Verde Environmental Consultants

Preliminary Site Assessment Report for Fairhill – Wolfe Tone Street

Cork City

ESB Site Ref: 2
Fairhill – Kilbarry 38 kV

April 2020

Project Title:	ESB Networks Historic Fluid Filled Cable Loss Environmental Assessment
Licence No:	N/A
Project No:	52458
Contract No:	52458 Stage 1
Report Ref:	Stage 1 Preliminary Site Assessment Report for Fair Hill – Wolfe Tone Street, Cork City. ESB Ref: 2 Fairhill-Kilbarry 38kV Cable
Status:	Final
Client:	ESB Networks
Client Details:	ESB Networks Engineering & Major Projects One Dublin Airport Central Dublin Airport Cloghran Co Dublin.
Issued By:	Verde Environmental Consultants Ltd, E7 Network Enterprise Park, Kilcoole, Co Wicklow, A63 KV04.

Document Production/Approval Record

	Name	Signature	Date	Position	% Input
Prepared by (consultant)	[redacted]		06/04/2020	Senior Environmental Consultant	60
Contributed by (consultant)	[redacted]		06/04/2020	Risk Assessor Specialist	20
Approved by (consultant)	[redacted]		08/03/2020	Operations Director	20

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.

TABLE OF CONTENTS

FIGURES

APPENDICES

EXECUTIVE SUMMARY

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a suspected hydrocarbon leak from a power cable section along Fair Hill and Wolfe Tone Street in Cork City (ESB Site Ref: 2 Fairhill – Kilbarry 38 kV).

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 1,595 litres of cable fluid consisting of linear alkyl benzene (LAB) mixed with Mineral Oil (MO) lost to ground from the leak point in question. The leak occurred in September 2018 approximately at the junction of North Monastery Road and Wolfe Tone Street. This leak point was confirmed during excavations and trial pitting exercises in May and July 2019 when visible hydrocarbon contamination was observed associated with the cable.

The leak point is situated in a residential area with house fronts being less than 10m from the indicative leak point. There are also small, roadside, green spaces near the leak site and a school (North Monastery Primary School) within 50m of the leak point. Utility maps and excavation activities show abundant service lines including foul sewerage, gas, communication and water lines along the entirety of the cable route. It is likely that there are numerous unmapped minor services along the route also.

This area of Cork is seen to have a similar land use in the 6-inch Cassini historical maps (1830's – 1940's) to today with residential, greenfield parks, ecclesiastical buildings and schools. The land in the area is largely zoned for residential, local services and institutional uses with the areas on the north side of Monastery Road being designated as Landscape Preservation Zones with those to the north being Areas of High Landscape Value.

The site is underlain by locally important (meaning capable of suppling moderate groundwater yields) green-grey and purple mudstones and sandstones of the Gyleen Formation. The vulnerability is High to Extreme indicating that bedrock is likely to be relatively close to surface (0-5metres) and that the subsoils are moderately permeability made ground subsoils, which provide a limited level of natural protection to the underlying bedrock aquifer. Under the Water Framework Directive, the groundwater body beneath the site is of good status but is at risk of deterioration in the future.

Following civil works completed in July 2019, the nearest surface watercourse appears to be represented by the culverted Glasheen Stream. Site investigations suggests that this culverted stream, now used as a combined storm sewer, flows across the cable route, and downhill towards the River Kiln/Bride where it would enter the Upper Lee Estuary on Pope's Quay. The culvert may coincide or be represented by; a storm sewerage line recorded in the Irish Water drainage network maps. Site works in the area of this culverted river appear to show that the culvert still conducts significant quantities of storm and household wastewater which appears to drain to the east as an arch-supported culvert. The River Bride, approximately 510m to the east, and downgradient of the site, flows, through a culvert under Leitrim Street (N20), in a southerly direction, eventually discharging to the River Lee to the southeast of the site. The Upper Lee Estuary is located approximately 580m to the south, also downgradient of the site.

There is one groundwater well within 1000m of the leak site; uphill, 300m to the north, which is recorded in the GSI well database as a poor yield (21.8m^3/day), dug well which was completed in 1973 to a depth of 2.1m. The use and current condition of the well is unknown.

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 fluid 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 G).

There are no designated areas of conservation or "European Sites" within 1000m of the site; the nearest being the Cork Lough proposed Natural Heritage Area (pNHA) 2km to the southwest, across the Lee Valley. Groundwater in the bedrock aquifer may be locally, semi-confined by the subsoils with groundwater flow direction in an easterly to south-easterly direction following site topography.

Based on the known cable leak point, contaminants 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;

Considering the uncovering of the culverted Glasheen Stream during civil works in July 2019, it appears there may be hydrological pathways connecting the leak site to the River Bride, Upper Lee Estuary and potentially to connected, downstream protected areas in the Lee Estuary area; however there is currently no evidence to suggest this is taking place

There is a potentially Low risk posed by LAB and MO 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;
- 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 potential risk posed by LAB and MO in suspected contamination in the soil and groundwater through;

- hydrocarbon vapours in preferential pathways such as services ducts to residents or other building users;
- leaching to shallow groundwater given the contaminant properties of low mobility and high sorption to soil, with rare shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.

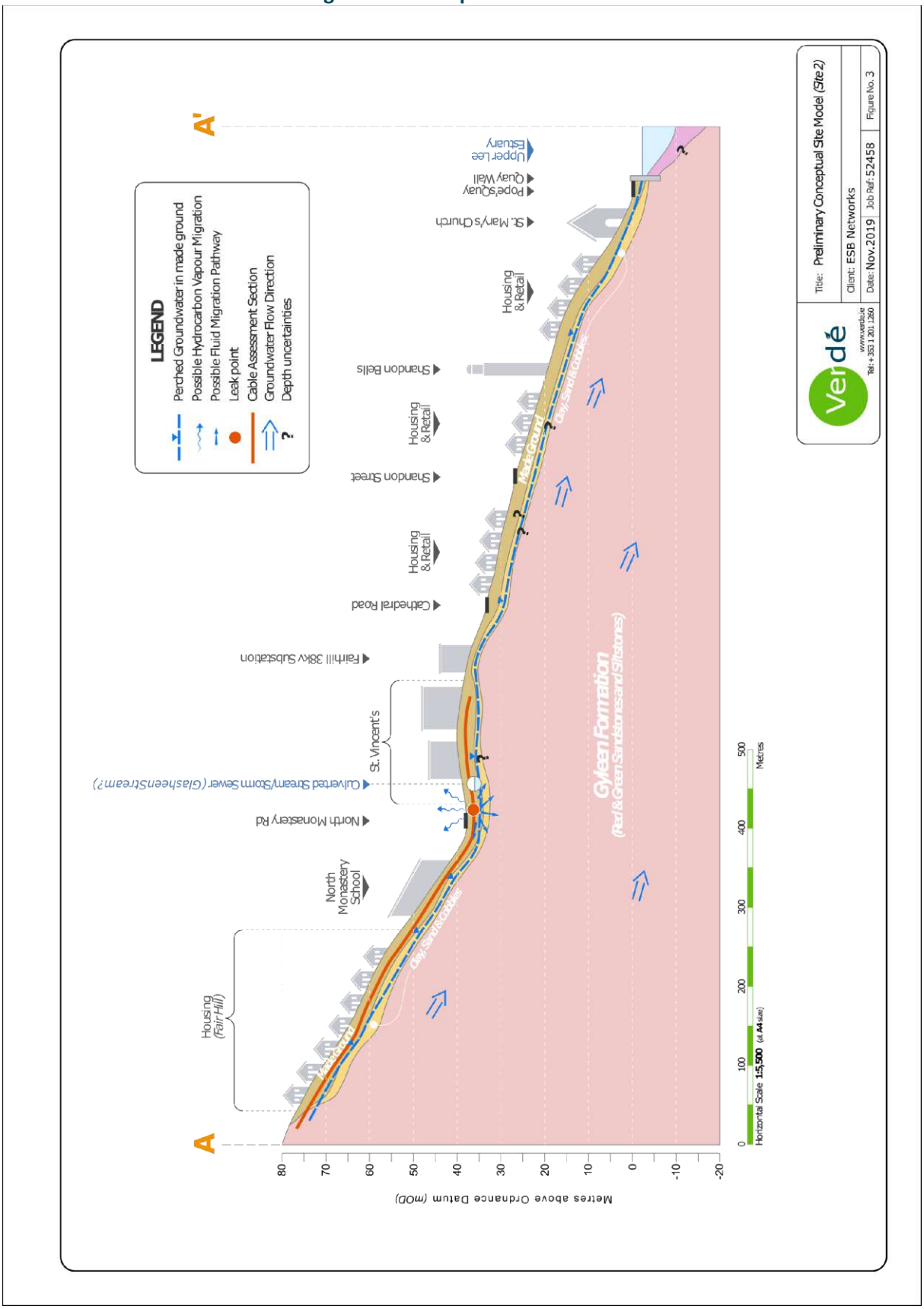
There is a potentially Moderate risk posed by LAB and MO in suspected contamination in the soil and groundwater through;

- hydrocarbon migration to the adjacent watercourse/sewerage network and the downstream River Bride/Kiln and the Upper Lee Estuary given the proximity of the culverted Glasheen Stream/storm

sewer which poses a potential pollutant linkage between the leak site and downgradient surface water receptors.

- hydrocarbon migration to the underlying aquifer given the possible connection to shallow groundwater or directly to bedrock through shallow rock in the area indicated by the high to extreme vulnerability.

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 April 2020	Final
1.2	**DETAILED SITE ASSESSMENT**			
1.3	**QUANTITATIVE RISK ASSESSMENT**			
	STAGE 2: CORRECTIVE ACTION FEASIBILITY & DESIGN			
2.1	**OUTLINE CORRECTIVE ACTION STRATEGY**			
2.2	**FEASIBILITY STUDY & OUTLINE DESIGN**			
2.3	**DETAILED DESIGN**			
2.4	**FINAL STRATEGY & IMPLEMENTATION PLAN**			
	STAGE 3: CORRECTIVE ACTION IMPLEMENTATION & AFTERCARE			
3.1	**ENABLING WORKS**			
3.2	**CORRECTIVE ACTION IMPLEMENTATION & VERIFICATION**			
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 along a 480m section of cable where there was suspected leakage of cable fluids and where works are proposed to remove the cable and install new service ducts. This report focuses on a hydrocarbon leak from a 38 kV power cable located along Fairhill and Wolfe Tone Street on the northern side of Cork City.

As well as this, Verde were commissioned to provide environmental consultancy support services to David Nodwell Ltd during the civil works associated with the removal and replacement of the 38 kV line. This involved the supervision of waste classification & disposal and risk analysis throughout the completion of site works on the cable section.

A site investigation was undertaken by a Verde Environmental Consultant on 28th and 29th of May 2019 and again on the 12th and 13th of June 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. During this site investigation, four trial pits were completed along the 480m section of cable (TP101 - TP104).

The detailed observations, results and recommendations of the waste classification and more-detailed risk analysis works along the cable route will be the subject of separate reports and are not wholly included in this report. For the purposes of the preliminary risk assessment carried out in this report; general observations made during site investigation works will be included as appropriate.

A site location map for the leak point and completed trial pits is presented in Figure 1 with a detailed map on the cable route and leak location presented in an ESB 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 cables 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 cable fluid leak from a 38 kV power cable along a 480m section of Fair Hill and Wolfe Tone Street in Cork City (ESB Ref: 2).

The leak is reported to have begun in September 2018; with an approximate volume of 1,595 litres (l) of linear alkyl benzene (LAB) mixed with mineral oil (MO) leaking from a 38kV cable at a rate of 266l/month. The leak was repaired in February 2019.

Details on the physical and chemical aspects of the hydrocarbon products used as Insulating Fluids in the cables 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 location and potential areas of impact. As requested by ESB, a risk-based approach has been applied to this assessment. This risk-based approach is also recommended in the best practice documents produced by the EPA on Management of Contaminated Land & Groundwater at EPA Licenced Sites published in 2013. Note, however, that the leak point in question is not an EPA licensed 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.
- Incorporate any preliminary findings and observations from completed site investigation works associated with the removal of the 38kV cable and installation of new service ducts.
- 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 leak point (ESB Ref: Joint 2) is located 15m south of the junction of Wolfe Tone Street and North Monastery Road in a mixed residential and greenspace area dominated by residential properties together with small open greenfield parklands and institutional areas, as presented in the map in Appendix A.

The leak point is situated in a residential area with house fronts being less than 10m from the indicative leak point and along the entire length of cable section in question. There are also small, roadside, green spaces near the leak site and a school (North Monastery Primary School) within 50m of the leak point. Approximately 30m to the southeast of the leak point is the boundary of the Saint Vincent's facility which contains a secondary school, a convent and a residential care facility on its grounds.

The ESB cable runs along the eastern side of Fair Hill and Wolfe Tone Street, as presented in Photograph 1 in Appendix C. There are numerous buried services under the concrete footpath between Fair Hill and Wolfe Tone Street and residential properties, as presented in Photograph 2. During excavations, a significant number of gas, water, stormwater, communication and foul sewerage utility lines were encountered; as seen in Photo 3 in Appendix C.

The leak point was located on the eastern side of the road as presented in Photograph 4 in Appendix C. On initial site walkover in May 2019, there was 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. Immediately to the east of the leak point on Wolfe tone Street is a grassed area, cul de sac avenue and footpath.

Irish Water utility maps show that there are stormwater, sewage and water mains running parallel as well as perpendicular to Fair Hill and Wolfe Tone Street, with sewerage typically running along the western side of the road and water mains on the centre and eastern side of the roads. Excavation works carried out in July 2019 encountered such utilities in abundance, in particular, PVC water mains feeding residential premises and clay foul sewerage lines serving the same. Many of these service lines were associated with some form of pea-gravel, sand blinding or other homogenous backfill material. It should be noted that the water services encountered during these excavations works were all seen to be at least 500mm above the level of the 38kV cable.

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

2.2. PREVIOUS SITE OPERATIONS

This area of Cork is seen to have a similar land use in the 6-inch Cassini historical maps (1830's – 1940's) to today with residential, greenfield parks and roadways as shown in the historical desk study maps in Appendix B. The existing location of the North Monastery School on the north side of the Fair Hill and Monastery Road junction appears to have been established in the early 1800's as shown in the historical maps in Appendix B. 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. CONTAMINANTS OF POTENTIAL CONCERN (COPC)

The fluid in the power cable is a mixture of two components Mineral Oil and Linear Alkyl Benzenes (T3788). Material safety data sheets (MSDS) for the fluids are 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, 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;
- Does not bio accumulate;
- The Predicted No Effect Concentration (PNEC) is the concentration of a chemical which marks the limit 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.

2.3.2 Mineral Oil

In scientific terminology, the term mineral oil tends to be non-specific in that it can refer to a substance which contains varying substances depending on its manufacture process.

Mineral oils are manufactured from petroleum with about 10-25% comprising of additives which can include antioxidants, metal deactivators, detergents, dispersants, corrosion inhibitor etc. Their composition will also have changed over time and, in the context of cable fluid, will vary according to when cables were installed. In summary, the following characteristics have been identified:

- Physical properties can vary widely being defined by the crude oil source, carbon number distribution, boiling range and viscosity.
- Mineral oils are refined from petroleum crude oils, and are complex mixtures of straight- and

branched chain paraffinic, naphthenic, and aromatic hydrocarbons with 15 or more carbons and boiling points in the range of 300°C to 600°C.

- Are insoluble in water and alcohol, but soluble in benzene, chloroform, ether, carbon disulfide and petroleum ether. They have ranging viscosities.
- Mineral oils from paraffinic crude oils are characterised by high wax content, high natural viscosity index, and relatively low aromatic hydrocarbon content. Naphthenic crude oils are generally low in wax content and relatively high in cyclo-paraffins and aromatic hydrocarbons. All crude oils contain some polycyclic aromatic hydrocarbons, and the proportions and types of these compounds in the finished mineral oils are determined primarily by the refining process.
- In the past, many mineral oils were only mildly refined and contained significant levels of polycyclic aromatic hydrocarbons (PAHs). Acid treatment was initially used to remove PAHs and other impurities and to improve the technical properties of the finished oils. In recent decades, acid treatment has largely been replaced by extensive refining with solvent extraction and/or hydro-treatment, which has further reduced the level of PAHs and other contaminants.
- In conclusion to the above, due to mineral oils likely varying composition, its physical, fate and transport and toxicological properties are best determined through consideration of the TPH CWG framework which characterises petroleum hydrocarbons according to the number of carbons. For a mineral oil, carbon fractions of C_{15} and above are relevant and PAHs. Additives may also be wide ranging and so their characteristics can be determined by the presence of analysed volatile and semi-volatile organic compounds.
- Mineral oil as represented by TPH hydrocarbon fractions of C_{15} and greater have a very low mobility and low degradation half lives. They therefore have the potential to persist in the environment.
- The longer carbon chain lengths also mean that mineral oil will have a relatively low volatility, with carbon fractions of greater than C_{16} not being considered to be volatile.
- The MSDS for Masse 106 (the Mineral Oil leaked from the cable) has identified that the product if it enters soil will be absorbed to soil particles and so will not be mobile. It has the potential to bio-accumulate. The MSDS also identifies that the product is expected to be non-toxic to aquatic organisms and that toxicologically it is not toxic and not carcinogenic. However more recently studies such as those for TPH CWG, have published health criteria values for carbon range $C_{16\text{-}35}$ and along with potential additives potential impacts to human health and the environment will need to be considered.

3. SITE ENVIRONMENTAL SETTING

3.1. GENERAL INTRODUCTION

The area of interest is an approximate 480m stretch of 38 kV cable along Fair Hill and Wolfe Tone Street extending 330m North West along Fair Hill from the Junction with North Monastery Road and 150m southeast along Wolfe Tone Street. This section of cable suffered a leak at a cable joint in September 2018, causing the uphill section of cable to drain of insulating cable fluids and causing the failure of the cable section. The main land use in this area is primarily residential and institutional with some roadside green areas along the top of Wolfe Tone Street. The North Monastery institutional grounds on the north side of the Fair Hill and Monastery Road junction includes a primary and secondary school with associated outdoor recreation areas and playgrounds. Saint Vincent's, 60-bed residential and day-care facility is located 50m to the south east of the leak point.

The land in the area is zoned for various uses. To the north of the leak site, the land is zoned for residential use primarily, with areas of public open space with some areas of Sports Grounds zoning. Most of the areas on the north-eastern side of Fair Hill are also designated as Areas of High Landscape Value, as presented in the Cork City Council Development Plan map in Appendix B. Some areas to the west of the leak site are zoned as open space/amenity with most of the land being Residential. The land immediately to the east of the leak, on the north side of North Monastery Road is designated as a Landscape Preservation Zone.

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 3.2 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 some structures within the confines of both the North Monastery school campus and Saint Vincent's care centre that are listed on the National Inventory of Architectural Heritage. Namely, these include former convent buildings, schoolhouses and chapels; all of which appear to have been repurposed to some degree and are in active use.
	Historic Mapping: <u>OSI 6 inch map (Black and White) (1837-1842):</u> The road layout resembles that of present times with respect to Fair Hill and Wolfe Tone Street, with similar roadside buildings and layout. The layout of the roads east to west were significantly different to present day, with the current main road from Sunvalley Drive to North Monastery Road being a more recent modification. The small avenue on the south side of North monastery Road, known as Peacock Row, comprised the main road in this time, known as Peacock Lane, which joined across a junction. No road was present on the western

	side of the junction. Most of the roadside residences seen along Fair Hill and Wolfe Tone Street appear to have been in place at this time. The Monastery School to the north of "Peacock Lane" and Saint Vincent's Centre on the south side of the road (then a nunnery) are also visible in these maps. A "Magdalene Asylum" building was in place within the confines of the current Saint Vincent's Centre and Saint Vincent's School. Much of the land to the west of Fair Hill and Wolfe Tone Street appear to have been undeveloped apart from the roadside terraced housing. To the west of the junction of Wolfe Tone Street and Fair Hill, small stream is denoted as running towards the intersection where it appears to sink or enter a culvert approximately 50m west of the junction. A feature titled "Fahy's Well" is also listed about 200m west of the junction. <u>OSI 25 inch map (Black and White) (1888-1913):</u> This map appears to show much the same semi-urban layout as the previous maps. There is added detail of Saint Vincent's Centre and then-asylum with chapels, lodges and school buildings visibly expanded on those in previous maps. <u>Cassini 6 inch (1830-1930):</u> This map appears to show a broadly similar layout to the area as the 6-inch (Black and White) maps previously discussed. The main notable difference seen is that there was significantly more residential, terraced housing developed at the time of these maps; suggesting that the Cassini series was completed at a later date to the aforementioned 6-inch maps. In particular, significant development appears to have occurred to the west of Fair Hill. <u>Recent History (1940's Onwards):</u> 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. Aerial Photo 2000: The site and its surroundings remain largely similar to the previous image. Aerial Photo 2005: There are few notable changes since the previous image in the immediate surroundings of the site. However, to the north west of the leak site it is apparent that a series of apartments were constructed along the south side of Sunvalley Drive. Aerial Photo 2012: The site and its immediate surroundings remain largely unchanged.

3.3. REGIONAL GEOLOGY AND HYDROGEOLOGY

The site is underlain by red siltstones and red-green sandstones of the Gyleen Formation (GSI) which is overlain by subsoils comprising Made Ground which is bordered by a pocket of tills derived chiefly from Devonian sandstones to the north east (Teagasc).

Following civil works completed in July 2019, the nearest surface watercourse appears to be represented by the culverted Glasheen Stream. Site investigations suggests that this culverted stream, now used as a combined storm sewer, flows across the cable route, and downhill towards the River Kiln/Bride where it would enter the Upper Lee Estuary on the Pope's Quay. The culvert may coincide or be represented by; a storm sewerage line recorded in the Irish Water drainage network maps. Site works in the area of this culverted river appear to show that the culvert still conducts significant quantities of storm and household wastewater which appears to drain to the east as an arch-supported culvert. The River Bride, approximately 510m to the east, and downgradient of the site, flows, through a culvert under Leitrim Street (N20), in a southerly direction, eventually discharging to the River Lee to the southeast of the site. The Upper Lee Estuary is located approximately 580m to the south, also downgradient of the site. The River Bride catchment area is a subcatchment of the Lee, Cork Harbour and Youghal Bay Catchment as defined by the River Basin Management Plan which covers a total area of 2,181.8km^2.

Within the Water Framework Directive (WFD), the River Bride segment, 500m to the east of the site has been classed as having an "Unassigned" overall status and is "At Risk" of deteriorating in the future. The Upper River Lee Estuary has been assigned a "Moderate" overall status and "At Risk" of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E. The groundwater water body in the area of the site, as defined in the WFD, is entitled CorkCity_1 and has been assigned an overall status of "Good" and an overall risk of "At Risk".

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.

- Cork 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 site itself steeply dips to the south along the northern section of Fair Hill, becoming relatively flat at the road junction with North Monastery Road, and rising to dip gently northwards along Wolfe Tone Street. The regional topography of the area slopes gently to the

	south east toward Cork City and the River Lee. The route of North monastery Road appears to be small valley/gully which likely defines the route of the now-culverted Glasheen Stream, running downhill to the east.
Geology	**Overburden:** The GSI and EPA databases describe the soils at the site as Made Ground with the subsoils in the area consisting of Urban deposits with small areas bordered by a pocket of tills derived chiefly from Devonian sandstones to the north east.
	Solid Geology: The site is underlain by siltstones and sandstones of the Gyleen Formation. The Gyleen Formation comprises red siltstones and red-green sandstones defined by fining-upward sequences.
Hydrogeology	**Regional Classification:** According to the GSI the Gyleen 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 (100-400m^3/d). Groundwater flow occurs predominantly through fractures, fissures and joints (secondary permeability) in a south-easterly flow direction towards the Lee Estuary. 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 GSI vulnerability map for the area describes the aquifer as having a vulnerability rating of High to Extreme across the site. Based on the Aquifer Vulnerability Mapping Guidelines provided by the GSI, this indicates that bedrock could be encountered in the upper 0 to 5 metres (mBGL). This was confirmed from geotechnical drilling works in the area where the bedrock is within 5.5 to 6.5mBGL in the central and southern areas of the site. The drilling reports show Made Ground/Fill to an average depth of 4.1mBGL underlain by a stiff to hard clay with boulder clay identified in several boreholes. However, geotechnical reports and trial pit excavations in the northern areas of the site show that bedrock in the northern areas of the cable section is close to surface locally with 0-1m of overburden. This is reflected in the extreme vulnerability in the north of the site. A similar feature of extreme vulnerability is noted at the southern extent of the cable assessment section where it appears bedrock is close to surface.
	Groundwater Body: Under the Water Framework Directive (WFD) the groundwater body beneath the site is CorkCity_1 (code: IE_SW_G_030) and is categorised as having Good status, an Overall Objective of Protect and an Overall Risk of At Risk.

	Well Search: There is a groundwater well c.300m north, uphill from the leak site, which is recorded in the GSI well database as a poor yield (21.8m^3/day), dug well which was completed in 1973 to a depth of 2.1m. The use and current condition of the well is unknown. The only other groundwater well recorded within 1000m of the site is located 850m to the south, across the Upper Lee Estuary. This well is recorded as an 18m site investigation borehole, installed in 1899, of unknown yield or status.
Hydrology	**Surface Water Courses/Abstractions:** The Cassini and 6-inch historical maps show a small stream, titled Glasheen Stream, running towards the leak site from the west. Approximately, 60m west of the site, the stream appears to sink or enter a culvert. A site walkover in August 2019, as well as excavation works in July 2019, confirmed the presence of a culverted stream with significant volume, flowing to the east under Peacock Row. This culvert appears to be used for combined storm drainage with visible evidence of "grey" wastewater. The cable section in question was seen to be installed through this culvert at the northern end of Wolfe Tone Street. Historical records appear to show this culverted river/drain joining the culverted Kiln river section of the Bride, underneath the Leitrim Street (N20), where it flows south into the Lee Estuary on Pope's Quay. The nearest surface watercourse is the River Bride (Kiln), approximately 510m to the east of the site, and downgradient of the site flowing in a southerly direction eventually discharging to the River Lee to the south of the site. The Upper Lee Estuary is located approximately 580m to the south, also downgradient of the site.
Geotechnical	Three boreholes were drilled within the boundaries of the Presentation Convent in September 1965, with the available logs and dates presented in Appendix F. The Presentation Convent is between 50-150m south-east of the leak site, on the eastern side of the Wolfe Tone Street and the southern side of Monastery Road. The logs show a general (averaged) layered sequence of thin topsoil (0.0-0.75mBGL) overlying stiff brown sandy/stony gravels and clays to approximately 3.81mBGL which are overlying bedrock.
	The upper area of the site, on Fair Hill, is within 350m of several boreholes drilled and trial pits dug as part of an investigation carried out into sub-soil conditions under proposed all-weather playing pitches on Knockfree Avenue, Gurranabraher, as presented in Appendix F. The works were completed in September 1996. Further information is provided in Section 3.4.
Protected Areas	**Nearest Areas of Conservation** There are no designated areas of conservation or "European Sites" within 1km of the site; with the nearest being the Cork Lough proposed Natural Heritage Area (pNHA) 2km to the southwest; across the Lee Valley and Upper Estuary. Further to the east of the leak site, connected to the Upper Lee Estuary, there are several designated ecological sites; namely the Dunkettle Shore pNHA (Site ID: 001082), Douglas River Estuary pNHA (Site ID: 001046) and Cork Harbour SPA (Site ID: 004030), all of which are located approximately 5.0km to the east of the leak site.

Flooding	According to OPW flood mapping the site does not appear to be at risk of any coastal, fluvial or pluvial flooding.

3.4. SITE GEOLOGY AND HYDROGEOLOGY

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 a cable 350mm
- Width of trench 1100mm
- Backfill can be either arisings or Clause 804.

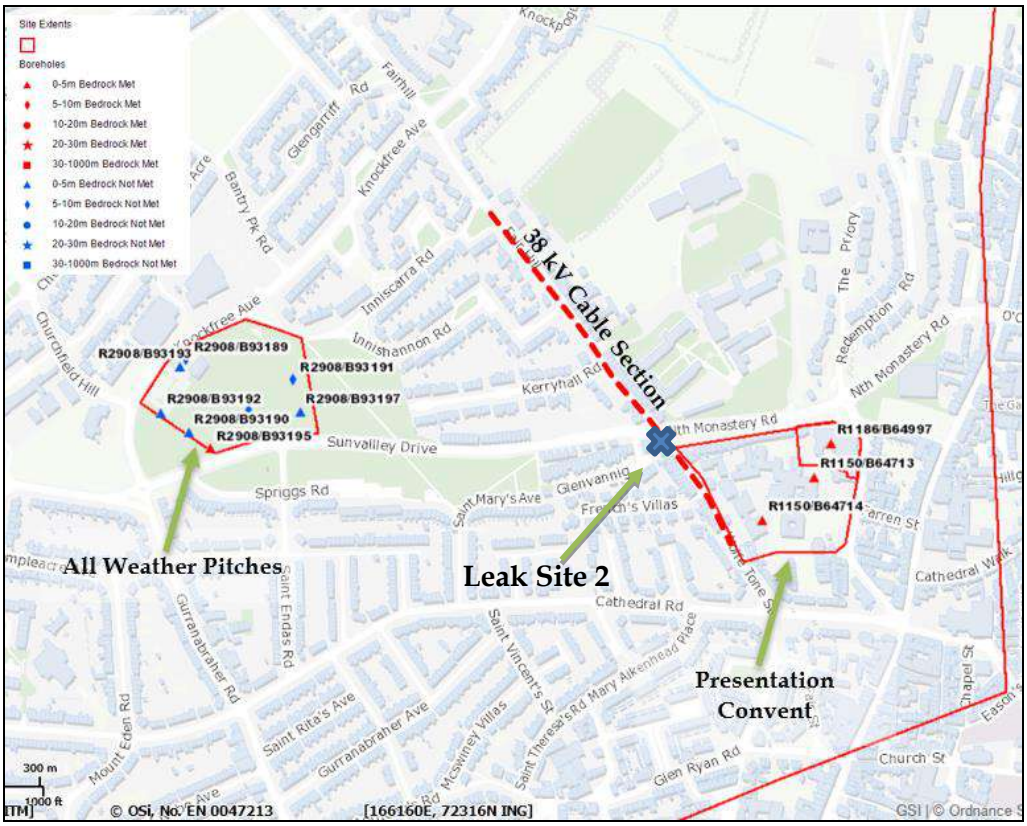
According to the GSI Database the site is located within the red and green siltstones and sandstones of the Gyleen Formation overlain by Urban deposits, Made Ground and some clays up to approximately 7mBGL, but typically 1-4m thick; as indicated by the high and extreme groundwater vulnerability rating. This was confirmed from geotechnical drilling works in the area where it can be seen that the bedrock is typically within 1.9 to 7.0mBGL. The drilling reports show, in the northern Fair Hill area, Made Ground/Fill to an average depth of 2.1mBGL underlain by soft gravelly and sandy clay to an average depth of 4.9mBGL as identified in a number of boreholes; these are subsequently underlain by boulders or bed rock of undescribed nature. Excavation works at the northernmost point of the cable section showed bedrock at less than 1mBGL with the cable ducts laid in a cut section of rock. In the Wolfe Tone Street area, to the south of the cable section, the nearby boreholes from the Presentation Convent geotechnical report outline a general (averaged) layered sequence of thin topsoil (0.0-0.75mBGL) overlying stiff brown sandy/stony gravels and clays to approximately 3.81mBGL which are overlying bedrock.

Below are the details of boreholes completed in the two sites as outlined in figure 3.1.

Two boreholes were drilled on the grounds of the Presentation Convent in September 1965 on behalf of Malachy Walsh & Partners. The summary details of the logs from the boreholes are presented in Appendix F.

The moderately permeable made ground is reported to be generally dry in both sites, with some level of drainage likely being assisted by the relatively steep gradient of the hill along Wolfe Tone Street and Fair Hill. Both sites record significant thickness of clays underneath topsoil; suggesting that the permeability may be somewhat lower than initially thought. The presence, however, of locally gravelly and cobble-rich clay and sand deposits; as well as permeable Made Ground, suggests permeability may be quite high locally. In the northern area of the site, towards Fair Hill, thicker accumulations of up to 7 meters of clay and boulders suggest that the subsoils may be locally thicker than initially suggested in this area; offering more protection to the underlying bedrock aquifer. This is tempered however by the observation of bedrock at surface along the northern-most 5m section of the cable.

Figure 3.1 Geotechnical Borehole Locations (from GSI database)



The absence of any perched groundwater observed on both sites, suggests that in general, the subsoils in this area are relatively well drained and do not appear to have notable clay-rich baffles or aquitards that would inhibit lateral groundwater migration. The only examples of water observed on both sites were noted at the bedrock-subsoil interface; suggesting that water is near surface in the aquifer.

The accumulation of relatively thick, moderately permeable clayey subsoils, seen locally to be up to 4.5m thick beneath the made ground, may restrict migration of waters to the underlying siltstone and sandstone bedrock aquifer, as presented in the conceptual site model in Figures 3 and 4.

The topography of the area as obtained from the GSI database show the northern-most cable section is located at approximately 60 meters above the ordnance datum (mOD) with a steep gradient towards the southeast. These topographic contours are orientated approximately northeast-southwest which infers that the groundwater flow direction is likely to be in a south-easterly to south flow direction, as presented in Figure 2 and within the CSM in Figures 3 and 4.

The cable leak point (ESB Ref: 2) is located at approximately 40 meters above the ordnance datum (mOD) with a more gradual downward gradient towards the east; along the axis defined by the North Monastery Road and slight uphill gradient to the south up Wolfe Tone Street. These topographic contours define an east-west oriented “valley” which infers that the groundwater flow direction is likely to be in an easterly 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 was seen to be up to 1.2m deep and contained sand and backfill material. Trial pitting and excavation works completed May to August 2019, as part of cable replacement works, showed a grey medium-grained, sand blinding fill material associated with the ESB 38 kV cable. The 38 kV cable was replaced with modern XLPE high-voltage cables and the length of trench completed in June to August 2019 was backfilled with a lean-mix concrete fill material along its entire length. Soil and fill material above the cable route was replaced with new, clean fill material and removed from site appropriately. Locally associated with other service lines such as gas and water, coarse cobble-rich 804 fill material and coarse "pea-gravel" was observed. Nearby geotechnical reports suggest that the underlying boulder clay is of low to moderate permeability with a thickness up to 4.5m.

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 fluid 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 G).

There is no available soil/vapour or groundwater quality information from the area in the vicinity of the cable leak point. There is a groundwater well within 300m of the leak site, which is recorded in the GSI well database as a poor yield (21.8m^3/day), dug well which was completed in 1973 to a depth of 2.1m. The use and current condition of the well is unknown. A summary of the Environmental and Human Health Pollutant Linkages for the COPC 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.

- **Mineral Oils** are refined from petroleum crude oils and are complex mixtures of straight- and branched hydrocarbons and are insoluble in water. Mineral oil with hydrocarbon fractions of C15 and greater have a very low mobility and low degradation half-lives. They therefore have the potential to persist in the environment. The longer carbon chain lengths also mean that mineral oil will have a relatively low volatility.

4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1. PRELIMINARY QUALITATIVE RISK ASSESSMENT (PQRA)

4.1.1 Risk Assessment Methodology

Currently there is no specific legislation addressing contaminated land in Ireland and therefore 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 and 4.2 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 1,595 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) September 2018 to February 2019. PCOCs include: TPH fractions, Speciated PAHs Mineral Oil SVOCs VOCs	LAB and MO 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 within 15m of the leak point along. Two schools are located within 165m of the leak point. A residential care centre is located 50m to the southeast of the leak site. Potential vapour phase migration may preferentially focus along utility service lines and through more permeable made ground soils and or sand/gravel fractions of soils if present (backfill).
	LAB and MO 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 within 15m of the leak point along. Two schools are located within 165m of the leak point. A residential care centre is located 50m to the southeast of the leak site. The cable source of leak is at a depth of 0.9-1.2m 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 and MO 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; however, they appear to be at least 500mm above 38 kV cable level and potential COPCs. If coincident with pipes, LAB and MO have the potential to permeate through the wall of plastic supply pipes under low-pressure conditions (leak/burst) and also through joins and

				gaskets. Literature review 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 and MO 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 and MO 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 1,595 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) September 2018 to February 2019. PCOCs include:	LAB and MO partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and clayey subsoils	Shallow groundwater	Y	LAB and MO 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 and MO direct downward migration as NAPL until reaches shallow groundwater where forms LNAPL and with a limited dissolved plume based on low solubilities, then lateral	River Bride (Culverted Kiln River) and Upper Lee Estuary	Y	The Kiln River approximately 500m to the east. There is a potential direct link between the leak point and the river in the form of a culverted stream/storm sewer that the cable is installed through (old Glasheen Stream).

TPH fractions, Speciated PAHs Mineral Oil SVOCs VOCs	migrations towards surface waters			The River Bride then drains into the Upper Lee Estuary.
	LAB and MO migration downwards through glacial till to sandstone-siltstone bedrock aquifer and then lateral migration	Sandstone-siltstone bedrock aquifer / Groundwater Users	Y	There is one groundwater well recorded 450m, up-gradient to the north of the leak point. The status and use of the well is not known. The surrounding properties are serviced by mains water. The shallow bedrock, particularly in the northern sections of the site, presents a potential direct link to bedrock.

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 and 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 and Mineral Oil 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 and Mineral Oil

Source	Pathway	Receptor	Severity	Likelihood	Potential Risk Level	Comments
Human Health						
Historical leaks of cable fluid from underground electricity cable comprising of an approximate volume of 1,595 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) September 2018 to February 2019. PCOCs include: TPH fractions, Speciated PAHs Mineral Oil SVOCs VOCs	LAB and MO 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	LAB & MO have 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 in both soil and water and does not exist readily in the vapour-phase. Mineral oil is less biodegradable therefore has a greater tendency to accumulate and may present a greater risk. Given the distance of <10m to residences and the quantity of reported oil loss (1,595l) the potential risk to residents is low/moderate.
	LAB and MO 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	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. The contamination is also located under the

	grown produce					road and concrete surface in an area not known to flood.
	LAB and MO 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 are thought to be present typically 500mm above power cable with the leaked cable fluid that has the potential to permeate plastic water supply pipes. Contamination has been seen (in trial pitting) to be largely confined to the lower areas of completed trenches, usually 500mm below any water service lines. For this reason, the potential risk is Low. 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 and MO 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	Potential 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 and MO 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	Potential 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 1,595 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) September 2018 to February 2019.	LAB and MO 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	Likely	Low/Moderate	Potentially Low/Moderate risk due to alkyl benzene contamination strongly absorbs to soil, has low mobility, readily biodegrades in both soil and water. Mineral oil is less biodegradable therefore has a greater tendency to accumulate and may present a greater risk. Rare shallow groundwater in made ground and clayey subsoils is unlikely to be used as an actual resource due to low water volumes and location in a residential urban area. Overall potential risk is low/moderate.

PCOCs include: TPH fractions, Speciated PAHs Mineral Oil SVOCs, VOCs,	LAB & MO migration downwards through glacial till to Sandstone/siltstone bedrock aquifer and then lateral migration	Sandstone-siltstone bedrock aquifer / Groundwater Users	Medium	Likely	Moderate	Has the potential to migrate downwards in thin made ground. The contamination will strongly sorb to soil, has low mobility, readily biodegrades in both soil and water (LAB). Mineral oil is less biodegradable therefore has a greater tendency to accumulate and may present a greater risk. In locations where overburden is thin or absent, the risk is higher, hence the potential risk is Moderate.
	LAB and MO 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 Bride (Kiln) and Upper Lee Estuary via culverted storm drains	Medium	Likely	Moderate	Has the potential to migrate in shallow groundwater in made ground. The contamination will strongly sorb to soil and has low mobility. There was a significant loss (1,595L) from the cable which is likely, to some degree, to be transmitted to the adjacent environmental receptor from the leak point considering the proximity and potential direct pathway.

4.4. SUMMARY OF PRELIMINARY QUANTITATIVE RISK ASSESSMENT (PQRA)

A desktop study, site walkover, trial pit excavations and trenching works were conducted at the Fair Hill – Wolfe Tone Street Site in Cork City after there was a volume of 1,595 litres of linear alkyl benzene mixed with mineral oil lost from the cable at an approximate rate of 266L/month for 6 months. The leaks began in September 2018 and were repaired in February 2019. Results of the PQRA are summarised below:

4.4.1 Human Health:

- There is a Low/Moderate potential risk posed by LAB and MO 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 Low potential risk posed by LAB and MO 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 Low potential risk posed by LAB and MO contact from ingestion contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes;
- There is a Low potential 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 Low/Moderate potential risk posed by LAB and MO to shallow groundwater from suspected contamination in the shallow made ground and clay subsoils given the contaminant properties of low mobility and high sorption to soil, with rare shallow groundwater in made ground and clayey subsoils is unlikely to be used as an actual resource due to low water volumes and location in a residential urban area
- There is a Moderate potential risk posed by LAB and MO to the River Bride and the Upper Lee Estuary from the suspected contamination given the contaminant properties of low mobility and high sorption to soil along with the culverted nature of the storm drain/ Glasheen Stream and considering its direct proximity to the leak point.
- There is a Moderate potential risk posed by LAB and MO to the underlying Sandstone/Siltstone Bedrock Aquifer given the high to extreme vulnerability and observed shallow/outcropping bedrock in the area.

4.5. SUMMARY AND CONCLUSIONS

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a cable fluid leak from a power cable section along Fair Hill and Wolfe Tone Street in Cork City (ESB Site Ref: 2 Fairhill – Kilbarry 38 kV).

There was an approximate volume of 1,595 litres of cable fluid consisting of linear alkyl benzene (LAB) mixed with Mineral Oil (MO) lost to ground from the leak point in question. The leak occurred in September 2018 and was repaired in February 2019; approximately at the junction of North Monastery Road and Wolfe Tone Street. This leak point was confirmed during excavations and trial

pitting exercises in May and June 2019 when visible hydrocarbon contamination was observed associated with the cable.

The leak point is situated in a residential area with house fronts being less than 10m from the indicative leak point. There are also small, roadside, green spaces near the leak site and a school (North Monastery Primary School) within 50m of the leak point. Utility maps and excavation activities show abundant service lines including foul sewerage, gas, communication and water lines along the entirety of the cable route. It is likely that there are numerous unmapped minor services along the route also.

The site is underlain by locally important (meaning capable of suppling moderate groundwater yields) green-grey and purple mudstones and sandstones of the Gyleen Formation. The vulnerability is High to Extreme indicating that bedrock is likely to be relatively close to surface (0-5metres) and that the subsoils are moderately permeability made ground subsoils, which provide limited natural protection to the underlying bedrock aquifer. Under the Water Framework Directive, the groundwater body beneath the site is of good status but is at risk of deterioration in the future. Groundwater in the bedrock aquifer may be locally, semi-confined by the subsoils with groundwater flow direction in an easterly to south-easterly direction following site topography

Following civil works completed in July 2019, the nearest surface watercourse appears to be represented by the culverted Glasheen Stream. Site investigations suggests that this culverted stream, now used as a combine storm sewer, flows across the cable route, and downhill eastwards towards the River Kiln/Bride where it would enter the Upper Lee Estuary on the Pope's Quay. The culvert may coincide or be represented by; a storm sewerage line recorded in the Irish Water drainage network maps. Site works in the area of this culverted river appear to show that the culvert still conducts significant quantities of storm and household wastewater which appears to drain to the east as an arch-supported culvert. The River Bride, approximately 510m to the east, and downgradient of the site, flowing flows, through a culvert under Leitrim Street (N20), in a southerly direction, eventually discharging to the River Lee to the southeast of the site. The Upper Lee Estuary is located approximately 580m to the south, also downgradient of the site.

There is a groundwater well uphill, 300m to the north of the leak site, which is recorded in the GSI well database as a poor yield (21.8m^3/day), dug well which was completed in 1973 to a depth of 2.1m. The use and current condition of the well is unknown. The only other groundwater well recorded within 1000m of the site is located 850m to the south, across the Upper Lee Estuary. This well is recorded as an 18m site investigation borehole, installed in 1899, of unknown yield or status.

There are no designated areas of conservation or "European Sites" within 1000m of the site; with the nearest being the Cork Lough proposed Natural Heritage Area (pNHA) 2km to the southwest, across the Lee Valley.

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

- dermal/inhalation and ingestion pathways to construction workers which can be managed by appropriate use of PPE and H&S procedures;
- 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;
- direct dermal/inhalation and ingestion contact to residents or other building users;

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

- hydrocarbon vapours in preferential pathways such as services ducts to residents or other building users;
- leaching to shallow groundwater given the contaminant properties of low mobility and high sorption to soil, with rare shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.

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

- hydrocarbon migration to the adjacent watercourse/sewerage network and the downstream River Bride/Kiln and the Upper Lee Estuary given the short distance to the culverted Glasheen Stream/storm sewer which poses a potential pollutant linkage between the leak site and the surface water receptors;
- hydrocarbon migration to the underlying aquifer given the possible connection to shallow groundwater or directly to bedrock through shallow rock in the area indicated by the high vulnerability.

5. REFERENCES

- Investigation of potentially contaminated sites – Code of Practice, BS 10175:2011 + A2 2017, published by BSI, 2017.
- Code of Practice for Site Investigations, BS 5930:2015, published by BSI, 2015.
- "Model Procedures for the Management of land Contamination" Contaminated Land Report 11 (CLR 11), published by the UK Environment Agency & DEFRA, 2004, being withdrawn shortly to be replaced with online guidance called Land Contamination Risk Management (LCRM).
- Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites, EPA 2013.
- Guidance on Authorisation of Discharges to Groundwater, published by the EPA (Ireland) in December 2011.
- Petroleum Products in Drinking-water Background document for development of WHO Guidelines for Drinking-water Quality, World Health Organization 2008.
- MSDS for T3788 and REACH database for C10-C13 Linear Alkyl Benzenes CAS No. 67774-74-4 - https://echa.europa.eu/registration-dossier/-/registered-dossier/15763/6/1.
- Mineral Oils: Untreated and Mildly Treated. Report on Carcinogens 14th Edition. National Toxicology Programme https://ntp.niehs.nih.gov/ntp/roc/content/profiles/mineraloils.pdf.
- Petroleum Hydrocarbons in Groundwater. Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies. CLAIRE 2017.
- IARC Monograph 100F - MINERAL OILS, UNTREATED OR MILDLY TREATED - https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100F-19.pdf.
- The LQM/CIEH S4ULs for Human Health Risk Assessment, Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3484, All rights reserved, November 2014.
- European Standard (BS EN 858-1:2002 and BS EN 858-2:200)3; for the design, use, selection, installation, operation and maintenance of prefabricated oil separators.
- Towards setting guideline values for the protection of groundwater in Ireland, interim report, Environmental Protection Agency, 2003.
- European Communities Environmental Objectives (Groundwater) Regulations, 2010, S.I. No.9 of 2010.
- European Union Environmental Objectives (Surface Waters) (amendment) Regulations 2015, European Communities Environmental Objectives (Surface Waters) Regulations 2009.
- http://www.epa.ie/pubs/advice/drinkingwater/drinkingwatersupplies.
- National Authority for Occupational Safety and Health 2011 Code of Practice for in support of the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001.
- European Union Risk Assessment Report. Benzene C_{10-13} Alkyl Derivs, 1st Priority List, Volume 3. European Commission – Joint Research Centre Institute for Health and Consumer Protection European Chemicals Bureau (ECB), 1999.
- European Commission. Guidance Document for the implementation of the European PRTR, May 2006.

- Classification of Hazardous and Non-Hazardous Substances in Groundwater 2010, EPA 2010.
- Report on a Site Investigation at North Presentation Convent, Blackpool, Cork for Malachy Walsh and Partners, September 1965.
- Report on a Site Investigation at Knockfree Avenue, Cork for Malachy Walsh and Partners, Report No. 3634, September 1996.

oo0oo

Respectfully submitted

On behalf of Verde Environmental Consultants

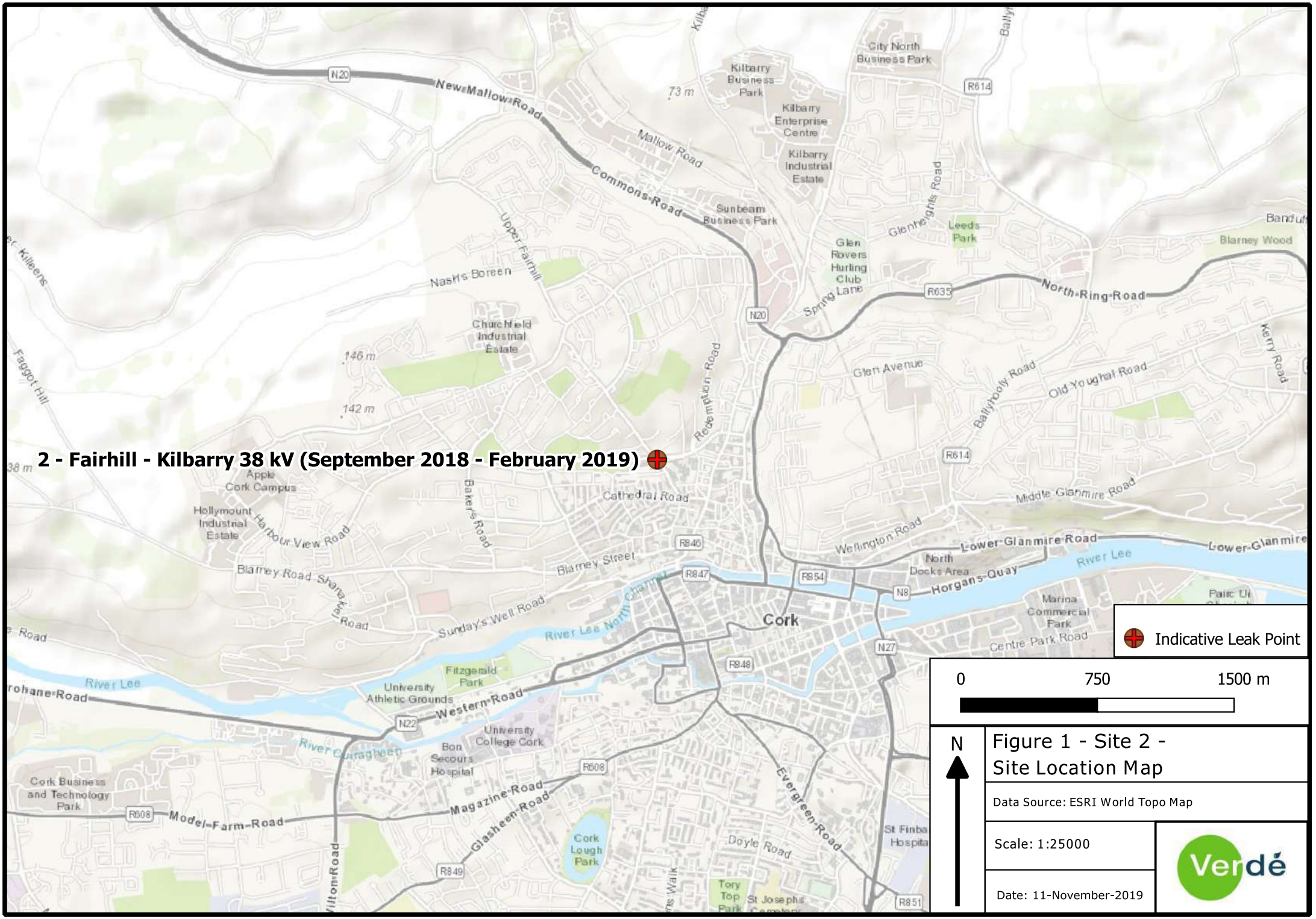
[redacted]

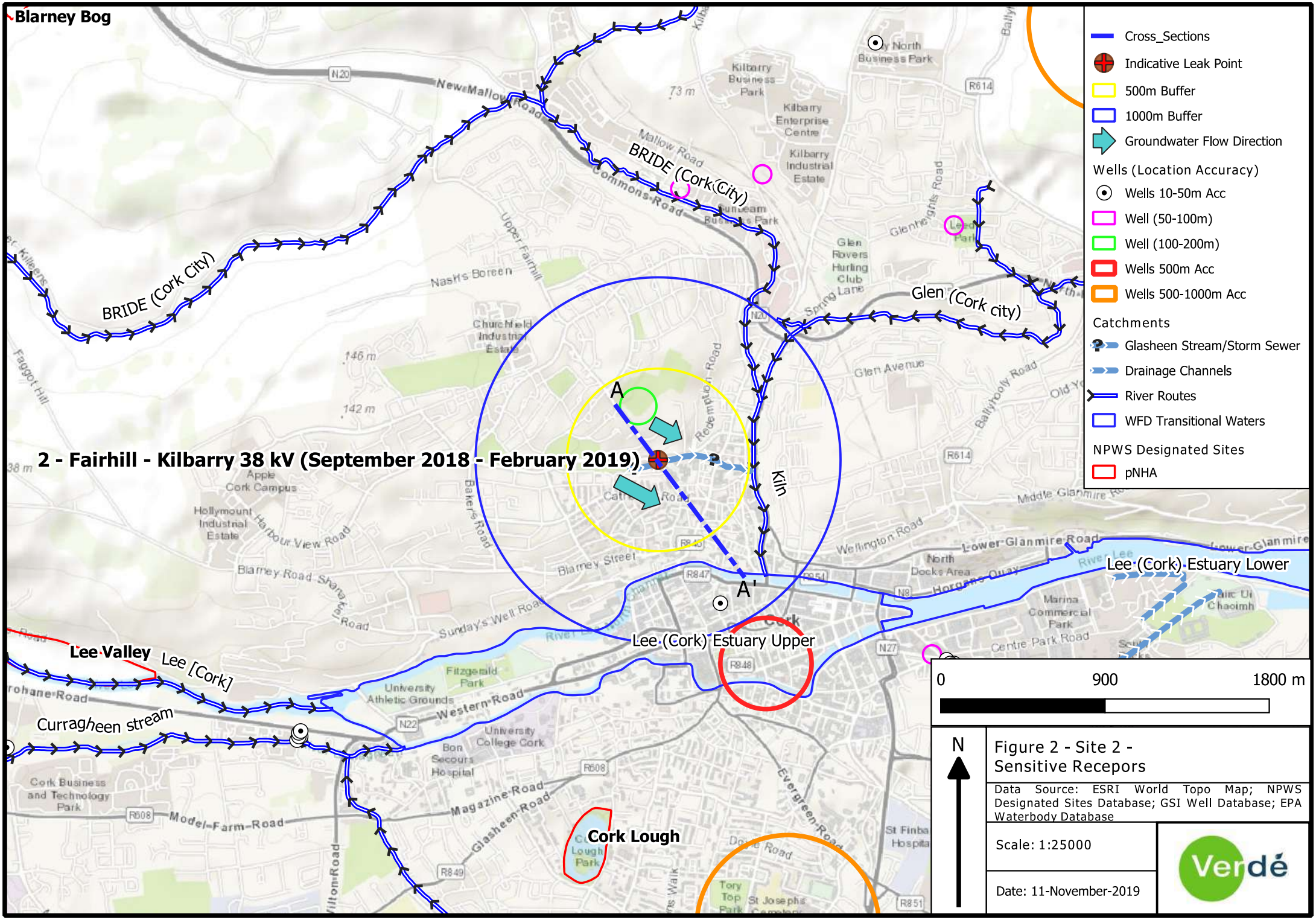
SENIOR ENVIRONEMENTAL CONSULTANT

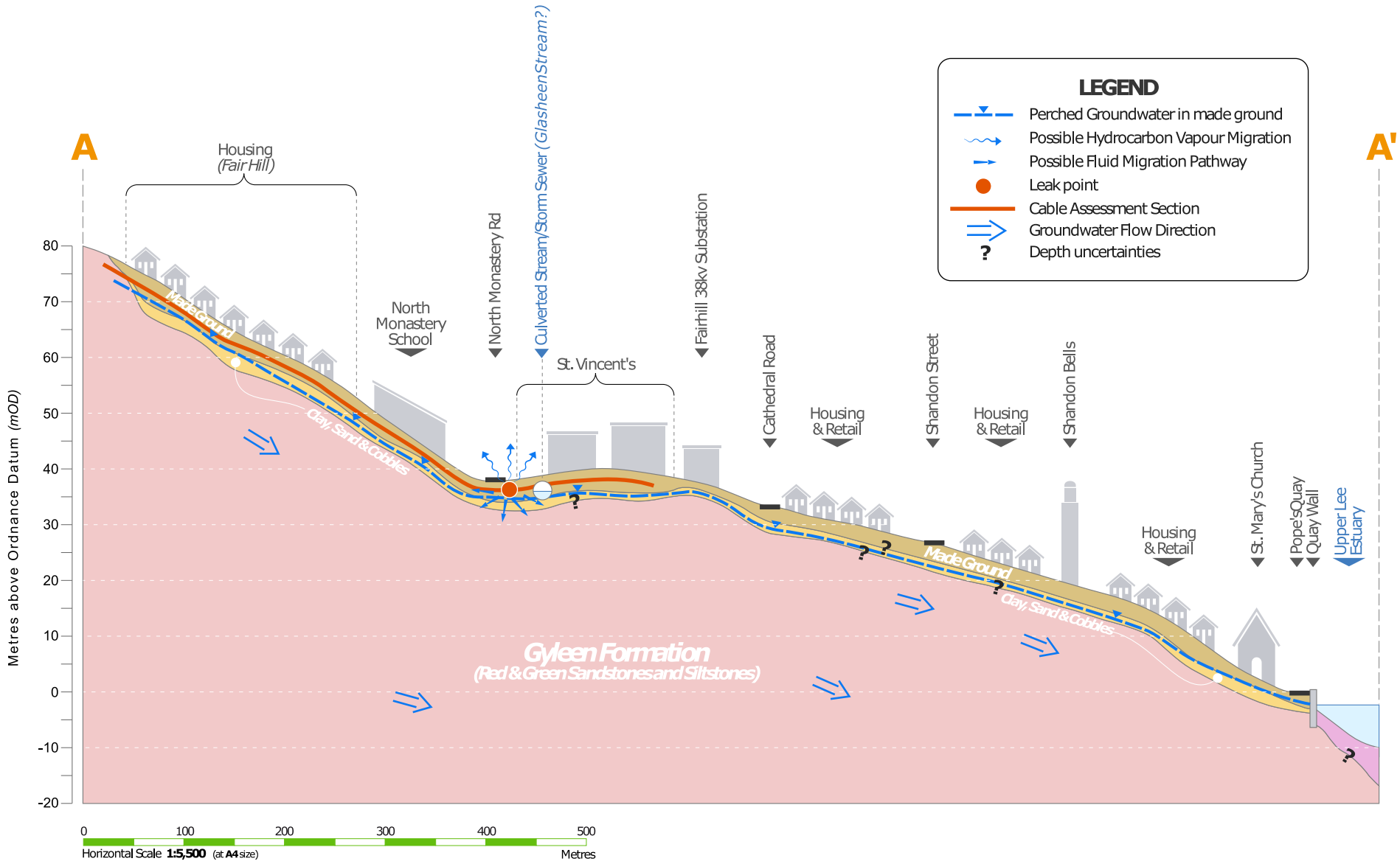
[redacted]

PROJECT DIRECTOR

FIGURES


2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
Indicative Leak Point
0
750
1500 m
N
Figure 1 - Site 2 -
Site Location Map
Data Source: ESRI World Topo Map
Scale: 1:25000
Date: 11-November-2019
Verdé
Cork
New Mallow Road
Commons Road
Mallow Road
Kilbarry Business Park
City North Business Park
Kilbarry Enterprise Centre
Kilbarry Industrial Estate
Sunbeam Business Park
Glen Rovers Hurling Club
Leeds Park
Blarney Wood
North Ring Road
Spring Lane
Glenheights Road
Upper Fairhill
Nash's Boreen
Churchfield Industrial Estate
Redemption Road
Glen Avenue
Ballyhooly Road
Old Youghal Road
Kerry Road
Faggot Hill
Apple Cork Campus
Hollymount Industrial Estate
Harbour View Road
Baker's Road
Cathedral Road
Middle Glanmire Road
Wellington Road
Lower Glanmire Road
Blarney Street
Blarney Road
Shanakiel Road
Sunday's Well Road
River Lee North Channel
River Lee
North Docks Area
Horgans Quay
Marina Commercial Park
Centre Park Road
Fitzgerald Park
University Athletic Grounds
Western Road
University College Cork
Bon Secours Hospital
River Curragheen
Cork Business and Technology Park
Model Farm Road
Magazine Road
Glasheen Road
Cork Lough Park
Doyle Road
Evergreen Road
St Finbarr's Hospital
Tory Top Park
St Joseph's
N20
N22
N27
N8
R608
R614
R635
R846
R847
R848
R849
R851
R854
73 m
146 m
142 m
38 m


Blarney Bog
BRIDE (Cork City)
BRIDE (Cork City)
Glen (Cork city)
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
A
A'
Kiln
Lee (Cork) Estuary Upper
Lee (Cork) Estuary Lower
Lee Valley
Lee [Cork]
Curraghheen stream
Cork Lough
Cross_Sections
Indicative Leak Point
500m Buffer
1000m Buffer
Groundwater Flow Direction
Wells (Location Accuracy)
Wells 10-50m Acc
Well (50-100m)
Well (100-200m)
Wells 500m Acc
Wells 500-1000m Acc
Catchments
Glasheen Stream/Storm Sewer
Drainage Channels
River Routes
WFD Transitional Waters
NPWS Designated Sites
pNHA
0
900
1800 m
N
Figure 2 - Site 2 - Sensitive Recepors
Data Source: ESRI World Topo Map; NPWS Designated Sites Database; GSI Well Database; EPA Waterbody Database
Scale: 1:25000
Date: 11-November-2019
Verdé

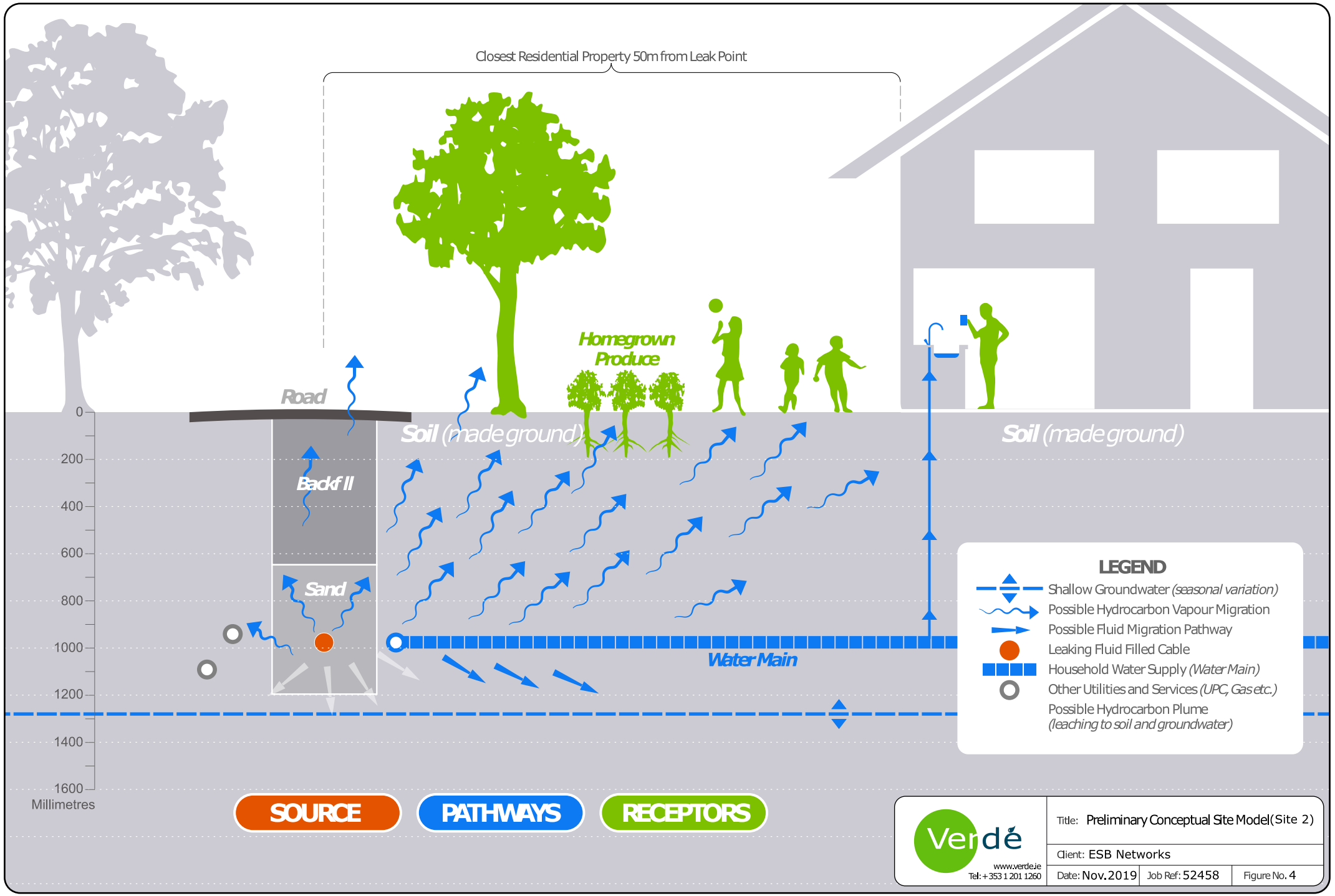


Verdé
www.verde.ie
Tel: +353 1 201 1260

Title: Preliminary Conceptual Site Model *(Site 2)*

Client: ESB Networks

Date: Nov. 2019 | Job Ref: 52458 | Figure No. 3



Verdé
www.verde.ie
Tel: +353 1 201 1260

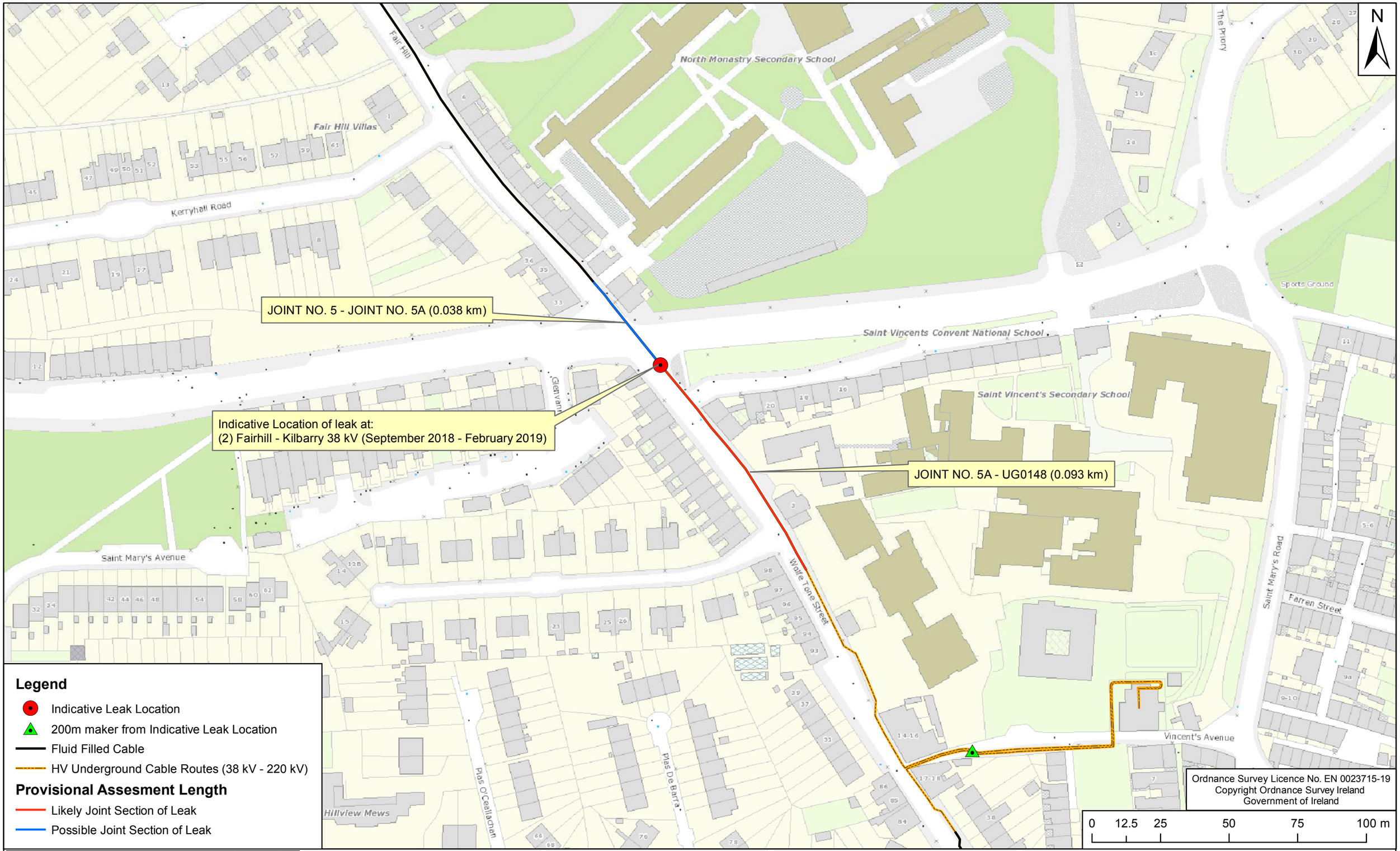
Title: Preliminary Conceptual Site Model (Site 2)

Client: ESB Networks

Date: Nov. 2019 | Job Ref: 52458 | 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 ☐

Energy for generations

Engineering and Major Projects,
One Dublin Airport Central,
Dublin Airport, Cloghran,
Co. Dublin, K67 XF72, Ireland.

Tel: 353 1 703 8000 Web: www.esb.ie

Engineering and Major Projects is a division of ESB.

CLIENT: **ESB Networks**

PROJECT: **P.R.A.**

CONTRACT

PRODUCTION UNIT: **Civil & Environmental Engineering**

DRAWING TITLE: **Indicative Cable Fluid Leakage Locations & Cable Sections (2) Fairhill - Kilbarry 38 kV (September 2018 - February 2019)**

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

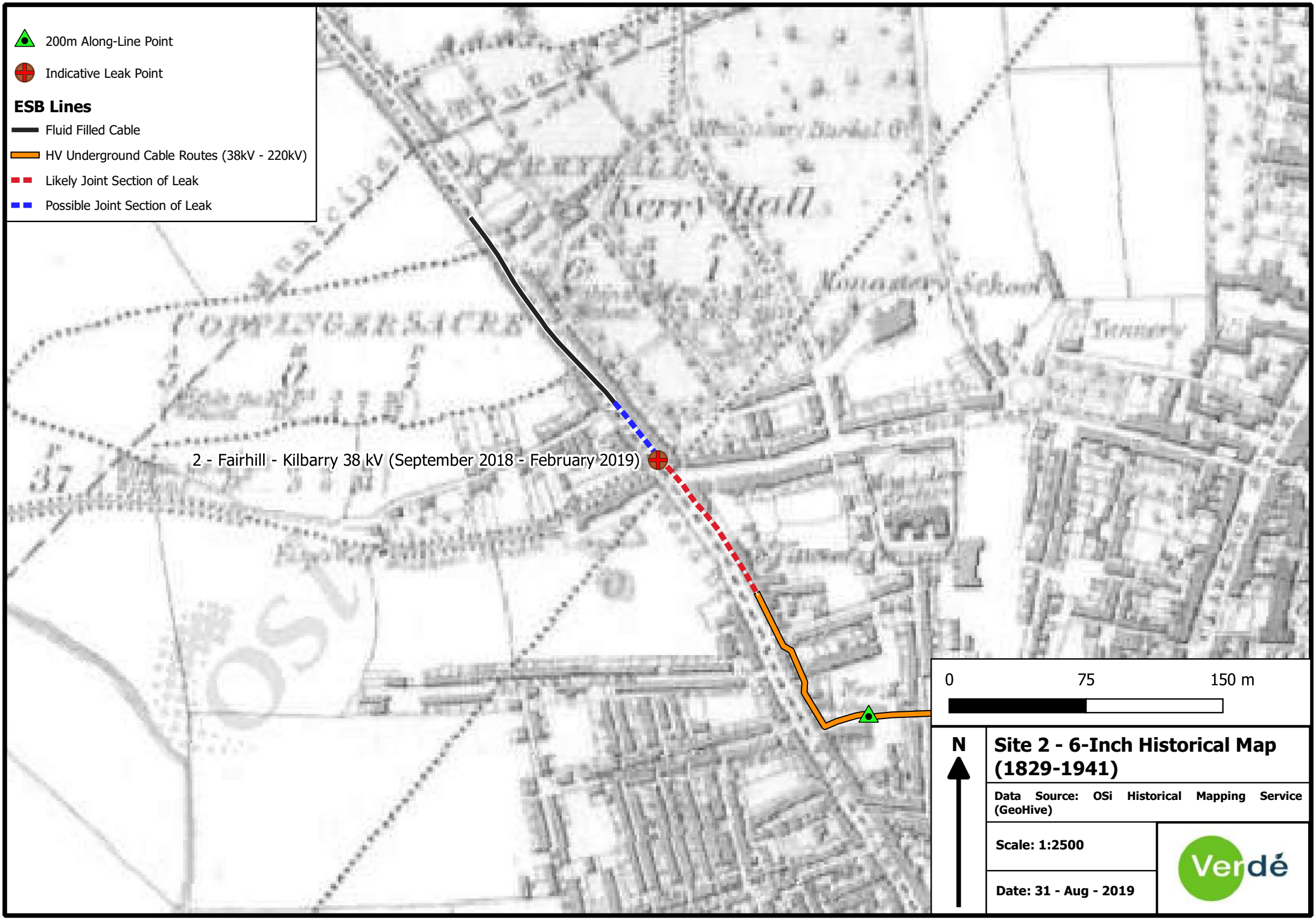
DRAWING NUMBER: **QD-354120-01-D460-001-006-001**

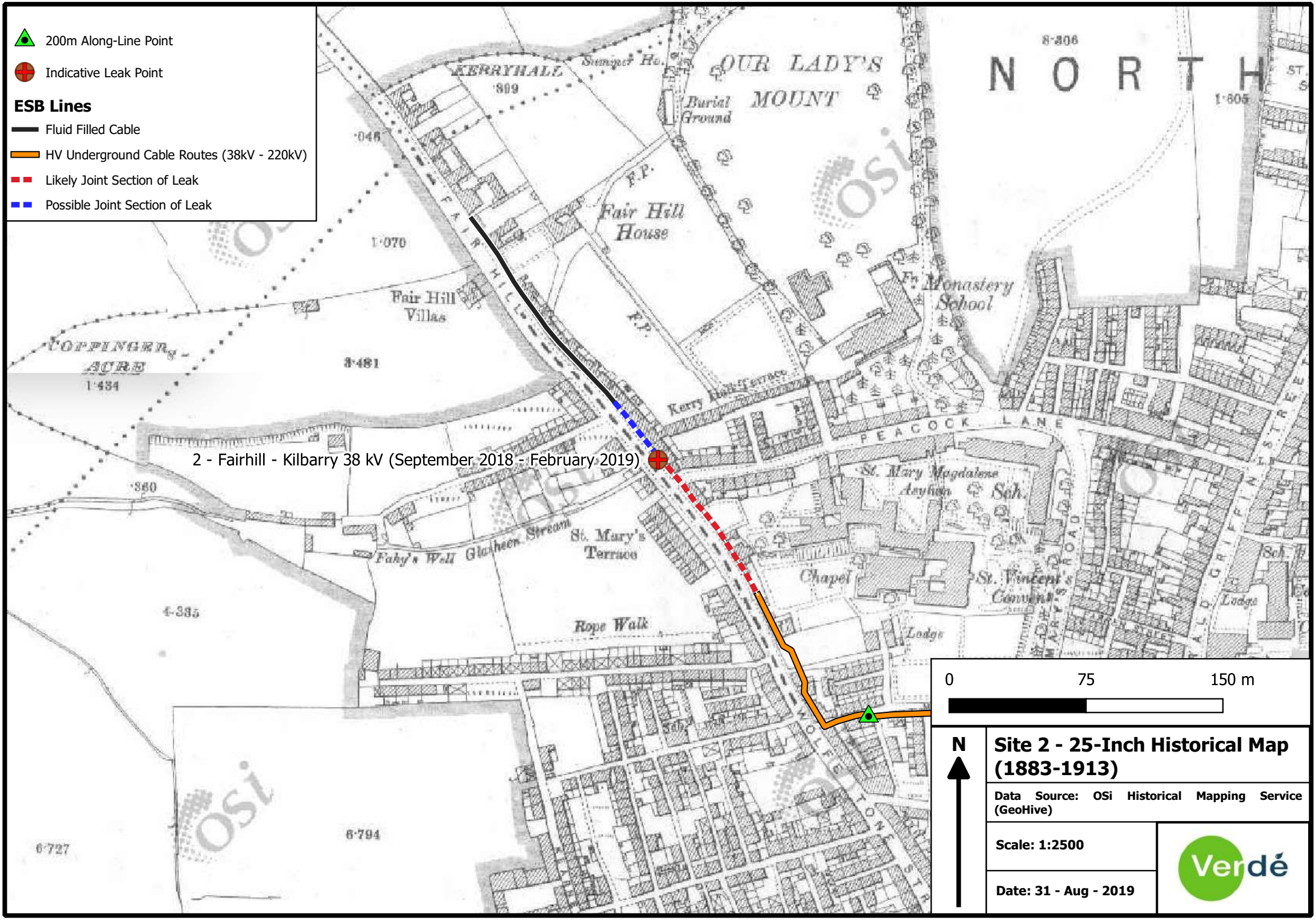
APPENDIX B

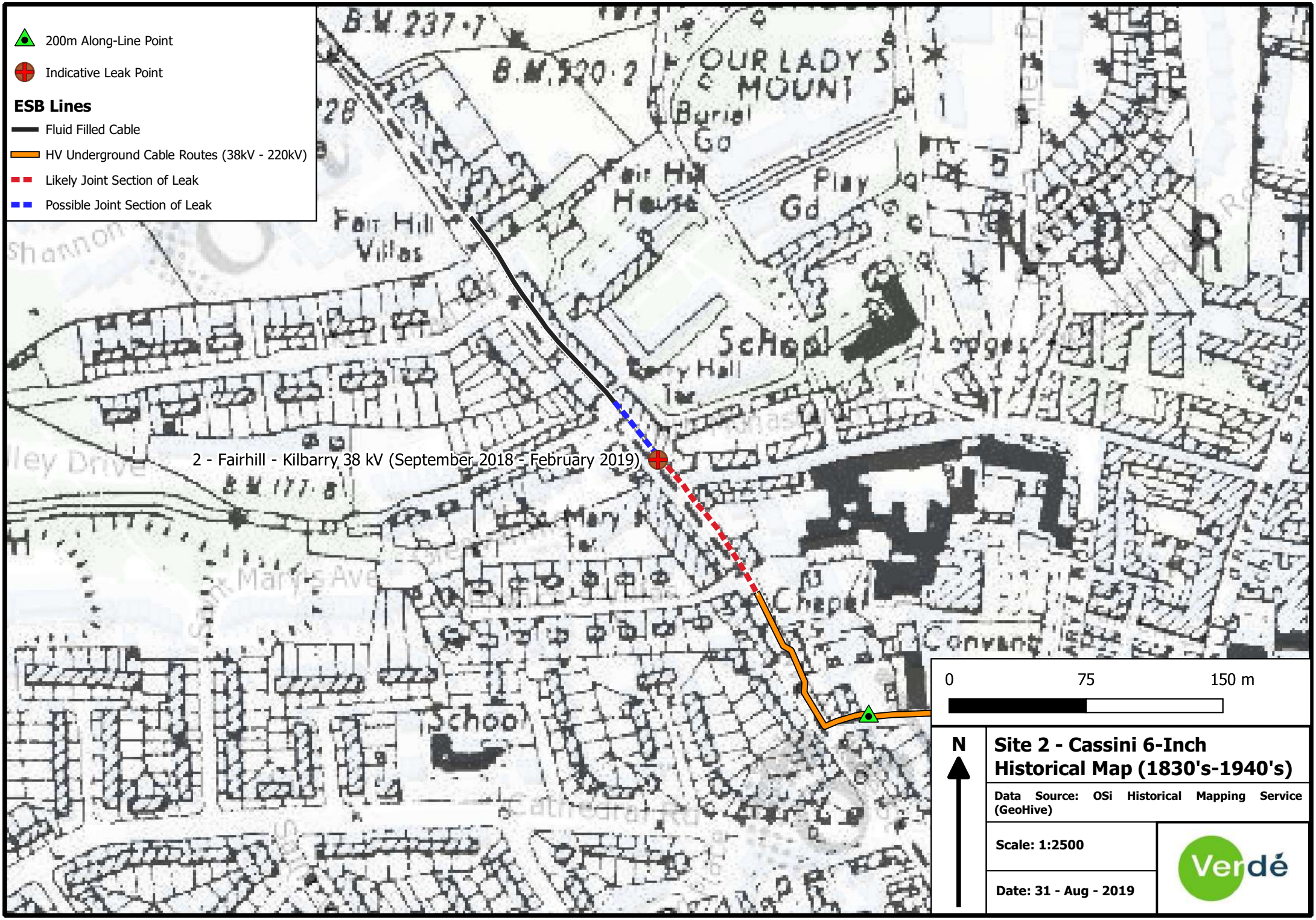
DESK STUDY MAPS

APPENDIX B

DESK STUDY MAPS

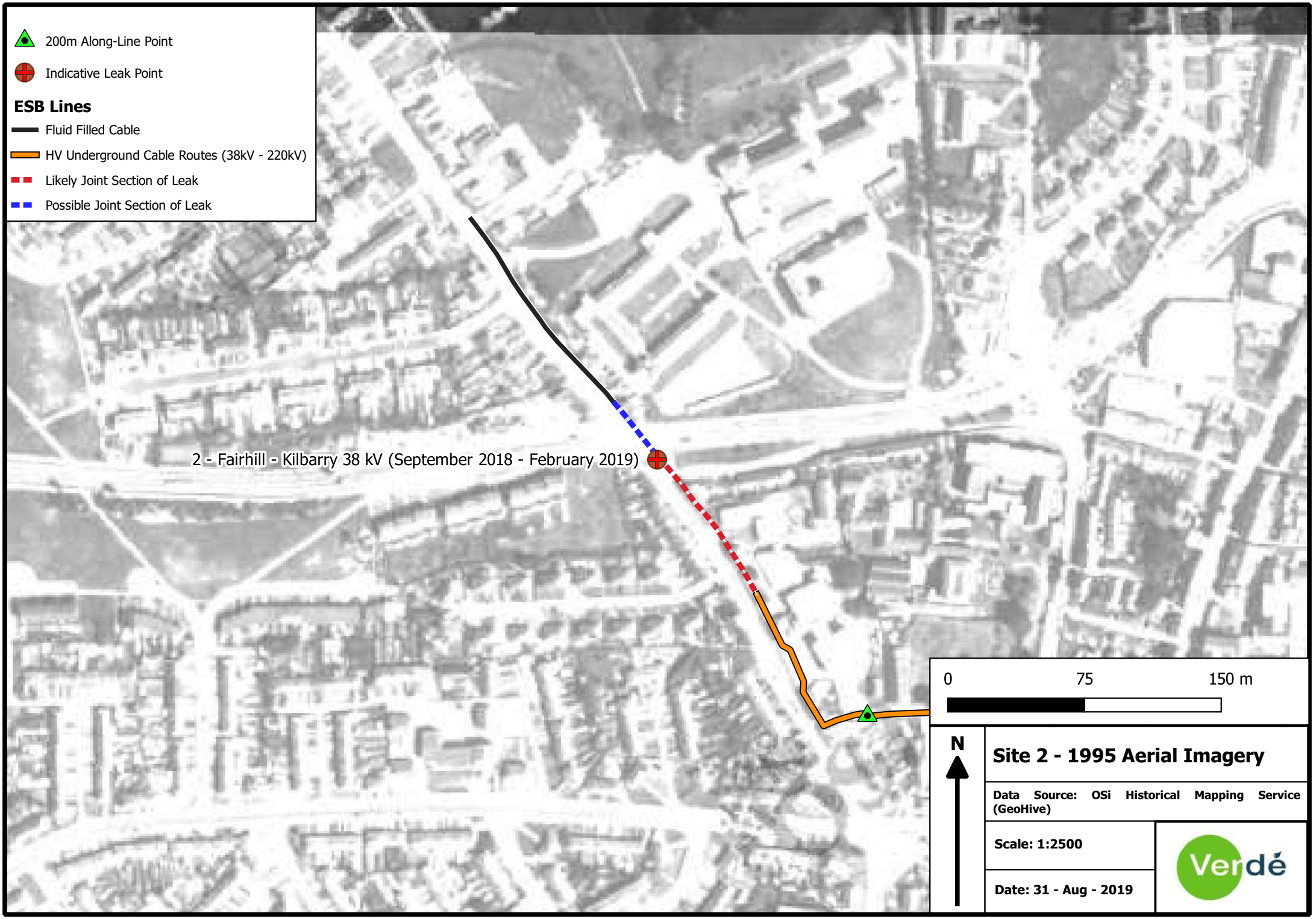

200m Along-Line Point
Indicative Leak Point
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
75
150 m
N
Site 2 - 6-Inch Historical Map (1829-1941)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé


200m Along-Line Point
Indicative Leak Point
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
KERRYHALL
OUR LADY'S MOUNT
Burial Ground
Fair Hill House
Fair Hill Villas
COPPINGER'S ACRE
Monastery School
PEACOCK LANE
St. Mary Magdalene Asylum Sch.
St. Mary's Terrace
Fahy's Well
Glasheen Stream
Chapel
St. Vincent's Convent
Lodge
Rope Walk
NORTH
0
75
150 m
N
Site 2 - 25-Inch Historical Map (1883-1913)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé


200m Along-Line Point
Indicative Leak Point
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
B.M. 237·1
B.M. 220·2
OUR LADY'S MOUNT
Burial Gd
Fair Hill House
Fair Hill Villas
Play Gd
School
Lodge
Chapel
Convent
0
75
150 m
N
Site 2 - Cassini 6-Inch Historical Map (1830's-1940's)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé

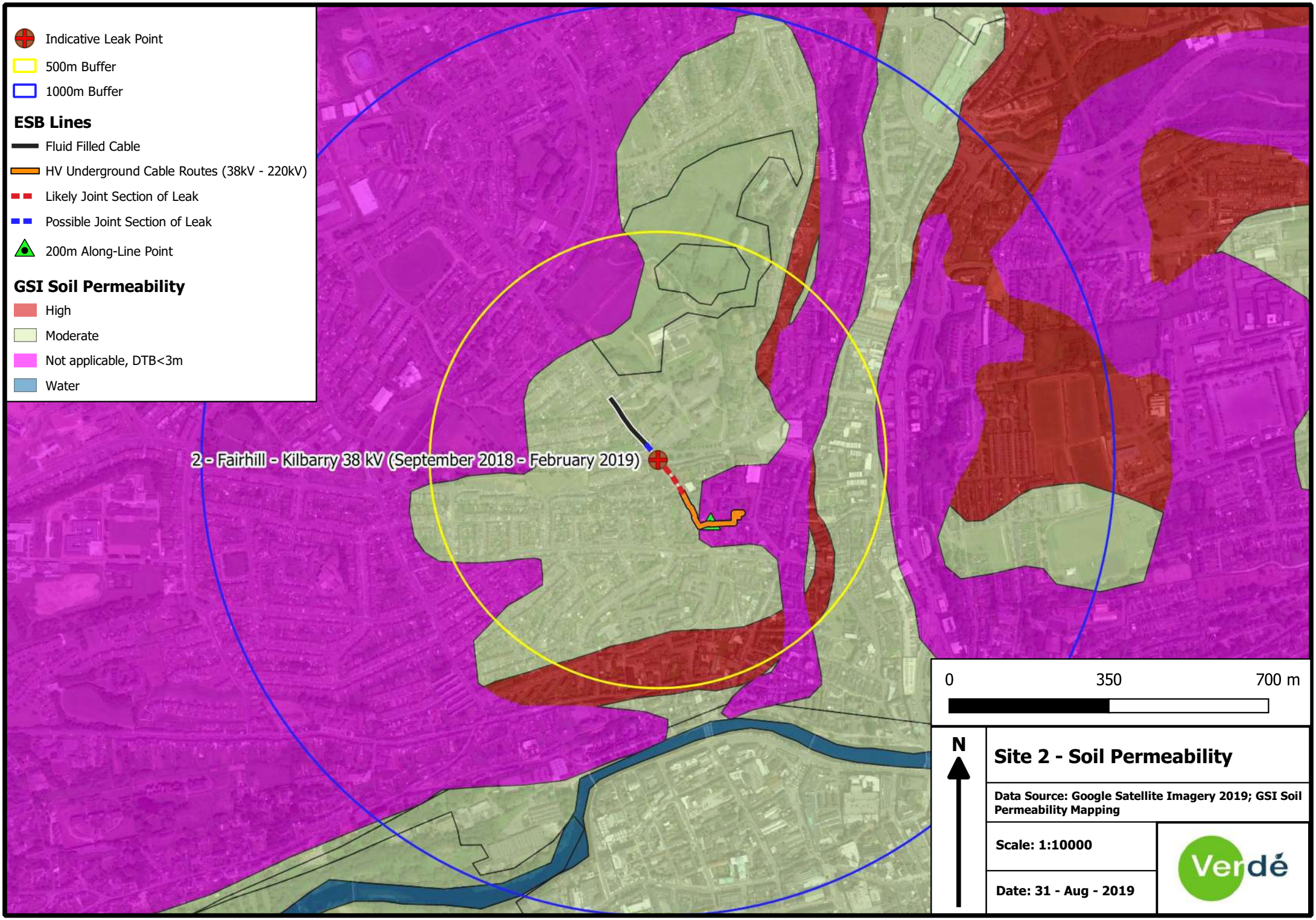

200m Along-Line Point
Indicative Leak Point
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
75
150 m
N
Site 2 - 2000 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé

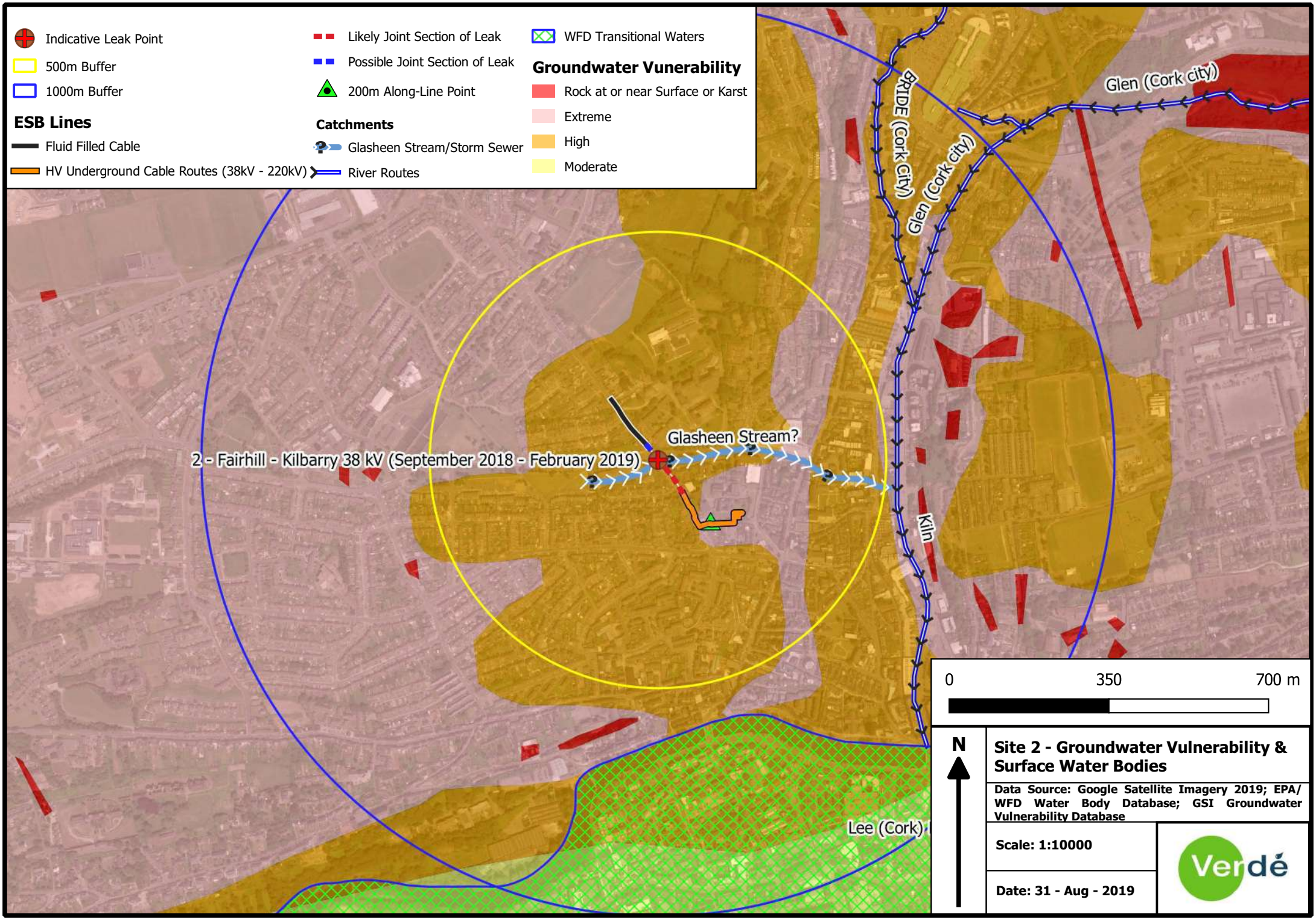

Indicative Leak Point
500m Buffer
1000m Buffer
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
200m Along-Line Point
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
75
150 m
N
Site 2 - 2005 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé

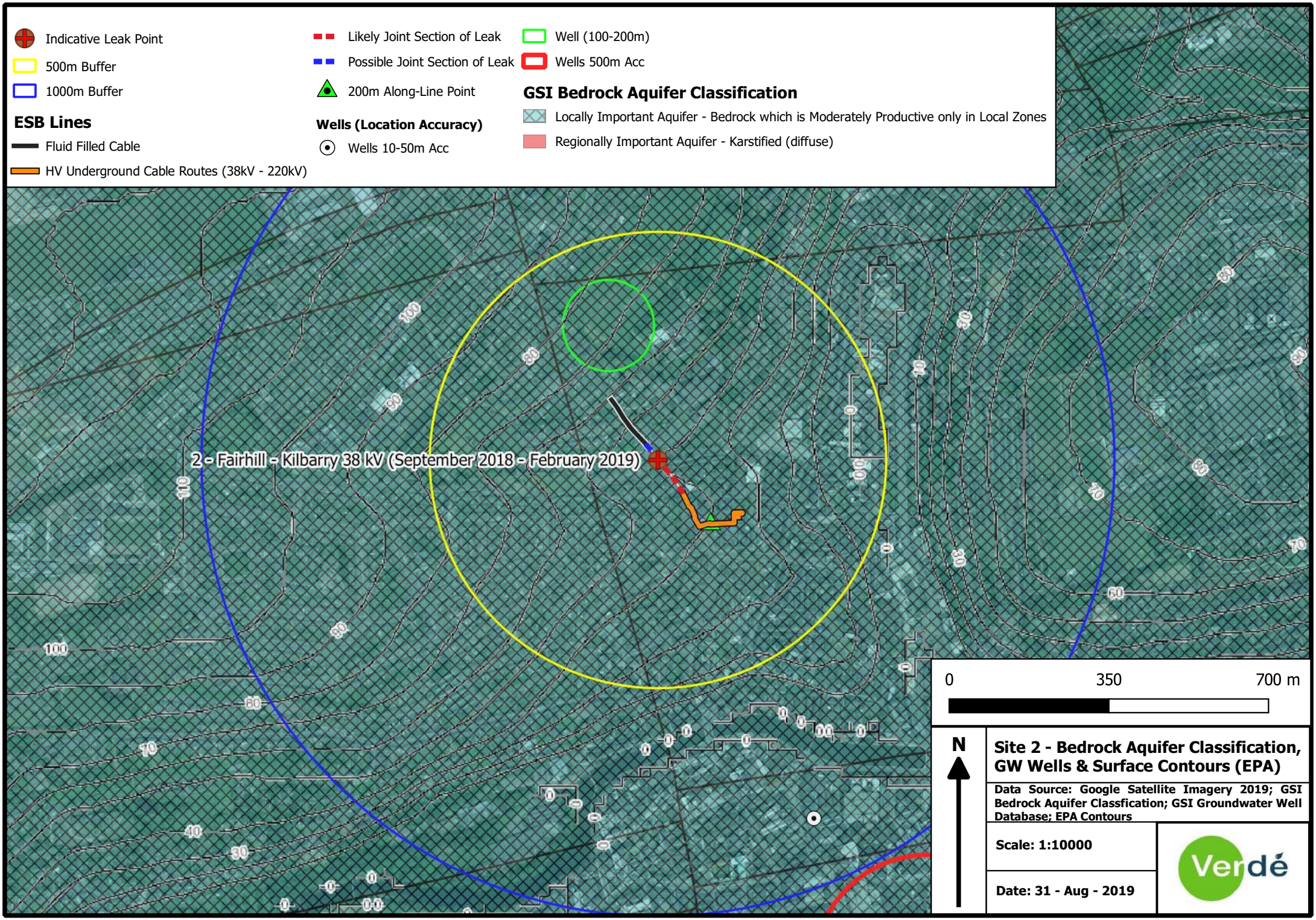

200m Along-Line Point
Indicative Leak Point
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
75
150 m
N
Site 2 - 1995 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé

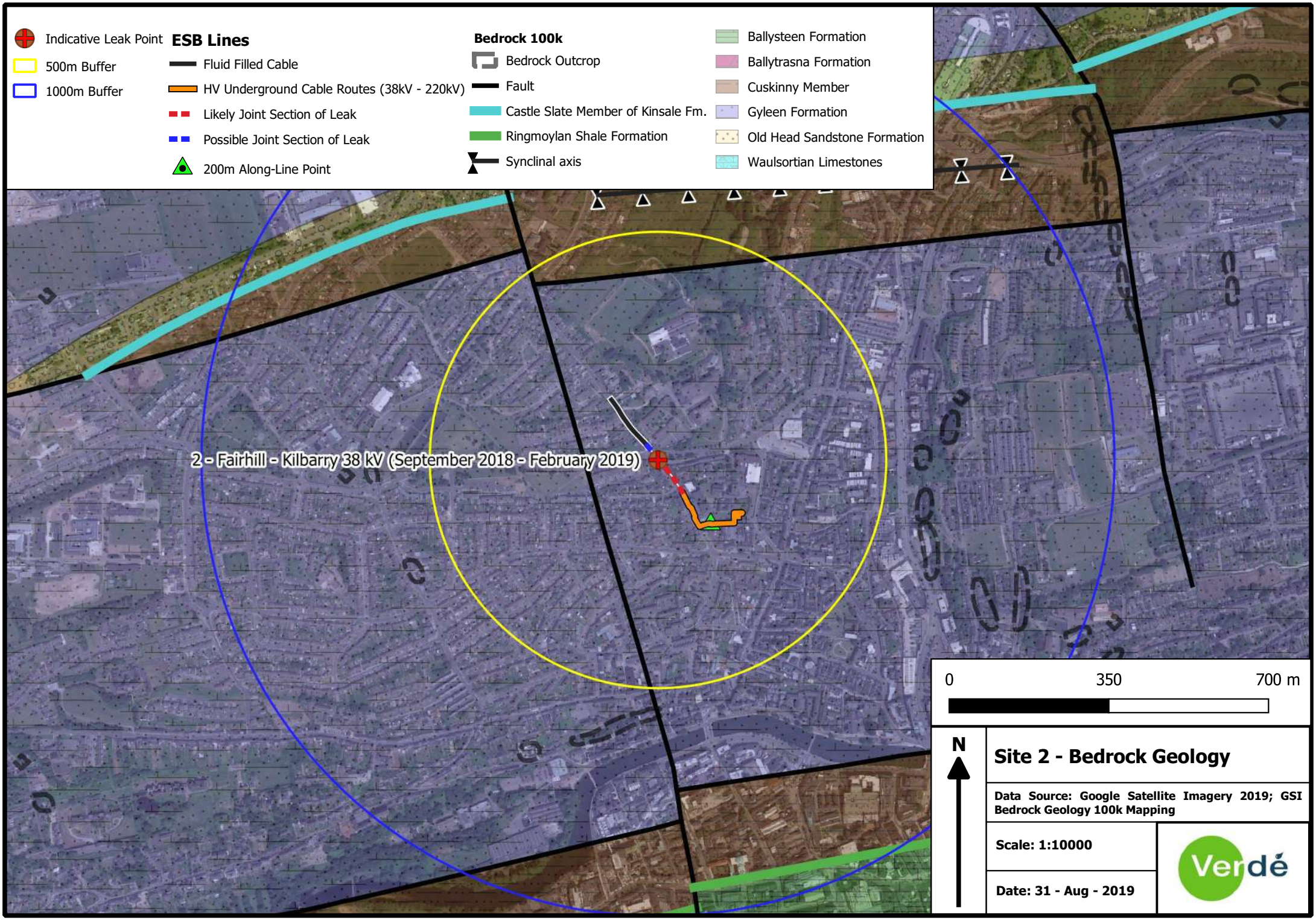

200m Along-Line Point
Indicative Leak Point
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
75
150 m
N
Site 2 - Current Aerial Imagery
Data Source: Google Satellite Imagery 2019
Scale: 1:2500
Date: 31 - Aug - 2019
Verdé


Indicative Leak Point
500m Buffer
1000m Buffer
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
200m Along-Line Point
National Soils (EPA)
Mineral alluvium
Deep well-drained mineral soil, Derived from mainly acidic parent materials
Poorly drained mineral soils with peaty topsoil derived from mainly acidic parent materials
Shallow reasonable drained mineral soil derived from mainly acidic parent materials
Shallow well drained mineral soil derived from mainly acidic parent materials
Made Ground
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
350
700 m
N
Site 2 - Soils
Data Source: Google Satellite Imagery 2019; National Soil Database (EPA)
Scale: 1:10000
Date: 31 - Aug - 2019
Verdé

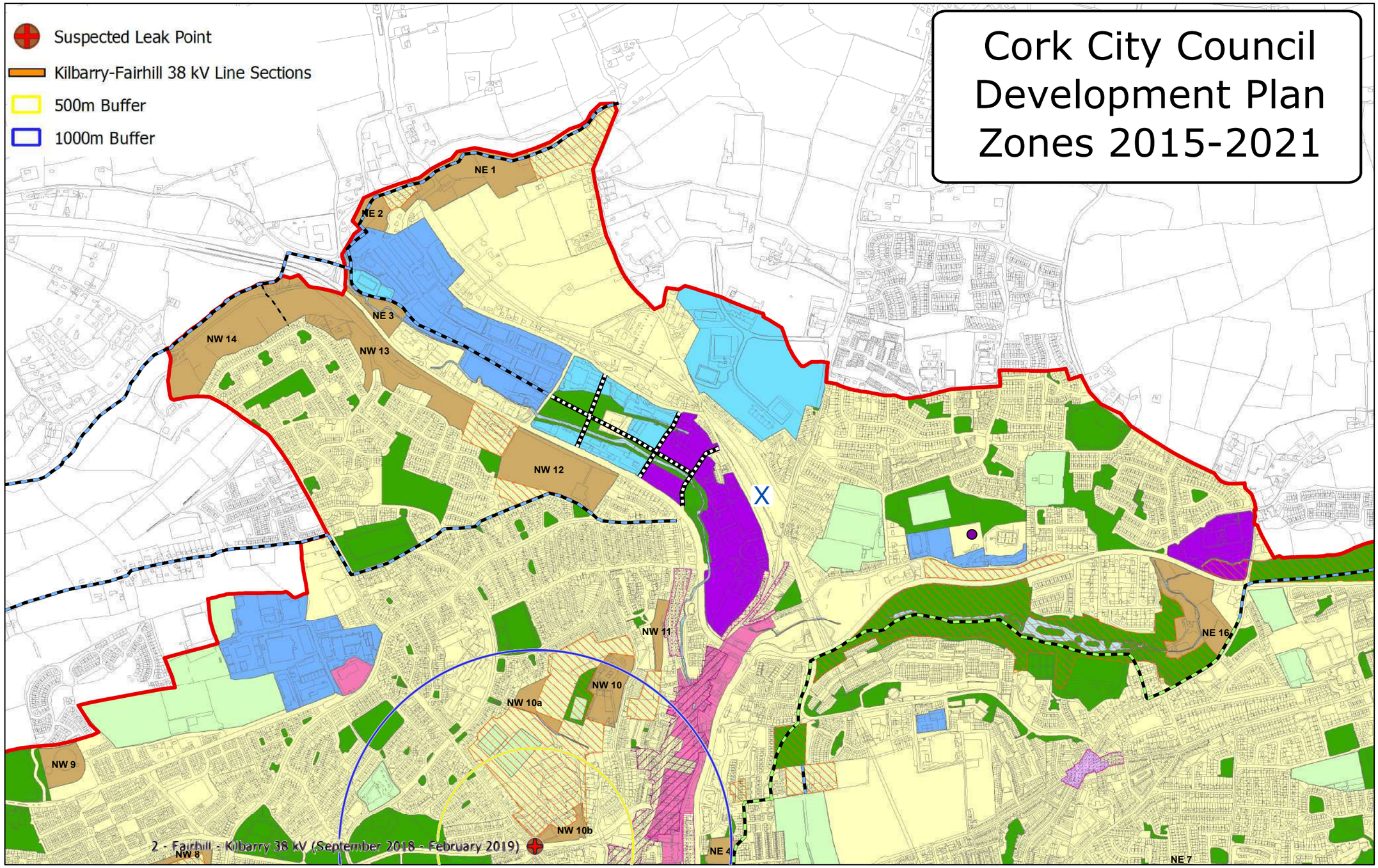

Indicative Leak Point
500m Buffer
1000m Buffer
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
200m Along-Line Point
GSI Soil Permeability
High
Moderate
Not applicable, DTB<3m
Water
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
350
700 m
N
Site 2 - Soil Permeability
Data Source: Google Satellite Imagery 2019; GSI Soil Permeability Mapping
Scale: 1:10000
Date: 31 - Aug - 2019
Verdé


Indicative Leak Point
500m Buffer
1000m Buffer
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
200m Along-Line Point
Catchments
Glasheen Stream/Storm Sewer
River Routes
WFD Transitional Waters
Groundwater Vunerability
Rock at or near Surface or Karst
Extreme
High
Moderate
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
Glasheen Stream?
BRIDE (Cork City)
Glen (Cork city)
Glen (Cork city)
Kiln
Lee (Cork)
0
350
700 m
N
Site 2 - Groundwater Vulnerability & Surface Water Bodies
Data Source: Google Satellite Imagery 2019; EPA/ WFD Water Body Database; GSI Groundwater Vulnerability Database
Scale: 1:10000
Date: 31 - Aug - 2019
Verdé


Indicative Leak Point
500m Buffer
1000m Buffer
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
200m Along-Line Point
Wells (Location Accuracy)
Wells 10-50m Acc
Well (100-200m)
Wells 500m Acc
GSI Bedrock Aquifer Classification
Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
Regionally Important Aquifer - Karstified (diffuse)
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
350
700 m
N
Site 2 - Bedrock Aquifer Classification, GW Wells & Surface Contours (EPA)
Data Source: Google Satellite Imagery 2019; GSI Bedrock Aquifer Classfication; GSI Groundwater Well Database; EPA Contours
Scale: 1:10000
Date: 31 - Aug - 2019
Verdé


Indicative Leak Point
500m Buffer
1000m Buffer
ESB Lines
Fluid Filled Cable
HV Underground Cable Routes (38kV - 220kV)
Likely Joint Section of Leak
Possible Joint Section of Leak
200m Along-Line Point
Bedrock 100k
Bedrock Outcrop
Fault
Castle Slate Member of Kinsale Fm.
Ringmoylan Shale Formation
Synclinal axis
Ballysteen Formation
Ballytrasna Formation
Cuskinny Member
Gyleen Formation
Old Head Sandstone Formation
Waulsortian Limestones
2 - Fairhill - Kilbarry 38 kV (September 2018 - February 2019)
0
350
700 m
N
Site 2 - Bedrock Geology
Data Source: Google Satellite Imagery 2019; GSI Bedrock Geology 100k Mapping
Scale: 1:10000
Date: 31 - Aug - 2019
Verdé

MAP 4 - North Central Suburbs Objectives



Zoomable map available on our website: www.corkcitydevelopmentplan.ie

- Areas of High Landscape Value
- Architectural Conservation Areas
- Historic Street Character Areas
- 4-Residential, Local Services and Institutional Uses
- 5-Light Industry and Related Uses
- 7-Business and Technology
- 8-District Centres
- 9-Neighbourhood Centres
- 10-Local Centres
- 12-Landscape Preservation Zones
- 13-Sports Grounds
- 14-Public Open Space
- 19-Rivers/Water Bodies Protection
- Traveller Accommodation
- Proposed Railway Station
- New or Realigned Streets
- Amenity Routes
- Proposed New Amenity Routes/Upgrades

APPENDIX C

SITE PHOTOGRAPHS

Photo 1 Cable route located on eastern side of Fair Hill.

Photo 2 Location of gas and utility lines marked on road in preparation of trial pit works.

Photo 3 Occurrence of underground services during excavations. Gas, sewerage and communication ducts visible in image.

Photo 4 Location of known leak point on eastern side of Wolfe Tone Street. Trial pit works in progress.

Photo 5 Trial pit and inspection hole works being completed at the location of the known leak point (ESB Ref: 2)

Photo 6. Image showing the ingress of water into trial pit excavation during initial site investigation activities in June 2019. Note the visible hydrocarbon sheen thought to be associated with residual cable fluid in soils.

APPENDIX D

MSDS FOR COPC

1. LINEAR ALKYL BENZENES

2. MINERAL OIL

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°C
Flash point:	>135°C
Flammability:	Non flammable
Explosive properties:	Not explosive
Oxidising properties:	Not applicable
Vapour pressure at 20°C:	<0.02 kPa
Density:	0.86 g/cm^{-3} at 20°C typical
Solubility in water:	Insoluble
Kinematic Viscosity at 20°C:	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°C typical
Expansion coefficient:	0.0007 /°C 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°C
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.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

1. Identification of Substance/Preparation and Company

Product name:

Masse 106

Supplier:

FELTEN & GUILLEAUME Energietechnik AG
Schanzenstraße 24-30
51063 Köln

Emergency telephone number: 0221/676-3333

2. Composition/Information on Ingredients

Blend of highly refined mineral oils and additives.
On the basis of available information, the components of this preparation are not expected to impart hazardous properties to this product.

3. Hazards Identifikation

Human Health Hazards

If swallowed, aspiration into the lungs may cause chemical pneumonitis.
Prolonged or repeated exposure may give rise to dermatitis.
No specific hazards under normal use conditions.

Safety hazards

The preparation contains mineral oil, for which an exposure limit for oil mist applies.

Environmental hazards

Avoid spillage.
The poduct is not readily biodegradable.

4. First Aid Measures

Inhalation

Remove to fresh air.
If breathing but unconscious, place in the recovery position.
If breathing has stopped, apply artificial respiration.
Medical attention is to be obtained immediately.

Skin

Remove contaminated clothing and wash affected skin with soap and water.

If high pressure injection injuries occur, obtain medical attention immediately.

Eye

Rinse immediately with plenty of water for ar least 10 minutes and seek medical advice.

Ingestion

Do not induce vomiting.
Aspiration into the lungs may occur directly or following ingestion. This can cause chemical pneumonitis which may be fatal.
If breathing but unconscious, place in the recovery position.
If breathing has stopped, apply artificial respiration.
Medical attention is to be obtained immediately.

Advice to physicians

Treat symptomatically

5. Fire Fighting Measures

Extinguishing media

Foam, dry chemical powder, carbon dioxide, sand or earth.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

Product name: Masse 106

5. Fire Fighting Measures (continued)

Unsuitable extinguishing media

Do not use water in a jet

Specific hazards

- Combustion is likely to give rise to a complex mixture of gases and airborne particulates, including carbon monoxide, oxides of sulphur and unidentified organic and inorganic compounds.

6. Accidental Release Measures

Personal precautions

Ventilate contaminated area thoroughly.

Minimise contact with skin.

Environmental precautions

Prevent further leakage or spillage and prevent from entering drains.

Prevent from spreading or entering into drains, ditches or rivers by using sand, earth or other appropriate barriers.

Clean-up methods

Absorb or contain liquid with sand, earth or spill control material.

Shovel into a suitable, clearly marked container for disposal or reclamation in accordance with local regulations.

7. Handling and Storage

Handling

When using do not eat or drink.

When handling product in drums, safety footwear should be worn and proper handling equipment should be used

Prevent spillages.

Storage

Keep container tightly closed and in a well ventilated place. Avoid direct sunlight, heat sources and strong oxidising agents.

Recommended materials: mild steel, high density polyethylene for containers or container linings.

8. Exposure Controls/Personal Protection

Engineering control measures

Use only in well ventilated areas.

Occupational exposure standards

Component name	Limit type	Value/Unit	Other information
Oil mist	8 h TWA	5 mg/m³	ACGIH
	10 min STEL	10 mg/m³	ACGIH

Respiratory Protection

Not normally required.

If oil mist cannot be controlled, a respirator fitted with an organic vapour cartrige combined with a particulate prefilter should be used.

Hand Protection

PVC or nitril rubber gloves if splashes are likely to occur and if applicable.

Eye Protection

Safety spectacles

Body Protection

Minimise all forms of skin contact.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

Product name: Masse 106

8. Exposure Controls and Personal Protection (continued)

Hygiene measures

Don't keep oily rags in your pockets.
Wash hands before eating and drinking.

9. Physical and Chemical Properties

form	liquid	
colour	yellow	
pourpoint	< -60°C	DIN ISO 3016
flashpoint	145°C	DIN 51758
flammability - lower limit (vol%)	0,6	
flammability - upper limit (vol%)	6,5	
vapour pressure (20°C)	< 0,01 hPa	
density (15°C)	888 kg/m³	DIN 51757
solubility in water (20°C)	negligible	
n-octanol/water partition coeff.	na	
kinematic viscosity (40°C)	8,5 mm²/s	DIN 51562

10. Stability/Reactivity

Stability

stable under normal use conditions

Materials to avoid

strong oxidising agents

Hazardous decomposition products

Hazardous decomposition products are not expected to form during normal storage.

11. Toxicological Information

Toxicological Data:

Acute toxicity - oral

LD 50 is expected to be > 2000 mg/kg.

Irritation of skin, irritation of eye

The product is expected to be slightly irritant.

Sensitisation of skin

The produkt is not expected to be a skin sensitiser.

Prolonged and/or repeated contact

Prolonged/repeated contact may cause defatting of the skin, which can lead to dermatitis and may make the skin more susceptible to irritation and penetration by other materials.

Carcinogenicity

Product is based on mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Other components are not known to be associated with carcinogenic effects.

Other information

Aspiration into the lungs may occur directly or following ingestion. This can cause chemical pneumonitis which may be fatal.

Information given is based on a knowledge of the toxicology of similar products.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

Product name: Masse 106

12. Ecological Information

Basis for assessment

Information given is based on data on the components and the ecotoxicology of similar products.

Mobility

Product floats on water. It is liquid under most environmental conditions.
If it enters soil, it will be adsorbed to soil particles and will not be mobile.
Product has the potential to bioaccumulate.

Ecotoxicity

Product is expected to be practically non-toxic to aquatic organisms, LC/EC50 > 100 mg/L.

13. Disposal Considerations

Product

Precautions: Dispose to licensed disposal contractor.
Waste disposal Nr. (D): 54106

Container disposal

Drain container thoroughly.
Dispose to licensed disposal contractor.

Recomanded cleaning procedure

Cleaning by disposal contractor

14. Transport Information

Product is not dangerous for conveyance under UN, IMO, ADR/RID and IATA/ICAO codes. (According ADR/RID regulations from 1.1.1995)

15. Regulatory Information

Classification

The Product is not classified as dangerous under EC criteria.

16. Other Information

Additional informations

Concawe Report 5/87 Health Aspects of Lubricants.

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 therefore not be construed as guaranteeing any specific property of the product.

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

Ballinhassig GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
19 Cork Co. Co.	**Rivers:** Awboy, Blarney, Butterstown, Dissour, Dripsey, Dungourney, Foherish, Glashaboy, Glasheen, Kiltha, Leamlara, Owenboy, Owennacurra, Owennagearagh, Bride, Laney, Lee, Martin, Shournagh, Sullane, Toon, Tramore, Womanagh, Aughnaboy, Butlerstown, Caha, Cummer, Cusloura, Douglas, Finnow, Garrane, Keel, Templebodan. **Lakes:** Blarney, Cleanrath, Gouganebarra, Kilbanna, Allua, Beg, Carrignafurark, Carrignamork, Gal, Nambrackderg, Ovens, Quarry, River Lee Reservoirs	Mullaghanish Bog (001890), Blarney Bog (001857), Glashgarriff River (001055), Blarney Lake (001798), Douglas River Estuary (001046), Lough Allua (001065), Owenboy River (001990), Gouganebarra Lake (001057) *To be re-checked*	1762

Topography	This GWB occupies the uplands of the Lee catchment and its tributaries in County Cork. The GWB is bounded to the north by the Glenville GWB, and to the south by the Bandon GWB. The Ballincollig and Midleton karstic GWBs intrude deep into this GWB. The topography is very rugged in the west, encompassing the Sheehy, Derrynasaggart and Boggeragh mountains. Ground elevations range from sea level to over 500 m OD.	
Geology and Aquifers	**Aquifer categories**	**Ll:** Locally important aquifer which is moderately productive only in local zones (86%). **Pl:** Poor aquifer which is generally unproductive except for local zones (14%). *There are also some very small areas with an aquifer category of:* ***Rk^d*/Pending Classification:*** **Where these rocks occur in other areas they are classified as Rk^d. In this GWB they may be karstified but are unlikely to be regionally important due to their small size (<10km^2) – a new classification code to represent these areas is pending (<1%)*
	Main aquifer lithologies	Devonian Old Red Sandstones (92%); Dinantian Mudstones and Sandstones (Cork Group) (6%); Namurian Sandstones (1%); Dinantian Pure Unbedded Limestones (0.5%); Dinantian Lower Impure Limestones (0.1%).
	Key structures	The rocks have been folded into anticlines and synclines, with approximately East-West axes, by the Variscan Orogeny. The rocks are also broken by a strong system of steeply-dipping cross faults running approximately NNW-SSE, roughly at right angles to the fold axes. There are also other faults roughly parallel to the fold axes. The widespread faulting and folding has given rise to zones of enhanced permeability in the mudstones and sandstones. These can occur close to faults and fold axes, but such zones are generally local.
	Key properties	Permeability generally decreases rapidly with depth in all aquifers. In general, transmissivities will be in the range 2-20 m^2/d, with median values towards the lower end of the range. However, 'Excellent' yielding wells (>400 m^3/d) are known in some of the ORS units – these yields are usually associated with boreholes being situated on fault zones. Summer yields are sometimes unsustainable. Aquifer storativity will be low in all rock units. Groundwater gradients are likely to be in the range 0.01 to 0.04. Storativity is low, but may be enhanced by overlying sand and gravel deposits which are in continuity.
	Thickness	The Dinantian Mudstones and Sandstones (Cork Group) and Devonian Old Red Sandstone units form sequences which can be several kilometres thick (Sleeman & Pracht, 1994). However, in all aquifers within this GWB, most groundwater flow occurs within the top 15-20 m of the aquifer, in the layer that comprises a weathered zone of a few metres and a connected fractured zone below this. Deeper flows occur along generally isolated faults or significant fractures.
Overlying Strata	**Lithologies**	*Subsoil Types identified in Ballinhassig GWB by Teagasc Parent Material Mapping (Draft): Alluvium (A); Blanket Peat (BktPt); Cutover Peat (Cut); Sandstone sands and gravels (Devonian) (GDSs); Lake Sediments (Undifferentiated); Made Ground (Made); Rock outcrop and rock close to surface (Rck); Till – Devonian Sandstone Till (TDSs).* Till is the most widespread subsoil in Cork. Tills found close to bedrock and where the deposits are relatively thin, comprise a coarse matrix with angular clasts and can be described as broken up bedrock or immature till. Sands and gravels occur in isolated areas along the Sullane River in western areas of South Cork at Ballyvourney and Carrigaphooca as well as at Dunisky on the River Lee.

	Thickness	In general the subsoils are relatively shallow with about 50% of the total area estimated to have less than 3m of subsoil cover. The thinnest subsoils and areas of 'rock close to surface' occur in the smaller valleys where there are rock outcrops along the stream beds; along the east - west trending ridges, particularly in centre and east of the region; and in the mountains in West Cork (Derrynasaggart, Boggeragh). Depth to bedrock is also seen to be very shallow in a lot of coastal areas around the cliffs of South Cork. The thickest deposits are generally encountered in the major river valleys of the Lee, Bride and Bandon. The most frequent occurrences of outcrop and shallow rock are found in the west of the region near Macroom and the Derrynasaggart and Boggeragh Mountains. Subsoil depths of 10-15m are occasionally recorded in this region. In the south of the region there are also frequent occurrences of outcrop and shallow rock particularly in coastal areas and along river valleys. Outside areas of outcrop and shallow rock, subsoils are generally <10m deep, although depths of >10m are occasionally recorded. In general sand and gravel deposits are usually more than 10 m thick, in particular where they have been laid down with tills as morainic deposits. Thicknesses of lake, alluvial and estuarine deposits are usually unknown but it is unlikely that they are more than 10 m thick. Peat on higher ground is typically 3 m thick or less.
	% area aquifer near surface	High
	Vulnerability	A large proportion of the county is classed as having either extreme or high vulnerability while areas of moderate and low vulnerability are much less common. The 3 m contour, which influences the extreme and high vulnerability categories, is based on outcrop information, Quaternary mapping and borehole data. There may be more areas of moderate and low vulnerability than currently depicted.
Recharge	**Main recharge mechanisms**	Diffuse recharge will occur via rainfall percolating through the subsoil or areas of outcropping rock. The generally 'moderate' permeability subsoils will generally not restrict percolation of recharge. However, due to the generally low permeability of the aquifers within this GWB, and the high slopes, a high proportion of the recharge will discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer.
	Est. recharge rates	*To be assessed.*
Discharge	**Large springs and high yielding wells (m^3/d)**	*Note: The following data need to be checked and updated by RBD Project Consultants.* Data from GSI Well Database: Additional data from EPA Groundwater Sources List: Excellent BH – Knockmonalea (436 m^3 /d), Courtbrack (873 m^3 /d), Gurteen (>400 m^3 /d) Good BHs (general)– No. of BHs > 300 m^3/d = 1 > 200 m^3/d = 12 > 100 m^3/d = 44 Water Schemes – Coachford WS (122 m^3 /d), Grenagh WS (147 m^3 /d), Macroom U.D. WS, infil Gallery (1700 m^3 /d), Rylane WS (150 m^3 /d). (*All WS listed above are BHs > 100m3/d unless stated otherwise)*
	Main discharge mechanisms	The main discharges are to the gaining rivers and streams crossing the sandstones, mudstones, shales and impure limestone rock units and to generally small springs and seeps. Groundwater will also discharge at the coast. Localised seepages may develop on the cliff faces. Cross-flow may occur from the aquifers in this GWB to the adjacent karstic GWBs.
	Hydrochemical Signature	This GWB is underlain by non-carbonate rock units, which include Old Red Sandstone rocks and the sandstones and mudstones of the Cork Group. Alkalinity ranges about 10-300 mg/l (as $CaCO_3$) and hardness ranges about 40-220 mg/l (moderately soft to moderately hard). The Old Red Sandstone formations largely contain calcium bicarbonate type water. Conductivities in these units are relatively low, ranging 125-600 µS/cm, with an average of about 300 µS/cm. Conductivities in the Cork Group rocks are quite similar with an average of 380 µS/cm and a range from 160 to 430 µS/cm. In general, high iron (Fe) and manganese (Mn) concentrations can occur in groundwater derived from ORS, due to the dissolution of Fe and Mn from the sandstone/shale where reducing conditions occur. Background chloride concentrations in all aquifers will be higher than in the Midlands, due to the proximity to the sea.
Groundwater Flow Paths		The Devonian ORS and Dinantian Mudstones & Sandstones of this GWB have no intergranular permeability; groundwater flow occurs in fractures and faults; in-filling of fractures is to be expected. The permeability of individual fractures and the degree of interconnection will be generally low, with fracturing confined to local zones. Permeability is highest in the upper few metres but generally decreases rapidly with depth. In general, groundwater flow is concentrated in the upper 15 m of the aquifer, although deeper inflows from along fault zones or connected fractures can be encountered. Significant yields can be obtained where boreholes are drilled into known fault zones. In these rocks groundwater flow paths are expected to be relatively short, typically from 30-300 m, with groundwater discharging to small springs, or to the streams that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. Groundwater is generally unconfined.

Groundwater & Surface water interactions	Groundwater in the Devonian ORS and Dinantian Mudstones & Sandstones (Cork Groups) will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low.

Conceptual model	• The groundwater body is bounded to the south by the Bandon GWB, and to the north by the Glenville GWB • The topography of this body is rugged, especially in the west, and elevations range from sea level to over 500 metres. • The groundwater body primarily comprises Devonian ORS and Dinantian Mudstones & Sandstones (Cork Group) which have low transmissivity and storativity, although localised zones of enhanced permeability occur along fault zones. Flow occurs along fractures, joints and faults. Flows in the aquifer are generally concentrated in a thin zone at the top of the rock, although deeper groundwater flows along faults and major fractures. • Diffuse recharge occurs across the GWB through the subsoils and rock outcrops. • The water table can vary from a few metres up to more than 10 m below ground surface, depending upon topography. Groundwater is generally unconfined. Flow path lengths are generally short, ranging from 30-300 m. Local groundwater flow directions are controlled by local topography. Groundwater discharges to the numerous streams and rivers crossing the aquifer and to small springs and seeps.
Attachments	
Instrumentation	**Stream gauges:** 19001*, 19004, 19006*, 19007, 19008, 19009, 19010, 19011, 19013, 19015*, 19017*, 19018, 19020, 19021, 19023, 19024, 19027, 19028, 19030, 19031*, 19032, 19033, 19034, 19036, 19037, 19038, 19039, 19040, 19041, 19042, 19043, 19044, 19045, 19046, 19047, 19048, 19060, 19066, 19090, 19091. * Dry water Flow available **EPA Water Level Monitoring boreholes:** Kilnamatra (COS 34) **EPA Representative Monitoring points:** Ballincurrig (COS 4), Dungourney WS (COS 25), Rylane WS-south BH (COS 48), White Cross WS (COS 52), Rylane WS-north BH (COS 162)
Information Sources	Kelly D, Leader U, Wright G (2002) *South Cork Groundwater Protection Scheme*. Main Report. Final Report to South Cork County Council. Geological Survey of Ireland. Sleeman AG, Pracht M (1994) *Geology of South Cork. A geological description of South Cork to accompany the Bedrock Geology 1:100,000 Map Series, Sheet 25*. Geological Survey of Ireland, 59pp
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

List of Rock units in Ballinhassig GWB

Rock unit name and code	Description	Rock unit group	Aquifer Classification
White Strand Formation	Sandstone & interbedded pyritic mudstone	Namurian Sandstones	Ll
Lispatrick Formation (LP)	Pyritic cherty mudstone with dolomite	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Courtmacsherry Formation (CY)	Calcareous mudstone with limestone	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Ardaturrish Member (KNat)	Black mudstone & silt-lensed mudstone	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Pigs Cove Member ((KNpc)	Sand-lensed mudstone	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Narrow Cove Member (KNnc)	Flaser-bedded sandstone & mudstone	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Cuskinny Member (Kncu)	Flaser-bedded sandstone & mudstone	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Old Head Sandstone Formation (OH)	Flaser-bedded sandstone & minor mudstone	Dinantian Mudstones and Sandstones (Cork Group)	Ll
Old Red Sandstone (undifferentiated) ORS	Red conglomerate, sandstone & mudstone	Devonian Old Red Sandstones	Ll
Little Island Formation (LI)	Massive and crinoidal fine limestone	Dinantian Pure Unbedded Limestones	*Rk^d*/Pending Classification*
Waulsortian Limestones (WA)	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones	*Rk^d*/Pending Classification*
Ballysteen Formation (BA)	Fossiliferous dark-grey muddy limestone	Dinantian Lower Impure Limestones	Ll
Ringmoylan Formation (RM)	Calcareous shale & crinoidal limestone	Dinantian (early) Sandstones, Shales and Limestones	Pl
Gyleen Formation (GY)	Sandstone with mudstone & siltstone	Devonian Old Red Sandstones	Ll
Ballyknock Member (Gybn)	Green sandstone, siltstone & mudstone	Devonian Old Red Sandstones	Ll
Ballytrasna Formation (BS)	Purple mudstone and sandstone	Devonian Old Red Sandstones	Ll
Toe Head Formation (TH)	Cross-bedded sandstone & minor mudstone	Devonian Old Red Sandstones	Ll
Castlehaven Formation (CE)	Purple mudstone and siltstone	Devonian Old Red Sandstones	Pl
Gun Point Formation (GP)	Green-grey sandstone & purple siltstone	Devonian Old Red Sandstones	Ll
Caha Mountain Formation (CH)	Purple & green sandstone & siltstone	Devonian Old Red Sandstones	Pl
Gortanimill Formation (GM)	Sandstone and siltstone	Devonian Old Red Sandstones	Ll
Slaheny Sandstone Formation (SL)	Cross-bedded sandstone & siltstone	Devonian Old Red Sandstones	Ll
Bird Hill Formation	Purple siltstone & fine sandstone	Devonian Old Red Sandstones	Pl
Glenflesk Chloritic Sandstone Formation	Green sandstone & purple siltstone	Devonian Old Red Sandstones	Ll

water matters
'our Plan'

Full Report for Waterbody CorkCity_1

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The WaterMaps viewer is an integral part of the River Basin Management Plan and provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland.

The following report provides summary plan information about the selected waterbody (indicated by the pin in the map above) relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters. Other relevant information not included in this report can be viewed using the WaterMaps viewer, including areas listed in the Register of Protected Areas.

You will find brief notes at the bottom of some of the individual report sheets that will help you in interpreting the information presented. More detailed information can be obtained in relation to all aspects of the RBMPs at www.wfdireland.ie.

Date Reported to Europe:July 2010

Date Report Created 31/07/2019

water matters
'our Plan'

Summary Information:

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_1
WaterBody Code:	IE_SW_G_030
Overall Status:	Good
Overall Objective:	Protect
Overall Risk:	1a At Risk
Heavily Modified:	No

south western river basin district

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 Reported to Europe:July 2010

Date Report Created 31/07/2019

water matters
'our Plan'

Chemical and Quantitative Status Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_1
WaterBody Code:	IE_SW_G_030
Overall Status Result:	Good
Heavily Modified:	No

south western river basin district

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

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 Reported to Europe:July 2010

Date Report Created 31/07/2019

water matters
'our Plan'

Risk Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: CorkCity_1

WaterBody Code: IE_SW_G_030

Overall Risk Result: 1a At Risk

Heavily Modified: No

south western river basin district

	Risk Test Description	Risk
	Groundwater Dependent Terrestrial Ecosystems	
TE	GWDTE Risk	N/A
	Groundwater Quality	
DIF	Diffuse Elements (General) Risk	N/A
DW	Drinking Waters Risk	N/A
INT	Intrusions Risk	N/A
WB	Water Balance Risk	N/A
	Groundwater Quality (General)	
GQ	General Groundwater Quality Risk	N/A
	Groundwater Quality (Point Risk)	
CL	Contaminated Land Risk	N/A
LF	Landfill Risk	N/A
MI	Mine Risk	N/A
QY	Quarry Risk	N/A
UR	Urban Risk	N/A
UW	UWWT Risk	N/A
	GW Diffuse Risk Sources	
WB3	Mobile Nutrients (NO3)	N/A
WB4	Mobile Chemicals	N/A
WB5	Clustered OSWTSs and leaking urban sewerage systems	N/A
	GW Hydrology	
WB1	Water balance - Abstraction	N/A
WB2	Abstraction - Intrusion	N/A

Date Reported to Europe:July 2010

Date Report Created 31/07/2019

	GW Point Risk Sources		
WB10	Risk from Point sources of pollution - Contaminated Land		N/A
WB11	Risk from Point sources of pollution - Trade Effluent Discharges		N/A
WB12	Risk from Point sources of pollution - Urban Wastewater Discharges		N/A
WB6	Risk from Point sources of pollution - Mines		N/A
WB7	Risk from Point sources of pollution - Quarries		N/A
WB8	Risk from Point sources of pollution - Landfills		N/A
WB9	Risk from Point sources of pollution - Oil Industry Infrastructure		N/A
	Overall Risk		
RA	Groundwater Overall - Worst Case		N/A
	Risk information		
CLR	Contaminated land risk	2b	Not At Risk
DR	Risk of groundwater due to pressure from diffuse sources of pollution	1a	At Risk
DWR	Risk associated with exceedances of water quality above specific standards	2b	Not At Risk
GDR	Groundwater dependant terrestrial ecosystems risk	2b	Not At Risk
GWR	General groundwater quality risk	1a	At Risk
INR	Risk associated with saline intrusion into groundwater	2b	Not At Risk
LR	Risk due to landfills sites/old closed dump sites	2b	Not At Risk
MR	Mines risk	2b	Not At Risk
NULL	Diffuse nitrates from agriculture risk		N/A
QR	Risk due to quarries	2b	Not At Risk
RA	Revised risk assessment	1a	At Risk
RPR	Risk associated with MRP loading to rivers	2a	Probably Not At Risk
SQR	Risk associated with dependant surface water quantitative status	2b	Not At Risk
SWR	Overall risk associated with nutrient loadings to rivers and transitional and coastal waters	1b	Probably At Risk
TNR	Risk associated with nitrate loading to transitional and coastal waters	1b	Probably At Risk
UAR	Risk of groundwater due to pressures from urban areas	1b	Probably At Risk
UWR	Risk due to direct discharges of urban wastewater	2b	Not At Risk

Risk
By 'risk' we mean the risk that a waterbody will not achieve good ecological or good chemical status/potential at least by 2015. To examine risk the various pressures acting on the waterbody were identified along with any evidence of impact on water status. Depending on the extent of the pressure and its potential for impact, and the amount of information available, the risk to the water body was placed in one of four categories: 1a at risk; 1b probably at risk; 2a probably not at risk; 2b not at risk. Note that '2008' after the risk category means that the risk assessment was revised in 2008. All other risks were determined as part of an earlier risk assessment in 2005.

You can read more about risk assessment in our 'WFD Risk Assessment Update' document in the RBMP document library, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).

Date Reported to Europe:July 2010

Date Report Created 31/07/2019

water matters
'our Plan'

Objectives Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: CorkCity_1

WaterBody Code: IE_SW_G_030

Overall Objective: Protect

Heavily Modified: No

south western river basin district

	Objectives Description	Result
	Extended timescale information	
E1	Extended deadlines due to agricultural P	No Status
E2	Extended deadlines due to agricultural N	No Status
E3	Extended deadlines due to mines	No Status
E4	Extended deadlines due to urban areas	No Status
E5	Extended deadlines due to contaminated lands	No Status
EO	Extended deadlines - overall	No Status
	Objectives information	
OB1	Prevent deterioration objective	Protect
OB2	Restore at least good status objective	No Status
OB3	Reduce chemical pollution objective	No Status
OB4	Protected areas objective	No Status
OBO	Overall objectives - objective	Protect

Extended timescales
Extended timescales have been set for certain waters due to technical, economic, environmental or recovery constraints. Extended timescales are usually of one planning cycle (6 years, to 2021) but in some cases are two planning cycles (to 2027).

Objectives
In general, we are required to ensure that our waters achieve at least good status/potential by 2015, and that their status does not deteriorate. Having identified the status of waters (this is given earlier in this report), the next stage is to set objectives for waters. Objectives consider waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery. Four default objectives have been set initially:-

Prevent Deterioration
Restore Good Status
Reduce Chemical Pollution
Achieve Protected Areas Objectives

These objectives have been refined based on the measures available to achieve them, the latter's likely effectiveness, and consideration of cost-effective combinations of measures. Where it is considered necessary extended deadlines have been set for achieving objectives in 2021 or 2027.

Date Reported to Europe:July 2010

Date Report Created 31/07/2019

water matters
'our Plan'

Measures Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: CorkCity_1

WaterBody Code: IE_SW_G_030

Heavily Modified: No

south western river basin district

	Measures Description	Applicable
BC	Total number of basic measures which apply to this waterbody	25
BW	Directive - Bathing Waters Directive	No
BIR	Directive - Birds Directive	Yes
HAB	Directive - Habitats Directive	No
DW	Directive - Drinking Waters Directive	Yes
MAE	Directive - Major Accidents and Emergencies Directive	Yes
EIA	Directive - Environmental Impact Assessment Directive	Yes
SS	Directive - Sewage Sludge Directive	Yes
UWT	Directive - Urban Waste Water Treatment Directive	Yes
PPP	Directive - Plant Protection Products Directive	Yes
NIT	Directive - Nitrates Directive	Yes
IPC	Directive - Integrated Pollution Prevention Control Directive	Yes
CR	Other Stipulated Measure - Cost recovery for water use	Yes
SUS	Other Stipulated Measure - Promotion of efficient and sustainable water use	Yes
DWS	Other Stipulated Measure - Protection of drinking water sources	Yes
ABS	Other Stipulated Measure - Control of abstraction and impoundment	Yes
POI	Other Stipulated Measure - Control of point source discharges	Yes
DIF	Other Stipulated Measure - Control of diffuse source discharges	Yes
GW	Other Stipulated Measure - Authorisation of discharges to groundwaters	Yes
PS	Other Stipulated Measure - Control of priority substances	Yes
MOD	Other Stipulated Measure - Controls on physical modifications to surface waters	Yes
OA	Other Stipulated Measure - Controls on other activities impacting on water status	Yes
AP	Other Stipulated Measure - Prevention or reduction of the impact of accidental pollution incidents	Yes
OTS	On-site waste water treatment systems	Yes
FPM	Freshwater Pearl Mussel sub-basin plan	No
SHE	Shellfish Pollution Reduction Plan	Yes
IPR	IPPC licences requiring review	Yes
WPR	Water Pollution Act licences requiring review	No
FOR	Forestry guidelines and regulations	Yes

Date Reported to Europe:July 2010

Date Report Created 31/07/2019

HQW	Protect high quality waters	Yes

Measures
Measures are necessary to ensure that we meet the objectives set out in the previous page of this report. Many measures are already provided for in national legislation and must be implemented. Other measures have been recently introduced or are under preparation. A range of additional potential measures are also being considered but require further development. Any agreed additional measures can be introduced through the update of Water Management Unit Action Plans during the implementation process.

You can read more about Basic Measures in 'River Basin Planning Guidance' and in other documents in our RBMP Document Library at www.wfdireland.ie.

Date Reported to Europe:July 2010

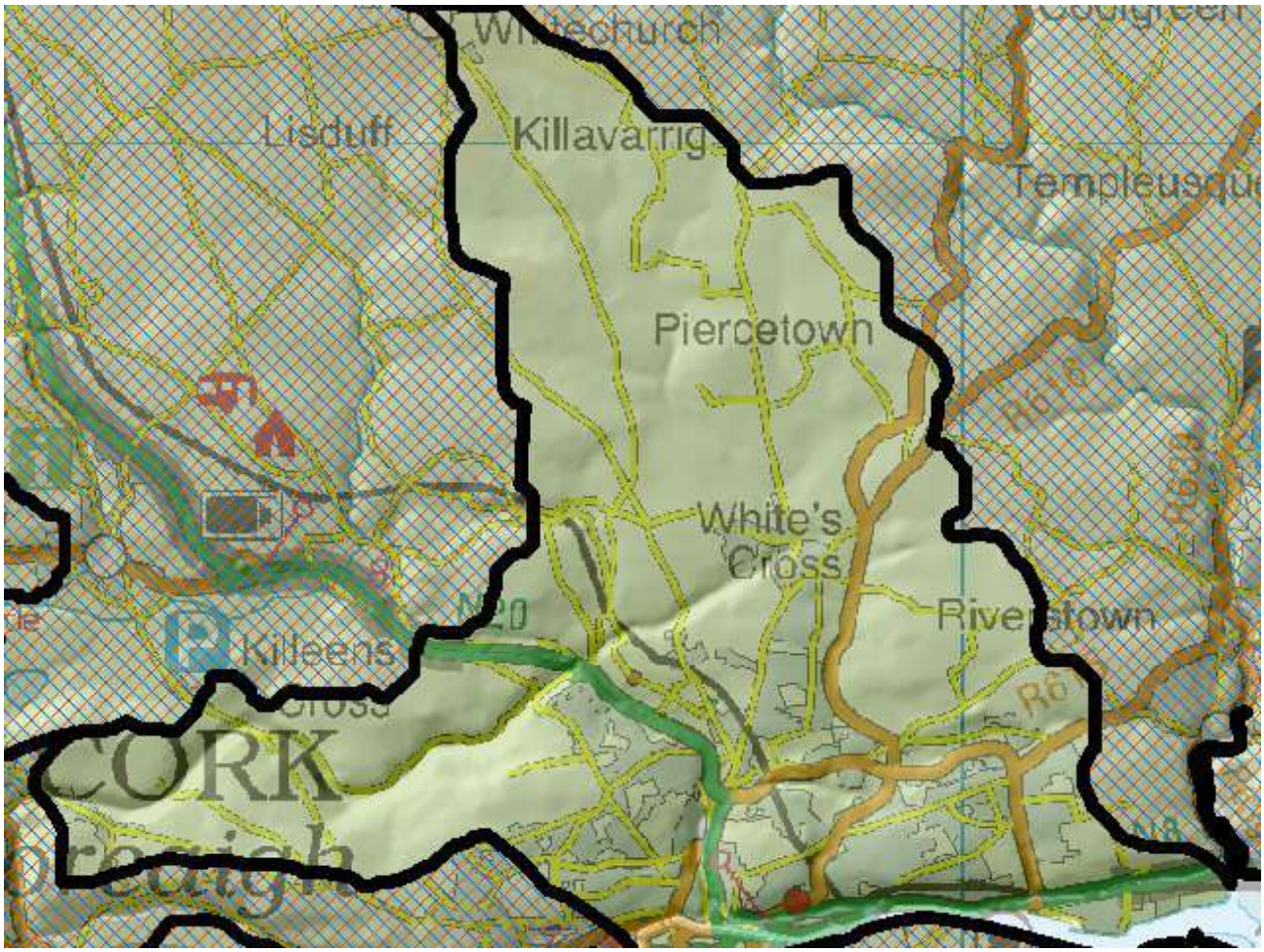
Date Report Created 31/07/2019

WFD Cycle 2

Catchment Lee, Cork Harbour and Youghal Bay

Subcatchment Kiln_SC_010

Code 19_1



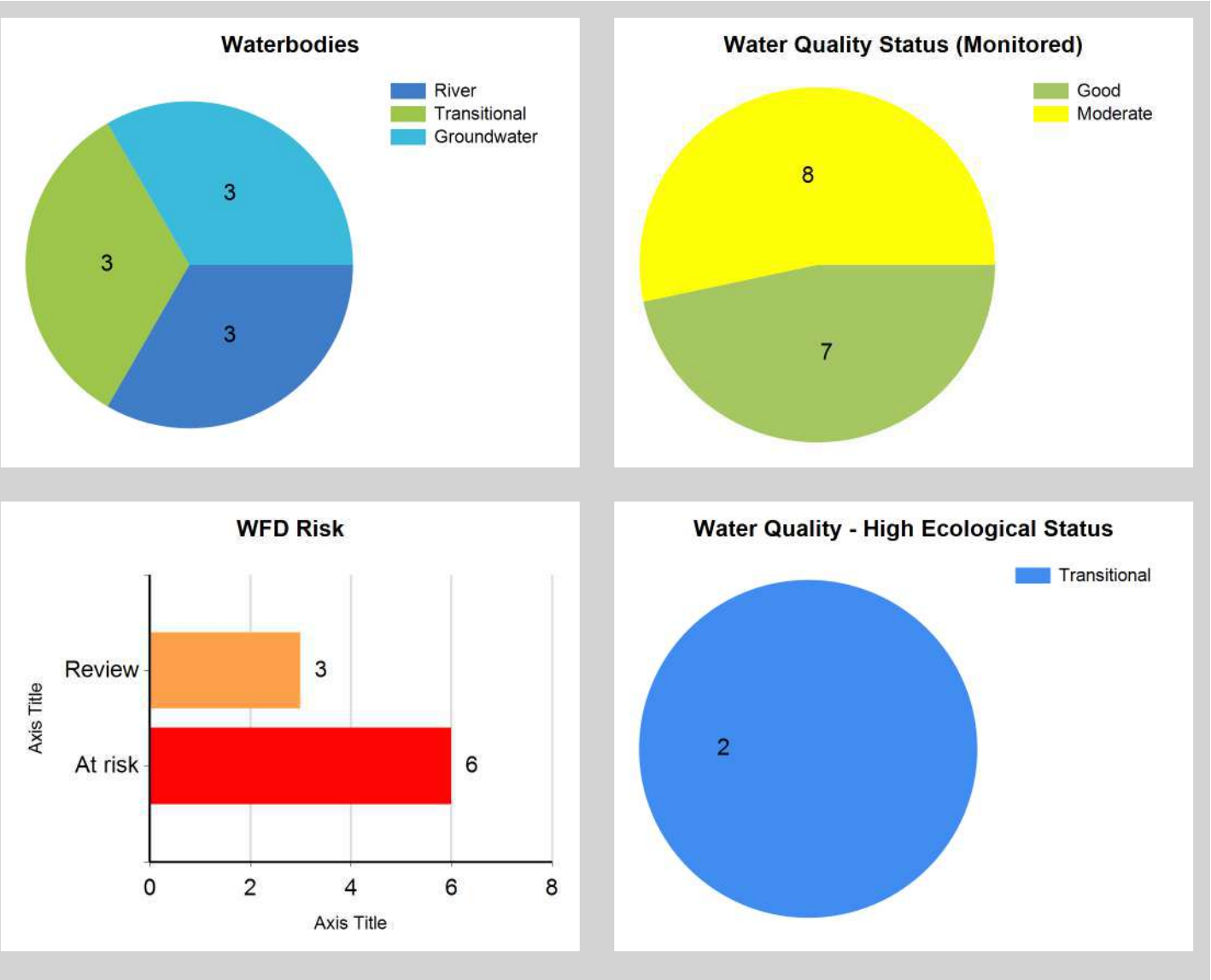
Generated on: 07 Jan 2019

Generated by WFD Application

Assessment Purpose

This assessment has been produced as part of the national characterisation programme undertaken for the second cycle of Water Framework Directive river basin management planning. It has been led by the EPA, with input from Local Authorities and other public bodies, and with support from RPS consultants.

The characterisation assessments are automatically generated from the information stored in the WFD Application. They are based on information available to the end of 2015 but may be subject to change until the final 2018-21 river basin management plan is published. Users should ensure that they have the most up to date information by downloading the latest assessment before use.

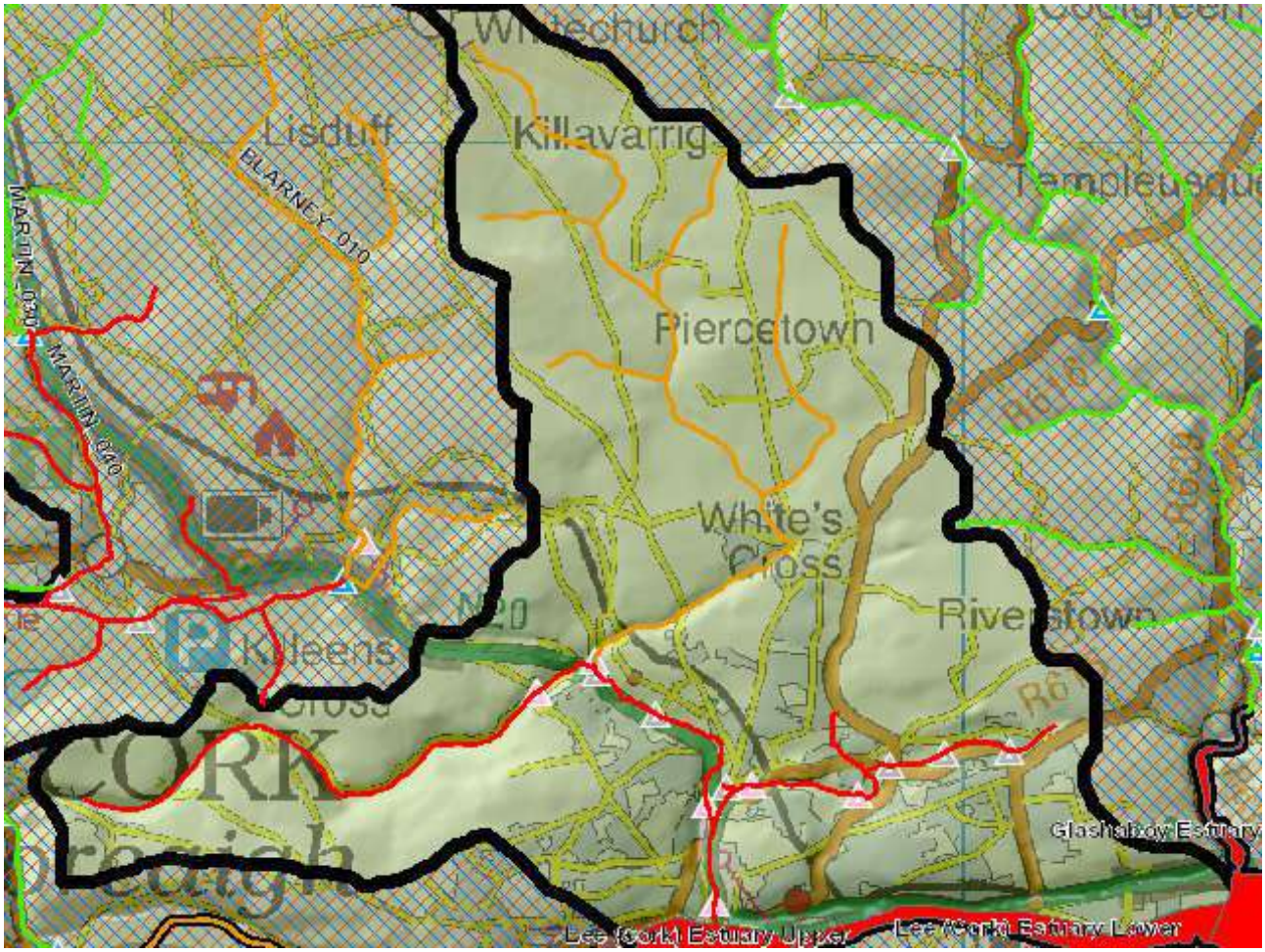


Evaluation of PrioritySubcatchment Issues

Two out of three river water bodies within this subcatchment are unassigned but AT RISK due to elevated nutrients, Bride (Cork City)_010 and Bride (Cork City)_020. Glennamought Trib Bride_010 is under REVIEW due to its unassigned status.

Diffuse urban appears to be the most significant pressure present within the subcatchment due to Cork City and its surrounds. Channelisation may also impact Bride (Cork City)_020 due to the presence of a drainage district scheme.

Map Subcatchment Risk Map

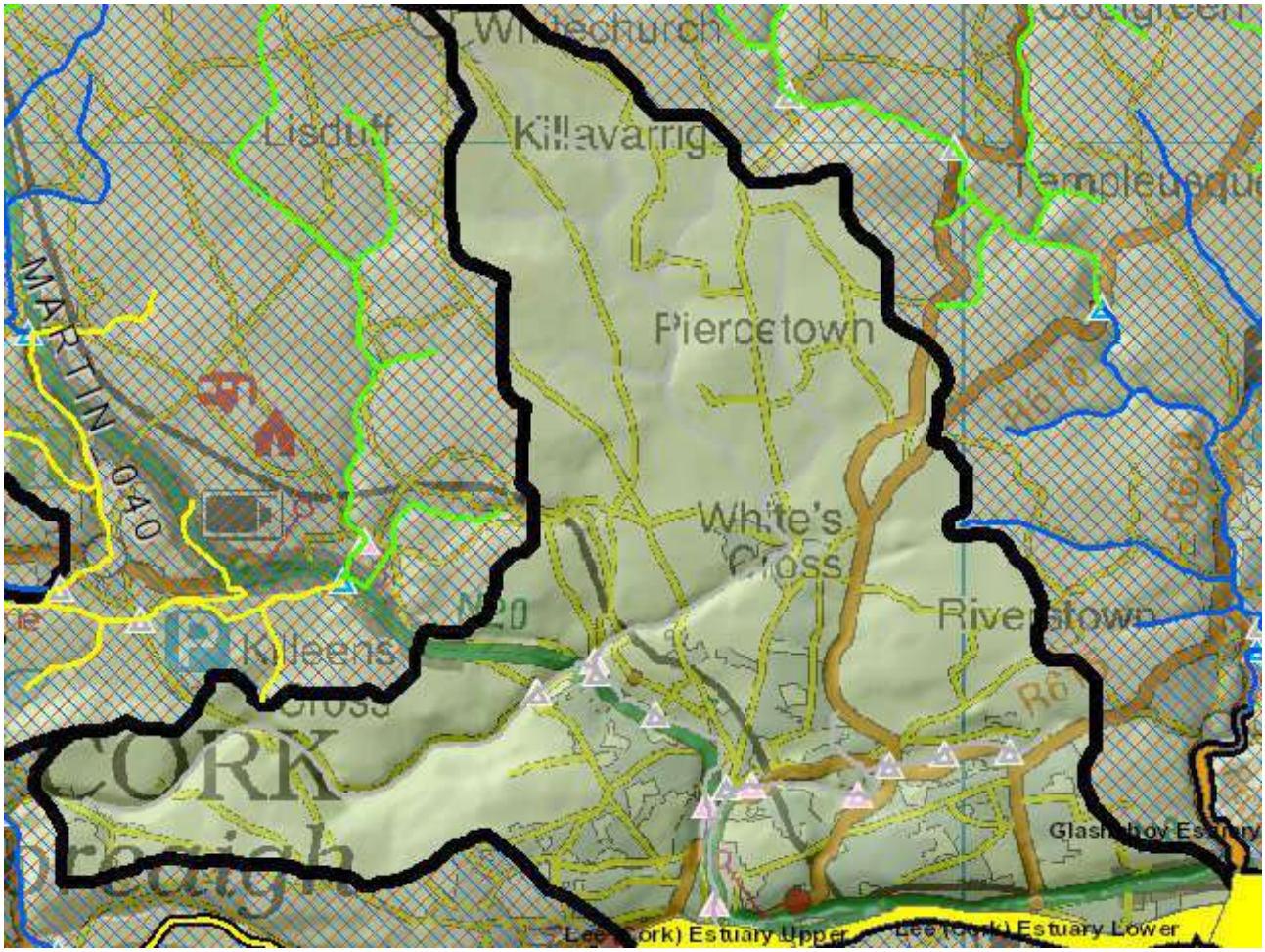


River And Lake Waterbodies: WFD Risk

The following river and lake waterbodies are in the subcatchment.

Code	Name	Type	WFD Risk	Significant Pressure
IE_SW_19B140110	BRIDE (Cork City)_010	River	At risk	Yes
IE_SW_19B140300	BRIDE (Cork City)_020	River	At risk	Yes
IE_SW_19G880990	GLENNAMOUGHT TRIB BRIDE_010	River	Review	Yes

Map Subcatchment Water Quality Status Map



River And Lake Waterbodies: Water Quality Status

The water quality status of river and lake waterbodies in the subcatchment is as follows.

Code	Name	Type	2007-09	2010-12	2010-15
IE_SW_19B140110	BRIDE (Cork City)_010	River	Unassigned	Unassigned	Unassigned
IE_SW_19B140300	BRIDE (Cork City)_020	River	Unassigned	Unassigned	Unassigned
IE_SW_19G880990	GLENNAMOUGHT TRIB BRIDE_010	River	Unassigned	Unassigned	Unassigned

Potentially Dependent Transitional and Coastal Waterbodies

The Transitional and Coastal waterbodies listed below intersect spatially with river and lake waterbodies in the subcatchment …

Code	Name	Type	Local Authority	WFD Risk
IE_SW_060_0750	Lough Mahon	Transitional	Cork County Council	At risk
IE_SW_060_0900	Lee (Cork) Estuary Lower	Transitional	Cork City Council	At risk
IE_SW_060_0950	Lee (Cork) Estuary Upper	Transitional	Cork City Council	At risk

Potentially Dependent Groundwater Waterbodies

The groundwaters listed below interset spatially with river and lake waterbodies in the subcatchment …

Code	Name	Type	Local Authority	WFD Risk
IE_SW_G_002	Ballincollig	Groundwater	Cork County Council	Review
IE_SW_G_004	Ballinhassig East	Groundwater	Cork County Council	Review
IE_SW_G_094	Lee Valley Gravels	Groundwater	Cork County Council	At risk

Protected Areas intersecting River and Lake Waterbodies

The Protected Areas listed below intersect spatially with river and lake waterbodies in the subcatchment …

Code	Name	Type	Waterbody Name	Association Type

Pressures

Below is a list of all significant pressures identified in the subcatchment.

Code	Name	WFD Risk	Pressure Category	Pressure Sub Category
IE_SW_060_0750	Lough Mahon	At risk	Urban Waste Water	Agglomeration PE > 10,000
IE_SW_060_0750	Lough Mahon	At risk	Urban Waste Water	Combined Sewer Overflows
IE_SW_060_0750	Lough Mahon	At risk	Urban Waste Water	Agglomeration PE of 2,001 to 10,000
IE_SW_060_0900	Lee (Cork) Estuary Lower	At risk	Urban Run-off	Diffuse Sources Run-Off
IE_SW_060_0900	Lee (Cork) Estuary Lower	At risk	Urban Waste Water	Combined Sewer Overflows
IE_SW_060_0950	Lee (Cork) Estuary Upper	At risk	Urban Waste Water	Combined Sewer Overflows
IE_SW_060_0950	Lee (Cork) Estuary Upper	At risk	Urban Run-off	Diffuse Sources Run-Off
IE_SW_19B140110	BRIDE (Cork City)_010	At risk	Hydromorphology	Channelisation
IE_SW_19B140110	BRIDE (Cork City)_010	At risk	Urban Run-off	Diffuse Sources Run-Off
IE_SW_19B140300	BRIDE (Cork City)_020	At risk	Urban Run-off	Diffuse Sources Run-Off
IE_SW_G_094	Lee Valley Gravels	At risk	Domestic Waste Water	Waste Water discharge
IE_SW_19G880990	GLENNAMOUGHT TRIB BRIDE_010	Review	Urban Run-off	Diffuse Sources Run-Off
IE_SW_G_002	Ballincollig	Review	Anthropogenic Pressures	Unknown
IE_SW_G_004	Ballinhassig East	Review	Anthropogenic Pressures	Unknown

Further Characterisation Actions

The following further characterisation actions have been identified. These are necessary to help understand more fully issues in the subcatchment and their likely cause.

Code	Name	Action	Responsible Organisation
IE_SW_19B140110	BRIDE (Cork City)_010	IA6 Multiple Sources in Large Urban Area	Cork City Council
IE_SW_19G880990	GLENNAMOUGHT TRIB BRIDE_010	IA6 Multiple Sources in Large Urban Area	Cork County Council
IE_SW_19G880990	GLENNAMOUGHT TRIB BRIDE_010	IA3 Determination of Water Quality (unassigned waterbody)	Cork City Council
IE_SW_19B140300	BRIDE (Cork City)_020	IA6 Multiple Sources in Large Urban Area	Cork City Council

APPENDIX F

HISTORIC GEOTECHNICAL INVESTIGATION REPORTS

Our Ref. JVM/MC. 2nd September, 1965.

Messrs. H.N. Walsh & Partners,
Consulting Engineers,
39, Sunday's Well,
CORK.

Dear Sirs,

re: Site Investigation at North Presentation Convent, Blackpool, Cork.

Referring to your letter of the 1st instant, it would appear that some misunderstanding has arisen over the description of the boreholes.

As you will note, three hours were spent chiselling in No. 1 and five hours chiselling in No. 2, and we understand from our operators on the site that a member of your staff examined the material encountered and was quite satisfied that it was rock, stating that it was similar to the rock discovered on another contract in the vicinity.

There is very little doubt that the rock encountered in both boreholes was in fact bedrock, but on a few occasions the existence of very large boulders or shelving of rock has been discovered (not in Co. Cork), and here the only method of proving the rock was to use a wagon drill or diamond drill, drilling some 8 to 10' into the rock, but we did not allow for this in the estimate, hence the description "presumed rock".

Trusting this will clear up the position, and assuring you of our best attention at all times.

Yours faithfully,
For THE CEMENTATION COMPANY (IRELAND) LTD.

(J.V. Marren)

THE CEMENTATION CO., (IRELAND) LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT **Presentation Convent, Cork** BOREHOLE No. **2**

Report No. Order No.

Bored for **Messrs. H.E. Walsh & Partners,**

Site Address **Blackpool, Cork**

Boring Commenced **16/7/65** Boring Completed **19/7/65**

Type of Boring **Percussive** Diameter of Borehole **15** ins.

Ground Level **15m.** O.D. **C**

Water Struck (1) **Nil** (2) (3) 64714

Standing Water Level **Nil**

Remarks

Box 90

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Samples Type	Samples Depth
	0					
Organic topsoil		2'	2'			
Brown sandstone & gravel	2'					
		11'	9'	10783	J	7'
Presumed rock 3.35m 11'						
(chiselling 5 hrs.)		12'	1'	10784	J	11'6"

Report No. 1150

Box No. 55

Investigation ID. 64713 – 64714 (2)

Standard Penetration Tests

At 5'6"	**28 blows to 12"**					
" 12'0"	**Refusal**					

Code : U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

Checked by : Date: Driller's Signature: Date:

This form to be returned to Head Office immediately the borehole is completed.

THE CEMENTATION CO., (IRELAND) LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT **Presentation Convent Cork** BOREHOLE No. **1**

Report No. Order No.

Bored for **Messrs. H.E. Walsh & Partners**

Site Address **Blackpool, Cork**

Boring Commenced **15/7/63** Boring Completed **18/7/63**

Type of Boring **Percussive** Diameter of Borehole **15** ins.

Ground Level O.D.

Water Struck (1) **Nil** (2) (3)

Standing Water Level **Nil**

Remarks

64718

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Samples Type	Samples Depth
Top Soil	0	3'	3'			
Soft brown stony clay with traces of fine sand	3'	8'	5'			
Stiff brown stony clay with traces of sand	8'	14'	6'	10781	J	10'
Pregnant rock (chiselling 3 hrs.) 4-26-M	14'	15' 6"	1'6"	10782	J	15'
Standard Penetration Tests						
At 5'6" 6 blows to 12"						
" 10'6" 35 " " 12"						
" 13'6" Refusal						

Code : U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

Checked by : Date: Driller's Signature: Date:

This form to be returned to Head Office immediately the borehole is completed.

KNOCKFREE AVENUE, CORK
MALACHY WALSH and PTNRS.

CONTENTS :

APPENDICES :

REPORT ON A SITE INVESTIGATION AT KNOCKFREE AVENUE, CORK ON BEHALF OF MALACHY WALSH AND PARTNERS

Report No. 3634 Sept. 1996

I Introduction

The area bounded by Knockfree Avenue and Sunvalley Drive is to be developed as all-weather playing pitches. Also included in the development plans is a changing pavilion.

An investigation of ground conditions has been carried out to ascertain earthworks and foundation requirements. The programme of the investigation included boreholes and trial pits from which samples were recovered for both visual examination and laboratory analysis. While provision was made for rotary coring of bedrock , this aspect of the investigation was not carried out since the bedrock level is below the proposed formation levels.

This report describes the work carried out and , from the information obtained , discusses ground conditions in relation to the proposed development.

II Fieldwork

The existing ground level falls in an approximately south-easterly direction from Knockfree Avenue to Sunvalley Drive.

Boreholes were constructed in three locations as shown on the site plan enclosed in Appendix III. In addition , trial pits were excavated in a further six locations. The descriptions and depths of the various strata encountered are shown on the records enclosed in Appendix I. Also shown on these records are the depths at which samples were recovered , the results of in-situ tests and the groundwater conditions observed during the course of boring and excavation operations.

The boreholes and trial pits revealed infill overlying firm to stiff gravelly clays .The depth of fill is greatest at Knockfree Road where it exceeds three metres. Over the area of the pitches the fill depth is generally between 2 and 3 metres while, at the lowest part of the site, Trial Pit No. 6 encountered no infill.

The boreholes were terminated on obstructions, encountered at depths of 7.0 metres , 3.9 metres and 7.0 metres at locations 1, 2 and 3 respectively. Examination of fragments recovered from the boreholes suggest that they were terminated at or near the rock horizon.

While the trial pits remained dry, groundwater was encountered in the boreholes in association with the obstructions. In each instance the water level rose, indicative of artesian conditions.

III Testing

(a) In-situ Standard Penetration Tests

The results of these tests are shown in the righthand column of the boring records and are expressed as N-values which are a measure of the number of blows required to drive the test cone through a measured 300 mm penetration.

The results indicate that the infill is in a dense state of compaction while the underlying clay is stiff .

(b) Classification Tests

The liquid and plastic limits of selected samples have been determined for classification purposes. The results of these tests give an indication of the likely behaviour of the soil under load and its suitability for re-use in earthworks operations.

The results lie within the CL zone of the plasticity chart , classifying the soil as clay of low plasticity.

IV Discussion

The only structure is the changing pavilion near the entrance at Knockfree Avenue. It is understood that this structure will incorporate a partial basement, although the design has not been finalised.

It is understood that the pitches will be tiered to follow , as near as possible, the existing contours, hence minimising earthworks operations

While the levels of the all-weather playing pitches are shown on the preliminary layout drawing, these can be altered, if necessary, to optimise the earthworks.

Pavilion :

From the drawing it would appear that the floor level of the pavilion will be around 87.0 to 88.0 m.o.d.

Trial Pit No. 2 and Borehole No. 1 revealed infill to around 85.0 m.o.d. where it overlies gravelly clay in a firm to stiff condition. The basement floor will, therefore, be around the level of the clay which will readily support the structural loads.

Foundations for the entire structure should be placed on the virgin soil, using trench fill techniques or piles. Alternatively, consideration could be given to a full basement.

Playing Pitches :

The proposed level of Pitch 3 would appear to be around 85.0 m.o.d. while Pit No. 3 and Borehole No. 2 suggest that infill is present to around 83.5 m.o.d in this area. The composition of the infill varies from gravelly clay to building rubble.

While the underlying virgin soils are relatively incompressible, it may not be economical or practical to excavate to this level. It may , therefore , be necessary to consider constructing the playing surfaces on the infill.
While the composition of the infill is variable , it should be borne in mind that there should be no increase in load on the subsoils and that site preparation will entail a reduction in ground level over a large portion of the pitch area. Direct construction on the fill should not ,therefore , induce settlement. It will, however, be necessary to ensure that the fill is stable and that there are no significant zones of soft or compressible material. Visual examination can be carried out at the site-stripping stage when any unsuitable material can be removed.

Prior to placement of the granular formation layer, the stripped surface should be rolled to improve the condition of the upper layers. Incorporation of a geotextile between the existing fill and the new formation would also be beneficial.

The proposed level of Pitch 4 would appear to be around 82.0 to 82.5 m.o.d. while Trial Pit No. 5 shows infill extending to 79.5 m.o.d. Construction on the fill as described above would appear to be the most practical solution.

Conclusions

The information gained from the investigation suggests that the site is overlain by 2 to 3 metres of assorted infill, varying from clay to general building rubble. There is , however , very little organic matter and the infill appears to be in a dense or stiff condition.

While total stability and minimal settlement of the playing pitches can only be guaranteed by removal of the fill and replacement , where necessary , with compacted granular material , this course of action may be considered uneconomical. Construction on the infill can be considered , subject to visual examination of the stripped surface and preparation as described above.

All structural loads should be supported on the virgin soils.

Note :

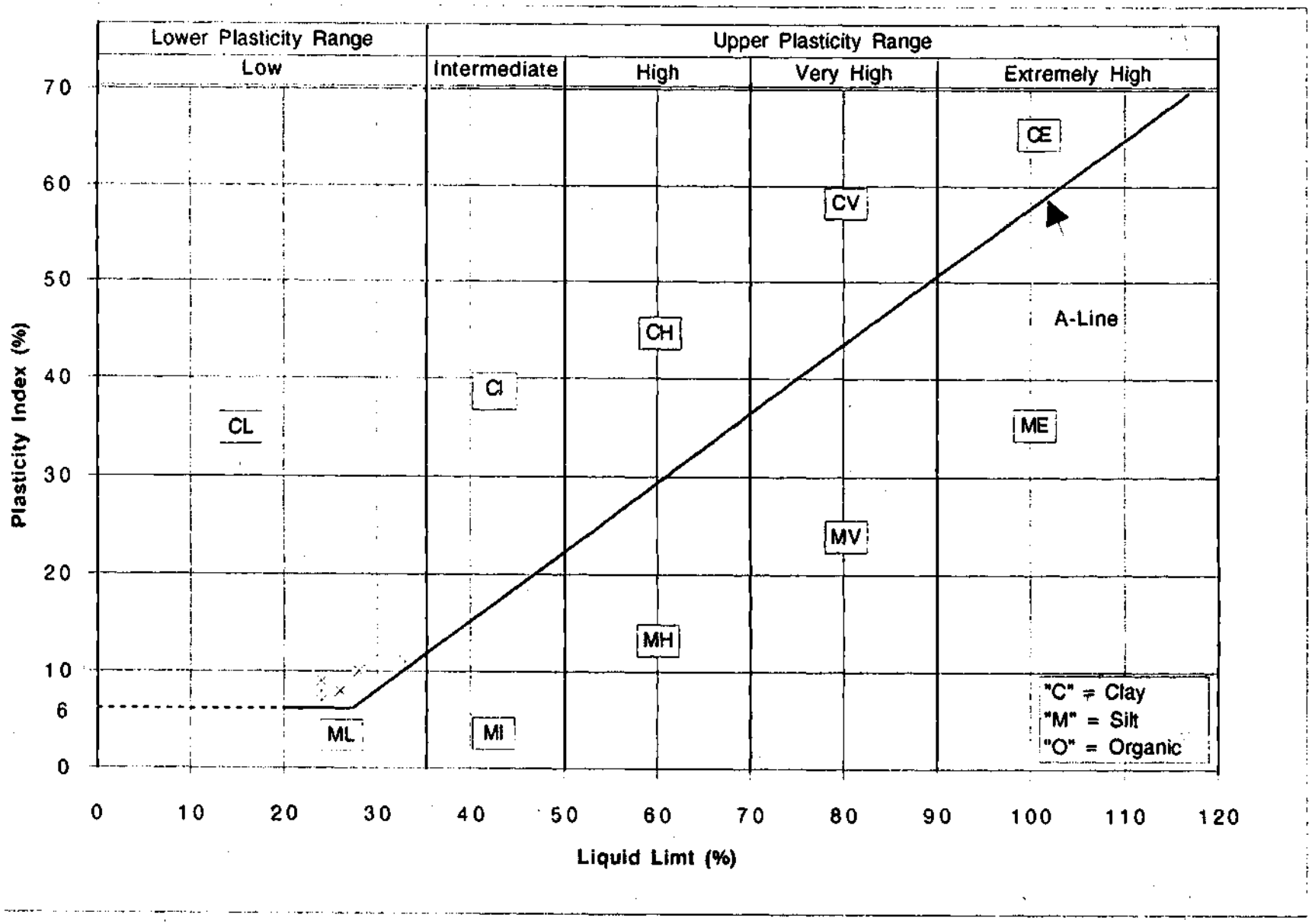
The quoted ground levels for the pits and boreholes have been taken from the ground contours and may not be totally accurate. Similarly, the proposed founding and formation levels have been taken from the contours.

APPENDIX I

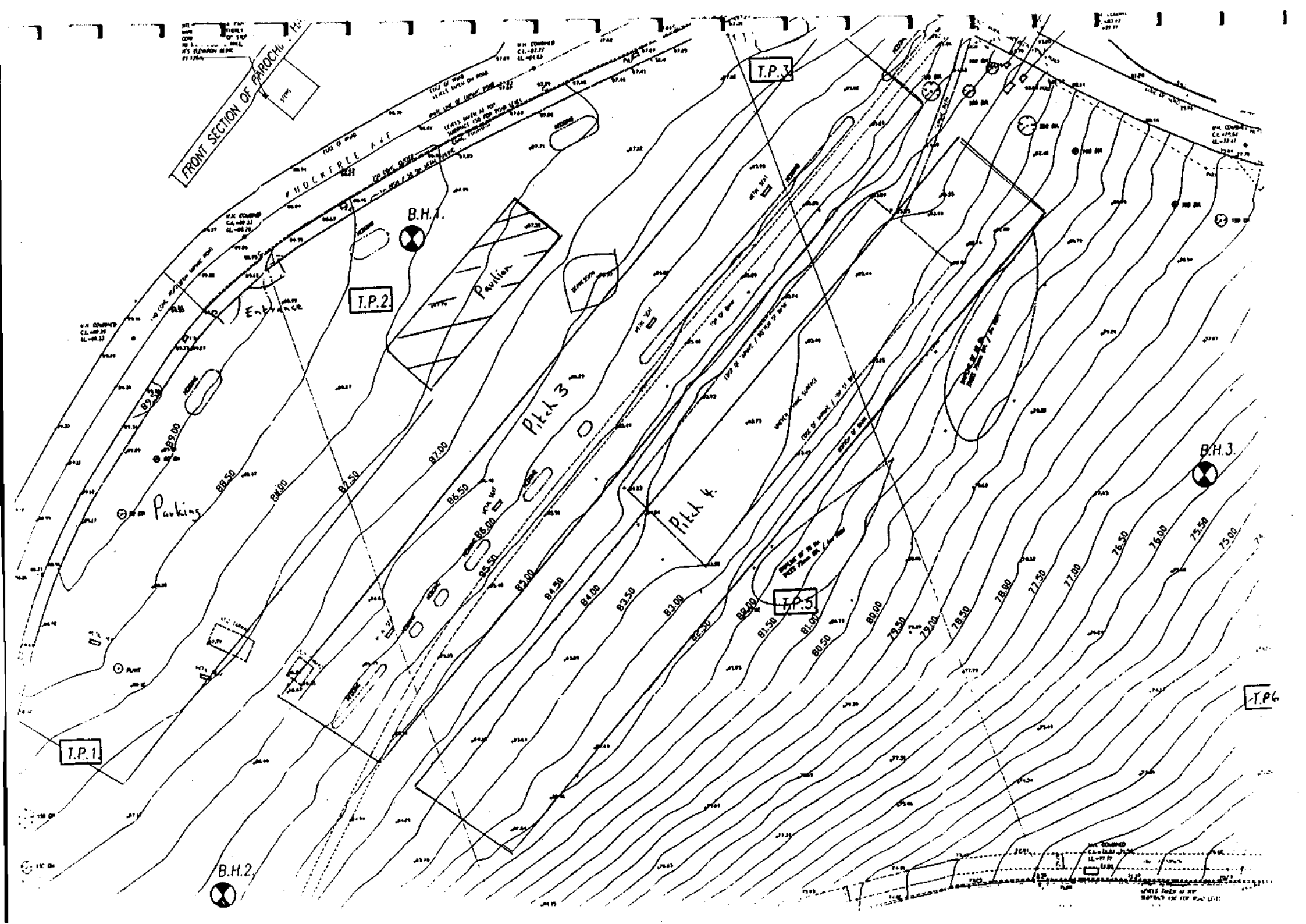
BORING RECORDS
TRIAL PIT RECORDS

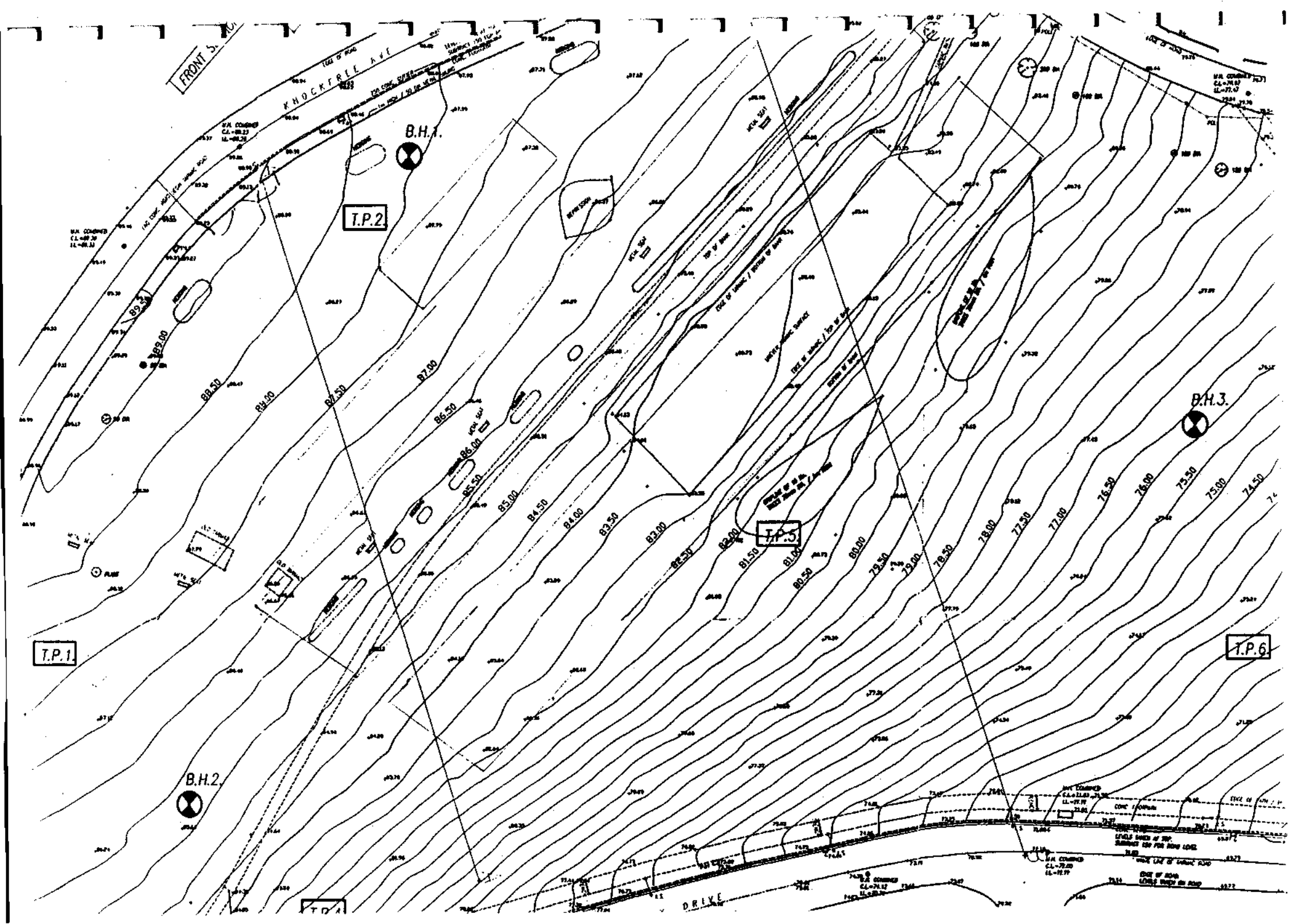
APPENDIX II TEST RESULTS

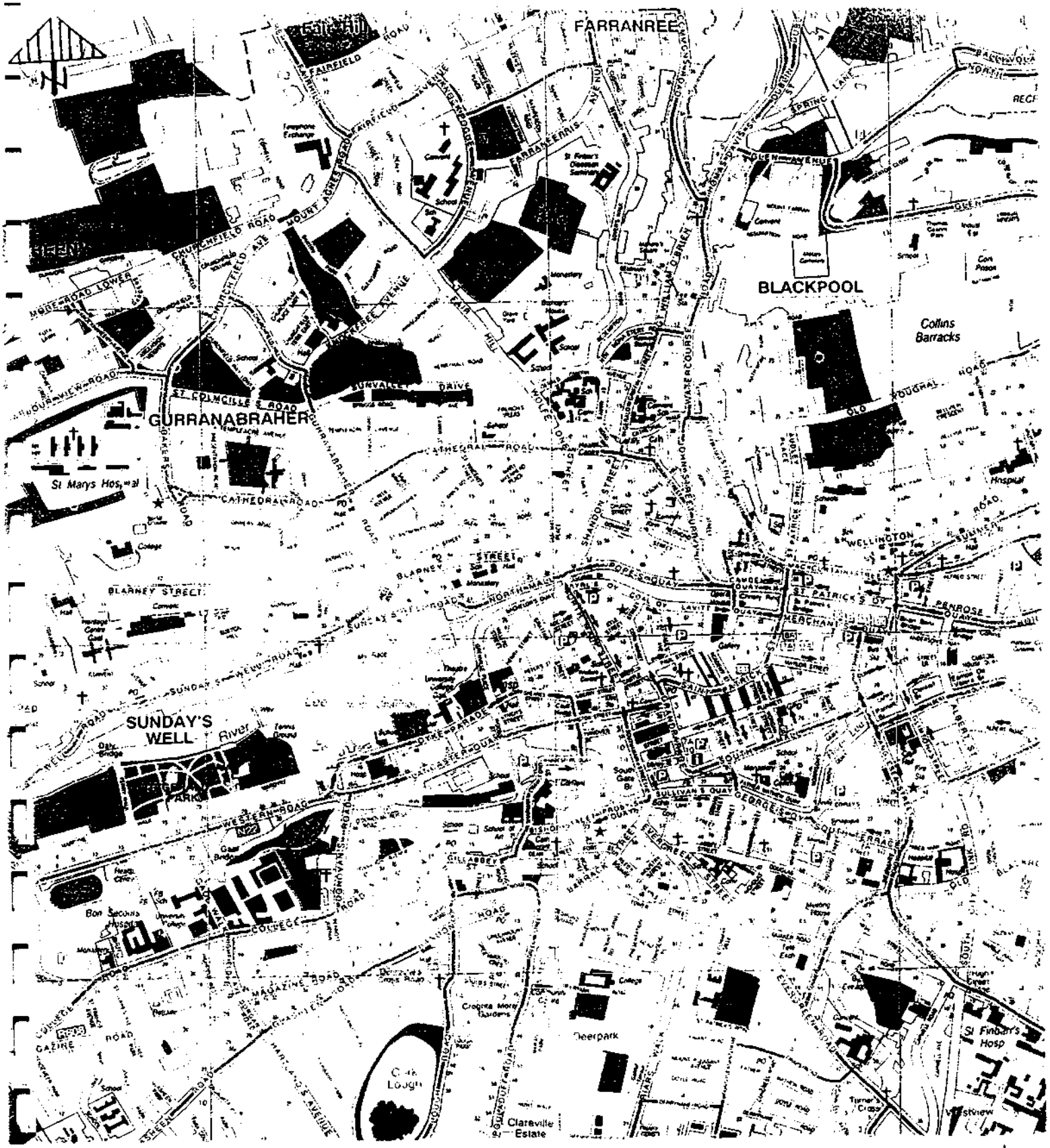
Report No.	CLASSIFICATION TEST RESULTS								IGSL
Contract: Knockfree Avenue									
Borehole No.	Depth (M)	Reference No.	Description	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Water Content %	pH	Sulphate Content %
BH.1	2.00	4032	Brown sandy gravelly CLAY with roots and some cobbles (Made Ground)	33	22	11	23.8		
BH.1	4.00	4034	Grey-brown sandy gravelly CLAY	24	16	8	13.7		
BH.2	3.00	4039	Grey gravelly sandy CLAY	26	18	8	13.2		
BH.3	3.00	4055	Brown gravelly sandy CLAY	24	15	9	12.8		
TP.3	3.50	4042	Grey gravelly sandy CLAY	24	17	7	16.6		
TP.6	1.50	4052	Mottled reddish brown sandy CLAY with gravel	28	18	10	14.7		


Lower Plasticity Range
Low
Upper Plasticity Range
Intermediate
High
Very High
Extremely High
Plasticity Index (%)
70
60
50
40
30
20
10
6
0
CL
CI
CH
CV
CE
ME
MV
MH
ML
MI
A-Line
"C" = Clay
"M" = Silt
"O" = Organic
0
10
20
30
40
50
60
70
80
90
100
110
120
Liquid Limt (%)

APPENDIX III SITE PLAN


FRONT SECTION OF PAROCHIAL
HOCKERILL AVE
B.H.1.
B.H.2.
B.H.3.
T.P.1.
T.P.2.
T.P.3.
T.P.5.
T.P.6.
Pavilion
Pitch 3
Pitch 4
Parking
Embankment
89.00
88.50
87.50
87.00
86.50
86.00
85.50
85.00
84.50
84.00
83.50
83.00
82.50
82.00
81.50
81.00
80.50
80.00
79.50
79.00
78.50
78.00
77.50
77.00
76.50
76.00
75.50
75.00


FRONT S.
KNOCKFREE AVE
B.H.1.
T.P.2.
B.H.2.
B.H.3.
T.P.1.
T.P.5.
T.P.6.
T.P.4.
DRIVE



Rev.	Date	Description	By	Ch'd	App.
A	9.6.96	ISSUED FOR INFORMATION			

Malachy Walsh and Partners
Consulting Engineers
Boreenmanna Rd. Cork.
Park House, 21 Denny Street Tralee
54 Old Street, London ECIV9AL

Project: PROPOSED PITCHES AT KNOCKFREE AVE. CORK

Scales		
Drawn		9.7.96
Ch'd(D.O.)		9.7.96
Ch'd(Eng.)		9.7.96
Approved		9.7.96

Title: SITE LOCATION PLAN.

Drg. No. 3018 / L1
rev. A

93192

TRIAL PIT RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No.

Client: Malachy Walsh and Partners
Date 14-8-96

PIT No. TP1
Sheet 1 of 1
Excavation method: JCB

Ground Level 87.75

Description	Red. Level	Legend	Depth	samples Ref. No.	samples Type	samples Depth	Remarks
TOPSOIL	87.65		0.10				
FILL - soil, clay, timber, rubble, brick, wire, glass	85.95		1.80	4045	D	1.00	
Grey silty gravelly CLAY	85.05		2.70	4046	D	2.00	
Brown gravelly CLAY with cobbles	84.25		3.50	4047	D	3.00	

Observations	Groundwater Conditions
	Pit dry

93196

TRIAL PIT RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No.

Client: Malachy Walsh and Partners
Date 14-8-96

PIT No. TP5
Sheet 1 of 1
Excavation method: JCB

Ground Level 81.50

Description	Red. Level	Legend	Depth	samples Ref. No.	samples Type	samples Depth	Remarks
TOPSOIL	81.30		0.20				
FILL - soil, boulders, clay, gravel, glass, tin				4050	D	1.50	
	79.50		2.00				
Grey-brown gravelly CLAY with cobbles				4051	D	3.00	
	78.00		3.50				

Observations	Groundwater Conditions
	Pit dry

93195

TRIAL PIT RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No.

Client: Malachy Walsh and Partners
Date 14-8-96

PIT No. TP4
Sheet 1 of 1
Excavation method: JCB

Ground Level 82.00

Description	Red. Level	Legend	Depth	samples Ref. No.	samples Type	samples Depth	Remarks
TOPSOIL	81.80		0.20				
FILL - boulders, soil, concrete, bricks, wire, clay, gravel, timber, glass	80.70		1.30	4048	D	1.00	
Grey silty gravelly CLAY with cobbles	80.10		1.90	4049	D	1.70	
ROCK	79.90		2.10				

Observations	Groundwater Conditions
	Pit dry

93194

TRIAL PIT RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No.

Client: Malachy Walsh and Partners
Date 14-8-96

PIT No. TP3
Sheet 1 of 1
Excavation method: JCB

Ground Level 86.75

Description	Red. Level	Legend	Depth	samples Ref. No.	samples Type	samples Depth	Remarks
TOPSOIL	86.65		0.10				
FILL - soil, cobbles, timber, concrete, pottery, wire				4041	D	2.00	
				4042	D	3.50	
	83.55		3.20				
Soft grey sandy gravelly CLAY with some roots	82.75		4.00				

Observations	Groundwater Conditions
	Pit dry

93193

TRIAL PIT RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No.

Client: Malachy Walsh and Partners
Date 14-8-96

PIT No. TP2
Sheet 1 of 1
Excavation method: JCB

Ground Level 88.25

Description	Red. Level	Legend	Depth	samples Ref. No.	samples Type	samples Depth	Remarks
TOPSOIL	88.15		0.10				
FILL - soil, rubble, bricks, timber, clay, tin, wire				4043	D	2.00	
	85.55		2.70	4044	D	3.00	
Grey-brown gravelly CLAY with cobbles							
	84.25		4.00				

Observations	Groundwater Conditions
	Pit dry

93189

BORING RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No. 3634

Client: Malachy Walsh and Partners
Dates: 13-8-96

Borehole No. B1
Sheet No. 1 of 1
Method Cable Tool
Dia. 200mm
Ground Level 88.10

	Description	Red. Level	Legend	Depth m	samples Ref. No.	Type	Depth	Field Tests
	TOPSOIL	87.90		0.20				
1	FILL - Brown sandy gravelly CLAY with cobbles and roots				4031	D	1.00	(1.00m) N = 22
2					4032	D	2.00	(2.00m) N = 21
3		85.00		3.10	4033	D	3.00	(3.00m) N = 24
4	Grey-brown sandy gravelly CLAY				4034	D	4.00	(4.00m) N = 31
5		83.00		5.10	4035	D	5.00	(5.00m) N = 26
6	Brown gravelly CLAY with cobbles				4036	D	6.00	
7		81.10		7.00				(7.00m)
	Obstruction (Presumed Rock)	80.70		7.40	4037	D	7.10	N = 34/75mm
8								
9								
10								

Remarks

Chiselling: 1.00-3.00m 1 hr.
7.00-7.40m 2 hrs.

Water level observations

Date	Hole Depth	Cased Depth	Water Depth	Remarks
13/08/96	7.00	7.00	7.00	Water strike
	7.00	7.00	4.20	30 mins.
	7.40	0.00	4.00	end of boring

Driller:

Sample/Test Key : U - tube sample. D - disturbed sample. W - water sample. S - SPT. C - CPT. R - Refusal. V- vane.

93190

BORING RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No. 3634

Client: Malachy Walsh and Partners
Dates: 13-8-96

Borehole No. B2
Sheet No. 1 of 1
Method Cable Tool
Dia. 200mm
Ground Level 85.75

	Description	Red. Level	Legend	Depth m	samples Ref. No.	samples Type	samples Depth	Field Tests
	TOPSOIL	85.45		0.30				
1	FILL - soil, bricks, cobbles, concrete, clay							(1.00m) N = 34
2					4038	D	1.50	(2.00m) N = 16
		83.35		2.40				
3	Grey silty gravelly CLAY				4039	D	3.00	(3.00m) N = 20
		82.65		3.10				
4	Brown gravelly CLAY and COBBLES				4040	D	3.70	
		81.85		3.90				
	Obstruction (Presumed Rock)	81.55		4.20				(4.20m) N = R
5								
6								
7								
8								
9								
10								

Remarks

Chiselling: 0.00-3.00m 1.5hrs
3.90-4.20m 1hr.

Water level observations

Date	Hole Depth	Cased Depth	Water Depth	Remarks
13/08/96	3.90	3.90	3.90	water strike
	3.90	3.90	2.30	30 mins.
	4.20	0.00	2.00	end of boring

Driller:

Sample/Test Key : U - tube sample. D - disturbed sample. W - water sample. S - SPT. C - CPT. R - Refusal. V- vane.

93197

TRIAL PIT RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No.

Client: Malachy Walsh and Partners
Date 14-8-96

PIT No. TP6
Sheet 1 of 1
Excavation method: JCB

Ground Level 72.50

Description	Red. Level	Legend	Depth	samples Ref. No.	samples Type	samples Depth	Remarks
TOPSOIL with cobbles	72.10		0.40				
Mottled reddish brown sandy CLAY with gravel, cobbles and boulders				4052	D	1.50	
				4053	D	3.00	
	69.00		3.50				

Observations	Groundwater Conditions
	Pit dry

93191

BORING RECORD

I.G.S.L.

Contract: Knockfree Avenue, Cork
No. 3634

Client: Malachy Walsh and Partners
Dates: 14-8-96

Borehole No. B3
Sheet No. 1 of 1
Method Cable Tool
Dia. 200mm
Ground Level 76.25

	Description	Red. Level	Legend	Depth m	samples Ref. No.	Type	Depth	Field Tests
	TOPSOIL	76.05		0.20				
1	FILL - clay, gravel, cobbles, boulders, timber							(1.00m) N = 22
					4054	D	1.50	
2								(2.00m) N = 21
		73.85		2.40				
3	Brown gravelly CLAY with cobbles and boulders				4055	D	3.00	(3.00m) N = 25
4								
5					4056	D	5.00	(5.00m) N = 19
6								
					4057	D	6.50	
7		69.25		7.00				
	Obstruction (Presumed Rock)	68.85		7.40				(7.40m) N = R
8								
9								
10								

Remarks

Chiselling: 0.00-7.40m 3 hrs.

Water level observations

Date	Hole Depth	Cased Depth	Water Depth	Remarks
14/08/96	7.00	7.00	7.00	water strike
	7.00	7.00	5.90	30 mins.
	7.40	0.00	5.00	end of boring

Driller:

Sample/Test Key : U - tube sample. D - disturbed sample. W - water sample. S - SPT. C - CPT. R - Refusal. V- vane.

APPENDIX G

IRISH WATER RISK ASSESSMENT CORRESPONDENCE

From: John Leamy
Sent: Wednesday 19 February 2020 12:34
To: Arthur. Robert (ESB Networks)
Cc: HQDWcompliance ; Niall Horgan ; Katherine Walshe
Subject: RE: ESB enquiry regarding risk to water supply from cable fluid leaks

Dear Robert,

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,

John Leamy
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]

Pesticide awareness – the protective foil of a pesticide container can contain enough product to cause a pesticide exceedance along a 30km stretch of a stream!