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Irish Industrial Explosives, Clonagh, Enfield, Co. Kildare

December 2022

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LIMITATIONS

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EXECUTIVE SUMMARY

Verdé Environmental Consultants Ltd. (VEC) was commissioned by Irish Industrial Explosives Ltd (IIE) to undertake environmental monitoring and sampling of groundwater and surface water as part of the site's ongoing quarterly IPC compliance monitoring, which has been undertaken at the site since 1995. Licenced explosive manufacture has not taken place on-site since 2003. This report presents the results from the Q3 monitoring round conducted in September 2022.

The contaminants of potential concern (COPC) associated with the site include Nitrotoluene compounds 2,4 and 2,6 Dinitrotoluene (DNT), 2 Nitrotoluene (ortho–nitrotoluene / o-NT) and Ammoniacal Nitrogen (NH4-N). These contaminants originate from historical activities associated with explosives manufacture. Nitrotoluene compounds are no longer stored or used on-site.

A detailed quantitative risk assessment (DQRA) was completed in 2015 to establish remedial target concentrations (RTCs) for soil and groundwater at the site. Remediation works were completed at the site in 2015 and 2018 to remove contaminated soils from the main identified contamination areas and install sumps to assist in the pump & recovery of perched groundwater.

Detailed follow-on investigations have been completed subsequently and while the vast majority of areas have been appropriately validated, localised residual contamination has been detected during monitoring on site. Findings from the Q3 September 2022 monitoring event are summarised as follows:

- Nitrotoluene contamination is being detected in shallow groundwater wells specifically GW9a and lower levels (in some cases below Laboratory LOD) in GW8a.
- The detailed soil and perched groundwater site investigation in the Garage and Store Building areas in 2021 and 2022 detected localised hotspots of nitrotoluenes and ammonia beneath these buildings. This contamination is related to historical site activities and is present in low permeability subsoils beneath the buildings and in close proximity to the east of the Store Building.
- Concentrations of Ammoniacal Nitrogen which exceeded the RTC for their respective area were detected in shallow perched groundwater wells GW2, GW3, GW6, GW7, GW9a and GW10. These wells are located close to the Ammonium Nitrate Storage Pad and western drain with the exception of GW10.
- Bedrock wells (GW14, GW15 and GW16) confirm that bedrock groundwater quality is good with no observable impact from historical site activities.
- Surface water monitoring results for upstream monitoring locations (SW1-3) show elevated and variable nitrogen-based compounds (Ammonia, Nitrates and Nitrites). This is consistent with historical trends and these results may be related to agricultural, residential and/or forestry land uses directly upstream. SW4 has detected elevated concentrations of Ammonia throughout monitoring and concentrations improve downgradient of this location (SW5). These consistent findings appear to be seasonal and correlate with rainfall. Concentrations increase during the rainy seasons and decrease during drier periods.
- Nitrotoluene concentrations that were detected in SW4 at fluctuating concentrations historically were undetected in the quarterly monitoring rounds to date (Q1 to Q3) in 2021 but prior to 2021 nitrotoluenes have been detected. Levels have been undetected for four consecutive years in SW5 with very low level of 2,6-DNT in Q3 2022. Additional sampling of two other western drain samples taken opposite the garage area (WD1 & WD2) commenced in 2021 which did not detect any nitrotoluenes in the surface watercourse, however since Q2 2022 nitrotoluenes have been detected. The Pump Outlet sample also detected nitrotoluenes in Q3 2022, but the results show a decrease compared to Q2 2022 samples.

In conclusion, the Q3 2022 results for monitoring locations outside the site activity area (Store, Garage Building and Ammonium Nitrate Store Pad) show groundwater in the bedrock and surface water quality is largely stable. Nitrotoluene and ammoniacal nitrogen compounds are being detected at elevated concentrations in shallow groundwater adjacent to the Store and Garage Buildings.

With regard to Nitrotoluenes, the shallow perched groundwater wells GW7 and GW8a have remained steady or decreased with time. GW9a continues to report elevated concentrations of Nitrotoluene in this localised area of shallow perched groundwater.

Recent site investigations in 2021 and 2022 beneath the Garage and Store Buildings identified localised contamination hotspots of nitrotoluenes and ammonia beneath these buildings and to the east of the Store Building.

	EPA Contaminated Land & Groundwater Risk Assessment Methodology	Report Reference	Report Date	Status
	STAGE 1: SITE CHARACTERISATION & ASSESSMENT			
1.1	**PRELIMINARY SITE ASSESSMENT**	Tier I Unregulated Waste Report, VEC Interpretative Report, Sediment Survey, VEC	18/01/2013 19/02/2014	Final
1.2	**DETAILED SITE ASSESSMENT**	Trial Pit SI Q1-2015 Monitoring Q2-2015 Monitoring	26/08/2014 30/03/2015 14/07/2015	Final Final Final
1.3	**QUANTITATIVE RISK ASSESSMENT**	Quantitative Risk Assessment Report	17/03/2015	Final
	STAGE 2: CORRECTIVE ACTION FEASIBILITY & DESIGN			
2.1	**OUTLINE CORRECTIVE ACTION STRATEGY**	Corrective Action Feasibility Report	24/04/2015	Final
2.2	**FEASIBILITY STUDY & OUTLINE DESIGN**			
2.3	**DETAILED DESIGN**			
2.4	**FINAL STRATEGY & IMPLEMENTATION PLAN**			
	STAGE 3: CORRECTIVE ACTION IMPLEMENTATION & AFTERCARE			
3.1	**ENABLING WORKS**			
3.2	**CORRECTIVE ACTION IMPLEMENTATION & VERIFICATION**	Corrective Action Implementation and Verification Report	27/11/2015	Final
3.3	**AFTERCARE**	2015 – Q4 Monitoring 2016: Q1-Q4 Monitoring 2017: Soil & Sediment Analysis Western Drain 2017 Q1-Q4 Monitoring 2018 Q1-Q4 Monitoring 2019 Q1-Q4 Monitoring 2020 Q1 – Q4 Monitoring 2021 Q1 – Q4 Monitoring 2022 Q1 – Q3 Monitoring	Dec 2015 Feb – Nov 2016 May 2017 Mar – Nov 2017 Mar – Dec 2018 March – Dec 2019 Jan – Dec 2020 March – Dec 2021 April – Sept 2022	Final Final Final Final Final Final Final Final Final

1. INTRODUCTION

1.1. PROJECT CONTRACTUAL BASIS

Verdé Environmental Consultants Ltd (VEC) was commissioned by Irish Industrial Explosives Ltd (IIE) to undertake a quarterly groundwater and surface water monitoring and sediment sampling as part of the site's Integrated Pollution Control (IPC) licence compliance monitoring requirement (Licence Ref P0055-01).

1.2. PERSONNEL INVOLVED

Site works were completed by Ronan Doyle and Rebecca Bradford who are both qualified and experienced in environmental monitoring. Reporting was completed by Rebecca Bradford an Environmental Scientist with four years' experience in environmental consultancy and Kevin Cleary, Verde's Operations Director with over 20 years' experience in environmental consultancy and management. Laboratory analysis was carried-out by UKAS Accredited Element Materials Technology Environmental Laboratory in the UK.

2. SITE INFORMATION

2.1. SITE DESCRIPTION

The IIE site is located in the townland of Clonagh, near Enfield in rural County Kildare (see Figure 1). The wider site covers a total area of circa 50 hectares with the "working" site (red boundary Figure 2) as delineated by security fencing, taking up c. 40 hectares.

The IIE site is located in a broadly flat area in the upper reaches of the River Blackwater Valley where the ground level varies between 70 and 80 m above sea level. The region is characterised by the vast areas given over to the commercial development of peat bogs that are characteristic of this part of the Irish midlands. The IIE site is bounded on all sides by agricultural land which is used for light grazing. The wider area is a mixture of agricultural, one-off and low-density residential housing and cutaway bog (see Figure 1).

2.2. SITE ACTIVITIES

The manufacturing site consists of a number of segregated storage and production units. The majority of these areas are surrounded by constructed embankments. Additional activities on the site include administration, vehicle maintenance and wash-down, and controlled burning of explosives packaging wastes. Normal working hours at the facility are between 08:00 – 16:30 Monday to Thursday, 08:00 – 16:00 Friday. Twenty-four-hour security is maintained at the site by the Gardaí and Irish Army.

The facility has been manufacturing explosive products since 1967 and was granted an IPC Licence by the EPA in 1996. During 2013 the EPA informed IIE that they consider the site's licence to have lapsed and they will no longer be enforcing it with the exception of the Residuals Management Plan to include ongoing monitoring.

2.3. ENVIRONMENTAL SETTING

Table 2.1 provides a summary of the environmental setting for the site.

Table 2.1 - Site Physical Setting

Feature	Details and comments
Topography	The regional topography in the vicinity of the site is northwards towards the River Blackwater
Geology	Overburden: From previous site investigations the natural overburden encountered is summarised as follows: • TOPSOIL with a thickness of c. 0.2m • PEAT with a thickness c. 0.6m • CLAY with a thickness of c.10m. The Geological Survey of Ireland (GSI) database describes the soils at the site as consisting of limestone tills with peat deposits to the east of the site. There are also sand and gravel deposits recorded immediately to the east of the site. Previous site investigations have shown that above the bedrock there are two distinct clay layers separated by a thin layer of sand and gravel (total overburden thickness c. 14m). The bottom clay layer is taken to be of glacial origin and to consist of 'boulder clay', i.e. gravel and boulders set in a dense clay matrix. The sand and gravel layer represent an outwash period at the end of the glacial period while the overlying clays were most likely deposited in either an alluvial setting or a lake environment. The sand and gravel layer that is positioned between the two clay layers is taken as representing the extent of the Local Important gravel aquifer (Lg) beneath the IIE site.

	Regional Geology: The Geology of Kildare and Wicklow shows this part of County Kildare underlain by Calp Limestone. Specifically, the IIE site is shown as being underlain by rocks belonging to the Toberculleen and Lucan Formations both of which can be considered as facies within the very extensive Calp unit which is characterised by basinal limestones. Both the Toberculleen and Lucan Formations consist of dark grey argillaceous limestones and shale. Site investigations to date show that the site is underlain by limestone bedrock at a depth of about 14m BGL to the north of the site and 15m in the centre of the site. When reduced to meters above ordnance datum it appears that the bedrock surface is relatively level across the site.
Hydrogeology	Regional Hydrogeology The local groundwater body (GWB) is the Trim GWB and the limestone bedrock is classified as a Locally Important (Lm) aquifer, which is moderately productive. Confined conditions have been reported from a number of third-party investigations. The sand and gravel layer as described previously is sufficiently extensive to also be classified as a Locally Important Aquifer (Lg) by the GSI. Groundwater flow in the bedrock is largely controlled by and flows towards the River Blackwater, i.e. north/north-eastwards from the IIE site, with groundwater contributing significantly to the base flow in the river. The region can be considered as a groundwater discharge area with an upward groundwater flow component in addition to the normal horizontal flow component. Local Hydrogeology From recent site investigations a number water bearing strata with different properties have been identified on-site. This is discussed in greater detail later in the report.
	Vulnerability: According to the GSI Vulnerability Guidelines, the aquifer vulnerability rating for the site is classified as High. Site investigations have shown that a vulnerability rating of Moderate to Low is more appropriate for the site.

	Groundwater Users: Kildare County Council have a series of supply wells installed within the Limestone bedrock aquifer which are located to the north of the site as shown on Figure 1 together with the outline of the source protection zones around each of the abstractions. The well field is not in production at present and Kildare County Council has indicated they plan to start production in the coming years. It can be seen from Figure 1 that the IIE site lies partly within the Inner Source Protection Zone (SI) for the Dysart abstraction and partly within the wider Outer Source Protection Zone (SO) for the well field generally. The SI is defined by the GSI as the 100-day travel time from any point below the water table to the source. The SO essentially defines the overall catchment of the pumping well(s). Figure 1 also shows the location of domestic wells that are recorded on the GSI online data base. The number of domestic wells reflects the rural and agricultural character of the area.
	Groundwater Flow: The Horizontal groundwater flow direction in the clays is in a north-northeast direction towards the River Blackwater. Groundwater flow investigations on-site confirm that there is an upward flow gradient. The area is considered to be a groundwater discharge as groundwater endeavours to make its way to the receiving waters of the River Blackwater and River Boyne. Localised groundwater flow in the perched groundwater in the shallow subsoils is seen to flow locally towards the western drain.
Hydrology/Ecology	Surface Water Courses/ Abstractions The site lies in the Boyne catchment (HA07), and within the sub-catchment of the Upper Blackwater River, which is the main hydrogeological feature in the wider area. The Upper Blackwater flows in a roughly north-westerly direction approximately 2km from the eastern boundary of the site (see Figure 1). A number of surface water ditches and small streams are present in the vicinity of the site as illustrated on Figure 1. Surface water flow is northwards towards the River Blackwater. The western drain which bounds the area of contaminated land and converges with other drains from adjacent agricultural land as it flows north where it discharges to the Blackwater within the townland of Dysart c.2km to the northeast of the site.
	Designated Areas: The Upper Blackwater has no conservation designations; however, it is listed as a brown trout fishery by the South-eastern Regional Fisheries Board. The Upper Blackwater joins the River Blackwater at Rourestown c. 20km to the northwest of the site. The River Blackwater is designated as an SAC (site code 002299). The river basin management plan states that the Blackwater Upper catchment has good overall status but has been classified at risk due primarily to morphological threats (e.g. channelisation, impoundments and drainage works). Donadea Wood pNHA is located c. 5km southeast of the site and the Royal Canal pNHA is located c.4.6km to the north of the site boundary.

2.4. SITE MONITORING INFRASTRUCTURE

Groundwater Wells and Sumps

There are currently 53 no. groundwater wells and 6 no. Sumps installed on-site (see Figure 2 attached to this report and Figure 2 in the Site Investigation 2022 Report[1]). The number of monitoring wells was increased over a number of years commencing during Q3 – 2014 initially having 15 no. groundwater wells and since then four redundant wells have been decommissioned and two new wells drilled:

- GW17 was decommissioned in June 2015 as it was suspected to be acting as a migration pathway for downward migration of contamination;
- GW1 and GW8 were removed during excavations in September 2015 as they were installed into shallow soils requiring excavation;
- GW9 was found to have limited recharge capacity and was functioning poorly and so is no longer in use. Two new wells were installed at the site in November 2016 to replace GW8 and GW9. These wells (identified as GW8a and GW9a) are located in the garage/store area beside the western drain in close proximity to the wells they replaced.

The number of monitoring wells increased during Q3 2021 with 21 no groundwater wells installed as part of a site investigation to delineate the residual contamination beneath the Garage and Store buildings part of the IIE site. An additional 17 no groundwater wells were installed in Q1 2022 as part of a further phase site investigation to further delineate the residual hotspot of nitrotoluene and ammonia contamination identified in the vicinity of this part of the site.

All monitoring wells in use at the site are summarised below:

- 12 no. wells installed within the overburden geology (GW2 to GW13); these include GW8a and GW9a which are located in close proximity to now redundant wells GW8 and GW9.
- 3 no. wells installed within limestone bedrock (GW14, GW15 and GW16).
- 4 no. sumps installed in the overburden geology (Sumps 8a, 8b, 9a and 9b).

Routine quarterly monitoring includes sampling of the following wells:

- Shallow overburden wells - GW7, GW8a, GW9a
- Bedrock wells - GW14, GW15, GW16

In Q2 2018, interception trenches were excavated and backfilled with clean drainage stone and sumps were installed to allow for the recovery of any contaminated water between the garage area and western drain (in the area between GW8a and GW9b). This system will further protect the western drain and aims to accelerate the removal and degradation of residual contamination in localised perched groundwater. Sumps had been installed previously on site in the same general area on site, but older sumps have been re-organised and improved. The sumps currently installed are labelled Sump 8a, Sump 8b, Sump 9a and Sump 9b. Sumps have been monitored during recent monitoring events to provide further information on residual contamination that may be in the vicinity of the garage area and will be presented in a separate report.

Groundwater Wells from August 2021 Site Investigation

In August 2021 a detailed site investigation was undertaken in the Garage and Store Building area to further investigation the potential for contamination beneath these building on-site, as a result of historical site activities. A total of 34 No. shallow boreholes were drilled with 21 No. shallow groundwater monitoring wells installed in order to obtain soil and perched groundwater samples in these areas. The findings are presented in a Verde report titled "Contamination Assessment to Support Remediation and Licence Surrender, Irish Industrial

[1] Contamination Assessment to Support Remediation and Licence Surrender, Irish Industrial Explosives Clonagh Enfield Co. Kildare, Verde Environmental Consultants, July 2022

Explosives, Clonagh, Enfield, Co. Kildare, November 2021" The findings identified localised hotspots of nitrotoluene compounds and ammonia in the shallow soil and perched groundwater in this area. These shallow wells were not sampling at part of this quarterly investigation.

Groundwater Wells from February 2022 Site Investigation

In February 2022 a further phase of investigation works was undertaken to further delineate the residual hotspot of nitrotoluene and ammonia contamination encountered during the 2021 site investigation. A total of 17 No. shallow boreholes were drilled with groundwater monitoring well installations. The findings are presented in a Verde report titled "Contamination Assessment to Support Remediation and Licence Surrender, Irish Industrial Explosives, Clonagh, Enfield, Co. Kildare, July 2022". The findings identified localised hotspots of nitrotoluene compounds and ammonia in the shallow soil and perched groundwater in this area and to the east of the Store Building. These shallow wells were not sampling at part of this quarterly investigation.

Surface Water Sampling Locations

There are eight surface water sampling locations associated with the site; locations SW1 to SW5 as illustrated on Figure 2 and an additional off-site monitoring location SW6 is illustrated on Figure 1. In Q3 2021 additional surface water samples were recovered from the western drain (WD1 and WD2) which runs along the western perimeter of the site, as presented in Figure 2. These additional surface water samples from the western drain have been sampled since August 2021 as part of the site investigation of the Garage and Store Building areas and are included in the quarterly sampling.

3. SITE CONTAMINATION HISTORY

3.1. CONTAMINANTS OF POTENTIAL CONCERN

The contaminants of potential concern (COPC) associated with historical activities at the site include Nitro – aromatic compounds 2,4 and 2,6 Dinitrotoluene and 2 Nitrotoluene (Ortho-nitrotoluene, o-NT) are the primary COPCs. Ammoniacal Nitrogen is also included as a COPC, originating from ammonium nitrate and activities associated with explosives manufacture. Details of COPCs are presented in Table 3.1 below.

Table 3.1- Contaminants of Potential Concern

Contaminant of Concern	Details
Dinitrotoluene (2,4-DNT and 2,6-DNT)	Used in the historical manufacture of explosives on-site (25/75% o-NT/DNT mix) and known to be present in the source areas.
2-Nitrotoluene (o-NT)	Neither DNT nor o-NT are listed as 'hazardous substances' by the EPA.
Ammoniacal Nitrogen	Originating from ammonium nitrate and potentially in smaller amounts from the decomposition of organic materials within the made ground. On-going monitoring also indicates surface water influences from forestry and agricultural activities nearby. Not listed as a hazardous substance.

Biodegradation Information

2,4-DNT and o-NT are known to biodegrade rapidly in acclimated surface waters, generally exhibiting a half-life of less than 1 month; significantly faster rates are reported for effluent bioreactor systems – not relevant for this site) (Verschueren, 2001; Montgomery, 2007; Spain et al., 2000).

Laboratory microcosms prepared using soil and groundwater from explosive-contaminated sites have been reported to give 2,4-DNT and o-NT half-lives in the order of 70 days (Spain et al., 2000). Although attenuation has been demonstrated in groundwater on a field-scale (Spain et al., 2000; Wikstrom et al. 2000); in-situ biodegradation rate data does not appear to be available. Modelling completed by Verdé as part of the DQRA in 2015 applied a low rate of biodegradation for 2,4-DNT and o-NT with half-life of 365 days (1 year), based upon a circa 5x safety factor applied to the laboratory-measured rate.

2,6-DNT is also vulnerable to degradation, but the rate is usually slower than that of the other organic contaminants of concern (Verschueren, 2001; Montgomery, 2007; Spain et al., 2000). In 2015 DQRA modelling, Verdé applied a lower rate of biodegradation for 2,6-DNT with a half-life of 730 days (2 years).

For Ammonia, evidence from scientific literature has confirmed that anaerobic ammonia oxidation ("anammox") can play a significant role in the attenuation of ammonia plumes in groundwater, including those arising from septic tank discharges and landfills (Clark et al., 2008; Moore et al., 2011; Robertson et al., 2012). Consequently, ammonia attenuation considers the combined effects of aerobic and anaerobic ammonia oxidation within a groundwater body. On this basis, Verdé adopted a biodegradation half-life range of 1642 days, which is consistent with the guidance for aerobic aquifer conditions presented in Environment Agency (2003).

3.2. CONTAMINATED LAND AREAS

Contaminated Land Remediation

Historical contamination in soils was delineated during detailed investigations completed between 2014 and

2015. A DQRA was completed in 2015 to quantify risks associated with the COPCs and develop site specific remedial target concentrations (RTCs) for both soil and groundwater. Remediation works were completed between August and October 2015 during which soils were excavated in order to achieve the soil remedial target concentrations. Validation sampling completed as part of remediation works indicated that soil RTCs were achieved for all main areas with only minor localised residues of contaminants remaining. Full details of remediation works and validation sampling are recorded in Verdé Report *Ref 50559: Corrective Action Implementation and Verification Report* (27th November 2015). The report concluded that soils may be excluded as a contamination source.

Further site work was undertaken at the facility.

- November 2016 involved the installation of two new monitoring wells in the garage/store area to replace two wells damaged as part of the above-mentioned remediation works (GW8a replaced GW8 and GW9a replaced GW9).

- Based on findings from the monitoring well installation, it was decided to extend the scope of works to include a determination of potential soil and sediment contamination in the vicinity of the two newly installed wells. These additional works were conducted in January 2017 and findings presented in Verdé Letter Report *Ref 50990: Soil and Sediment Analysis - Western Dain Area, Irish Industrial Explosives* (31st May 2017). The report concluded that all soil and sediment samples returned with nitrotoluene concentrations less than the laboratory limits of detection and less than the remedial target concentrations for the area with the exception of one sample taken from well GW9a.

- In January 2018 a site investigation was conducted by Verde in relation to the residual, localised soil contamination found in an area beside the Garage and Store Buildings at the western side of the site. Nine boreholes were drilled as part of the investigation which included the installation of three as shallow groundwater monitoring wells. Results of the investigation concluded that soil contamination is isolated in localised zones beside the Store building (at depths of 2.0-3.0mBGL) and in one location beside the Garage Building (at a depth of 2.5-3.0mBGL).

- June 2018, further remediation works were conducted by Verde which involved the installation of slit trenches (approx. 25m long each) in the area west of Store and Garage and the Installation of collection Sumps within each trench to capture water for appropriate recovery on site. Q3 2018 showed high concentration of Nitrotoluene compounds (COPCs) were detected in two of the shallow groundwater wells (GW8a & GW9a). All remaining wells sampled recorded Nitrotoluene concentrations below the laboratory limits of detection (LOD) and their respective RTCs. However elevated levels of NH4-N were detected in groundwater wells GW7, GW8a and GW9a.

- December 2018 concluded that groundwater and surface water quality is largely stable at the site and is improving in the shallow overburden monitoring wells GW8a and GW9a. However, a high concentration of nitrotoluene compounds remained detected in GW9a.

- In August 2021, Verde completed a further phase of investigation works the purpose of which was to further delineate the residual contamination across this part of the site under existing buildings, and to validate certain areas of the wider site which had not been investigated or sampled previously. Three distinct hotspots of 2,4 DNT, 2,6 DNT and of o-NT contamination were identified in shallow soils of 0-3m within the Garage and Store buildings. One distinct hotspot of NH4 contamination was identified in shallow soils in close proximity to boreholes BH522 and BH526 within the Garage building.

- In August 2021 a soil assessment consisting of samples from trial pits and hand augers were taken in areas where historical or current activities were undertaken, as part of a site wide assessment of soils. All soil results from the site-wide investigation with respect to COC were below applicable Commercial Standards.

- The groundwater sampling in September 2021 of the new shallow monitoring wells identified two distinct hotspots of 2,4-DNT and 2,6-DNT in shallow groundwater in the Store building and Garage building. Two distinct hotspots of o-NT contamination were identified in shallow groundwater in an area of the Store and Garage buildings. Two distinct hotspots of ammonia contamination were identified in shallow groundwater within the Garage and Store buildings.

- Additionally in February 2022, Verde completed a further phase of investigation works to further delineate the residual contamination across this part of the site under existing buildings. In summary with regards to the soil samples, three distinct hotspots of 2,4-DNT and 2,6-DNT were identified in shallow soils in both the Garage and Store buildings. Three distinct o-NT contamination hotspots were identified in shallow soils in both the Garage building and two hotspots in the Store building. Two distinct hotspots of Ammonia were identified in the shallow soils in the Garage building and in close proximity to the east of the Store building.

- In relation to the groundwater samples from the February 2022 site investigation, two distinct hotspots of 2,4-DNT and 2,6-DNT were identified within both the Store and Garage building. Three hotspots of o-NT were identified in both the Garage and Store building. Two distinct hotspots of Ammonia were identified within the Garage building and to the east of the Store building.

Sediment

A sediment survey conducted in September 2016 identified localised contamination at one of six sampled locations within the western drain. Trace concentrations of Dinitrotoluene were recorded in one sediment sample within the western drain (at location SD4) however levels were significantly lower than those observed in a 2013 survey. As no further Dinitrotoluene contamination was observed in any other sediment samples it was concluded that these trace levels are confined to a localised zone adjacent to an area of previous remediation works only.

A sediment survey conducted in January 2017 saw 2,4 and 2,6 DNT concentrations in the western drain below the laboratory limits of detection, further supporting this conclusion. Some low-level semi volatile organic compounds were present in a sediment sample further downstream (at location SD10). Further sediment sampling undertaken in the western drain on-site in January 2020 showed most of the western drain samples remain clean apart from nitrotoluene detected in two sediment samples taken in localised areas opposite the Garage Building.

Landfill Gas

Landfill gas monitoring was completed in 2014 on site and results indicated that there are trace amounts of Methane (1.4%) in GW7. All other locations reported gas within normal ranges. Landfill gas has not been measured since Q3 2014 due to the low levels detected.

3.3. WATER CONTAMINATION

3.3.1 Surface Water and Shallow Perched Groundwater

Three of the surface water monitoring locations, SW1, SW2 and SW3 are considered to be upstream of site activities (see Figure 2). It is noted that SW2 and SW3 are on a separate drainage ditch which flows around the site in a north easterly direction whereas SW1 is located on the western drainage ditch on the western boundary of the site. SW 4, 5 and 6 are downstream of site activities.

Analytical results have shown historical contamination in shallow perched groundwater and also in the on-site surface water (Western Drain) monitoring network. Elevated concentrations of 2,4 DNT and 2,6 DNT isomers, ortho-nitrotoluene (o-NT) and ammonium ions have been identified historically in both the surface water and

shallow groundwater. DNT concentrations have decreased since completion of the remediation works carried out in 2015. No nitrotoluenes were detected in the western drain in 2021 to date.

Ammoniacal nitrogen has remained elevated in localised monitoring wells (GW7, GW8a and GW9a) since February 2015 and has steadily shown a downward trend with time. Surface water results indicate that ammoniacal nitrogen is elevated in upstream monitoring locations suggesting that concentrations are dominated by local off-site agricultural or forestry activities.

3.3.2 Bedrock Groundwater

Bedrock groundwater wells (GW14, GW15 and GW16) remain free from contamination of Nitrotoluenes and Ammoniacal nitrogen.

4. CONCEPTUAL SITE MODEL

Based upon the evaluation of the previous phases of site investigations, a Conceptual Site Model (CSM) has been developed with respect to the protection of the water environment. The CSM summarises our current understanding of the surface and sub-surface features, the potential contaminant sources, transport pathways and receptors in order to assess potential contaminant linkages.

4.1. GROUND CONDITIONS

Made Ground

During previous ground investigations at the site, made ground soils encountered within the area to the north of the Ammonium Nitrate (AN) Storage Pad consisted of natural peat and clay, which contained waste of a number of types to varying degrees. The depth of made ground varied from 0.5 to 1.5mBGL. Made ground soils between the garage/store buildings and the Western Drain were limited in extent but, where encountered these comprised gravelly sand to a maximum depth of 0.8mBGL. Some minor waste material (plastics and rubble, burned ash etc.) are located in made ground on the northern end of the AN Pad.

Remediation works completed at the site between August and October 2015 involved the excavation of source contamination from localised areas on-site. Any soils removed during excavation works were reinstated with clean soils or fill of similar permeability.

Superficial Deposits

Based on previous site investigations, underlying the made ground is cohesive soil. Typically, these strata comprise two distinct units of clay with a total thickness of about 14m.

Between the clay units is a thin bed of sand and gravel, which most probably represents an outwash. This granular horizon is taken as representing the extent of the Locally Important gravel aquifer (Lg) present beneath the site and surrounding region.

Underlying ground conditions within the northern AN Pad area consisted of localised areas of shallow but apparently discontinuous granular deposits (e.g. GW2, GW6, and GW14) to between about 0.5-1.2mBGL, and were underlain by soft becoming firm sandy gravelly clay. An appreciable thickness of silt was also recorded within the north-eastern part of the site, this being interbedded with clay, sand and gravel to in excess of 10mBGL. Similar ground conditions were encountered along the alignment of the Western Drain where interbedded horizons of clay and sand/gravel were proven to about 3.0mBGL in the boreholes. Further underlying sand and gravel deposits to a depth of between about 4.5-5.5mBGL were recorded with some localised variation in depths.

Bedrock

The underlying solid geology comprises Calp limestone from a depth of about 14mBGL in the north of the site and 15mBGL in the centre of the site. During previous drilling of GW14 and GW17, a layer of weathered limestone and shale was encountered from approximately 11mBGL. This layer contained significant groundwater which recharged quickly and was relatively clear following a brief period of airlifting. Competent bedrock was encountered in GW14 at 15mBGL. When the casing was progressed into the rock the water in the weathered zone was sealed, with the rock being dry to a depth of about 26mBGL. At 26mBGL some water was encountered, which was associated with a fracture which contained brown/orange (tertiary) clay.

4.2. GROUNDWATER AND FLOW CHARACTERISTICS

Overburden sediments are continuous across the site and were noted to be largely dry with the exception of some localised perched groundwater present as seepages. Shallow perched groundwater flow on the basis of levels recorded where water was present is westerly, this being within the granular strata. Little information is given in the GSI data for groundwater in the overlying superficial deposits in the GWB and how this interacts with the underlying limestone formations. It is envisaged, however, that the main recharge process for limestone will be diffuse, this occurring in the large lowland areas of the GWB. Groundwater flow will be from local areas

of high recharge (e.g. areas of thin subsoil in upland areas) to surface water bodies overlying the aquifer, such as the Upper Blackwater River and River Boyne.

Available information with respect to the Trim GWB suggests that the nature of groundwater flow in the limestone aquifer is largely determined by the degree of karstification, fracturing and the purity of the formation. In highly karstified limestone, flow will be concentrated into conduits, which may draw water deep underground; where the limestone is less karstified the flow system will be shallower and more diffuse. Whilst ground investigation data for the deeper limestone unit is limited, no karst features were encountered.

The overlying Quaternary deposits at the site comprise limestone till and other cohesive soils from subsequent deposition events. Overall these have been proven to be about 14m in thickness.

As stated in the GWB information, such deposits can act as a confining layer and thus produce artesian supplies. Overall, the region may be considered to be a groundwater discharge area with an upward groundwater flow component. Furthermore, the complexity of distribution, both vertically and horizontally, of the overburden deposits will result in localised variations in groundwater flow patterns as the groundwater in both the limestone bedrock and the superficial soils discharges into the local river system.

Given the presence of cohesive soils, lateral migration of shallow groundwater will effectively be restricted to the thin horizons of granular soils that are interbedded with the near(er) surface stratum, and, potentially, to more granular layers of the on-site made ground deposits.

The August & September 2021 and February 2022 detailed site investigation in the Garage and Store Building areas showed perched groundwater in the area is westerly towards the western drain. The perched groundwater is seen to be contained locally around the collection pumps when pumping which are minimising the potential for contaminated perched groundwater to enter the western drain receptor.

4.3. CONTAMINATION SOURCES

During 2015 remediation works at the site (Aug-Oct 2015) source contamination was excavated from the two main risk areas:

- Area A: Former drum storage and wash areas to rear and side of garage and store; and
- Area B: Drum hotspot area at the N/E Corner of the AN Pad.

Full details of remediation work and Validation sampling are recorded in Verdé Report Ref 50559: Corrective Action Implementation and Verification Report dated 27th November 2015.

Some minor waste material (plastics and rubble, burned ash etc.) are located on the northern end of the AN Pad but previous trial pit investigations and risk assessments concluded that this material poses an insignificant risk.

The bedrock groundwater beneath the site is of good quality and results to date do not indicate any significant contamination historically.

Sediment surveys undertaken in the western drain between September 2016 and January 2020 identified only localised contamination in two locations within the western drain across an approximate 200m distance.

The recent August and September 2021 and February 2022 detailed site investigation works within and around the Garage and Store Buildings on-site identified three distinct hotspots of 2,4-DNT and 2,6-DNT in shallow soils in both the Garage and Store buildings. Three distinct o-NT contamination hotspots were identified in shallow soils in both the Garage building and two hotspots in the Store building. Two distinct hotspots of Ammonia were identified in the shallow soils in the Garage building and in close proximity to the east of the Store building. In relation to the groundwater samples, two distinct hotspots of 2,4-DNT and 2,6-DNT were identified within both the Store and Garage building. Three hotspots of o-NT were identified in both the Garage and Store building. Two distinct hotspots of Ammonia were identified within the Garage building and to the east of the Store building.

4.4. CONTAMINATION PATHWAYS

Considering that source contamination has been excavated during remediation works, the primary contamination pathways are now removed. However, in order to understand pollutant linkages associated with the site due to historical activities and conditions the following pathways are discussed:

- Infiltration into the ground with subsequent lateral migration of dissolved-phase contamination within the shallow perched groundwater body.
- Lateral migration of shallow contamination in made ground in close proximity to the western drain.
- Direct release from sediments.

Groundwater flow direction in the bedrock is to the north-northeast and within the overburden soils perched groundwater migration is towards the west to the western drain, as illustrated in Figure 3 attached. The western drain flows in a northerly direction.

The site is underlain by limestone till and other cohesive soils proven to be approx. 10-14m in thickness which is expected to act as a confining layer. Considering the above and following the removal of source contamination areas, pathways involving infiltration into the ground are deemed to be minimal. Also, one of the groundwater wells GW17 was decommissioned in June 2015 as it was suspected that it may act as a pathway for downward migration.

4.5. CONTAMINATION RECEPTORS

On the basis of historic data and ground investigation findings that the water environmental receptors of concern comprise:

- The wider sand and gravel groundwater body (classified as a Locally Important (Lg) aquifer); and
- The Western Drain.

5. RISK ASSESSMENT

5.1. QUANTITATIVE ASSESSMENT SUMMARY

A Generic Quantitative Risk Assessment (GQRA) was carried-out and was submitted to the EPA in March 2013 and following more detailed site investigations, a Detailed Quantitative Risk Assessment (DQRA) was completed in March 2015 according to guidance published by the UK Environment Agency's Remedial Targets Methodology (RTM) for assessing risk to the water environment and having regard for and reported having regard to the 2013 EPA guidance on "Management of Contaminated Land & Groundwater at EPA Licenced Sites".

The DQRA demonstrated that there is low risk to groundwater from the identified source areas due to the low permeability boulder clay that underlies the site. The clay which underlies the site is thick (circa 10m) and of low permeability (K=6.7 x 10^{-10} m/s) affords good protection to the underlying bedrock. Furthermore, it has been confirmed that the bedrock groundwater has an upwards head gradient, which will effectively prevent the downward migration of contaminants.

The DQRA assessed the risk to the western drain due to the now former soil contamination at the site and calculated site-specific remedial target concentrations (RTCs) for source contamination in soils and groundwater to impact upon two theoretical compliance points;

- Western Drain receptor, located on-site around 5m from Area A former contaminated soils and
- Western drain points 250m from the Ammonium Nitrate (AN) Pad former source Area B;

The risk assessment modelling developed separate RTCs for primary contaminants of potential concern (COPC) for the above areas. In advance of remediation works, all contamination levels in soils and groundwater were below the RTC for the 250m compliance point therefore the objective of the remediation works was to achieve the much more stringent RTCs for the 5m compliance point between soils contamination in Area A and the Western Drain.

5.2. ASSESSMENT CRITERIA

DQRA modelling completed in March 2015 has been used to calculate Remedial Target Concentrations (RTCs) for COPCs in groundwater to determine levels of risk posed to the defined water environment receptors. The model was run assuming that the principal pathways were via the granular soil horizons that exist within the near-surface cohesive soils. On this basis, the model has assumed a worst-case scenario. The assumption of infinite source terms and travel times within the models and the hydrogeological conditions represented in the model will also have contributed to a conservative assessment. Table 5.1 below provides a summary of RTCs for the three main contamination source zones on-site.

Table 5.1 - Calculated Remedial Target Concentrations

Analyte	Level 3 RTC (µg/l in groundwater)		
	Barrel Area adj.to AN Pad (GW1 & GW2)*	Waste/Ash Area adj. to AN Pad (GW3)	Garage/Store Area (GW8 & GW9)**
Ammoniacal Nitrogen as N	39,800	32,100	0.179
2,4-DNT	1.01E+11	-	1.42
2,6-DNT	8,520,000	-	1.04
2-Nitrotoluene (o-NT)	3.82E+19	-	2.52

* These RTCs may also be applied to results from GW4 & GW5 as they are in close proximity and in the direction of GW flow (broadly NE).

** These RTCs may also be applied to results from GW6 & GW7 and also conservatively GW12 & GW13 given their close proximity to the Western Drain.

Appropriate Generic Assessment Criteria (GAC) values are utilised to assess various other groundwater parameters. These include the following:

- Groundwater Regulation Threshold Values under S.I. No. 366 of 2016;
- Environmental Protection Agency (EPA) Interim Guideline Values as detailed in the "Interim Report Towards Setting Guideline Values for the Protection of Groundwater in Ireland", 2003.

Analytical data for surface water were compared to GAC values based on the following:

- Parametric Value Levels (PVLs) from the EU Surface Water Regulations SI 77 of 2019;
- Interim Guideline Values (IGVs) from the EPA Discussion Documents "Environmental Quality Objectives and Environmental Quality Standards, The Aquatic Environment". Previous sampling rounds are also included to identify trends.

6. 2022 QUARTER 3 MONITORING

6.1. SITE WORKS

Groundwater and surface water sampling were undertaken on the 26th September 2022. Groundwater wells were purged of water from the monitoring borehole prior to sample collection. Surface water sampling involved the collection of grab water samples from the monitoring locations. Sample locations are illustrated in Figure 2.

6.1.1 Groundwater Monitoring

Groundwater monitoring focused on groundwater wells where residual contamination is being observed at the western-side of the site. There are additional wells and sumps in close proximity which were installed during investigation and remediation works over the past few years. These additional wells are monitored to provide additional information. Monitoring on selected deeper groundwater wells was also proposed to confirm the findings of the DQRA that risks to the groundwater aquifer remain very low. The following wells were sampled in Q3 2022:

- GW7, GW8A, GW9A where contaminants of potential concern have been identified and are the key drivers of risk to the western drain as identified in the DQRA for the site.
- Additional shallow overburden wells; GW2, GW3, GW4, GW5, GW6, GW10, GW11, GW12 and GW13.
- GW14, GW15 and GW16, nearby deeper bedrock wells to prove that deeper groundwater remains unaffected.
- Analysis included a full suite of parameters to include contaminants of potential concern (COPC) and other physicochemical and hydrochemical parameters.

Q3 included a wider number of additional groundwater wells monitored annually across the site for various physiochemical and hydrochemical parameters.

All sampling was undertaken following best practice and sampling guidelines including using dedicated sampling equipment and purging monitoring wells of three well volumes prior to sampling. All samples were obtained using laboratory supplied sampling containers and stored in cool boxes prior to dispatch to appropriate accredited laboratories. Sample bottles contained appropriate preservatives for relevant compounds.

Calibrated field equipment was used to measure pH, Temperature, Dissolved Oxygen, Redox Potential and Electrical Conductivity at the well head and any physical evidence of contamination was noted. Standard procedures were maintained to prevent cross-contamination between monitoring wells (e.g. use of dedicated sampling apparatus, decontamination of dipper and pH/conductivity meters and use of disposable sampling gloves between sampling locations).

Samples were sent to an accredited laboratory for analysis. Table 6.1 presents a summary of the analytical scope. Groundwater sampling logs are presented in Appendix A.

6.1.2 Surface Water Monitoring

The five on-site surface water monitoring points (SW1 to SW5) and one off-site location (SW6) were sampled as per the monitoring programme. A more detailed analytical suite was prescribed for down-stream locations SW4, 5 and 6.

All sampling was undertaken following best practice and sampling guidelines including using dedicated sampling equipment. Samples were obtained using laboratory supplied sampling containers and stored in cool boxes prior to dispatch to appropriate accredited laboratories. Sample bottles contained appropriate preservatives for relevant compounds and samples for metals will be filtered on site.

Calibrated field equipment was used to measure pH, Temperature, Dissolved Oxygen, Redox Potential and Electrical Conductivity at the surface water monitoring location. Any physical evidence of contamination was noted. Appropriate measures were taken to prevent cross-contamination between monitoring locations (e.g.

decontamination of sampler and pH/conductivity meters and use of disposable sampling gloves between sampling locations).

Samples were sent to an accredited laboratory for analysis. Table 6.1 presents a summary of the analytical scope. Surface water Sampling logs are presented in Appendix A.

6.1.3 Additional Monitoring

On this occasion, additional monitoring was undertaken in five additional locations to include the following:

MW401 and MW408 – these are shallow wells installed previously as temporary wells during soil investigations however have been retained on site within the buildings adjacent to the western drain.

Pump Outlet – this sample was taken from a holding tank that accepts the water pumped from the perched groundwater pumping system installed in the vicinity of GW8a and GW9a. This water is recovered for use in the manufacturing activities on site as mentioned earlier. Sampling of this water provides an indication of the contamination levels present in the recovered water.

WD1 and WD2 – these extra surface water sampling locations in the western drain are located opposite the garage building area to provide more information on this receptor. These located were also sampled in August and September 2021 as part of the detailed recent site investigation in this area of the site.

6.2. LABORATORY ANALYSIS

Laboratory Analysis was carried-out by Element Materials Technology, an accredited facility in the UK. All analysis was carried-out within the required stability times.

Analysis suites were chosen to give a good representation of groundwater, surface water and sediment quality and included site specific compounds. Samples were tested and their parameters are provided in Table 6.1 below.

Table 6.1 – Sampling & Analytical Detail

Analyte	GW Suite 1	GW Suite 2	SW Suite 1	SW Suite 2	Additional for Q3 2022
Sample Locations	GW: 3, 7, 8A, 9A, 14, 15	GW: 2, 4, 5, 6, 10, 11, 12, 13, 16	SW: 4, 5, 6	SW: 1, 2, 3	MW401, MW408, Pump Outlet, WD1 and WD2
Field Parameters:					
pH	x	x	x	x	x
Conductivity	x	x	x	x	x
Temperature	x	x	x	x	x
Water level	x	x			x
Dissolved Oxygen			x	x	x
Laboratory Parameters					
Ammonia as NH3	x	x	x	x	x
Ammoniacal Nitrogen	x	x	x	x	x
Nitrate as N	x	x	x	x	
Nitrite	x	x	x	x	
Total Nitrogen	x	x	x	x	
Sulphate as SO4		x			
Ortho Phosphate as PO4	x	x	x	x	
Metals: Al, As, Ba, Ca, Fe, Mn, Na		x	x		
SVOCs full screen to include: Nitrotoluenes (2,4-DNT 2,6-DNT) and TICs [Note 1]	x		x		x

Note 1: Full screen to include: Nitrotoluenes (2,4 DNT 2,6 DNT) and tentatively identified compounds (TICs) for Nitrotoluene derivatives.

7. RESULTS & DISCUSSION OF MONITORING PROGRAMME

7.1. GROUNDWATER RESULTS

Groundwater analytical results are presented in Tables 1 and 2 where they are compared against site specific RTCs (where available) and generic assessment criteria. For comparison purposes the relevant environmental standards and previous monitoring results are also presented in graphs. Mann-Kendall Tables and Graphs are included for selected wells in Appendix B and Laboratory certificates are presented in Appendix C.

7.1.1 Perched Groundwater Analytical Results (Overburden Wells GW2 – GW13)

The perched groundwater wells installed within made ground which were sampled in Quarter 3 2022 were GW2 to GW13. Groundwater sampling logs for the monitoring round are presented in Appendix A. There was physical evidence of contamination from samples recovered from the made ground wells. Each of the samples exhibited a brown or yellow tint. There was an almond odour in GW8a which is indicative of o-NT contamination and a stagnant odour from GW3.

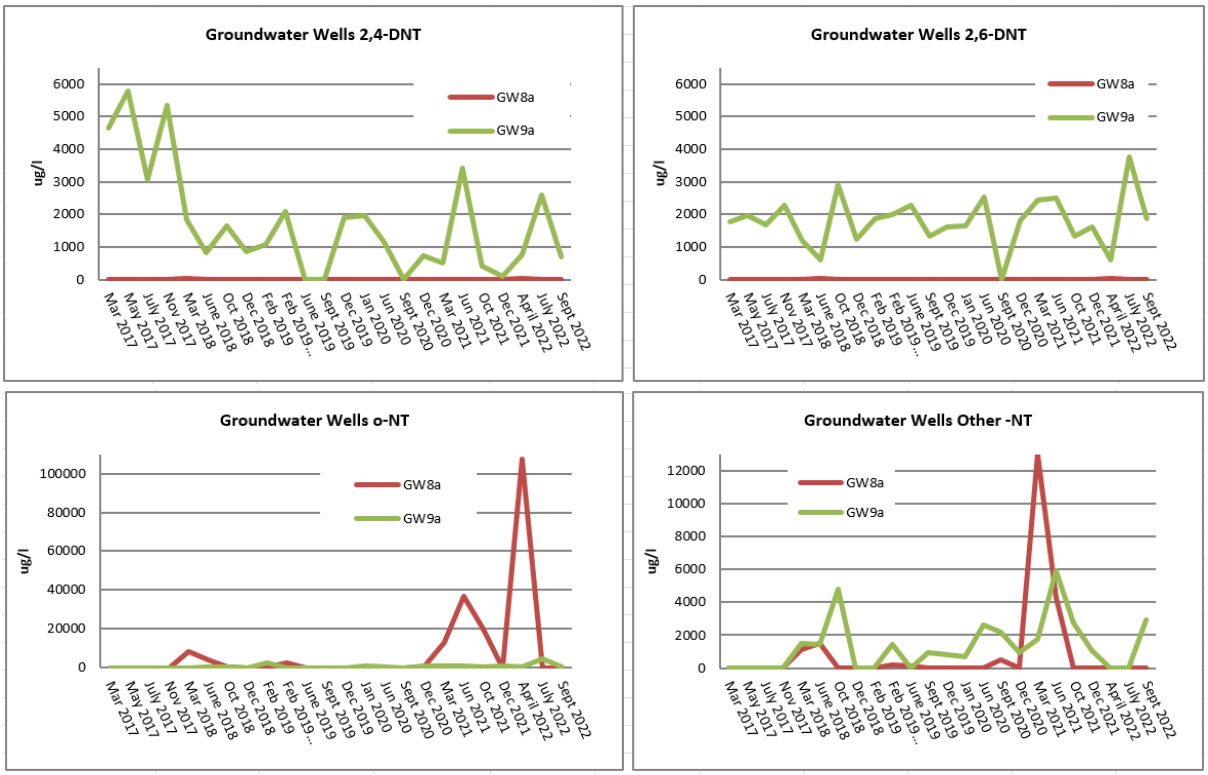
Explosives / SVOCs

The Nitrotoluene compounds of potential concern (2,4 DNT, 2,6 DNT and o-NT) are Semi-volatile Organic Compounds (SVOCs) and their presence was analysed as part of a standard SVOC suite including TICs (Tentatively Identified Compounds) on the overburden wells GW3, GW7, GW8a, GW9a. Wells located in the Garage/Store area beside the western drain had reasonably high concentrations of Nitrotoluene compounds historically. The following observations were made from the recent Q3 2022 groundwater sample results:

- A high concentration of 2,4 DNT and 2,6 DNT was detected in GW9a (689ug/l and 1,897ug/l respectively) which exceeds the RTCs for the garage/store area (see Table 5.1 for a summary of RTCs). Concentrations of 2,4 DNT in GW9a has decreased considerably from the previous sample round in Q2 2022 (2,592ug/l) and from 2017 with a level recorded at 5,784ug/l but Mann-Kendall suggests there is no obvious trend over time. Concentrations of 2,6 DNT in GW9a has decreased from the previous monitoring round in Q2 2022 (2,592ug/l), concentrations have fluctuated in this well historically and the Mann-Kendall suggests there is a probable increase trend over time.
- GW3 and GW7 reported below Laboratory LOD (Limit of Detection) for all Nitrotoluene compounds.
- o-NT was detected in GW8a April 2022 with a concentration of 107,280ug/l (highest concentration level detected from this well) and in GW9a in July 2022 with a contention of 4,620ug/l, both of which exceed the RTC of 2.52ug/l. This shows a decrease in o-NT concentrations from Q2 2022 in GW8a which o-NT was not detected and GW9a which was detected at 123ug/l.
- SVOC screening detected additional high concentrations of nitroaromatic compounds in GW9A (2,934ug/l) but no additional nitroaromatic compounds in GW8A. Some of these compounds are breakdown products of the primary nitrotoluenes on site. Other nitroaromatic compounds were not detected in Q1 or Q2 2022 in GW9a.

A groundwater pumping system is installed to pump and recover shallow perched groundwater water from sumps in the vicinity of GW8a and GW9a. Pumping has been optimised to recover 10m^3 or more per week from this area and water is combined with rainwater for use in the manufacturing process on site. It is considered that increased pumping is reducing the concentration levels in GW8a and GW9a in particular.

Graph 7.1 – Nitrotoluenes (ug/l) in Groundwater Wells GW8a and GW9a

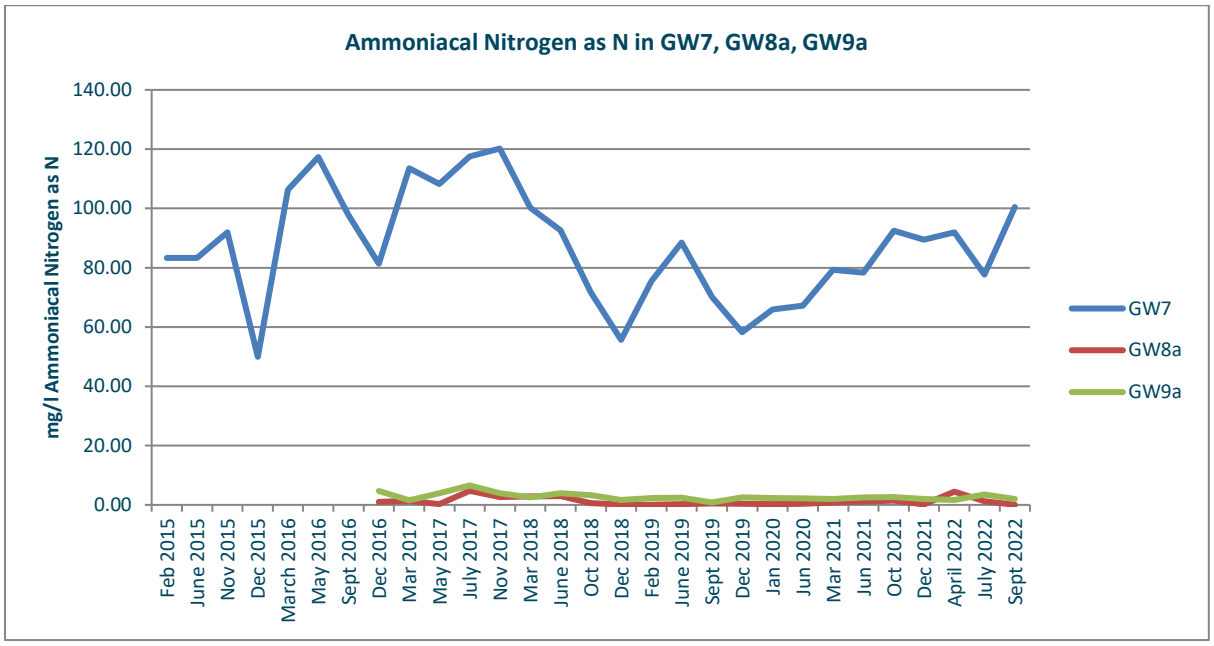


Ammoniacal Nitrogen, Nitrate and Nitrite

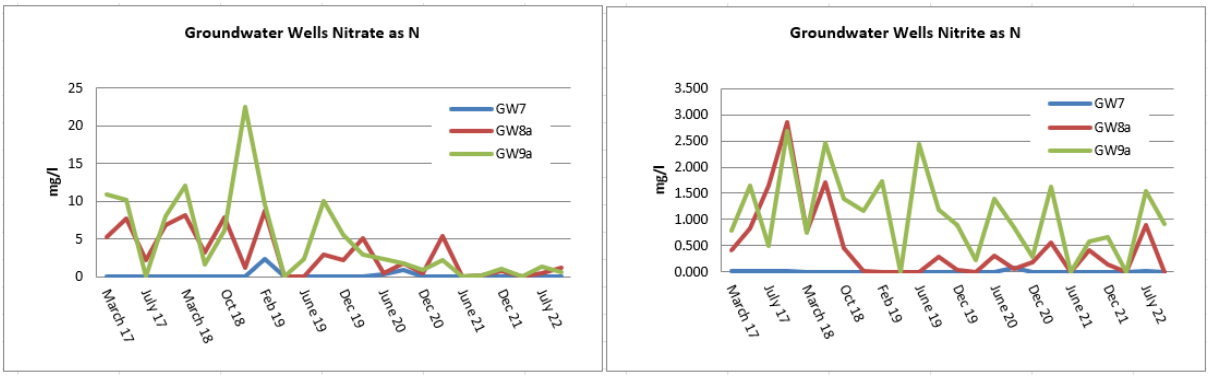
Ammoniacal Nitrogen, nitrate and nitrite was sampled in all the overburden groundwater wells; GW2 to GW13.

- A site specific RTC is available for ammoniacal nitrogen (0.179 mg/l in shallow wells adjacent to the western drain). The highest concentration of ammoniacal nitrogen was observed in GW7 (100.45mg/l) which has increased compared to the concentration measured in July 2022 (77.72ug/l). Despite this increase and elevated concentrations in GW7 the overall trend is decreasing, as presented in the Mann Kendall statistical analysis in Appendix B. A concentration level similar to this was sampled in March 2018.
- GW2, GW3, GW6 and GW9a are also adjacent to the western drain. Concentrations of ammoniacal nitrogen in these wells were 3.9mg/l (GW2), 59.05mg/l (GW3), 8.72mg/l (GW6) and 2.01mg/l (GW9a) which exceed the RTC. GW9a shows a stable trend in recent monitoring rounds, as presented in the Mann Kendall statistical analysis. GW8a (0.09mg/l) is below the RTC compared and shows no overall trend.
- GW10 detected ammoniacal nitrogen concentrations of 0.74mg/l which is slightly above the RTC value however GW10 is located to the northeast of the Ammonium Pad.
- There are no calculated RTCs for Nitrate and Nitrite but comparison of concentrations with generic groundwater GACs suggest that Nitrate concentrations are generally low and within acceptable criteria with occasional variations. Nitrate remained below the GAC (37.5mg/l) in all wells. This is a considerable decrease in GW3 which recorded a concentration of 59.24mg/l in Q3 2021. Nitrite was slightly elevated in GW2 and GW9A in September Q3 2022.

Graph 7.2 – Ammoniacal Nitrogen as N in Groundwater



Graph 7.3 – Nitrate and Nitrite in GW7, GW8a and GW9a



pH, Conductivity, COD & TDS

The pH results ranged between 7.08 and 8.12 for all wells with the exception of GW2 which had a pH of 12.2. This pH level is similar to results recorded in previous years and appears to be localised in this shallow overburden well.

Conductivity measurements ranged from 667µS/cm to 2,7378µS/cm. Measurements that were above GAC limits were in wells GW2, GW3, GW6 and GW7 (ranged from 1,135µS/cm to 2,738µS/cm). All remaining wells were low and in-line with previous findings. These wells represent localised shallow perched groundwater in made ground above the underlying bedrock aquifer.

Metals

The measured results for metals in overburden wells are not compared against groundwater GACs as they are not representative of risk particularly for this site, which is underlain by deep clays. Metal results are relevant in terms of shallow groundwater hydrochemistry and are discussed in terms of observed trends. Metals were

tested for in select overburden wells and bedrock wells; the most notable observations are as follows:

- Total Dissolved Iron concentration in GW10 had an elevated concentration of 1,414ug/l similar to previous rounds. Iron concentrations in well GW5 (873ug/l) was elevated above the drinking water standards. The remaining overburden wells were below the LOD and drinking water standards. Iron is a common indicator of reduced hydro-chemical conditions where iron (III) in soil minerals is reduced to iron (II) which is more soluble in groundwater.
- Dissolved Manganese concentrations were recorded in each of the wells tested and exceeded the drinking water standard except GW2 which is consistent with previous monitoring rounds. Manganese is a common indicator of reduced hydro-chemical conditions where Mn (IV) is utilised as an electron acceptor and is converted to more soluble Mn (II).
- Dissolved Aluminium was below laboratory LOD in all wells except GW2 (1,274ug/l) which is above its GAC limit and GW10 (53ug/l) which is below the GAC limits of 150ug/l for Groundwater and 200ug/l for Drinking Water Standards. Dissolved Arsenic was detected in GW5 (16.9ug/l) with concentrations from GW5 being above its GACs.
- Dissolved barium and calcium were detected in all wells but there are no GAC limits for comparison.
- Other metal concentrations showed no significant variations between previous monitoring results.

Various parameters

Concentrations of various other parameters are similar to those previously measured in recent monitoring rounds. Sulphate as SO4 was detected in all wells that was analysed for with concentration levels below the GAC limits. Ortho phosphate as PO4 was detected below the laboratory LOD in all wells except GW3 (5.27mg/l) which exceeds the IGV and drinking water standard 0.03mg/l.

Mann-Kendall

Trend analysis is also undertaken for certain parameters in accordance with the Mann-Kendall Trend Test Methodology. This is a non-parametric test used to identify a trend in a series, even if there is a seasonal component in the series.

Best practice requires the demonstration of groundwater plume control or stability to confirm protective conditions. Monitored Natural Attenuation (MNA) is an accepted method of managing residual contamination at low-risk sites and a primary line of evidence supporting MNA as a remedy is demonstration of a stable or shrinking plume condition, based upon historical monitoring data (ASTM 2004; USEPA 1999). The Mann-Kendall protocol is one of the most commonly used statistical tools for the evaluation of plume stability.

A Mann Kendall toolkit software was used which employs the same Mann-Kendall plume stability methodology that was previously developed for the MAROS software (Aziz et al., 2003; AFCEE, 2004). This software tool can be used to demonstrate the plume stability condition (expanding, stable, or decreasing) and track the progress of any monitored natural attenuation processes in play at the site. Mann-Kendall reports are attached in Appendix B for GW7, GW8a and GW9a.

2,4 DNT for GW7, GW8a and GW9a showed no trend in the Mann-Kendall plots. 2,6 DNT showed no trend for GW7 and GW8a and a probable increasing trend in GW9a. Ammoniacal nitrogen showed a decreasing trend in GW7 and no trend in GW8a and a stable trend in GW9a.

7.1.2 Groundwater Analytical Results (Bedrock Wells – GW14, GW15 and GW16)

Three bedrock wells were monitored on this occasion: GW14, GW15 and GW16. Groundwater sampling logs for the monitoring round are presented in Appendix A.

Explosives/ Semi-volatile organic compounds (SVOC)

Testing for a complete suite of SVOCs was undertaken to include a semi-quantitative examination for nitrotoluene compounds of potential concern (2,4 DNT, 2,6 DNT, o-NT etc.).

- No explosive compound or any other SVOCs (including o-NT) were detected in bedrock monitoring wells GW14, GW15 and GW16, which is consistent with previous monitoring rounds.

Nitrite, Nitrate, Ammonium and Total Nitrogen

Nitrite, Nitrate, Ammoniacal Nitrogen and Total Nitrogen are all low as expected with deeper groundwater in the three bedrock wells sampled. Ammoniacal Nitrogen concentration remains below groundwater limit value of 0.175ug/ in GW14, GW15 and GW16.

pH, Conductivity, COD & TDS

The pH in groundwater of the bedrock wells are within acceptable ranges.

Conductivity was low and below relevant guidance limits. No contamination issues or significant variations were noted in these parameters.

Metals

Concentrations of Iron were below the drinking water standards in GW14 and GW15. GW16 detected 451ug/l which exceeds the 200ug/l limit. Dissolved manganese levels in GW15 and GW16 have exceeded its GAC limit and are likely to be naturally occurring in the limestone bedrock. Dissolved arsenic was below the LOD in GW15 and was detected at 5.1ug/l in GW16 with both remaining below the GAC. Results show overall good quality groundwater with all concentrations similar to previous monitoring rounds.

Various Parameters

Groundwater quality is generally good and based on a review of various other parameters no additional contamination trends are observed.

Mann-Kendall

GW14 shows no trend for Ammoniacal Nitrogen in the Mann-Kendall plot, concentrations are below groundwater standards in this bedrock monitoring well.

7.2. SURFACE WATER RESULTS

Six monitoring locations, SW1 – 6 (routinely sampled) were sampled in Q3 September 2022 along with two additional surface water samples from the western drain WD1 and WD2. Tables 3 & 4 attached to this report shows all surface water results. SW1 - 3 are considered to be upstream of site activities (see Figure 2). It is noted that SW2 and SW3 are on a separate stream which flows around the site in a north-easterly direction whereas the remaining sampling locations are located on the western drainage ditch on the western boundary of the site.

7.2.1 Upstream Monitoring Points

Historically, the upstream locations generally fall within the expected range for the local setting with no major variation between sampling rounds. The most notable observation has been the on-going presence of nitrogen-based compounds (Ammonia, Nitrates and Nitrites), which is evidence of nutrient enrichment; historically this has been particularly notable at location SW2.

- SW1 sample location was dry during the sample exercises in Q3 2022 and therefore no sample was retrieved.
- Concentrations of Ammonia in SW2 and SW3 exceeded its GACs in the September 2022 monitoring round. It is suggested that these results are related to agricultural and/or forestry land uses directly upstream.

- In Q3 2022 the SW2 ammonia concentration decreased to 1.74mg/l compared to high levels detected in 2021 (156.65mg/l in October 2021). This source of elevated ammonia in this upstream location of the site is most likely a result of recent agricultural activities further upstream.

7.2.2 Downstream Monitoring Points

Three of the regular routine surface water monitoring locations, SW4, SW5 and SW6 are considered to be downstream of site activities (see Figure 2). Locations SW4 and SW5 are on the western drainage ditch that bounds the site and has historically reported low level Dinitrotoluene and hydrocarbon contamination. Monitoring of downstream surface water locations on this occasion included an analysis of metals, SVOCs and general screening parameters.

- Nitrotoluenes concentrations were detected above the LOD in the two of the downstream monitoring locations (SW4 and SW5). 2,4 and 2,6-DNT were detected in SW4 in July and September 2022. Previous to these sample rounds December 2021 and all through 2020 nitrotoluenes were detected. Historically, nitrotoluenes traces have been observed occasionally at SW5 but never at the offsite location SW6.
- Nitrotoluenes concentrations were detected in SW4 historically, which is located downstream of the Ammonium Nitrate Storage Pad. The Mann Kendall statistical trend for nitrotoluenes in SW4 is stable and no trend for 2,6-DNT and 2,4-DNT respectively and SW5 is decreasing for both compounds, as presented in Appendix B.
- Overall ammoniacal nitrogen has a decreasing trend in SW4, SW5 has no trend and SW6 has remained stable, as presented in Appendix B.

Lower concentrations of Ammoniacal Nitrogen are present in all three of the downstream surface water locations (SW4, SW5 and SW6), compared with SW2. These levels are consistent with historical results and appear to be affected by off-site influences as upstream levels are also high. Contamination levels are seasonal and are expected to correlate with rainfall; higher rainfall has resulted in higher concentrations.

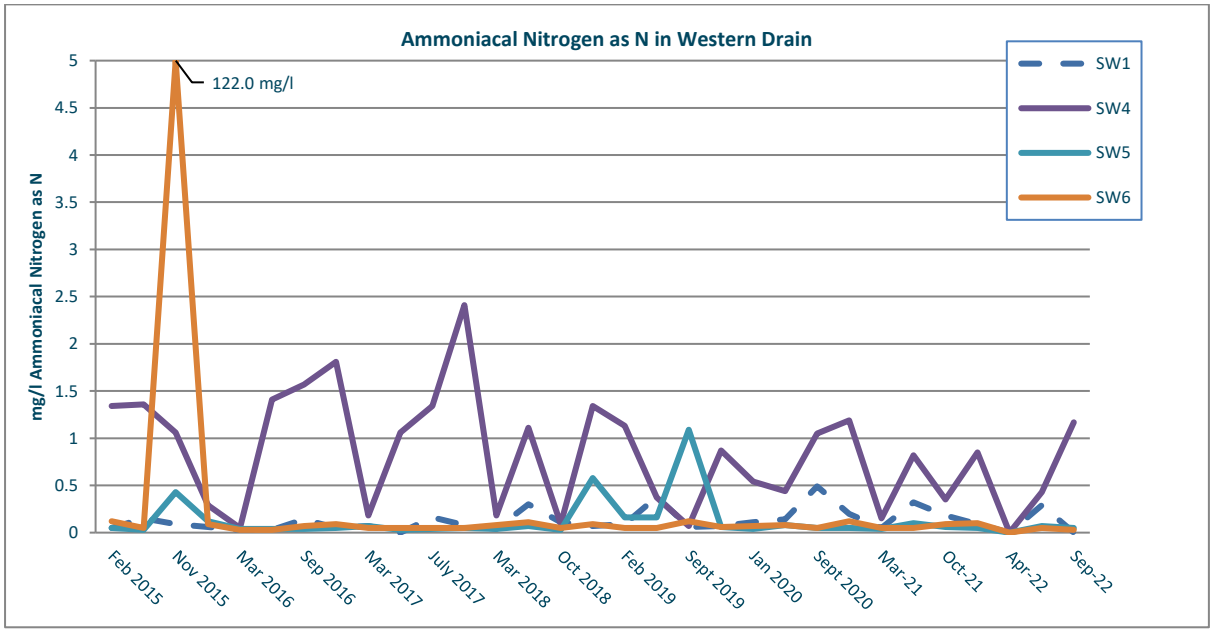
Monitoring of the new western drain sampling points (WD1 & WD2) located opposite the garage building showed similar results to SW4, SW5 and SW6 of;

- Low levels of Nitrotoluenes were detected in both samples (WD1 and WD2). Q2 2022 detected nitrotoluenes in WD1 only. There are no GAC limits for this area of the site.
- Phenols, PAHs and Phthalates were below the limit of detection in both samples.
- Ammonical Nitrogen was detected at 0.16mg/l in WD1 and 0.05mg/l in WD2. These levels are consistent with historical results from the other samples from the western drain and appear to be affected by off-site influences as upstream levels are also high.

7.2.3 Surface Water Trends

Concentrations of Ammoniacal Nitrogen have varied historically in SW2, SW3 and SW4. As both SW2 and SW3 are up-gradient of site activities it indicates Ammoniacal Nitrogen influences from off-site agricultural or forestry sources. SW1 is located on the upstream side of the Western Drain and concentrations overall appear low. SW4 Ammoniacal Nitrogen results appear seasonally influenced. Concentrations in most down gradient SW5 and SW6 are generally low and have remained steady over the sampling period.

Graph 7.4 - Ammoniacal Nitrogen Trends in Surface Water



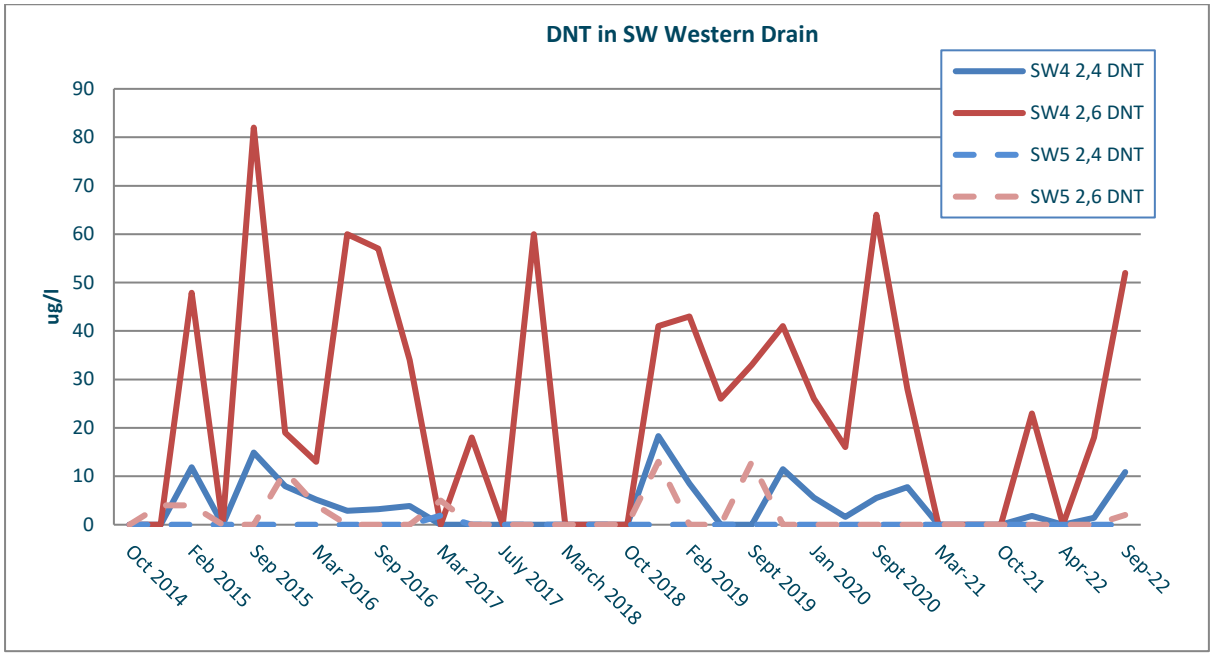
Notes:

SW1 is upstream (represented by dashed lines) and SW4-6 are located downstream (represented by solid lines).

*SW6 true value for Nov 2015 is 122mg/l. For the purpose of the graph 5mg/l value has replaced this.

In Q3 September 2022 nitrotoluenes were detected SW4 and SW5 (downstream monitoring locations). SW4 detected 10.9ug/l and 52ug/l (2,4 and 2,6-DNT respectively) which has increased compared to July 2022 samples. SW5 detected a low level of 2,6-DNT (2ug/l) which has not been detected since September 2019. SW4 and SW5 have historically shown seasonally variable low levels of Nitrotoluenes historically. The Mann Kendall statistical trend for nitrotoluene 2,4 in SW4 is no trend and stable for 2,6-DNT, as presented in Appendix B. SW5 is stable for 2,4-DNT and has no trend for 2,6-DNT.

Graph 7.5 - Nitrotoluenes Trends in the Western Drain



Note:
SW4 concentrations of DNT represented by solid lines and SW5 concentrations of DNT represented by dashed lines.

7.3. ADDITIONAL ANALYSIS

During Q3 2022 additional monitoring was undertaken in shallow wells (MW401 and MW408) within buildings adjacent to the western drain and also waste from the pump outlet tank which holds water pumped from the perched groundwater pumping system prior to recovery in the manufacturing process on site. Findings for these additional sampling locations are discussed as follows:

- Low level nitrotoluenes were detected in MW401 (92.5ug/l 2,4-DNT, 150 2,6-DNT and <LOD for o-NT) which is similar to the levels recorded in Q3 2021 (91.6ug/l 2,4-DNT, 153ug/l 2,6-DNT and < LOD for o-NT) and no nitrotoluenes were detected in MW408. These results suggest that the contamination is localised in zones closer to GW8a and GW9a.

- The pump outlet tank had concentrations of nitrotoluenes: 282ug/l 2,4-DNT and 552ug/l 2,6-DNT and no detection of o-NT. This is a considerable decrease from July 2022 sample round with levels of 1,204ug/l, 2527ug/l and 1,859ug/l (2,4-DNT, 2,6-DNT and o-NT respectively). Ammoniacal Nitrogen was recorded at 0.83mg/l. This water poses no environmental risk as it is recycled in manufacturing operations on site. The presence of contamination indicates that the sumps installed on site are effectively removing Nitrotoluenes and other contaminants from the perched groundwater in the shallow subsoils which is seen to be present beneath the garage and store buildings from recent site investigation works.

7.4. DISCUSSION OF POLLUTANT LINKAGES

The primary contaminants of potential concern (COPCs) associated with historical site activities are:

- 2,4-Dinitrotoluene (2,4 DNT)
- 2,6-Dinitrotoluene (2,6 DNT)
- 2-Nitrotoluene (o-NT)
- Ammonia

The primary risk receptor for the site is the Western Drain. The following observations are made:

- Surface water results from upstream monitoring conducted from 2015 to 2022 confirm the presence of nitrogen- based compounds (Ammonia, Nitrates and Nitrites) particularly at SW2. These results suggest evidence of nutrient enrichment from off-site agricultural and/or forestry. SW4 downstream from the site activity shows similar levels of Ammoniacal Nitrogen throughout the years but overall showing a decreasing trend. It appears that the contamination levels are seasonal and are expected to correlate with rainfall.
- Nitrotoluene concentrations that were detected in SW4 and SW5 at fluctuating concentrations historically were undetected in Q1 – Q3 2021 but since then nitrotoluenes have been detected. Levels have been undetected for four consecutive years in SW5 with very low level of 2,6-DNT in Q3 2022. Additional sampling of two other western drain samples taken opposite the garage area (WD1 & WD2) commenced in 2021 which did not detect any nitrotoluenes in the surface watercourse, however since Q2 2022 nitrotoluenes have been detected at low levels. The Pump Outlet sample also detected nitrotoluenes in Q3 2022, but the results show a decrease compared to Q2 2022 samples.

The groundwater aquifer beneath, shallow overburden groundwater and associated drinking water schemes close to the site are the other key receptors. Key points are summarised as follows:

- The DQRA concluded a low risk primarily due to the site being underlain by low permeability clays of thickness >10m. Furthermore, it has been confirmed that the bedrock groundwater has an upwards head gradient, which will effectively prevent the downward migration of contaminants.
- Since the completion of remediation works in October 2015, quarterly monitoring has shown an overall ongoing improvement in groundwater quality across the site, which supports the findings of the risk assessment. GW8a 2,4 and 2,6-DNT levels have remained undetectable to very low levels recorded. o-NT levels did show a decrease until Q4 2020 through to Q3 2021 with undetectable levels thereafter with the exception of Q1 2022.
- GW9a shows a slight to steady overall improvement with levels fluctuating throughout the monitoring events. 2,4-DNT shows no trend whereas 2,6-DNT resembles a steady to probable increasing trend.
- Neighbouring well GW7 has generally seen a decreasing trend in Nitrotoluene concentrations to below Laboratory LOD in the same area suggesting a localised area of contamination exists in the immediate vicinity of GW9a.
- The detailed soil and perched groundwater site investigation in the Garage and Store Building areas in August & September 2021 detected localised hotspots of nitrotoluenes and ammonia beneath these buildings. This contamination is related to historical site activities and is present in low permeability subsoils beneath the buildings. Similarly in the February 2022 investigation, hotspots of nitrotoluenes were detected beneath this area of the site that were further delineated. Two distinct hotspots of Ammonia were identified within the Garage building and to the east of the Store building.
- Remaining overburden groundwater wells detected nitrites, ammoniacal nitrogen, arsenic and iron and in some cases exceeded its RTC. Manganese levels exceed drinking water standards in all wells except GW2. Nitrotoluenes remain undetected in the bedrock wells however there were exceedances in manganese and iron concentration levels.
- Ammoniacal Nitrogen in GW7 exceed the RTC for that area. Concentrations appear to be steadily decreasing with time. GW8a and GW9a show a no trends to stable trend but still exceed the RTC in GW9a. Ammoniacal Nitrogen was recorded at below the compliance criteria in all three bedrock wells. Ammonia was seen to have increased in SW2 in October 2021 from Q1 2021 and is located on the upstream site of the site indicating a likely off-site agricultural source in the catchment area. Q3 2022 SW2 levels decreased which are consistent with historic levels.

8. SUMMARY CONCLUSIONS

Monitoring undertaken during Q3 – 2022 and historical rounds may be summarised as follows:

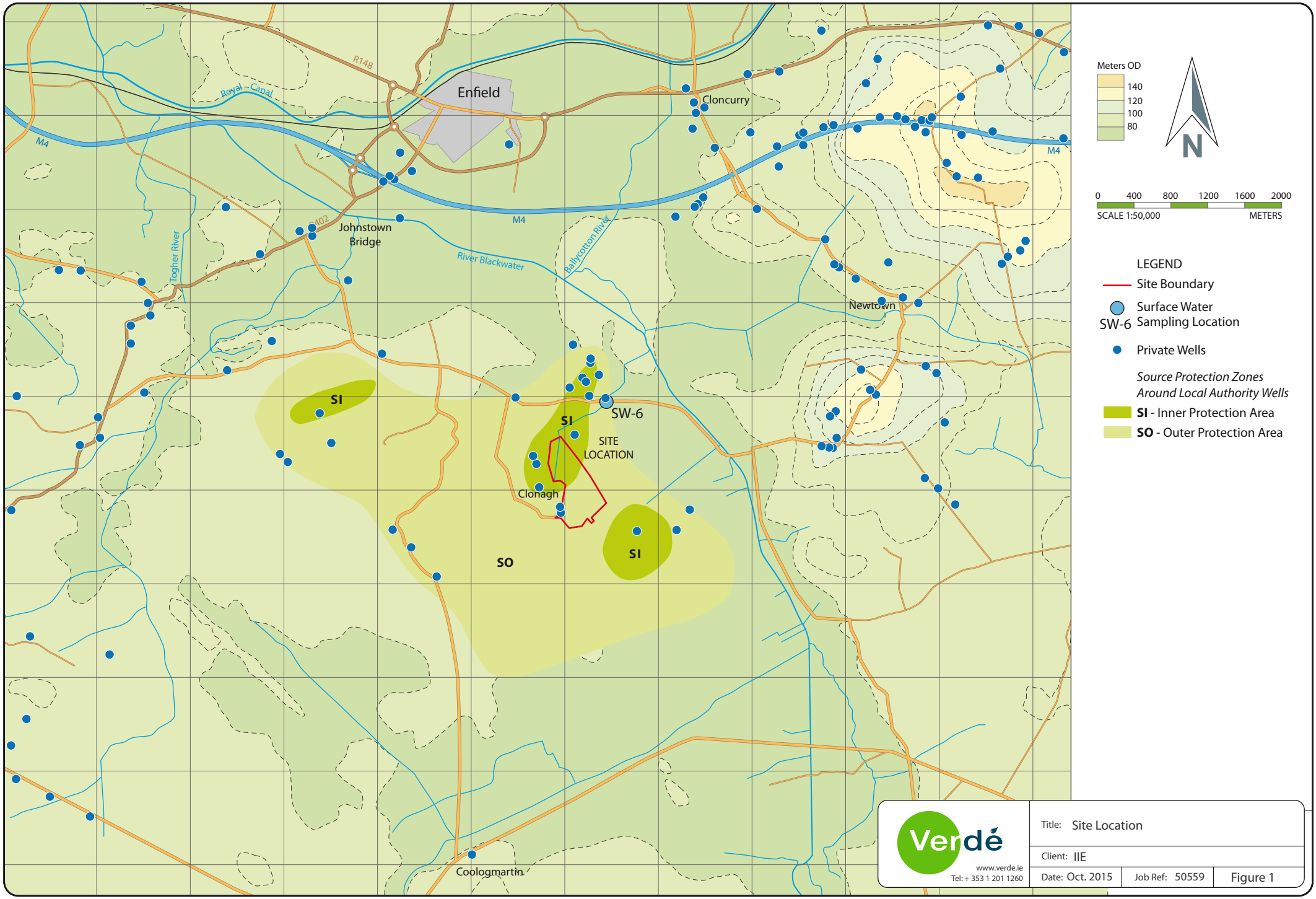
- Nitrotoluene contamination is being detected in shallow groundwater wells specifically GW9a and lower levels (in some cases below Laboratory LOD) in GW8a.
- The detailed soil and perched groundwater site investigation in the Garage and Store Building areas in 2021 and 2022 detected localised hotspots of nitrotoluenes and ammonia beneath these buildings. This contamination is related to historical site activities and is present in low permeability subsoils beneath the buildings and in close proximity to the east of the Store Building.
- Concentrations of Ammoniacal Nitrogen which exceeded the RTC for their respective area were detected in shallow perched groundwater wells GW2, GW3, GW6, GW7, GW9a and GW10. These wells are located close to the Ammonium Nitrate Storage Pad and western drain with the exception of GW10.
- Bedrock wells (GW14, GW15 and GW16) confirm that bedrock groundwater quality is good with no observable impact from historical site activities.
- Surface water monitoring results for upstream monitoring locations (SW1-3) show elevated and variable nitrogen-based compounds (Ammonia, Nitrates and Nitrites). This is consistent with historical trends and these results may be related to agricultural, residential and/or forestry land uses directly upstream. SW4 has detected elevated concentrations of Ammonia throughout monitoring and concentrations improve downgradient of this location (SW5). These consistent findings appear to be seasonal and correlate with rainfall. Concentrations increase during the rainy seasons and decrease during drier periods.
- Nitrotoluene concentrations that were detected in SW4 at fluctuating concentrations historically were undetected in the quarterly monitoring rounds to date (Q1 to Q3) in 2021 but prior to 2021 nitrotoluenes have been detected. Levels have been undetected for four consecutive years in SW5 with very low level of 2,6-DNT in Q3 2022. Additional sampling of two other western drain samples taken opposite the garage area (WD1 & WD2) commenced in 2021 which did not detect any nitrotoluenes in the surface watercourse, however since Q2 2022 nitrotoluenes have been detected. The Pump Outlet sample also detected nitrotoluenes in Q3 2022, but the results show a decrease compared to Q2 2022 samples.

In conclusion, the Q3 2022 results for monitoring locations outside the site activity area (Store, Garage Building and Ammonium Nitrate Store Pad) show groundwater in the bedrock and surface water quality is largely stable. Nitrotoluene and ammoniacal nitrogen compounds are being detected at elevated concentrations in shallow groundwater adjacent to the Store and Garage Buildings.

With regard to Nitrotoluenes, the shallow perched groundwater wells GW7 and GW8a have remained steady or decreased with time. GW9a continues to report elevated concentrations of Nitrotoluene in this localised area of shallow perched groundwater.

Recent site investigations in 2021 and 2022 beneath the Garage and Store Buildings identified localised contamination hotspots of nitrotoluenes and ammonia beneath these buildings and to the east of the Store building.

FIGURES



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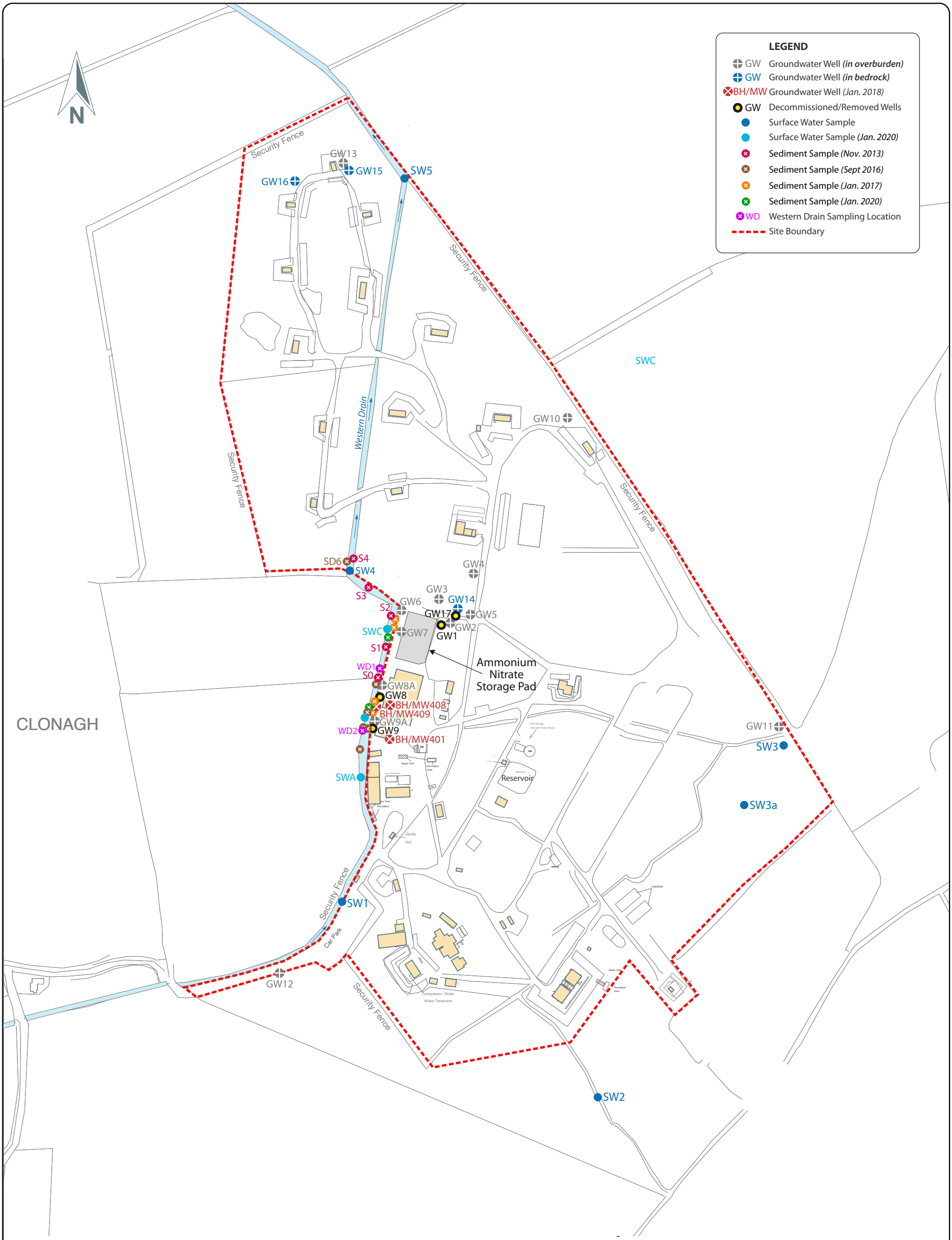
Title: Site Location
Client: IIE
Date: Oct. 2015 | Job Ref: 50559 | Figure 1


N
LEGEND
GW Groundwater Well (in overburden)
GW Groundwater Well (in bedrock)
BH/MW Groundwater Well (Jan. 2018)
GW Decommissioned/Removed Wells
Surface Water Sample
Surface Water Sample (Jan. 2020)
Sediment Sample (Nov. 2013)
Sediment Sample (Sept 2016)
Sediment Sample (Jan. 2017)
Sediment Sample (Jan. 2020)
WD Western Drain Sampling Location
Site Boundary
Security Fence
Western Drain
CLONAGH
GW13
GW15
GW16
SW5
SWC
GW10
GW4
GW3
GW14
GW6
GW17
GW5
GW2
GW7
GW1
S1
WD1
S0
GW8A
GW8
BH/MW408
BH/MW409
GW9A
WD2
GW9
BH/MW401
SWA
SD6
S4
SW4
S3
S2
Ammonium Nitrate Storage Pad
GW11
SW3
Reservoir
SW3a
SW1
Car Park
GW12
Compressor / Boiler
Water Treatment
SW2
0 50 100 150 200 250 300
Scale (at A3 size)
Metres
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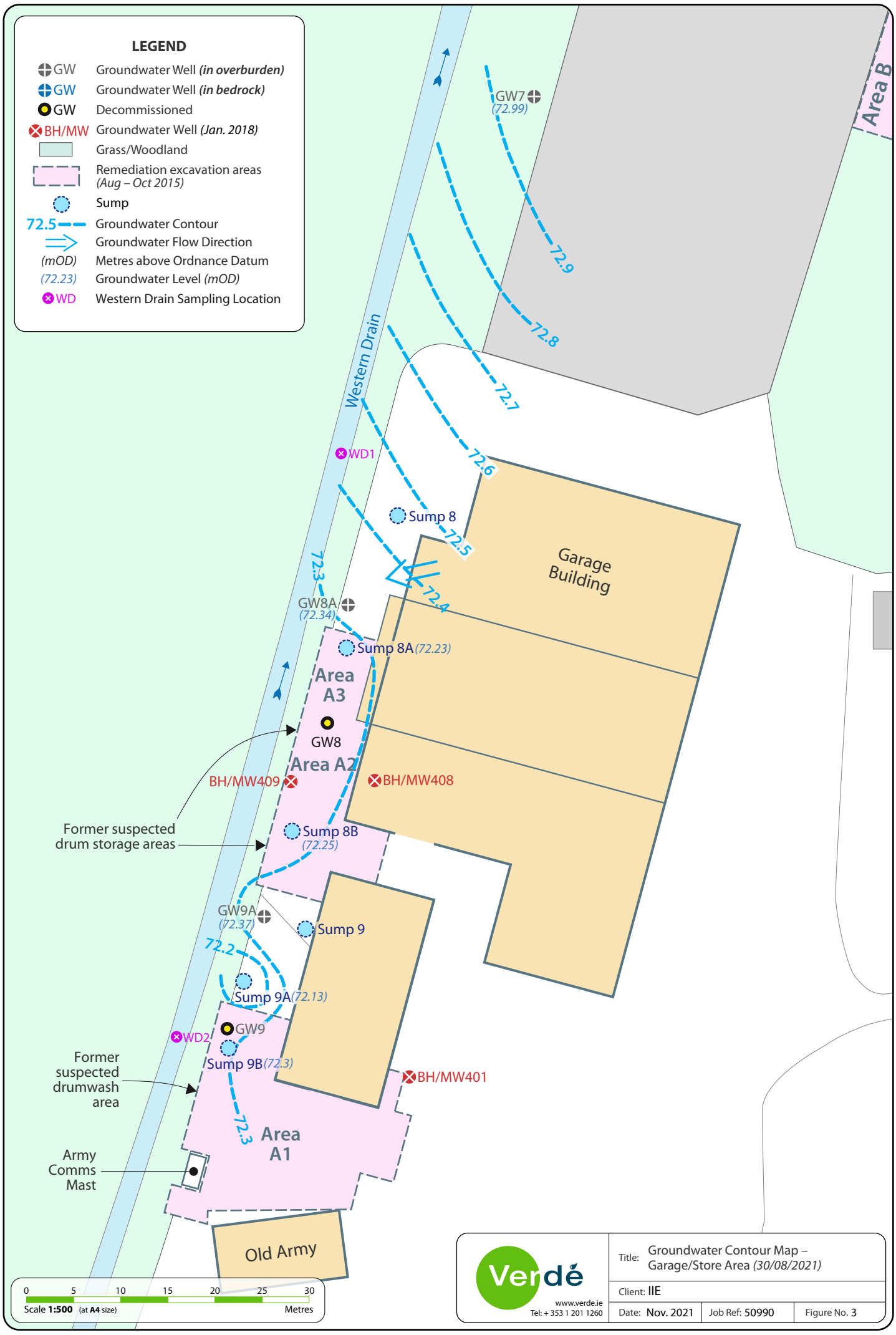
Title: Sampling Locations
Client: IIE
Date: Nov. 2021
Job Ref: 50990
Figure No. 2


LEGEND
GW Groundwater Well (in overburden)
GW Groundwater Well (in bedrock)
GW Decommissioned
BH/MW Groundwater Well (Jan. 2018)
Grass/Woodland
Remediation excavation areas (Aug – Oct 2015)
Sump
72.5 Groundwater Contour
Groundwater Flow Direction
(mOD) Metres above Ordnance Datum
(72.23) Groundwater Level (mOD)
WD Western Drain Sampling Location
Area B
GW7 (72.99)
72.9
72.8
72.7
72.6
72.5
72.4
72.3
Western Drain
WD1
Sump 8
Garage Building
GW8A (72.34)
Sump 8A (72.23)
Area A3
GW8
Area A2
BH/MW409
BH/MW408
Former suspected drum storage areas
Sump 8B (72.25)
GW9A (72.37)
Sump 9
72.2
Sump 9A (72.13)
WD2
GW9
Sump 9B (72.3)
BH/MW401
Former suspected drumwash area
Area A1
Army Comms Mast
Old Army
0 5 10 15 20 25 30
Scale 1:500 (at A4 size)
Metres
Verdé
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Tel: + 353 1 201 1260
Title: Groundwater Contour Map – Garage/Store Area (30/08/2021)
Client: IIE
Date: Nov. 2021
Job Ref: 50990
Figure No. 3

TABLES

Table 1A - Shallow Groundwater Analysis - COPCs

Analyte	Well:	Compliance Criteria	MADE GROUND												
			GW2	GW3	GW4	GW5	GW6	GW7	GW8A	GW9A	GW10	GW11	GW12	GW13	Pump Outlet
	Units		26/09/2022												
Nitrogen - based compounds															
Nitrate as N	mg/l	37.5**	0.19	4.4	<0.05	<0.05	18.88	0.07	1.2	0.62	0.05	4.4	3.93	0.17	ND
Nitrite as N	mg/l	0.375**	**1.353**	0.351	<0.006	<0.006	0.121	<0.006	<0.006	**0.906**	0.03	0.016	0.052	<0.006	ND
Ammonical Nitrogen as N	mg/l	0.179	**3.9**	**59.05**	0.13	0.07	**8.72**	**100.45**	0.09	**2.01**	**0.74**	0.09	<0.03	0.05	0.83
Ammonical Nitrogen as NH4	mg/l	-	5.03	76.17	0.17	0.09	11.25	129.58	0.12	2.59	0.95	0.12	<0.03	0.06	1.07
Total Nitrogen	mg/l	-	6.1	70.5	<0.5	<0.5	27.4	109.5	12.3	9.7	0.7	6.6	5.1	0.6	ND
Explosives															
2,4-DNT	ug/l	1.42	NA	<0.5	NA	NA	NA	<0.5	<0.5	**689.3**	NA	NA	NA	NA	**282**
2,6-DNT	ug/l	1.04	NA	<1	NA	NA	NA	<1	<1	**1879**	NA	NA	NA	NA	**552**
o-NT	ug/l	2.52	NA	NA	NA	NA	NA	NA	NA	**123**	NA	NA	NA	NA	NA
Other nitrotoluenes	ug/l	-	NA	NA	NA	NA	NA	NA	NA	2934	NA	NA	NA	NA	291

Notes:

NA - Not Anlysed

ND - Not Detected

* Compliance Criteria Level 3 RTCs quoted in DQRA - March 2015, For wells on site the most appropriate conservative RTC has been used.

** Compliance Criteria is based on Schedule 5 Groundwater Threshold Values European Communties Environmental Objectives (GROUNDWATER) Regulations, 2010

* Bedrock limit values are based on S.I. 366 of 2016 for groundwater

* Other nitrotoluenes includes: 3 Nitrotoluene, 4 Nitrotoluene, 3,4-Dinitrotoluene & 2,3-DNT

Table 1B - Bedrock Groundwater Analysis - COPCs

Analyte	Well:	Compliance Criteria	BEDROCK		
			GW14	GW15	GW16
	Units		26/09/22		
Nitrogen - based compounds					
Nitrate as N	mg/l	8.5	<0.05	<0.05	<0.05
Nitrite as N	mg/l	-	<0.006	<0.006	<0.006
Ammonical Nitrogen as N	mg/l	0.175	0.11	0.05	0.12
Ammonical Nitrogen as NH4	mg/l	-	0.14	0.06	0.15
Total Nitrogen	mg/l	-	<0.5	<0.5	<0.5
Explosives					
2,4-DNT	ug/l	1.3	<0.5	<0.5	NA
2,6-DNT	ug/l	1	<1	<1	NA
o-NT	ug/l	1.9	ND	ND	NA
Other nitrotoluenes	ug/l	-	ND	ND	NA

Notes

NA - Not Analysed

ND - Not Detected

* Bedrock limit values are based on S.1. 366 of 2016 for groundwater

Table 2 - Groundwater Analysis - General Parameters

Analyte	IGV	S.I. 122 of 2014 (DW)	S.I. 366 of 2016 (GW)	ID:	GW2	GW3	GW4	GW5	GW6	GW7	GW8A	GW9A	GW10	GW11	GW12	GW13	GW14	GW15	GW16	Pump Outlet
				Strata:	Made ground / Overburden												Bedrock			
				Units	26/09/22												26/09/22			
Dissolved Aluminium	200	200	150	ug/l	**1274**	NA	<20	<20	<20	NA	NA	NA	53	<20	<20	<20	NA	<20	<20	ND
Dissolved Arsenic	10	10	7.5	ug/l	<2.5	NA	<2.5	**16.9**	<2.5	NA	NA	NA	5.5	<2.5	<2.5	<2.5	NA	<2.5	5.1	ND
Dissolved Barium	-	-	-	ug/l	152	NA	205	128	67	NA	NA	NA	486	51	124	40	NA	<3	45	ND
Dissolved Calcium	-	-	-	mg/l	125	NA	76.8	78.6	203.2	NA	NA	NA	150.2	142.1	144.5	137.2	NA	61.5	77.3	ND
Total Dissolved Iron	200	200	-	ug/l	<20	NA	191	**873**	<20	NA	NA	NA	**1414**	<20	<20	<20	NA	56	**451**	ND
Dissolved Manganese	50	50	-	ug/l	<2	NA	**232**	**750**	**562**	NA	NA	NA	**253**	**373**	**594**	**624**	NA	**215**	**813**	ND
Dissolved Sodium	150	200	-	mg/l	50.6	NA	15.1	14	4	NA	NA	NA	13.8	6.6	7.3	5.2	NA	29.8	12.1	ND
Nitrate as N	50	50	37.5	mg/l	0.19	4.4	<0.05	<0.05	18.88	0.07	1.2	0.62	0.05	4.4	3.93	0.17	<0.05	<0.05	<0.05	ND
Nitrite as N	0.5	0.5	375	mg/l	**1.353**	0.351	<0.006	<0.006	0.121	<0.006	<0.006	**0.906**	0.03	0.016	0.052	<0.006	<0.006	<0.006	<0.006	ND
Ammonical Nitrogen as N	-	-	-	mg/l	3.9	59.05	0.13	0.07	8.72	100.45	0.09	2.01	0.74	0.09	<0.03	0.05	0.11	0.05	0.12	0.83
Ammonical Nitrogen as NH4	0.15	0.3	0.175	mg/l	**5.03**	**76.17**	**0.17**	0.09	**11.25**	**129.58**	0.12	**2.59**	**0.95**	0.12	<0.03	<0.03	0.14	0.06	0.15	1.07
Total Nitrogen	-	-	-	mg/l	6.1	70.5	<0.5	<0.5	27.4	109.5	12.3	9.7	0.7	6.6	5.1	0.6	<0.5	<0.5	<0.5	ND
Sulphate as SO4	200	250	187.5	mg/l	12.5	NA	11.4	13.9	62.5	NA	NA	NA	97.1	49.9	39.1	13.8	NA	18.8	10.6	ND
Ortho Phosphate as PO4	0.03	0.03	-	mg/l	<0.06	**5.27**	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	ND
Total Alkalinity as CaCO3	-	-	-	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND
pH #	6.5 - 9.5	6.5 - 9.5	-	pH units	**12.2**	8.12	7.59	7.55	7.08	7.48	7.08	7.19	7.35	7.25	7.18	7.3	7.55	7.8	7.53	ND
Electrical Conductivity #	1000	2500	1875	uS/cm	**1343**	**2738**	671	667	**1135**	**1298**	754	785	936	762	703	725	667	646	636	ND
Phenols (various)	-	-	-	ug/l	NA	<LOD	NA	NA	NA	<LOD	<LOD	<LOD	NA	NA	NA	NA	<LOD	<LOD	NA	ND
PAHs (various)	-	-	-	ug/l	NA	<LOD	NA	NA	NA	<LOD	<LOD	<LOD	NA	NA	NA	NA	<LOD	<LOD	NA	ND
Phthalates (various)	-	-	-	ug/l	NA	<LOD	NA	NA	NA	<LOD	<LOD	<LOD	NA	NA	NA	NA	<LOD	<LOD	NA	ND

Notes
NA - Not Analysed
ND - Not Detected
<LOD - below the limit of detection
"#" = field reading
S.I. 122 of 2014 (Drinking Water Regulations)
S.I. 366 of 2016 (Groundwater Regulations)
IGV taken from EPA Interim Guideline Values 2003

Table 3 - Surface Water Analysis - COPCs

Analyte	PVL	IGV	Units	SW1	SW2	SW3	SW4	SW5	SW6	WD1	WD2
				26/09/2022							
Field Parameters											
pH #	4.5-9.0	5.5-9.0	-	DRY	7.44	7.29	7.37	7.41	7.64	7.62	7.65
Electrical Conductivity #	1000	1000	uS/cm		872	645.2	811	791	679.2	878	880
Dissolved Oxygen #	>3	9 mg/l *	mg/l		2.03	2.11	**6.26**	**5.98**	**7.96**	**6.18**	**9.52**
Oxidation Reduction Potential #	-	-	mV		238.8	434.9	50.6	27.9	274.9	282.1	356.6
Nitrotoluenes											
2,4-DNT	-	-	ug/l	DRY	NA	NA	10.9	<0.5	<0.5	2.1	1.3
2,6-DNT	-	-	ug/l		NA	NA	52	2	<1	13	4
2-Nitrotoluene	-	-	ug/l		NA	NA	NA	NA	NA	NA	NA
Other Nitrotoluenes	-	-	ug/l		NA	NA	NA	NA	NA	NA	NA
SVOCs (various additional)											
Phenols (various)	-	-	ug/l	DRY	NA	NA	<LOD	<LOD	<LOD	<LOD	<LOD
PAHs (various)	-	-	ug/l		NA	NA	<LOD	<LOD	<LOD	<LOD	<LOD
Phthalates (various)	-	-	ug/l		NA	NA	<LOD	<LOD	<LOD	<LOD	<LOD

Notes

"#" = field reading

NA - Not Analysed

ND - Not Detected

PVL taken from EU Surface Water (Amendments) Regulations 2019; Annual Average - EQS for inland surface waters

IGV taken from- EPA Discussion Document “Environmental Quality Objectives and Environmental Quality Standards, The Aquatic Environment” 1997

*For copper and zinc, the standard quoted is for soft water ≤ 10 mg/l CaCO3, a higher standard applies for hard water

LOD = limit of detection ; various individual SVOCs are not listed here when below LOD. Full laboratory laboratory certificates are included in appendices

Table 4 - Surface Water Analysis - Various Parameters

Analyte	PVL	IGV	Units	SW1	SW2	SW3	SW4	SW5	SW6	WD1	WD2
				26/09/22							
pH #	4.5-9.0	5.5-9.0	-	DRY	7.44	7.29	7.37	7.41	7.64	7.62	7.65
E. Conductivity #	1000	1000	uS/cm		872	645.2	811	791	679.2	878	880
TDS #	-	-	mg/l		565.50	419.25	513.50	520.00	441.35	672	572
Dissolved O2 #	>3	9 mg/l *	mg/l		2.03	2.11	**6.26**	**5.98**	**7.96**	**6.18**	**9.52**
Nitrate as N	-	50	mg/l		25.24	4.04	2.14	0.95	1.02	0.30	<0.05
Nitrite as N	-	-	mg/l		0.47	0.06	0.10	<0.006	<0.006	0.03	<0.006
Ammonical Nitrogen as N	-	-	mg/l		1.43	0.05	1.17	0.05	0.03	0.16	0.05
Ammonia, NH3	≤ 0.04 or ≤ 0.065	0.02	mg/l		**1.74**	**0.06**	**1.42**	**0.06**	**0.04**	**0.19**	**0.06**
Total Nitrogen	-	-	mg/l		29.50	4.90	3.60	1.00	1.00	1.30	0.70
Sulphate as SO4	200	200	mg/l		NA	NA	117.00	66.20	59.40	151.80	155.70
Ortho Phosphate as PO4	-	0.03	mg/l		<0.06	<0.06	**0.07**	<0.06	<0.06	**0.07**	**0.08**

Notes

PVL taken from EU Surface Water Regulations (Amendment) 2019

IGV taken from- EPA Discussion Document “Environmental Quality Objectives and Environmental Quality Standards, The Aquatic Environment” 1997

* guideline value of 9 mg/l demonstrates high oxygen saturation

"#" = Field reading

APPENDIX A

SAMPLE LOGS

GROUNDWATER SITE LOG SHEET

Client:	IIE	**Job Ref:**	50990
Date:	26-Sep-22	**Log by:**	RD and RB
Site:	Clonagh Enfield	**Weather:**	Cold, Calm & Dry

Sample ID	pH	Temp (°C)	EC (µS/cm)	DO, mg/l	ORP, mV	Water Level, mBTOC	Well Depth, mBTOC	Purge Vol (L)	Recharge Notes	Odour	Visual Notes
GW-2	12.2	12.2	1343		-93.3	0.78m				None	Brown tint
GW-3	8.12	11.9	2738		-52.1	1.89m				Stagnant odour	Brown tint
GW-4	7.59	11.8	671		57.4	0.90m				None	Yellow tint
GW-5	7.55	11.2	667		1.4	0.88m				None	Yellow tint
GW-6	7.08	13.3	1135		163.5	1.74m				None	Brown tint
GW-7	7.48	13.2	1298		-135.3	1.40m				None	Yellow tint
GW-8A	7.08	12.1	754		116.5	2.69m				Almond	Brown tint
GW-9A	7.19	15.9	785		109.3	2.35m				None	Brown tint
GW-10	7.36	12.6	936		-22.8	2.25m				None	Yellow tint
GW-11	7.25	13.2	762		157	2.44m				None	Yellow tint
GW-12	7.18	13.3	703	2.25	427.4	2.05	4.53		Good	None	Brown tint
GW-13	7.3	13.1	725		216	3.79m				None	Brown tint
GW-14	7.55	11.3	667		0.93	0.50m				None	Brown tint
GW-15	7.8	11.1	646		107.3	4.01m				None	Brown tint
GW-16	7.53	10.8	636		-156.7	3.10m				None	Brown tint

Notes

SURFACE WATER SITE LOG SHEET

		Client:	IIE				**Job Ref:**	50990
		Date:	26-Sep-22				**Log by:**	RB
		Site:	Clonagh, Enfield				**Weather:**	Dry, windy mild
Sample ID	**pH**	**Temp (°C)**	**EC (µS/cm)**	**DO, mg/l**	**ORP, mV**	**Odour**	**Flow**	**Visual Notes**
SW1	-	-	-	-	-	-	Dry	Dry over grown
SW2	7.44	10.1	872	2.03	238.8	none	Stagnant	No PEC significant fine black sediment, debris from trees
SW3	7.29	11.6	645.2	2.11	434.9	none	Stagnant	No PEC slight brown guilt with fine brown sediment, weeds in stream
SW4	7.37	9.5	811	6.26	50.6	none	Stagnant	No PEC clear with minor brown sediment
SW5	7.41	9.7	791	5.98	27.9	none	Stagnant	No PEC, Clear
SW6	7.64	10.2	679.2	7.96	274.9	none	Medium	No PEC very slight brown tint
WD1	7.62	9.5	878	6.18	282.1	none	Stagnant	No PEC brown tint with fine brown sediment, debris from trees and tree branches
WD2	7.65	9.9	880	9.52	356.6	none	Stagnant	No PEC very slight brown tint and minor brown sediment, debris from trees and branches

General Notes: All drainage ditches on site are almost stagnant or very slow flowing

PEC: Physical Evidence of Contamination

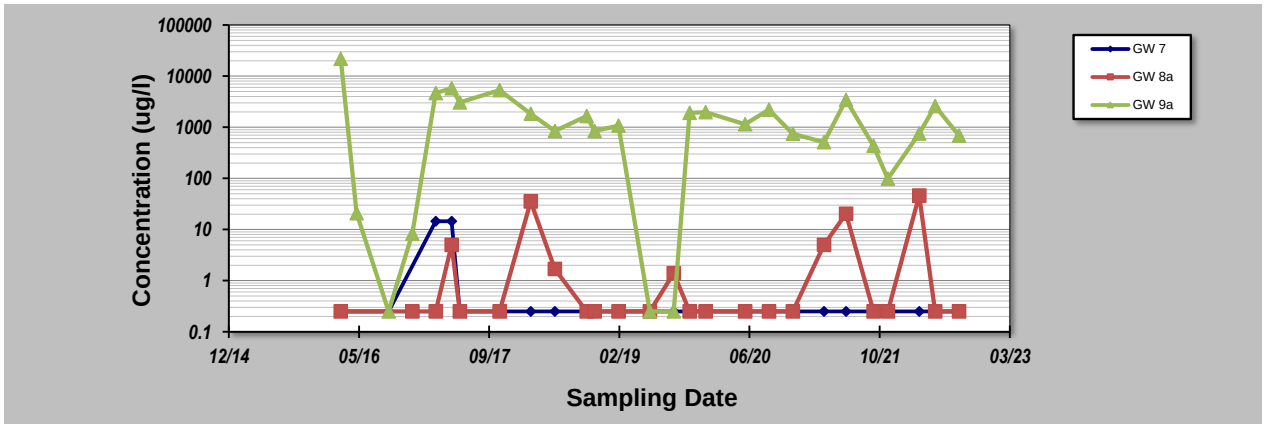
APPENDIX B

MANN-KENDALL

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	29-Nov-22	Job ID:	Ground Water Monitoring Wells 2015-2022
Facility Name:	IIE	Constituent:	2, 4 Dinitrotoluene
Conducted By:	Verdé	Concentration Units:	ug/l

Sampling Point ID:	GW 7	GW 8a	GW 9a				
Sampling Event	Sampling Date	2, 4 DINITROTOLUENE CONCENTRATION (ug/l)						
1	Mar-2016	0.25	0.25	21779				
2	May-2016			20.8				
3	Sep-2016	0.25		0.25				
4	Dec-2016		0.25	8.3				
5	Mar-2017	14.5	0.25	4647				
6	May-2017	14.5	5	5784				
7	Jun-2017	0.25	0.25	3069				
8	Nov-2017	0.25	0.25	5344				
9	Mar-2018	0.25	35.2	1834				
10	Jun-2018	0.25	1.7	843.8				
11	Oct-2018	0.25	0.25	1657				
12	Nov-2018	0.25	0.25	847				
13	Feb-2019	0.25	0.25	1083				
14	Jun-2019	0.25	0.25	0.25				
15	Sep-2019	0.25	1.4	0.25				
16	Nov-2019		0.25	1905.1				
17	Jan-2020	0.25	0.25	1962.3				
18	Jun-20	0.25	0.25	1149.6				
19	Sep-20	0.25	0.25	2196.1				
20	Dec-20	0.25	0.25	748.3				
21	Mar-21	0.25	5	509.4				
22	Jun-21	0.25	20.3	3423.7				
23	Oct-21	0.25	0.25	433.2				
24	Dec-21	0.25	0.25	98.6				
25	Apr-22	0.25	46.2	751.3				
26	Jun-22	0.25	0.25	2592.4				
27	Sep-22	0.25	0.25	689.3				
28								
29								
30								
Coefficient of Variation:		2.80	2.45	1.79				
Mann-Kendall Statistic (S):		-36	12	-48				
Confidence Factor:		80.5%	60.0%	83.5%				
Concentration Trend:		No Trend	No Trend	No Trend				



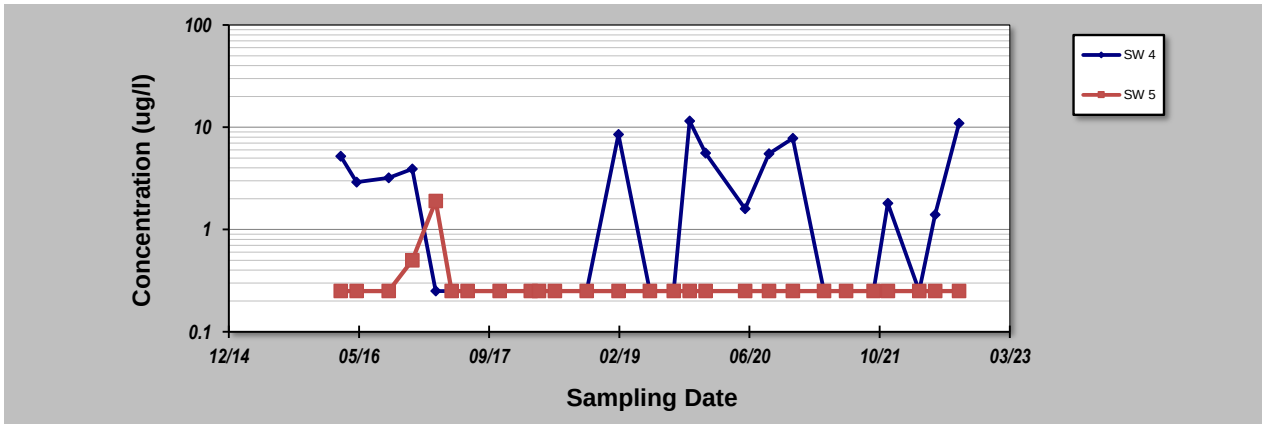
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.
4. **Site Specific RTC for 2,4-DNT is 1.42 ug/l .**

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	29-Nov-22	Job ID:	Surface Water Monitoring 2016-2022
Facility Name:	IIE	Constituent:	2, 4 Dinitrotoluene
Conducted By:	Verdé	Concentration Units:	ug/l

Sampling Point ID:	SW 4	SW 5					
Sampling Event	Sampling Date	2, 4 DINITROTOLUENE CONCENTRATION (ug/l)						
1	Mar-2016	5.2	0.25					
2	May-2016	2.9	0.25					
3	Sep-2016	3.2	0.25					
4	Dec-2016	3.9	0.5					
5	Mar-2017	0.25	1.9					
6	May-2017	0.25	0.25					
7	Jul-2017	0.25	0.25					
8	Nov-2017	0.25	0.25					
9	Mar-2018	0.25	0.25					
10	Apr-2018	0.25	0.25					
11	Jun-2018	0.25	0.25					
12	Oct-2018	0.25	0.25					
13	Feb-2019	8.5	0.25					
14	Jun-2019	0.25	0.25					
15	Sep-2019	0.25	0.25					
16	Nov-2019	11.5	0.25					
17	Jan-2020	5.6	0.25					
18	Jun-2020	1.6	0.25					
19	Sep-2020	5.5	0.25					
20	Dec-2020	7.8	0.25					
21	Mar-2021	0.25	0.25					
22	Jun-2021	0.25	0.25					
23	Oct-2021	0.25	0.25					
24	Dec-2021	1.8	0.25					
25	Apr-2022	0.25	0.25					
26	Jun-2022	1.4	0.25					
27	Sep-2022	10.9	0.25					
28								
29								
30								
Coefficient of Variation:		1.28	1.00					
Mann-Kendall Statistic (S):		18	-37					
Confidence Factor:		63.7%	77.2%					
Concentration Trend:		No Trend	Stable					



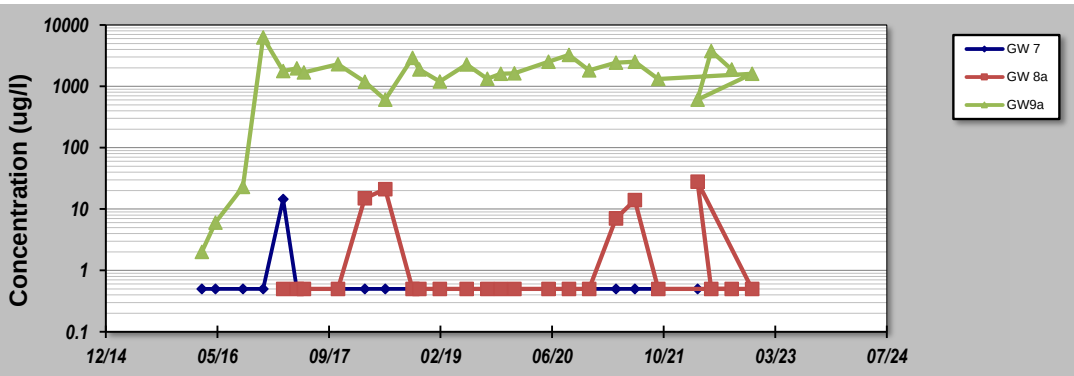
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.
4 **Site Specific RTC for 2,4-DNT is 1.42 ug/l .**

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	29-Nov-22	Job ID:	Ground Water Monitoring Wells 2016-2022
Facility Name:	IIE	Constituent:	2, 6 Dinitrotoluene
Conducted By:	Verdé	Concentration Units:	ug/l

Sampling Point ID:	GW 7	GW 8a	GW9a				
Sampling Event	Sampling Date	2, 6 DINITROTOLUENE CONCENTRATION (ug/l)						
1	Mar-2016	0.5		2				
2	May-2016	0.5		6				
3	Sep-2016	0.5		23				
4	Dec-2016	0.5		6246				
5	Mar-2017	14.5	0.5	1775				
6	May-2017	0.5	0.5	1969				
7	Jun-2017	0.5	0.5	1689				
8	Nov-2017	0.5	0.5	2291				
9	Mar-2018	0.5	15	1189				
10	Jun-2018	0.5	21	607				
11	Oct-2018	0.5	0.5	2922				
12	Nov-2018	0.5	0.5	1879				
13	Feb-2019	0.5	0.5	1196				
14	Jun-2019	0.5	0.5	2282				
15	Sep-2019	0.5	0.5	1333				
16	Nov-2019	0.5	0.5	1603				
17	Jan-2020	0.5	0.5	1631				
18	Jun-2020	0.5	0.5	2516				
19	Sep-2020	0.5	0.5	3259				
20	Dec-2020	0.5	0.5	1818				
21	Mar-2021	0.5	7	2436				
22	Jun-2021	0.5	14	2513				
23	Oct-2021	0.5	0.5	1317				
24	Dec-2022	0.5	0.5	1606				
25	Apr-2022	0.5	28	604				
26	Jun-2022	0.5	0.5	3769				
27	Sep-2022	0.5	0.5	1879				
28								
29								
30								
Coefficient of Variation:		2.65	1.89	0.69				
Mann-Kendall Statistic (S):		-18	16	76				
Confidence Factor:		63.7%	65.3%	94.1%				
Concentration Trend:		No Trend	No Trend	Prob. Increasing				



Notes:

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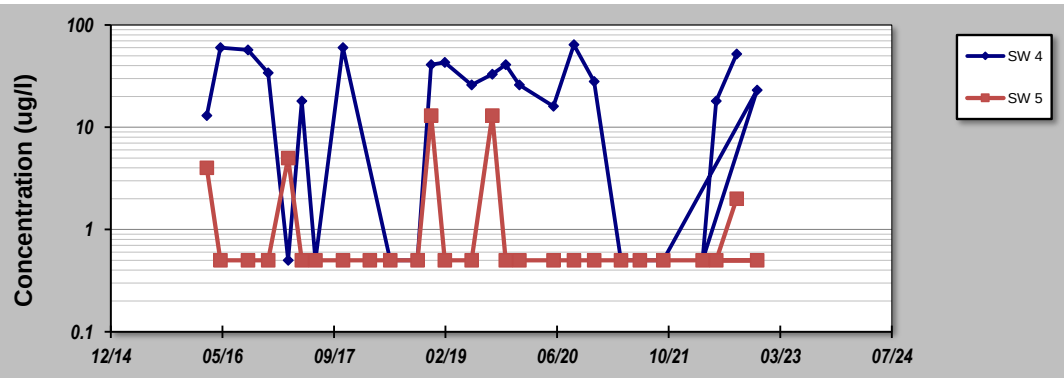
4 **Site Specific RTC for 2,6-DNT is 1.04 ug/l .**

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	29-Nov-22	Job ID:	Surface Water Monitoring 2016-2022
Facility Name:	IIE	Constituent:	2, 6 Dinitrotoluene
Conducted By:	Verdé	Concentration Units:	ug/l

Sampling Point ID:	SW 4	SW 5					
Sampling Event	Sampling Date	2, 6 DINITROTOLUENE CONCENTRATION (ug/l)						
1	Mar-2016	13	4					
2	May-2016	60	0.5					
3	Sep-2016	57	0.5					
4	Dec-2016	34	0.5					
5	Mar-2017	0.5	5					
6	May-2017	18	0.5					
7	Jul-2017	0.5	0.5					
8	Nov-2017	60	0.5					
9	Mar-2018		0.5					
10	Jun-2018	0.5	0.5					
11	Oct-2018	0.5	0.5					
12	Dec-2018	41	13					
13	Feb-2019	43	0.5					
14	Jun-2019	26	0.5					
15	Sep-2019	33	13					
16	Nov-2019	41	0.5					
17	Jan-2020	26	0.5					
18	Jun-2020	16	0.5					
19	Sep-2020	64	0.5					
20	Dec-2020	28	0.5					
21	Mar-2021	0.5	0.5					
22	Jun-2021	0.5	0.5					
23	Oct-2021	0.5	0.5					
24	Dec-2022	23	0.5					
25	Apr-2022	0.5	0.5					
26	Jun-2022	18	0.5					
27	Sep-2022	52	2					
28								
29								
30								
Coefficient of Variation:		0.86	1.92					
Mann-Kendall Statistic (S):		-41	-19					
Confidence Factor:		80.9%	64.5%					
Concentration Trend:		Stable	No Trend					



Notes:

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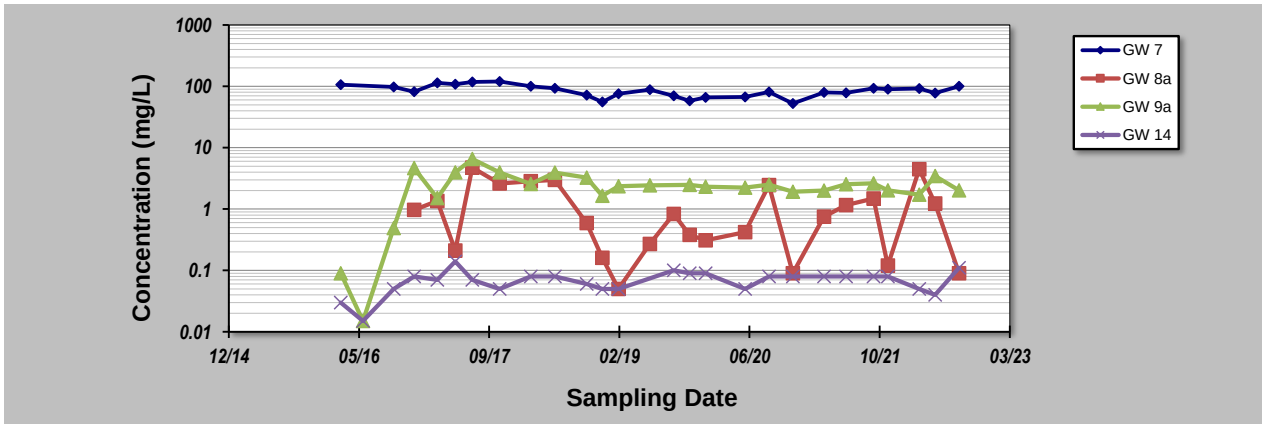
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.
4. **Site Specific RTC for 2,6-DNT is 1.04 ug/l .**

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	29-Nov-22	Job ID:	Ground Water Well Results 2016-2022
Facility Name:	IIE	Constituent:	Ammoniacal Nitrogen as N
Conducted By:	Verdé	Concentration Units:	mg/L

Sampling Point ID:	GW 7	GW 8a	GW 9a	GW 14			
Sampling Event	Sampling Date	AMMONIACAL NITROGEN AS N CONCENTRATION (mg/L)						
1	Mar-16	106.28		0.09	0.03			
2	May-16	117.27		0.015	0.015			
3	Sep-16	97.78		0.49	0.05			
4	Dec-16	81.38	0.97	4.65	0.08			
5	Mar-17	113.59	1.35	1.51	0.07			
6	May-17	108.28	0.21	3.96	0.14			
7	Jul-17	117.55	4.74	6.55	0.07			
8	Nov-17	120	2.61	3.95	0.05			
9	Mar-18	100.29	2.83	2.56	0.08			
10	Jun-18	92.54	3	3.91	0.08			
11	Oct-18	71.79	0.59	3.26	0.06			
12	Dec-18	55.86	0.16	1.65	0.05			
13	Feb-19	75.51	0.05	2.35	0.05			
14	Jun-19	88.46	0.27	2.44				
15	Sep-19	70.1	0.83		0.1			
16	Nov-19	58.22	0.38	2.48	0.09			
17	Jan-20	65.96	0.31	2.31	0.09			
18	Jun-20	67.24	0.42	2.24	0.05			
19	Sep-20	81.11	2.45	2.49	0.08			
20	Dec-20	52.53	0.09	1.91	0.08			
21	Mar-21	79.32	0.75	2	0.08			
22	Jun-21	78.39	1.16	2.55	0.08			
23	Oct-21	92.49	1.49	2.62	0.08			
24	Dec-21	89.51	0.12	2.02	0.08			
25	Apr-22	91.91	4.46	1.72	0.05			
26	Jun-22	77.72	1.23	3.45	0.04			
27	Sep-22	100.45	0.09	2.01	0.11			
28								
29								
30								
Coefficient of Variation:		0.22	1.08	0.55	0.37			
Mann-Kendall Statistic (S):		-101	-29	-13	56			
Confidence Factor:		98.7%	75.4%	60.3%	88.6%			
Concentration Trend:		Decreasing	No Trend	Stable	No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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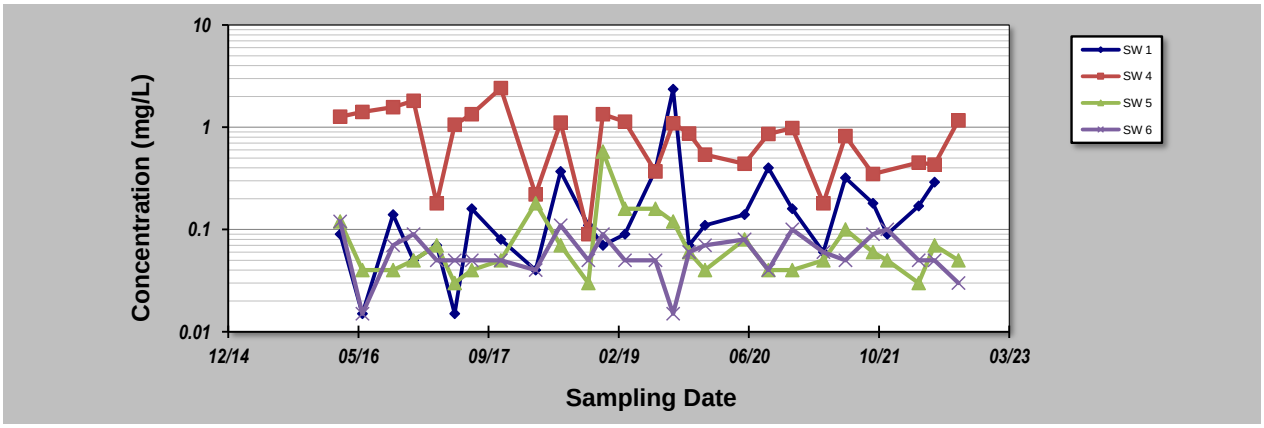
4. **Site Specific RTC for Ammonical Nitrogen as N is 0.179 mg/l .**

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	29-Nov-22	Job ID:	Surface Water Monitoring Results 2016-2022
Facility Name:	IIE	Constituent:	Ammoniacal Nitrogen as N
Conducted By:	Verdé	Concentration Units:	mg/L

Sampling Point ID:	SW 1	SW 4	SW 5	SW 6			
Sampling Event	Sampling Date	AMMONIACAL NITROGEN AS N CONCENTRATION (mg/L)						
1	Mar-16	0.09	1.27	0.12	0.12			
2	May-16	0.015	1.41	0.04	0.015			
3	Sep-16	0.14	1.57	0.04	0.07			
4	Dec-16	0.05	1.81	0.05	0.09			
5	Mar-17	0.07	0.18	0.07	0.05			
6	May-17	0.015	1.06	0.03	0.05			
7	Jul-17	0.16	1.34	0.04	0.05			
8	Nov-17	0.08	2.41	0.05	0.05			
9	Mar-18	0.04	0.22	0.18	0.04			
10	Jun-18	0.37	1.11	0.07	0.11			
11	Oct-18	0.11	0.09	0.03	0.05			
12	Dec-18	0.07	1.34	0.58	0.09			
13	Feb-19	0.09	1.13	0.16	0.05			
14	Jun-19	0.38	0.37	0.16	0.05			
15	Sep-19	2.35	1.09	0.12	0.015			
16	Nov-19	0.07	0.87	0.06	0.06			
17	Jan-20	0.11	0.54	0.04	0.07			
18	Jun-20	0.14	0.44	0.08	0.08			
19	Sep-20	0.4	0.86	0.04	0.04			
20	Dec-20	0.16	0.98	0.04	0.1			
21	Mar-21	0.06	0.18	0.05	0.06			
22	Jun-21	0.32	0.82	0.1	0.05			
23	Oct-21	0.18	0.35	0.06	0.09			
24	Dec-21	0.09	0..85	0.05	0.1			
25	Apr-22	0.17	0.45	0.03	0.05			
26	Jun-22	0.29	0.43	0.07	0.05			
27	Sep-22		1.17	0.05	0.03			
28								
29								
30								
Coefficient of Variation:		1.93	0.63	1.20	0.44			
Mann-Kendall Statistic (S):		111	-105	-9	-8			
Confidence Factor:		99.3%	99.0%	56.6%	55.8%			
Concentration Trend:		Increasing	Decreasing	No Trend	Stable			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.
4. **Site Specific RTC for Ammonical Nitrogen as N is 0.179 ug/l .**

APPENDIX C

LABORARTORY ANALYSIS CERTIFICATES

Element Materials Technology
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Attention :	Rebecca Bradford
Date :	8th December, 2022
Your reference :	50990
Our reference :	Test Report 22/15702 Batch 1 & 22/15695 (17-28)
Location :	IIE
Date samples received :	26 & 27th September, 2022
Status :	Final Report
Issue :	1

Twenty five samples were received for analysis on 26 & 27th September, 2022 of which twenty five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Phil Sommerton BSc
Senior Project Manager

Element Materials Technology

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

EMT Sample No.	1-5	6-10	11-15	16-20	21-26	27-31	32-34	35-37	38-40	41-43	LOD/LOR	Units	Method No.
Sample ID	GW7	GW8A	GW9A	GW14	GW15	GW3	GW2	GW4	GW5	GW6			
Depth													
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H HN P G	V H P G	H HN P	H HN P	H HN P	H HN P			
Sample Date	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022			
Dissolved Aluminium #	-	-	-	-	<20	-	1274	<20	<20	<20	<20	ug/l	TM30/PM14
Dissolved Antimony #	-	-	-	-	<2	-	<2	<2	<2	<2	<2	ug/l	TM30/PM14
Dissolved Arsenic #	-	-	-	-	<2.5	-	<2.5	<2.5	16.9	<2.5	<2.5	ug/l	TM30/PM14
Dissolved Barium #	-	-	-	-	<3	-	152	205	128	67	<3	ug/l	TM30/PM14
Dissolved Boron	-	-	-	-	<12	-	<12	13	<12	29	<12	ug/l	TM30/PM14
Dissolved Cadmium #	-	-	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM30/PM14
Dissolved Calcium #	-	-	-	-	61.5	-	125.0	76.8	78.6	203.2_{AA}	<0.2	mg/l	TM30/PM14
Total Dissolved Chromium #	-	-	-	-	<1.5	-	<1.5	<1.5	<1.5	<1.5	<1.5	ug/l	TM30/PM14
Dissolved Copper #	-	-	-	-	<7	-	<7	<7	<7	<7	<7	ug/l	TM30/PM14
Total Dissolved Iron #	-	-	-	-	56	-	<20	191	873	<20	<20	ug/l	TM30/PM14
Dissolved Lead #	-	-	-	-	<5	-	<5	<5	<5	<5	<5	ug/l	TM30/PM14
Dissolved Manganese #	-	-	-	-	215	-	<2	232	750	562	<2	ug/l	TM30/PM14
Dissolved Nickel #	-	-	-	-	<2	-	36	<2	<2	8	<2	ug/l	TM30/PM14
Dissolved Selenium #	-	-	-	-	<3	-	<3	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Sodium #	-	-	-	-	29.8	-	50.6	15.1	14.0	4.0	<0.1	mg/l	TM30/PM14
Dissolved Zinc #	-	-	-	-	<3	-	<3	<3	<3	<3	<3	ug/l	TM30/PM14
SVOC TICs	ND	ND	See Attached	ND	ND	ND	-	-	-	-		None	TM16/PM30
Sulphate as SO4 #	-	-	-	-	18.8	-	12.5	11.4	13.9	62.5	<0.5	mg/l	TM38/PM0
Ortho Phosphate as PO4 #	<0.06	<0.06	<0.06	<0.06	<0.06	5.27	<0.06	<0.06	<0.06	<0.06	<0.06	mg/l	TM38/PM0
Nitrate as N #	0.07	1.20	0.62	<0.05	<0.05	4.40	0.19	<0.05	<0.05	18.88	<0.05	mg/l	TM38/PM0
Nitrite as N #	<0.006	<0.006	0.906	<0.006	<0.006	0.351	1.353	<0.006	<0.006	0.121	<0.006	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	100.45	0.09	2.01	0.11	0.05	59.05	3.90	0.13	0.07	8.72	<0.03	mg/l	TM38/PM0
Total Nitrogen	109.5	12.3	9.7	<0.5	<0.5	70.5	6.1	<0.5	<0.5	27.4	<0.5	mg/l	TM38/TM125/PM0

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

EMT Sample No.	44-46	47-49	50-52	53-55	56-58	59-60	61-62	63-68	69-74	75-80			
Sample ID	GW10	GW11	GW12	GW13	GW16	SW2	SW3	SW4	SW5	SW6			
Depth											Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	H HN P	H HN P	H HN P	H HN P	H HN P	H P	H P	V H HN P G	V H HN P G	V H HN P G			
Sample Date	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	LOD/LOR	Units	Method No.
Dissolved Aluminium #	53	<20	<20	<20	<20	-	-	<20	<20	<20	<20	ug/l	TM30/PM14
Dissolved Antimony #	<2	<2	<2	<2	<2	-	-	3	<2	<2	<2	ug/l	TM30/PM14
Dissolved Arsenic #	5.5	<2.5	<2.5	<2.5	5.1	-	-	<2.5	<2.5	<2.5	<2.5	ug/l	TM30/PM14
Dissolved Barium #	486	51	124	40	45	-	-	102	74	66	<3	ug/l	TM30/PM14
Dissolved Boron	<12	14	<12	<12	23	-	-	15	<12	<12	<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	ug/l	TM30/PM14
Dissolved Calcium #	150.2	142.1	144.5	137.2	77.3	-	-	171.5	155.5	137.9	<0.2	mg/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5	<1.5	<1.5	-	-	6.5	9.8	5.8	<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	<7	<7	<7	-	-	<7	<7	<7	<7	ug/l	TM30/PM14
Total Dissolved Iron #	1414	<20	<20	<20	451	-	-	54	66	94	<20	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5	<5	<5	-	-	<5	<5	<5	<5	ug/l	TM30/PM14
Dissolved Manganese #	253	373	594	624	813	-	-	250	107	50	<2	ug/l	TM30/PM14
Dissolved Nickel #	<2	12	10	9	<2	-	-	2	<2	<2	<2	ug/l	TM30/PM14
Dissolved Selenium #	<3	<3	<3	<3	<3	-	-	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Sodium #	13.8	6.6	7.3	5.2	12.1	-	-	15.1	10.3	8.9	<0.1	mg/l	TM30/PM14
Dissolved Zinc #	<3	<3	<3	5	<3	-	-	30	<3	<3	<3	ug/l	TM30/PM14
SVOC TICs	-	-	-	-	-	-	-	ND	ND	ND		None	TM16/PM30
Sulphate as SO4 #	97.1	49.9	39.1	13.8	10.6	-	-	117.0	66.2	59.4	<0.5	mg/l	TM38/PM0
Ortho Phosphate as PO4 #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.07	<0.06	<0.06	<0.06	mg/l	TM38/PM0
Nitrate as N #	0.05	4.40	3.93	0.17	<0.05	25.24	4.04	2.14	0.95	1.02	<0.05	mg/l	TM38/PM0
Nitrite as N #	0.030	0.016	0.052	<0.006	<0.006	0.465	0.059	0.098	<0.006	<0.006	<0.006	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.74	0.09	<0.03	0.05	0.12	1.43	0.05	1.17	0.05	0.03	<0.03	mg/l	TM38/PM0
Total Nitrogen	0.7	6.6	5.1	0.6	<0.5	29.5	4.9	3.6	1.0	1.0	<0.5	mg/l	TM38/TM125/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	81-86	87-92									LOD/LOR	Units	Method No.
Sample ID	WD1	WD2											
Depth													
COC No / misc													
Containers	V H HN P G	V H HN P G											
Sample Date	26/09/2022	26/09/2022											
Sample Type	Surface Water	Surface Water											
Batch Number	1	1											
Date of Receipt	27/09/2022	27/09/2022											
Dissolved Aluminium #	<20	<20									<20	ug/l	TM30/PM14
Dissolved Antimony #	<2	<2									<2	ug/l	TM30/PM14
Dissolved Arsenic #	<2.5	<2.5									<2.5	ug/l	TM30/PM14
Dissolved Barium #	108	116									<3	ug/l	TM30/PM14
Dissolved Boron	<12	<12									<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5									<0.5	ug/l	TM30/PM14
Dissolved Calcium #	173.2	174.7									<0.2	mg/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5									<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7									<7	ug/l	TM30/PM14
Total Dissolved Iron #	23	<20									<20	ug/l	TM30/PM14
Dissolved Lead #	<5	<5									<5	ug/l	TM30/PM14
Dissolved Manganese #	387	82									<2	ug/l	TM30/PM14
Dissolved Nickel #	<2	<2									<2	ug/l	TM30/PM14
Dissolved Selenium #	<3	<3									<3	ug/l	TM30/PM14
Dissolved Sodium #	16.0	16.5									<0.1	mg/l	TM30/PM14
Dissolved Zinc #	<3	<3									<3	ug/l	TM30/PM14
SVOC TICs	ND	ND										None	TM16/PM30
Sulphate as SO4 #	151.8	155.7									<0.5	mg/l	TM38/PM0
Ortho Phosphate as PO4 #	0.07	0.08									<0.06	mg/l	TM38/PM0
Nitrate as N #	0.30	<0.05									<0.05	mg/l	TM38/PM0
Nitrite as N #	0.029	<0.006									<0.006	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.16	0.05									<0.03	mg/l	TM38/PM0
Total Nitrogen	1.3	0.7									<0.5	mg/l	TM38/TM125/PM0

Element Materials Technology

Client Name: Verde Environmental Consultants
Reference: 50990
Location: 11E
Contact: Rebecca Bradford
EMT Job No: 22/15695

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

EMT Sample No.	17-20	21-24	25-28									
Sample ID	MW401	MW408	PUMPOUTLET									
Depth										Please see attached notes for all abbreviations and acronyms		
COC No / misc												
Containers	V H G	V H G	V H G									
Sample Date	26/09/2022	26/09/2022	26/09/2022									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	27/09/2022	27/09/2022	27/09/2022									
										LOD/LOR	Units	Method No.
SVOC TICs	ND	ND	See Attached								None	TM16/PM30
Ammoniacal Nitrogen as N #	5.37	0.07	0.83							<0.03	mg/l	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

SVOC Report : **Liquid**

EMT Sample No.	1-5	6-10	11-15	16-20	21-26	27-31	63-68	69-74	75-80	81-86	LOD/LOR	Units	Method No.
Sample ID	GW7	GW8A	GW9A	GW14	GW15	GW3	SW4	SW5	SW6	WD1			
Depth													
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H HN P G	V H P G	V H HN P G	V H HN P G	V H HN P G	V H HN P G			
Sample Date	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022			
SVOC MS													
Phenols													
2-Chlorophenol #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
4-Methylphenol	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<200 AB	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Pentachlorophenol	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Phenol	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
PAHs													
2-Chloronaphthalene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylnaphthalene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Naphthalene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Acenaphthylene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Acenaphthene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Fluorene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Phenanthrene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Anthracene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Fluoranthene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Pyrene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Benzo(a)anthracene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Chrysene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Benzo(bk)fluoranthene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Benzo(a)pyrene	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Indeno(123cd)pyrene	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Dibenzo(ah)anthracene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Benzo(ghi)perylene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Phthalates													
Bis(2-ethylhexyl) phthalate	<5	<5	<100 AB	<5	<5	<5	<5	<5	<5	<5	<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5	<1.5	<30.0 AB	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Diethyl phthalate #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Dimethyl phthalate	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30

Please see attached notes for all abbreviations and acronyms

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

SVOC Report : **Liquid**

EMT Sample No.	1-5	6-10	11-15	16-20	21-26	27-31	63-68	69-74	75-80	81-86	LOD/LOR	Units	Method No.
Sample ID	GW7	GW8A	GW9A	GW14	GW15	GW3	SW4	SW5	SW6	WD1			
Depth													
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H HN P G	V H P G	V H HN P G	V H HN P G	V H HN P G	V H HN P G			
Sample Date	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022	26/09/2022			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022			
SVOC MS													
Other SVOCs													
1,2-Dichlorobenzene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
1,3-Dichlorobenzene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
1,4-Dichlorobenzene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
2-Nitroaniline	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
2,4-Dinitrotoluene #	<0.5	<0.5	689.3 AB	<0.5	<0.5	<0.5	10.9	<0.5	<0.5	2.1	<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	<1	<1	>>1879 AB	<1	<1	<1	52	2	<1	13	<1	ug/l	TM16/PM30
3-Nitroaniline	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
4-Bromophenylphenylether #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chloroaniline	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chlorophenylphenylether #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Azobenzene #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Carbazole #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Dibenzofuran #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Hexachlorobenzene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachlorobutadiene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachloroethane #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Isophorone #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine #	<0.5	<0.5	<10.0 AB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Nitrobenzene #	<1	<1	<20 AB	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	103	123	121 AB	128	121	110	124	124	127	103	<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	106	125	104 AB	137 SV	125	108	129	128	129	121	<0	%	TM16/PM30

Please see attached notes for all abbreviations and acronyms

All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

SVOC Report : **Liquid**

EMT Sample No.	87-92												
Sample ID	WD2												
Depth													
COC No / misc													
Containers	V H HN P G												
Sample Date	26/09/2022												
Sample Type	Surface Water												
Batch Number	1												
Date of Receipt	27/09/2022												
SVOC MS													
Phenols													
2-Chlorophenol #	<1											<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5											<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5											<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5											<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1											<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5											<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1											<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol #	<0.5											<0.5	ug/l	TM16/PM30
4-Methylphenol	<1											<1	ug/l	TM16/PM30
4-Nitrophenol	<10											<10	ug/l	TM16/PM30
Pentachlorophenol	<1											<1	ug/l	TM16/PM30
Phenol	<1											<1	ug/l	TM16/PM30
PAHs														
2-Chloronaphthalene #	<1											<1	ug/l	TM16/PM30
2-Methylnaphthalene #	<1											<1	ug/l	TM16/PM30
Naphthalene #	<1											<1	ug/l	TM16/PM30
Acenaphthylene #	<0.5											<0.5	ug/l	TM16/PM30
Acenaphthene #	<1											<1	ug/l	TM16/PM30
Fluorene #	<0.5											<0.5	ug/l	TM16/PM30
Phenanthrene #	<0.5											<0.5	ug/l	TM16/PM30
Anthracene #	<0.5											<0.5	ug/l	TM16/PM30
Fluoranthene #	<0.5											<0.5	ug/l	TM16/PM30
Pyrene #	<0.5											<0.5	ug/l	TM16/PM30
Benzo(a)anthracene #	<0.5											<0.5	ug/l	TM16/PM30
Chrysene #	<0.5											<0.5	ug/l	TM16/PM30
Benzo(bk)fluoranthene #	<1											<1	ug/l	TM16/PM30
Benzo(a)pyrene	<1											<1	ug/l	TM16/PM30
Indeno(123cd)pyrene	<1											<1	ug/l	TM16/PM30
Dibenzo(ah)anthracene #	<0.5											<0.5	ug/l	TM16/PM30
Benzo(ghi)perylene #	<0.5											<0.5	ug/l	TM16/PM30
Phthalates														
Bis(2-ethylhexyl) phthalate	<5											<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1											<1	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5											<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1											<1	ug/l	TM16/PM30
Diethyl phthalate #	<1											<1	ug/l	TM16/PM30
Dimethyl phthalate	<1											<1	ug/l	TM16/PM30

Please see attached notes for all abbreviations and acronyms

All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford
EMT Job No: 22/15702

SVOC Report : **Liquid**

EMT Sample No.	87-92												
Sample ID	WD2												
Depth													
COC No / misc													
Containers	V H HN P G												
Sample Date	26/09/2022												
Sample Type	Surface Water												
Batch Number	1												
Date of Receipt	27/09/2022												

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
SVOC MS													
Other SVOCs													
1,2-Dichlorobenzene #	<1										<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene #	<1										<1	ug/l	TM16/PM30
1,3-Dichlorobenzene #	<1										<1	ug/l	TM16/PM30
1,4-Dichlorobenzene #	<1										<1	ug/l	TM16/PM30
2-Nitroaniline	<1										<1	ug/l	TM16/PM30
2,4-Dinitrotoluene #	1.3										<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	4										<1	ug/l	TM16/PM30
3-Nitroaniline	<1										<1	ug/l	TM16/PM30
4-Bromophenylphenylether #	<1										<1	ug/l	TM16/PM30
4-Chloroaniline	<1										<1	ug/l	TM16/PM30
4-Chlorophenylphenylether #	<1										<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5										<0.5	ug/l	TM16/PM30
Azobenzene #	<0.5										<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane #	<0.5										<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether #	<1										<1	ug/l	TM16/PM30
Carbazole #	<0.5										<0.5	ug/l	TM16/PM30
Dibenzofuran #	<0.5										<0.5	ug/l	TM16/PM30
Hexachlorobenzene #	<1										<1	ug/l	TM16/PM30
Hexachlorobutadiene #	<1										<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1										<1	ug/l	TM16/PM30
Hexachloroethane #	<1										<1	ug/l	TM16/PM30
Isophorone #	<0.5										<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine #	<0.5										<0.5	ug/l	TM16/PM30
Nitrobenzene #	<1										<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	95										<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	114										<0	%	TM16/PM30

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Verde Environmental Consultants
Reference: 50990
Location: 11E
Contact: Rebecca Bradford
EMT Job No: 22/15695

SVOC Report : **Liquid**

EMT Sample No.	17-20	21-24	25-28									
Sample ID	MW401	MW408	PUMPOUTLET									
Depth										Please see attached notes for all abbreviations and acronyms		
COC No / misc												
Containers	V H G	V H G	V H G									
Sample Date	26/09/2022	26/09/2022	26/09/2022									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	27/09/2022	27/09/2022	27/09/2022									
SVOC MS										LOD/LOR	Units	Method No.
Phenols												
2-Chlorophenol #	<1	<1	<1							<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1	<1	<1							<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1	<1	<1							<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
4-Methylphenol	<1	<1	<1							<1	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<10							<10	ug/l	TM16/PM30
Pentachlorophenol	<1	<1	<1							<1	ug/l	TM16/PM30
Phenol	<1	<1	<1							<1	ug/l	TM16/PM30
PAHs												
2-Chloronaphthalene #	<1	<1	<1							<1	ug/l	TM16/PM30
2-Methylnaphthalene #	<1	<1	<1							<1	ug/l	TM16/PM30
Naphthalene #	<1	<1	<1							<1	ug/l	TM16/PM30
Acenaphthylene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Acenaphthene #	<1	<1	<1							<1	ug/l	TM16/PM30
Fluorene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Phenanthrene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Anthracene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Fluoranthene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Pyrene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Benzo(a)anthracene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Chrysene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Benzo(bk)fluoranthene #	<1	<1	<1							<1	ug/l	TM16/PM30
Benzo(a)pyrene	<1	<1	<1							<1	ug/l	TM16/PM30
Indeno(123cd)pyrene	<1	<1	<1							<1	ug/l	TM16/PM30
Dibenzo(ah)anthracene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Benzo(ghi)perylene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Phthalates												
Bis(2-ethylhexyl) phthalate	<5	<5	<5							<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1	<1	<1							<1	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5	<1.5	<1.5							<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1	<1	<1							<1	ug/l	TM16/PM30
Diethyl phthalate #	<1	<1	<1							<1	ug/l	TM16/PM30
Dimethyl phthalate	<1	<1	<1							<1	ug/l	TM16/PM30

All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Verde Environmental Consultants
Reference: 50990
Location: 11E
Contact: Rebecca Bradford
EMT Job No: 22/15695

SVOC Report : **Liquid**

EMT Sample No.	17-20	21-24	25-28									
Sample ID	MW401	MW408	PUMPOUTLET									
Depth										Please see attached notes for all abbreviations and acronyms		
COC No / misc												
Containers	V H G	V H G	V H G									
Sample Date	26/09/2022	26/09/2022	26/09/2022									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	27/09/2022	27/09/2022	27/09/2022									
SVOC MS										LOD/LOR	Units	Method No.
Other SVOCs												
1,2-Dichlorobenzene #	<1	<1	<1							<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene #	<1	<1	<1							<1	ug/l	TM16/PM30
1,3-Dichlorobenzene #	<1	<1	<1							<1	ug/l	TM16/PM30
1,4-Dichlorobenzene #	<1	<1	<1							<1	ug/l	TM16/PM30
2-Nitroaniline	<1	<1	<1							<1	ug/l	TM16/PM30
2,4-Dinitrotoluene #	92.5	<0.5	>>282.0							<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	150	<1	>>552							<1	ug/l	TM16/PM30
3-Nitroaniline	<1	<1	<1							<1	ug/l	TM16/PM30
4-Bromophenylphenylether #	<1	<1	<1							<1	ug/l	TM16/PM30
4-Chloroaniline	<1	<1	<1							<1	ug/l	TM16/PM30
4-Chlorophenylphenylether #	<1	<1	<1							<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Azobenzene #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether #	<1	<1	<1							<1	ug/l	TM16/PM30
Carbazole #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Dibenzofuran #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Hexachlorobenzene #	<1	<1	<1							<1	ug/l	TM16/PM30
Hexachlorobutadiene #	<1	<1	<1							<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1	<1	<1							<1	ug/l	TM16/PM30
Hexachloroethane #	<1	<1	<1							<1	ug/l	TM16/PM30
Isophorone #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine #	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Nitrobenzene #	<1	<1	<1							<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	116	122	130							<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	125	126	138 SV							<0	%	TM16/PM30

All solid results are expressed on a dry weight basis unless stated otherwise.

Job number: 22/15702
Sample number: 15
Sample identity: GW9A
Sample depth:
Sample Type: Ground Water
Units: ug/l

Method: SVOC
Matrix: Liquid

Note: Only samples with TICs (if requested) are reported. If TICs were requested but no compounds found they are not reported.

CAS No.	Tentative Compound Identification	Retention Time (minutes)	% Match	Concentration
95-53-4	o-Toluidine	4.856	97	123
88-72-2	Benzene, 1-methyl-2-nitro-	5.686	91	518
601-87-6	Benzenamine, 3-methyl-2-nitro-	7.540	99	148
578-46-1	5-Methyl-2-nitroaniline	8.195	98	502
618-85-9	Benzene, 1-methyl-3,5-dinitro-	8.237	98	130
610-39-9	Benzene, 4-methyl-1,2-dinitro-	8.418	94	1435
99-52-5	Benzenamine, 2-methyl-4-nitro-	8.976	95	201

All solid results are expressed on a dry weight basis unless stated otherwise.

Job number: 22/15695
Sample number: 28
Sample identity: PUMPOUTLET
Sample depth:
Sample Type: Ground Water
Units: ug/l

Method: **SVOC**
Matrix: **Liquid**

Note: Only samples with TICs (if requested) are reported. If TICs were requested but no compounds found they are not reported.

CAS No.	Tentative Compound Identification	Retention Time (minutes)	% Match	Concentration
603-02-1	2,4-Dinitro-1,3-dimethyl-benzene	8.059	97	140
616-72-8	4,6-Dinitro-1,3-dimethyl-benzene	8.364 - 8.672	91,93	151

Client Name: Verde Environmental Consultants
Reference: 50990
Location: IIE
Contact: Rebecca Bradford

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/15702 & 22/15695						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/15702 & 22/15695

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution
AB	x20 Dilution

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/15702 & 22/15695

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes			
TM38/TM125	Total Nitogen/Organic Nitrogen by calculation	PM0	No preparation is required.				