Verde Environmental Consultants

Preliminary Site Assessment Report for Griffith Avenue, Dublin 9

ESB Site Ref: 5
Ballymun - Fairview 38kV

March 2020

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LIMITATION

This report represents the results of a site inspection and desk study research conducted at the above referenced site. Best practice was followed at all times and within the limitations stated. This report is the property of Verde Environmental Consultants Limited (Verde) and cannot be used, copied or given to any third party without the explicit prior approval or agreement of Verde.

This report is intended as a preliminary stage assessment of the site in question and, as such, all assessments and analysis of the environmental aspects of the site, whilst based of the best-available data and information, are theoretical and conservative in nature. Any risks identified within this report are entirely potential in nature and based on the most-conservative risk analysis scenario and the available information. This is in-keeping with best practice guidelines and does not necessarily reflect the actual environmental scenario on site. Further environmental information, as it becomes available, would likely change the assessments and analysis contained within this report.

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This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a suspected hydrocarbon leak from a power cable on Griffith Avenue, Dublin 9 (ESB Ref: 5 Ballymun – Fairview). There was another leak within 280m of this location on Griffith Avenue identified as ESB Site Ref: 6 Ballymun-Fairview. The reported data for these hydrocarbons insulating cable fluid leaks is combined. This report covers the leak at ESB Site Ref. 5 Ballymun – Fairview with the leak at Site Ref. 6 Ballymun- Fairview in a separate report.

This report is intended as a preliminary stage assessment of the site in question and, as such, all assessments and analysis of the environmental aspects of the site, whilst based of the best-available data and information, are theoretical and conservative in nature. Any risks identified within this report are entirely potential in nature and based on the most-conservative risk analysis scenario and the available information. This is in-keeping with best practice guidelines and does not necessarily reflect the actual environmental scenario on site. Further environmental information, as it becomes available, would likely change the assessments and analysis contained within this report.

There was an approximate volume of 5,170 litres of cable fluid consisting of linear alkyl benzene (LAB) lost to ground from the two leaks on Griffith Avenue at an approximate rate of 575 L/month for nine months. The leaks began in December 2017 and were repaired in August 2018.

The known leak point is located on the southern side of the roadway of Griffith Avenue which is a residential area. No physical evidence of hydrocarbon contamination was observed during a site walkover on the surface in terms of oil odours/staining or impact to vegetation. There is evidence of abundant site services near the ESB cable route. The land in the area is zoned primarily for residential use with small areas of public open space.

The site is underlain by locally important (capable of suppling moderate groundwater yields) dark calp limestones of the Lucan Formation. GSI records indicate that the vulnerability is Low with thick (> 10 metres) of low permeability till subsoils overlying the bedrock aquifer, which provide it with a good level of protection.

The nearest surface watercourse is the Tolka River located approximately 890m to the south. There are no groundwater wells or ecologically sensitive receptors located within a 1km radius of the site. Groundwater in the bedrock aquifer is likely to be semi-confined by the thick subsoils with the groundwater flow direction expected to be in a southerly direction following the topography of the area.

At the time of reporting, Irish Water have examined all available drinking water quality sample data and have concluded that there is no evidence that COPCs from the leak site have infiltrated the local drinking water supply. This evaluation is based on a review of all samples taken from customer-points, between 2014 and 2019; which showed no evidence that the COPCs (PAHs and Benzenes) were present in the water supply at levels above drinking water standards (PAHs: 0.1µg/L; Benzene: 1.0µg/L). These results (which are from samples taken at the customer tap) would not indicate that leaks from oil filled cables have contaminated the drinking water supply for these areas, or at least to an extent where any contamination arising has resulted in a breach of the parametric value for PAHs and Benzene (Appendix F).

Based on the known cable leak point, contaminant of potential concern (COPC) fate and transport and hydrogeological desk study information the CSM has the following initial key findings for human health and environmental risks;

There are no hydrogeological pathways connecting the project area to the River Tolka or to protected areas occurring at and in the vicinity of the River Tolka Estuary at Dublin Bay.

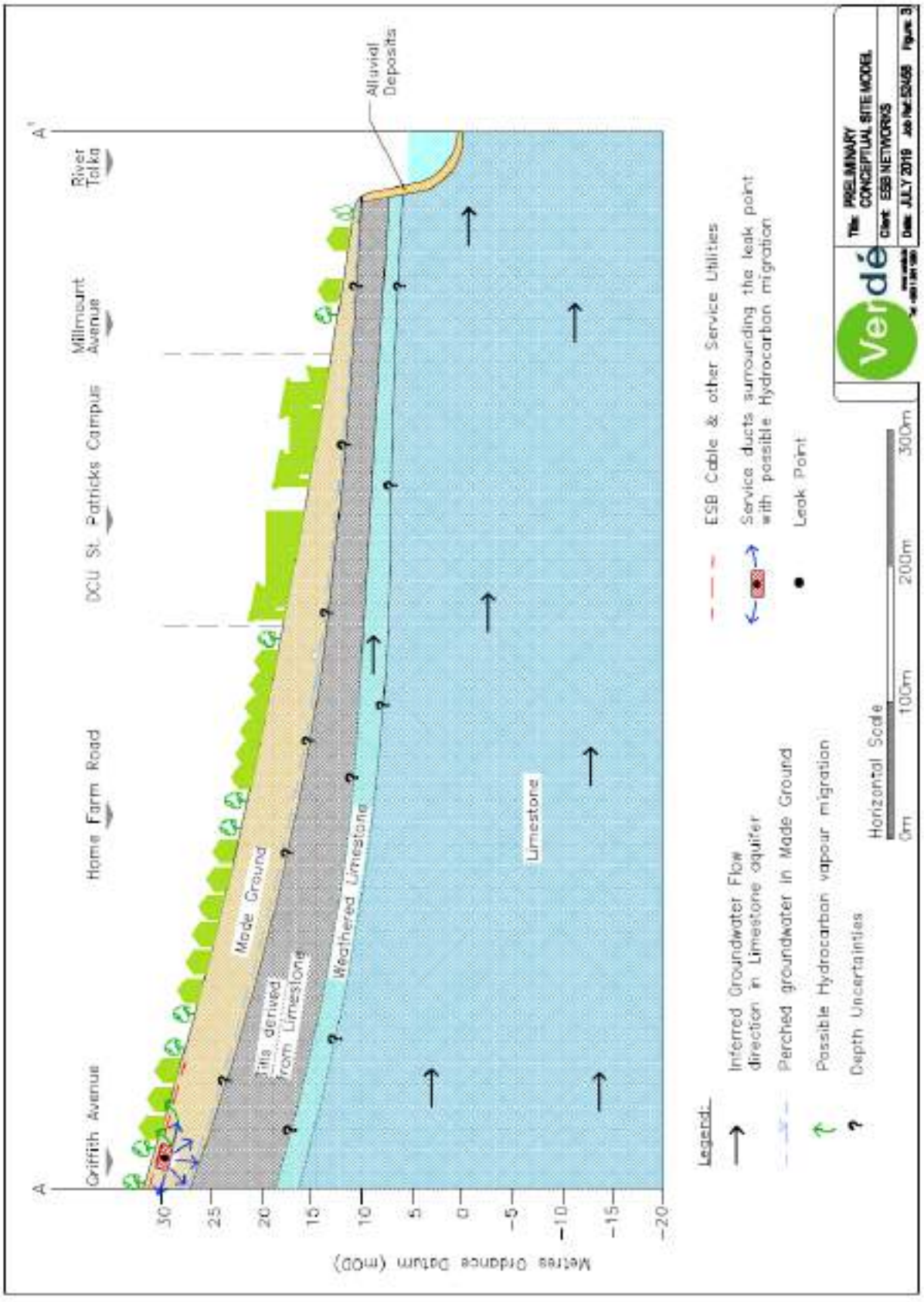
There is a Low risk posed by LAB from contact with suspected contamination in the soil and groundwater through;

- direct dermal/inhalation and ingestion contact to residents or other building users;
- dermal/inhalation and ingestion pathways to construction workers, which can be managed by appropriate use of PPE and H&S procedures;
- Leaching to shallow groundwater given the contaminant properties of low mobility and high sorption to soil, with shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting;
- ingestion contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes or through low-pressure infiltration of possible soil contamination into water pipes via nearby breaks or leaks;

There is a Low/Moderate risk posed by LAB in suspected contamination in the soil and groundwater through;

- hydrocarbon vapours in preferential pathways such as service ducts to residents and other nearby building users.

Figure 3 – Conceptual Site Model



	EPA Contaminated Land & Groundwater Risk Assessment Methodology	Report Reference	Report Date	Status
	STAGE 1: SITE CHARACTERISATION & ASSESSMENT			
1.1	**PRELIMINARY SITE ASSESSMENT**	Preliminary Report, Verde, Ref: 52458	6th March 2020	Final
1.2	**DETAILED SITE ASSESSMENT**			
1.3	**QUANTITATIVE RISK ASSESSMENT**			
	STAGE 2: CORRECTIVE ACTION FEASIBILITY & DESIGN			
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3.2	**CORRECTIVE ACTION IMPLEMENTATION & VERIFICATION**			
3.3	**AFTERCARE**			

1. INTRODUCTION

1.1. PROJECT CONTRACTUAL BASIS AND PERSONNEL INVOLVED

Verde Environmental Consultants, (Verde) was commissioned by ESB Engineering & Major Projects to undertake Preliminary Risk Assessments at six locations where there were suspected leaks of cable fluids. This report focuses on a hydrocarbon leak from a 38 kV power cable on Griffith Avenue, Dublin 9. (ESB Ref: 5 Ballymun – Fairview).

A site visit was undertaken by a Verde Hydrogeologist on 4th July 2019 to examine the area of the known cable leak point in relation to any observed evidence of contamination and surrounding land uses and sensitive human health and environmental receptors.

A site location map for the leak point is presented in Figure 1 with a detailed map on the cable route and leak location presented in an ESB supplied map in Appendix A.

1.2. BACKGROUND INFORMATION

The ESB cable fluid acts as an electrical insulator and aids the conduction of heat away from the conductor allowing the cable to be run more efficiently. Fluid filled cables are largely located in urban/suburban areas and so are particularly vulnerable to third party interference or damage. Over time a cable can develop leaks due to corrosion / fracture/ defects in the cable sheath and in joints and terminations. When such leaks occur, there is potential for pollution to occur to surface water, groundwater, soils and ecology.

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a suspected hydrocarbon leak from a power cable on Griffith Avenue, Dublin 9 (ESB Ref: 5). There was another leak within 280m of this location on Griffith Avenue identified as ESB Site Ref: 6 Ballymun-Fairview. Both leaks for Site Ref 5 & 6 commenced in December 2017. Site ref: 6 Ballymun-Fairview is the subject of a separate report. However, the reported volumes presented below for these hydrocarbon insulating cable fluid leaks is for both sites combined.

There was an approximate volume of 5,170 litres (l) of cable fluid consisting of linear alkyl benzene (LAB) lost to ground from the two leaks on Griffith Avenue at an approximate rate of 575l/month for nine months. The leaks were reported to have begun in December 2017 and were repaired in August 2018.

Details on the physical and chemical aspects of the hydrocarbon products used as Insulating Fluids in a cable are discussed in Section 2.3 below.

1.3. PROJECT OBJECTIVES

The project objective was to determine the potential risks to human health and the environment at the leak locations and potential areas of impact. As requested by ESB, a risk-based approach has been applied to this assessment. This risk based approach is recommended in the best practice documents produced by the EPA on Management of Contaminated Land & Groundwater at EPA Licenced Sites published in 2013. This ESB site is not a licenced site. Although the scope of this guidance specifically applies to licensed sites, the approach presented is consistent with UK and mainland European best-practice guidance in the assessment and management of potentially contaminated land. It is therefore considered to be a robust basis for the assessment of the subject site.

This report has been prepared in accordance with the EPA guideline reporting template for Preliminary Site Assessments under the EPA Contaminated Land & Groundwater Risk Assessment Methodology.

1.4. SCOPE OF WORKS

In order to complete the assessment and meet the objective of the brief the following scope of works was completed:

- A desk study review of available historical, geological and hydrogeological and environmental sensitivity information for the site. The desk study includes an assessment of historical land uses. Information on site utility services from various providers was examined together with detailed information on the cable route with a known leak point on the EBS cable, such as cable ends or joints.
- Site walkover to undertake a detailed site inspection to establish as much information as possible regarding site operations, activities, observed evidence of contamination and land use to include detailed site notes and photographs.
- Prepare a report in accordance with best practice guidance, in that the information gathered will be used to develop a preliminary conceptual model for the site.

1.5. SCOPE OF ANALYSIS AND CONCLUSIONS

This report is intended as a preliminary stage assessment of the site in question and, as such, all assessments and analysis of the environmental aspects of the site, whilst based of the best-available data and information, are theoretical and conservative in nature. Any risks identified within this report are entirely potential in nature and based on the most-conservative risk analysis scenario and the available information. This is in-keeping with best practice guidelines and does not necessarily reflect the actual environmental scenario on site. Further environmental information, as it becomes available, would likely change the assessments and analysis contained within this report.

As such, the reader is encouraged to view the findings, conclusions and recommendations contained within this report as the most-conservative, theoretically possible environmental scenario; and not necessarily the actual scenario currently persisting on the site question.

2. SOURCE AUDIT FINDINGS – PRODUCTION & OPERATIONAL HISTORY

2.1. CURRENT SITE OPERATIONS

The known leak point (ESB Ref: 5) is located on the southern side of the roadway of Griffith Avenue which is in a residential area consisting of detached and semi-detached houses, as presented in the site photographs in Appendix C.

There is a grass verge adjacent to the roadway and ESB cable route, inside which is a concrete footpath which was being replaced at the time of the site walkover. There was evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers and kiosks. Services in the area included sewers, road gully drains, water mains, telecom, UPC and ESB. There are several different service kiosks near the roadway consisting of ESB, traffic and others which are unknown, such as in Photograph 5 in Appendix C.

The cable leak point area and downgradient area are shown in Photograph 2 & 3 respectively in Appendix C. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation with healthy looking trees and hedges.

Only a combined reported leak volume loss of 5,170 litres is available for both this site and the other repaired leak on the same roadway (ESB Ref: 6 Ballymun – Fairview). Consequently, the specific volume lost at leak point ESB Ref. 5 cannot be determined. Both leaks on this cable route were repaired in August 2018.

The known presence of permeable made ground around the power cable together with the presence of other underground services along the roadway indicates there is a high potential for preferential lateral migration from the leak point along the underground services routes.

2.2. PREVIOUS SITE OPERATIONS

This area of Dublin was undeveloped greenfield up to the early 1900's as shown in the historical desk study maps in Appendix B. Subsequent land use changed to a largely residential development on or before the 1940s and are as seen on-site today. The ESB power cable was installed in the area in 1950. Further details on the site history are presented in section 3.2.

2.3. CHEMICALS OF POTENTIAL CONCERN (COPC)

The fluid in the power cable is Linear Alkyl Benzenes (T3788). Material Safety Data Sheets (MSDS) for the fluid is included in Appendix D and further detail on their physical, fate and transport and toxicological properties provided below.

2.3.1 Linear Alkyl Benzenes

Linear Alkyl Benzene is a benzene compound with a side alkyl chain of 10-13 carbon atoms in length. The following presents relevant information on its Fate and Transport in the environment.

- low solubility (0.041mg/l), which means it doesn't mix with water easily;
- low to moderate volatility with the MSDS providing that the compound should not present an inhalation hazard under ambient conditions and that exposure to vapour or oil mists may

irritate the mucous membranes and cause dizziness, headaches and nausea;

- Strongly absorbs to soil and combined with its low solubility means it generally has low mobility in the water environment;
- Its preference in soil will be to remain as free product or sorb to soil with a smaller proportion in the vapour phase;
- It will form a Light Non-Aqueous Phase Liquid (LNAPL) on water;
- It is readily biodegradable under aerobic conditions in both water and soil, with a half life in soils of 15.3 days and less than 28 days in water. Half-life is the time required for a quantity to reduce to half of its initial value (REACH database, 2011);
- Does not bio accumulate;
- The Predicted No Effect Concentration (PNEC) is the concentration of a chemical which marks the limit at below which no adverse effects of exposure in an ecosystem are measured. LAB is toxic to the water environment with a PNEC aqua (freshwater) of 0.001mg/l: PNEC soil terrestrial organisms of 0.329mg/kg and PNEC sediment of 1.65mg/kg for freshwater sediment and 0.165mg/kg for marine sediments (REACH database, 2011).

3. SITE ENVIRONMENTAL SETTING

3.1. GENERAL INTRODUCTION

The area of interest is an approximate 400m stretch of the road extending from the east of Corpus Christi Church to the intersection of Griffith Avenue and Drumcondra Road Upper. The area examined as part of this investigation covers a 200m stretch of cable to the east and a 200m stretch to the west of the known leak point, as presented in Appendix A. The main land use in this area is residential with private gardens. Griffith Avenue also hosts the Office of the State Pathologist, Whitehall Garda Station, a Post Office delivery office, a number of schools and numerous commercial properties.

The land in the area is zoned primarily for residential use with small areas of public open space. There is an extensive volume of residential properties in the area as evident from aerial photographs and Dublin City Council Development Plan map, as presented in Appendix B.

The River Tolka is located approximately 890m to the south of the site flowing in an easterly direction eventually draining to Dublin Bay approximately 2.65km to the south east of the site. Under the Water Framework Directive, the River Tolka has been assigned a "Bad" status and has also been categorised as being at risk of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E.

The River Tolka flows into the South Dublin Bay and River Tolka Estuary SPA (Site Code: 4024). This SPA is located approximately 2.2km downstream of the nearest point of the River Tolka to the leak location. The South Dublin Bay and River Tolka Estuary SPA is designated as a SPA for its role in supporting a number of bird species.

According to the GSI database there are no groundwater wells located within a 1km radius of the site. There are two wells located approximately 1.3km to the south west of the leak point where there is a trial well and a production well in the townland of Glasnevin. The wells were drilled to depths of 90mBGL and 106mBGL respectively. Rock was encountered at an average depth of 13mBGL. The yield produced by the wells varies with poor and good yields reported in the trial well and an excellent yield of approximately 482m^3/day reported in the production well. The current use of the well is unknown. There are no known domestic supply wells or groundwater drinking water protection areas in the vicinity of the site with water supply highly likely to be from the mains, as observed by the presence of water meters at the entrance to the residential properties.

3.2. SITE HISTORY

Primary sources used to research the history of the site included available extracts from historical Ordnance Survey Ireland (OSI) maps, aerial photographs and planning information from Myplan.ie.

The maps consulted include the OSI 6-inch historic maps from 1837 to 1842, the OSI 25-inch historical maps surveyed between 1888 and 1913 and the OSI 6-inch Cassini map surveyed in early 20th century. Table 3.1 below gives further details of the site history and the land use of the surrounding area.

Table 3.1 – Site History

History	**National Monuments Service**: There are no monuments of significance within 1km of the area of interest.
	Historic Mapping: OSI 6 inch map (Black and White) (1837-1842): From this map it is apparent that the road overlying the cable of interest has not yet been constructed. There is a road in place to the immediate east of the site which is in the location of the current Drumcondra Road Upper. The area of interest appears to be undeveloped green fields as does much of the adjoining land. OSI 25 inch map (Black and White) (1888-1913): This map appears to be similar to the previous map with notable changes as follows; The location of the current Drumcondra Road Upper east of the site is now marked as a "tramway" and there is a small housing development labelled as "Well Park" to the south of the site. Cassini 6 inch (1830-1930): The road layout in the map resembles that of current times. There are extensive housing developments lining the roads in the area and a catholic church and an adjoining school marked in the area immediately south of the current location of the Corpus Christi Church which was constituted in approximately 1953. The ESB power cable is reported to have been laid in the area in 1950.
Aerial Photos	Aerial Photo 1995: The road lay out and position of residential properties remains largely the same as present times. The Corpus Christi Church is present in its current position and layout. Aerial Photo 2000: The site and its immediate surroundings remain largely unchanged. Aerial Photo 2005: The site and its immediate surroundings remain largely unchanged. Aerial Photo 2012: The site and its immediate surroundings remain largely unchanged.

3.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

The site is underlain in dark calp limestones of the Lucan Formation (GSI) which is overlain of subsoils comprising of tills derived from limestones and made ground (Teagasc). The closest surface water course is the Tolka River located approximately 890m to the south of the site flowing in an easterly direction eventually draining to Dublin Bay approximated 2.65km to the south east of the site.

The following information sources were consulted as part of this desk based research and the relevant information has been compiled in Table 3.2 below.

- Dublin City Council (Planning and Environment Sections)
- Ordnance Survey Ireland (historic map series)
- National Monuments Service (protected structures)
- Dept. of the Environment, Community and Local Government
- Geological Survey of Ireland
- Environmental Protection Agency data bases

- National Parks and Wildlife Services
- Office of Public Works (flood maps)

Table 3.2 – Site Physical Setting

Feature	Details & Comments
Topography	The area of interest is relatively flat. The regional topography of the area slopes gently to the south toward Dublin Bay.
Geology	**Overburden**: The GSI and EPA databases describe the soils at the site as Made Ground with the subsoils in the area consisting of tills derived from limestone.
	Solid Geology: The site is underlain by calp limestones of the Lucan Formation. The Lucan Formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.
Hydrogeology	**Regional Classification:** According to the GSI the Lucan Formation below the area of interest is classified as a Locally Important aquifer, bedrock which is moderately productive only in local zones. This type of bedrock aquifer unit is typically capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or 'good' yields (100-400 m^3/d). Groundwater flow occurs predominantly through fractures, fissures and joints (secondary permeability) in a southerly flow direction towards the Tolka River. This type of aquifer typically has a limited and relatively poorly connected network of fractures, fissures and joints, giving a low fissure permeability which tends to decrease further with depth. A shallow zone of higher permeability may exist within the top few metres of more fractured/weathered rock, and higher permeability may also occur along fault zones. These zones may be able to provide larger 'locally important' supplies of water. In general, the lack of connection between the limited fissures results in relatively poor aquifer storage and flow paths that may only extend a few hundred metres. The typical recharge rate of this type of aquifer is 200mm/year.
	Vulnerability: The vulnerability rating for the aquifer beneath the site is classified as low indicating the depth to bedrock can be >10 metres below ground level (mBGL). The overlying strata are expected to be low permeability glacial deposits.
	Groundwater Body: Under the Water Framework Directive (WFD) the groundwater body beneath the site is Dublin Urban (code: IE_EA_G_005) and is classed as having Good status.
	Well Search: There are no groundwater wells located within a 1km radius of the site, as presented in the desk study maps in Appendix B. There are two wells located approximately 1.3km of the leak point to the south west of the site where there is a trial well and a production well in the townland of Glasnevin. The wells were drilled to depths of 90mBGL and 106mBGL respectively. Rock was encountered at an average depth of 13mBGL. The yield produced by

	the wells varies with poor and good yields reported in the trial well and an excellent yield of approximately 482m³/day reported in the production well. These wells are not located directly downgradient of the leak point.
Hydrology	**Surface Water Courses/Abstractions:** There is one surface watercourse within 1km of the area of interest. The River Tolka flows in an easterly direction approximately 890m to the south of the site draining into Dublin Bay approximately 2.65km to the southeast of the site.
Geotechnical	There have been no reported geotechnical significant investigations close to the area of the cable leak.
Protected Areas	**South Dublin Bay and River Tolka Special Protection Area (SPA)** The boundary of this Special Protection Area (SPA) (*site code: 004024*) is located approximately 2.71km to the south east of the project area. This SPA occupies a substantial part of Dublin Bay and comprises extensive intertidal flats which support wintering waterfowl which are part of the overall Dublin Bay population.
	North Dublin Bay (SAC) The boundary of the North Dublin Bay Special Area of Conservation (SAC) (*site code: 000206*) is located approximately 5km to the south east of the site.
	Proposed Natural Heritage Area (pNHA) The boundary of the North Dublin Bay pNHA (*site code: 000205*) is located approximately 2.7km to the south east of the site.
Flooding	According to OPW flood mapping the site does not appear to be at risk of any coastal, fluvial or pluvial flooding.
Zoning	The primary land use in this area is residential. There is a small area of land zoned as an open space.

3.4 SITE GEOLOGY AND HYDROGEOLOGY

There is no site investigation data available from the site location.

The details of the typical cable and trench dimensions for a fluid filled cable includes the following;

- Depth to the base of trench 1200mm
- Depth to top of cable 900mm-1000mm
- Thickness of sand surrounding cable 350mm
- Width of trench 1100mm
- Backfill can be either arisings or Clause 804.

The permeable made ground is likely to contain perched groundwater which will be restricted from vertical migration by thick low permeability glacial tills. The thick low permeability tills are potentially in excess of 10metres thick as indicated by the Low Vulnerability GSI classification and therefore restricting migration to the underlying limestone bedrock aquifer, as presented in the conceptual site

model in Figures 3 and 4. The groundwater in the underlying limestone bedrock aquifer is likely to be confined or semi-confined by the glacial tills.

The topography of the area as obtained from the GSI database show the leak point is located at approximately 30metres ordnance datum (mOD) with the Tolka River downgradient at approximately 10mOD. The topographic contours are orientated approximately east-west which infers that the groundwater flow direction is likely to be in a southerly flow direction, as presented in Figure 2 and within the CSM in Figures 3 and 4.

3.5 SUMMARY OF PREVIOUS SITE SAMPLING AND MONITORING DATA

The made ground within the cable trench is reported to be up to 1.2m deep and contained sand and backfill material. The underlying limestone derived glacial till is reported to be of low permeability with a thickness up to 10m.

At the time of reporting, Irish Water have examined all available drinking water quality sample data and have concluded that there is no evidence that COPCs from the leak site have infiltrated the Cork City drinking water supply. This evaluation is based on a review of all samples taken from customer-points, between 2014 and 2019; which showed no evidence that the COPCs (PAHs and Benzenes) were present in the water supply at levels above drinking water standards (PAHs: 0.1µg/L; Benzene: 1.0µg/L). These results (which are from samples taken at the customer tap) would not indicate that leaks from oil filled cables have contaminated the drinking water supply for these areas, or at least to an extent where any contamination arising has resulted in a breach of the parametric value for PAHs and Benzene (Appendix F).

There is no available soil/vapour or groundwater quality information from the area in the vicinity of the cable leak point. There are no groundwater abstractions or monitoring wells in the vicinity of the leak point. A summary of the Environmental and Human Health Pollutant Linkages for the COPCs (TPH fractions, BTEX compounds, Speciated PAHs, SVOCs, VOCs) in relation to the known leak point details and available desk study information is presented in Section 4.0 and summarised below.

For the COPC the following can be determined;

- **Linear Alkyl Benzenes (LAB)** is of low mobility and strongly absorbs to soil. It has low to moderate volatility and will remain largely as free product or sorb to soil/fill material. It is readily biodegradable in aerobic conditions and does not bio-accumulate.

4 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 PRELIMINARY QUALITATIVE RISK ASSESSMENT (PQRA)

4.1.1 Risk Assessment Methodology

This report has been prepared considering the most relevant guidance published by the Irish Environmental Protection Agency (EPA) and the UK Environment Agency (EA) guidance, specifically as follows:

1. Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites, EPA 2013;
2. Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR 11), UK EA 2004.

Both approaches advocate a risk-based assessment when dealing with contaminated land and groundwater issues and this is considered as best practice.

Current surface water and groundwater pollution legislation is taken into account for these assessments as required under the Water Framework Directive, Directive 2000/60/EC, that was adopted in 2000 as a single piece of legislation covering rivers, lakes, groundwater and transitional (estuarine) and coastal waters and includes heavily modified and artificial waterbodies. Its objectives are to prevent further deterioration of and to protect, enhance and restore the status of all bodies of water with the aim of achieving at least good status.

It was given effect in Ireland under the European Communities (Water Policy) Regulations 2003 as amended, the European Communities Objectives (Surface Waters) Regulations 2009, as amended and the European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended. These Water Policy Regulations govern the shape of the WFD characterisation, monitoring and status assessment programmes.

A critical element of the risk assessment process is the establishment of a Conceptual Site Model (CSM) for the land and groundwater environment. A CSM describes the potential sources of contamination at a site, the migration pathways it may follow and the receptors it could impact. If complete source-pathway-receptor scenarios exist, then there is a potential pollutant linkage that needs to be characterised and assessed (via formal risk assessment). The CSM is updated as more information is gathered from subsequent desk studies and site investigations with a preliminary CSM presented in Figures 3 and 4.

4.2 OUTLINE SITE CONCEPTUAL MODEL

On the basis of the desk study and site walkover, a number of possible pollutant linkages have been identified for this site. Based on available information the outline site conceptual model is presented in Tables 4.1 below which considers possible pollutant linkages for the site.

Table 4.1 – Outline Site Conceptual Model (Environmental and Human Health)

Source	Pathway	Receptor	Potential Pollutant Linkage (Y/N)	Discussion
Human Health				
Historical leaks of cable fluid from underground electricity cable comprising of an approximate volume of 5,170 litres of linear alkyl benzene (LAB) (Sites 5 & 6) Dec 2017 to August 2018. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation.	Residents & other commercial or retail building users	Y	There are residential properties approximately 20m to the south and downgradient of the suspected leaks. Vapour phase migration will be preferential potentially along utility service runs and through more permeable made ground soils and or sand/gravel fractions of soils if present.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce.	Residents & other commercial or retail building users	Y	There are residential properties approximately 20m to the south and downgradient of the suspected leak. The cable source of leak is at a depth of 0.9m and so direct contact and ingestion pathways are unlikely to be viable unless groundwater levels are near ground surface bringing contamination upwards into shallow soils where direct contact is possible.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then permeation through plastic potable water supply pipes and ingestion.	Nearby residents	Y	The water supply pipes could potentially run through contaminated zones. LAB has the potential to permeate through the wall of plastic supply pipes and also through joins and gaskets. An internet search has not identified proven instances where this has occurred elsewhere. Any permeating compounds would be diluted depending on water flows in the pipe. A WHO drinking water standard for hydrocarbons >C10 is 0.09mg/l which exceeds the LAB theoretical solubility limit of 0.041mg/l. So, unless NAPL is present within the pipe then this WHO drinking water standard would not be exceeded.

	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation	Workers undertaking any subsurface works	Y	Unlikely to be significant as workers exposed in outdoor air where vapours cannot accumulate to high concentrations. Also, risks are localised areas of contamination which can be managed with the correct PPE and H&S procedures.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Y	Unlikely to be significant as contamination is likely to be localised and can be managed with the correct PPE and H&S procedures.
Environmental – Water Receptors				
Historical leaks of cable fluid from underground electricity cable comprising of an approximate volume of 5,170 litres of linear alkyl benzene (LAB) (Sites 5 &6) Dec 2017 to August 2018. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and glacial till soils	Shallow groundwater	Y	LAB present in soils as sorbed and NAPL phases can leach downwards with infiltrating rainwater and soil water movements to groundwater. In groundwater will form LNAPL due to low solubility. There may also be limited dissolved concentrations.
	LAB direct downward migration as NAPL until reaches shallow groundwater where forms LNAPL and with a limited dissolved plume based on low solubilities, then lateral migrations towards surface waters	River Tolka	N	The River Tolka is 890m south of the site and drains into Dublin Bay approximately 2.65km to the southeast of the site. Given the presence of glacial till underlying the project area and its capacity to limit the lateral migration of groundwater and that groundwater underlying the project area is likely to be perched at the base of made ground there is no potential for a hydrogeological pathway to connect the project area to the River Tolka to the south.
	LAB migration downwards through glacial till to Limestone bedrock aquifer and then lateral migration	Limestone bedrock aquifer / Groundwater Users	N	There are no known recorded domestic groundwater abstraction wells located within a 1km radius of the suspected leak. The surrounding properties are serviced by mains water.

				Additionally, downward contaminant migration into the limestone will be precluded by depths of glacial till.

4.3 POLLUTANT LINKAGE ASSESSMENT

As outlined in Tables 4.1 above a number of possible pollutant linkages were identified, which have been further risk assessed with reference to BS10175:2011 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequences, taking into account both the potential severity of the hazard and the sensitivity of the target, based on categories given in Table 4.2 below.

Table 4.2 - Potential Hazard Severity Definition

CATEGORY	DEFINITIONS
Severe	Acute risks to human health, catastrophic damage to buildings, major risk to an environmental receptor such as a river
Medium	Chronic risk to human health, pollution of sensitive environmental receptor, significant damage to buildings and structures.
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given in Table 4.3 below.

Table 4.3 - Probability of Risk Definition

CATEGORY	DEFINITIONS
High likelihood	Pollutant linkages may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable

The potential severity of the risk and probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard, as presented in Table 4.4 below.

Table 4.4 - Level of Risk for Potential Hazard Definition

PROBABILITY OF RISK	POTENTIAL SEVERITY			
	Severe	Medium	Mild	Minor
High likelihood	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low likelihood	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very Low	Very low

The assessment is discussed below in terms of plausible pollutant linkages.

The pollutant linkages of Linear Alkyl Benzene in the shallow soils/groundwater and nearby receptors are summarised in Tables 4.5 below.

Table 4.5 - Pollutant Linkage Assessment for Linear Alkyl Benzene

Source	Pathway	Receptor	Severity	Likelihood	Risk Level	Comments
Human Health						
Historical leaks of cable fluid from underground electricity cable comprising of an approximate volume of 5,170 litres of linear alkyl benzene (LAB) (Sites 5 & 6) Dec 2017 to August 2018.	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation	Residents & other commercial or retail building users	Medium	Low Likelihood	Low/Moderate	Has the potential to migrate along preferential pathways such as service trenches. Outside of preferential pathways, contamination will strongly sorb to soil, has low mobility, readily biodegrades under aerobic conditions in both soil and water and does not exist readily in the vapour-phase, consequently the risk to nearby residents is low/moderate.
PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce	Residents & other commercial or retail building users	Medium	Unlikely	Low	The cable source of leak is at a depth of 0.9m and so direct contact and ingestion pathways are unlikely to be viable unless groundwater levels are near ground surface or capillary action brings contamination upwards into shallow soils where direct contact is possible.

	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then permeation through plastic potable water supply pipes and ingestion	Nearby residents and other users of the water mains	Medium	Unlikely	Low	Water supply pipes could potentially be present next to power cable with the leaked cable fluid that has the potential to permeate plastic water supply pipes. With the exception of NAPL presence, the risk is unlikely to cause actual harm to health because any permeating contaminants would be diluted by water flows in the water supply pipe and the dissolved concentrations will be less than WHO drinking water threshold guidelines due to low solubility limits. Also, Irish Water reviews of sampling data and subsequent risk assessments suggest that there has been no impact to potable water pipes based on the absence of COPC detections and the high-pressure nature of supply pipes. Risk rating may change if evidence of dynamic hydrological regime is observed or significant free phase product is observed proximal to pipe.
	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation	Workers undertaking any subsurface works	Medium	Unlikely	Low	Risk to workers from localised areas of contamination and vapours is unlikely due to low volatility and exposure in outdoor air, if it does occur it will be short term and can be managed with the correct PPE and H&S procedures.

	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Medium	Unlikely	Low	Risk to workers from localised areas of contamination will be short term and can be managed with the correct PPE and H&S procedures.
Environmental – Water Receptors						
Historical leaks of cable fluid from underground electricity cable comprising of an approximate volume of 5,170 litres of linear alkyl benzene (LAB)) (Sites 5 & 6) Dec 2017 to August 2018. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs	LAB partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and glacial till soils	Shallow groundwater	Mild	Low Likelihood	Low	Low risk due to alkyl benzene contamination strongly absorbs to soil, has low mobility, readily biodegrades in aerobic conditions in both soil and water. Shallow groundwater in made ground and glacial till unlikely to be used as an actual resource due low water volumes and location in a residential urban area. Overall risk is low.

SVOCs, VOCs,						

4.4 SUMMARY OF PRELIMINARY QUANTITATIVE RISK ASSESSMENT

A desktop study and site walkover were conducted at the Fairview site in Ballymun after there was a suspected volume of 5,170 litres of linear alkyl benzene lost from the cable combined between two leaks (Sites 5 & 6) at an approximate rate of 575L/month for 9 months. The leaks began on December 2017 and were repaired in August 2018. The volume of fluid at each site is unknown. Results of the PQRA are summarised below:

4.4.1 Human Health:

- There is a potential Low/Moderate risk posed by LAB vapours in suspected contamination in the soil and groundwater through preferential pathways such as services ducts to residents or other building users;
- There is a potential Low risk posed by LAB from contact with suspected contamination in the soil and groundwater through direct dermal/inhalation and ingestion contact to residents or other building users;
- There is a potential Low risk posed by LAB contact from ingestion contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes;
- There is a potential Low risk to construction workers from dermal/inhalation and ingestion pathways which can be managed by appropriate use of PPE and H&S procedures.

4.4.2 Environmental:

- There is a potential Low risk posed by LAB to shallow groundwater from suspected contamination in the shallow made ground and glacial till subsoils given the contaminant properties of low mobility and high sorption to soil, with shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.
- Any potential contamination arising from the leakages will be restricted to shallow groundwater underlying the project area. As noted in the above bullet point the risk to this shallow groundwater body will be low. Due to the presence of the shallow groundwater body, which is likely to be perched at the base of made ground and due to the presence of glacial till underlying the project area and its capacity to limit the lateral migration of groundwater no pathway is considered to occur between the project area and the River Tolka to the south.

4.5 SUMMARY AND CONCLUSIONS

This preliminary environmental site assessment consists of a review of the potential environmental impacts associated with a hydrocarbon leak from a power cable on Griffith Avenue, Dublin 9 (ESB Ref: 5). There was another leak within 280m of this location on Griffith Avenue (ESB Site Ref: 6). The reported data for these hydrocarbon insulating cable fluid leaks is combined.

There was an approximate volume of 5170 litres of cable fluid consisting of linear alkyl benzene lost to ground from the two leaks on Griffith Avenue at an approximate rate of 575L/month for nine months. The leaks began in December 2017 and were repaired in August 2018.

The known leak point is located on the southern side of the roadway of Griffith Avenue which is a residential area. There is evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers and service kiosks. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation.

The site is underlain by the locally important dark calp limestones of the Lucan Formation. The vulnerability is Low indicating low permeability limestone till subsoils, which provide a good level of natural protection to the underlying bedrock aquifer.

The nearest surface watercourse is the Tolka River located approximately 890m to the south. There are no groundwater wells or ecologically sensitive receptors located within a 1km radius of the site. Groundwater in the bedrock aquifer is likely to be semi-confined by the thick subsoils with groundwater flow direction in a southerly direction following site topography.

There are no hydrogeological pathways connecting the project area to the River Tolka or to protected areas occurring at and in the vicinity of the River Tolka Estuary at Dublin Bay.

Based on the known cable leak point, COPC fate and transport and hydrogeological desk study information the CSM has the following initial key findings for human health and environmental risks;

There is no risk posed by LAB to:

- Surface waters in the wider surrounding area. The River Tolka is the nearest watercourse to the project area and there is no hydrogeological pathway connecting the project area to this watercourse. Hence there is no link to the any protected sites in the area.

There is a potential Low risk posed by LAB from contact with suspected contamination in the soil and groundwater through;

- direct dermal/inhalation and ingestion contact to residents or other building users;
- dermal/inhalation and ingestion pathways to construction workers, which can be managed by appropriate use of PPE and H&S procedures;
- Leaching to shallow groundwater given the contaminant properties of low mobility and high sorption to soil, with shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.
- ingestion contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes or through low-pressure infiltration of possible soil contamination into water pipes via nearby breaks or leaks;

There is a potential Low/Moderate risk posed by LAB in suspected contamination in the soil and groundwater through;

- hydrocarbon vapours in preferential pathways such as service ducts to residents and other nearby building users.

In order to further develop the conceptual site model and investigate the identified potential risks to sensitive receptors further investigation has been recommended in the form of site investigation.

5 REFERENCES

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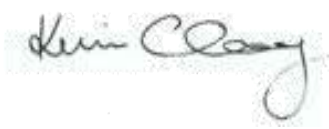
oo0oo

Respectfully submitted

On behalf of Verde Environmental Consultants



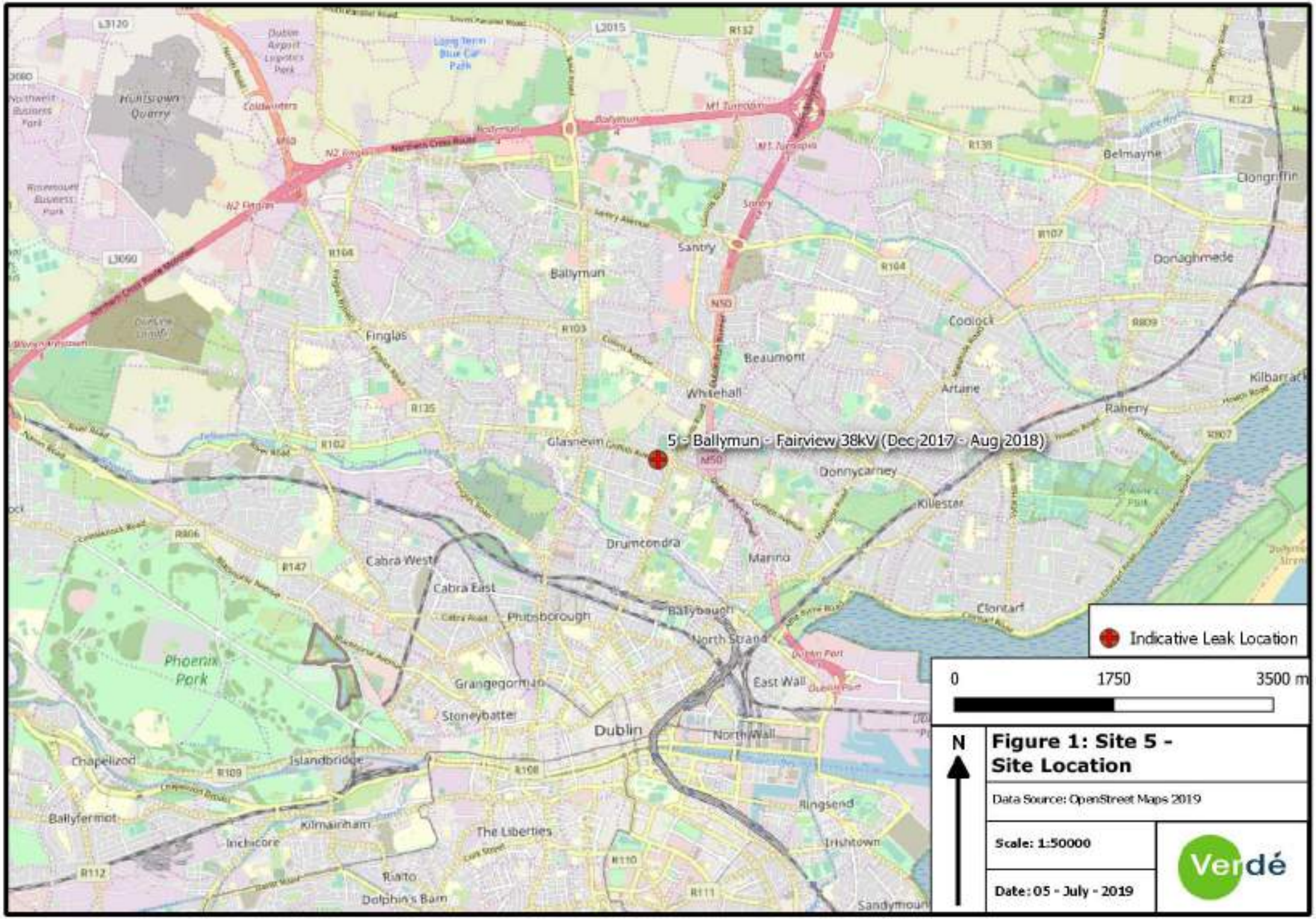
[redacted]

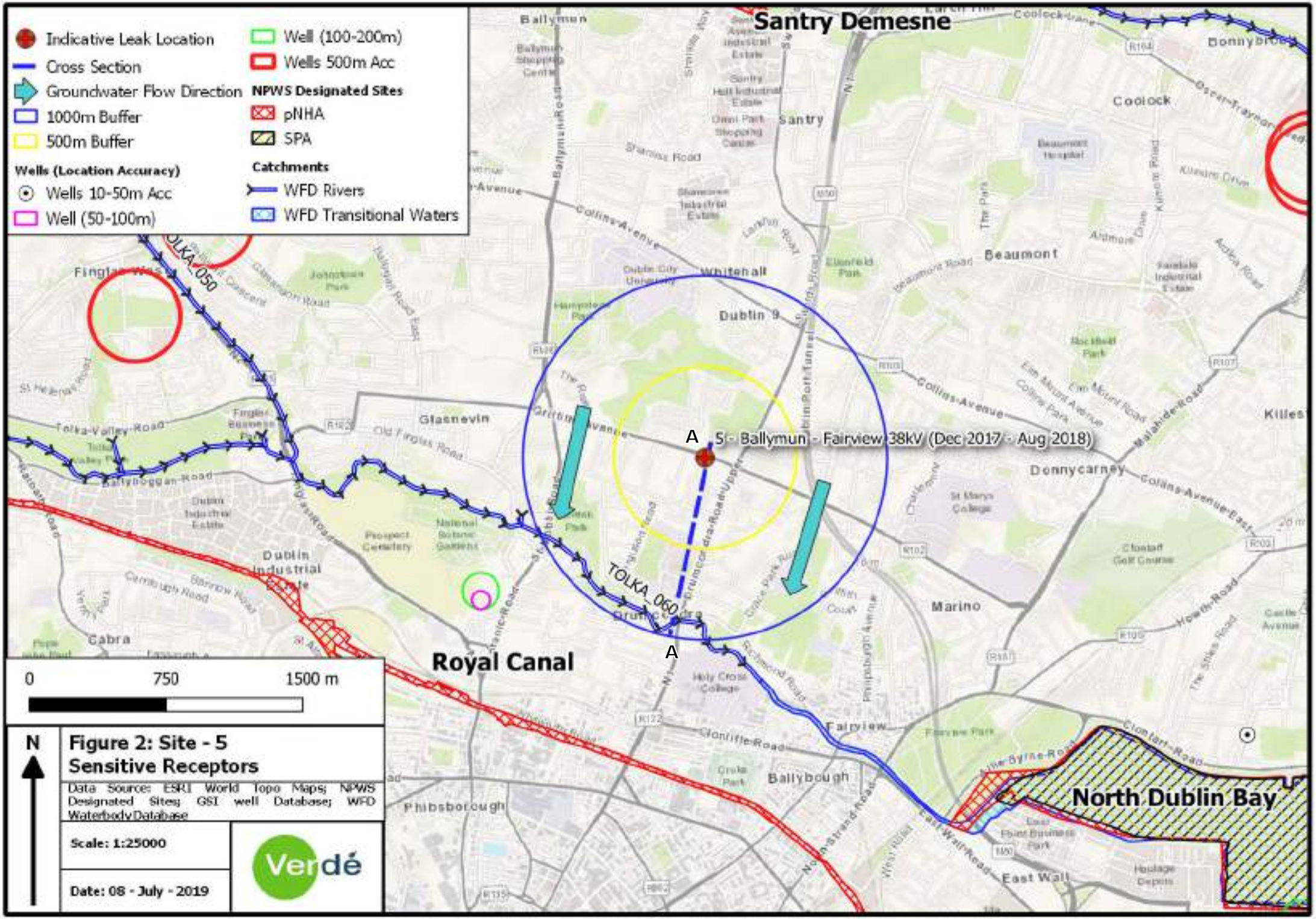
Senior Hydrogeologist

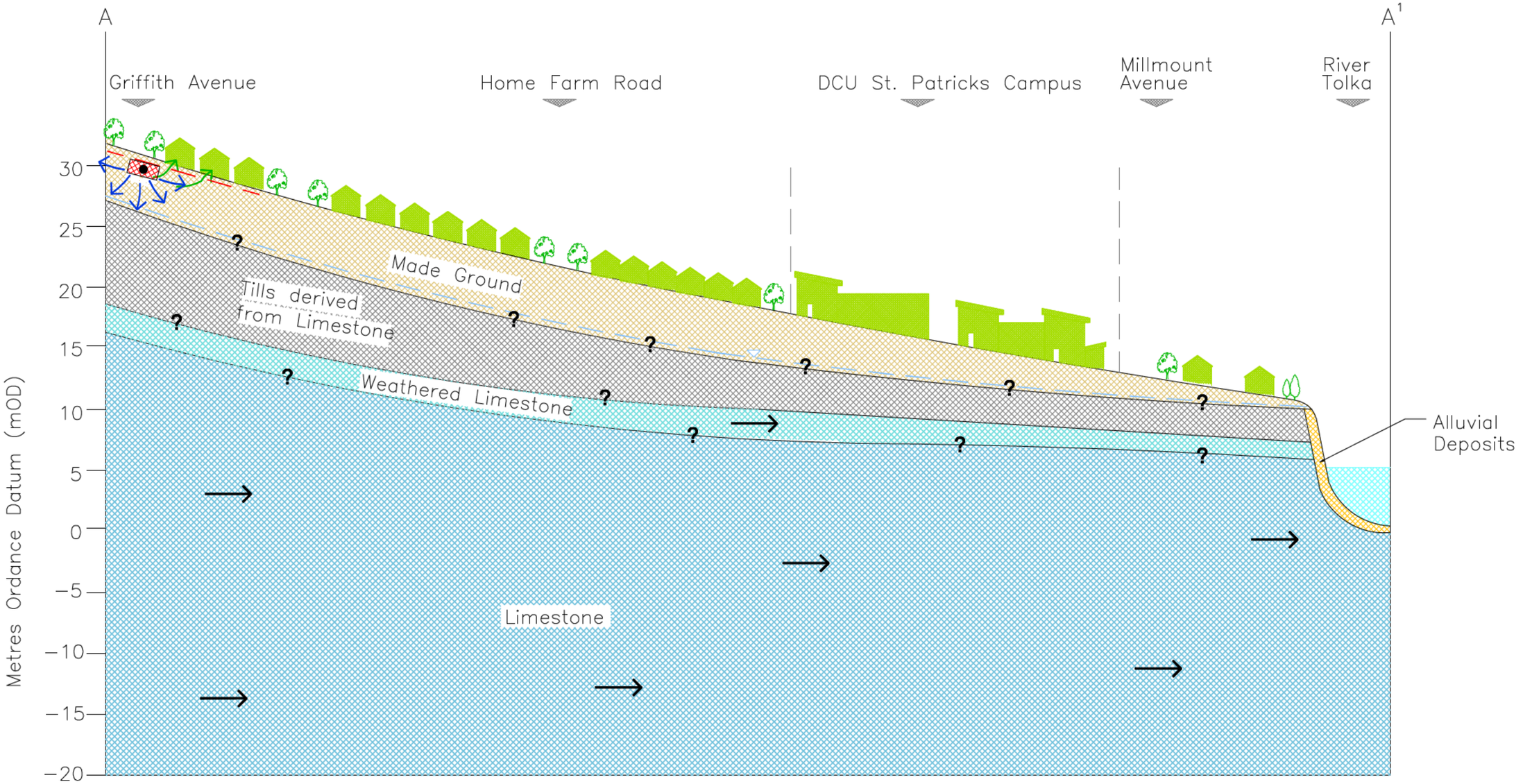
[redacted]

Project Director

FIGURES


5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
Indicative Leak Location
0
1750
3500 m
N
Figure 1: Site 5 - Site Location
Data Source: OpenStreet Maps 2019
Scale: 1:50000
Date: 05 - July - 2019
Verdé
Ballymun
Finglas
Santry
Glasnevin
Whitehall
Beaumont
Coolock
Donaghmede
Belmayne
Clongriffin
Raheny
Kilbarrack
Donnycarney
Drumcondra
Marino
Clontarf
Cabra West
Cabra East
Phibsborough
Ballybough
North Strand
East Wall
North Wall
Dublin
Grangegorman
Stoneybatter
Phoenix Park
Chapelizod
Islandbridge
Ballyfermot
Kilmainham
Inchicore
The Liberties
Ringsend
Irishtown
Sandymount
Rialto
Dolphin's Barn


Indicative Leak Location
Cross Section
Groundwater Flow Direction
1000m Buffer
500m Buffer
Wells (Location Accuracy)
Wells 10-50m Acc
Well (50-100m)
Well (100-200m)
Wells 500m Acc
NPWS Designated Sites
pNHA
SPA
Catchments
WFD Rivers
WFD Transitional Waters
A
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
A
TOLKA_050
TOLKA_060
Santry Demesne
Royal Canal
North Dublin Bay
Ballymun
Santry
Coolock
Beaumont
Whitehall
Dublin 9
Glasnevin
Donnycarney
Marino
Fairview
Ballybough
Phibsborough
Cabra
Finglas
Killes
East Wall
0
750
1500 m
N
Figure 2: Site - 5
Sensitive Receptors
Data Source: ESRI World Topo Maps; NPWS Designated Sites; GSI well Database; WFD Waterbody Database
Scale: 1:25000
Date: 08 - July - 2019
Verdé



Legend:

- Inferred Groundwater Flow direction in Limestone aquifer
- Perched groundwater in Made Ground
- Possible Hydrocarbon vapour migration
- ? Depth Uncertainties
- ESB Cable & other Service Utilities
- Service ducts surrounding the leak point with possible Hydrocarbon migration
- Leak Point

Horizontal Scale

0m 100m 200m 300m

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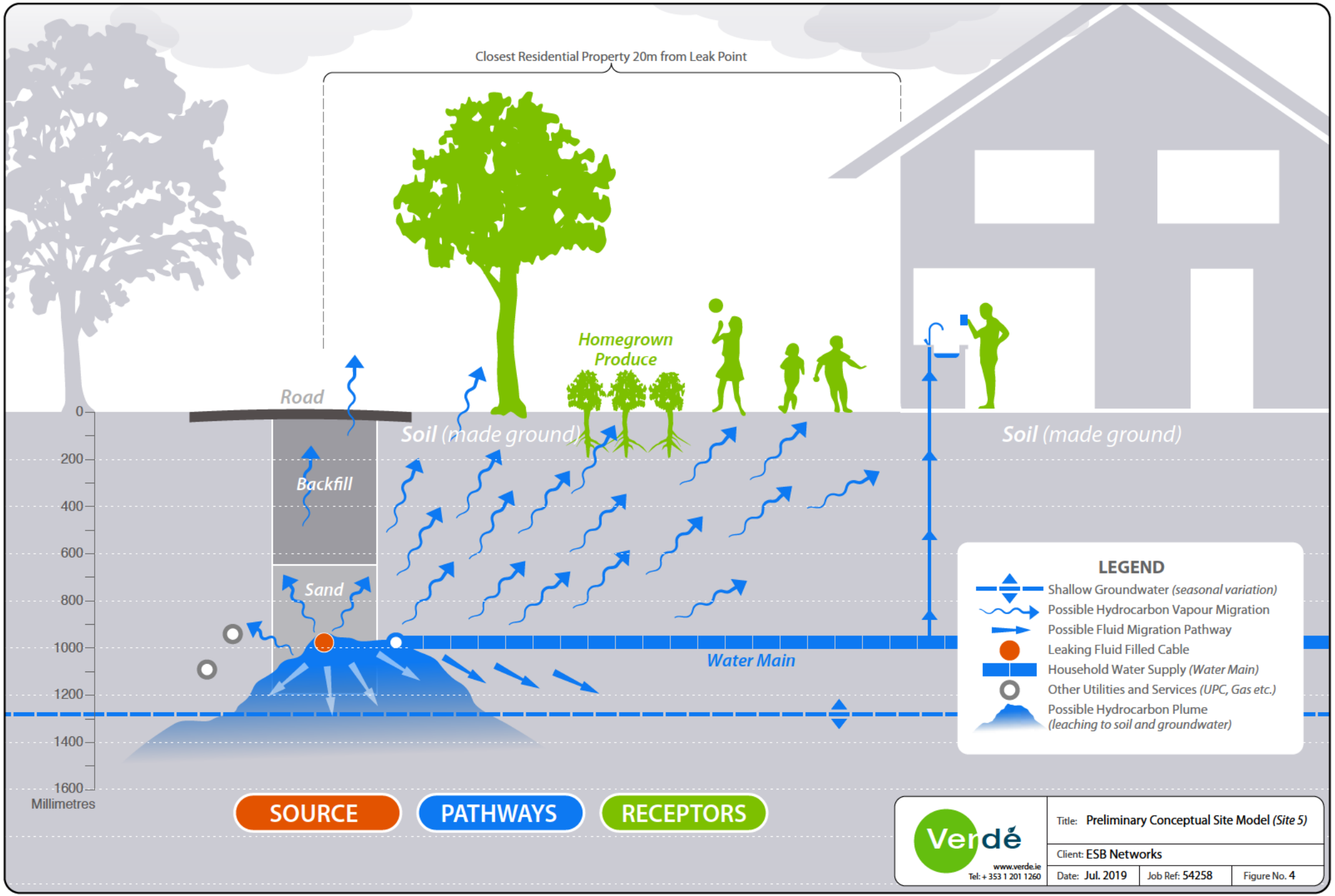
Title: PRELIMINARY CONCEPTUAL SITE MODEL
Client: ESB NETWORKS
Date: JULY 2019 Job Ref: 52458 Figure: 3



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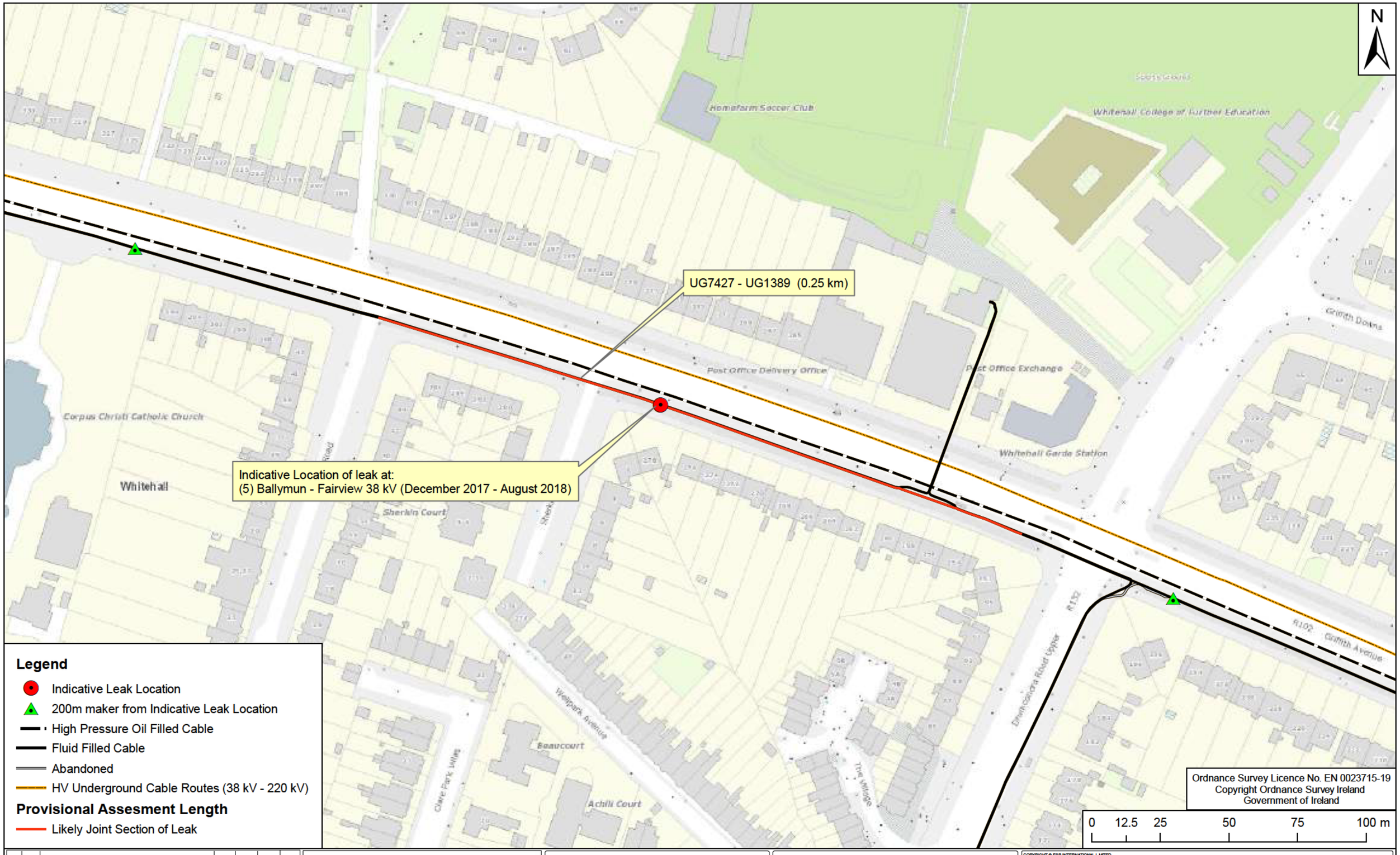
Title: Preliminary Conceptual Site Model *(Site 5)*

Client: ESB Networks

Date: Jul. 2019 | Job Ref: 54258 | Figure No. 4

APPENDIX A

ESB SITE LAYOUT PLAN WITH INDICATIVE CABLE FLUID LEAKAGE LOCATION



REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
1	26/06/19	ADDITIONAL SPATIAL INFORMATION ADDED	T.O'R	T.O'R	J.F	A.M.C
0	26/06/19	REQUEST FOR PROPOSAL	T.O'R	T.O'R	J.F	A.M.C

CLIENT APPROVAL ☐ PLANNING ☐ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

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Engineering and Major Projects is a division of ESB.

CLIENT: ESB

PROJECT: P.R.A.

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Indicative Cable Fluid Leakage Locations & Cable Sections (5) Ballymun - Fairview 38 kV (December 2017 - August 2018)

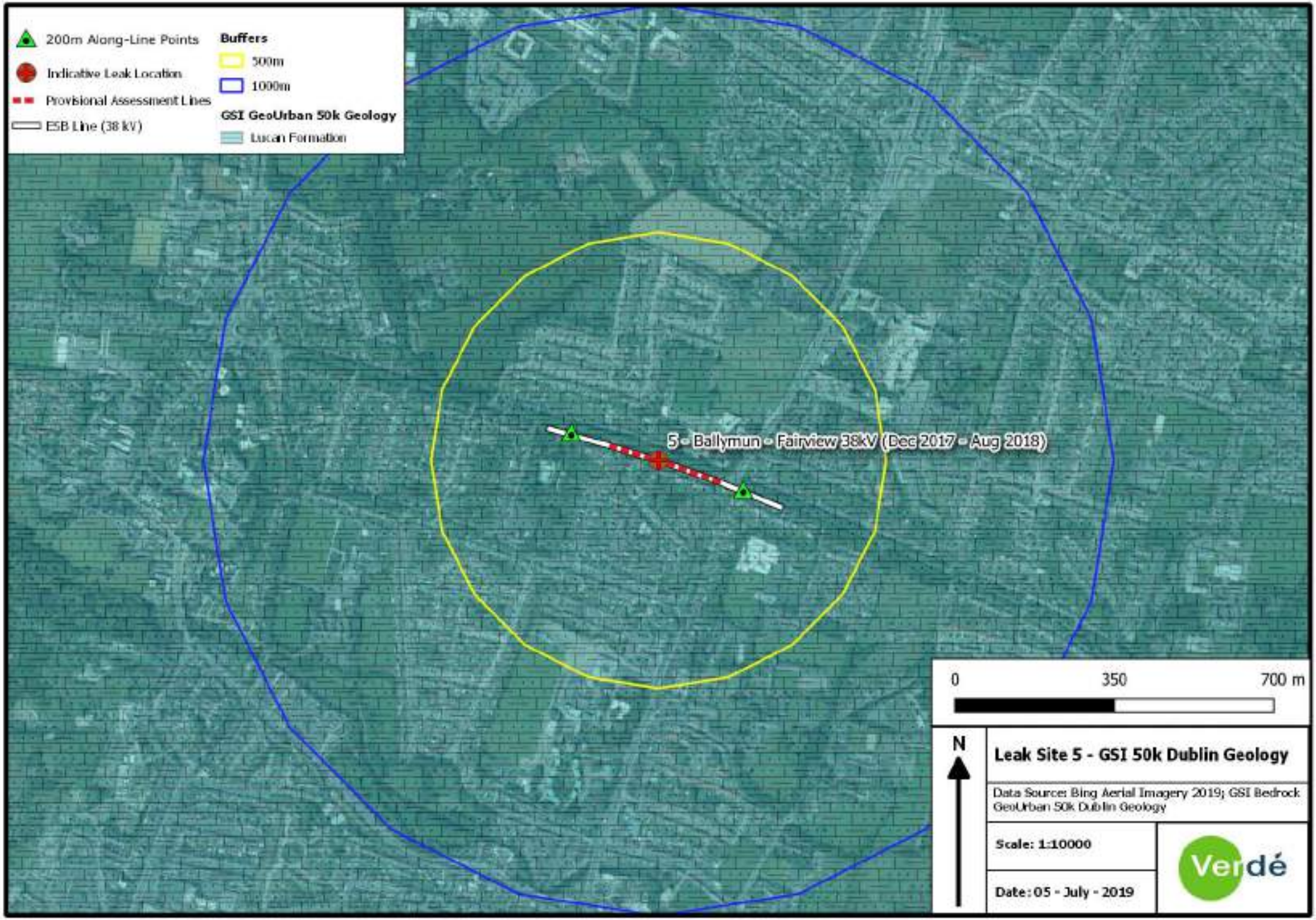
DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	26/06/2019

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
00-00	1	1 of 1	A3	1:1,250

DRAWING NUMBER: QD-354120-01-D460-001-009-001

APPENDIX B

DESK STUDY MAPS


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
ESB Line (38 kV)
Buffers
500m
1000m
GSI GeoUrban 50k Geology
Lucan Formation
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
0
350
700 m
N
Leak Site 5 - GSI 50k Dublin Geology
Data Source: Bing Aerial Imagery 2019; GSI Bedrock GeoUrban 50k Dublin Geology
Scale: 1:10000
Date: 05 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
ESB Line (38 kV)
Buffers
500m
1000m
GSI Bedrock Aquifer Classification
Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
Wells (Location Accuracy)
Well (50-100m)
Well (100-200m)
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
0
350
700 m
N
Leak Site 5 - GSI Bedrock Aquifer Classification and Well Locations
Data Source: Bing Aerial Imagery 2019; GSI Bedrock Aquifer Database; GSI Well Location Database
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Date: 05 - July - 2019
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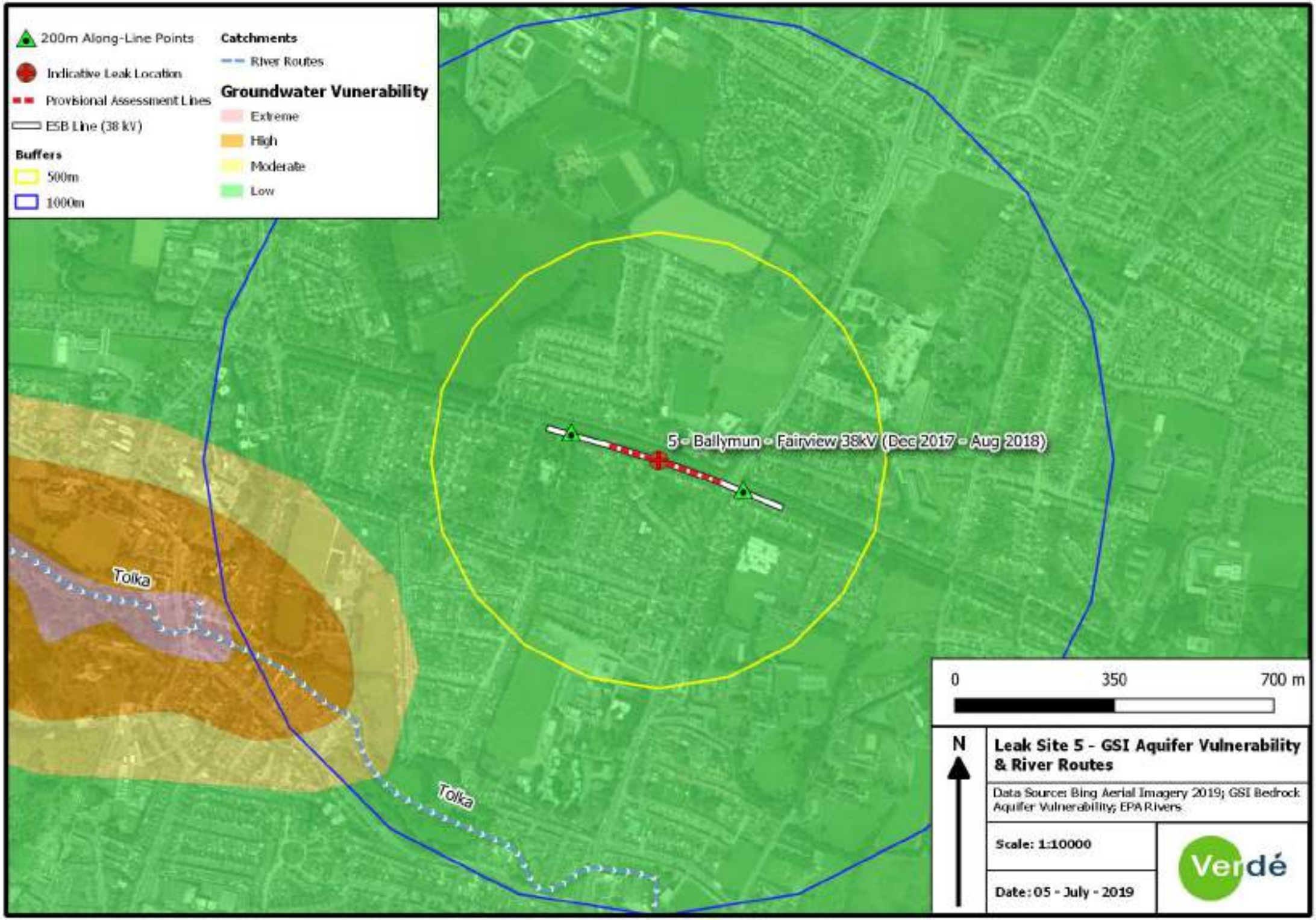
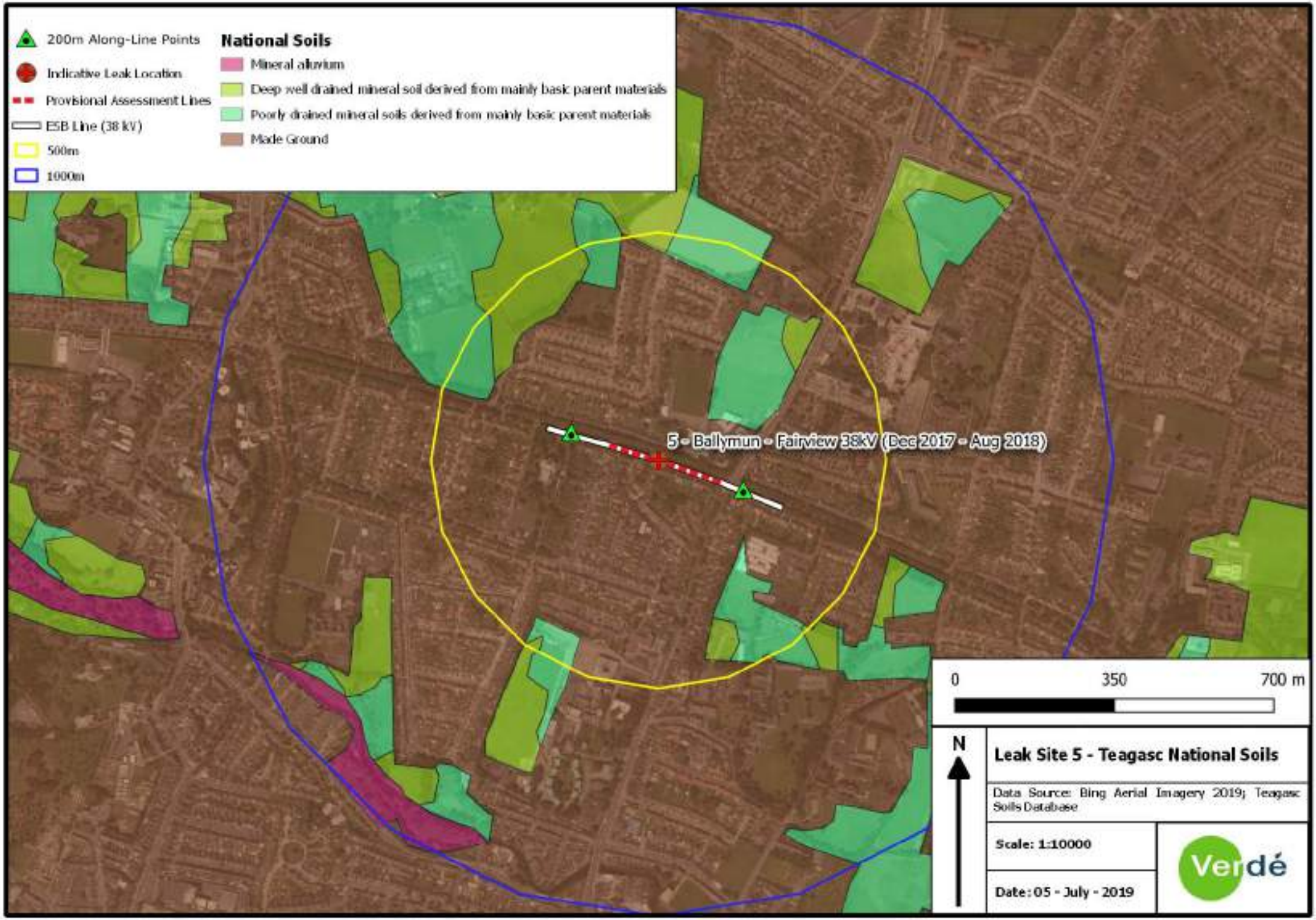
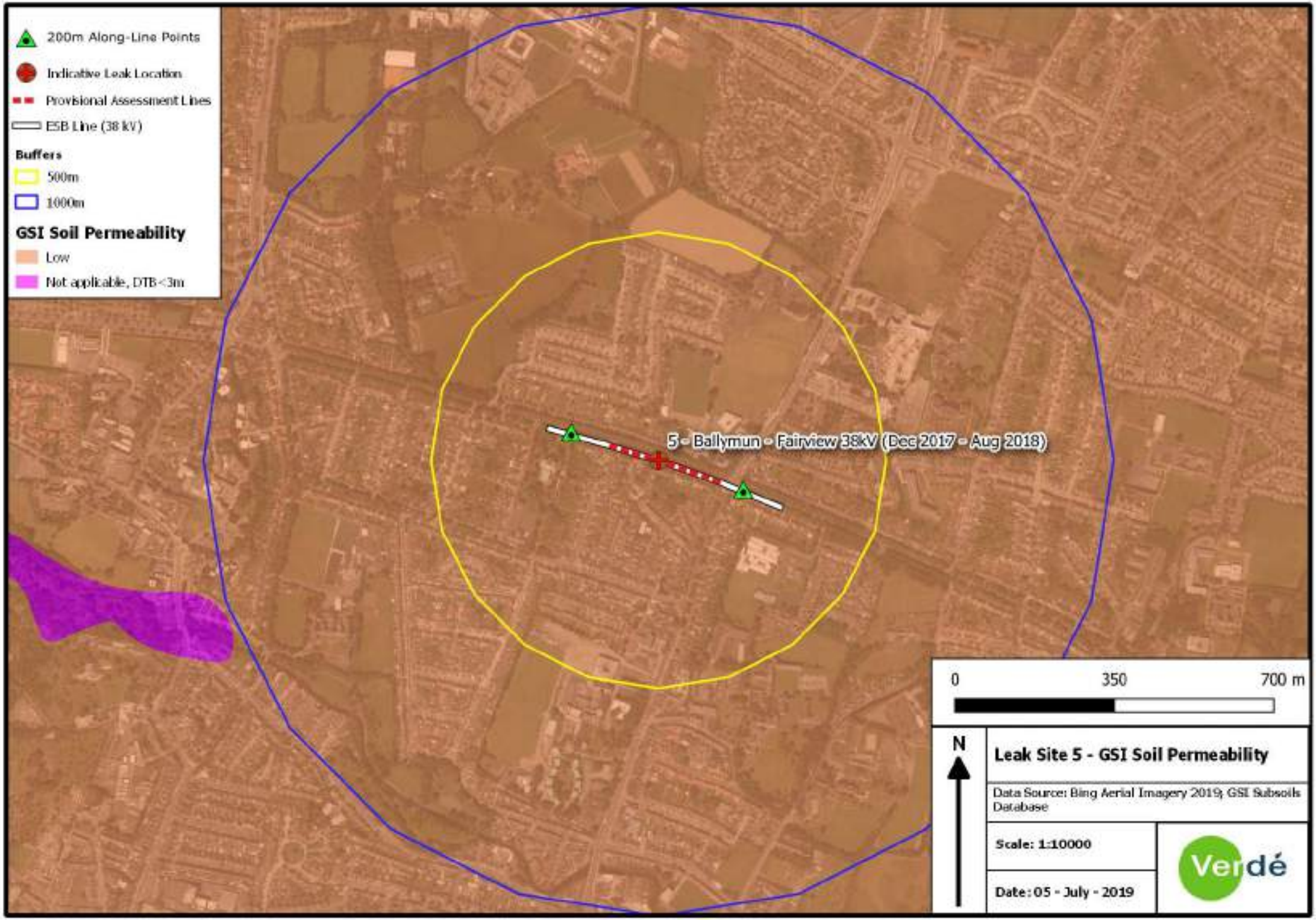
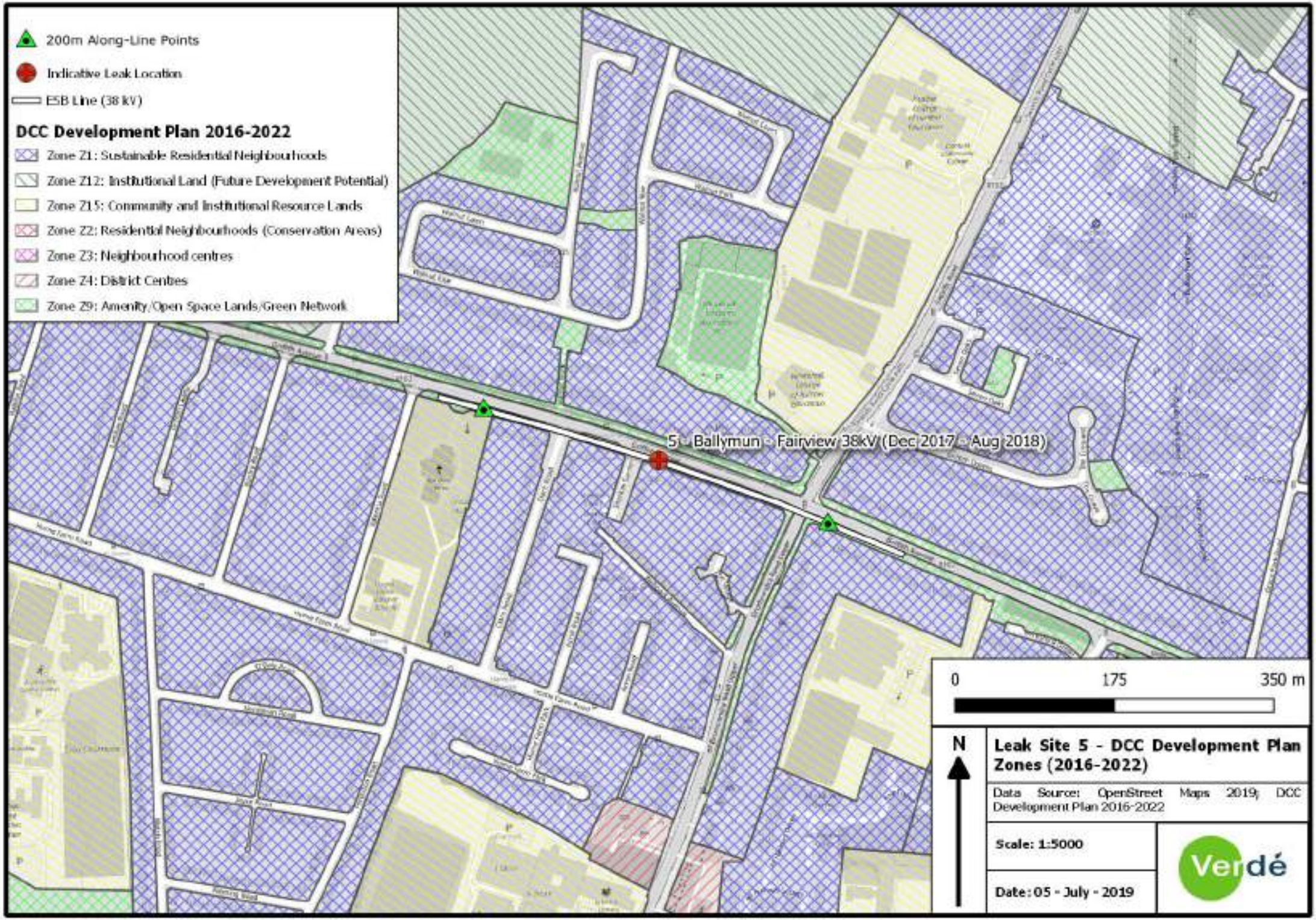
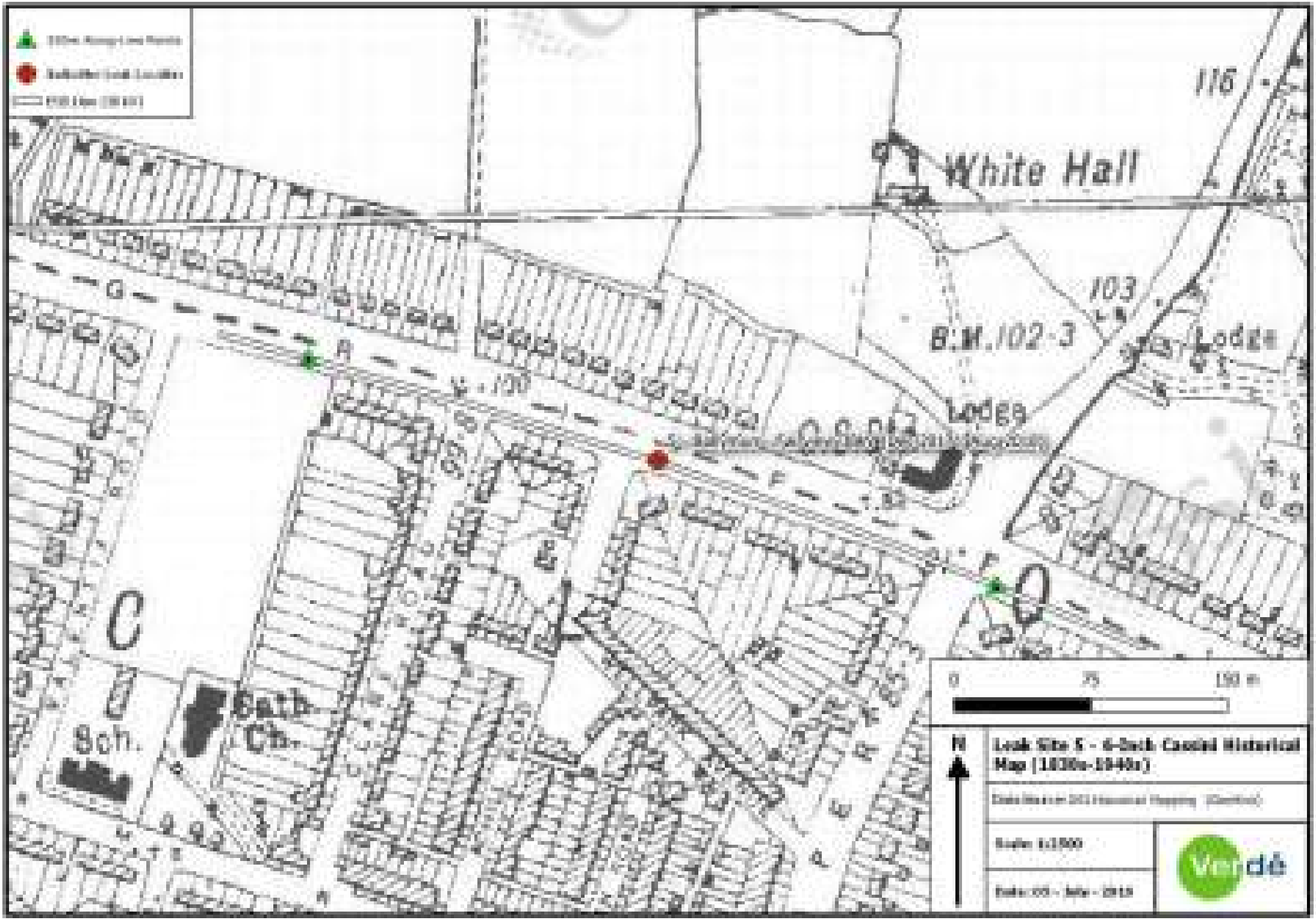
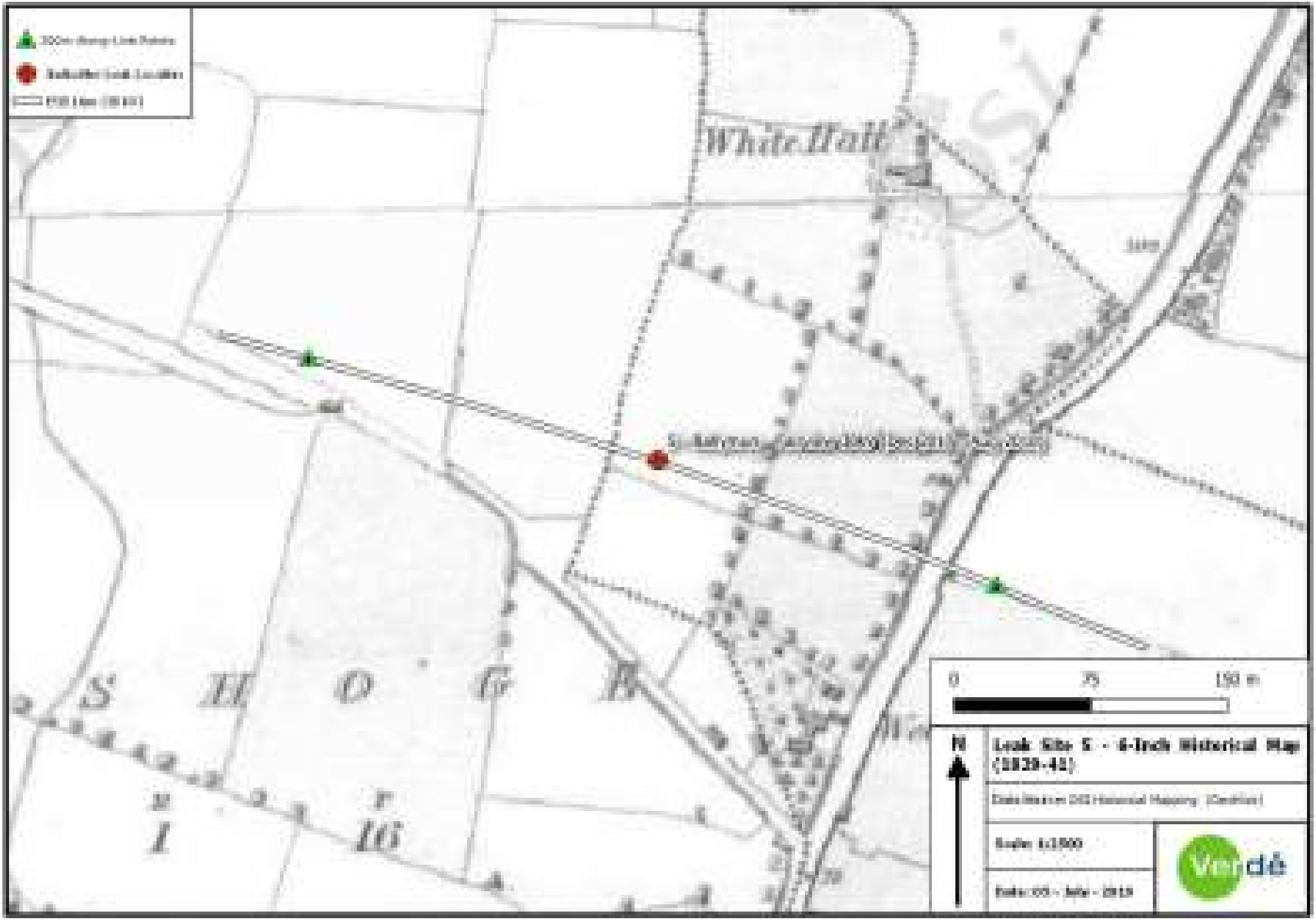

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
ESB Line (38 kV)
Buffers
500m
1000m
Catchments
River Routes
Groundwater Vunerability
Extreme
High
Moderate
Low
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
Tolka
Tolka
0
350
700 m
N
Leak Site 5 - GSI Aquifer Vulnerability & River Routes
Data Source: Bing Aerial Imagery 2019; GSI Bedrock Aquifer Vulnerability; EPA Rivers
Scale: 1:10000
Date: 05 - July - 2019
Verdé

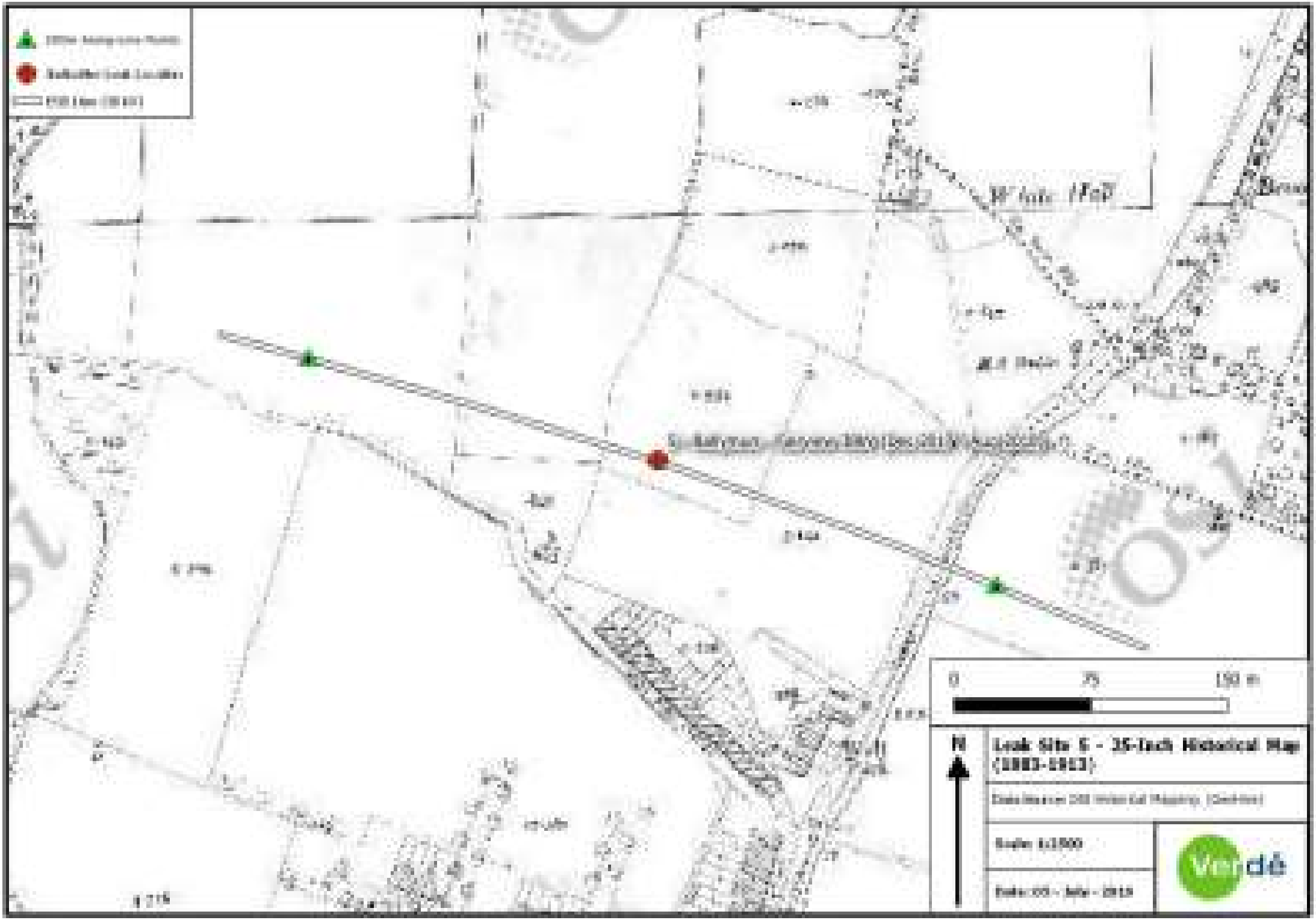

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
ESB Line (38 kV)
500m
1000m
National Soils
Mineral alluvium
Deep well drained mineral soil derived from mainly basic parent materials
Poorly drained mineral soils derived from mainly basic parent materials
Made Ground
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
0
350
700 m
N
Leak Site 5 - Teagasc National Soils
Data Source: Bing Aerial Imagery 2019; Teagasc Soils Database
Scale: 1:10000
Date: 05 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
ESB Line (38 kV)
Buffers
500m
1000m
GSI Soil Permeability
Low
Not applicable, DTB<3m
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
0
350
700 m
N
Leak Site 5 - GSI Soil Permeability
Data Source: Bing Aerial Imagery 2019; GSI Subsoils Database
Scale: 1:10000
Date: 05 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
ESB Line (38 kV)
DCC Development Plan 2016-2022
Zone Z1: Sustainable Residential Neighbourhoods
Zone Z12: Institutional Land (Future Development Potential)
Zone Z15: Community and Institutional Resource Lands
Zone Z2: Residential Neighbourhoods (Conservation Areas)
Zone Z3: Neighbourhood centres
Zone Z4: District Centres
Zone Z9: Amenity/Open Space Lands/Green Network
5 - Ballymun - Fairview 38kV (Dec 2017 - Aug 2018)
0
175
350 m
N
Leak Site 5 - DCC Development Plan Zones (2016-2022)
Data Source: OpenStreet Maps 2019; DCC Development Plan 2016-2022
Scale: 1:5000
Date: 05 - July - 2019
Verdé


White Hall
116
103
B.M.102-3
Lodge
Lodge
Sch.
Sch.
C
0
75
150 m
N
Leak Site 5 - 6-Inch Coastal Historical Map (1830s-1940s)
Scale: 1:1500


White Hall
0
75
150 m
N
Leak Site 5 - 6-Inch Historical Map (1839-42)
Scale: 1:1500
Verdé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Leak Site 5 - 35-Inch Historical Map (1883-1913)
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Leak Site 5 – 1995 Aerial Imagery
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Leak Site 5 - 2000 Aerial Imagery
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Leak Site 5 - 2005 Aerial Imagery
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Leak Site 5 – Aerial Pressure Imagery (DSI)
Scale: 1:1000
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APPENDIX C

SITE PHOTOGRAPHS

Photo 1: Approx 180m east of Leak Point - View to west. UPC services on grass verge

Photo 2: Leak point location in area next to new concrete footpath – abundant services in area

Photo 3: Area downgradient of leak point

Photo 4: Approx 80m east of leak point. Abundant services on roadway next to ESB cable. Layby area available on the roadway verge for car parking.

Photo 5: Approx 90m east of leak point. Kiosk location adjacent to ESB cable.

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Photo 6: ESB Kiosk approx. 135m east of leak point.

Photo 7: Green Kiosk approx. 180m east of leak point located on Drumcondra Road Upper near southern branch of ESB Cable

Photo 8: Tolka River approx. 890m south west of leak point

APPENDIX D

MSDS FOR COPC

1. LINEAR ALKYL BENZENES

MATERIAL SAFETY DATA SHEET

1: IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name: T 3788

Application: Hollow-core Energy Cable Saturant

Company: H&R ESP Ltd.

Address: Matrix House
North 4th Street
Milton Keynes, MK9 1NJ
United Kingdom

Telephone: +44 (0)1908 351 111 Fax: +44 (0)1908 351122

2: COMPOSITION / INFORMATION ON INGREDIENTS

Composition: Low viscosity compound based on a blend of linear alkyl benzenes that have side alkyl chains of 10 – 13 carbon atoms in length.

Synonyms: Linear Alkyl Benzenes
Alkyl C10-C13, benzenes
Benzene, C10-13-alkyl-deriv.
Detergent Alkylate

Composition	EINECS number	CAS number	Symbol letters	Risk numbers	Concentration range
C10 – C13 Linear Alkyl Benzenes	267-051-0	67774-74-7	Not regulated		100%

All constituents of this product are listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of Notified Chemical Substances) or are exempt.

3: HAZARDS IDENTIFICATION

Classification of preparation: This product is not classified as a dangerous substance / preparation in accordance with The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP3).

Physical and Chemical Properties: Not classified as flammable, but will burn. Avoid contact with strong oxidisers.

Health Effects

Skin:	Contact with the skin may cause irritation. Prolonged or repeated skin contact may cause drying of the skin, progressing to dermatitis. Symptoms may include itching, discolouration, swelling and blistering.
Eyes:	Contact with the eyes may cause irritation. Symptoms may include reddening, swelling and impaired vision.
Ingestion:	Ingestion of small amounts may cause nausea and vomiting.
Inhalation:	Due to low volatility, this product should not present an inhalation hazard under ambient conditions. Exposure to vapour or mineral oil mists may irritate the mucous membranes and cause dizziness, headaches and nausea.

Environmental Effects

No specific hazards under normal use conditions.

4: FIRST AID MEASURES

Inhalation:	Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a doctor. If breathing has stopped, administer artificial respiration.
Skin contact:	Remove contaminated clothing and wash affected skin with soap and water. If persistent irritation occurs, obtain medical attention. If high pressure injection injuries occur, obtain medical attention immediately.
Eye contact:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion:	Wash out mouth with water and obtain medical attention. DO NOT INDUCE VOMITING.

5: FIRE FIGHTING MEASURES

Suitable extinguishing media:	Carbon dioxide (CO_2), dry chemical, foam or water spray.
Unsuitable extinguishing media:	Do not use water jets.
Special exposure hazards:	Combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates and gases, including carbon monoxide, and unidentified organic and inorganic compounds.
Special protective equipment:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Spilt product presents a significant slip hazard. Remove any sources of heat.
Environmental Precautions:	Prevent from spreading or entering into drains, sewers and watercourses by using inert absorbent material or other appropriate barriers. Inform local authorities if this cannot be prevented.
Methods for cleaning up:	Absorb liquid with inert absorbent material. Sweep up and remove to a suitable, clearly marked container for disposal in accordance with local and national regulations

7: HANDLING AND STORAGE

Handling:	Do not eat, drink or smoke whilst using this product. To avoid the possibility of skin disorders repeated or prolonged contact with products of this type must be avoided. It is essential to maintain a high standard of personal hygiene.
Storage:	Store in a cool place away from sources of heat and out of direct sunlight to avoid pressure build up. Do not store near oxidisers.

Handling and Storage Materials and Coatings

Suitable:	Carbon steel, baked epoxy or Phenolic coatings, aluminium.
Unsuitable:	Natural rubber, Butyl rubber

8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Limits:	Not established.
Engineering control measures:	Use of local exhaust ventilation is recommended whenever this product is used in a confined space, is heated above ambient temperatures, or is agitated.
Hygiene measures:	Wash hands before eating, drinking, smoking and using the toilet. Gloves should be washed before being removed.
Respiratory Protection:	Normally not required if adequate ventilation is in place. Where concentrations in air may exceed the limits given in this section, it is recommended to use a half mask respirator to protect from over exposure by inhalation. Suitable filter material depends on the amount and type of chemicals being handled, but filter material suitable for organic vapours may be considered for use.
Hand Protection:	When handling this product it is recommended to wear chemical resistant gloves. Suggested materials for protective gloves include: PVC, Neoprene or similar.
Eye Protection:	Wear eye protection such as safety glasses, chemical goggles, or face shield if engineering controls or work practices are not adequate to prevent eye contact. Have suitable eye wash water available.

Skin Protection:	Wear impervious protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted.

9: PHYSICAL AND CHEMICAL PROPERTIES

General Information

Appearance:	Clear, colourless liquid
Odour:	Mild petroleum odour

Health, safety and environmental information

pH:	Not determined
Boiling point/range:	280℃
Flash point:	>135℃
Flammability:	Non flammable
Explosive properties:	Not explosive
Oxidising properties:	Not applicable
Vapour pressure at 20℃:	<0.02 kPa
Density:	0.86 g/cm^{-3} at 20℃ typical
Solubility in water:	Insoluble
Kinematic Viscosity at 20℃:	4.0 – 4.5 cSt (4.0 – 4.5 mm^2/s) typical
Vapour density (Air=1):	>1
Evaporation rate:	Not determined

Other information

Pour point:	-60℃ typical
Expansion coefficient:	0.0007 /℃ typical
Neutralisation value:	0.03 mg KOH g^{-1} maximum

10: STABILITY AND REACTIVITY

Chemical stability:	This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure and will not polymerise.
Conditions to avoid:	Temperatures above 140℃
Materials to avoid:	Strong oxidising agents, such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, peroxides etc, as this may present an explosion hazard.
Hazardous decomposition products:	Carbon monoxide and irritant fumes may be generated if this product is burned in an enclosed space.

11: TOXICOLOGICAL INFORMATION

Basis for assessment:	Toxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the toxicology of similar products.
Acute toxicity:	Oral LD50 expected to be >5000 mg/kg (rat) Inhalation LC50/4hr expected to be >1.8 mg/l (rat) Dermal LD50 expected to be >2000 mg/kg (rabbit)
Corrosivity/irritation:	
Eye:	May be slightly irritant
Skin:	May be slightly irritant
Respiratory tract:	If mists are inhaled, slight irritation of the respiratory tract may occur
Skin sensitisation:	Not expected to be a skin sensitiser
Repeated-dose toxicity:	Prolonged and/or repeated contact may lead to irritation and possibly dermatitis, especially under conditions of poor personal hygiene.
Mutagenicity:	Not expected to be a mutagen.
Carcinogenicity:	Not expected to be a carcinogen.
Reproductive toxicity:	The preparation has not been assessed at all for this end-point, so its hazardous property in this regard is not known.

12: ECOLOGICAL INFORMATION

Basis for assessment:	Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.
Ecotoxicity:	Poorly soluble mixture. Product is not expected to be ecotoxic to fish/daphinia/algae, or sewage bacteria. This preparation is expected to be removed in a wastewater treatment facility
Mobility:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence and degradability:	Readily biodegradable. Soils degradation – half life approx. 15 days. Natural waters degradation – half life approx. 4 – 9 days.
Bioaccumulative potential:	May have the potential to bioaccumulate

13: DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.

Unused Product:	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
Used/Contaminated Product:	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
Packaging:	Dispose of through an authorised waste contractor. May be steam cleaned and recycled.

14: TRANSPORT INFORMATION

This product is not classified as dangerous for transport.

15: REGULATORY INFORMATION

Classification/Symbol: Not Regulated

This preparation is not classified as Dangerous according to EU Directives

This safety data sheet is intended to assist in compliance with the following UK legislation:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- Control of Substances Hazardous to Health Regulations 2002.
- Health and Safety at Work, etc. Act 1974.
- Environmental Protection Act 1990
- Environmental Protection (Duty of Care) Regs. 1991
- COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations

Further Guidance
The following guidance notes are available from HMSO or HSE.

Occupational exposure limits (EH 40). Effects of mineral oil on the skin (SHW 397).
Preventing dermatitis at work (INDG 233)
A step by step guide to COSHH assessment (HSG 97)
Assessing and managing risks at work from skin exposure to chemical agents (HSG 205)
The selection, use and maintenance of respiratory protective equipment: A practical guide (HSG 53)
Relevant EC Directives:

- Dangerous Substances Directive (DSD)
- Dangerous Preparations Directive (DPD)
- Safety Data Sheets Directive (SDSD)
- Health & Safety Framework Directive

16: OTHER INFORMATION

This data sheet was prepared in accordance with Commission Directive 2001/58/ECand SI 2002 No. 1689 (CHIP 3)

Key References:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- The compilation of safety data sheets. Approved Code of Practice (third edition)
- Approved supply list (7th Edition). Information approved for the classification and labelling of substances and preparations dangerous for supply. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- Approved classification and labelling guide. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Guidance on regulations (Fifth edition).
- EH40/2005 Workplace Exposure Limits 2005
- COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations
- European Inventory of Existing Commercial Substances (EINECS)

The data and advice given apply when the product is sold for the stated application or applications. The product is not sold as suitable for any other application. Use of the product for applications other than as stated in this sheet may give rise to risks not mentioned in this sheet. You should not use the product other than for the stated application or applications without seeking advice from us.

If you have purchased the product for supply to a third party for use at work, it is your duty to take all necessary steps to secure that any person handling or using this product is provided with the information in this sheet.

If you are an employer, it is your duty to tell your employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

We believe, in good faith and to the best of our knowledge that the preceding information is accurate. However, we give no guarantee or warranty in this respect. The information provided herein may not be adequate for all individuals and/or all situations. The purchaser/user of the product remains responsible for storing, using or dealing with the product safely and in accordance with all applicable laws and regulations.

Material Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name : **Shell Diala Cable Oil**
Uses : Insulating oil.
Product Code : 001D8369

Manufacturer/Supplier : **Shell UK Oil Products Limited**
PO BOX 3
Ellesmere Port
CH65 4HB
United Kingdom

Telephone : +44 (0) 151-350-4000
Fax : +44 (0) 151-350-4000
Email Contact for MSDS : If you have any enquiries about the content of this MSDS please email lubricantSDS@shell.com

Emergency Telephone Number : +44-(0) 151-350-4595

2. HAZARDS IDENTIFICATION

EC Classification : Harmful.

Health Hazards : Repeated exposure may cause skin dryness or cracking. Harmful: may cause lung damage if swallowed.

Signs and Symptoms : If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Ingestion may result in nausea, vomiting and/or diarrhoea.

Safety Hazards : Not classified as flammable but will burn.
Environmental Hazards : Not classified as dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Preparation Description : Alkyl benzene.

Hazardous Components

Chemical Identity	CAS	EINECS	Symbol(s)	R-phrase(s)	Conc.
Benzene, C10-C13 alkyl derivitives	67774-74-7	267-051-0	Xn	R65; R66	90.00 - 100.00 %

Additional Information : Refer to chapter 16 for full text of EC R-phrases.

4. FIRST AID MEASURES

Inhalation	:	No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact	:	Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (37° C), shortness of breath, chest congestion or continued coughing or wheezing.
Advice to Physician	:	Treat symptomatically. Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Call a doctor or poison control center for guidance.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe the relevant local and international regulations.

Protective measures	:	Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods	:	Slippery when spilt. Avoid accidents, clean up immediately. Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.
Additional Advice	:	Local authorities should be advised if significant spillages

cannot be contained.

7. HANDLING AND STORAGE

General Precautions	:	Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Handling	:	Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.
Storage	:	Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50°C / 32 - 122°F The storage of this product may be subject to the Control of Pollution (Oil Storage) (England) Regulations. Further guidance maybe obtained from the local environmental agency office.
Recommended Materials	:	For containers or container linings, use mild steel or high density polyethylene.
Unsuitable Materials	:	PVC.
Additional Information	:	Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion. Exposure to this product should be reduced as low as reasonably practicable. Reference should be made to the Health and Safety Executive's publication "COSHH Essentials".

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Exposure Controls	:	The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne

		concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN141.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
Eye Protection	:	Wear safety glasses or full face shield if splashes are likely to occur. Approved to EU Standard EN166.
Protective Clothing	:	Skin protection not ordinarily required beyond standard issue work clothes. It is good practice to wear chemical resistant gloves.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless. Liquid at room temperature.
Odour	:	Slight hydrocarbon.
pH	:	Not applicable.
Initial Boiling Point and Boiling Range	:	> 280 °C / 536 °F estimated value(s)
Pour point	:	< -60 °C / -76 °F Data not available
Flash point	:	Typical 140 °C / 284 °F (PMCC / ASTM D93)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V)
Auto-ignition temperature	:	> 320 °C / 608 °F
Vapour pressure	:	< 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Density	:	Typical 857 kg/m3 at 20 °C / 68 °F
Water solubility	:	Negligible.
n-octanol/water partition coefficient (log Pow)	:	> 6 (based on information on similar products)
Kinematic viscosity	:	Typical 4.2 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 1 (estimated value(s))
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to Avoid	:	Extremes of temperature and direct sunlight.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	:	Expected to be slightly irritating. Repeated exposure may cause skin dryness or cracking.
Eye Irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation.
Sensitisation	:	Not expected to be a skin sensitiser.
Repeated Dose Toxicity	:	Not expected to be a hazard.
Mutagenicity	:	Not considered a mutagenic hazard.
Carcinogenicity	:	Components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	:	Not expected to be a hazard.
Additional Information	:	Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	:	Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Mobility	:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	:	Expected to be inherently biodegradable.
Bioaccumulation	:	Has the potential to bioaccumulate.
Other Adverse Effects	:	Product is a mixture of non-volatile components, which are not

expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
Container Disposal	:	Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. EU Waste Disposal Code (EWC): 13 03 08 synthetic insulating and heat transmission oils. Classification of waste is always the responsibility of the end user. Hazardous Waste (England and Wales) Regulations 2005.

14. TRANSPORT INFORMATION

ADR
This material is not classified as dangerous under ADR regulations.

RID
This material is not classified as dangerous under RID regulations.

ADNR
This material is not classified as dangerous under ADNR regulations.

IMDG
This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)
This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

EC Classification	:	Harmful.
EC Symbols	:	Xn Harmful.
EC Risk Phrases	:	R65 Harmful: may cause lung damage if swallowed. R66 Repeated exposure may cause skin dryness or cracking.
EC Safety Phrases	:	S62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Chemical Inventory Status

EINECS	:	All components listed or polymer exempt.
TSCA	:	All components listed.
Classification triggering components	:	Contains alkyl benzene derivatives.
Other Information	:	Environmental Protection Act 1990 (as amended). Health and Safety at Work Act 1974. Consumers Protection Act 1987. Control of Pollution Act 1974. Environmental Act 1995. Factories Act 1961. Carriage of Dangerous Goods by Road and Rail (Classification, Packaging and Labelling) Regulations. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Control of Substances Hazardous to Health Regulations 1994 (as amended). Road Traffic (Carriage of Dangerous Substances in Packages) Regulations. Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations. Road Traffic (Carriage of Dangerous Substances in Road Tankers in Tank Containers) Regulations. Road Traffic (Training of Drivers of Vehicles Carrying Dangerous Goods) Regulations. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations. Health and Safety (First Aid) Regulations 1981. Personal Protective Equipment (EC Directive) Regulations 1992. Personal Protective Equipment at Work Regulations 1992.

16. OTHER INFORMATION

R-phrase(s)

R65	Harmful: may cause lung damage if swallowed.
R66	Repeated exposure may cause skin dryness or cracking.

MSDS Version Number	:	1.0
MSDS Effective Date	:	16.09.2010
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	Regulation 1907/2006/EC
MSDS Distribution	:	The information in this document should be made available to all who may handle the product.
Disclaimer	:	This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

APPENDIX E

WATER FRAMEWORK DIRECTIVE RIVER AND GROUNDWATER BODY MAPS

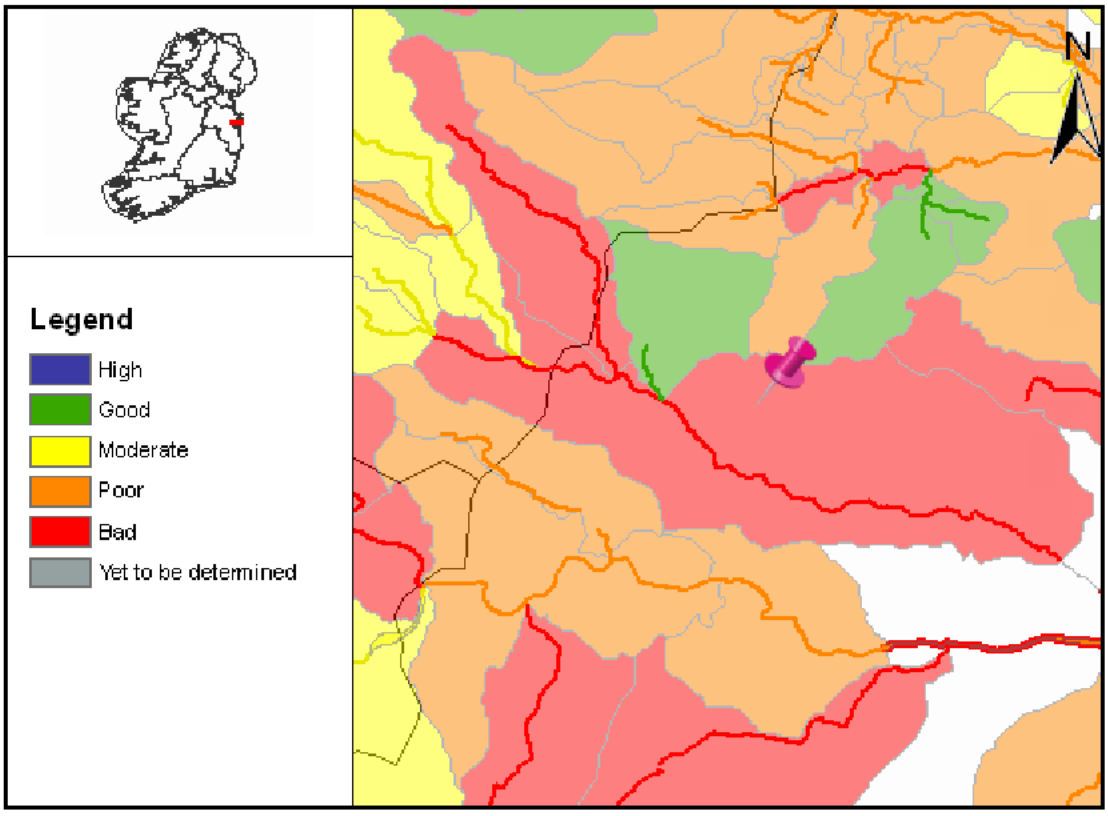
water matters

Status Report

Water Management Unit:	IE_EA_Tolka
WaterBody Category:	River Waterbody
WaterBody Name:	Tolka Lower
WaterBody Code:	IE_EA_09_1868
Overall Status Result:	Bad
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.



Date Report Created 08/07/2019

water matters

Status Report

Water Management Unit:	IE_EA_Tolka
WaterBody Category:	River Waterbody
WaterBody Name:	Tolka Lower
WaterBody Code:	IE_EA_09_1868
Overall Status Result:	Bad
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

	Status Element Description	Result
	Status information	
Q	Macroinvertebrate status	Bad
PC	General physico-chemical status	Moderate
FPQ	Freshwater Pearl Mussel / Macroinvertebrate status	N/A
DIA	Diatoms status	N/A
HYM	Hydromorphology status	N/A
FIS	Fish status	Poor
SP	Specific Pollutants status (SP)	N/A
ES	Overall ecological status	Bad
CS	Overall chemical status (PAS)	n/a
EXT	Extrapolated status	N/A
MON	Monitored water body	YES
DON	Donor water bodies	N/A

n/a - not assessed

Status
By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 status classes: High, Good, Moderate, Poor, Bad. However, not all waterbodies have been monitored, and in such cases the status of a similar nearby waterbody has been used (extrapolated) to assign status. If this has been done the first line of the status report shows the code of the waterbody used to extrapolate.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

Date Report Created 08/07/2019

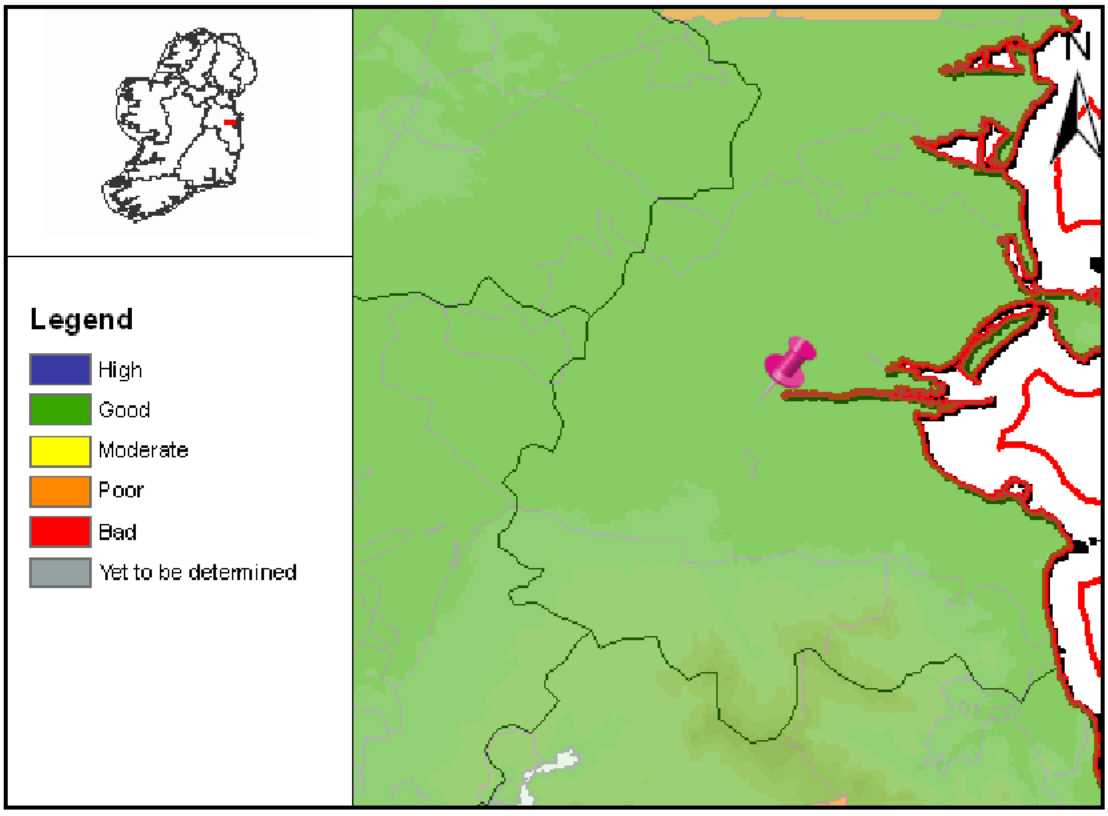
water matters

Chemical and Quantitative Status Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	Dublin Urban
WaterBody Code:	IE_EA_G_005
Overall Status Result:	Good
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.



Date Report Created 08/07/2019

water matters

Chemical and Quantitative Status Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: Dublin Urban

WaterBody Code: IE_EA_G_005

Overall Status Result: Good

Heavily Modified: No

Report data based upon final RBMP, 2009-2015.

	Status Element Description	Result
	Status information	
INS	Status associated with saline intrusion into groundwater	N/A
DWS	Status associated with exceedances of water quality above specific standards	N/A
DS	Chemical status of groundwater due to pressure from diffuse sources of pollution	N/A
CLS	Chemical status of groundwater due to pressure from contaminated soil or land.	N/A
MS	Chemical status of groundwater due to pressure from mine sites (active or closed).	N/A
UAS	Chemical status of groundwater due to pressures from urban areas	N/A
GWS	General groundwater quality status	N/A
RPS	Status associated with MRP loading to rivers	N/A
TNS	Status associated with nitrate loading to transitional and coastal waters	N/A
SWS	Overall status associated with nutrient loadings to rivers and transitional and coastal waters	N/A
SQS	Status associated with dependant surface water quantitative status	N/A
GDS	Groundwater dependant terrestrial ecosystems status	N/A
QSO	Quantitative status overall	Good
CSO	Chemical status overall	Good
OS	Overall status	Good

Date Report Created 08/07/2019

GS -HC : Good status High Confidence
GS- LC : Good status Low Confidence
n/a - not assessed

Status
By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and quantitative status, whichever is worse. Groundwaters are ranked in one of 2 status classes: Good or Poor.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

Date Report Created 08/07/2019

APPENDIX F

IRISH WATER RISK ASSESSMENT CORRESPONDENCE

From: [redacted]
Sent: Wednesday 19 February 2020 12:34
To: [redacted] (ESB Networks)
Cc: HQDWcompliance ; [redacted] ; [redacted]
Subject: RE: ESB enquiry regarding risk to water supply from cable fluid leaks

Dear [redacted]

Further to your query (within the attached email), we have examined the locations within your interactive map and cross referenced against the results from our regulatory monitoring programme for **Total Polyaromatic Hydrocarbons** (Total PAHs) and **Benzene**, from 2014 to date. Without knowing the exact chemical composition of the oil used to fill ESB cables, these are the closest parameters we can find from our monitoring programme that would be representative of potential oil contamination.

For the relevant supplies within the Greater Dublin Area, we have recorded zero exceedances of the parametric value (i.e. legally allowable limit) for Total PAHs (which is 0.1µg/L) and Benzene (which is 1µg/L) within this period. The same is true for the Cork City area.

A summary of these results are collated in the following table

Location Assessed	**Number of Samples tested for PAH**	**Number of exceedances for PAH**	**Number of Detections* for PAH**	**Number of Samples tested for Benzene**	**Number of exceedances for Benzene**	**Number of Detections* for Benzene**
Greater Dublin Area	981	0	15 (Range detected 0.01-0.04µg/L)	980	0	2 (Range detected 0.1-0.4µg/L)
Cork City	61	0	1 (Result: 0.02µg/L)	61	0	0

* **Detections** – where the result was above the limit of detection for the test in question, i.e. the test returned an actual concentration of the analyte

These results (which are from samples taken at the customer tap) would not indicate that leaks from oil filled cables have contaminated the drinking water supply for these areas, or at least to an extent where any contamination arising has resulted in a breach of the parametric value for PAHs and Benzene.

Notwithstanding what these results indicate, oil contamination in drinking water is a **serious public health matter**, and every effort should be made to ensure the likelihood of oil leaks from ESB cables coming into contact with water pipes is minimised to the **lowest possible extent**. Whilst our water mains are pressurised, should pressure levels drop for any reason (nearby burst for example),

contaminated groundwater could potentially infiltrate into our mains. Benzene in particular could also pose a risk to our PVC and Polyethylene pipes.

I trust this analysis and commentary is sufficient for your risk assessment.

Regards,

[redacted]
Drinking Water Compliance Lead
Environmental Regulation

Uisce Éireann
Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1
Irish Water
Colvill House, 24-26 Talbot Street, Dublin 1, Ireland

[redacted]