	8280677	<0.050	8280677	0.54	0.050	8280677
Conductivity	umho/cm	810	8281671	690	8279765	1100	1.0	8279765
Total Dissolved Solids	mg/L	430	8278411	360	8278411	590	10	8278411
Total Kjeldahl Nitrogen (TKN)	mg/L	0.11	8279523	<0.10	8279523	0.83	0.10	8279523
pH	pH	8.01	8281665	8.21	8279760	7.99		8279760
Dissolved Sulphate (SO4)	mg/L	72	8282166	57	8279734	43	1.0	8279734
Alkalinity (Total as CaCO3)	mg/L	410	8281669	360	8279770	500	1.0	8279770
Dissolved Chloride (Cl-)	mg/L	1.3	8282163	1.9	8279724	65	1.0	8279724
Nitrite (N)	mg/L	<0.010	8281621	<0.010	8279163	0.059	0.010	8279836
Nitrate (N)	mg/L	<0.10	8281621	<0.10	8279163	0.53	0.10	8279836
Nitrate + Nitrite (N)	mg/L	<0.10	8281621	<0.10	8279163	0.59	0.10	8279836

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C2T2017
Report Date: 2022/11/17

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TYK436			TYK436			TYK437		
Sampling Date		2022/10/06			2022/10/06			2022/10/06		
COC Number		900142-01-01			900142-01-01			900142-01-01		
	UNITS	SW-1	RDL	QC Batch	SW-1 Lab-Dup	RDL	QC Batch	SW-7	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	280	1.0	8271103				380	1.0	8271103
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	8280677				<0.050	0.050	8280677
Total Carbonaceous BOD	mg/L	<2	2	8273369				<2	2	8273369
Total Chemical Oxygen Demand (COD)	mg/L	31	4.0	8279568	34	4.0	8279568	140	4.0	8279568
Conductivity	umho/cm	550	1.0	8279765				1000	1.0	8279765
Total Dissolved Solids	mg/L	360	10	8278411				765	10	8278411
Total Kjeldahl Nitrogen (TKN)	mg/L	0.44	0.10	8279499				0.97	0.10	8279499
pH	pH	8.31		8279760				7.97		8279760
Phenols-4AAP	mg/L	<0.0010	0.0010	8284388				<0.0010	0.0010	8284388
Total Phosphorus	mg/L	0.034	0.004	8279549				0.049	0.004	8279549
Total Suspended Solids	mg/L	6	1	8279286				54	1	8279286
Dissolved Sulphate (SO4)	mg/L	37	1.0	8279734				310	1.0	8279734
Alkalinity (Total as CaCO3)	mg/L	280	1.0	8279770				160	1.0	8279770
Dissolved Chloride (Cl-)	mg/L	7.9	1.0	8279724				55	1.0	8279724
Nitrite (N)	mg/L	0.011	0.010	8279163				<0.010	0.010	8279163
Nitrate (N)	mg/L	0.21	0.10	8279163				<0.10	0.10	8279163
Nitrate + Nitrite (N)	mg/L	0.22	0.10	8279163				<0.10	0.10	8279163

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QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2T2017
Report Date: 2022/11/17

GM BluePlan Engineering Limited
Client Project #: Arran (M1174)
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TYK438		
Sampling Date		2022/10/06		
COC Number		900142-01-01		
	UNITS	SW-10	RDL	QC Batch
Calculated Parameters				
Hardness (CaCO3)	mg/L	380	1.0	8271103
Inorganics				
Total Ammonia-N	mg/L	<0.050	0.050	8280677
Total Carbonaceous BOD	mg/L	3	2	8273369
Total Chemical Oxygen Demand (COD)	mg/L	67	4.0	8279568
Conductivity	umho/cm	1000	1.0	8283626
Total Dissolved Solids	mg/L	785	10	8278411
Total Kjeldahl Nitrogen (TKN)	mg/L	0.89	0.10	8279499
pH	pH	7.95		8283614
Phenols-4AAP	mg/L	<0.0010	0.0010	8284388
Total Phosphorus	mg/L	0.37	0.004	8279549
Total Suspended Solids	mg/L	320	5	8279286
Dissolved Sulphate (SO4)	mg/L	310	1.0	8284663
Alkalinity (Total as CaCO3)	mg/L	160	1.0	8283632
Dissolved Chloride (Cl-)	mg/L	56	1.0	8284652
Nitrite (N)	mg/L	0.016	0.010	8273780
Nitrate (N)	mg/L	<0.10	0.10	8273780
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8273780

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		TYK429	TYK430	TYK431	TYK432	TYK433	TYK434		
Sampling Date		2022/10/06	2022/10/06	2022/10/06	2022/10/06	2022/10/06	2022/10/06		
COC Number		900142-01-01	900142-01-01	900142-01-01	900142-01-01	900142-01-01	900142-01-01		
	UNITS	TW-1	TW-10	TW-12	TW-15	TW-24	TW-25S	RDL	QC Batch
Metals									
Dissolved Calcium (Ca)	mg/L	130	110	100	83	52	44	0.05	8279641
Dissolved Iron (Fe)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	8279641
Dissolved Magnesium (Mg)	mg/L	52	65	80	35	62	53	0.05	8279641
Dissolved Potassium (K)	mg/L	1	2	<1	<1	2	2	1	8279641
Dissolved Sodium (Na)	mg/L	11	41	45	4.2	48	39	0.5	8279641

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas ID		TYK434	TYK435			TYK436		TYK437		
Sampling Date		2022/10/06	2022/10/06			2022/10/06		2022/10/06		
COC Number		900142-01-01	900142-01-01			900142-01-01		900142-01-01		
	UNITS	TW-25S Lab-Dup	TW-27	RDL	QC Batch	SW-1	QC Batch	SW-7	RDL	QC Batch
Metals										
Dissolved Calcium (Ca)	mg/L	44	100	0.05	8279641					
Dissolved Iron (Fe)	mg/L	<0.02	<0.02	0.02	8279641					
Dissolved Magnesium (Mg)	mg/L	53	69	0.05	8279641					
Mercury (Hg)	mg/L					<0.00010	8280843	<0.00010	0.00010	8280557
Dissolved Potassium (K)	mg/L	2	11	1	8279641					
Dissolved Sodium (Na)	mg/L	39	40	0.5	8279641					
Total Arsenic (As)	ug/L					<1.0	8280518	1.0	1.0	8280518
Total Barium (Ba)	ug/L					18	8280518	48	2.0	8280518
Total Boron (B)	ug/L					20	8280518	420	10	8280518
Total Cadmium (Cd)	ug/L					<0.090	8280518	<0.090	0.090	8280518
Total Calcium (Ca)	ug/L					80000	8280518	120000	200	8280518
Total Chromium (Cr)	ug/L					<5.0	8280518	<5.0	5.0	8280518
Total Cobalt (Co)	ug/L					<0.50	8280518	0.50	0.50	8280518
Total Copper (Cu)	ug/L					<0.90	8280518	4.5	0.90	8280518
Total Iron (Fe)	ug/L					320	8280518	330	100	8280518
Total Lead (Pb)	ug/L					<0.50	8280518	<0.50	0.50	8280518
Total Magnesium (Mg)	ug/L					26000	8280518	32000	50	8280518
Total Potassium (K)	ug/L					930	8280518	25000	200	8280518
Total Sodium (Na)	ug/L					4600	8280518	44000	100	8280518
Total Zinc (Zn)	ug/L					<5.0	8280518	<5.0	5.0	8280518

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QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		TYK438		
Sampling Date		2022/10/06		
COC Number		900142-01-01		
	UNITS	**SW-10**	**RDL**	**QC Batch**
Metals				
Mercury (Hg)	mg/L	<0.00010	0.00010	8280843
Total Arsenic (As)	ug/L	7.5	1.0	8280518
Total Barium (Ba)	ug/L	170	2.0	8280518
Total Boron (B)	ug/L	410	10	8280518
Total Cadmium (Cd)	ug/L	0.19	0.090	8280518
Total Calcium (Ca)	ug/L	270000	200	8280518
Total Chromium (Cr)	ug/L	32	5.0	8280518
Total Cobalt (Co)	ug/L	16	0.50	8280518
Total Copper (Cu)	ug/L	32	0.90	8280518
Total Iron (Fe)	ug/L	33000	100	8280518
Total Lead (Pb)	ug/L	12	0.50	8280518
Total Magnesium (Mg)	ug/L	86000	50	8280518
Total Potassium (K)	ug/L	27000	200	8280518
Total Sodium (Na)	ug/L	41000	100	8280518
Total Zinc (Zn)	ug/L	75	5.0	8280518

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QC Batch = Quality Control Batch

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TEST SUMMARY

Bureau Veritas ID: TYK429
Sample ID: TW-1
Matrix: Water

Collected: 2022/10/06
Shipped:
Received: 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8281669	N/A	2022/10/15	Kien Tran
Chloride by Automated Colourimetry	KONE	8280753	N/A	2022/10/14	Alina Dobreanu
Conductivity	AT	8281671	N/A	2022/10/15	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279836	N/A	2022/10/15	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8281665	2022/10/13	2022/10/15	Kien Tran
Sulphate by Automated Colourimetry	KONE	8280765	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK429 Dup
Sample ID: TW-1
Matrix: Water

Collected: 2022/10/06
Shipped:
Received: 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford

Bureau Veritas ID: TYK430
Sample ID: TW-10
Matrix: Water

Collected: 2022/10/06
Shipped:
Received: 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279163	N/A	2022/10/15	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK431
Sample ID: TW-12
Matrix: Water

Collected: 2022/10/06
Shipped:
Received: 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu

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TEST SUMMARY

Bureau Veritas ID: TYK431 **Collected:** 2022/10/06
Sample ID: TW-12 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279163	N/A	2022/10/15	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK431 Dup **Collected:** 2022/10/06
Sample ID: TW-12 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu

Bureau Veritas ID: TYK432 **Collected:** 2022/10/06
Sample ID: TW-15 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279163	N/A	2022/10/15	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK433 **Collected:** 2022/10/06
Sample ID: TW-24 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8281669	N/A	2022/10/15	Kien Tran
Chloride by Automated Colourimetry	KONE	8282163	N/A	2022/10/14	Alina Dobreanu
Conductivity	AT	8281671	N/A	2022/10/15	Kien Tran

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TEST SUMMARY

Bureau Veritas ID: TYK433 **Collected:** 2022/10/06
Sample ID: TW-24 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8281621	N/A	2022/10/14	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8281665	2022/10/13	2022/10/15	Kien Tran
Sulphate by Automated Colourimetry	KONE	8282166	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK434 **Collected:** 2022/10/06
Sample ID: TW-25S **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279163	N/A	2022/10/15	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK434 Dup **Collected:** 2022/10/06
Sample ID: TW-25S **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr

Bureau Veritas ID: TYK435 **Collected:** 2022/10/06
Sample ID: TW-27 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/14	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	8279641	2022/10/12	2022/10/14	Medhat Nasr

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TEST SUMMARY

Bureau Veritas ID: TYK435 **Collected:** 2022/10/06
Sample ID: TW-27 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279836	N/A	2022/10/15	Chandra Nandlal
Organic Nitrogen	CALC	8271933	N/A	2022/10/18	Automated Statchk
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279523	2022/10/12	2022/10/14	Massarat Jan

Bureau Veritas ID: TYK436 **Collected:** 2022/10/06
Sample ID: SW-1 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Carbonaceous BOD	DO	8273369	2022/10/08	2022/10/13	Nusrat Naz
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Chemical Oxygen Demand	SPEC	8279568	N/A	2022/10/14	Nimarta Singh
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/17	Automated Statchk
Mercury in Water by CVAA	CV/AA	8280843	2022/10/13	2022/10/13	Japneet Gill
Total Metals Analysis by ICPMS	ICP/MS	8280518	N/A	2022/10/13	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279163	N/A	2022/10/15	Chandra Nandlal
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Phenols (4AAP)	TECH/PHEN	8284388	N/A	2022/10/14	Mandeep Kaur
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279499	2022/10/12	2022/10/13	Rajni Tyagi
Total Phosphorus (Colourimetric)	SKAL/P	8279549	2022/10/12	2022/10/14	Sachi Patel
Low Level Total Suspended Solids	BAL	8279286	2022/10/12	2022/10/13	Arthel Dzumford

Bureau Veritas ID: TYK436 Dup **Collected:** 2022/10/06
Sample ID: SW-1 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	8279568	N/A	2022/10/14	Nimarta Singh

Bureau Veritas ID: TYK437 **Collected:** 2022/10/06
Sample ID: SW-7 **Shipped:**
Matrix: Water **Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8279770	N/A	2022/10/14	Kien Tran
Carbonaceous BOD	DO	8273369	2022/10/08	2022/10/13	Nusrat Naz

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TEST SUMMARY

Bureau Veritas ID: TYK437
Sample ID: SW-7
Matrix: Water

Collected: 2022/10/06
Shipped:
Received: 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	8279724	N/A	2022/10/14	Alina Dobreanu
Chemical Oxygen Demand	SPEC	8279568	N/A	2022/10/14	Nimarta Singh
Conductivity	AT	8279765	N/A	2022/10/14	Kien Tran
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/17	Automated Statchk
Mercury in Water by CVAA	CV/AA	8280557	2022/10/13	2022/10/13	Japneet Gill
Total Metals Analysis by ICPMS	ICP/MS	8280518	N/A	2022/10/13	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8279163	N/A	2022/10/15	Chandra Nandlal
pH	AT	8279760	2022/10/12	2022/10/14	Kien Tran
Phenols (4AAP)	TECH/PHEN	8284388	N/A	2022/10/14	Mandeep Kaur
Sulphate by Automated Colourimetry	KONE	8279734	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279499	2022/10/12	2022/10/13	Rajni Tyagi
Total Phosphorus (Colourimetric)	SKAL/P	8279549	2022/10/12	2022/10/14	Sachi Patel
Low Level Total Suspended Solids	BAL	8279286	2022/10/12	2022/10/13	Arthel Dzumford

Bureau Veritas ID: TYK438
Sample ID: SW-10
Matrix: Water

Collected: 2022/10/06
Shipped:
Received: 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8283632	N/A	2022/10/15	Yogesh Patel
Carbonaceous BOD	DO	8273369	2022/10/08	2022/10/13	Nusrat Naz
Chloride by Automated Colourimetry	KONE	8284652	N/A	2022/10/19	Alina Dobreanu
Chemical Oxygen Demand	SPEC	8279568	N/A	2022/10/14	Nimarta Singh
Conductivity	AT	8283626	N/A	2022/10/15	Yogesh Patel
Hardness (calculated as CaCO3)		8271103	N/A	2022/10/17	Automated Statchk
Mercury in Water by CVAA	CV/AA	8280843	2022/10/13	2022/10/13	Japneet Gill
Total Metals Analysis by ICPMS	ICP/MS	8280518	N/A	2022/10/14	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8280677	N/A	2022/10/17	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8273780	N/A	2022/10/17	Chandra Nandlal
pH	AT	8283614	2022/10/14	2022/10/15	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	8284388	N/A	2022/10/14	Mandeep Kaur
Sulphate by Automated Colourimetry	KONE	8284663	N/A	2022/10/17	Alina Dobreanu
Total Dissolved Solids	BAL	8278411	2022/10/12	2022/10/13	Arthel Dzumford
Total Kjeldahl Nitrogen in Water	SKAL	8279499	2022/10/12	2022/10/13	Rajni Tyagi
Total Phosphorus (Colourimetric)	SKAL/P	8279549	2022/10/12	2022/10/14	Sachi Patel
Low Level Total Suspended Solids	BAL	8279286	2022/10/12	2022/10/13	Arthel Dzumford

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8273369	Total Carbonaceous BOD	2022/10/13					<2	mg/L	NC	30	103	85 - 115
8273780	Nitrate (N)	2022/10/17	101	80 - 120	96	80 - 120	<0.10	mg/L	5.1	20		
8273780	Nitrite (N)	2022/10/17	102	80 - 120	102	80 - 120	<0.010	mg/L	14	20		
8278411	Total Dissolved Solids	2022/10/13					<10	mg/L	3.5	20	100	90 - 110
8279163	Nitrate (N)	2022/10/15	NC	80 - 120	108	80 - 120	<0.10	mg/L	5.0	20		
8279163	Nitrite (N)	2022/10/15	NC	80 - 120	111	80 - 120	<0.010	mg/L	6.7	20		
8279286	Total Suspended Solids	2022/10/13					<1	mg/L	14	20	95	85 - 115
8279499	Total Kjeldahl Nitrogen (TKN)	2022/10/13	98	80 - 120	105	80 - 120	<0.10	mg/L	NC	20	94	80 - 120
8279523	Total Kjeldahl Nitrogen (TKN)	2022/10/14	97	80 - 120	109	80 - 120	<0.10	mg/L	NC	20	92	80 - 120
8279549	Total Phosphorus	2022/10/14	111	80 - 120	111	80 - 120	<0.004	mg/L	1.4	20	110	80 - 120
8279568	Total Chemical Oxygen Demand (COD)	2022/10/14	106	80 - 120	101	80 - 120	<4.0	mg/L	8.0	20		
8279641	Dissolved Calcium (Ca)	2022/10/14	NC	80 - 120	102	80 - 120	<0.05	mg/L	0.92	25		
8279641	Dissolved Iron (Fe)	2022/10/14	101	80 - 120	102	80 - 120	<0.02	mg/L	NC	25		
8279641	Dissolved Magnesium (Mg)	2022/10/14	NC	80 - 120	102	80 - 120	<0.05	mg/L	0.76	25		
8279641	Dissolved Potassium (K)	2022/10/14	101	80 - 120	102	80 - 120	<1	mg/L	0.92	25		
8279641	Dissolved Sodium (Na)	2022/10/14	NC	80 - 120	101	80 - 120	<0.5	mg/L	0.88	25		
8279724	Dissolved Chloride (Cl-)	2022/10/14	NC	80 - 120	106	80 - 120	<1.0	mg/L	1.0	20		
8279734	Dissolved Sulphate (SO4)	2022/10/17	120	75 - 125	103	80 - 120	<1.0	mg/L	NC	20		
8279760	pH	2022/10/14			101	98 - 103			0.81	N/A		
8279765	Conductivity	2022/10/14			100	85 - 115	1.0, RDL=1.0	umho/cm	0.83	25		
8279770	Alkalinity (Total as CaCO3)	2022/10/14			97	85 - 115	<1.0	mg/L	1.7	20		
8279836	Nitrate (N)	2022/10/15	105	80 - 120	105	80 - 120	<0.10	mg/L	NC	20		
8279836	Nitrite (N)	2022/10/15	109	80 - 120	112	80 - 120	<0.010	mg/L	NC	20		
8280518	Total Arsenic (As)	2022/10/13	101	80 - 120	99	80 - 120	<1.0	ug/L				
8280518	Total Barium (Ba)	2022/10/13	95	80 - 120	94	80 - 120	<2.0	ug/L				
8280518	Total Boron (B)	2022/10/13	94	80 - 120	95	80 - 120	<10	ug/L				
8280518	Total Cadmium (Cd)	2022/10/13	99	80 - 120	100	80 - 120	<0.090	ug/L				
8280518	Total Calcium (Ca)	2022/10/13	NC	80 - 120	96	80 - 120	<200	ug/L				
8280518	Total Chromium (Cr)	2022/10/13	96	80 - 120	96	80 - 120	<5.0	ug/L				
8280518	Total Cobalt (Co)	2022/10/13	95	80 - 120	96	80 - 120	<0.50	ug/L				

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8280518	Total Copper (Cu)	2022/10/13	97	80 - 120	97	80 - 120	<0.90	ug/L				
8280518	Total Iron (Fe)	2022/10/13	96	80 - 120	97	80 - 120	<100	ug/L				
8280518	Total Lead (Pb)	2022/10/13	96	80 - 120	96	80 - 120	<0.50	ug/L				
8280518	Total Magnesium (Mg)	2022/10/13	NC	80 - 120	94	80 - 120	<50	ug/L				
8280518	Total Potassium (K)	2022/10/13	97	80 - 120	96	80 - 120	<200	ug/L				
8280518	Total Sodium (Na)	2022/10/13	NC	80 - 120	96	80 - 120	<100	ug/L				
8280518	Total Zinc (Zn)	2022/10/13	98	80 - 120	104	80 - 120	<5.0	ug/L				
8280557	Mercury (Hg)	2022/10/13	98	75 - 125	102	80 - 120	<0.00010	mg/L	1.9	20		
8280677	Total Ammonia-N	2022/10/18	100	75 - 125	101	80 - 120	<0.050	mg/L	NC	20		
8280753	Dissolved Chloride (Cl-)	2022/10/14	NC	80 - 120	104	80 - 120	<1.0	mg/L	NC	20		
8280765	Dissolved Sulphate (SO4)	2022/10/17	125	75 - 125	104	80 - 120	<1.0	mg/L	2.2	20		
8280843	Mercury (Hg)	2022/10/13	98	75 - 125	99	80 - 120	<0.00010	mg/L	NC	20		
8281621	Nitrate (N)	2022/10/14	97	80 - 120	101	80 - 120	<0.10	mg/L	NC	20		
8281621	Nitrite (N)	2022/10/14	104	80 - 120	107	80 - 120	<0.010	mg/L	NC	20		
8281665	pH	2022/10/15			101	98 - 103			0.77	N/A		
8281669	Alkalinity (Total as CaCO3)	2022/10/15			97	85 - 115	<1.0	mg/L	2.2	20		
8281671	Conductivity	2022/10/15			101	85 - 115	<1.0	umho/cm	1.3	25		
8282163	Dissolved Chloride (Cl-)	2022/10/14	NC	80 - 120	105	80 - 120	<1.0	mg/L	5.8	20		
8282166	Dissolved Sulphate (SO4)	2022/10/17	NC	75 - 125	104	80 - 120	<1.0	mg/L	0.28	20		
8283614	pH	2022/10/15			101	98 - 103			0.29	N/A		
8283626	Conductivity	2022/10/15			100	85 - 115	<1.0	umho/cm	1.3	25		
8283632	Alkalinity (Total as CaCO3)	2022/10/15			95	85 - 115	<1.0	mg/L	0.19	20		
8284388	Phenols-4AAP	2022/10/14	101	80 - 120	101	80 - 120	<0.0010	mg/L	NC	20		
8284652	Dissolved Chloride (Cl-)	2022/10/19	NC	80 - 120	104	80 - 120	<1.0	mg/L	1.0	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8284663	Dissolved Sulphate (SO4)	2022/10/17	NC	75 - 125	105	80 - 120	<1.0	mg/L	4.1	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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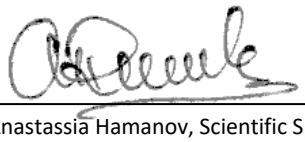
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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