Verde Environmental Consultants

Preliminary Site Assessment Report for Sallynoggin Road, Sallynoggin, Co. Dublin

ESB Site Ref: 26
Deansgrange - Sallynoggin 38kV

March 2020

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LIMITATION

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

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

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EXECUTIVE SUMMARY

This preliminary environmental site assessment consists of a review of the potential environmental impacts associated with a hydrocarbon leak from a power cable adjacent to the Sallynoggin Road, Co. Dublin (ESB Ref: 26 Deansgrange - Sallynoggin).There was an approximate volume of 3,468 litres of cable fluid, consisting of linear alkyl benzene, lost to ground from the leak point located close to the junction of Sallynoggin Road and Pearse Street. The leak began in March 2017 and was repaired in February 2019 with an estimated loss of 144 litres/month over this 24-month period.

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.

The leak point is understood to have occurred inside the car park boundary wall of a commercial premises that runs parallel to the Sallynoggin Road. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining. The tarmacadam surface at the leak point was in excellent condition on the day of the site visit.

Land use in the immediate vicinity of the leak location is predominantly commercial, with warehouse type showrooms and large commercial outlets.

Bedrock geology in the area comprises granite, which is overlain by subsoil comprising glacial till derived from limestone and granite. A made ground layer above the natural soils is ubiquitous across the area. According to the GSI, groundwater vulnerability is moderate, indicating that the low permeability subsoils provide some natural protection to the underlying bedrock aquifer. A site investigation carried out at Holy Child Community School located approximately 320m south east of the leak point in July 1969 show subsoil thicknesses of 2 – 2.56m indicating Extreme vulnerability.

The nearest surface water courses are the Monkstown Stream, located approximately 374m to the north west, which appears to flow in a north easterly direction and is partially culverted. The Deansgrange Stream is located 1.17km to the southwest of the site flowing in a south easterly direction eventually draining into the Irish Sea approximately 3.83km to the south east of the site. Groundwater in the bedrock aquifer (particularly in the upper weather zone) is likely to be flowing in a north westerly direction following site topography.

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

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

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

There is no risk posed by LAB to:

- Surface waters in the wider surrounding area. The Monkstown Stream is the nearest watercourses to the project area and there is no hydrogeological pathway connecting the project area to this watercourse. Hence there is no link to the SPA.

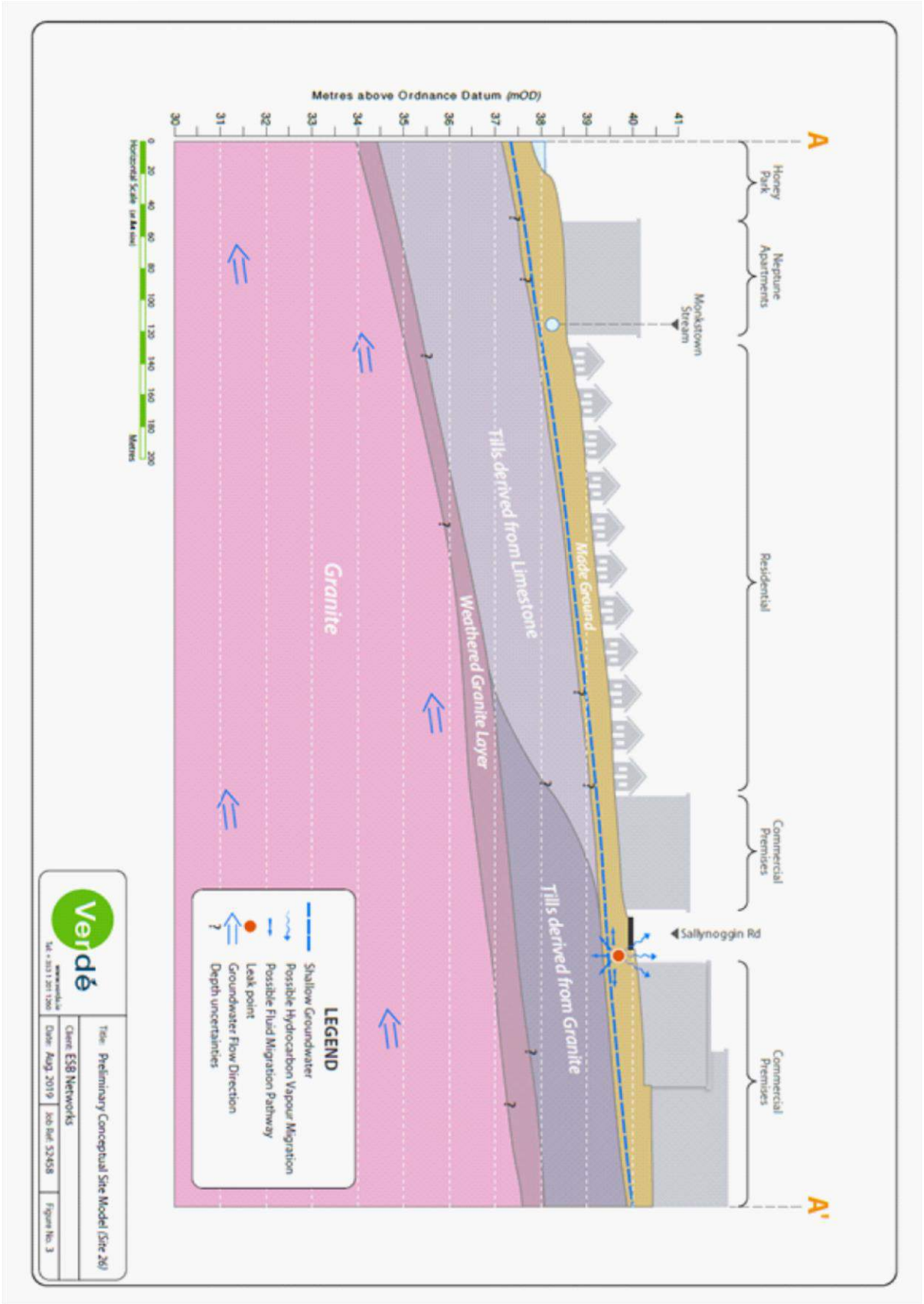
There is a Low risk posed by LAB from contact with suspected contamination in the soil and groundwater through:

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

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

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

Figure 3 – Conceptual Site Model



	EPA Contaminated Land & Groundwater Risk Assessment Methodology	Report Reference	Report Date	Status
	STAGE 1: SITE CHARACTERISATION & ASSESSMENT			
1.1	**PRELIMINARY SITE ASSESSMENT**	Preliminary Report, Verde, Ref: 52458	6th March 2020	Final
1.2	**DETAILED SITE ASSESSMENT**			
1.3	**QUANTITATIVE RISK ASSESSMENT**			
	STAGE 2: CORRECTIVE ACTION FEASIBILITY & DESIGN			
2.1	**OUTLINE CORRECTIVE ACTION STRATEGY**			
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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 at locations where there were leaks of cable fluids. This report focuses on a hydrocarbon leak from a 38 kV power cable on Sallynoggin Road, Co. Dublin. (ESB Ref: 26 Deansgrange – Sallynoggin 38kV).

A site visit was undertaken by an experienced Verde Environmental Consultant on 31st July 2019 to examine the area of the known cable leak point in relation to any observed evidence of contamination and surrounding land uses and sensitive human health and environmental receptors.

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

1.2. BACKGROUND INFORMATION

The 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 impacts associated with a hydrocarbon leak from a power cable on Sallynoggin Road, Co. Dublin (ESB Ref: 26).

There was an approximate volume of 3.468 litres (l) of cable fluid consisting of linear alkyl benzene (LAB) lost to ground from the leak on Sallynoggin Road at an approximate rate of 144l/month for 24 months. The leak was reported to have started in March 2017 and were repaired in February 2019.

The preliminary site conceptual model illustrating the contamination source, possible pathways and receptors is presented in Figures 3 and 4 and discussed in detail in this report.

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

This report has been prepared in accordance with the EPA guideline reporting template for

Preliminary Site Assessments under the EPA Contaminated Land & Groundwater Risk Assessment Methodology.

1.4. SCOPE OF WORKS

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

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

1.5. SCOPE OF ANALYSIS AND CONCLUSIONS

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

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

2. SOURCE AUDIT FINDINGS – PRODUCTION & OPERATIONAL HISTORY

2.1. CURRENT SITE OPERATIONS

The known leak point (ESB Ref: 26) is located close to the junction of Sallynoggin Road and Pearse Street in the administrative area of Dun Laoghaire-Rathdown (Photo 4). Sallynoggin Road is dominated by large commercial units and showrooms on its northern side and smaller commercial premises and residential units on its southern side. According to maps provided, the leak occurred within the carpark area of Davies Bathroom and Tile Design showrooms, which occupies a long-established, warehouse-type premises with a main entrance off Pearse Street just southeast of the junction with Sallynoggin Road. There is a cluster of shops on the Sallynoggin Road opposite the intersection with Pearse Street including a Centra, a pharmacy and a pizza take away. Adjacent to these shops almost directly across the road from the leak site is a car park associated with a large Power City outlet.

The leak is understood to have occurred inside the car park boundary wall which runs parallel to the Sallynoggin Road (Photos 1-2) and is believed to have been on-going for a period of up to 24 months before it was repaired in February 2019. Surfacing of the car park in this area is in excellent condition and further repairs were observed to a low wall (0.5m) which is topped with metal bars. This wall separates the premises from the pavement of the Sallynoggin Road (Photo 3). The surface of the car parking area at the leak lcoation is circa. 2m higher than the concrete pavement immediately beyond the low boundary wall. There is a large, mature tree close by in the corner of the car park within a surrounding gravel/soil bed.

The underground cable route follows the direction of the road in a north easterly direction albeit the route appears to be located inside boundaries of premises that front onto the road (Photos 5-6 indicate north eastward route). The terrain generally rises in this direction towards a major roundabout approximately 400m north of the leak point.

To the north of the Davies showrooms is a second entrance to a car park serving the outlet. Some damage to the tarmacadam surfacing was observed (Photo 6). A large Woodies premises is to the north of the Davies showroom and the line of the cabling is suspected to run inside a low boundary wall which separates an overflow car park from a grass verge (circa. 3m wide), pathway and the Sallynoggin Road. A bare patch was noted along the verge adjacent to the low wall (Photos 7-8). The tarmacadam surface of the overflow carpark is circa. 0.3m higher than the ground level of the grass verge. A red mark on the wall is adjacent to the area of grass loss. There was no associated odour or notable staining of the wall itself. The cable crosses the wide entrance roadway leading to Woodies and continues inside the boundary wall of M. Kelly interiors (single storey, warehouse-type building). There are several services along the pavement on this side of the Sallynoggin Road notably eircom cables, gas, storm drainage and water services which could potentially act as conduits for leak that has occurred.

A laneway separates M. Kelly Interiors from an adjacent large Lidl store, which has been recently developed and includes a ground level covered car park. The fluid filled cable diverts up this laneway to the Sallynoggin 38kV substation (Photo 9). A location along this laneway is a marker point from the leak point which is 200m to the southwest. The entrance to the sub-station is circa. 75 metres from the Sallynoggin Road and is shown on Photo 10. The substation includes two transformers and a control room and has concrete and some gravel surfacing.

Directly across the road from M. Kelly and Lidl is a row of single storey cottages approximately 50m from the leak site. Overhead cabling runs alongside the northern side of Sallynoggin Road.

To the south of the leak point in Davies Showroom car parks, the route of the cabling cross to the north side of the Sallynoggin Road, close to the junction with Pearse Street (Photo 14), before entering Wood Park a small communal park associated with the adjacent residential estate (O'Rourke Park). There was no evidence of leakage observed along this section (Photos 15-16). After traversing Wood Park, the cable route veers to the northwest and passes through a narrow alley that links to additional area of the residential estate (Photo 17).

Closer to the known leak point the Cobble-lock pavement is new, possibly associated with the recent Aldi development, adjoining southern boundary of Davies property.

2.2. PREVIOUS SITE OPERATIONS

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

2.3. CHEMICALS OF POTENTIAL CONCERN (COPC)

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

2.3.1 Linear Alkyl Benzenes

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

- low solubility (0.041mg/l), which means it doesn't mix with water easily;
- low to moderate volatility with the MSDS providing that the compound should not present an inhalation hazard under ambient conditions and that exposure to vapour or oil mists may irritate the mucous membranes and cause dizziness, headaches and nausea;
- Strongly absorbs to soil and combined with its low solubility means it generally has low mobility in the water environment;
- Its preference in soil will be to remain as free product or sorb to soil with a smaller proportion in the vapour phase;
- It will form a Light Non-Aqueous Phase Liquid (LNAPL) on water;
- It is readily biodegradable under aerobic conditions in both water and soil, with a half life in soils of 15.3 days and less than 28 days in water. Half-life is the time required for a quantity to reduce to half of its initial value (REACH database, 2011);
- Does not bio accumulate;
- The Predicted No Effect Concentration (PNEC) is the concentration of a chemical which marks the limit at below which no adverse effects of exposure in an ecosystem are measured. LAB is toxic to the water environment with a PNEC aqua (freshwater) of 0.001mg/l: PNEC soil terrestrial organisms of 0.329mg/kg and PNEC sediment of 1.65mg/kg for freshwater sediment and 0.165mg/kg for marine sediments (REACH database, 2011).

3. SITE ENVIRONMENTAL SETTING

3.1. GENERAL INTRODUCTION

The area of interest is located close to the junction of the Sallynoggin Road with Pearse Street, as presented in Appendix A. The land use in the general area is a mixture of residential and commercial/enterprise. The immediate area of the leak location is dominated by large commercial units and showrooms to the north and smaller commercial premises and residential units to the south.

The land use in the general area is a mixture of residential and commercial/enterprise. The nearest residential property is located approximately 50m to the north west of the leak point. There is extensive residential development in the area as evident from aerial photographs and Dublin City Council Development Plan map, as presented in Appendix B.

The Monkstown Stream is located approximately 374m to the north-west of the site and it appears to be partially culverted. The stream flows in an open channel through the rear of houses on Carrickbrennan Road and Pakenham Road before entering a large diameter culvert (900mm diameter), which carries the stream under Pakenham Road and down to the sea outfall adjacent to the West Pier Pumping Station (Dun Laoghaire Harbour). This stream has not yet received a status or risk rating under the Water Framework Directive There is another stream (Deansgrange Stream) located approximately 1.17km to the west of the site which flows in a south easterly direction draining directly into the sea. This stream is part of the Loughlinstown Lower catchment (IE_EA_10_1570) which has been assigned “Poor” status and has also been categorised as being at risk of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E.

The Monkstown Stream flows into Dublin Bay at the location of the West Pier Pumping Station at Dun Laoghaire Harbour. Proximal to this outflow are several protected ecological sites, including; the South Dublin Bay and River Tolka Estuary SPA (Site Code: 4024), South Dublin Bay SAC (Site Code: 210) and the South Dublin Bay pNHA (Site Code: 210). These protected sites are located approximately 3.3km downstream of the nearest point of Monkstown Stream to the leak location. The South Dublin Bay and River Tolka Estuary SPA is designated as a SPA for its role in supporting a number of bird species.

According to the GSI database there are no groundwater wells located within a 2.5km radius of the site. There are no known domestic supply wells or groundwater drinking water protection areas in the vicinity of the site with water supply highly likely to be from the mains, as observed by the presence of water meters at the entrance to the residential properties.

3.2. SITE HISTORY

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

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

Table 3.1 – Site History

History	**National Monuments Service**: There are several monuments of significance within 1km of the area of interest. Located mainly to the south west of the site there are a number of 18th and 19th century houses and a post box dating from the 1920's.
	Historic Mapping: OSI 6 inch map (Black and White) (1837-1842): From this map it is apparent that the road overlying the cable is in place with terraced houses lining the road to the north. The area to the south now occupied by industrial units and Aldi appears to be undeveloped greenfields with large houses dotted throughout the area. OSI 25 inch map (Black and White) (1888-1913): Similar features are evident to those of the previous map with no notable changes. The leak site remains undeveloped and the Sallynoggin Road appears to be in its current position with its northern boundary being lined with houses with large narrow gardens extending further north. Cassini 6 inch (1830-1930): The leak point is still undeveloped greenfields to the south of the Sallynoggin Road. There is now a larger housing development in the area to the north of the Sallynoggin Road. 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 and commercial properties remains largely the same as present times. Aerial Photo 2000: The site and its immediate surroundings remain largely unchanged. Aerial Photo 2005: The site and its immediate surroundings remain largely unchanged. Aerial Photo 2012: The site and its immediate surroundings remain largely unchanged.

3.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

The site is underlain by the pale granite of the North and Upper Liffey Pluton which is overlain of subsoils comprising of tills derived from granite and limestones and made ground (Teagasc). The closest surface water course is the Monkstown Stream located approximately 374m to the north west and the Deansgrange Stream is located 1.17km to the southwest of the site flowing in a south easterly direction eventually draining into the Irish sea approximately 3.83km to the south east of the site.

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

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

- Geological Survey of Ireland
- Environmental Protection Agency data bases
- National Parks and Wildlife Services
- Office of Public Works (flood maps)

Table 3.2 – Site Physical Setting

Feature	Details & Comments
Topography	The area of interest is relatively flat. The regional topography of the area slopes gently to the north toward Dun Laoghaire Harbour and Dublin Bay.
Geology	**Overburden**: The GSI and EPA databases describe the soils at the site as Made Ground with the subsoils in the area consisting of tills derived from limestone with a small pocket of tills derived from granite located directly beneath the leak site.
	Solid Geology: The site is underlain by the pale granites of the Northern and Upper Liffey Valley Pluton comprising granite with microcline phenocrysts.
Hydrogeology	**Regional Classification:** According to the GSI the granite below the area of interest is classified as a Poor Aquifer, bedrock which is generally unproductive except for local zones. Groundwater flow occurs predominantly through fractures, fissures and joints (secondary permeability) in a northerly flow direction towards Dun Laoghaire Harbour and Dublin Bay. This type of aquifer typically has few poorly connected fractures, fissures and joints. The crystalline rock will be less permeable and/or have less zones of high permeability. 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 100mm/year.
	Vulnerability: The vulnerability rating for the aquifer beneath the site is classified as moderate indicating the depth to bedrock can be 5 to 10 metres below ground level (mBGL). The overlying strata are expected to be low permeability glacial deposits.
	Groundwater Body: Under the Water Framework Directive (WFD) the groundwater body beneath the site is Dublin Urban (code: IE_EA_G_005) and is categorised as having Good status.
	Well Search: There are no groundwater wells located within a 2.5km radius of the site, as presented in the desk study maps in Appendix B.
Hydrology	**Surface Water Courses/Abstractions:** There is one surface watercourse within 1km of the area of interest. The Monkstown Stream is located approximately 374m to the northwest of the site flowing in a north westerly

	direction. The Deansgrange Stream is located approximately 1.17 km to the south west of the site and flows in a south-easterly direction draining into the Irish sea south of Dublin Bay approximately 3.83km to the south east of the site.
Geotechnical	There is a geotechnical report available for Holy Child Community School approx. 320m to the south-east of the leakage site, further information in Section 3.4 below.
Protected Areas	**South Dublin Bay and River Tolka Special Protection Area (SPA)** The boundary of this Special Protection Area (SPA) (*site code: 004024*) is located approximately 2.1km to the north west of the project area. This SPA occupies a substantial part of Dublin Bay and comprises extensive intertidal flats which support wintering waterfowl which are part of the overall Dublin Bay population.
	North Dublin Bay (SAC) The boundary of the North Dublin Bay Special Area of Conservation (SAC) (*site code: 000210*) is located approximately 2.1km to the north west of the site.
	Proposed Natural Heritage Area (pNHA) The boundary of the North Dublin Bay pNHA (*site code: 000210*) is located approximately 2.1km to the north west of the site.
Flooding	According to OPW flood mapping the site does not appear to be at risk of any coastal, fluvial or pluvial flooding.
Zoning	The primary land use in this area is residential. There is a small area of land zoned as an open space. Immediately south of the leak site there is a large area of land zoned for Industrial, Enterprise and Employment use.

3.4 SITE GEOLOGY AND HYDROGEOLOGY

There was a site investigation carried out approximately 320m to the east of the leak site at Holy Child Secondary School where 11no. boreholes were drilled to an average depth of 2.56mBGL. The following information was gathered:

Strata	Average Depth Range (mBGL)	Comments	Water Strikes
Topsoil	0 - 0.45		Water strikes in 2no. boreholes which were the deepest, water strikes at 3.35mBGL and 2.74mBGL.
Brown silty stony CLAY	0.46 - 2.06	Becoming increasingly harder with depth	
Weathered granite	2.06 – 2.55		
Granite BEDROCK	2.56		

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

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

The permeable made ground is likely to contain perched groundwater which will be restricted from vertical migration by thick low permeability glacial tills. The low permeability tills were found to be approximately 1.5 to 2m thick in a site investigation close to the site indicating a more Extreme vulnerability rating in the area despite the Moderate vulnerability indicated on GSI map, as presented in the conceptual site model in Figures 3 and 4. The groundwater in the underlying granite bedrock aquifer is likely to be confined or semi-confined by the glacial tills.

The topography of the area as obtained from the GSI database show the leak point is located at approximately 40 metres above ordnance datum (mOD), The topographic contours are orientated approximately north east- south west which infers that the groundwater flow direction is likely to be in a north westerly flow direction, as presented in Figure 2 and within the CSM in Figures 3 and 4.

3.5 SUMMARY OF PREVIOUS SITE SAMPLING AND MONITORING DATA

The made ground within the cable trench is reported to be up to 1.2m deep and contained sand and backfill material. The underlying limestone derived glacial till was found to have a thickness of 2 – 2.6m.

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

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

For the COPC the following can be determined;

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

4 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 PRELIMINARY QUALITATIVE RISK ASSESSMENT (PQRA)

4.1.1 Risk Assessment Methodology

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

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

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

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

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

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

4.2 OUTLINE SITE CONCEPTUAL MODEL

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

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

Source	Pathway	Receptor	Potential Pollutant Linkage (Y/N)	Discussion
Human Health				
Historical leak of cable fluid from an underground power cable comprising of an approximate volume of 3,468 litres of linear alkyl benzene (LAB) (Site 26) Mar 2017 to Feb 2019.	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation.	Residents & other commercial or retail building users	Y	There are residential properties approximately 50m to the north and downgradient of the leak point. Vapour phase migration will follow preferential flow paths, potentially along utility service runs and through more permeable made ground soils and or sand/gravel fractions of soils if present.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce.	Residents & other commercial or retail building users	Y	There are residential properties approximately 50m to the north and downgradient of the leak point. The cable source of leak is at a depth of 0.9m and so direct contact and ingestion pathways are unlikely to be viable unless groundwater levels are near ground surface bringing contamination upwards into shallow soils where direct contact is possible.
PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then permeation through plastic potable water supply pipes and ingestion.	Nearby residents	Y	The water supply pipes could potentially run through contaminated zones. LAB has the potential to permeate through the wall of plastic supply pipes and also through joints and gaskets. An internet search has not identified proven instances where this has occurred elsewhere. Any permeating compounds would be diluted depending on water flows in the pipe. A WHO drinking water standard for hydrocarbons >C10 is 0.09mg/l which exceeds the LAB theoretical solubility limit of 0.041mg/l. Unless NAPL is present within the pipe then this WHO drinking water standard would not be exceeded.

	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation	Workers undertaking any subsurface works	Y	Unlikely to be significant as workers exposed in outdoor air where vapours cannot accumulate to high concentrations. Also, risks are localised areas of contamination which can be managed with the correct PPE and H&S procedures.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Y	Unlikely to be significant as contamination is likely to be localised and can be managed with the correct PPE and H&S procedures.
Environmental – Water Receptors				
Historical leak of cable fluid from an underground power cable comprising of an approximate volume of 3,468 litres of linear alkyl benzene (LAB) (Site 26) Mar 2017 to Feb 2019. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and glacial till soils	Shallow groundwater	Y	LAB present in soils as sorbed and NAPL phases can leach downwards with infiltrating rainwater and soil water movements to groundwater. In groundwater will form LNAPL due to low solubility. There may also be limited dissolved concentrations.
	LAB direct downward migration as NAPL until reaches shallow groundwater where forms LNAPL and with a limited dissolved plume based on low solubilities, then lateral migrations towards surface waters	Monkstown Stream	Y	The Monkstown Stream is 374m north of the site the stream drains to the Irish Sea north of the site. There is a potential pathway from the site to the stream through shallow groundwater migration.
	LAB migration downwards through glacial till to Limestone bedrock aquifer and then lateral migration	Granite bedrock aquifer / Groundwater Users	N	There are no known recorded domestic groundwater abstraction wells located within a 1km radius of the leak point. The surrounding properties are serviced by mains water. Additionally, downward contaminant migration into the limestone will be precluded by depths of glacial till.

4.3 POLLUTANT LINKAGE ASSESSMENT

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

Table 4.2 - Potential Hazard Severity Definition

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

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

Table 4.3 - Probability of Risk Definition

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

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

Table 4.4 - Level of Risk for Potential Hazard Definition

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

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

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

Table 4.5 - Pollutant Linkage Assessment for Linear Alkyl Benzene

Source	Pathway	Receptor	Severity	Likelihood	Risk Level	Comments
Human Health						
Historical leak of cable fluid from an underground power cable comprising of an approximate volume of 3,468 litres of linear alkyl benzene (LAB) (Site 26) Mar 2017 to Feb 2019.	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation	Residents & other commercial or retail building users	Medium	Low Likelihood	Low/Moderate	Has the potential to migrate along preferential pathways such as service trenches. Outside of preferential pathways, contamination will strongly sorb to soil, has low mobility, readily biodegrades under aerobic conditions in both soil and water and does not exist readily in the vapour-phase, consequently the risk to nearby residents is low/moderate.
PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce	Residents & other commercial or retail building users	Medium	Unlikely	Low	The cable source of leak is at a depth of 0.9m and so direct contact and ingestion pathways are unlikely to be viable unless groundwater levels are near ground surface or capillary action brings contamination upwards into shallow soils where direct contact is possible.

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

	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Medium	Unlikely	Low	Risk to workers from localised areas of contamination will be short term and can be managed with the correct PPE and H&S procedures.
Environmental – Water Receptors						
Historical leak of cable fluid from an underground power cable comprising of an approximate volume of 3,468 litres of linear alkyl benzene (LAB)) (Site 26) Mar 2017 to Feb 2019.	LAB partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and glacial till soils	Shallow groundwater	Mild	Low Likelihood	Low	Low risk due to alkyl benzene contamination strongly absorbs to soil, has low mobility, readily biodegrades in aerobic conditions in both soil and water. Shallow groundwater in made ground and glacial till unlikely to be used as an actual resource due low water volumes and location in a residential urban area. Overall risk is low.

PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs, VOCs,	LAB direct downward migration as NAPL until reaches shallow groundwater where forms LNAPL and with a limited dissolved plume based on low solubilities, then lateral migrations towards surface waters	Monkstown Stream	Medium	Unlikely	Low	The Monkstown Stream is 374m north of the site the stream drains to the Irish Sea north of the site. Given the presence of glacial till underlying the project area and its capacity to limit the lateral migration of groundwater and that groundwater underlying the project area is likely to be perched at the base of made ground there is an overall Low risk to the stream.

4.4 SUMMARY OF PRELIMINARY QUANTITATIVE RISK ASSESSMENT

A desktop study and a site walkover were conducted at the Sallynoggin Site in the Dun Laoghaire – Rathdown area of Co. Dublin after there was a volume of 3,468 litres of linear alkyl benzene lost from the cable leak (Site 26) at an approximate rate of 144L/month for 24 months. The leak began in March 2017 and was repaired in February 2019. Results of the PQRA are summarised below:

4.4.1 Human Health:

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

4.4.2 Environmental:

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

4.5 SUMMARY AND CONCLUSIONS

This preliminary environmental site assessment consists of a review of the potential environmental impacts associated with a hydrocarbon leak close to the junction of Sallynoggin Road and Pearse Street in the administrative area of Dun Laoghaire-Rathdown (ESB Ref: 26).

There was an approximate volume of 3,468 litres of cable fluid consisting of linear alkyl benzene lost to ground from the leak point near the junction of Sallynoggin Road and Pearse Street. Leakage was at an estimated rate of 144 litres/month over 24 months (March 2017 to February 2019, the repair date).

The leak is understood to have occurred inside of a boundary wall which runs parallel to the Sallynoggin Road. There is no remaining physical evidence of hydrocarbon contamination at the surface (oil odours/staining). The tarmacadam surface appeared to be in excellent condition.

Granite bedrock is reported to underlie the site. This is overlain by superficial deposits comprising glacial till and made ground. Nearby site investigation data suggests that vulnerability is extreme - moderate, indicating that the presence of low permeability overburden may offer protection to the underlying bedrock aquifer. Groundwater in the bedrock aquifer is understood to flow in a north westerly direction following site topography.

The nearest surface watercourse is the Monkstown Stream located approximately 370m to the north west. There are no groundwater wells or ecologically sensitive receptors located within a 1km radius of the site. Groundwater in the bedrock aquifer is likely to be semi-confined by the thick subsoils with groundwater flow direction in a north to north-westerly direction following site topography.

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

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

There is no risk posed by LAB to:

- Surface waters in the wider surrounding area. The Monkstown Stream is the nearest watercourses to the project area and there is no hydrogeological pathway connecting the project area to this watercourse.

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

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

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

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

In order to further develop the conceptual site model and assess the identified potential risks to sensitive receptors site investigation works are recommended as previously referenced.

5 REFERENCES

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oo0oo

Respectfully submitted

On behalf of Verde Environmental Consultants

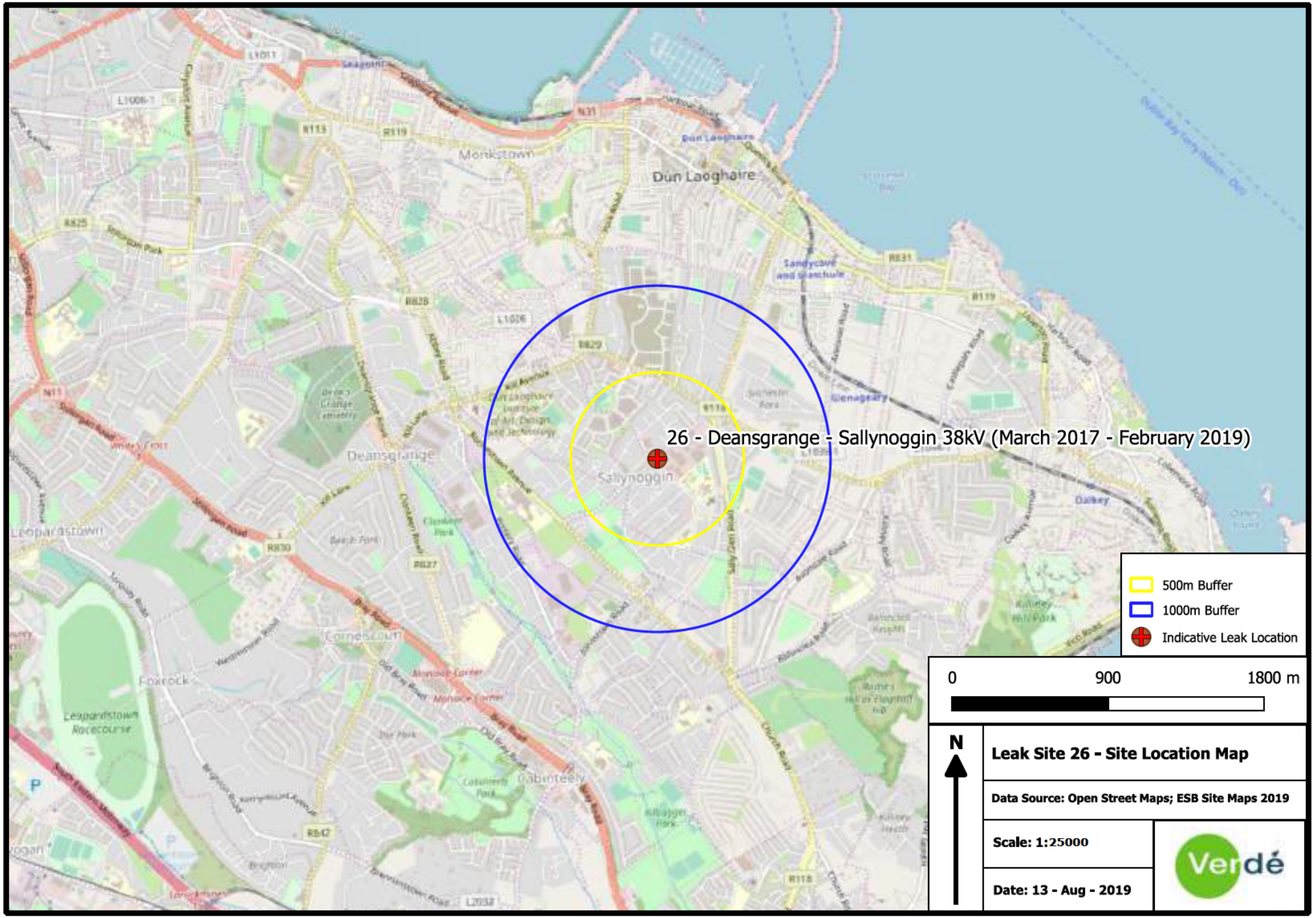
[redacted]

Principal Environmental Consultant

[redacted]

Project Director

FIGURES


26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
Monkstown
Dun Laoghaire
Deansgrange
Sallynoggin
Glenageary
Dalkey
Leopardstown
Foxrock
Carrickmines
Cabinteely
Leopardstown Racecourse
500m Buffer
1000m Buffer
Indicative Leak Location
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900
1800 m
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Leak Site 26 - Site Location Map
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Date: 13 - Aug - 2019
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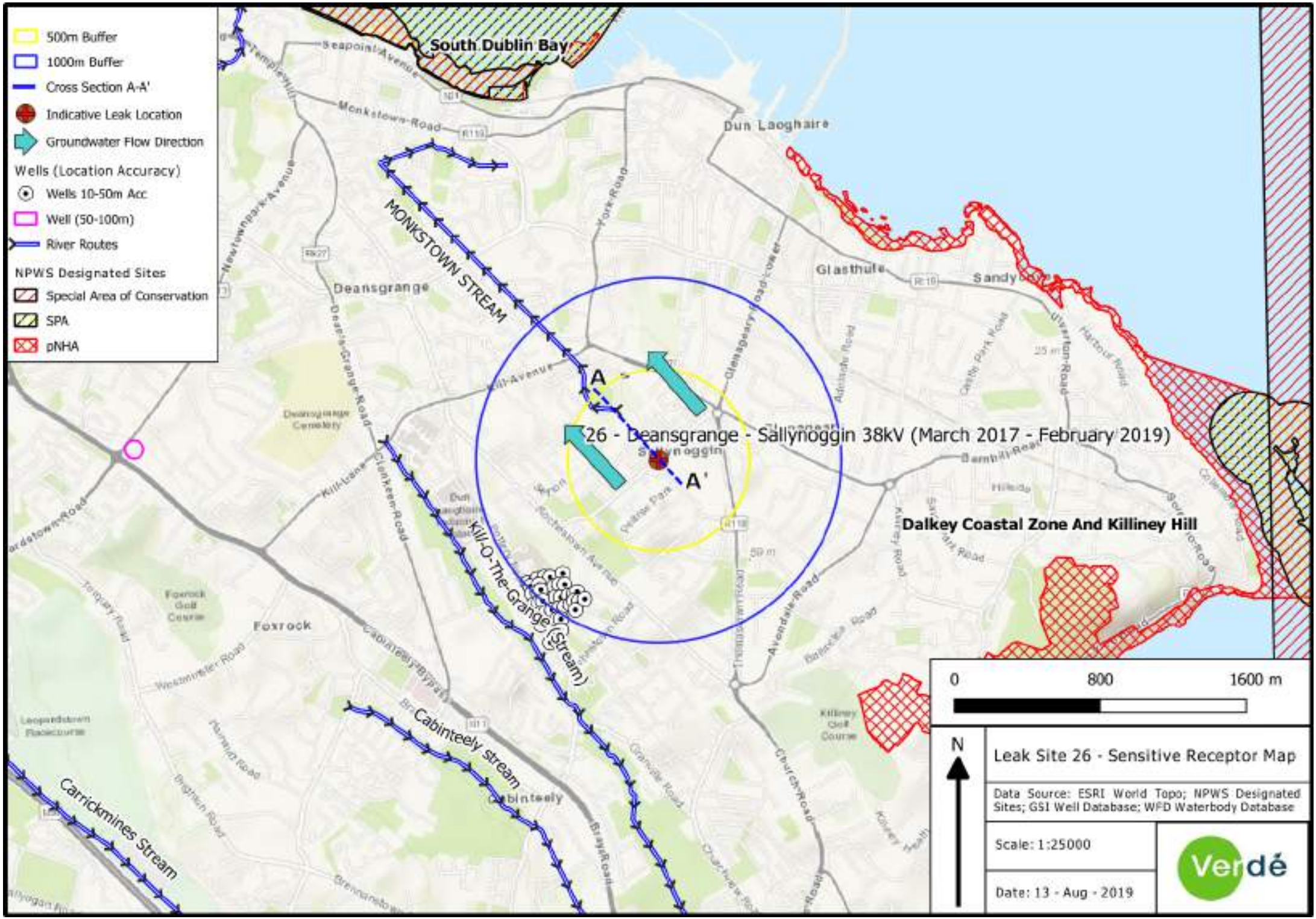
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1000m Buffer
Cross Section A-A'
Indicative Leak Location
Groundwater Flow Direction
Wells (Location Accuracy)
Wells 10-50m Acc
Well (50-100m)
River Routes
NPWS Designated Sites
Special Area of Conservation
SPA
pNHA
South Dublin Bay
Dun Laoghaire
Glasthule
Sandycove
Deansgrange
MONKSTOWN STREAM
A
A'
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
Dalkey Coastal Zone And Killiney Hill
Kill-O-The-Grange (Stream)
Cabinteely stream
Carrickmines Stream
Foxrock
Cabinteely
0
800
1600 m
N
Leak Site 26 - Sensitive Receptor Map
Data Source: ESRI World Topo; NPWS Designated Sites; GSI Well Database; WFD Waterbody Database
Scale: 1:25000
Date: 13 - Aug - 2019
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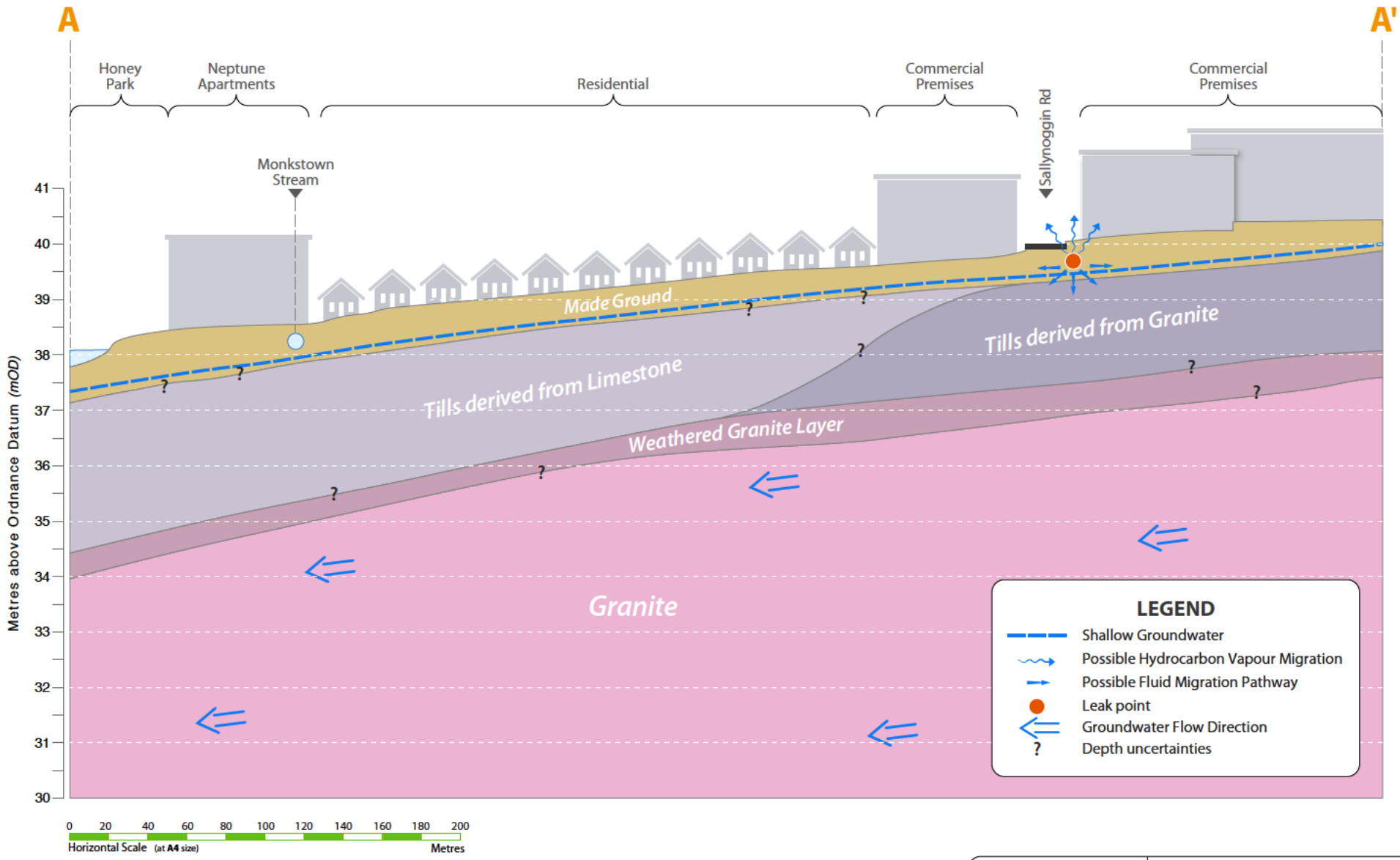

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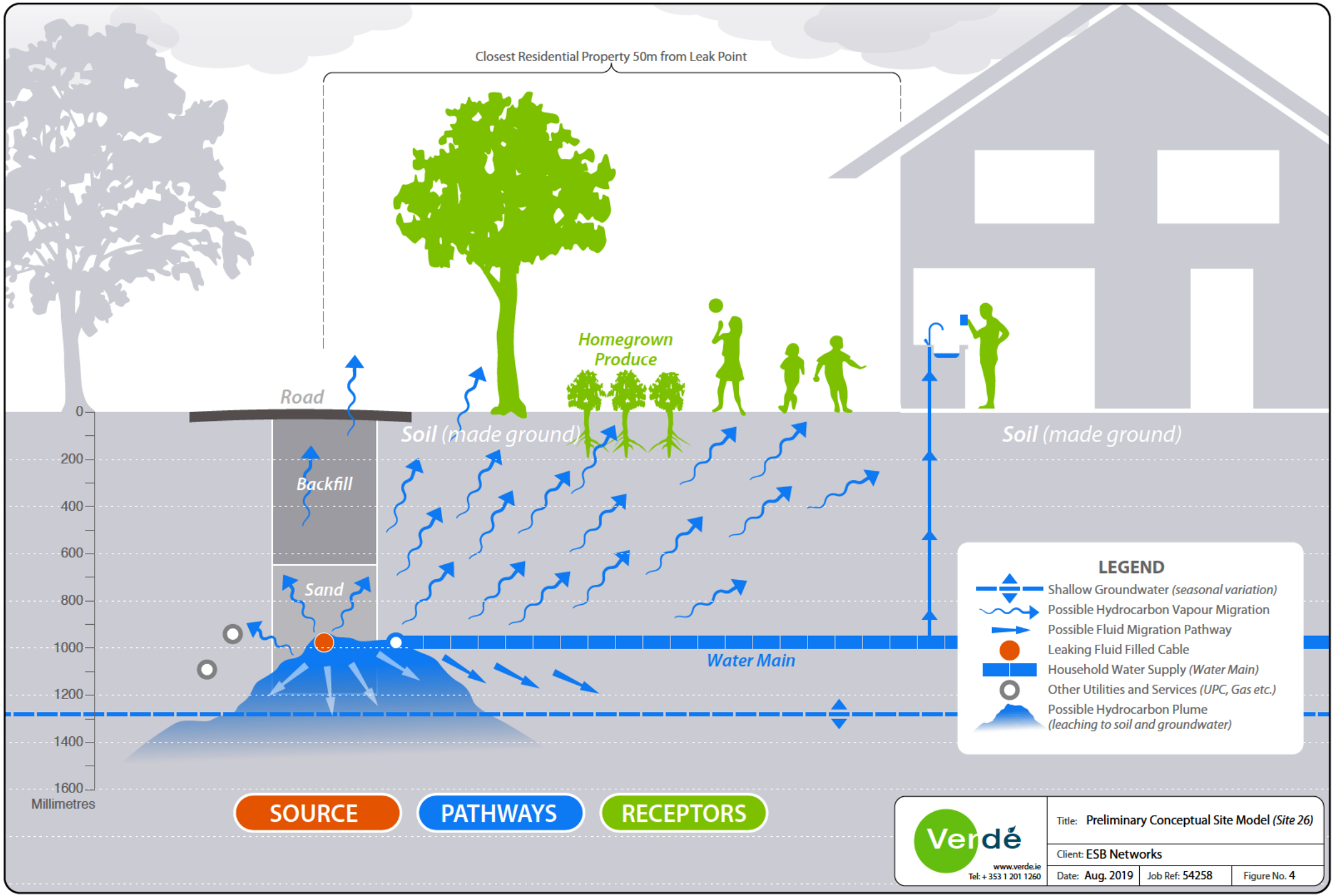
Client: ESB Networks

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



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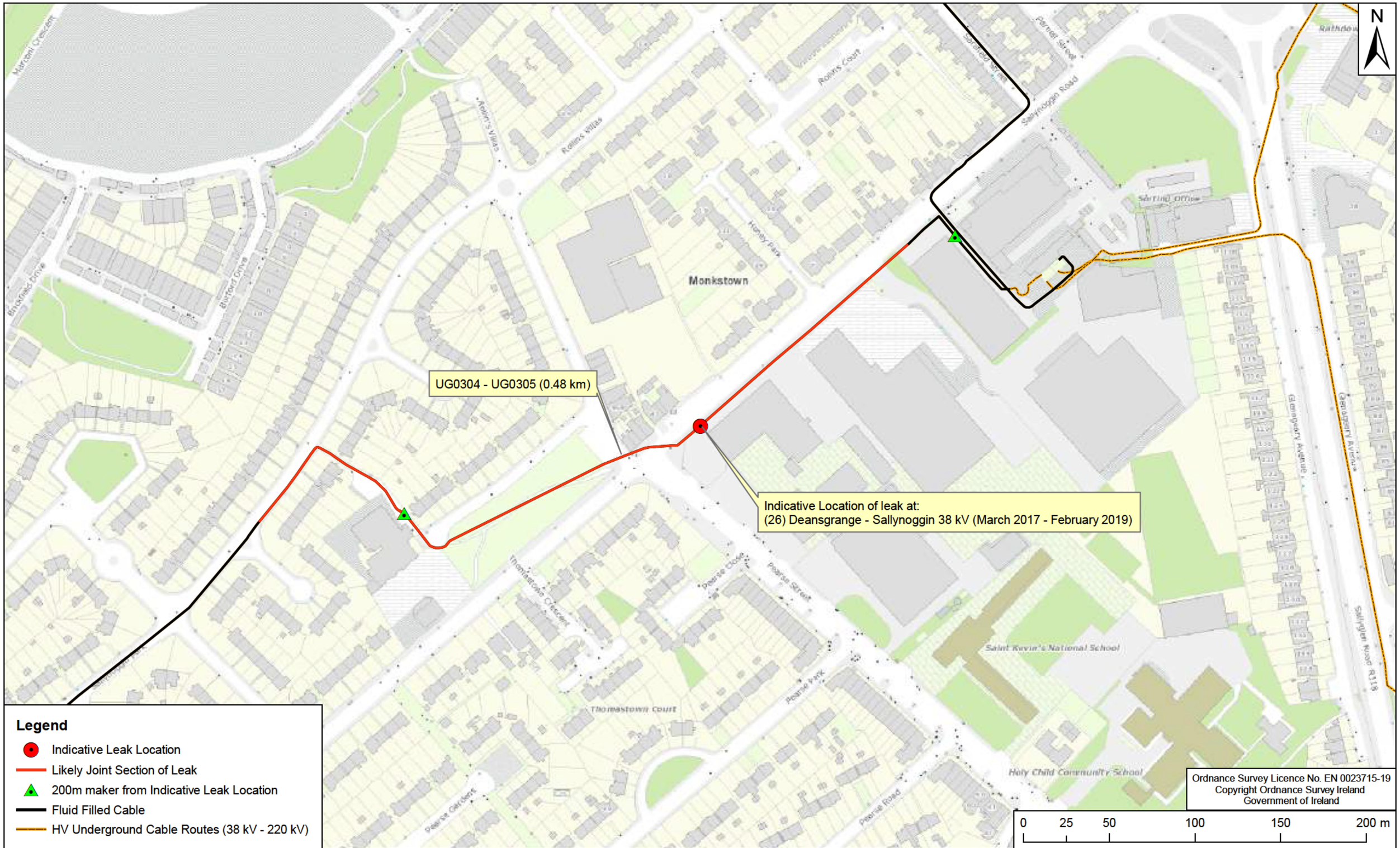
Title: Preliminary Conceptual Site Model *(Site 26)*

Client: ESB Networks

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

APPENDIX A

ESB SITE LAYOUT PLAN WITH INDICATIVE CABLE FLUID LEAKAGE LOCATION



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CLIENT: ESB Networks

PROJECT: P.R.A.

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Indicative Cable Fluid Leakage Locations & Cable Sections (26) Deansgrange - Sallynoggin 38 kV (March 2017 - February 2019)

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DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	24/07/2019

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
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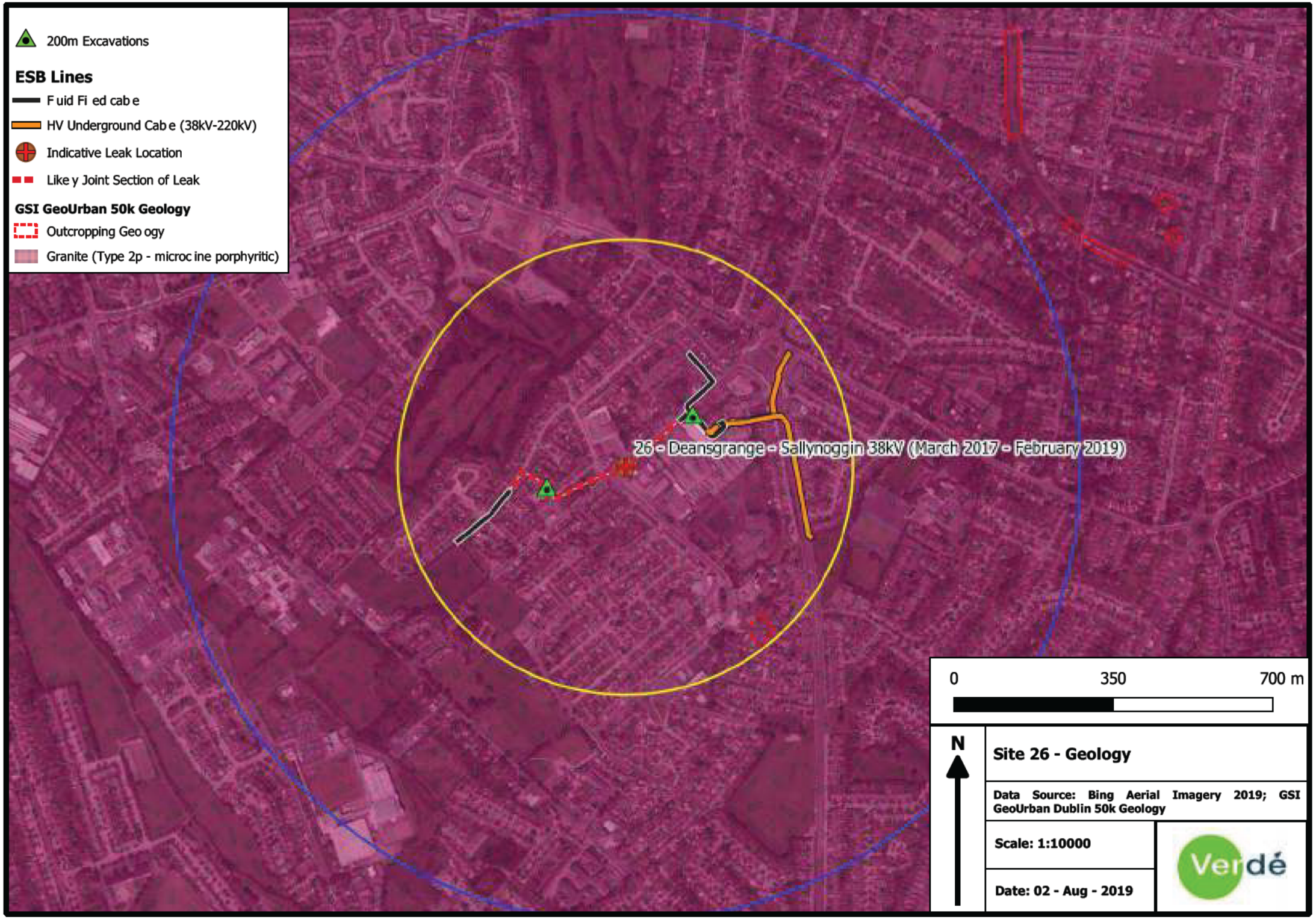
DRAWING NUMBER: QD-354120-01-D460-001-043-000

APPENDIX B

DESK STUDY MAPS


200m Excavations
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
Indicative Leak Location
Likely Joint Section of Leak
GSI GeoUrban 50k Geology
Outcropping Geology
Granite (Type 2p - microcline porphyritic)
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
0
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Site 26 - Geology
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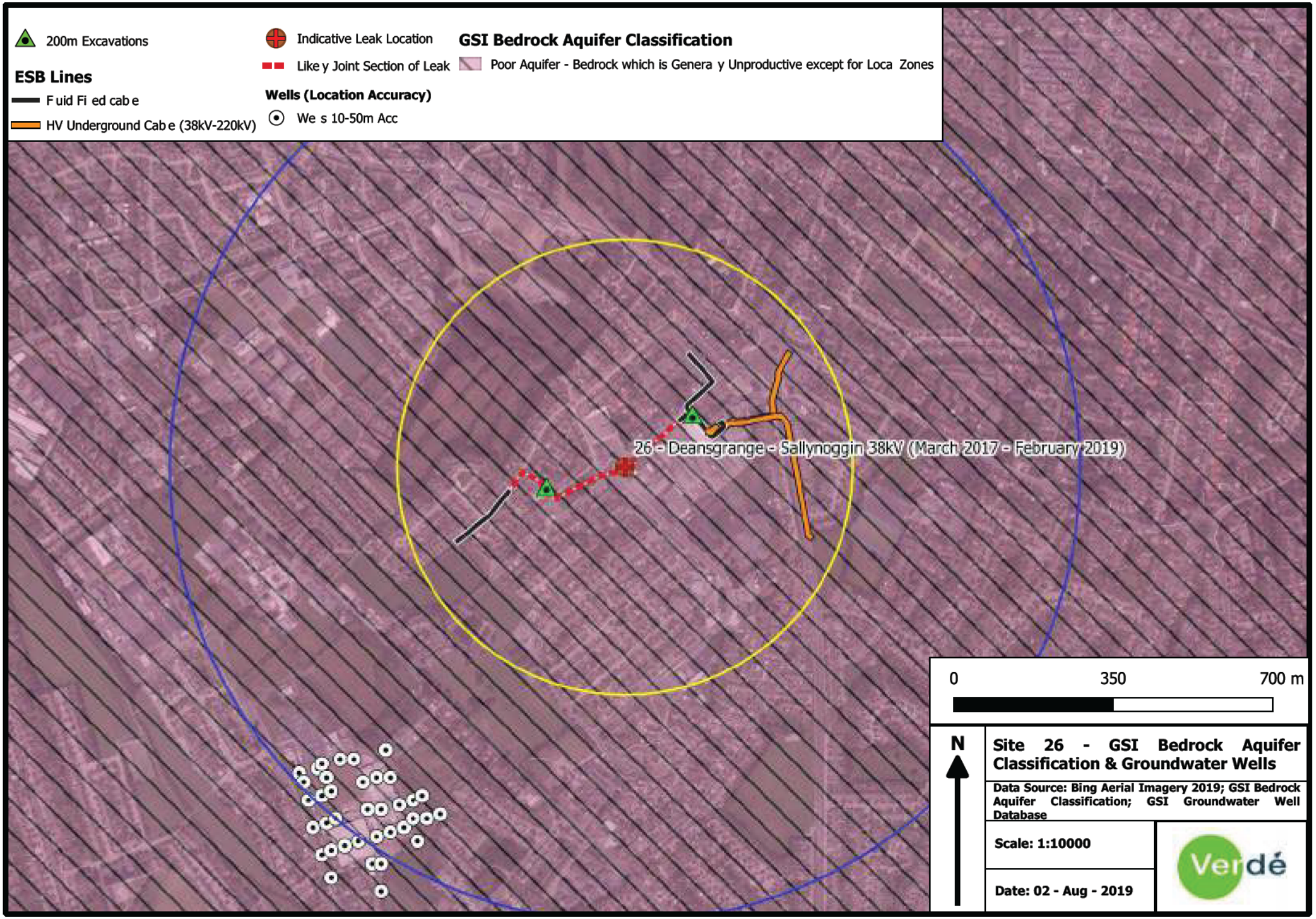
200m Excavations
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
Indicative Leak Location
Likely Joint Section of Leak
Wells (Location Accuracy)
Wells 10-50m Acc
GSI Bedrock Aquifer Classification
Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
0
350
700 m
N
Site 26 - GSI Bedrock Aquifer Classification & Groundwater Wells
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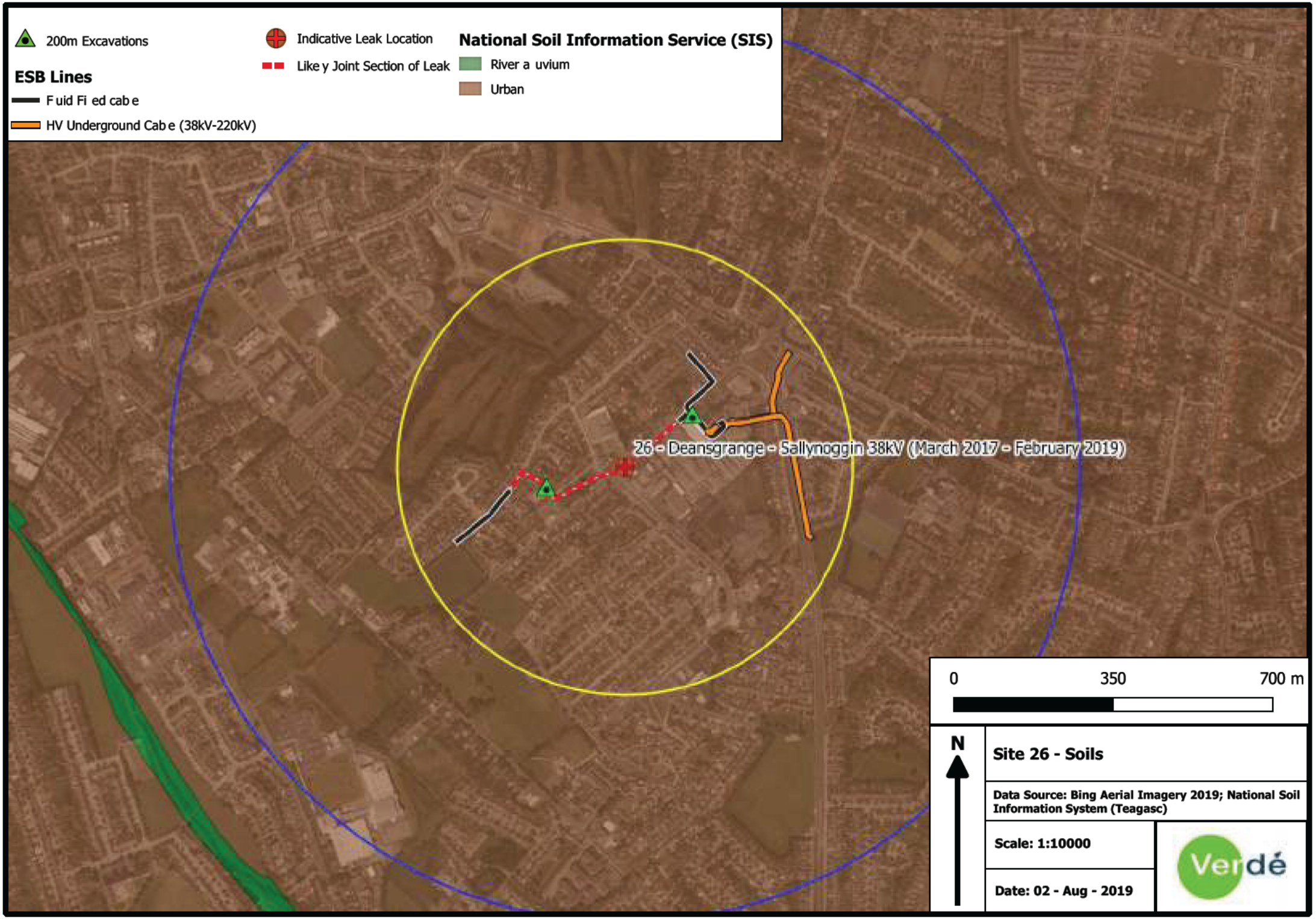
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Indicative Leak Location
Likely Joint Section of Leak
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
National Soil Information Service (SIS)
River alluvium
Urban
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
0
350
700 m
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Site 26 - Soils
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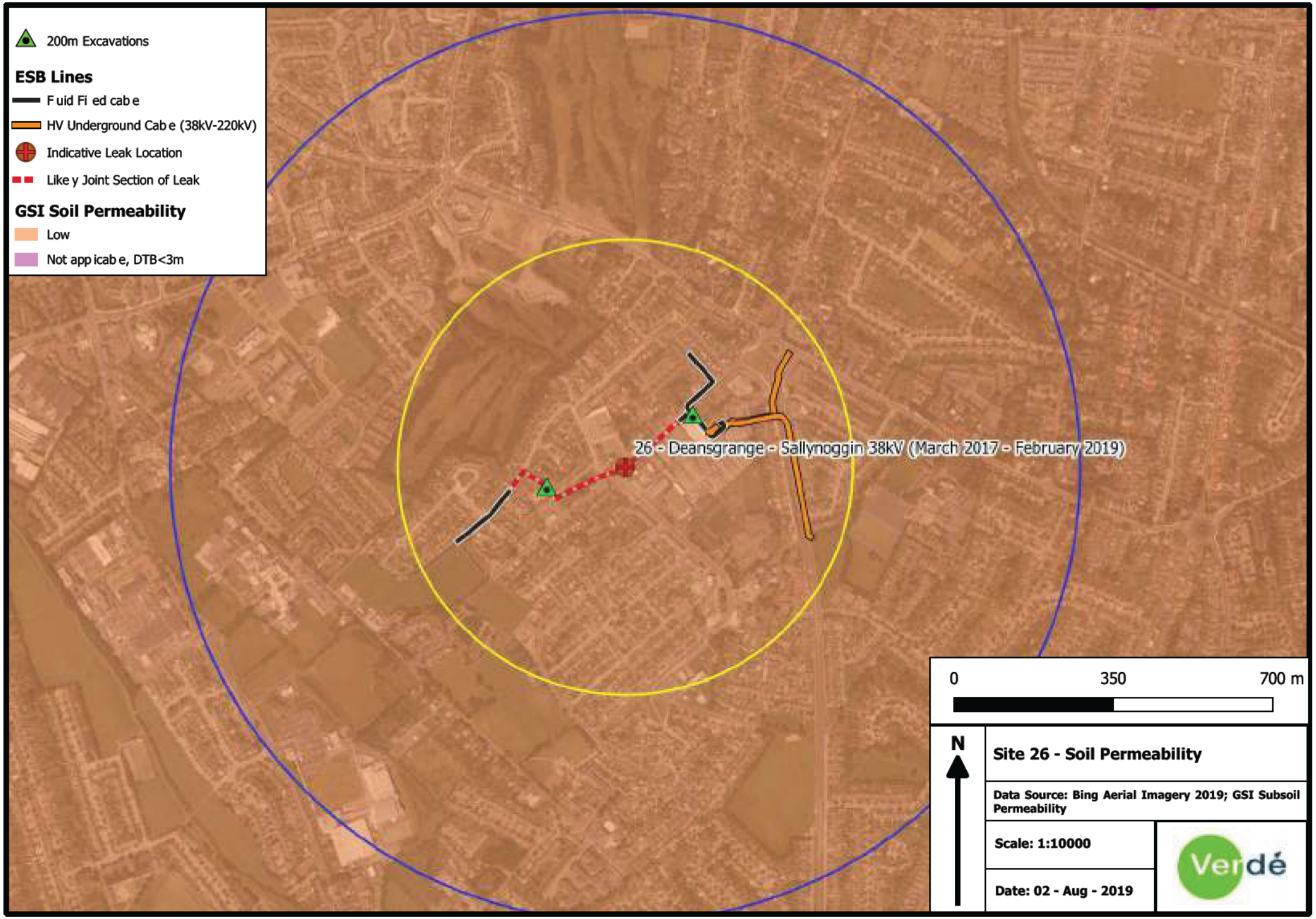
200m Excavations
ESB Lines
Fuid Fi ed cab e
HV Underground Cab e (38kV-220kV)
Indicative Leak Location
Like y Joint Section of Leak
GSI Soil Permeability
Low
Not app icab e, DTB<3m
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
0
350
700 m
N
Site 26 - Soil Permeability
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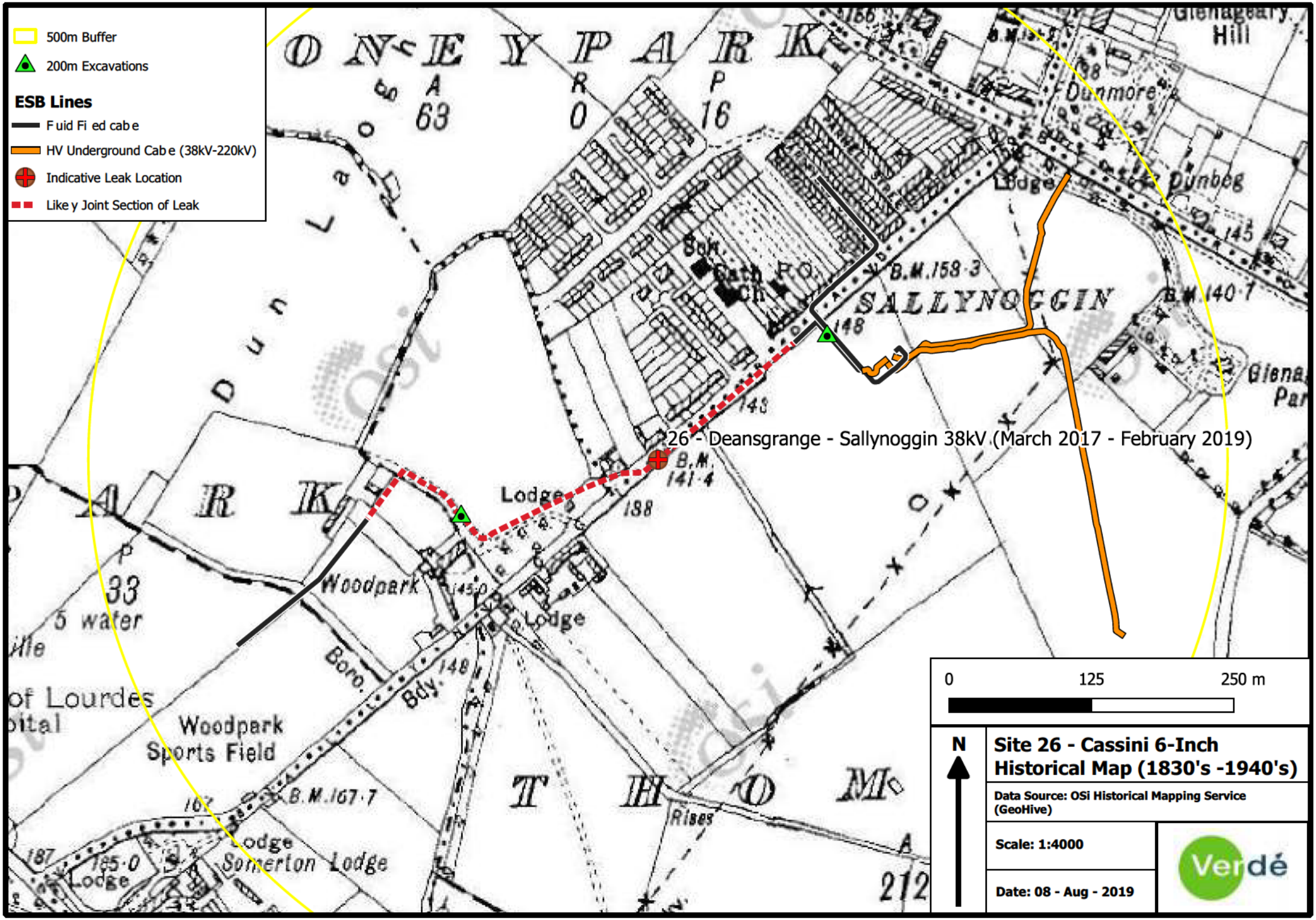
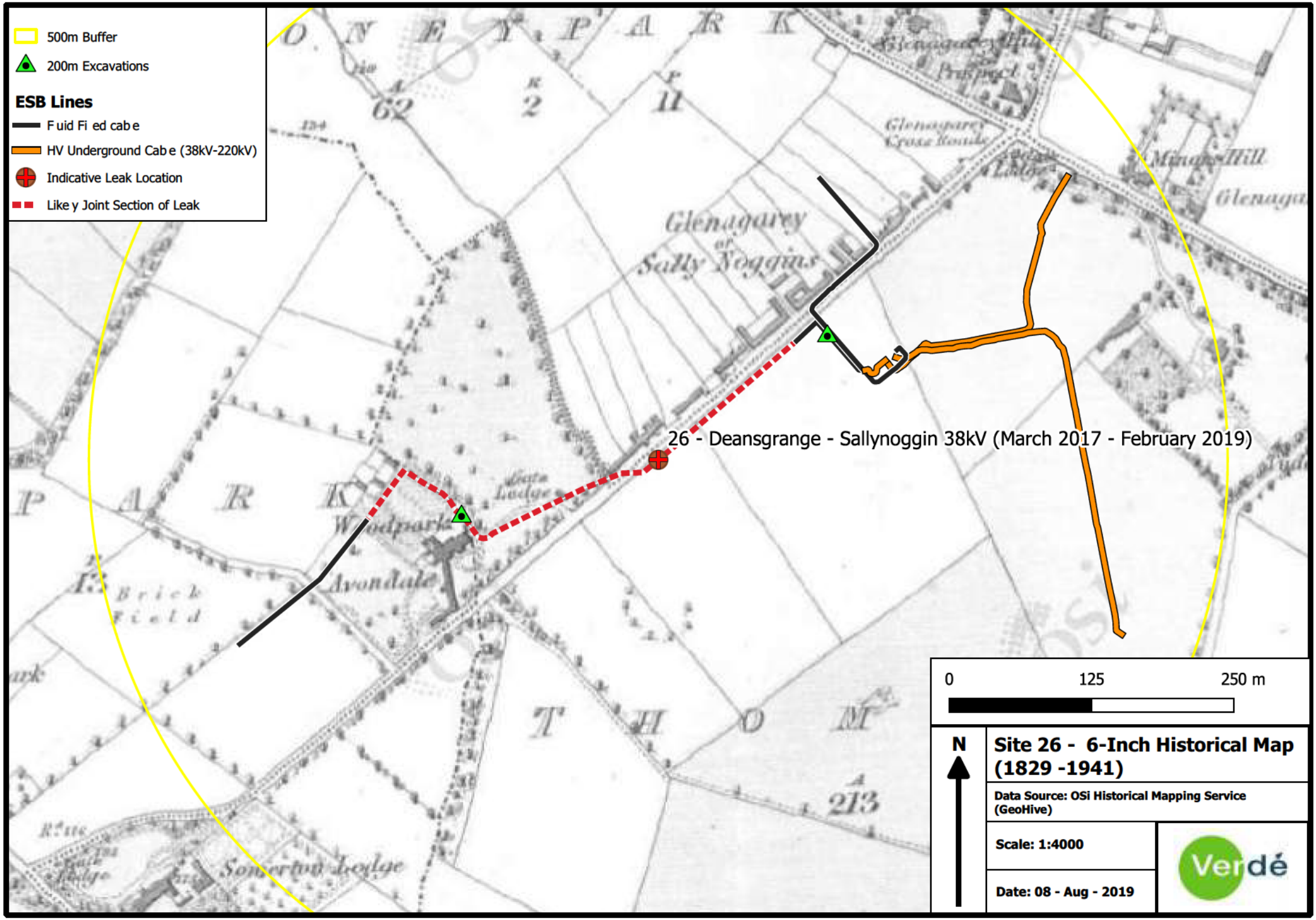

500m Buffer
200m Excavations
ESB Lines
Fuid Fi ed cab e
HV Underground Cab e (38kV-220kV)
Indicative Leak Location
Like y Joint Section of Leak
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
SALLYNOGGIN
Woodpark
Woodpark Sports Field
Somerton Lodge
Dunmore
Dunbeg
Glenageary Hill
0
125
250 m
N
Site 26 - Cassini 6-Inch Historical Map (1830's -1940's)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé


500m Buffer
200m Excavations
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
Indicative Leak Location
Likely Joint Section of Leak
26 - Deansgrange - Sallynoggin 38kV (March 2017 - February 2019)
Glenagarey or Sally Noggins
Woodpark
Avondale
Brick Field
Somerton Lodge
0
125
250 m
N
Site 26 - 6-Inch Historical Map (1829 -1941)
Data Source: OSi Historical Mapping Service (GeoHive)
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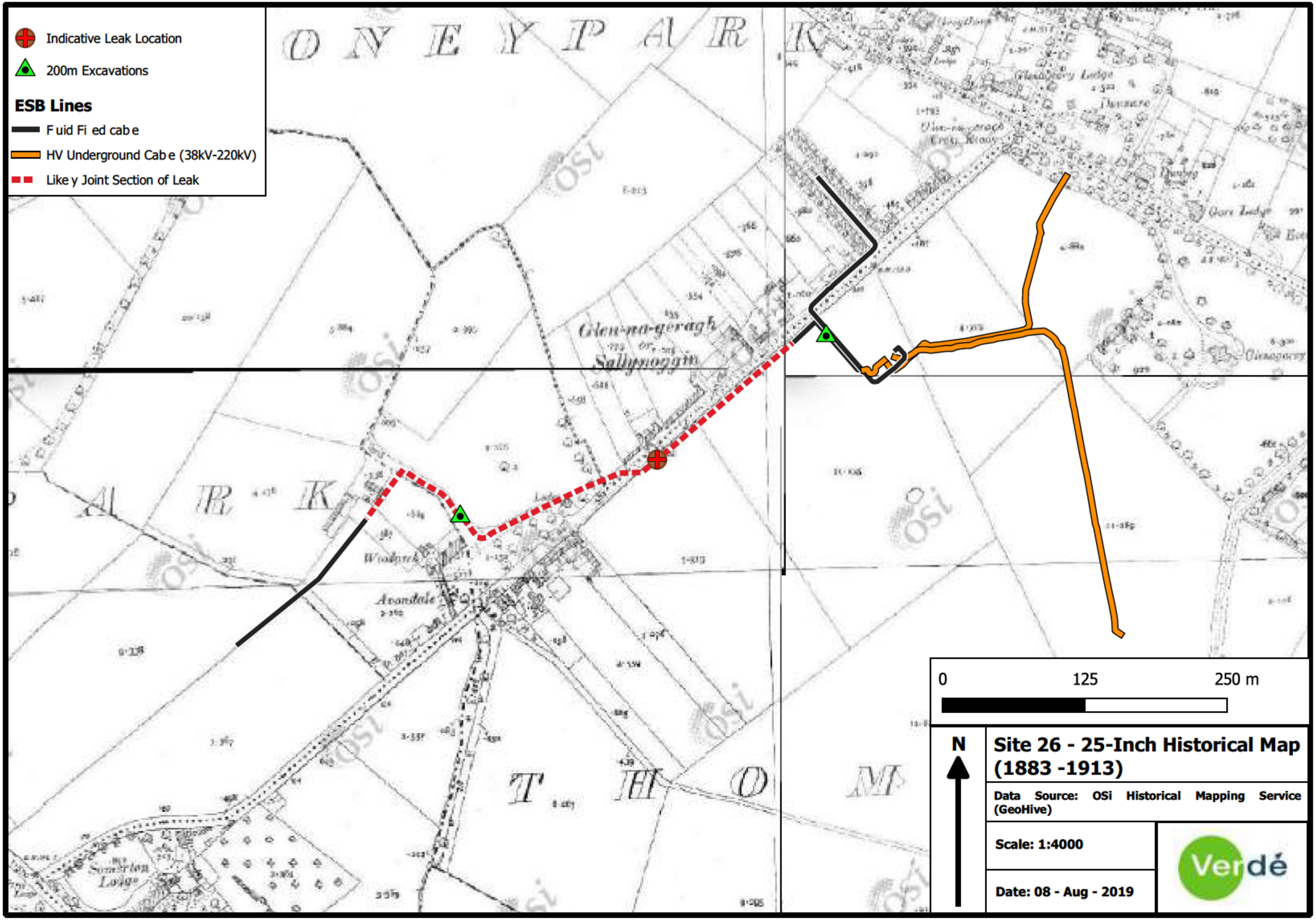
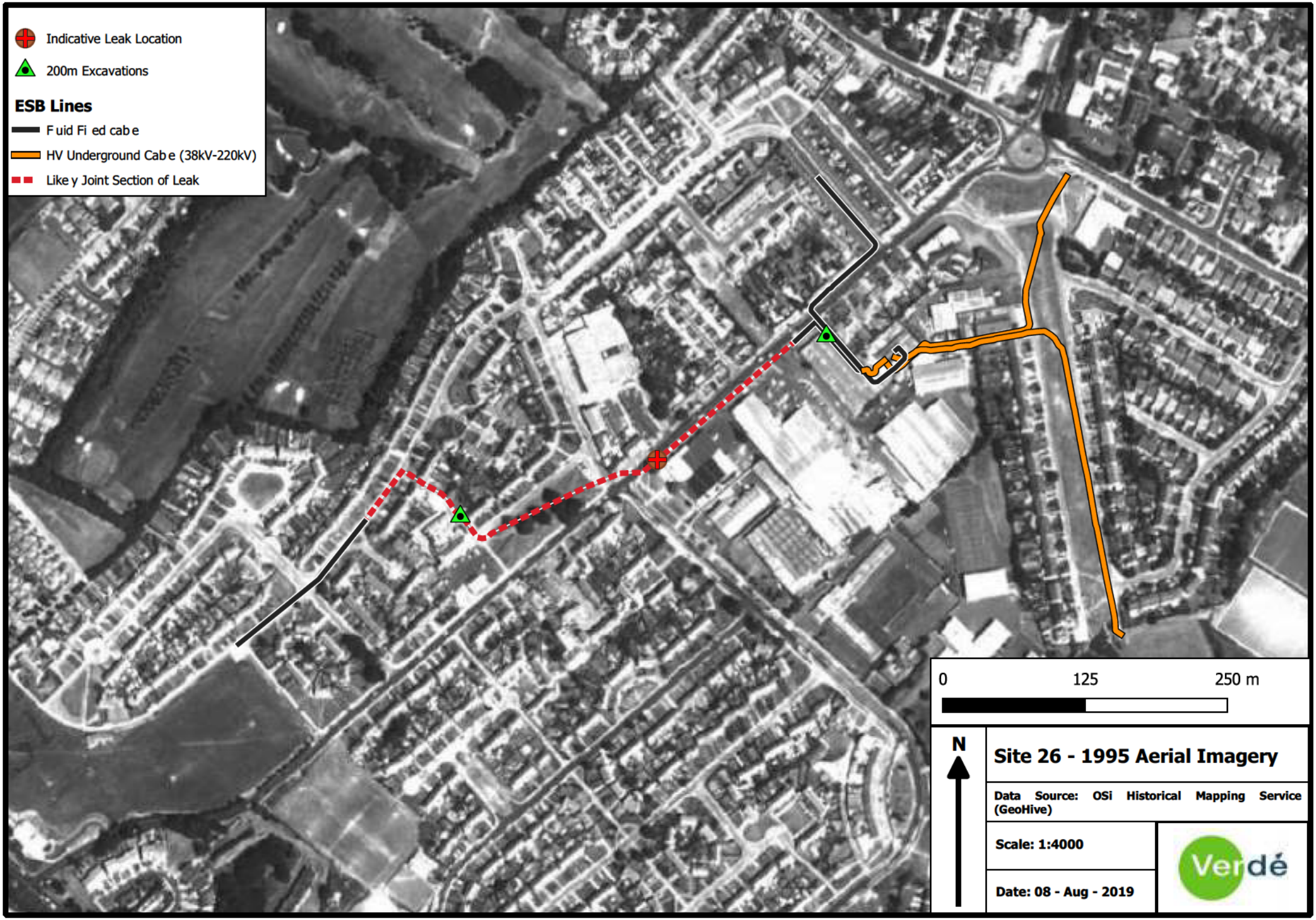
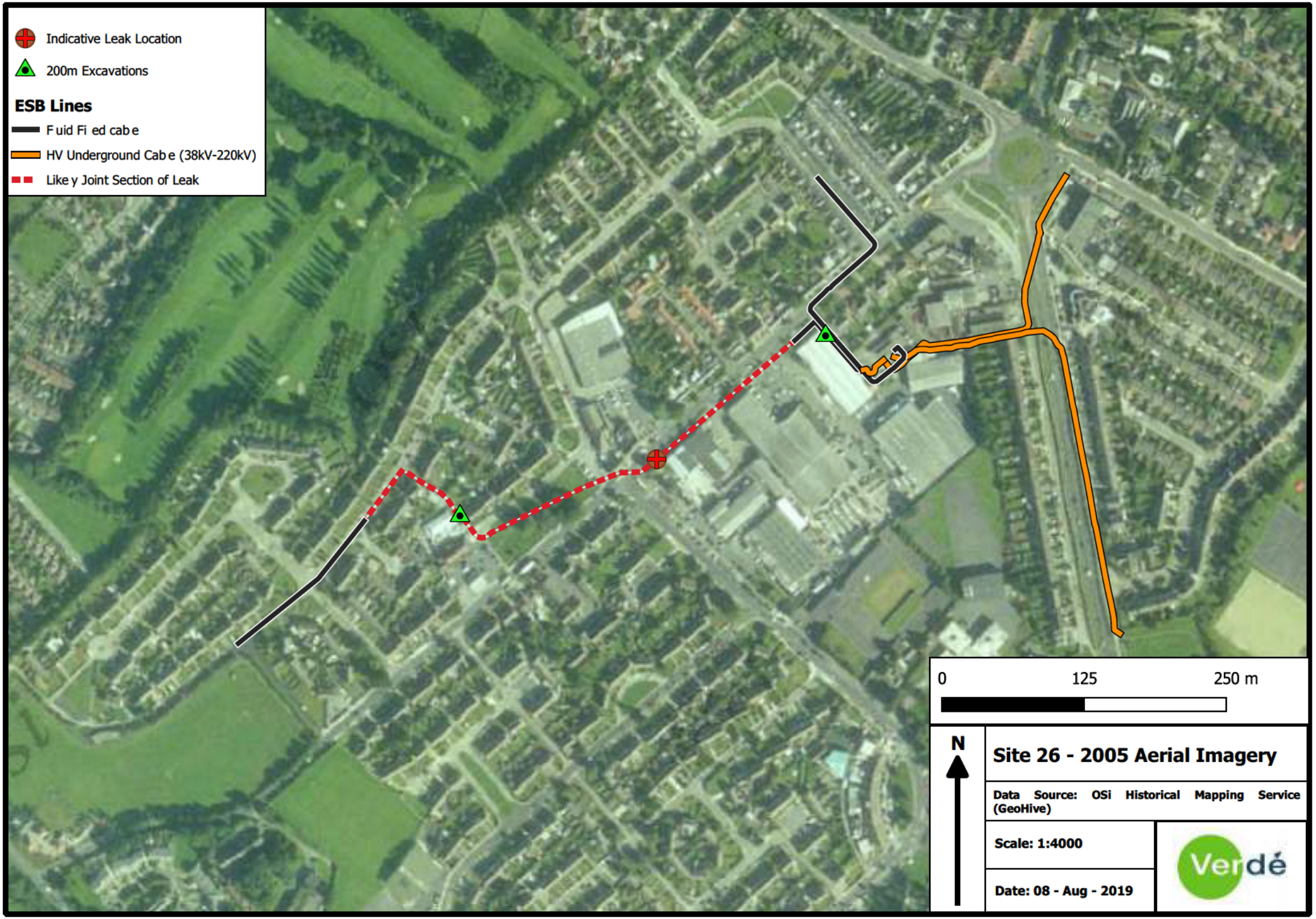
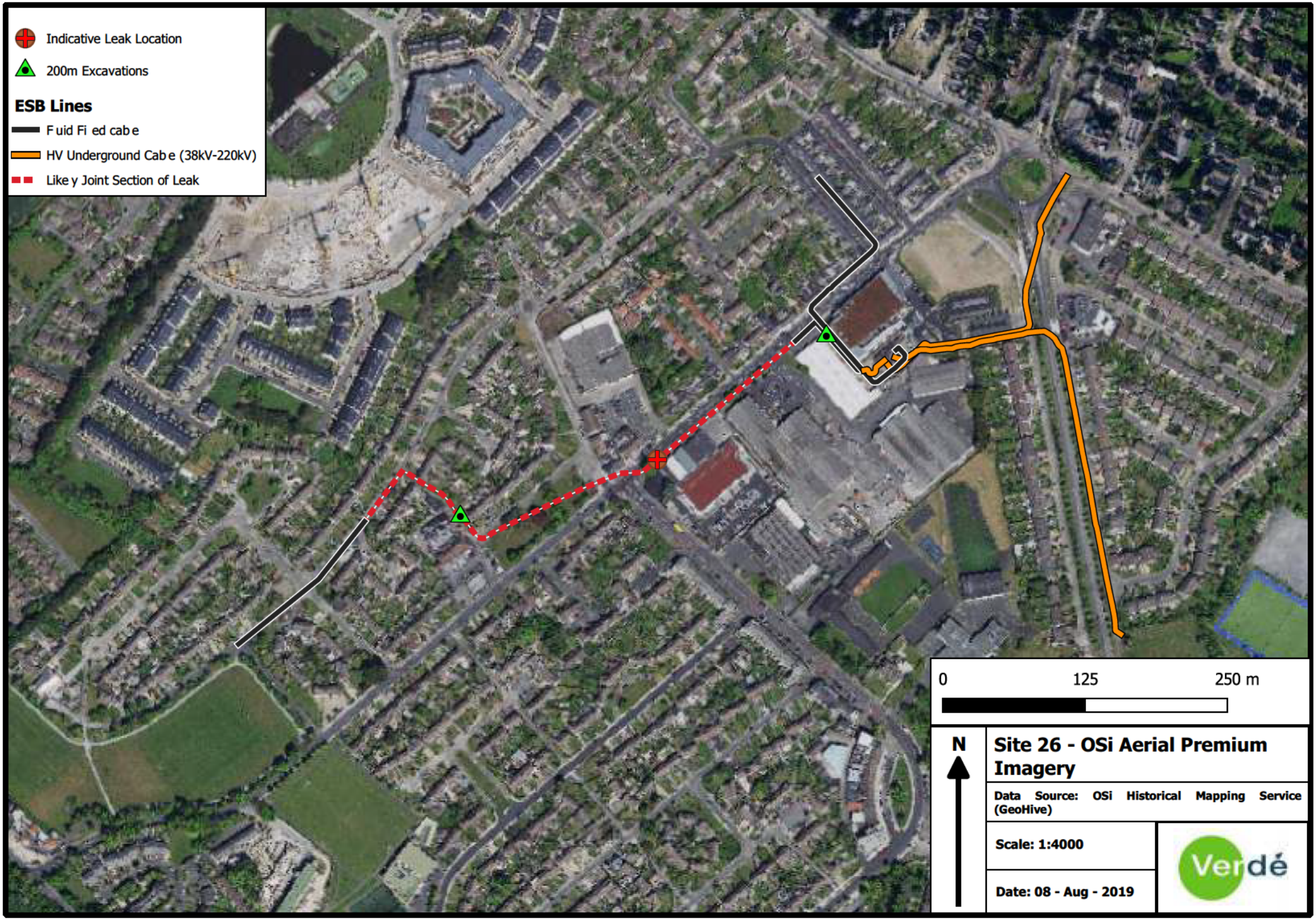
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
ESB Lines
F uid Fi ed cab e
HV Underground Cab e (38kV-220kV)
Like y Joint Section of Leak
Glen-na-geragh
Sallynoggin
Avondale
0
125
250 m
N
Site 26 - 25-Inch Historical Map (1883 -1913)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
Likely Joint Section of Leak
0
125
250 m
N
Site 26 - 1995 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
Likely Joint Section of Leak
0
125
250 m
N
Site 26 - 2000 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
ESB Lines
Fluid Filled cable
HV Underground Cable (38kV-220kV)
Likely Joint Section of Leak
0
125
250 m
N
Site 26 - 2005 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
ESB Lines
Fuid Fi ed cab e
HV Underground Cab e (38kV-220kV)
Like y Joint Section of Leak
0
125
250 m
N
Site 26 - OSi Aerial Premium Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé

APPENDIX C

SITE PHOTOGRAPHS

Photo 1: Presumed location of Leak Point (GSI Ref: 26) is beneath car park of Davies Bathroom and Tile Design showrooms, close to junction of Sallynoggin Road (background) and Pearse Street. Tarmacam surfacing has been re-laid over part of the carpark and there is evidence that boundary wall with Sallynoggin Road is repaired. Surface of car park is elevated (circa +0.5m) above footpath and road located behind wall.

Photo 2: View of leak site (looking southeast) with wall repair. From here, cabling crosses over Sallynoggin just to RHS of visible traffic light.

Photo 3: View of repaired wall and Davies Showroom from Sallynoggin Road. Leak site is far side of repaired wall.

Photo 4: Junction of Sallynoggin Road with Pearse Street to LHS. Cable is understood to cross from left to right on near side of visible traffic light

Photo 5: Leak site. Route of cabling is understood to run north eastwards parallel to Davies showroom (inside of boundary to Sallynoggin Road)

Photo 6: View southeast along Davies showroom (along presumed line of cabling). Some cracked tarmacadam. Leak point is located close to the large tree at far end.

Photo 7: Possible indication of leakage, circa. 75 m northeast of recorded leak point. Grass vegetation on verge damaged close to red mark on wall. Sallynoggin Road dips slightly in direction of known leak point near distinctive tree in background close to southern end of Davies showrooms.

Photo 8: Looking north eastwards along Sallynoggin Road. Further view of possible leak. Cabling understood to run on right hand side of wall which separates overflow car park for Woodies from grass verge.

Photo 9: Views along lane way to southeast off Sallynoggin Road which leads to substation (Sallynoggin 38Kv Station) at top of lane on LHS. Lidl is on let and M. Kelly Interiors is on RHS. The 200m marker location from the suspected leak is along this laneway.

Photo 10: Entrance to substation at end of laneway. Concrete yard with gravel areas. Substation is circa. 200m northeast of recorded leak point

Photos 11 and 12: Cabling below paving along Pearse Street adjacent to southern entrance to Davies car park

Photo 13: Cabling and ESB boxes along northern pavement of Pearse Street. Junction with Sallynoggin Road is on LHS

Photo 14: looking across junction at Davies showroom (in distance). Maps indicate cables traverse junction (Sallynoggin Road) diagonally at this location and continue into park

Photo 15: Cables traverse Wood Park in southwest direction to RHS of central path. No evidence on surface of leaks.

Photo16: At southwest corner of Wood Park, cables cross parking circle at end of O'Rourke Park residential estate. Cables veer to right and travel up narrow laneway which connects to further area of estate

Photo 17: Laneway that connects two areas of O'Rourke Park. Cabling is understood to run along this laneway.

APPENDIX D

MSDS FOR COPC

MATERIAL SAFETY DATA SHEET

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

Product Name: T 3788

Application: Hollow-core Energy Cable Saturant

Company: H&R ESP Ltd.

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

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

2: COMPOSITION / INFORMATION ON INGREDIENTS

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

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

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

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

3: HAZARDS IDENTIFICATION

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

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

Health Effects

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

Environmental Effects

No specific hazards under normal use conditions.

4: FIRST AID MEASURES

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

5: FIRE FIGHTING MEASURES

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

6: ACCIDENTAL RELEASE MEASURES

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

7: HANDLING AND STORAGE

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

Handling and Storage Materials and Coatings

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

8: EXPOSURE CONTROLS / PERSONAL PROTECTION

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

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

9: PHYSICAL AND CHEMICAL PROPERTIES

General Information

Appearance:	Clear, colourless liquid
Odour:	Mild petroleum odour

Health, safety and environmental information

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

Other information

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

10: STABILITY AND REACTIVITY

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

11: TOXICOLOGICAL INFORMATION

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

12: ECOLOGICAL INFORMATION

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

13: DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.

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

14: TRANSPORT INFORMATION

This product is not classified as dangerous for transport.

15: REGULATORY INFORMATION

Classification/Symbol: Not Regulated

This preparation is not classified as Dangerous according to EU Directives

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

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

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

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

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

16: OTHER INFORMATION

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

Key References:

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

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

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

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

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

APPENDIX E

WATER FRAMEWORK DIRECTIVE RIVER AND GROUNDWATER BODY MAPS

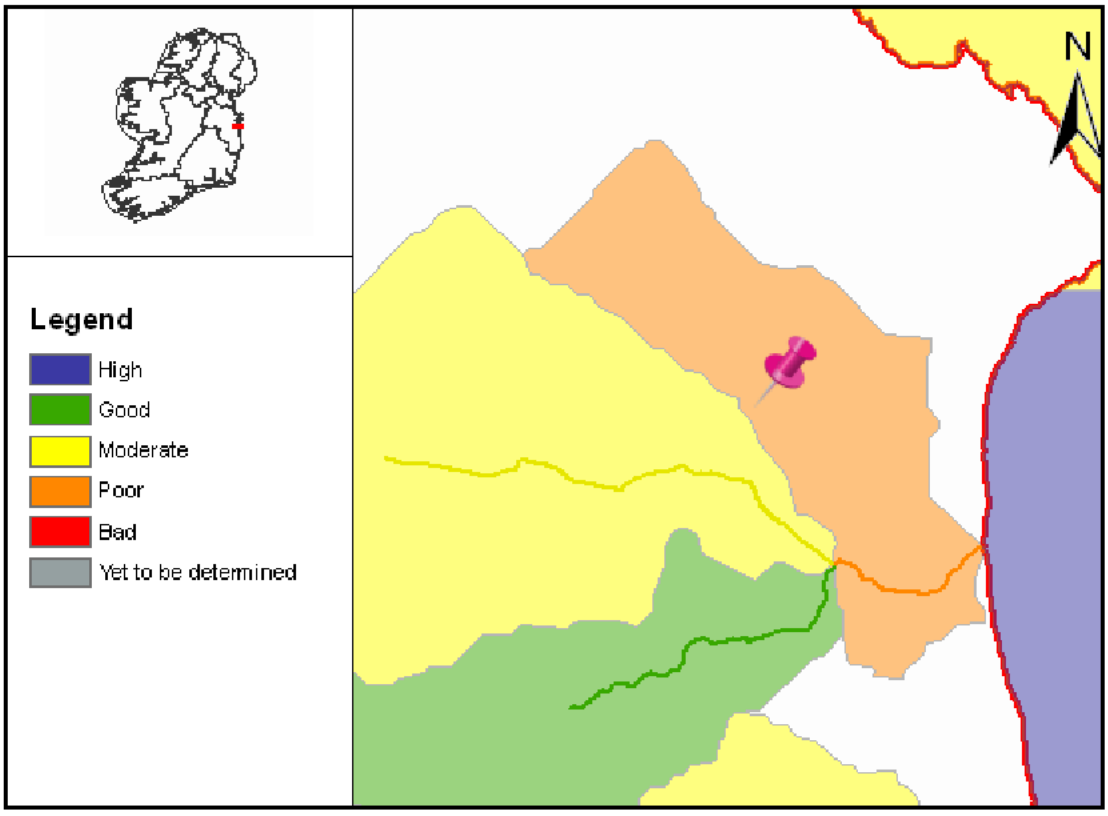
water matters
'Our Plan'

Status Report

Water Management Unit:	IE_EA_Shanganagh
WaterBody Category:	River Waterbody
WaterBody Name:	Loughlinstown Lower
WaterBody Code:	IE_EA_10_1570
Overall Status Result:	Poor
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

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



Date Report Created 14/08/2019

water matters

Status Report

Water Management Unit:	IE_EA_Shanganagh
WaterBody Category:	River Waterbody
WaterBody Name:	Loughlinstown Lower
WaterBody Code:	IE_EA_10_1570
Overall Status Result:	Poor
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

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

n/a - not assessed

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

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

Date Report Created 14/08/2019

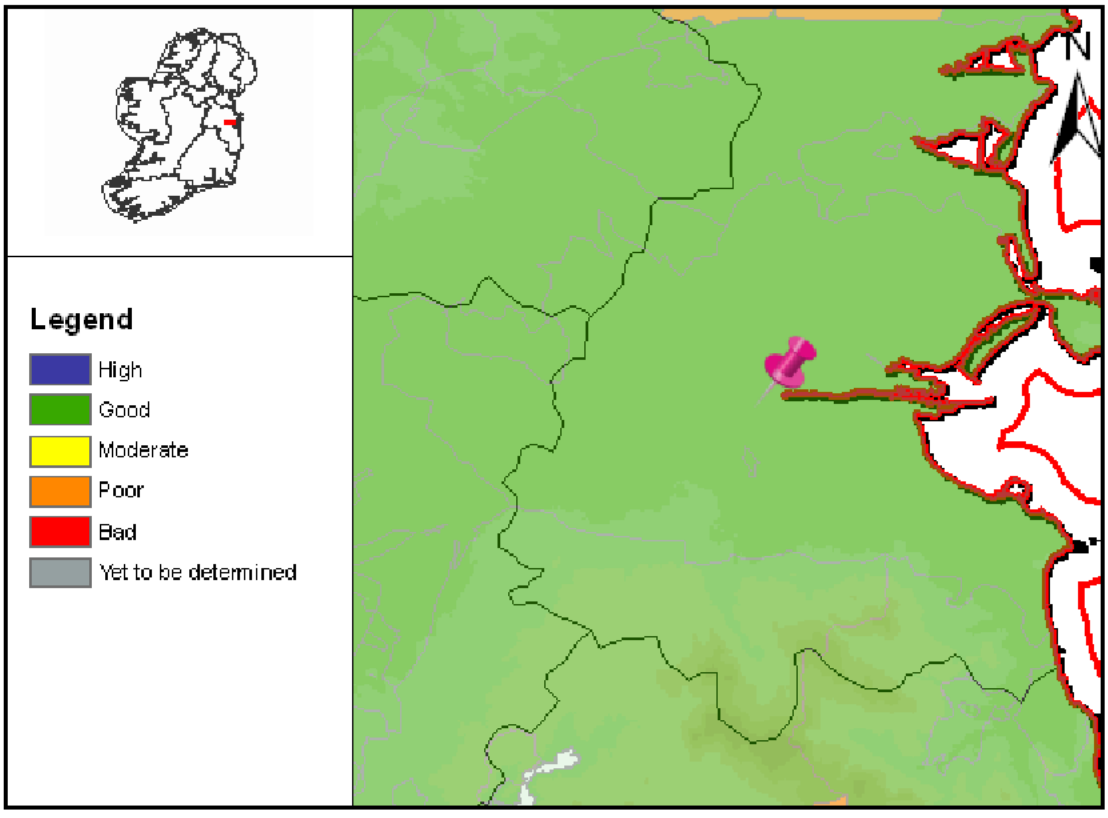
water matters
'Our Plan'

Chemical and Quantitative Status Report

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

Report data based upon final RBMP, 2009-2015.

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



Date Report Created 08/07/2019

water matters
'Our Plan'

Chemical and Quantitative Status Report

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

Report data based upon final RBMP, 2009-2015.

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

Date Report Created 08/07/2019

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

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

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

APPENDIX F

IRISH WATER RISK ASSESSMENT CORRESPONDENCE

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

Dear [redacted]

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

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

A summary of these results are collated in the following table

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

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

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

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

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

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

Regards,

[redacted]
Drinking Water Compliance Lead
Environmental Regulation

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

[redacted]

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!