Verde Environmental Consultants

Preliminary Site Assessment Report for Marina Commercial Park, Centre Park Road, Cork

ESB Site Ref: 27
Marina – Trabeg Two 110kV

March 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 Marina Commercial Park, Centre Park Road, Cork. ESB Ref: 27 Marina - Trabeg Two 110kV
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

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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 impact associated with a hydrocarbon leak from a power cable located in the Marina Commercial Park on Centre Park Road, Cork (ESB Ref: 27 Marina – Trabeg Two). There was an approximate volume of 773 litres of cable fluid consisting of linear alkyl benzene (LAB) mixed with Mineral Oil (MO) released from the cable at leak point. The leak occurred over an unknown period of time and was repaired in November 2012. An environmental incident report, associated with the ESB's Marina Generation Station, states that the leak occurred as a result of a digger-strike on the cable during excavation works. The leaked fluid was reportedly contained within the concrete trench of the cable route and subsequently pumped out to barrels for appropriate disposal. As a result of the containment, recovery, and remediation efforts at the time of the leak, the majority of the leaked cable fluid was not released to the environment and was sent for appropriate waste disposal.

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 known leak point is located approximately 15m north of the Centre Park Road, within the confines of the Marina ESB Facility/Campus in the Marina Commercial Park. The primary land use in the area is mixed commercial and industrial with small areas of open space defined throughout the surroundings; typically, along roadsides and near drainage channels. The nearest residential property is located 380m southeast of the leak point. There is evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers and service kiosks. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation. The land in the area is zoned primarily for residential use with small areas of public open space. Site 27 is located within the boundary of the Marina ESB generation facility, which is an IE-Licensed site (ID: P0578-03).

The cable section in question is underlain by a large, regionally important gravel aquifer (Rg), as classified by the GSI. This aquifer represents the primary environmental receptor for any contaminants. This aquifer is thought to be highly permeable and more than 10m thick (up to 50m locally).

The cable section in question is underlain by several bedrock formations. The northern section of the site is underlain by a locally important, moderately productive (Ll), bedrock aquifer of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the locally important bedrock aquifer (Ll), Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which are comprised a regionally important, karstified, diffuse production, bedrock aquifer (Rk).

The groundwater vulnerability in the northern and central areas of the site is classified as Moderate, suggesting some combination of moderate-low permeability soils and subsoils of 5-10m in thickness. The groundwater vulnerability in the southern-most section of the site is classified as High, suggesting that the area is underlain by some combination of higher permeability soils of lesser thickness. Moderately permeable Made Ground subsoils are mapped across the site length.

The nearest surface watercourses are represented by several drainage channels in the Marina Commercial Park area. A drainage channel runs along the south side of the Centre Park Road eastward towards the Atlantic Pond and the Lee Estuary. Another drainage channel is located at the southern end of the cable section, which also flows towards the Atlantic Pond which then drains into the Lee Estuary. There are also culverted drains/sewers on the north and south sides of the Centre Park Road, at the location of the leak point, which drain eastward into the drainage channels an onwards into the Atlantic Pond and Lee Estuary. These may represent a potential hydrological pathway between the leak site and downgradient, environmental receptors.

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 H).

Based on the known cable leak point, chemical 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;

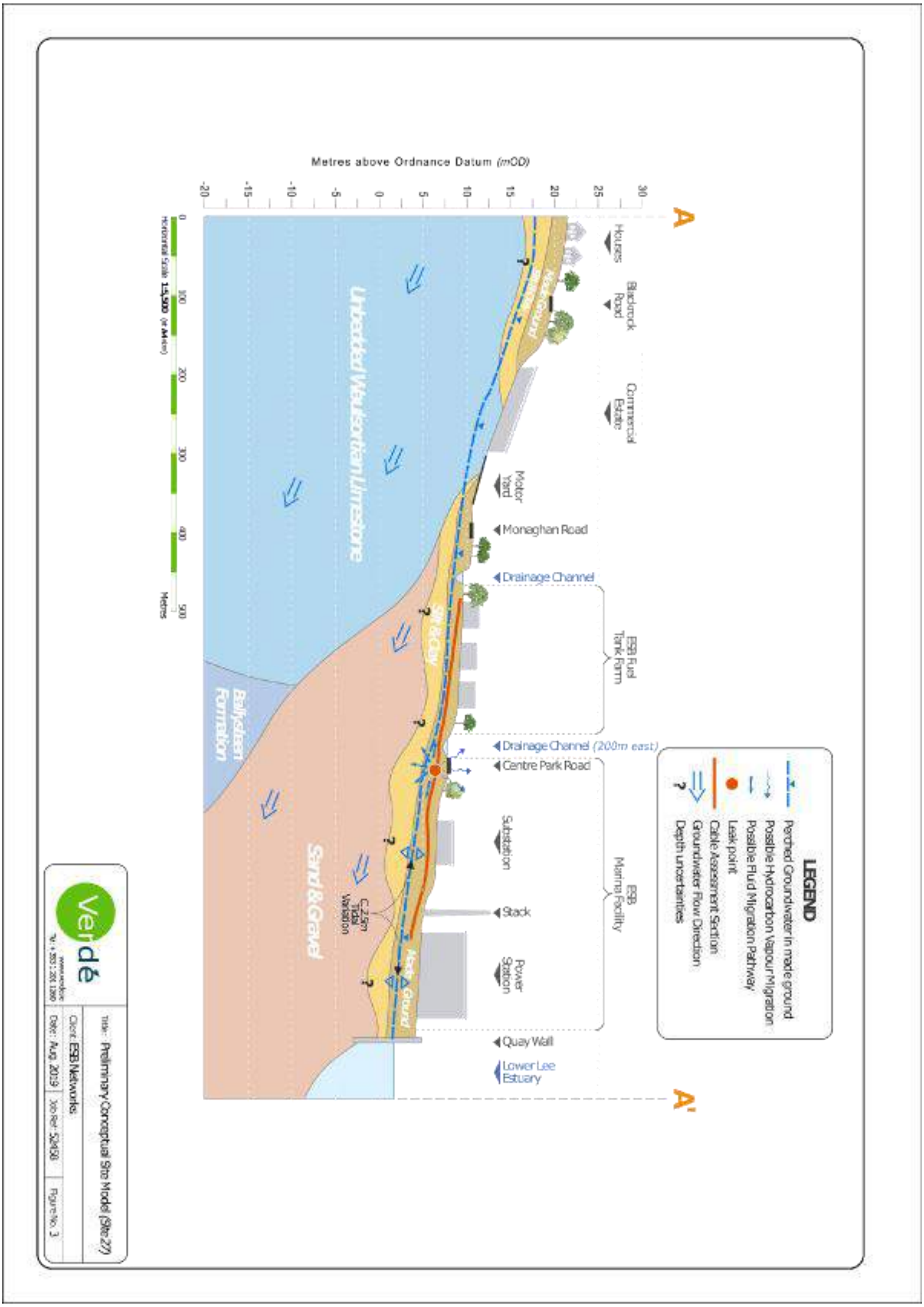
There is a Low risk posed by LAB and MO from contact with suspected contamination in the soil and groundwater through;

- 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;
- hydrocarbon vapours in preferential pathways such as services ducts to nearby building users;
- 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 commercial urban and tidally influenced setting;
- hydrocarbon migration downwards to the underlying aquifer given the possible connection to shallow groundwater through shallow rock and gravels in the area indicated by the moderate to high vulnerability. Lower risk due to absence of groundwater users downgradient, and the likelihood of saline interaction with groundwater locally.

hydrocarbon migration to the Atlantic Pond and Lee Estuary given the existence of a potential hydrogeological pathway between the leak site and the local drainage channels and the Atlantic Pond downstream.

It should be noted that the report contained within Appendix G states that the majority of the leaked fluid was recovered at the time of the leak and, as such, the risks associated with the leak have been assessed with this consideration.

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**			
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 at several locations where there were leaks of cable fluids. This report focuses on a hydrocarbon leak from a 110 kV power cable in the Marina Commercial Park on Centre Park Road, Cork (ESB Ref: 27 Marina – Trabeg Two).

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

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

1.2. BACKGROUND INFORMATION

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

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a hydrocarbon leak from a power cable in the Marina Commercial Park on Centre Park Road, Cork (ESB Ref: 27 Marina – Trabeg Two).

There was an approximate volume of 773 litres (l) of cable fluid consisting of linear alkyl benzene (LAB) mixed with Mineral Oil (MO) released from the cable at leak point. The leak is reported to have occurred on the morning of 22nd November 2012 and was repaired later the same day, after immediate containment, patching, and recovery works.. An environmental incident report (Appendix G), associated with the ESB's Marina Generation Station, states that the leak occurred as a result of a digger-strike on the cable during 3rd party excavation works. The leaked fluid was reportedly contained within the concrete trench of the cable route and subsequently pumped out to barrels for appropriate disposal. During the works, additional "top-up fluid" was added to the cable route to maintain the cable functionality; the quantity of this added fluid is not known but any fluid that was released from the leak point during works was captured and pumped to recovery barrels for disposal. The EPA was notified of the leak event at the time and, following the containment and remediation actions of ESB, no further queries or clarification were submitted by the agency.

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

1.3. PROJECT OBJECTIVES

The project objective was to determine the potential risks to human health and the environment at the leak locations and potential areas of impact. As requested by ESB, a risk-based approach has been applied to this assessment. This risk based approach is also recommended in the best practice documents produced by the EPA on Management of Contaminated Land & Groundwater at EPA

Licenced Sites published in 2013. Site 27 is located within the boundary of the Marina ESB generation facility, which is an IE-Licensed site (ID: P0578-03). 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 ESB 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 is located on the northern side of the Centre Park Road, at the entrance to the ESB's Marina substation and former generation facility as presented in the site photographs in Appendix C.

The leak is understood to have occurred in November 2012, as a result of a cable strike during excavations, and was repaired later in November 2012 as reported in the 2012 Annual Environmental Report (AER) provided to the EPA by the ESB as part of the Marina Generating Station's IPCC license conditions (ID: P0578-03).

There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation with healthy looking trees and hedges.

An estimated quantity of 773 litres of linear alkyl benzene/mineral oil mix is understood to have been released from the cable. No evidence of hydrocarbon contamination on the surface in terms of odours or staining or impact to vegetation was observed.

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

2.2. PREVIOUS SITE OPERATIONS

This area of Cork was used as the "Town Park" and racing grounds up to some point in the early 20th century as shown in the historical desk study maps in Appendix B. There is a notable change in land use seen between the 25-inch maps (1883-1913) and the Cassini 6-Inch Maps (likely 1940's). Between these periods, the land use changed from the largely recreational and open-space parkland of the "City Park" and racecourse to a commercial and industrial area containing industries such as the Ford and Dunlop Works (automotive and tyre manufacturers).

The ESB power cable was installed in the area in 1972. Further details on the site history are presented in section 3.2.

2.3. CHEMICALS OF POTENTIAL CONCERN (COPC)

The fluid in the electrical cables 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 (0.041 mg/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 and high viscosity 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);
- 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 (REACH database).

2.3.1 Mineral Oil

In scientific terminology, the term mineral oil tends to be nonspecific 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 cable of interest and leak site is located 80m from the Marina substation facility within the ESB's Marina Commercial Park facility on the Centre Park Road. The main land use in the area is commercial with some roadside green spaces and buffer zones. The nearest residential property is located 380m to the southeast of the leak point. The cable route runs north to south from the Marina Commercial Park in the North, across the Centre Park Road and south as far as the southern boundary of the commercial zone (as defined by a drainage channel), 60m north of Monaghan Road. The northern section of the cable, which runs through the Marina Commercial Park, is adjacent to several commercial premises including a furniture outlet, architecture office, fitness gym and crash repair facility.

The nearest surface watercourses were observed during a site walkover on 30th of July 2019. Several drainage channels were observed in the site area. A drainage channel runs along the south side of the Centre Park Road, which appears to serve as an artificial storm water drainage channel that flows to the east towards the Atlantic Pond and the Lee Estuary. Another drainage channel is located at the southern end of the cable section, which also flows towards the Atlantic Pong which then drains into the Lee Estuary. These drainage channels were seen, during the walkover, to be very low flow systems with no visible signs of contamination as seen in Appendix C.

The River Lee/ Lee Estuary is located 300m to the north of the leak point and 120m north of the northernmost section of cable this report is concerning. Topographic data from the GSI (LiDAR) and EPA (contours) show that the Marina Commercial Park is generally flat with sea level being defined by the quayside wall to the north of the commercial park. The ground level begins to slightly increase southwards from the southern boundary of the commercial estate

The Lower Lee Estuary connects to the Cork Harbour Special Protection Area (SPA) (Site Code: 4030). This SPA is located approximately 3.0km east of the nearest point of the Lower Lee Estuary to the leak location. Cork Harbour is designated as a SPA for its role in supporting a number of bird and invertebrate species. The two drainage channels located 200m south and 250m east of the leak point, both drain eastwards into the Atlantic Pond and, subsequently, the Lee Estuary, approximately 1km east of the leak point.

The cable section in question is underlain by a large, regionally important gravel aquifer (Rg), as classified by the GSI, extending from the lower marina quays, as far as the Upper Lee Valley, approximately 15km to the west. This aquifer represents the primary environmental receptor for any contaminants. Typically, the aquifer types support regionally important water abstractions such as large public water supplies with typically excellent yields of >400m3 /day. This aquifer is thought to be highly permeable, more than 10m thick (up to 50m locally) and covers an area of 11.58km2; comprising the majority of the Lee Valley. Groundwater flow in this aquifer is typified by intergranular flow through relatively uniform gravel pack. The groundwater gradient in this part of the aquifer is relatively low, with both the topography and water table being nearly flat. There is a generally strong interaction between gravel aquifers and surface water with a vice-versa relationship of discharge directions between the two depending on water levels and recharge.

The groundwater body in this area is described in the Water Framework Directive the "CorkCity2" groundwater body (WFD ID: IE_SW_G_031), which covers the majority of the Lee Valley and corresponds to the Lee Valley Gravel aquifer. This groundwater body has been assigned "Good" overall status and has also been classed as being "At Risk" of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E.

There are no known groundwater wells within 1km of the site; however, several boreholes (geotechnical) are recorded in the GSI well database within 1km of the leak point. A cluster of boreholes are located approximately 750m to the south of the leak point, in Ballintemple, whilst another cluster is recorded 800m to the west in the location of the Marina Filling Station on Victoria Road. The database indicates that both these clusters of boreholes are related to geotechnical investigations and are not thought to be producing groundwater wells.

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 and listed structures located within 1km of the site according to the National Monument Service. The closest of these are two souterrains recorded on the Blackrock Road and Boreenmanna Road, 650m and 800m to the southeast of the site respectively. Also, within 1km of the site are several other national monuments, most of which are various churches and house on the north side of the Lee Estuary. Within 1km of the site, there are numerous listed structures designated on the National Inventory of Architectural Heritage (NIAH) which include a wide range of iconic, distinct and historical structures.
	Historic Mapping: OSI 6 inch map (Black and White) (1837-1842): From this map it appears that the area of the wider Marina Commercial Park and the now-developed Cork docklands, comprised a large greenspace called City Park. This area appears to have been a large, open parkland likely resulting from drained estuary lands. Contained within the park, a large racetrack for horses; with associated grandstands to the southwest, training tracks and access routes. Approximately 1km to the southwest of the site, in the current location of Gas Network Ireland's HQ; a gas works site is shown on the map. These maps show several "Gasometers" or large gas holding tanks, tar tanks and other handling infrastructure. The boundary of the Lee Estuary appears to be relatively natural in these maps, with no artificial embankment, railway or boat ramps visible. It is likely that the Lee Estuary in these maps was generally unmodified and narrower. OSI 25 inch map (Black and White) (1888-1913): The area of the leak point remains largely unchanged from the previous map; with the City

	Park still in place and no evidence of commercial or industrial activity in the site area. Several notable changes in the surrounding area include the addition of the Cork, Blackrock & Passage railway which follows the southern boundary of the City Park, along part of what is no Monahan's Road. A slightly older OSi map from 1869 shows the railway following north of the City Park, along the Marina Walk area. It is possible the railway was reconstructed to the south to accommodate the development of the Marina Commercial area. Also noted, is the modification of the estuary boundary, with a wharf and associated landing places recorded. The position of the wharf resembles that of the modern day quay. Cassini 6 inch (1830-1930): This map series shows a marked change in the area from recreational and greenspace to industrial and commercial development. The City Park has been replaced with several large industrial premises including; the Ford Works and Dunlop Works, both of which were large automotive industries. The Centre Park Road is noted in this map as well as several additional drainage channels, likely installed to dewater and stabilise the former parkland for commercial use. Considering the level of development seen in this map series, it is likely that the map represents a later edition of the Cassini 6-inch mapping series; possibly in the early 20th century. The ESB power cable is reported to have been laid in the area in the 1972.
Aerial Photos	Aerial Photo 1995: The area is similar to that of present day with the Marina Commercial Park and associated warehouses, depots and Power Station visible. The road layout and position of commercial and nearby residential properties remains largely the same as present times. The western tank farm on the south side of the Centre Park Road appears to still be in use, with the tanks and berms in place. Also notable, is the absence of the newer Marina substation unit within the ESB Marina facility. Aerial Photo 2000: The road layout, positions of residential and commercial properties remains the same as the previous image. The notable change is that the gas works site to the southwest of the Marina Commercial Park, appears to have been decommissioned; and the development of the current office building was underway. Aerial Photo 2005: The road layout, positions of residential and commercial properties remains the same as the previous image. The lot to the immediate east of the Marin Power Station shows evidence of stockpiling of coal. The purpose and use of this coal is not certain but it is not thought that coal was being used as fuel in the station at this point and it is more likely that the stockpile relates to local coal suppliers in the area

3.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

The cable section in question runs for a length of approximately 450m over the boundary of several geological formations; which is oriented east west, thus dividing the ground underlying cable section into a northern, central and southern area as illustrated in Appendix B.

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 is overall, generally flat with a very gently slope to the north and northeast towards the nearby Lee Estuary. The site occupies a historically reclaimed section of tidal estuary and is largely artificially surfaced. Topographic data from the GSI (LiDAR) and EPA (contours) show that the Marina Commercial Park is generally flat with sea level being defined by the quayside wall to the north of the commercial park. To the south, the ground level begins to slightly increase southwards from the southern boundary of the commercial estate towards Blackrock from 5mOD to 25mOD.
Geology	**Overburden**: The GSI and EPA databases describe the soils and subsoils at the site as Made Ground. Geotechnical reports from within the Marina Commercial Park, show approximately 3-4m of Made Ground and 3-5m of silt and clay which is underlain by up to 50m of sand and gravel known as the Lee Valley Gravels.
	Solid Geology: The cable section in question runs north to south across several geological formation boundaries which comprise the northern limb of the Cork geological syncline. The formations underlying the site, generally dip at a high angle (70-80°) to the south. The site is also located on the southern side of the Lee River Valley, and as such, bedrock shallows rapidly to the south, with outcropping bedrock recorded 375m to the south of the leak point. The northern section of the site is underlain by the flaser bedded sandstones and mudstones of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the dark muddy limestones of the Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which are comprised of massive unbedded limestones (typically fine-grained micrites).
Hydrogeology	**Regional Classification:** According to the GSI the Lee Valley Gravels, which are up to the 50m thick and underlie the entirety of the site, represent a regionally important gravel aquifer (Rg). These gravels extend from the lower marina quays, as far as the Upper Lee Valley, approximately 15km to the west. This aquifer represents the primary environmental receptor for any contaminants. Typically, the aquifer types support regionally important water abstractions such as large public water supplies with typically excellent yields of >400m^3 /day. This aquifer is thought to be highly permeable, more than 10m thick (up to 50m locally) and covers an area of 11.58km^2; comprising the majority of the Lee Valley. Underlying the Lee Valley Gravels, at an unknown depth, are several bedrock aquifers. The

	northern section of the site is underlain by a locally important, moderately productive (Ll), bedrock aquifer of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the locally important bedrock aquifer (Ll), composed of the Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which represent a regionally important, karstified, diffuse production, bedrock aquifer (Rk).
	Vulnerability: The groundwater vulnerability in the northern and central areas of the site is classified as Moderate, suggesting some combination of moderate-low permeability soils and subsoils of 5-10m in thickness. The groundwater vulnerability in the southern-most section of the site is classified as High, reflecting the shallowing of bedrock to surface and the thinning of overlying, less-permeable silt and clay subsoils. Geological Survey of Ireland and Teagasc soil and subsoil maps show that the entire length of the cable section is classed as moderately permeable Made Ground deposits. The presence of Waulsortian Limestone in the southern areas of the site may represent an additional risk to groundwater due to the tendency of such bedrock to host karstic features.
	Groundwater Body: The groundwater body in this area is described in the Water Framework Directive as the Cork_City_2 groundwater body (WFD ID: IE_SW_G_031) which covers the majority of the Lee Valley and corresponds to the Lee Valley Gravel aquifer. This groundwater body has been assigned "Good" overall status and has also been classed as being "At Risk" of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E.
	Well Search: There are no known groundwater wells within 1km of the site. Several boreholes (geotechnical) are recorded in the GSI well database within 1km of the leak point. A cluster of boreholes are located approximately 750m to the south of the leak point, in Ballintemple, whilst another cluster is recorded 800m to the west in the location of the Marina Filling Station on Victoria Road. The database indicates that these clusters of boreholes are related to geotechnical investigations and are not thought to be producing groundwater wells. It is also thought that there are a series of groundwater monitoring wells present on the ESB's Marina generation facility; as part of its EPA-licenced activities and environmental obligations. The locations, depths and condition of these wells, was not available at the time of writing this report.
Hydrology	**Surface Water Courses/Abstractions:** The nearest surface watercourses were observed in the Marina area during a site walkover on 30th of July 2019. Several drainage channels were observed in the area of the proposed site. A drainage channel runs along the south side of the Centre Park Road, which appears to serve as an artificial storm water drainage channel that flows to the east towards the Atlantic Pond and the Lee Estuary. Another drainage channel is located at the southern end of the cable section, which also flows towards the Atlantic Pong which then drains into the Lee Estuary. There are also culverted drains/sewers on the north and south sides of the Centre Park Road, at the location of the leak point, which drain eastward into the drainage channels an onwards into the Atlantic Pond and Lee Estuary. These drainage channels were seen, during the walkover, to be very low flow systems with no visible signs of contamination as seen in Appendix C. The River Lee/ Lee Estuary is located 300m to the north of the leak point with the northernmost section of cable being 120m from

	the waterbody.
Protected Areas	**Cork Harbour Special Protection Area** The closest protected area to the site is the Cork Harbour Special Protection Area (SPA) (*site code: 004030*), which is approximately 2.8km east of the site; along the estuary. A closer portion of the SPA is located approximately 1.7km to the south of the site but this is thought to be less connected to the site due to the significant topography between the site and the SPA area to the south. Cork Harbour is designated as a SPA for its role in supporting a number of bird and invertebrate species. **Douglas River Estuary Proposed Natural Heritage Area (pNHA)** The Douglas River Estuary Proposed Natural Heritage Area (*site code: 001046*) overlies much of the same area of the Cork Harbour SPA and is approximately the same distance and location from the proposed site.
Flooding	According to OPW flood mapping (Appendix B) the site appears to be at risk of fluvial and coastal flooding in extreme events (Annual Exceedance Probability of 0.1%).
Zoning	The primary land use in the area is commercial with rare areas of open space and public amenity designated locally in the surrounding area. The Cork City Council Development Plan 2015-2021 (Appendix B) shows much of the area designated as Mixed Use Development, with District Centre designated along part of the cable section.

3.4 SITE GEOLOGY AND HYDROGEOLOGY

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

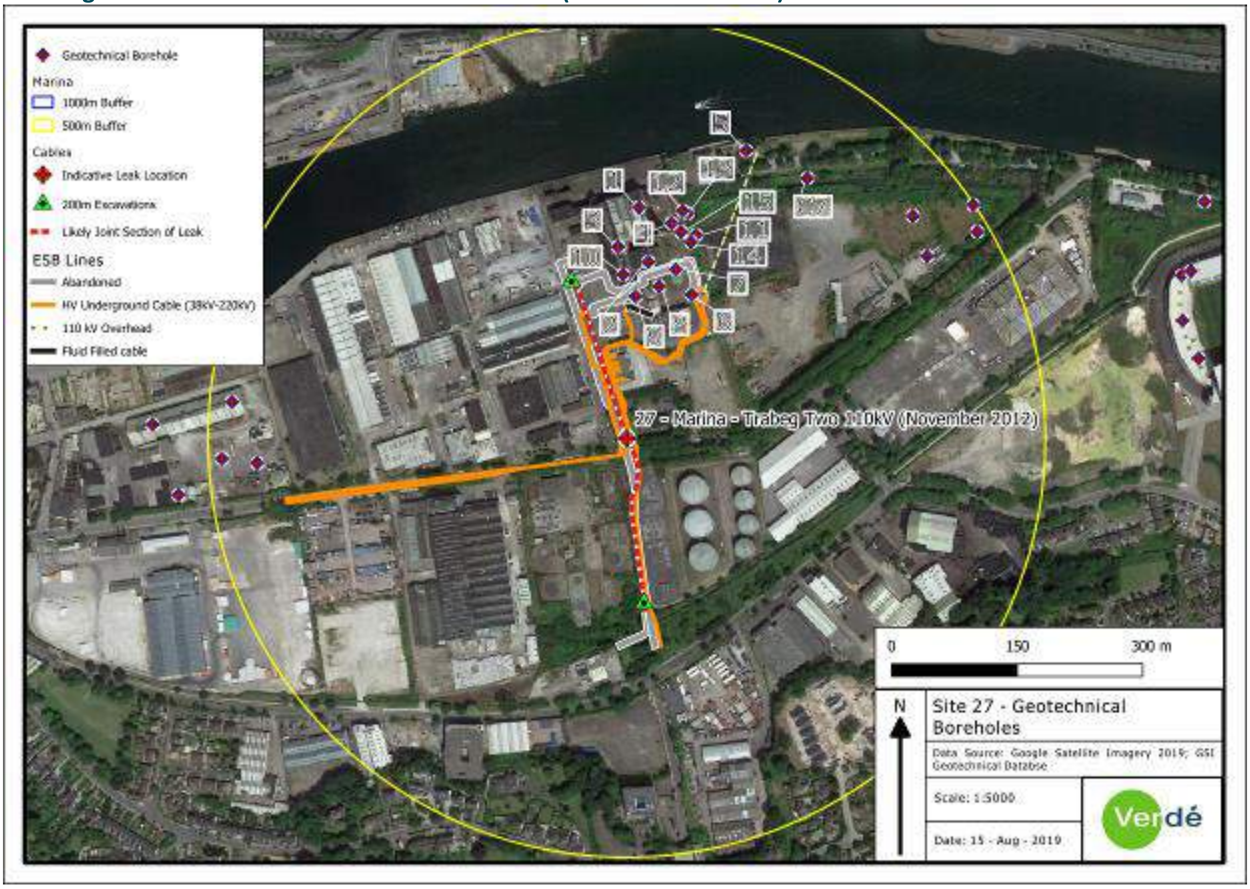
The details of the typical cable and trench dimensions for a fluid filled cable includes the following;

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

According to the GSI Database the site is underlain by several geological formations; the northern section of the site is underlain by the flaser bedded sandstones and mudstones of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the dark muddy limestones of the Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which are comprised of massive unbedded limestones (typically fine-grained micrites). These bedrock formations are overlain by approximately 3-4m of Made Ground and 3-5m of silt and clay which is underlain by up to 50m of sand and gravel known as the Lee Valley Gravels.

There have been several intrusive investigations in the vicinity of the site; the closest site investigation was that completed on the site of the Marina Power Station in 1974 (Appendix F), in preparation for the installation of a gas turbine unit. A series of 15 boreholes were completed on the site; the greatest depth of excavation was 46.6mBGL. Some of the boreholes were completed after a 10ft pit was dug and logged. A summary of the log details is available in Appendix F.

Figure 3.1 – Geotechnical Borehole locations (from GSI Database). Power station SI holes labelled.



A site investigation report from the 1950's site feasibility work prior to the development of the Marina Power Station, details the groundwater level variations on the site in response to tidal influence. A tidal variation of 2-3m was recorded in a series of 3-4 groundwater monitoring wells on the ESB station facility (Appendix F).

A detailed assessment and invitation of historic contamination in the Marina Commercial Park area was commissioned by Cork City Council in 2005. The investigation was carried out by T.J. O'Connor/D.H.V. Consulting Engineers and was completed in 2007. The investigation involved extensive ground investigation, sampling, analysis and risk assessment. In summary, the works showed that much of the Marina Commercial Park is significantly contaminated (in zones) by volumes of hydrocarbons and volatile chlorinated hydrocarbons (VCHs). It was found that, whilst the gravel aquifer underlying the area appears to be protected by a significant impermeable clay layer, building users in the area are at significant risk from ground contamination (see reference below).

The topography of the area as obtained from the GSI database show the leak point is located at approximately 6 metres above the ordnance datum (mOD) with the Lee Estuary downgradient at 0mOD. The topographic contours are orientated approximately east to west which infers that the groundwater flow direction is likely to be in a north/north-easterly flow direction, as presented in Figure 2 and within the CSM in Figure 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 and made ground is reported to be of low to moderate permeability with a thickness of 2 to 6m (above the gravel aquifer).

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 H).

The ESB Marina Generating facility operated under an EPA IPCC emission license up until 2018 when the plant was fully decommissioned. As part of this license, the ESB regularly reported noise, groundwater, surface water and air quality conditions on the site. The results of these samples were reported to the EPA as per the license agreements in place. A summary of the Environmental and Human Health Pollutant Linkages for the COPCs (TPH fractions, Speciated PAHs, BTEX Compounds, SVOCs, VOCs) in relation to the known leak point details and available desk study information is presented in Section 4.0.

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

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

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

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

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

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

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

4.2 OUTLINE SITE CONCEPTUAL MODEL

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

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

Source	Pathway	Receptor	Potential Pollutant Linkage (Y/N)	Discussion
Human Health				
Historical leaks of cable fluid from underground electricity cables comprising of an approximate volume of 773 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO); November 2012. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs VOCs	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation.	Residents & other commercial or retail building users	Y	There are commercial and retail properties in the immediate vicinity and downgradient of the leak point. Vapour phase migration will be preferential potentially along utility service runs and through more permeable made ground soils and or sand/gravel fractions of soils if present.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce.	Residents & other commercial or retail building users	Y	There are commercial and retail properties in the immediate vicinity 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.
	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 and MO have the potential to permeate through the wall of plastic supply pipes and also through joins and gaskets. An internet search has not identified proven instances where this has occurred elsewhere. Any permeating compounds would be diluted depending on water flows in the pipe. A WHO drinking water standard for hydrocarbons >C10 is 0.09mg/l which exceeds the LAB theoretical solubility limit of 0.041mg/l. So, unless NAPL is present within the pipe, then this WHO drinking water standard would not be exceeded.

	LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation	Workers undertaking any subsurface works	Y	Unlikely to be significant as workers exposed in outdoor air where vapours cannot accumulate to high concentrations. Also, risks are localised areas of contamination which can be managed with the correct PPE and H&S procedures.
	LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Y	Unlikely to be significant as contamination is likely to be localised and can be managed with the correct PPE and H&S procedures.
Environmental – Water Receptors				
Historical leaks of cable fluid from underground electricity cables comprising of an approximate volume of 773 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO); November 2012 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 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 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	Nearby drainage channels and connected Atlantic Pond and Lee Estuary	Y	The nearest, open drainage channel intersects the southern end of the cable section but is 250m from the leak point. These nearby channels drain surface and excess groundwater towards the Atlantic Pond and onto the Lee Estuary c.850m to the east. There are also culverted drains/sewers on the north and south sides of the Centre Park Road, at the location of the leak point, which drain eastward into the drainage channels an onwards into the Atlantic Pond and Lee Estuary.
	LAB migration downwards through glacial till to Limestone bedrock aquifer and then lateral migration	Limestone bedrock aquifer / Groundwater Users	Y	There are no known groundwater abstraction wells within 1km of the site. The surrounding properties are serviced by mains water. Downward contaminant

				migration into the gravel and limestone aquifer is possible due to the general vulnerability of both aquifers locally.

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 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	Risk Level	Comments
Human Health						
Historical leaks of cable fluid from underground electricity cables comprising of an approximate volume of 773 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO); November 2012 PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs SVOCs	LAB & 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	Commercial or retail building users & residents	Medium	Unlikely	Low	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 commercial customers is low with a residual risk associated with mineral oil. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.

VOCs	LAB & 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	Commercial or retail building users & residents	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 leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.
	LAB & 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 could potentially be present next to electrical cables 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. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time

						of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus, reducing the risk posed. 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 & 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. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.

	LAB & 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. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.
Environmental – Water Receptors						
Historical leaks of cable fluid from underground electricity cables comprising of an approximate volume of 773 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO); November 2012 PCOCs include: TPH fractions, BTEX compounds,	LAB & 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	Low Likelihood	Low	Low/Moderate potential risk due to alkyl benzene contamination strongly absorbs to soil, has low mobility, readily biodegrades in aerobic conditions in both soil and water. Mineral oil is less biodegradable therefore has a greater tendency to accumulate and may present a greater risk. Shallow groundwater in made ground and glacial till unlikely to be used as an actual resource due location in a commercial urban area and influence of saline tidal intrusion in groundwater. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of

Speciated PAHs SVOCs, VOCs,						remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.
	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	Drainage Channels, Atlantic Pond and Lee Estuary	Medium	Unlikely	Low	Has the potential to migrate in shallow groundwater in made ground. The contamination will strongly sorb to soil, has low mobility, readily biodegrades in both soil and water. There was a loss (773L) from the cable which is likely to be transmitted to the adjacent environmental receptor to the leak point. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.
	LAB and MO migration downwards through glacial till to Gravel and Limestone bedrock aquifer and then lateral migration	Gravel and Limestone bedrock aquifer / Groundwater Users	Mild	Low Likelihood	Low	Due to the moderate to high vulnerability in the area, there may be a linkage between the groundwater in the underlying aquifer and the shallow ground water in the overlying made ground and subsoils. The occurrence of low-moderately permeable clays and silt subsoils may offer some natural protection to the underlying gravel and bedrock aquifers. Given there are no

						groundwater users in the area downgradient and that the aquifer is likely tidally influenced locally. The leak occurred in a concrete-lined, impermeable service trench which was seen to retain much of the leaking fluid at the time of the incident. A significant level of remediation occurred at the time of the leak, with most of the fluid reportedly recovered and contaminated soil/fill material removed; thus reducing the risk posed.

4.4 SUMMARY OF PRELIMINARY QUANTITATIVE RISK ASSESSMENT

4.4.1 A desktop study and site walkover were conducted in relation to a recorded cable leak location along the Marina Commercial Park side of the Centre Park Road in Cork City. It is reported that 773 litres of linear alkyl benzene mixed with mineral oil were lost from the cable over a one-month period in November 2012. Results of the PQRA are summarised below:

4.4.2 Human Health:

- There is a potentially Low risk posed by LAB and MO vapours in suspected contamination in the soil and groundwater through preferential pathways such as services ducts to commercial or other building users;
- 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 commercial or other building users;
- There is a potentially Low 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 potentially Low risk to construction workers from dermal/inhalation and ingestion pathways which can be managed by appropriate use of PPE and H&S procedures.

4.4.3 Environmental:

- There is a potentially Low risk posed by LAB and MO to shallow groundwater from suspected contamination in the shallow made ground and sand and gravel 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 commercial urban and tidally-influenced setting.
- There is a potentially Low risk posed by LAB and MO to the nearby drainage channels that feed into the Atlantic Pond and the Lee estuary, from the suspected contamination within shallow groundwater.
- There is a potentially Low risk posed by LAB and MO to the underlying Gravel and Limestone Bedrock Aquifers given the moderate-high vulnerability indicating shallow to outcropping rock in the area and the known extent of sand and gravel below the site. The occurrence of low-moderately permeable clays and silt subsoils may offer some natural protection to the underlying gravel and bedrock aquifers.

4.5 SUMMARY AND CONCLUSIONS

This preliminary environmental site assessment consists of a review of the potential environmental impacts associated with a cable fluid leak from a power cable on the Marina Commercial Park side of the Centre Park Road in Cork City (ESB Ref: 27).

There was an approximate volume of 773 litres (l) of cable fluid consisting of linear alkyl benzene (LAB) mixed with Mineral Oil (MO) lost to ground fromreleased from the cable at leak at the Marina Commercial Parkpoint. The leak is reported to have occurred on the morning of 22nd in November 2012 and was repaired shortly later the same day after immediate containment, patching and recover works.afterwards in November 2012. Considering the containment, recovery and remediation actions taken immediately following the leak incident, the potential environmental and human health risks posed by the cable fluid leak have been largely remediated with regard to the presence/existence and size of a potential COPC source at the leak point. No work to date has investigated whether, if any, COPC was released beyond the concrete cable trench and into the surrounding environment. This lack of certainty means that some residual potential risk remains and has been assessed accordingly.

The known leak point is located close to the northern boundary of the Centre Park Road at the entrance to the ESB’s Marina Power Station and 110kV substation facility. There is evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers and service kiosks. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation.

The site is underlain by the regionally important gravel aquifer of the Lee Valley Gravels, the locally important bedrock aquifers of the Ballysteen and Kinsale Formations as well as the regionally important karstic aquifer of the Waulsortian Limestones. The vulnerability is Moderate - High, however there are some moderate to low permeability limestone till subsoils (estuarine clays and silts), which provide some natural protection to the underlying gravel and bedrock aquifers.

Local drainage channels are the nearest surface watercourses which lie along the southern end of the cable section and c.200m to the east of the leak point. There are also culverted drains/sewers on the north and south sides of the Centre Park Road, at the location of the leak point, which drain eastward into the drainage channels an onwards into the Atlantic Pond and Lee Estuary. There are no known 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 moderate-low permeability subsoils with groundwater flow direction in a northerly to north-easterly direction following site topography.

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 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;
- hydrocarbon vapours in preferential pathways such as services ducts to nearby building users;
- 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 commercial urban and tidally influenced setting;
- hydrocarbon migration downwards to the underlying aquifer given the possible connection to shallow groundwater through shallow rock and gravels in the area indicated by the moderate to high vulnerability. Lower risk due to absence of groundwater users downgradient, and the likelihood of saline interaction with groundwater locally.

- hydrocarbon migration to the Atlantic Pond and Lee Estuary given the existence of a potential hydrogeological pathway between the leak site and the local drainage channels and the Atlantic Pond & Lee Estuary downstream.

5 REFERENCES

- Cork South Docklands Contamination Study, Cork City Council, 2007 (http://sp1ral.corkcity.ie/services/strategicplanningeconomicdevelopment/docklands/infrastructure/landcontaminationstudy/)
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oo0oo

Respectfully submitted

On behalf of Verde Environmental Consultants

[redacted] [redacted]

Senior Hydrogeologist Project Director

FIGURES

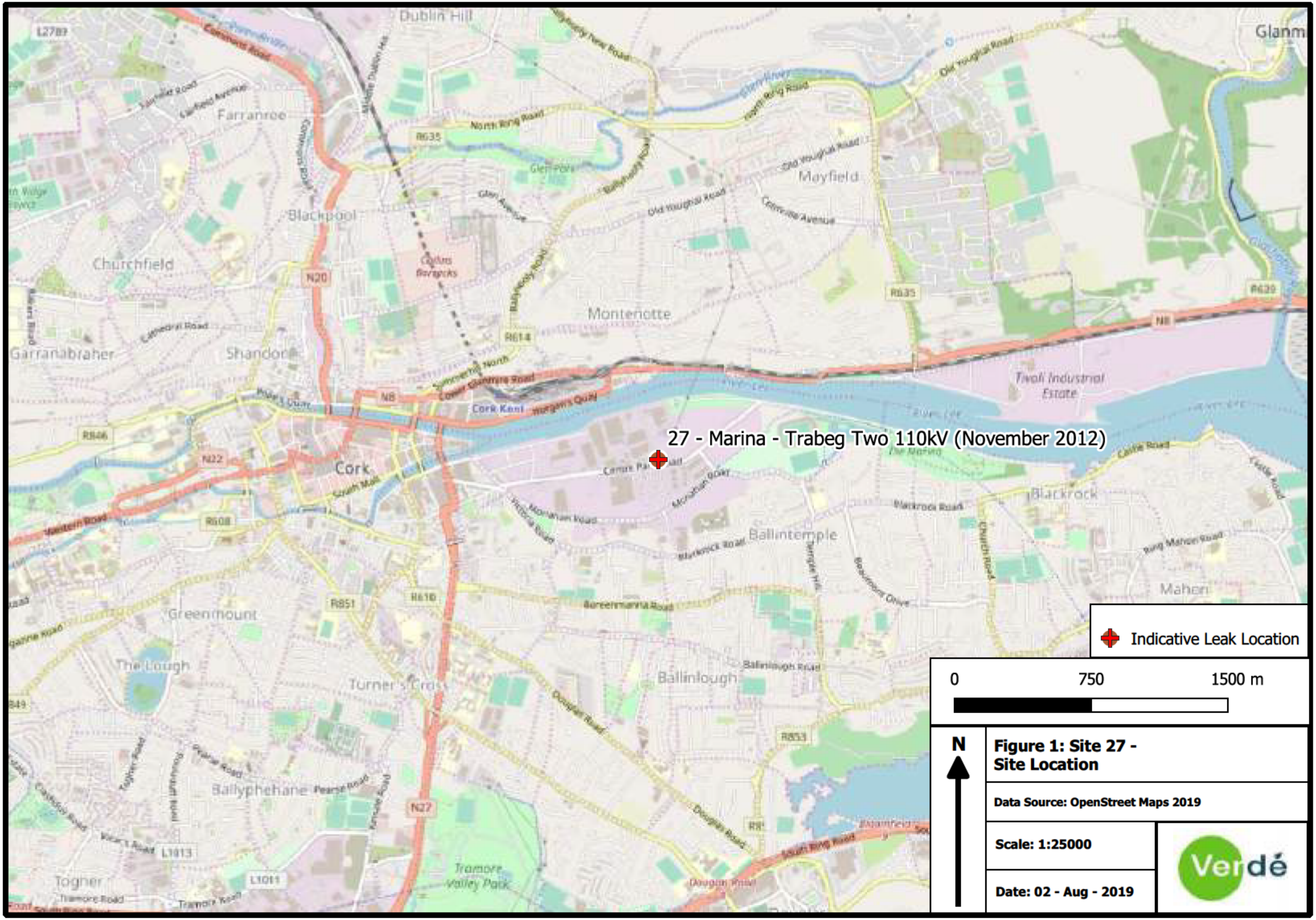
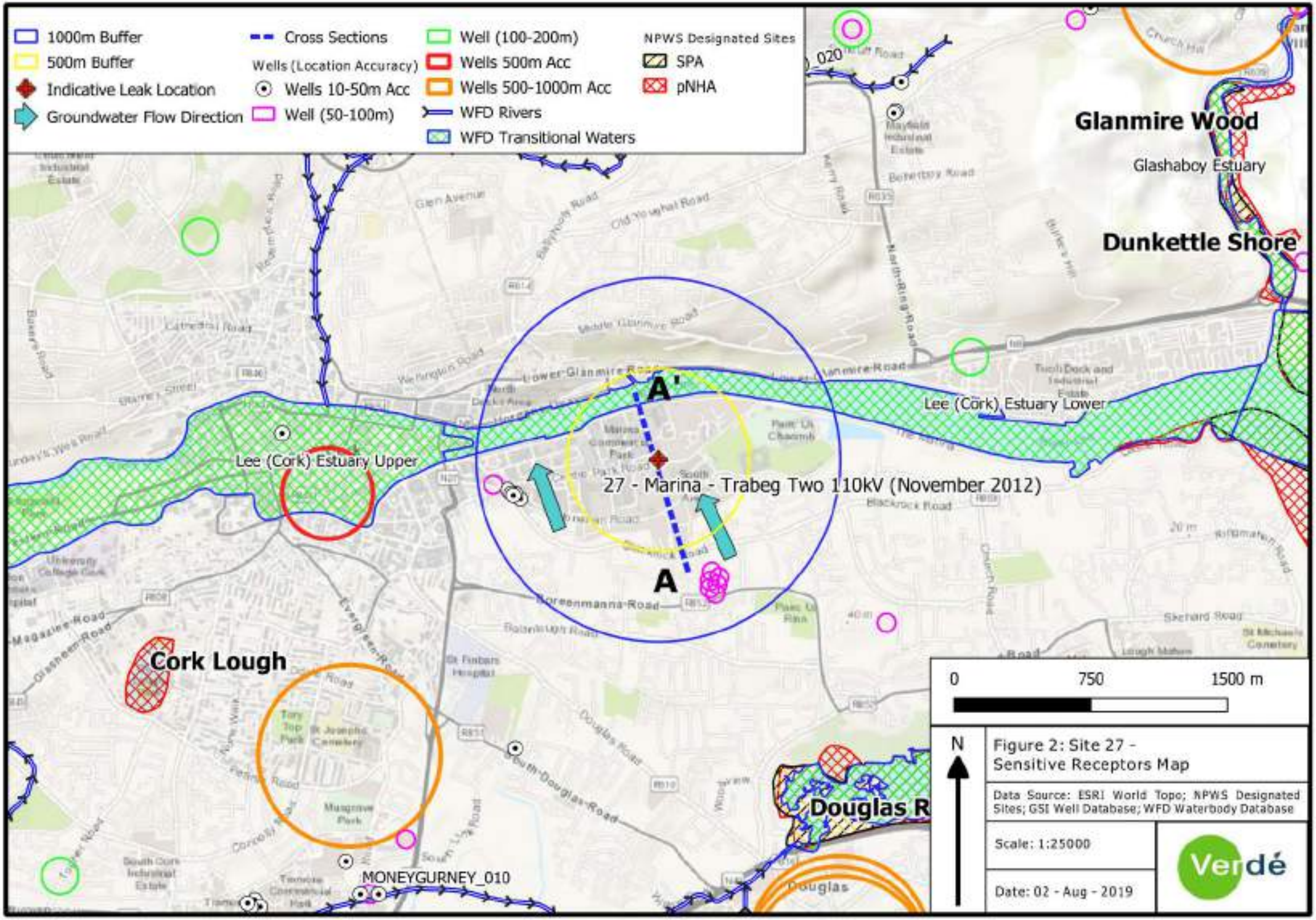


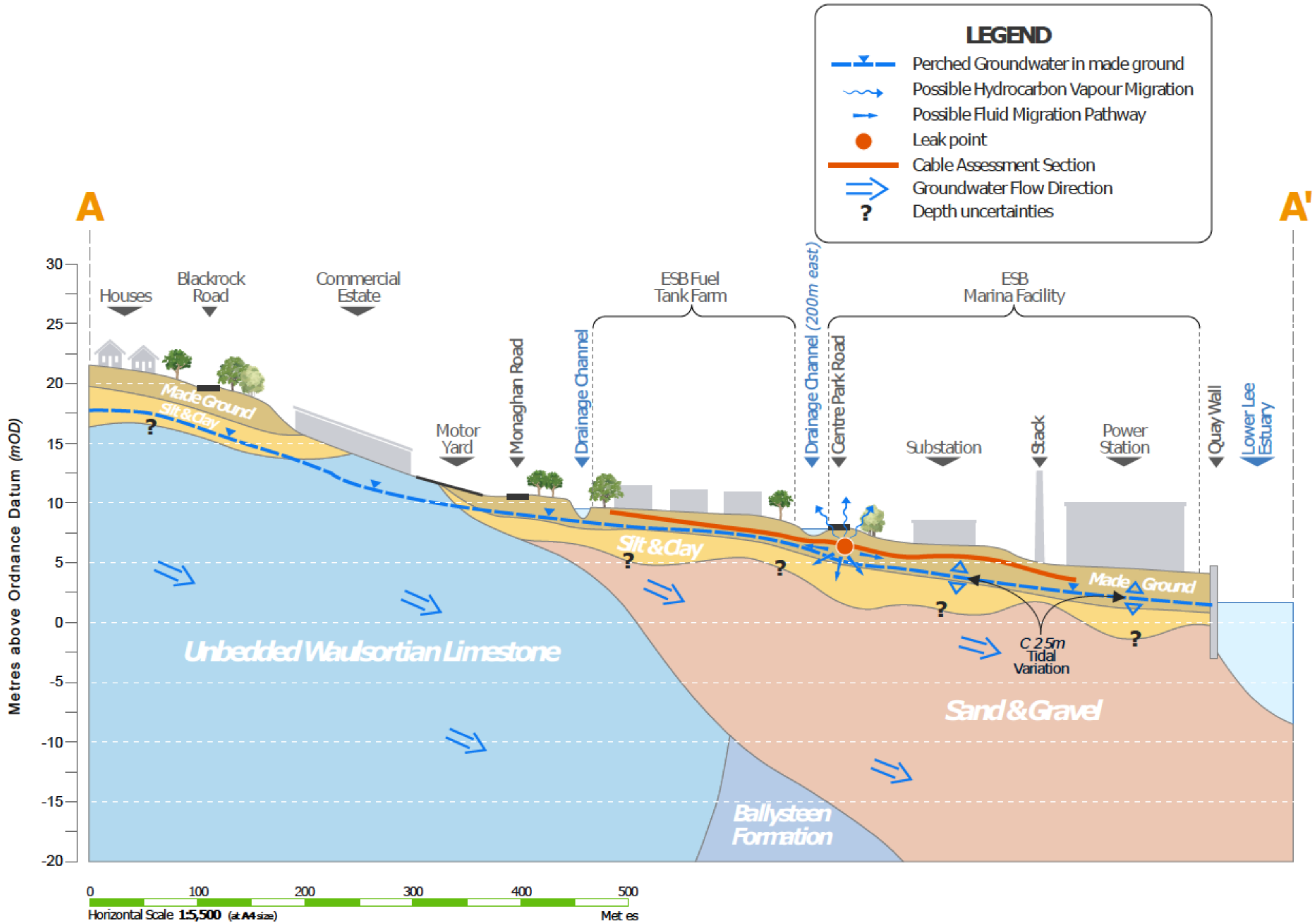
Figure 1: Site 27 - Site Location

Data Source: OpenStreet Maps 2019

Scale: 1:25000

Date: 02 - Aug - 2019


1000m Buffer
500m Buffer
Indicative Leak Location
Groundwater Flow Direction
Cross Sections
Wells (Location Accuracy)
Wells 10-50m Acc
Well (50-100m)
Well (100-200m)
Wells 500m Acc
Wells 500-1000m Acc
WFD Rivers
WFD Transitional Waters
NPWS Designated Sites
SPA
pNHA
Glanmire Wood
Glashaboy Estuary
Dunkettle Shore
Lee (Cork) Estuary Lower
Lee (Cork) Estuary Upper
A'
A
27 - Marina - Trabeg Two 110kV (November 2012)
Cork Lough
Douglas R
MONEYGURNEY_010
0
750
1500 m
N
Figure 2: Site 27 -
Sensitive Receptors Map
Data Source: ESRI World Topo; NPWS Designated Sites; GSI Well Database; WFD Waterbody Database
Scale: 1:25000
Date: 02 - Aug - 2019
Verdé



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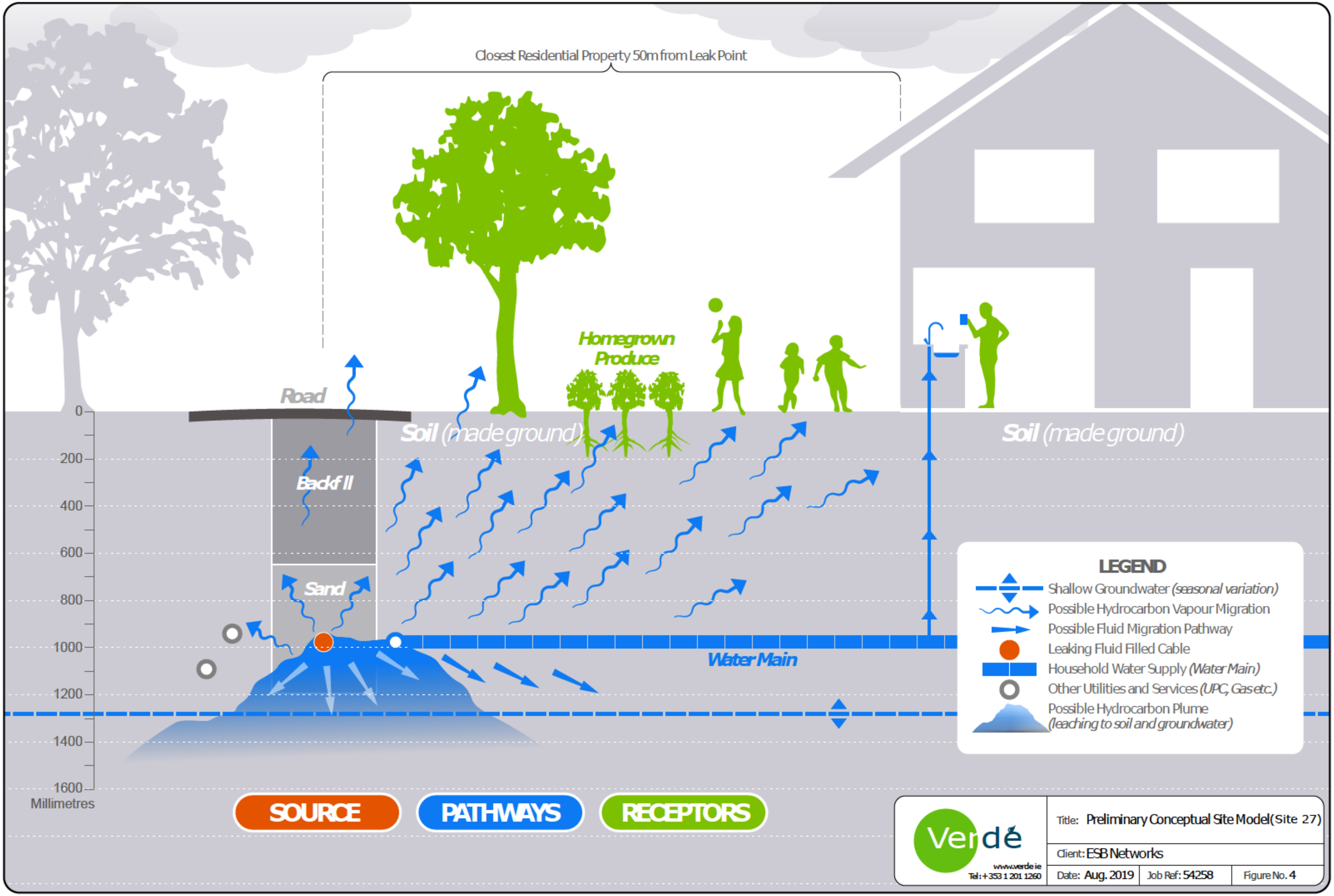
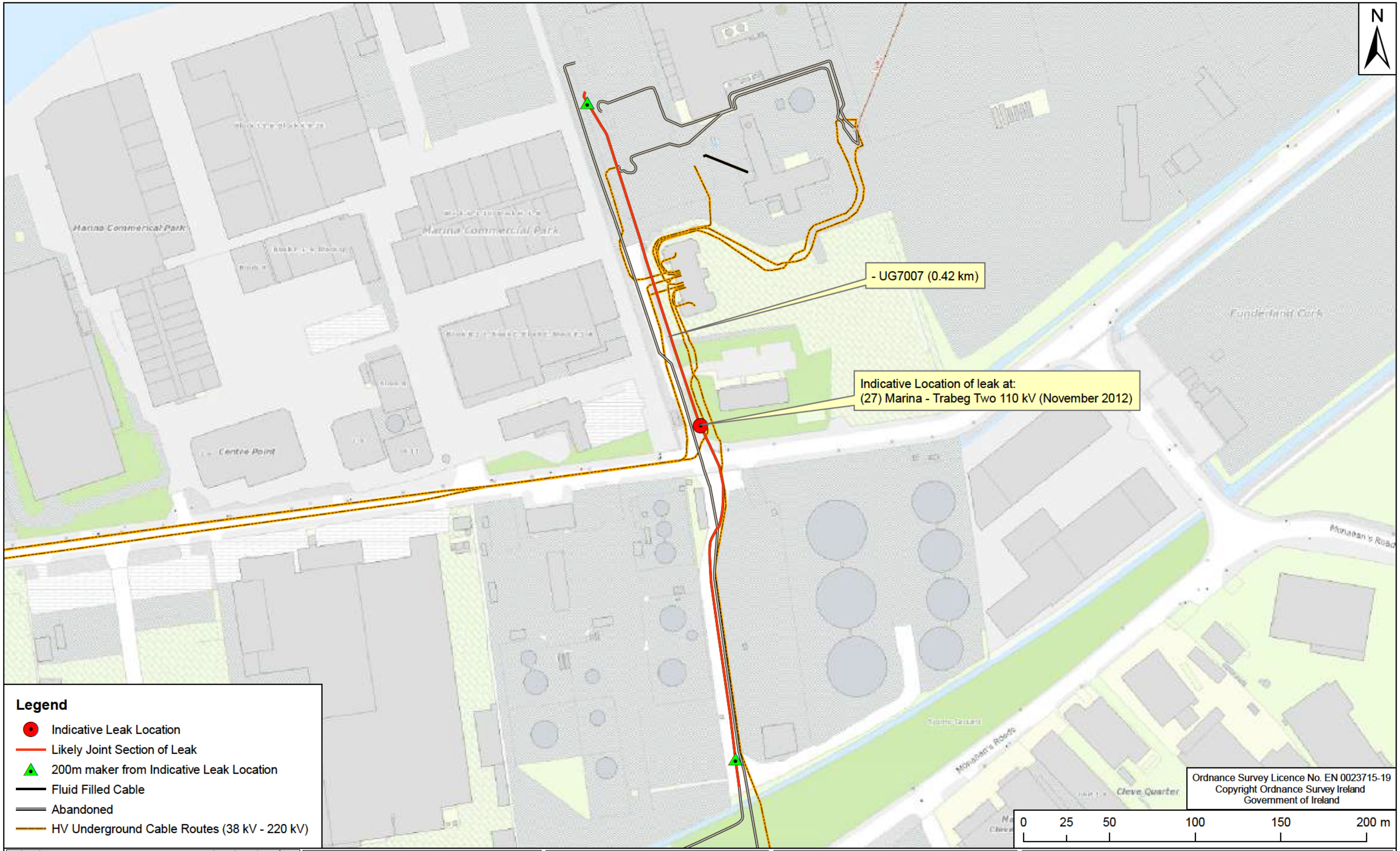
Tel: +353 1 201 1260

Title: Preliminary Conceptual Site Model *(Site 27)*		
Client: ESB Networks		
Date: Aug. 2019	Job Ref: 52458	Figure No. 3


Closest Residential Property 50m from Leak Point
Homegrown Produce
Road
Soil (made ground)
Backfill
Sand
Water Main
Soil (made ground)
0
200
400
600
800
1000
1200
1400
1600
Millimetres
LEGEND
Shallow Groundwater (seasonal variation)
Possible Hydrocarbon Vapour Migration
Possible Fluid Migration Pathway
Leaking Fluid Filled Cable
Household Water Supply (Water Main)
Other Utilities and Services (UPC, Gas etc.)
Possible Hydrocarbon Plume (leaching to soil and groundwater)
SOURCE
PATHWAYS
RECEPTORS
Verdé
www.verde.ie
Tel: +353 1 201 1260
Title: Preliminary Conceptual Site Model (Site 27)
Client: ESB Networks
Date: Aug. 2019
Job Ref: 54258
Figure No. 4

APPENDIX A

ESB SITE LAYOUT PLAN WITH INDICATIVE CABLE FLUID LEAKAGE LOCATION



Legend

- Indicative Leak Location
- Likely Joint Section of Leak
- 200m maker from Indicative Leak Location
- Fluid Filled Cable
- Abandoned
- HV Underground Cable Routes (38 kV - 220 kV)

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Copyright Ordnance Survey Ireland
Government of Ireland

0 25 50 100 150 200 m

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
0	2 07/19	REQUEST FOR PROPOSAL	T.O'R	T.O'R	J.F	A.M.C

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

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

Energy for generations

CLIENT: ESB Networks

PROJECT: P.R.A.

CONTRACT:

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Indicative Cable Fluid Leakage Locations & Cable Sections (27) Marina - Trabeg Two 110 kV (November 2012)

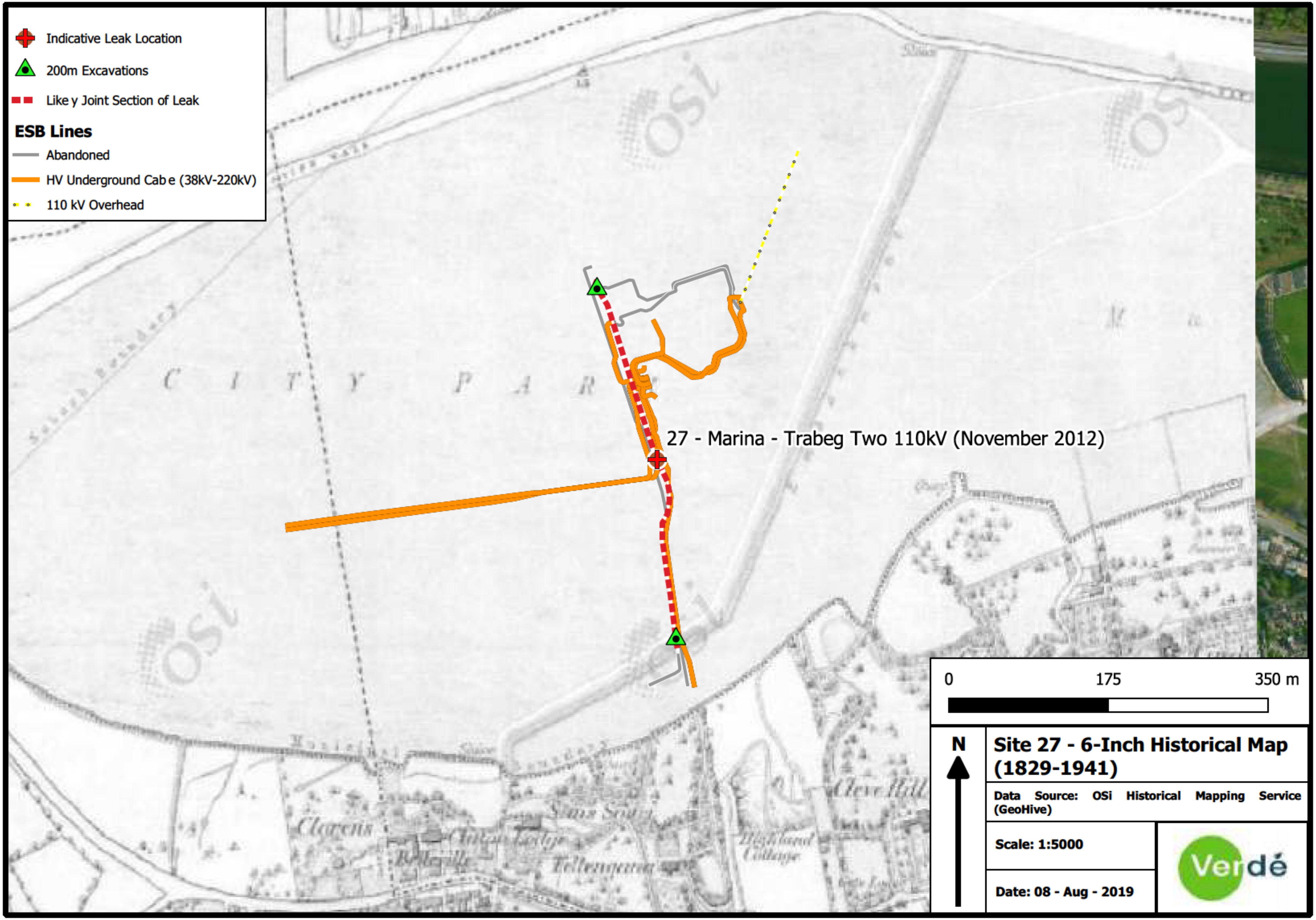
DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	24/07/2019

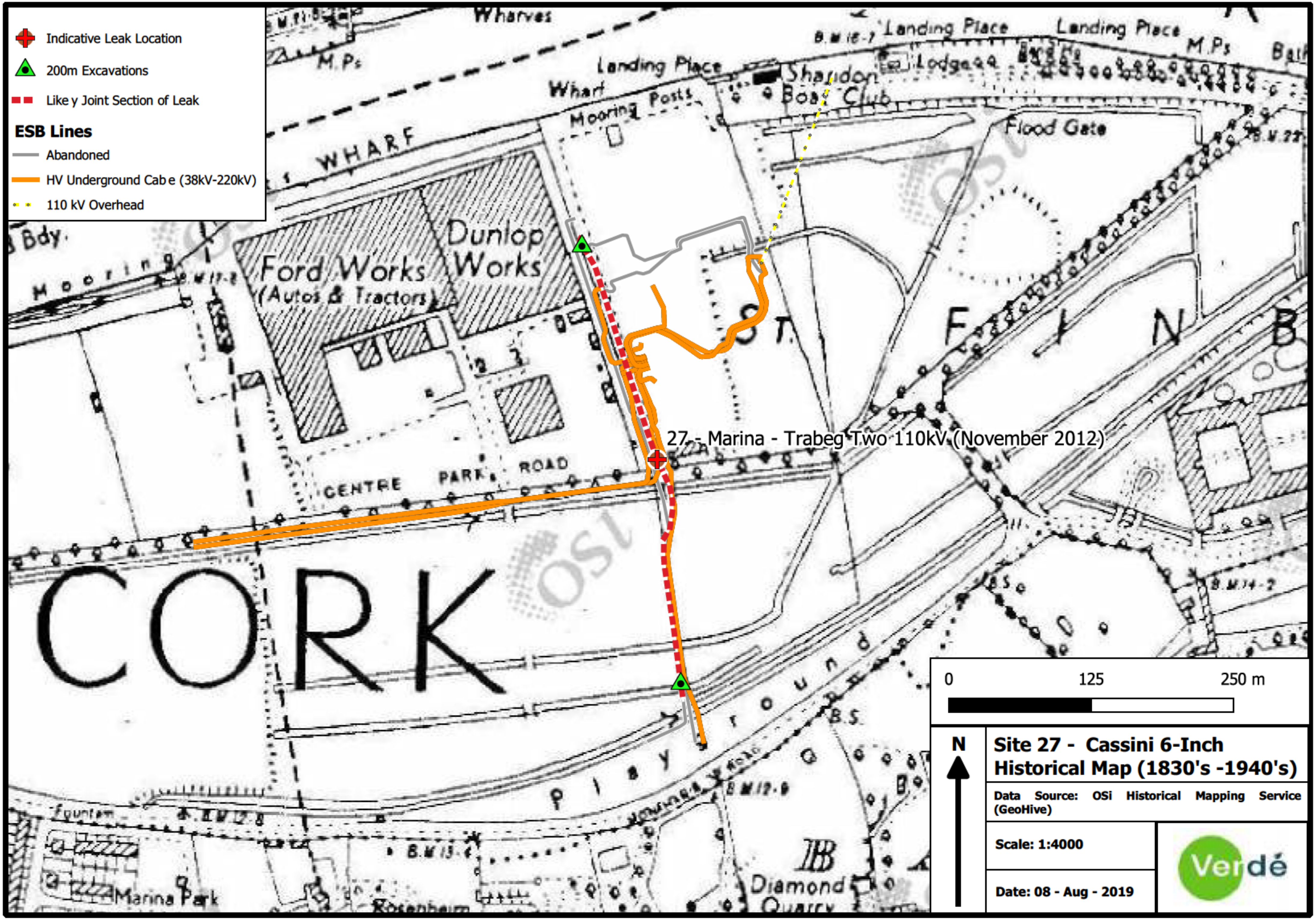
CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
00-00	0	1 of 1	A3	1:2,000

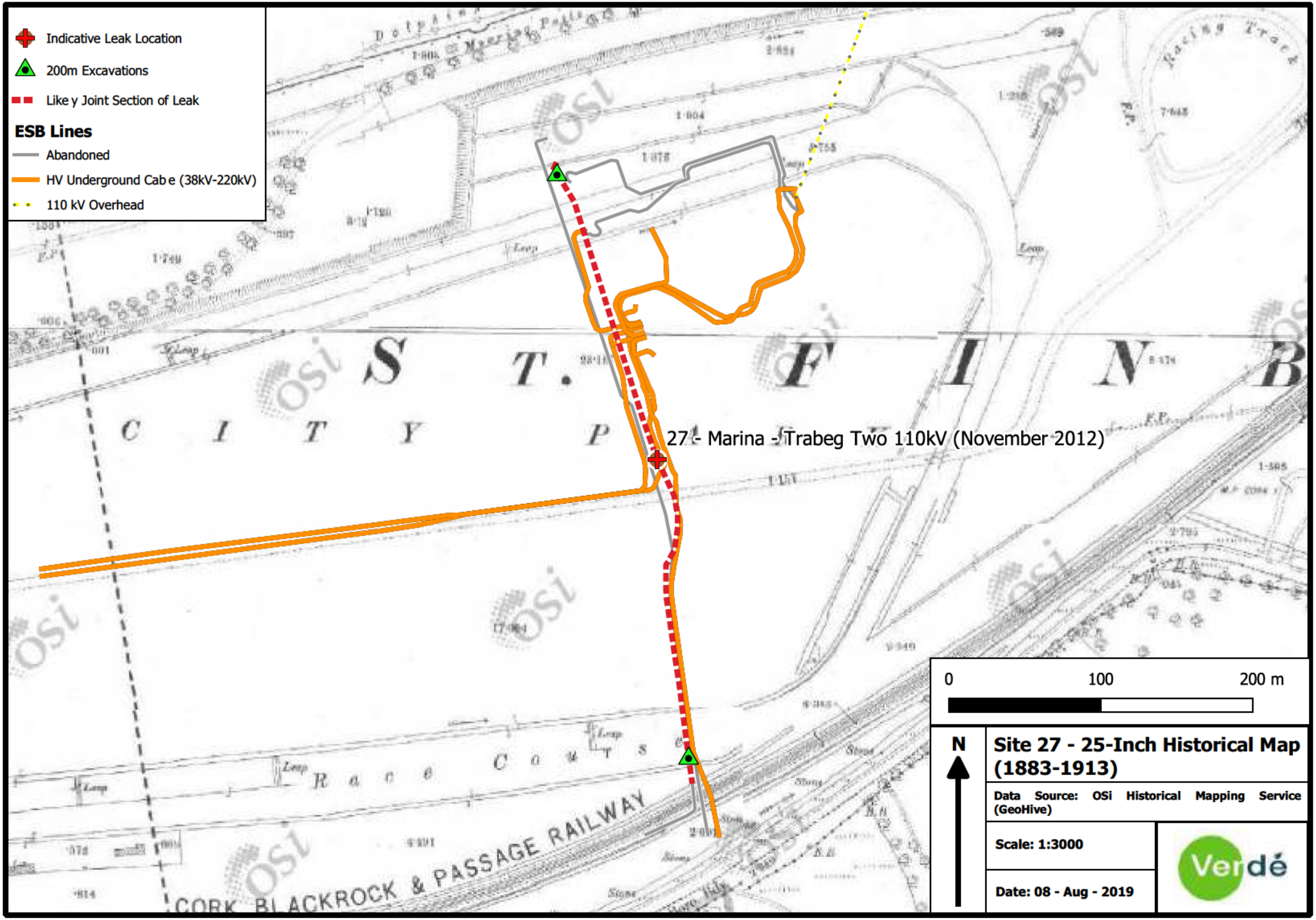
DRAWING NUMBER: QD-354120-01-D460-001-044-000

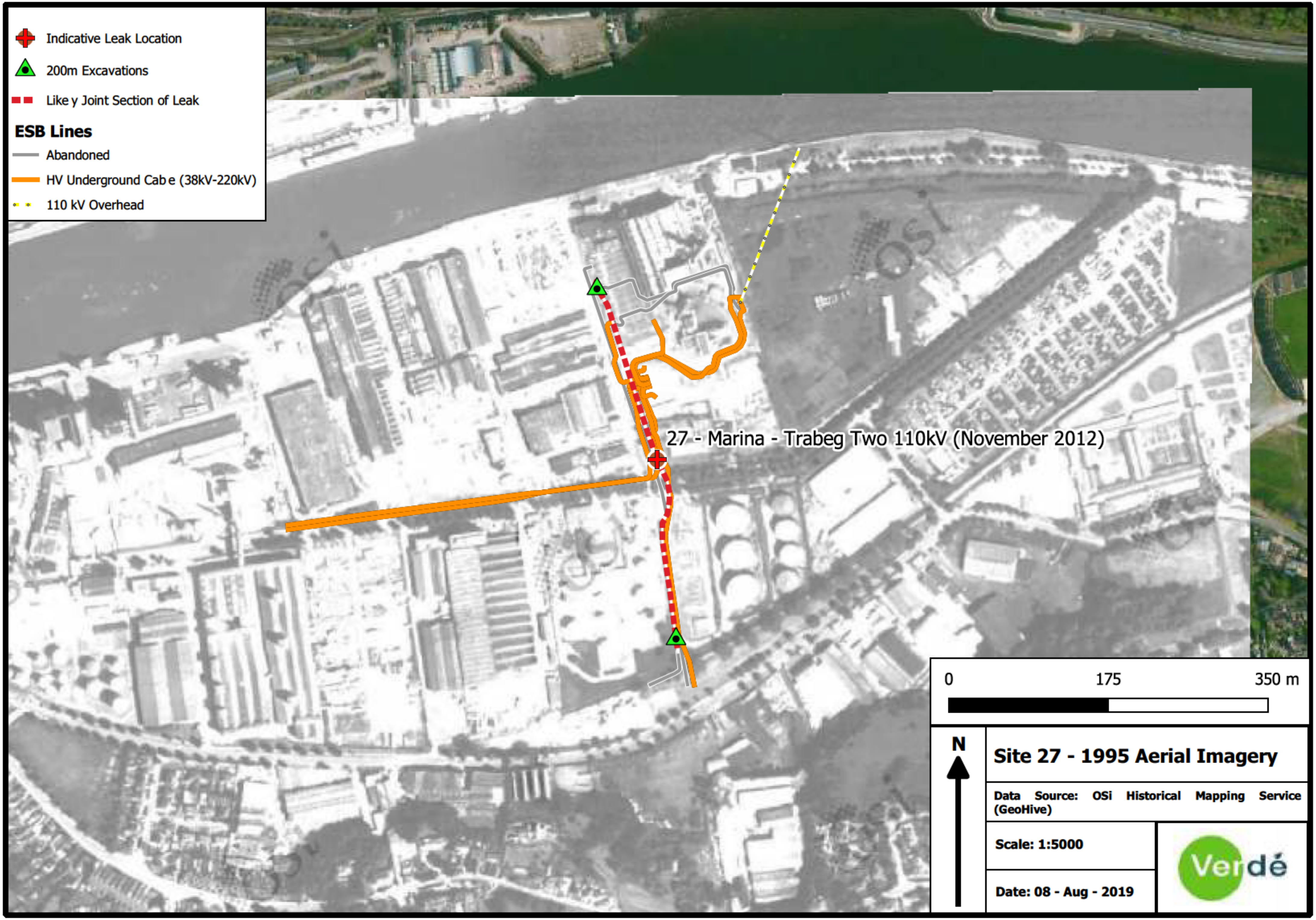
APPENDIX B

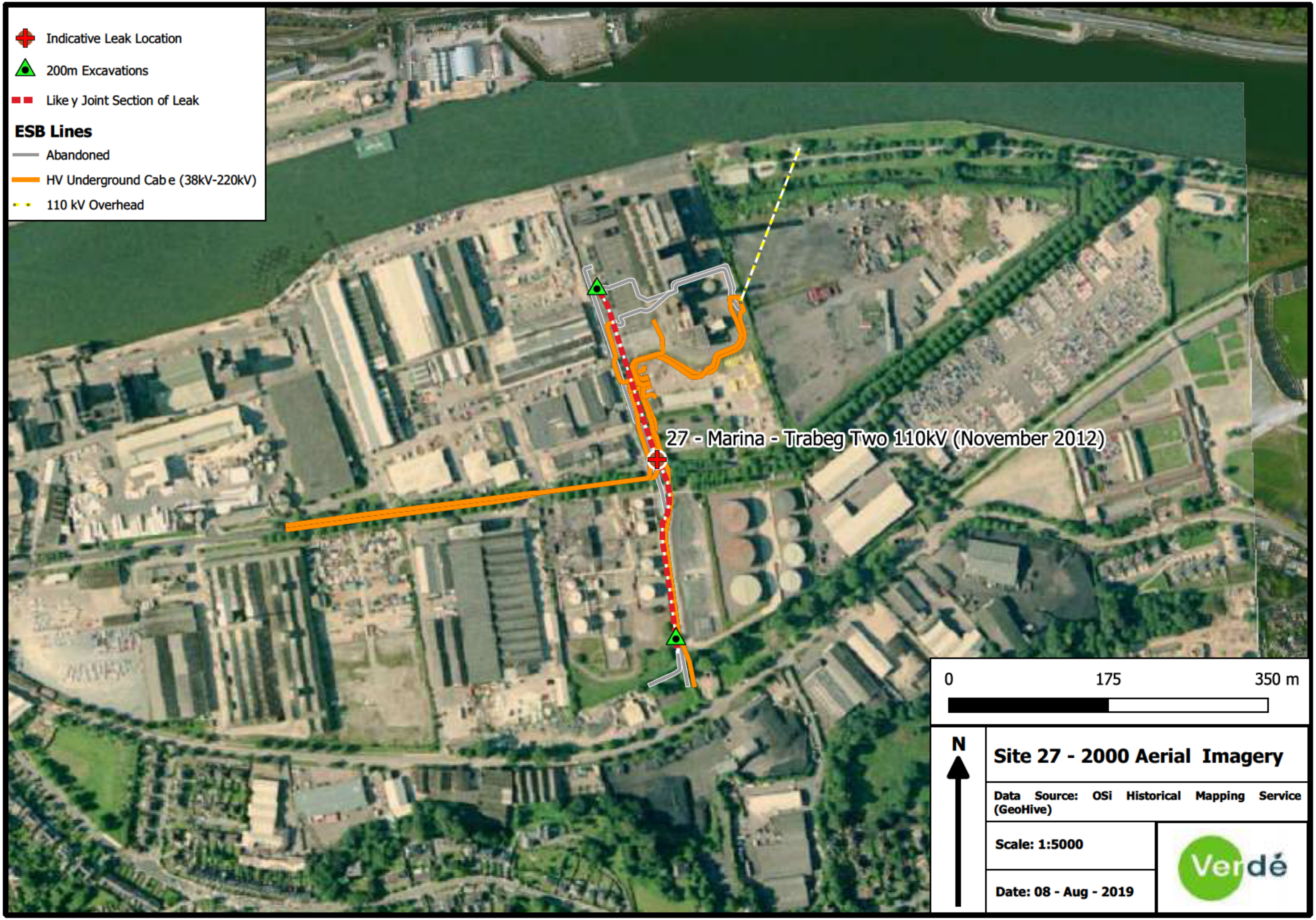
DESK STUDY MAPS

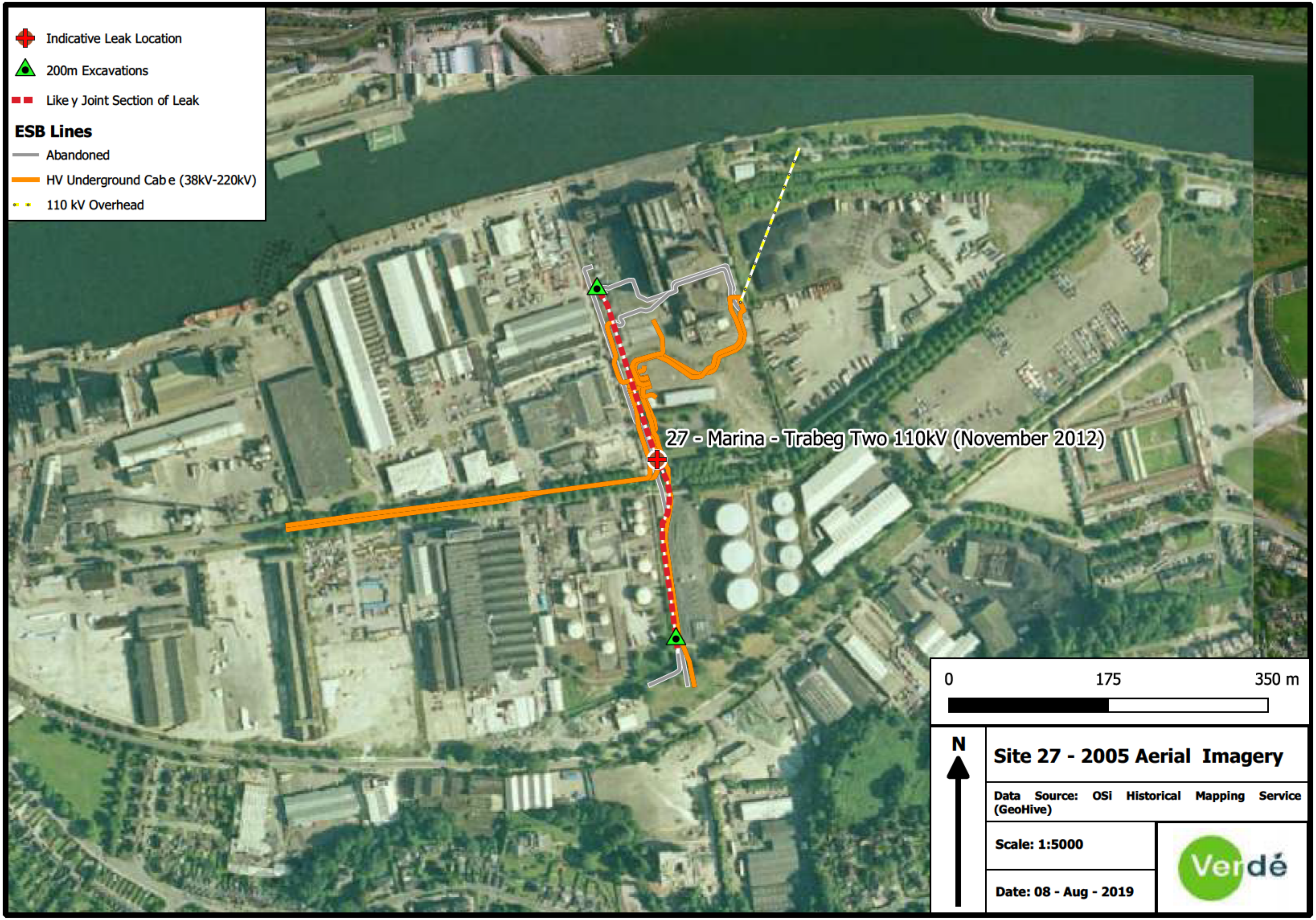

Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
0
175
350 m
N
Site 27 - 6-Inch Historical Map (1829-1941)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:5000
Date: 08 - Aug - 2019
Verdé

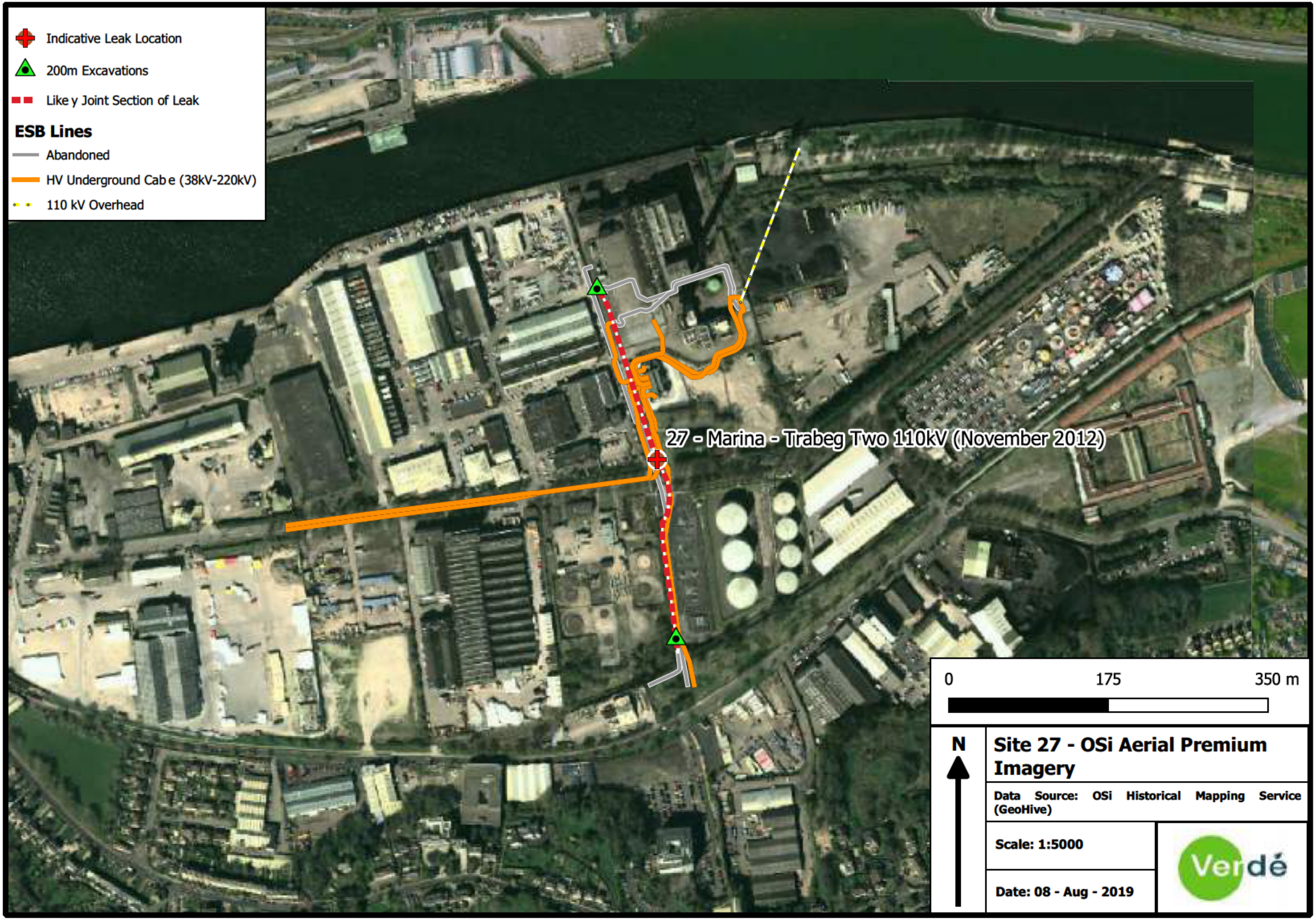

Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
Wharves
Landing Place
Landing Place
Wharf
Mooring Posts
Shandon Boat Club
Lodge
Flood Gate
WHARF
Ford Works (Autos & Tractors)
Dunlop Works
CENTRE PARK ROAD
CORK
Marina Park
Diamond Quarry
0
125
250 m
N
Site 27 - Cassini 6-Inch Historical Map (1830's -1940's)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:4000
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
CORK BLACKROCK & PASSAGE RAILWAY
0
100
200 m
N
Site 27 - 25-Inch Historical Map (1883-1913)
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:3000
Date: 08 - Aug - 2019
Verdé

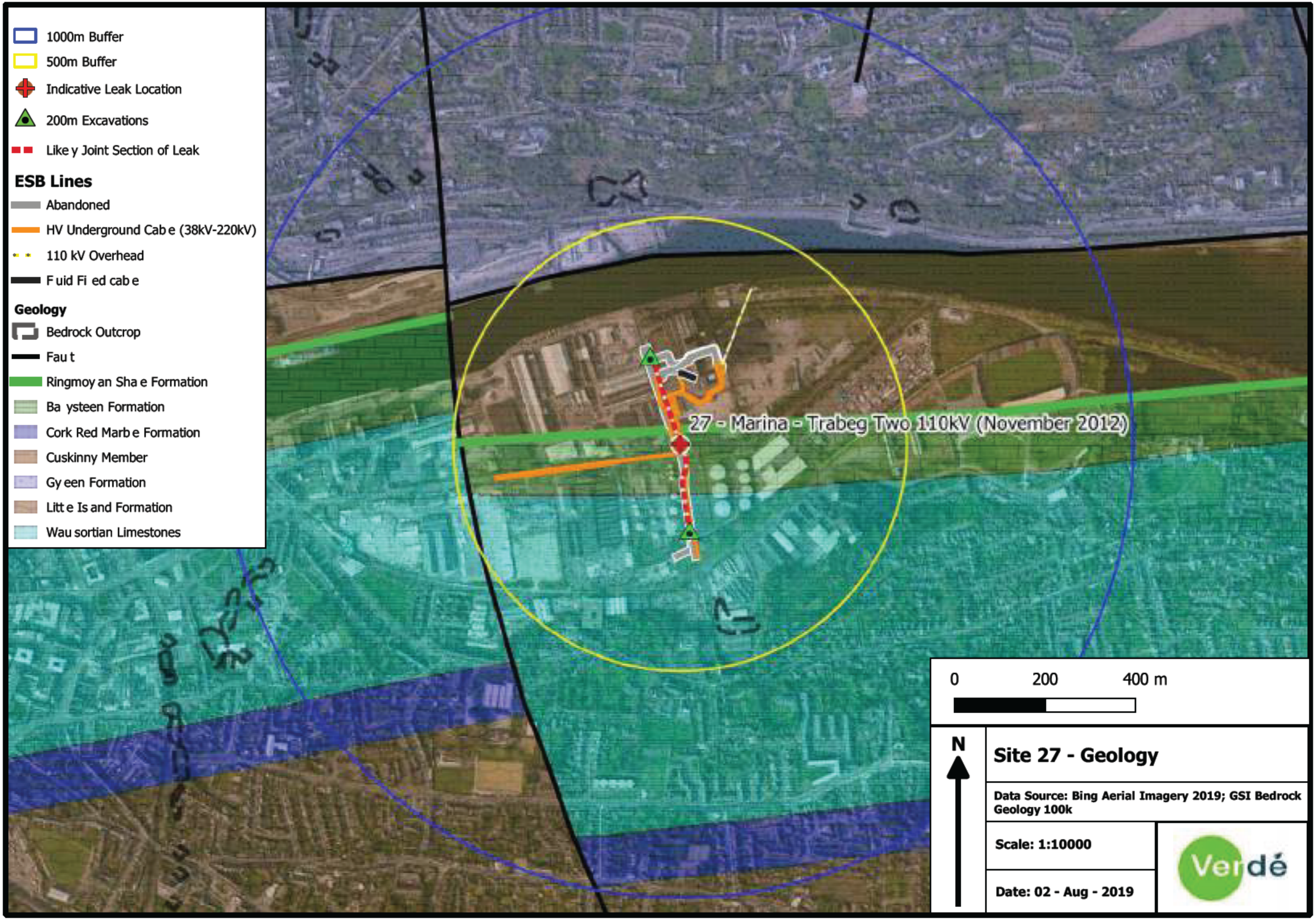

Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
0
175
350 m
N
Site 27 - 1995 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:5000
Date: 08 - Aug - 2019
Verdé

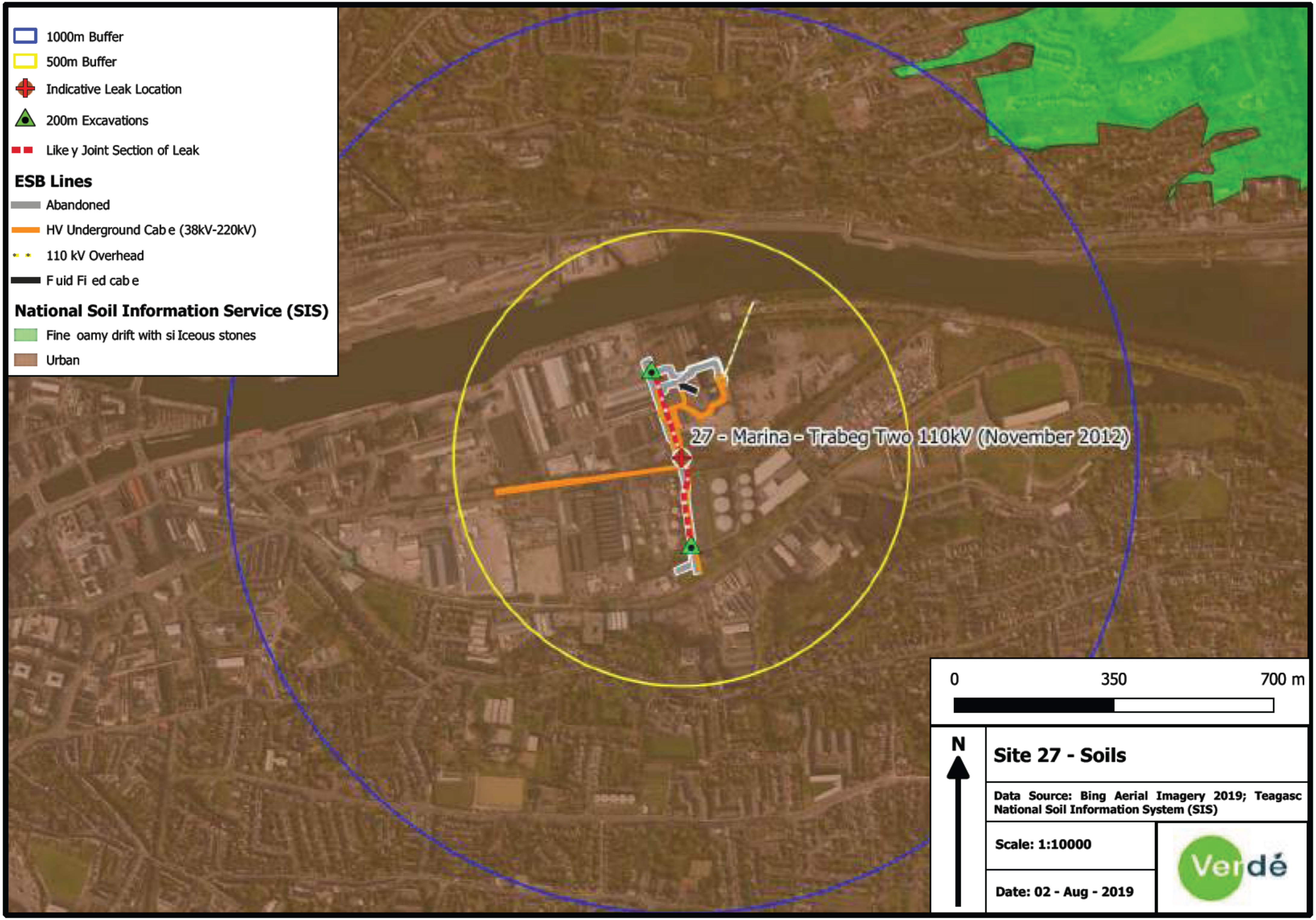

Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
0
175
350 m
N
Site 27 - 2000 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:5000
Date: 08 - Aug - 2019
Verdé


Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
0
175
350 m
N
Site 27 - 2005 Aerial Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:5000
Date: 08 - Aug - 2019
Verdé

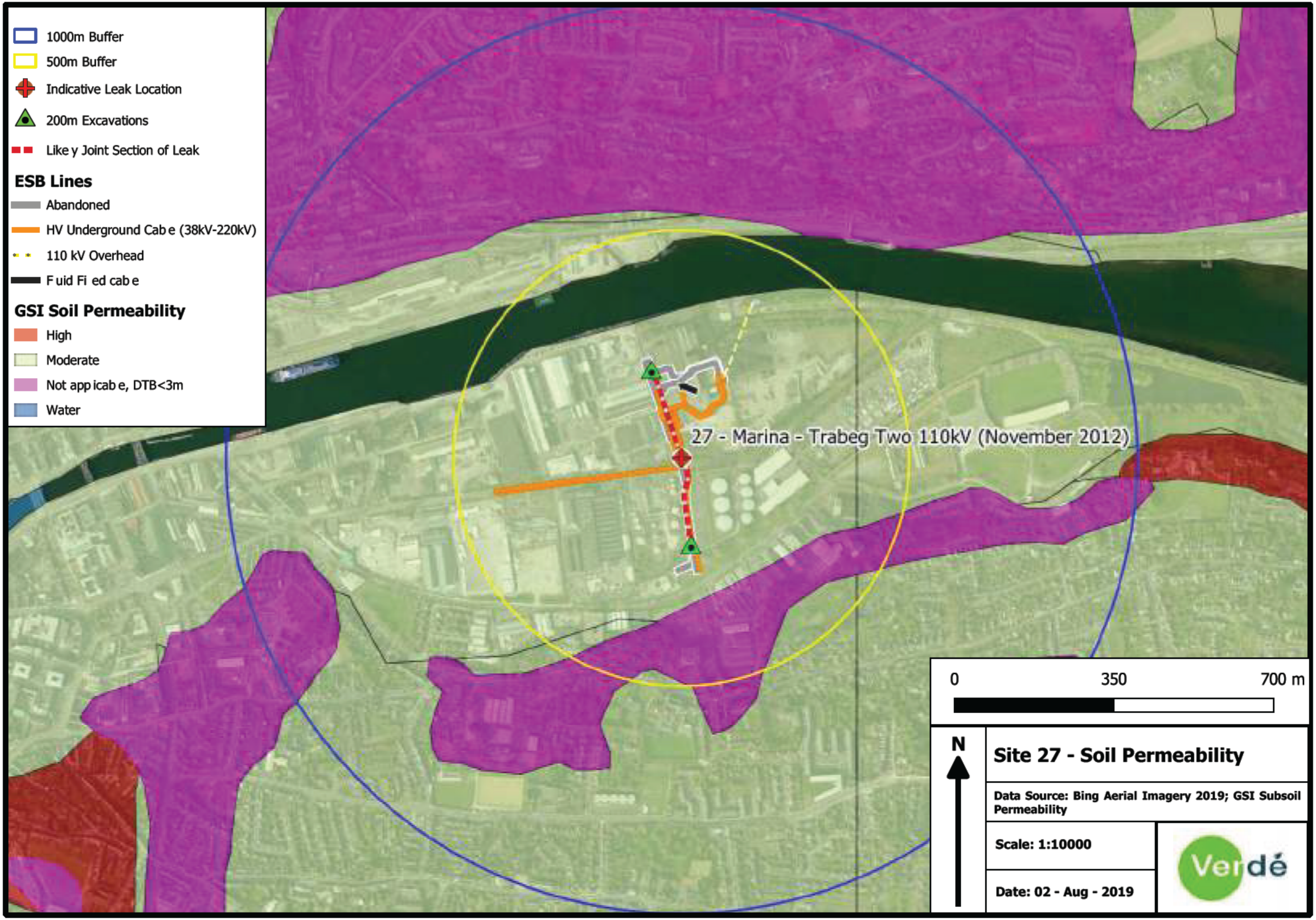

Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
27 - Marina - Trabeg Two 110kV (November 2012)
0
175
350 m
N
Site 27 - OSi Aerial Premium Imagery
Data Source: OSi Historical Mapping Service (GeoHive)
Scale: 1:5000
Date: 08 - Aug - 2019
Verdé

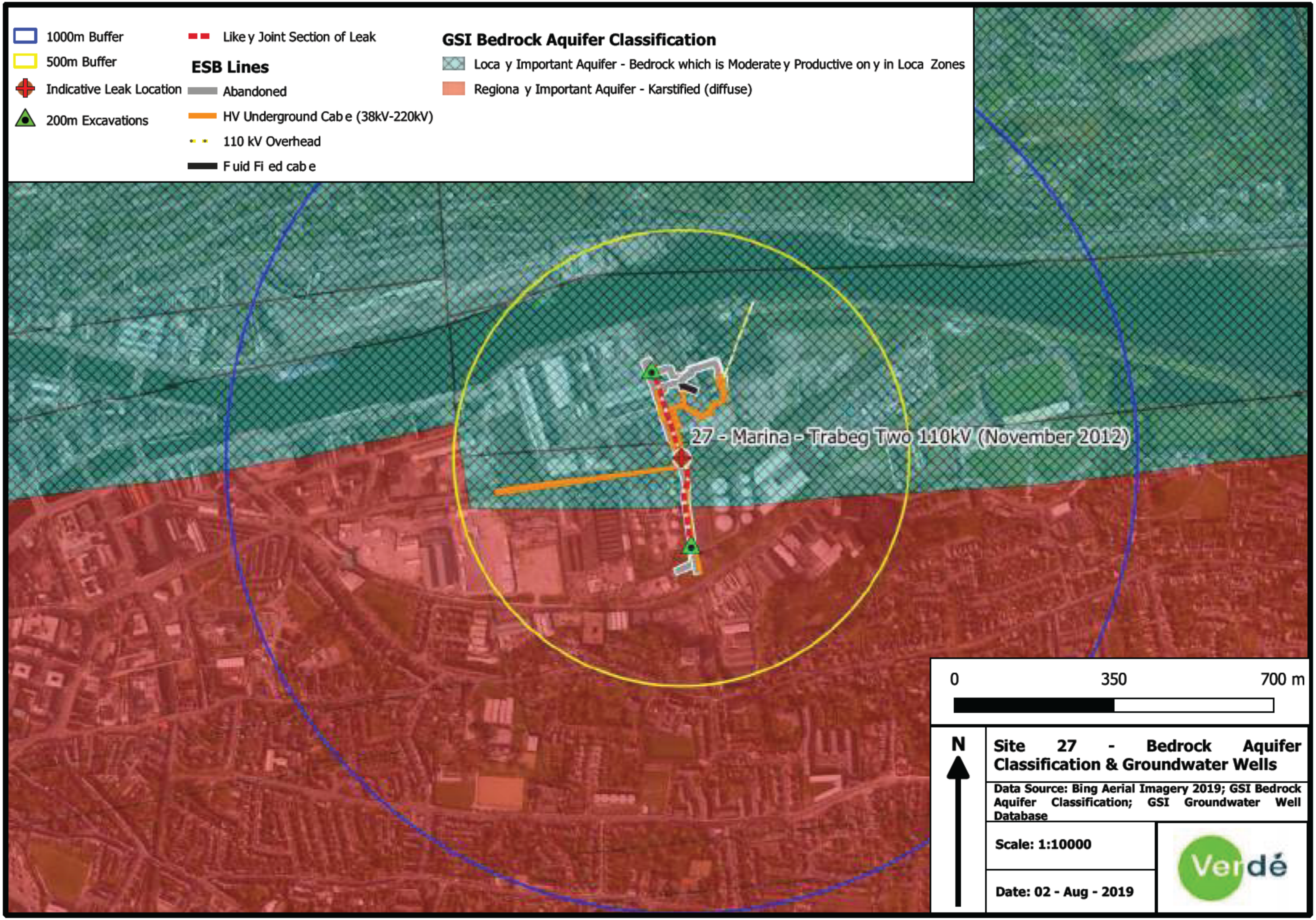

Geotechnical Borehole
Marina
1000m Buffer
500m Buffer
Cables
Indicative Leak Location
200m Excavations
Likely Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cable (38kV-220kV)
110 kV Overhead
Fluid Filled cable
5
1
12
13
15
C7
3
4
11
14
10
7
2
9
8
6
27 - Marina - Trabeg Two 110kV (November 2012)
0
150
300 m
N
Site 27 - Geotechnical Boreholes
Data Source: Google Satellite Imagery 2019; GSI Geotechnical Databse
Scale: 1:5000
Date: 15 - Aug - 2019
Verdé

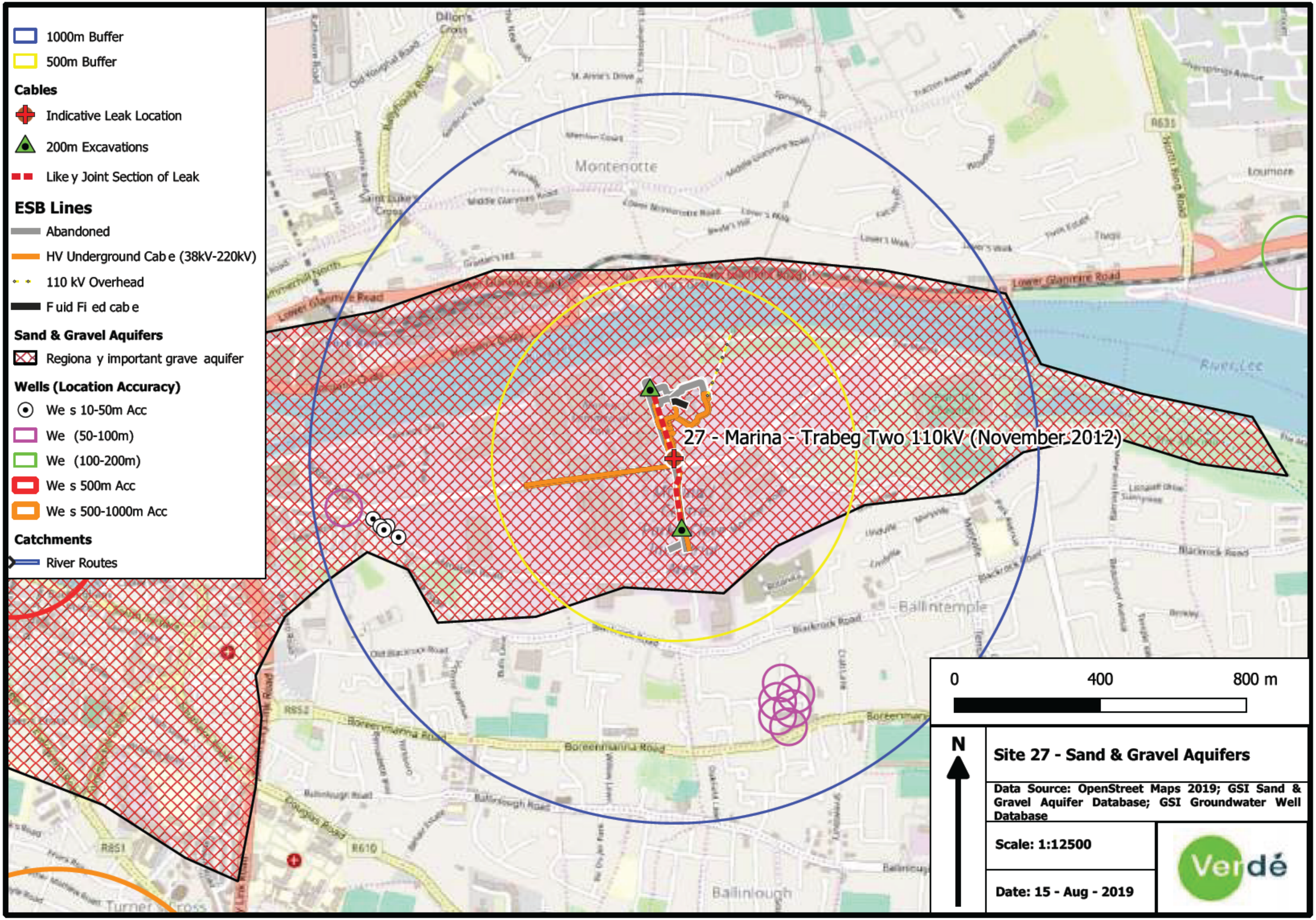

1000m Buffer
500m Buffer
Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
F uid Fi ed cab e
Geology
Bedrock Outcrop
Fau t
Ringmoy an Sha e Formation
Ba ysteen Formation
Cork Red Marb e Formation
Cuskinny Member
Gy een Formation
Litt e Is and Formation
Wau sortian Limestones
27 - Marina - Trabeg Two 110kV (November 2012)
0
200
400 m
N
Site 27 - Geology
Data Source: Bing Aerial Imagery 2019; GSI Bedrock Geology 100k
Scale: 1:10000
Date: 02 - Aug - 2019
Verdé



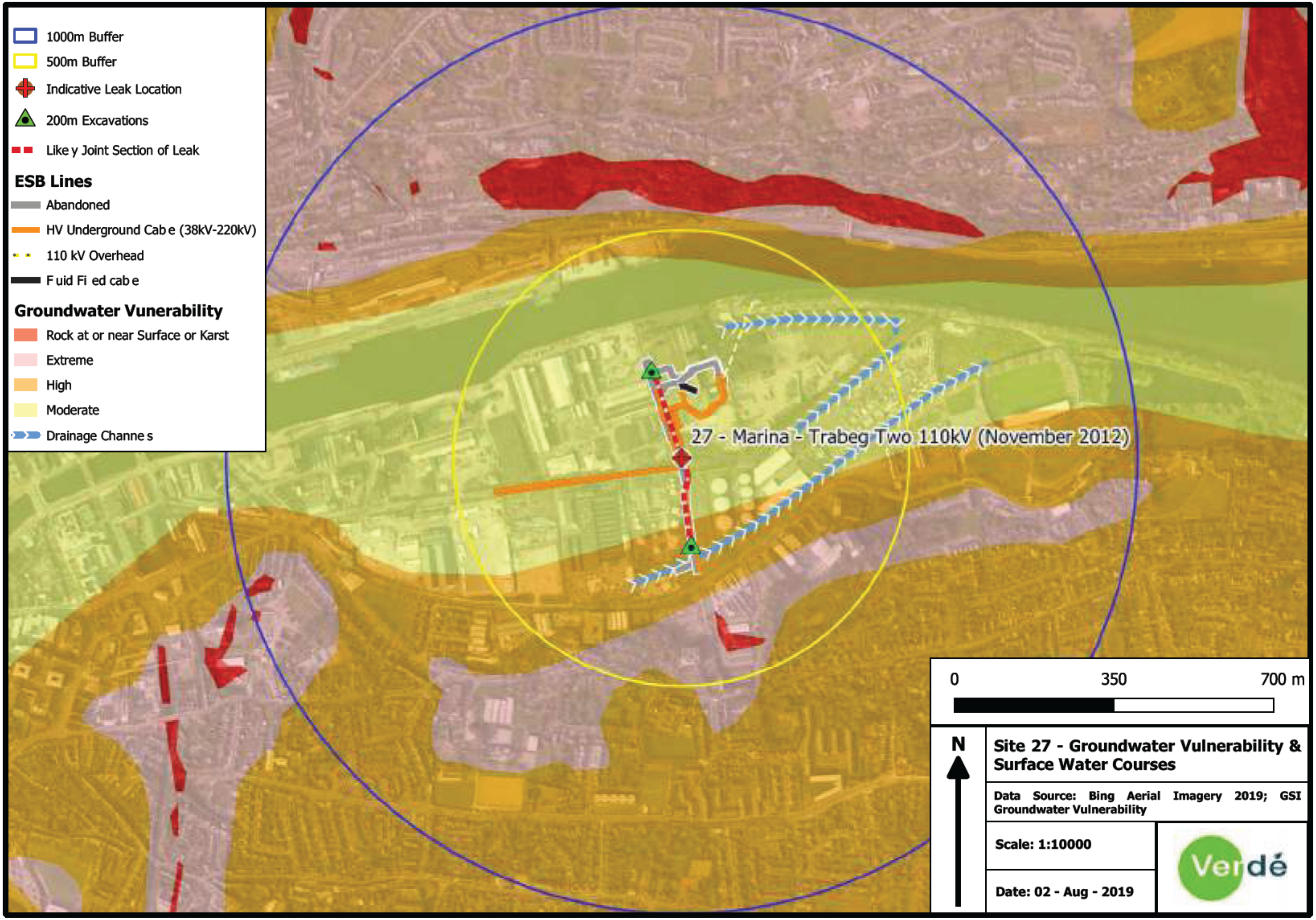
1000m Buffer
500m Buffer
Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
F uid Fi ed cab e
National Soil Information Service (SIS)
Fine oamy drift with si Iceous stones
Urban
27 - Marina - Trabeg Two 110kV (November 2012)
0
350
700 m
N
Site 27 - Soils
Data Source: Bing Aerial Imagery 2019; Teagasc National Soil Information System (SIS)
Scale: 1:10000
Date: 02 - Aug - 2019
Verdé


1000m Buffer
500m Buffer
Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
F uid Fi ed cab e
GSI Soil Permeability
High
Moderate
Not app icab e, DTB<3m
Water
27 - Marina - Trabeg Two 110kV (November 2012)
0
350
700 m
N
Site 27 - Soil Permeability
Data Source: Bing Aerial Imagery 2019; GSI Subsoil Permeability
Scale: 1:10000
Date: 02 - Aug - 2019
Verdé

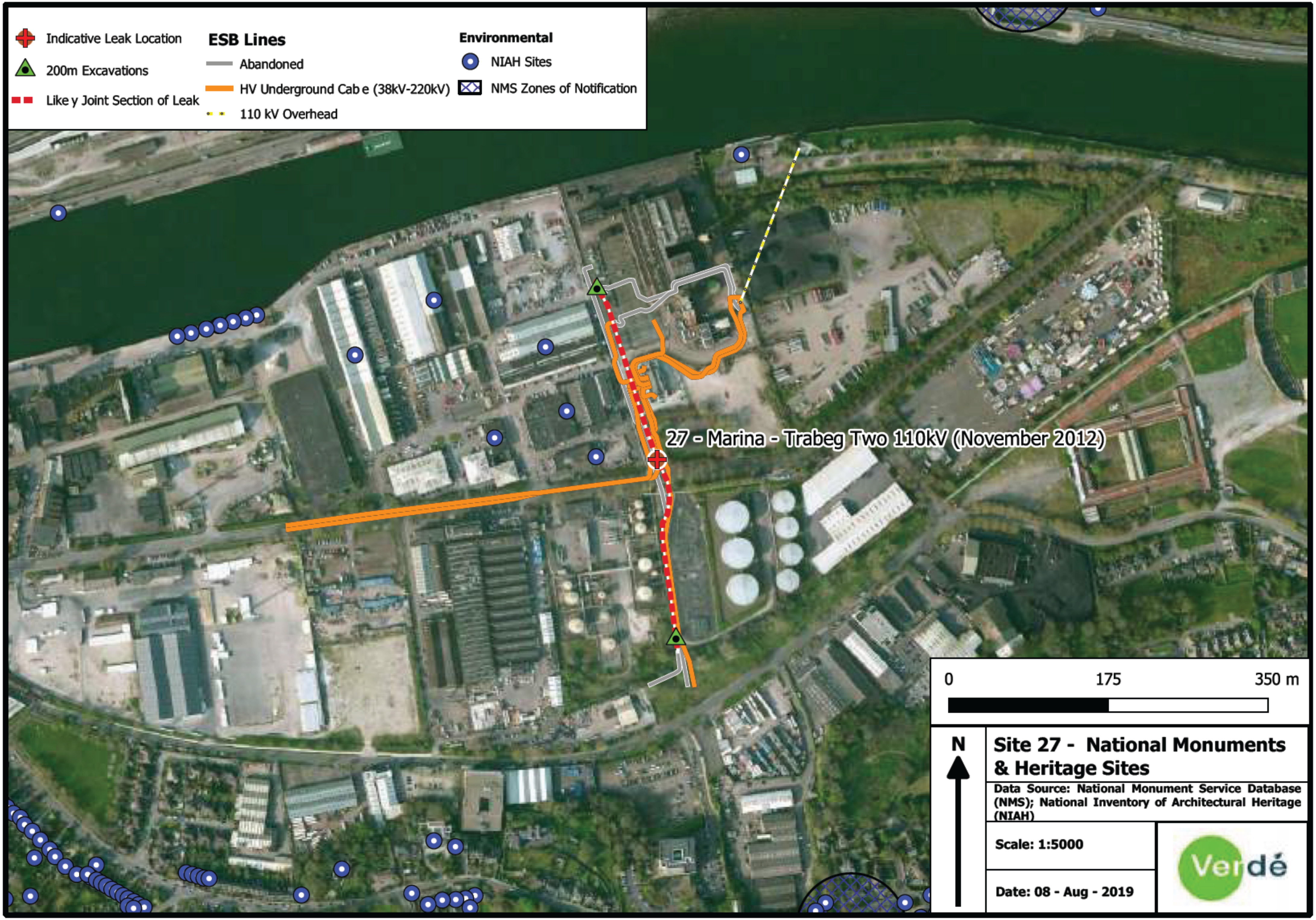

1000m Buffer
500m Buffer
Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
F uid Fi ed cab e
GSI Bedrock Aquifer Classification
Loca y Important Aquifer - Bedrock which is Moderate y Productive on y in Loca Zones
Regiona y Important Aquifer - Karstified (diffuse)
27 - Marina - Trabeg Two 110kV (November 2012)
0
350
700 m
N
Site 27 - Bedrock Aquifer Classification & Groundwater Wells
Data Source: Bing Aerial Imagery 2019; GSI Bedrock Aquifer Classification; GSI Groundwater Well Database
Scale: 1:10000
Date: 02 - Aug - 2019
Verdé



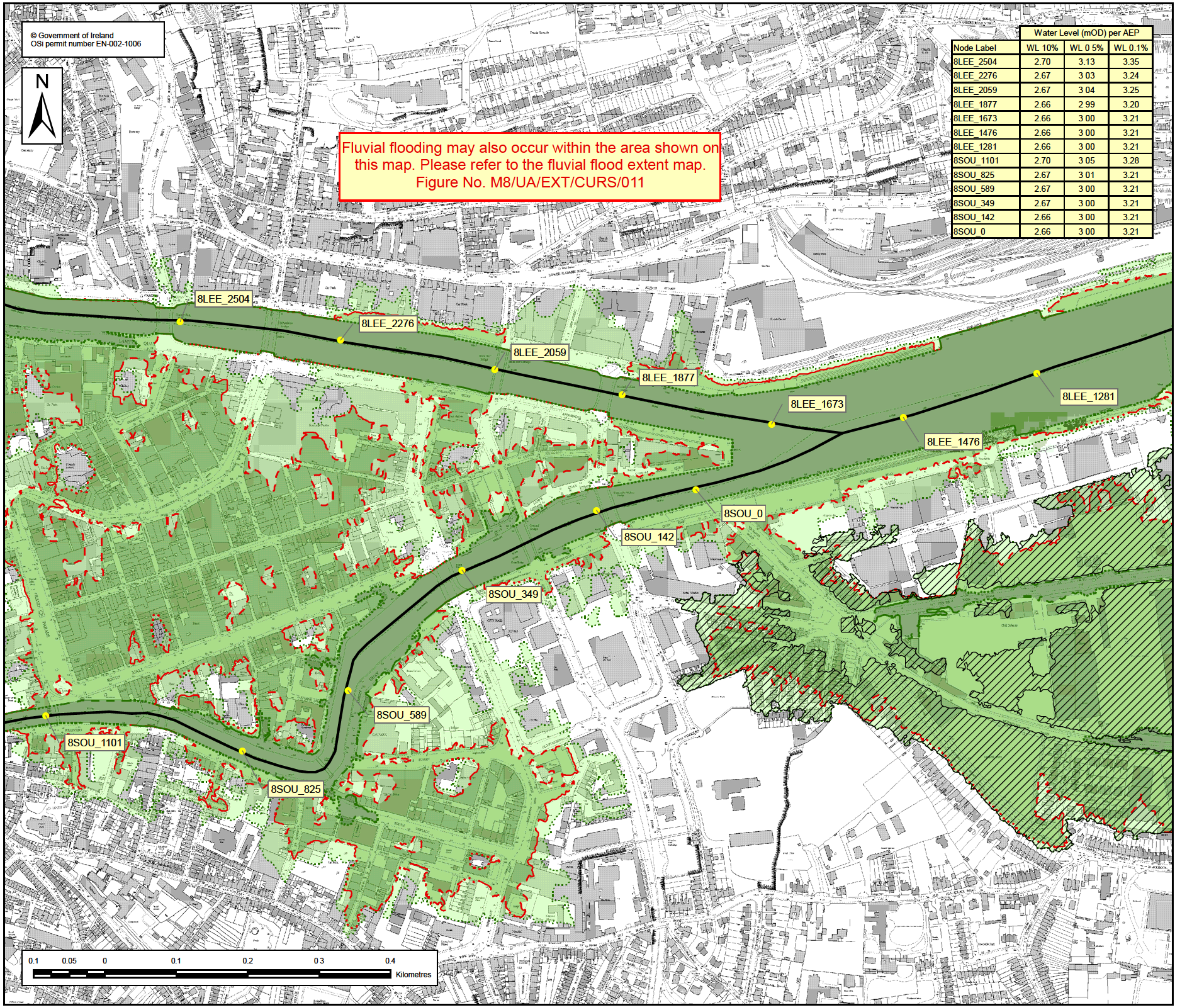
1000m Buffer
500m Buffer
Cables
Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
F uid Fi ed cab e
Sand & Gravel Aquifers
Regiona y important grave aquifer
Wells (Location Accuracy)
We s 10-50m Acc
We (50-100m)
We (100-200m)
We s 500m Acc
We s 500-1000m Acc
Catchments
River Routes
27 - Marina - Trabeg Two 110kV (November 2012)
Montenotte
Ballintemple
Ballinlough
River Lee
Lower Glanmire Road
Boreenmanna Road
Blackrock Road
0
400
800 m
N
Site 27 - Sand & Gravel Aquifers
Data Source: OpenStreet Maps 2019; GSI Sand & Gravel Aquifer Database; GSI Groundwater Well Database
Scale: 1:12500
Date: 15 - Aug - 2019


1000m Buffer
500m Buffer
Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
F uid Fi ed cab e
Groundwater Vunerability
Rock at or near Surface or Karst
Extreme
High
Moderate
Drainage Channe s
27 - Marina - Trabeg Two 110kV (November 2012)
0
350
700 m
N
Site 27 - Groundwater Vulnerability & Surface Water Courses
Data Source: Bing Aerial Imagery 2019; GSI Groundwater Vulnerability
Scale: 1:10000
Date: 02 - Aug - 2019
Verdé


1000m Buffer
500m Buffer
Cables
Indicative Leak Location
Ground waterbodies
Gravel
Karstic
Poorly productive bedrock
Productive fissured bedrock
Ballinhassig East
27 - Marina - Trabeg Two 110kV (November 2012)
Lee Valley Gravels
Ballincollig
Waste Facility (W0012-03)
0
800
1600 m
N
Site 27 - EPA Groundwater Bodies
Data Source: Google Satellite Imagery 2019; WFD Groundwater Bodies (EPA)
Scale: 1:25000
Date: 15 - Aug - 2019
Verdé

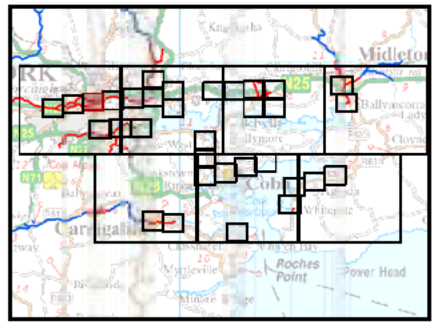


Indicative Leak Location
200m Excavations
Like y Joint Section of Leak
ESB Lines
Abandoned
HV Underground Cab e (38kV-220kV)
110 kV Overhead
Environmental
NIAH Sites
NMS Zones of Notification
27 - Marina - Trabeg Two 110kV (November 2012)
0
175
350 m
N
Site 27 - National Monuments & Heritage Sites
Data Source: National Monument Service Database (NMS); National Inventory of Architectural Heritage (NIAH)
Scale: 1:5000
Date: 08 - Aug - 2019
Verdé



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 0 5%	WL 0.1%
8LEE_2504	2.70	3.13	3.35
8LEE_2276	2.67	3 03	3.24
8LEE_2059	2.67	3 04	3.25
8LEE_1877	2.66	2 99	3.20
8LEE_1673	2.66	3 00	3.21
8LEE_1476	2.66	3 00	3.21
8LEE_1281	2.66	3 00	3.21
8SOU_1101	2.70	3 05	3.28
8SOU_825	2.67	3 01	3.21
8SOU_589	2.67	3 00	3.21
8SOU_349	2.67	3 00	3.21
8SOU_142	2.66	3 00	3.21
8SOU_0	2.66	3 00	3.21

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- River Centreline
- Node Point
- 001 Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

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Little Island
Cork
Ireland

OPW
Office of Public Works
17-19 Lower Hatch Street
Dublin 2
Ireland

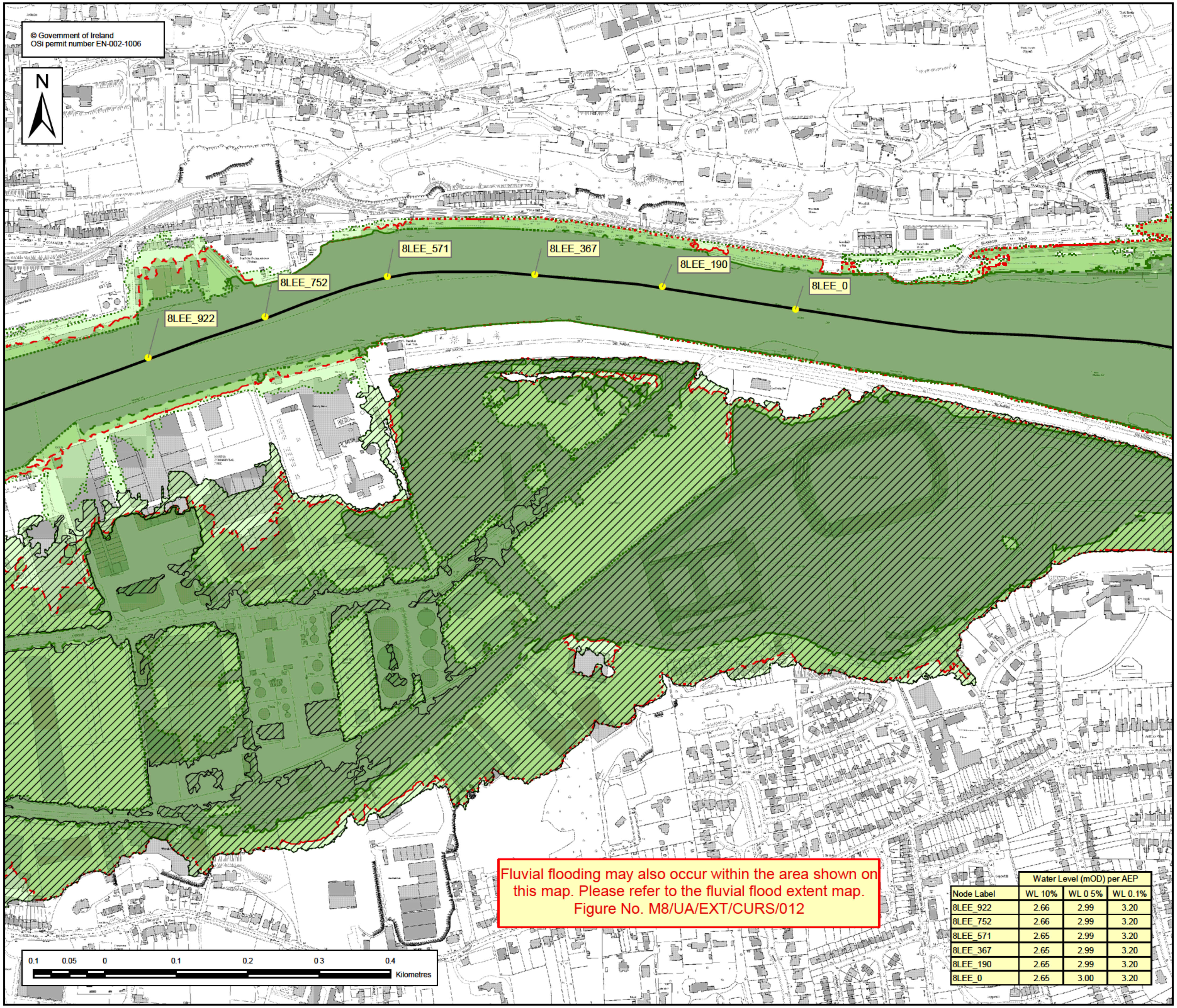
Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
CORK CITY

Map Type : FLOOD EXTENT
Source : TIDAL FLOODING
Map area : URBAN AREA
Scenario : CURRENT
Figure By : Valeria Medina Date : 10 March 2014
Checked By : Ricardo Santaella Date : 10 March 2014
Approved By : Clare Dewar Date : 10 March 2014

Figure No. : M9/UA/EXT/CURS/004
Revision 2

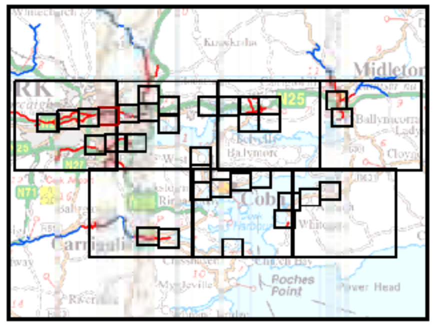
Drawing Scale : 1:5,000 Plot Scale : 1:1 @ A3



Fluvial flooding may also occur within the area shown on this map. Please refer to the fluvial flood extent map. Figure No. M8/UA/EXT/CURS/012

	Water Level (mOD) per AEP		
Node Label	WL 10%	WL 0.5%	WL 0.1%
8LEE_922	2.66	2.99	3.20
8LEE_752	2.66	2.99	3.20
8LEE_571	2.65	2.99	3.20
8LEE_367	2.65	2.99	3.20
8LEE_190	2.65	2.99	3.20
8LEE_0	2.65	3.00	3.20

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- River Centreline
- Node Point
- 001 Node Label (refer to table)

USER NOTE :

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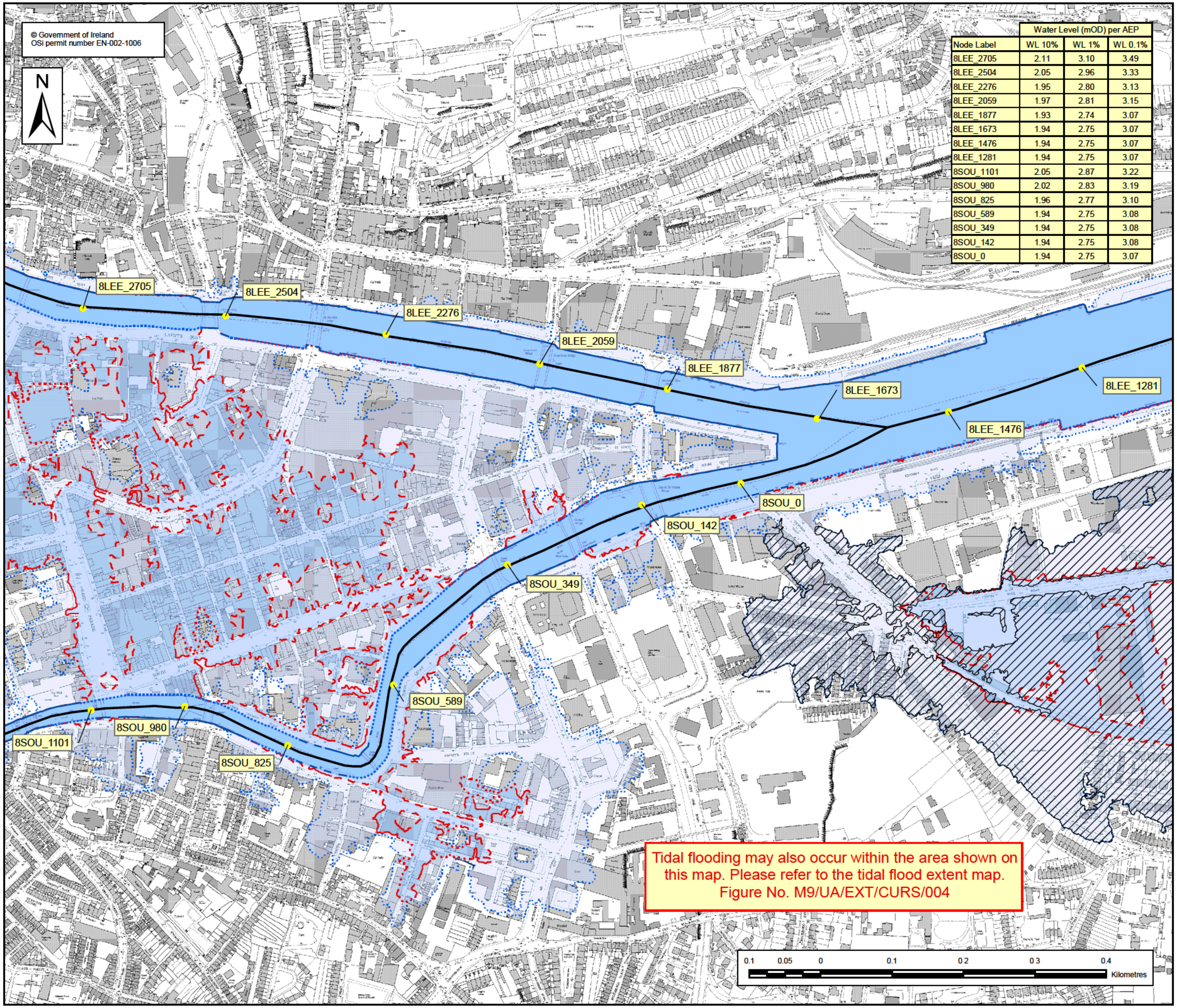
Little Island
Cork
Ireland

OPW
Office of Public Works
17-19 Lower Hatch Street
Dublin 2
Ireland

Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
CORK CITY

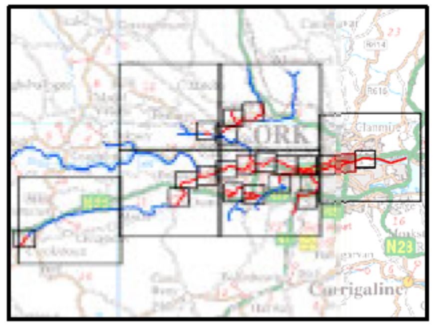
Map Type :	FLOOD EXTENT
Source :	TIDAL FLOODING
Map area :	URBAN AREA
Scenario :	CURRENT
Figure By : Valeria Medina	Date : 10 March 2014
Checked By : Ricardo Santaella	Date : 10 March 2014
Approved By : Clare Dewar	Date : 10 March 2014
Figure No. : M9/UA/EXT/CURS/005	Revision 2
Drawing Scale : 1:5,000	Plot Scale : 1:1 @ A3



Node Label	Water Level (mOD) per AEP WL 10%	WL 1%	WL 0.1%
8LEE_2705	2.11	3.10	3.49
8LEE_2504	2.05	2.96	3.33
8LEE_2276	1.95	2.80	3.13
8LEE_2059	1.97	2.81	3.15
8LEE_1877	1.93	2.74	3.07
8LEE_1673	1.94	2.75	3.07
8LEE_1476	1.94	2.75	3.07
8LEE_1281	1.94	2.75	3.07
8SOU_1101	2.05	2.87	3.22
8SOU_980	2.02	2.83	3.19
8SOU_825	1.96	2.77	3.10
8SOU_589	1.94	2.75	3.08
8SOU_349	1.94	2.75	3.08
8SOU_142	1.94	2.75	3.08
8SOU_0	1.94	2.75	3.07

Tidal flooding may also occur within the area shown on this map. Please refer to the tidal flood extent map. Figure No. M9/UA/EXT/CURS/004

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- 8OWG_376 Node Label (refer to table)

USER NOTE :

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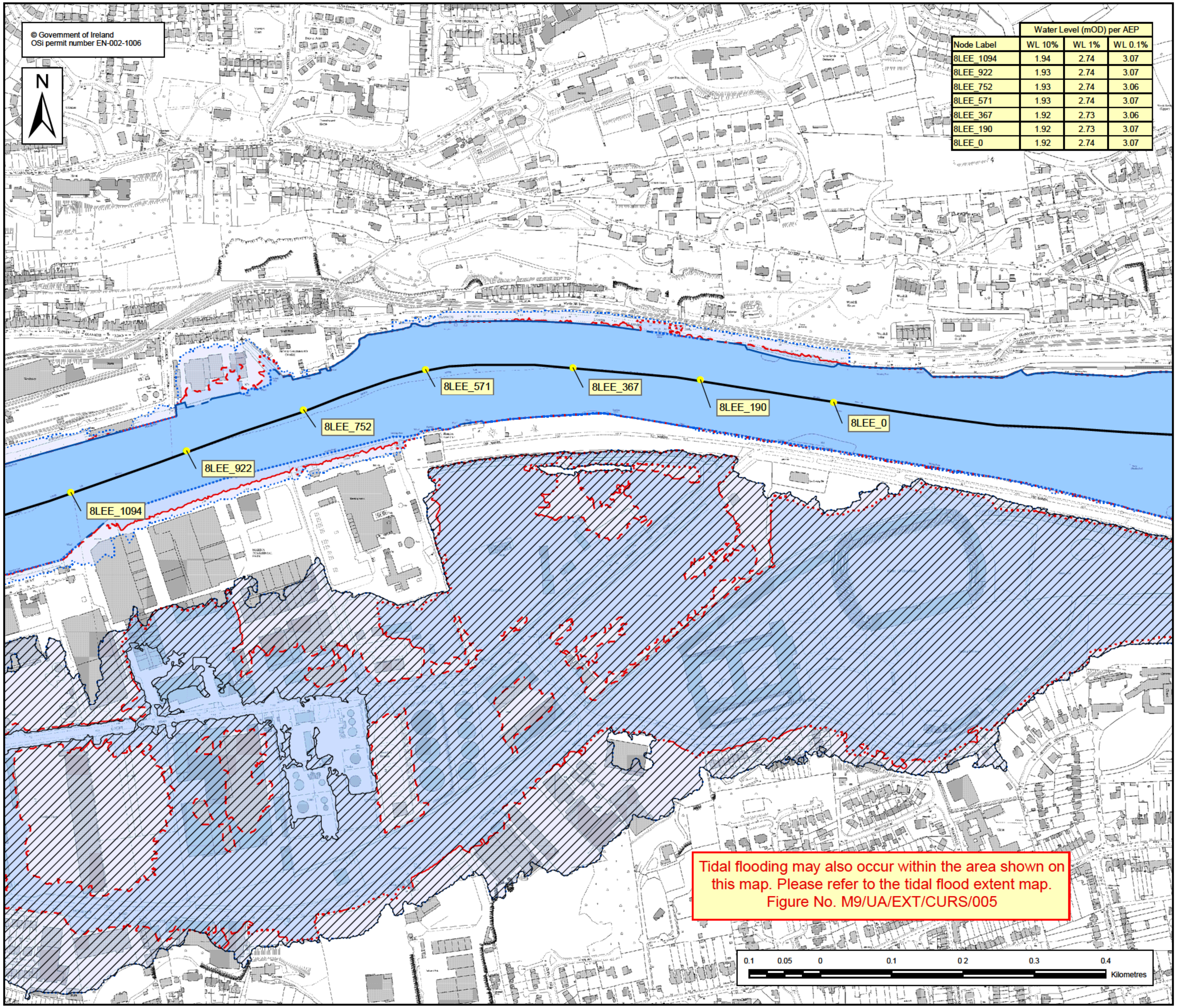
Project : LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map : CORK CITY

Map Type :	FLOOD EXTENT
Source :	FLUVIAL FLOODING
Map area :	URBAN AREA
Scenario :	CURRENT
Figure By : Valeria Medina	Date : 10 March 2014
Checked By : Ricardo Santaella	Date : 10 March 2014
Approved By : Clare Dewar	Date : 10 March 2014
Figure No. : M8/UA/EXT/CURS/011	Revision 2
Drawing Scale : 1:5,000	Plot Scale : 1:1 @ A3



Node Label	Water Level (mOD) per AEP WL 10%	WL 1%	WL 0.1%
8LEE_1094	1.94	2.74	3.07
8LEE_922	1.93	2.74	3.07
8LEE_752	1.93	2.74	3.06
8LEE_571	1.93	2.74	3.07
8LEE_367	1.92	2.73	3.06
8LEE_190	1.92	2.73	3.07
8LEE_0	1.92	2.74	3.07

Location Plan :

EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- BOWG_376 Node Label (refer to table)

USER NOTE :

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Map :
CORK CITY

Map Type :	FLOOD EXTENT
Source :	FLUVIAL FLOODING
Map area :	URBAN AREA
Scenario :	CURRENT
Figure By :	Valeria Medina — Date : 10 March 2014
Checked By :	Ricardo Santaella — Date : 10 March 2014
Approved By :	Clare Dewar — Date : 10 March 2014
Figure No. :	M8/UA/EXT/CURS/012
Revision	2

Drawing Scale : 1:5,000 Plot Scale : 1:1 @ A3

APPENDIX C

SITE PHOTOGRAPHS

Photo 1: View south from Centre Park Road into ESB property.
Cable route is along the left of the gravel roadway near the chain link fence.

Photo 2: Area west of cable route south of Centre Park Road
Concrete bunds in area of former fuel tanks and pipelines

Photo 3: Watercourse that drains along the southern boundary of the ESB property and cable route. Clear, low flowing water that drains in a north easterly flow direction

Photo 4: View of Cable Leak Point north of Centre Park Road.

Photo 5: Location of Cable Leak Point on area of fresher footpath concrete.
OPW offices in background.

Photo 6: View north from Centre Park Road into ESB property.
Cable route is along the concrete roadway north to the ESB Building in the foreground.

Photo 7: Watercourse approximately 150m east of leak point, north of centre park road (clear water, low flow).

Photo 8: Watercourse approximately 150m east of leak point, south of centre park road (clear water, low flow).

APPENDIX D

MATERIAL SAFETY DATA SHEETS FOR CONTAMINANTS OF CONCERN (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.

<u>Skin Protection:</u>	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

<u>General Information</u>

Appearance:	Clear, colourless liquid
Odour:	Mild petroleum odour

<u>Health, safety and environmental information</u>

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

<u>Other information</u>

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

10: STABILITY AND REACTIVITY

<u>Chemical stability:</u>	This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure and will not polymerise.
<u>Conditions to avoid:</u>	Temperatures above 140℃
<u>Materials to avoid:</u>	Strong oxidising agents, such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, peroxides etc, as this may present an explosion hazard.
<u>Hazardous decomposition products:</u>	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 nonnal 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.

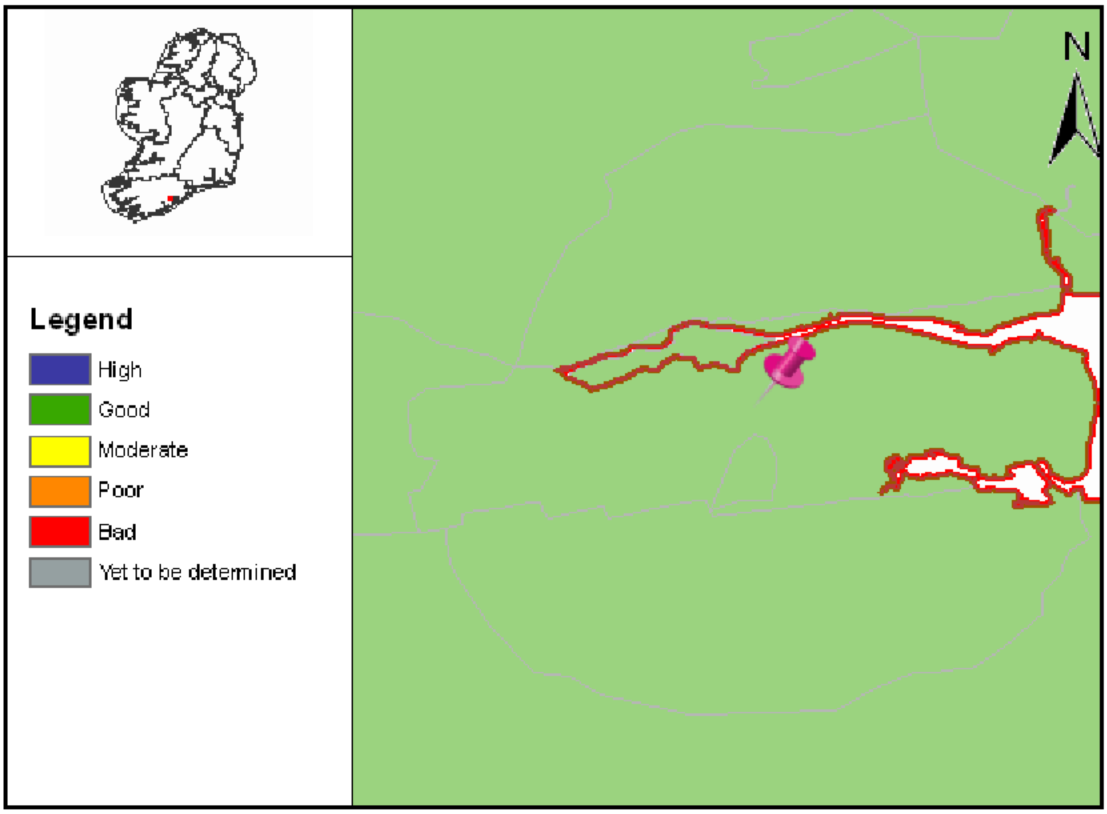
MSDS Version Number	:	1.0
MSDS Effective Date	:	16.09.2010
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	Regulation 1907/2006/EC
MSDS Distribution	:	The information in this document should be made available to all who may handle 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 WATERBODY DOCUMENTATION

water matters

Full Report for Waterbody CorkCity_2



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 12/08/2019

water matters
'our Plan'

Summary Information:

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_2
WaterBody Code:	IE_SW_G_031
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 12/08/2019

water matters
'our Plan'

Chemical and Quantitative Status Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_2
WaterBody Code:	IE_SW_G_031
Overall Status Result:	Good
Heavily Modified:	No

	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 12/08/2019

water matters
'our Plan'

Risk Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_2
WaterBody Code:	IE_SW_G_031
Overall Risk Result:	1a At Risk
Heavily Modified:	No

	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 12/08/2019

	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	1a	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	1a	At Risk
TNR	Risk associated with nitrate loading to transitional and coastal waters	1a	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 l brary, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).

Date Reported to Europe:July 2010

Date Report Created 12/08/2019

water matters
'our Plan'

Objectives Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_2
WaterBody Code:	IE_SW_G_031
Overall Objective:	Protect
Heavily Modified:	No

	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 12/08/2019

water matters
'our Plan'

Measures Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	CorkCity_2
WaterBody Code:	IE_SW_G_031
Heavily Modified:	No

	Measures Description	Applicable
BC	Total number of basic measures which apply to this waterbody	26
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	Yes
FOR	Forestry guidelines and regulations	Yes

Date Reported to Europe:July 2010

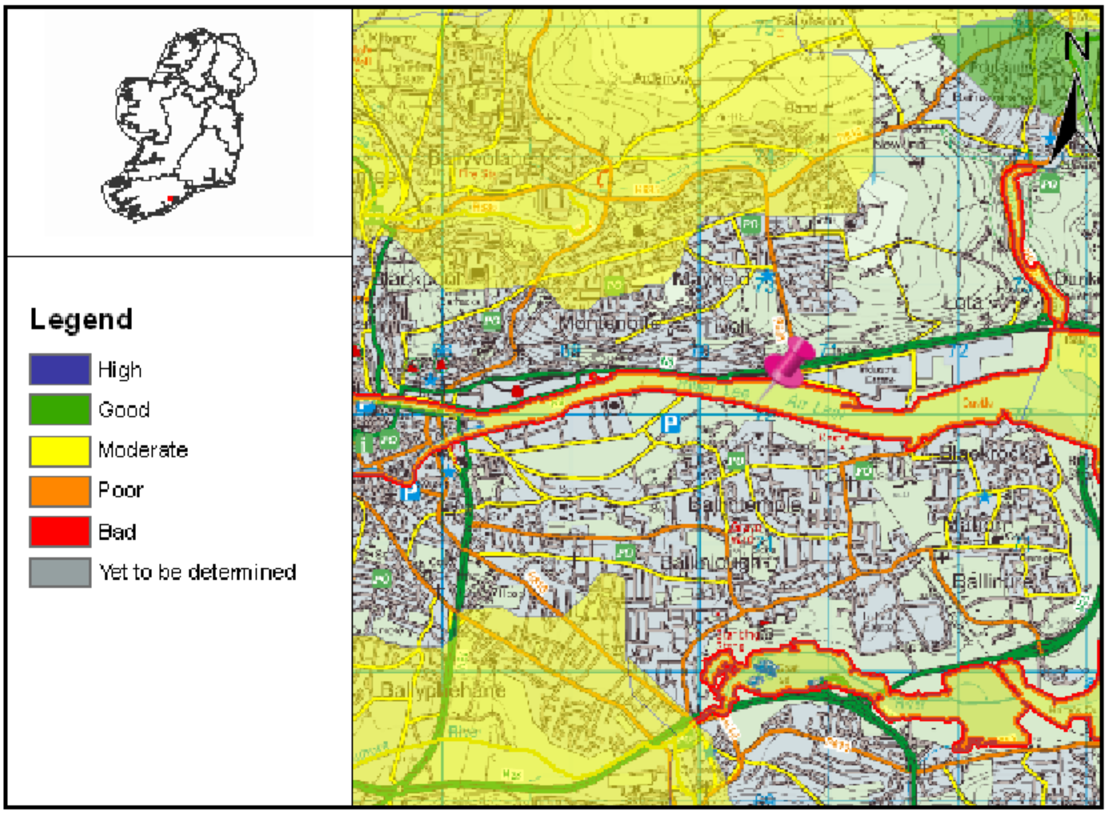
Date Report Created 12/08/2019

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.

Full Report for Waterbody Lee (Cork) Estuary Lower



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 12/08/2019

water matters
'our Plan'

Summary Information:

Water Management Unit:	N/A
WaterBody Category:	Transitional Waterbody
WaterBody Name:	Lee (Cork) Estuary Lower
WaterBody Code:	IE_SW_060_0900
Overall Status:	Moderate
Overall Objective:	Restore 2021
Overall Risk:	1a At Risk
Heavily Modified:	Yes
	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 12/08/2019

water matters 'our Plan'

Status Report

Water Management Unit:	N/A
WaterBody Category:	Transitional Waterbody
WaterBody Name:	Lee (Cork) Estuary Lower
WaterBody Code:	IE_SW_060_0900
Overall Status Result:	Moderate
Heavily Modified:	Yes

south western river basin district

	Status Element Description	**Result**
	Status information	
DIN	Dissolved Inorganic Nitrogen status	Moderate
MRP	Molybdate Reactive Phosphorus status	Good
DO	Dissolved oxygen as per cent saturation status	Moderate
BOD	Biochemical Oxygen Demand (5-days) status	Good
PHY	Macroalgae - phytobiomass status	Good
OPP	Macroalgae - opportunistic algae status	N/A
RSL	Macroalgae - reduced species list status	N/A
ANG	Angiosperms - Seagrass and Saltmarsh status	N/A
BIN	Benthic Invertebrates status	N/A
FIS	Fish status	Poor
HYD	Hydrology status	N/A
MOR	Morphology status	Less than Good
SP	Specific Pollutant Status	N/A
PAS	Overall protected area status	Less than good
ES	Ecological Status	Moderate
CS	Chemical Status	N/A
SWS	Surface Water Status	N/A
EXT	Extrapolated status	N/A
DON	Donor water bodies	N/A

Date Reported to Europe:July 2010

Date Report Created 12/08/2019

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).

water matters 'our Plan'

Risk Report

Water Management Unit:	N/A
WaterBody Category:	Transitional Waterbody
WaterBody Name:	Lee (Cork) Estuary Lower
WaterBody Code:	IE_SW_060_0900
Overall Risk Result:	1a At Risk
Heavily Modified:	Yes

south western river basin district

	Risk Test Description		**Risk**
	Hydrology		
THY1	Water balance - Abstraction	1a	At Risk
	Marine Direct Impacts		
TMDI 1	Dangerous Substances		N/A
TMDI 2	OSPAR	1a	At Risk
TMDI 3	UWWT Regs Designations	1a	At Risk
TMDI O	Marine Direct Impacts Overall - Worst Case	1a	At Risk
	Morphological Risk Sources		
TM1	Channelisation		N/A
TM2	Deposition		N/A
TM3	Coastal Defences		N/A
TM4	Impoundments		N/A
TM5a	Built Structures - Port Tonnage		N/A
TM5b	Built Structures - Industrial Intakes		N/A
TM6	Intensive Landuse		N/A
TMO	Morphology Overall - Worst Case		N/A
TMO	Overall (MIMAS) Morphological Risk - Worst Case (2008)		N/A
	Overall Risk		
RA	Transitional Overall - Worst CaseOverall (MIMAS) Morphological Risk - Worst Case (2008)	1a	At Risk
	Point / MDI Worst Case		
TPOL	Worst case of Point Overall and MDI OverallOverall (MIMAS) Morphological Risk - Worst Case (2008)	1a	At Risk

Date Reported to Europe:July 2010

Date Report Created 12/08/2019

	Point Risk Sources		
TP1	WWTPs (2008)	2b	Not At Risk
TP2	CSOs	1b	Probably At Risk
TP3	IPPCs (2008)	2b	Not At Risk
TP4	Section 4s (2008)	2b	Not At Risk
TP5	WTPs/Mines/Quarries/Landfills		N/A
TPO	Overall Risk from Point Sources - Worst Case (2008)	1b	Probably 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 l brary, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).

water matters
'our Plan'

Objectives Report

Water Management Unit:	N/A
WaterBody Category:	Transitional Waterbody
WaterBody Name:	Lee (Cork) Estuary Lower
WaterBody Code:	IE_SW_060_0900
Overall Objective:	Restore 2021
Heavily Modified:	Yes

south western river basin district

	Objectives Description	Result
	Extended timescale information	
E1	Extended timescales due to time requirements to upgrade WWTP discharges	No Status
E2	Extended timescales due to delayed recovery of chemical pollution and chemical status failures	No Status
E3	Extended timescales due to winter dissolved nitrogen exceedances	2021
E4	Extended timescales due to time requirements for status recovery	No Status
E5	Extended timescales from Northern Ireland Environment Agency	No Status
E0V	Overall extended timescale - combination of all extended timescales fields	2021
	Objectives information	
OB1	Prevent deterioration objective	No Status
OB2	Restore at least good status objective	No Status
OB3	Reduce chemical pollution objective	No Status
OB4	Protected areas objective	Restore 2021
OBO	Overall objectives	Restore 2021

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 12/08/2019

water matters
'our Plan'

Measures Report

Water Management Unit: N/A

WaterBody Category: Transitional Waterbody

WaterBody Name: Lee (Cork) Estuary Lower

WaterBody Code: IE_SW_060_0900

Heavily Modified: Yes

	Measures Description	Applicable
BC	Total number of basic measures which apply to this waterbody	14
BW	Directive - Bathing Waters Directive	No
BIR	Directive - Birds Directive	Yes
HAB	Directive - Habitats Directive	No
MAE	Directive - Major Accidents and Emergencies Directive	Yes
EIA	Directive - Environmental Impact Assessment Directive	Yes
UWT	Directive - Urban Waste Water Treatment Directive	No
PPP	Directive - Plant Protection Products Directive	Yes
NIT	Directive - Nitrates Directive	Yes
IPC	Directive - Integrated Pollution Prevention Control Directive	Yes
POI	Other Stipulated Measure - Control of point source discharges	Yes
DIF	Other Stipulated Measure - Control of diffuse source discharges	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
TP1	WSIP - Agglomerations with treatment plants requiring capital works	No
TP2	WSIP - Agglomerations with treatment plants requiring further investigation prior to capital works	No
TP3	WSIP - Agglomerations requiring the implementation of actions identified in Shellfish PRPs	No
TP4	WSIP - Agglomerations with treatment plants requiring improved operational performance	No
TP5	WSIP - Agglomerations requiring investigation of CSOs	No
TP6	WSIP - Agglomerations where exisitng treatment capacity is currently adequate but predicted loadings would result in overloading	No
OTS	On-site waste water treatment systems	Yes
SHE	Shellfish Pollution Reduction Plan	No
IPR	IPPC licences requiring review	Yes
WPR	Water Pollution Act licences requiring review	No

Date Reported to Europe:July 2010

Date Report Created 12/08/2019

HQW	Protect high quality waters	No

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.

APPENDIX F

HISTORIC GEOTECHNICAL INVESTIGATION REPORTS AND LOG DETAILS

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT Marina Generating Station. BOREHOLE No. 10

Report No.

Order No.

Bored for E.S.B.

Site Address Cork.

Boring Commenced 18.12.1974. Boring Completed 6.1.1975.

Type of Boring Percussive and Shell & Auger. Diameter of Borehole 15 and 8 ins.

Ground level 4.74m O.D.

Water Struck (1) 4.35m BGL. (2) (3)

Standing Water Level

Remarks Chiselling 6 hours.
All levels are related to ground level.

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Samples Type	Samples Depth
Concrete. (Chiselling 1 hour).	0	0.15	0.15			
Filling of clay, silt, stones etc.	0.15	2.70	2.55	6904 6901 6905	D U D	0.60 1.00 - 1.45 2.00
Soft grey silt with shells.	2.70	4.35	1.65	6906 6902 6903 6907	D U U D	2.85 2.85 - 3.30 3.90 - 4.35 4.00
Loose very sandy grey silt.	4.35	6.00	1.65	6914 6908	W D	4.30 4.50
Loose medium to coarse gravel.	6.00	6.50	0.50	6909	D	6.00
Loose very silty sandy gravel.	6.50	8.10	1.60	6910	D	6.65
Fairly compact fine to very coarse gravel.	8.10	11.25	3.15	6911 6912	D D	8.25 9.75
Compact very coarse sandy gravel with cobbles. (Chiselling 1½ hours).	11.25	15.60	4.35	6913 6915 6976 6977	D D D D	11.25 12.75 14.40 15.50
Compact coarse gravel with some sand.	15.60	16.00	0.40	6978	D	15.75
Compact coarse sandy gravel with cobbles & some slight traces of clay. (Chisel. 3½ hrs).	16.00	30.00	14.00	6979 6980 6982 6983	D D D D	17.20 18.55 21.70 23.20
Final level.	30.00			6984 6985 6986 6987	D D D D	24.70 26.25 27.70 29.20
				6988	W	29.90

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


IRISH DUNLOP COMPANY
Note For Details of General Basement Plan of Power Station Extension See C 45416
For Details of Cooling Water System to Power Station Extension See C 47013
For Plan locating Piled Foundation to " " See C 45141
For Details of Cooling Water Pump House See C 44283
For Details of Drainage See Drg No C 45300
For Details of Bund Area for Oil Service Tanks See C 443
For Outside Elevations See C 45463
For Logs of Bore Holes 7 to 10 incl See Drg C 43139
For Logs of Bore Holes 1 to 6 incl. & Trial Pits 1 & 2 See Drg CW/D 4811A
For Details of Franki Piles See Drg No. C 41845
ELECTRICITY SUPPLY BOARD
CIVIL WORKS DEPARTMENT
DUBLIN
MARINA GENERATING STATION
GENERAL LAYOUT WITH
LOCATION OF BOREHOLES
SCALE 1/800
DRG No C 95072
DRG. No. C 95072
Existing Bank
Boiler Bay
Turbine Hall
Engine Hall
Cycle Shed
Town Water Storage Tank
New Road
OLD COAL STORE
W.H. BOILER (FUTURE)
GAS TURBINE No 1
GAS TURBINE No 2 (FUTURE)
GAS TURBINE No 3 (FUTURE)
OIL STORAGE AREA
BUND WALL
BUND FOR FOUR No OIL TANKS
BUND FOR THREE No 10,000 TON OIL TANKS
Fuel Oil Pump House
Intersection of ℄ Tail Car Track & Fence
Existing fence - Boundary of E.S.B. Property
Cable to plug points for Tail Car
Septic Tank
Stand Pipe
Hydrant
Entrance Road
Gate Control Building
SUBSTATION
Cooling Water Intakes (Extension)
Cooling Water Screen & Pump House
Cooling Water Screen (Original)
COOLING WATER PUMP HOUSE
Fire Hydrant (Disconnected)
Access Manhole
Access to Cables
New Intake Culvert
Substation
Handrail
Termination of 24" pipe from Sewage Plant
Retaining Wall
P.H. 86

Dimensions of Base Line Survey

Bolt A to Bolt B	936'-7"
" E " " A	114'-4½"
" E " " F	111'-6"
" E " " D	506'-8"
" D " " C	114'-5¾"

Notes

1 Convention for Angles ∠XYZ, ∠ZYX

2 Dimensions given are those for straight lines between the terminal points.

3 Boundary marks were found at D, F, G, H, J and M. These were rectangular in plan and were taken as being totally outside E.S.B. Property. so that e.g. the line J H was measured thus:-

640'-7½"
Boundary Marks
J H

Levels

Stn	Level
Stn 1	17·95
" 2	18·25
" 3	18·11
" 4	8·85
" 5	10·21
" 6	10·55
" 7	11·04
" 8	11·66
" 9	14·99
" 10	18·29
" 11	18·36
" 14	18·93
" 15	18·28

All stns are bolts set in conc. except:- 14&15 - bars driven into ground
9 - Cross in Conc.
11 - Arrow in Conc.

Dimensions (Steel Taped)

Line	Dimension
A B	26'-2"
B C	34'-10"
C D	136'-2"
D E	973'-6"
E F	53'-4"
F G	433'-6"
F H	835'-0"
G H	570'-2½"
H J	640'-7½"
J K	52'-6"
J F	528'-3¼"
K E	528'-0"
K F	530'-3½"
K L	968'-7"
L M	116'-7"
M N	98'-4"
M A	499'-11"

Dimensions (Steel Taped)

Line	Dimension
1 2	166'-6½"
2 3	287'-4"
3 4	116'-6¾"
4 5	398'-11½"
5 6	117'-1¾"
6 7	308'-7¾"
6 13	415'-0"
7 8	163'-5½"
8 12	506'-10"
12 13	531'-7"
8-9	298'-11½"
9 10	314'-11¼"
10 11	408'-7½"
11 1	473'-5¾"
2 14	239'-8¼"
14 15	230'-0"
15 10	213'-11"

Angles

Angle	Value
11 1 2	275°-30'
1 2 3	165°-36½'
2 3 4	185°-50'
3 4 5	181°-38'
4 5 6	186°-13'
5 6 7	272° 41'
5 6 13	181° 18'
6 7 8	180° 29'
7 8 12	94° 15¾'
8 12 13	75° 36½'
12 13 6	98° 15'
7 8 9	253° 54'
8 9 10	190° 62'
9 10 11	175° 23'
10 11 1	271° 53'
1 2 14	263° 1½'
2 14 15	89° 9¼'
14 15 10	270°-30'
15 10 9	94° 33'

Dimensions (Steel Taped)

Line	Dimension
1 A	45'-6"
1 B	19'-4½"
1 C	31'-3½"
2 D	60'-5¼"
6 E	20'-7¾"
6 F	62'-5"
8 K	36'-10"
13 G	78'-0½"
12 H	193'-6"
12 J	
10 O	93'-1¼"
11 L	55'-9¼"
11 M	70'-0"
11 N	63'-9½"
2 B.H.4	60'-1½"
14 B.H.1	140'-0"
14 B.H.5	70'-6"
15 B.H.2	123'-0"

Angles

Angle	Value
11 1 A	90° 53½'
11 1 B	91° 30'
11 1 C	148° 34'
1 2 D	31° 19'
5 6 E	110° 8'
5 6 F	165° 8'
7 8 K	171° 21'
6 13 G	180° 1½'
8 12 H	177° 10'
J 12 B	4° 11'
9 10 O	37° 22'
10 11 L	25° 25'
10 11 M	160° 54'
10 11 N	70° 16'
1 2 B.H.4	173° 51'
B.H.1 15 14	106° 47'
15 14 B.H.3	0° 43½'
14 15 B.H.2	60° 42½'

REVISIONS
A Survey of Base Lines added 6·3·51 Drawn P. Healy

REPORT 1167 BOX 55

CORK GENERATING STATION
Survey of Site

Scale : 1/500

: 4998 A

IRISH DUNLOP COMPANY

Revisions	
A Drainage must altered	
B Existing Drainage at E side of site corrected	
C Drawing brought up to date with actual construction	
D	

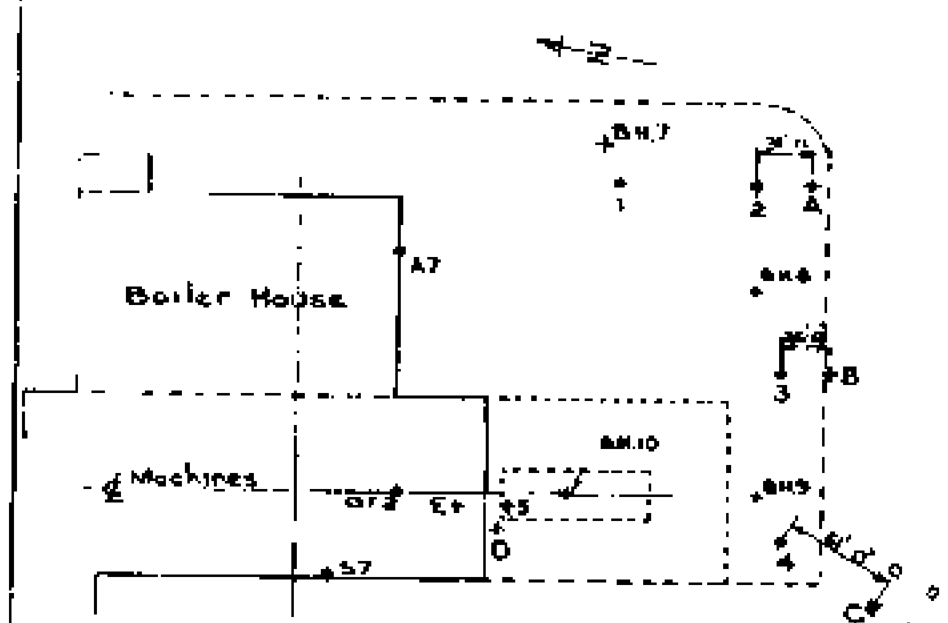
MARINA POWER STATION EXTENSION

General Plan of Works

Note For Details of General Basement Plan of Power Station Extension See C 46416
For Details of Cooling Water System to Power Station Extension See C 47013
For Plan locating Piled Foundation to " " " See C 45141
For Details of Control Water Pump House See C 44283
For Details of Drainage See Drg No C 45908
For Details of Bund Area for Oil Service Tanks See C 44..
For Outside Elevations See C 45463
For Logs of Bore Holes 7 to 10 incl See Drg C 43139
For Logs of Bore Holes 1 to 6 incl. & Trial Pits 1 & 2 See Drg CW/D 4811A
For Details of Franki Resistance Tests See Drg No C 41545

Surface Drains indicated thus
Sewer Drains
Water Mains
Oil Pipes
Cables

DRG. No. C 45604 C



SITE PLAN
Scale : 1/1250

Vibration Readings are noted thus :—

A to E = V (or H) — a — n

A to E = Positions of measurement of vibrations

V = Vertical Vibration

H = Horizontal Vibration

a = Single Amplitude in inches

n = Frequency in cycles per second

The positions of measurement of vibrations are as follows :—

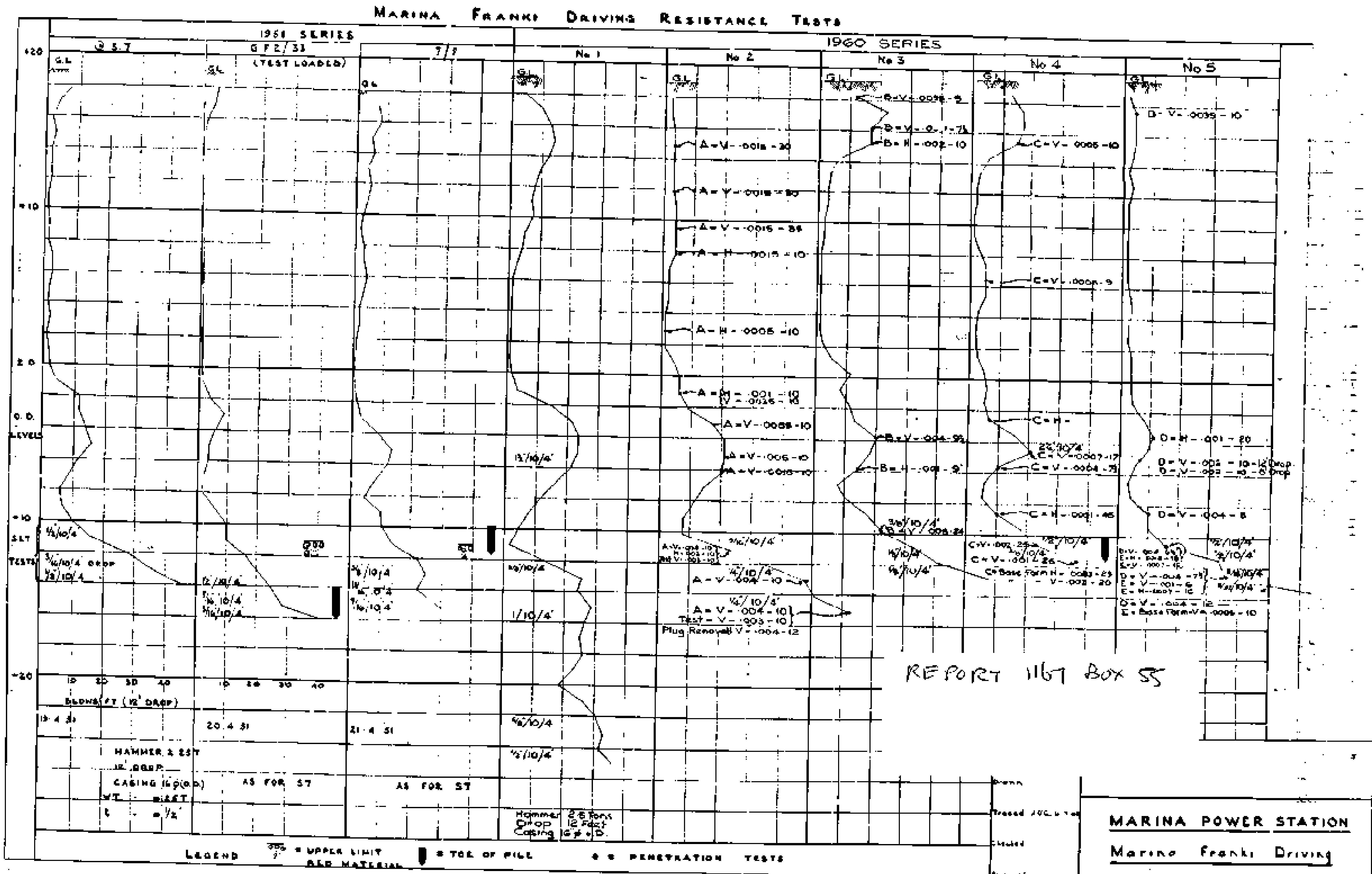
A = On Concrete Manhole

B = On edge of Roadway

C = On Concrete Plinth over Pile Cap for Transmission Mast

D = On edge of Pile Cap W.11.

E = On S.W. corner of G2 Turbine Foundation.



Drawn
Traced
Checked
Approved
Scale

MARINA POWER STATION

Marina Franki Driving Resistance Tests

41845

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT: Marina Generating Station. BOREHOLE No. 2

Report No.

Order No. 97172

Bored for: E.S.B.

Site Address: Cork.

Boring Commenced: 15.1.1976. Boring Completed: 23.1.1976.

Type of Boring: Percussion & Shell & Auger. Diameter of Borehole: 15 and 8 ins.

Ground level: 4.00m O.D.

Water Struck (1) 4.0m B.G.L. (2) 19.0m B.G.L. (3)

Water Level 1.40m B.G.L. on 23.1.1976.

Remarks: Chiselling 16½ hours. All levels are related to ground level. Failed to recover undisturbed sample at 18.35m B.G.L.

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Type	Depth
Concrete. Chiselling 1 hour.	0	0.15	0.15			
Filling of silt, ash, brick, etc.	0.15	2.00	1.85	6606 6619	D U	1.00 1.50
Soft grey stony silt.	2.00	2.70	0.70	6522 6607 6604	U D W	2.30 2.15 2.15 - 2.60
Dark grey organic silt.	2.70	4.00	1.30	6608 6605	D U	2.75 3.65 - 4.10
Loose medium to coarse gravel.	4.00	5.70	1.70	6609 6610	D D	4.15 4.35
Soft dark grey organic stony clay.	5.70	6.00	0.30	6611	D	5.85
Fine to medium sandy gravel.	6.00	6.50	0.50	6613	D	6.25
Grey clayey silt.	6.50	7.10	0.60	6614 6612	D W	6.65 6.65 - 7.10
Compact medium to coarse sandy gravel with cobbles & boulders. (Chiselling 2½ hrs)	7.10	14.00	6.90	6615 6616 6617 6618	D D D D	7.25 8.75 9.65 11.15
Stiff grey clay. (Chiselling 8 hours).	14.00	18.30	4.30	6620 6622 6621	D U D	17.65 14.15 - 14.60 14.15
Stiff grey very shelly clay (Chiselling 2 hours).	18.30	18.80	0.50	6512 6513 6514 6515	D U D U	15.65 15.65 - 16.10 17.15 17.15 - 17.60
Compact medium to coarse sandy gravel with cobbles & boulders. (Chiselling 4 hrs).	18.80	26.00	7.20	6516 6517 6518 6519	D D D D	18.45 19.15 20.65 22.15
Final level.	26.00		—	6520 6521	D D	23.65 26.00

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT Marina Generating Station. BOREHOLE No. 10

Report No. Order No.

Bored for E.S.B.

97279

Site Address Cork.

Boring Commenced 10.12.1974. Boring Completed 9.1.1975.

Type of Boring Percussive and Shell & Auger Diameter of Borehole 15 and 8 ins.

Ground level 4.74m O.D.

Water Struck (1) 4.35m BGL. (2) (3)

Standing Water Level

Remarks Chiselling 6 hours.
All levels are related to ground level.

Description of Strata	Depth From	Depth To	Thickness	Samples Ref. No.	Samples Type	Samples Depth
Concrete. (Chiselling 1 hour).	0	0.15	0.15			
Filling of clay, silt, stones etc.	0.15	2.70	2.55	6904 6901 6905	D U D	0.60 1.00 - 1.45 2.00
Soft grey silt with shells.	2.70	4.35	1.65	6906 6902 6903 6907	D U U D	2.05 2.85 - 3.30 3.90 - 4.35 4.00
Loose very sandy grey silt.	4.35	6.00	1.65	6914 6908	W D	4.50 4.50
Loose medium to coarse gravel.	6.00	6.50	0.50	6909	D	6.00
Loose very silty sandy gravel.	6.50	8.10	1.60	6910	D	6.65
Fairly compact fine to very coarse gravel.	8.10	11.25	3.15	6911 6912	D D	8.25 9.75
Compact very coarse sandy gravel with cobbles. (Chiselling 1½ hours).	11.25	15.60	4.35	6913 6915 6976 6977	D D D D	11.25 12.75 13.40 [illegible]
Compact coarse gravel with some sand.	15.60	16.00	0.40	6978	D	15.75
Compact coarse sandy gravel with cobbles & some slight traces of clay. (Chisc. 3½ hrs).	16.00	30.00	14.00	6979 6980 6982 6983	D D D D	17.20 [illegible] [illegible] [illegible]
Final level.	30.00			6984 6985 6986 6987	D D D D	24.70 26.25 27.70 [illegible]
				6988	W	29.90

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

97278

CONTRACT	Marina Generating Station.	BOREHOLE No.	9
Report No.		Order No.	
Bored for	E.S.B.		
Site Address	Cork.		
Boring Commenced	23.11.1974.	Boring Completed	3.12.1974.
Type of Boring	Percussive and Shell & Auger	Diameter of Borehole	10 and 8 ins.
Ground level	4.81m O.D.		
Water Struck (1)	3.45m BGL. (2)	(3)	
Standing Water Level	1.90m B.G.L. on completion.		
Remarks	All levels are related to ground level. Failed to recover undisturbed sample at 5.05m B.G.L.: Chiselling 8½ hours.		

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Samples Type	Samples Depth
Concrete.	0	0.10	0.10			
Filling of clay, brick, etc.	0.10	2.00	1.90	5711 5712 5721 5713	D D J J	0.25 0.75 2.10 [illegible]
Soft grey very silty clay.	2.00	3.45	1.45	5714 5715	D U	2.95 2.95 - 3.30
Soft grey silt with stones.	3.45	4.90	1.45	5716 5717	D U	3.60 3.60 - 4.05
Firm grey clayey silt.	4.90	5.30	0.40	5718 5719	D U	5.05 5.05 - 5.50
Loose medium to coarse sandy gravel with layers of silt.	5.30	7.45	2.15	5720 5722	D D	5.65 6.75
Firm grey clayey silt.	7.45	8.30	0.85	5723 5724	D U	7.60 7.60 - 8.05
Fairly compact coarse sandy gravel with cobbles.	8.30	10.80	2.50	5725 5726	D D	8.45 10.00
Compact coarse gravel with cobbles, boulders and some clay.	10.80	12.80	2.00	5727 5728	D D	10.95 12.50
Very stiff light brown sandy clayey silt with cobbles and boulders. (Chiselling 5 hrs).	12.80	14.15	1.35	5729	D	12.95
Grey silt and coarse sandy gravel with cobbles.	14.15	14.60	0.45	5730	D	14.30
Compact medium to coarse sandy gravel with cobbles.	14.60	17.00	2.40	5731 5732	D D	14.75 16.50
Very compact medium to coarse sandy gravel with cobbles and some clay. (Chiselling 1½ hrs)	17.00	30.00	13.00	5733 5734 5735	D D D	17.15 18.65 19.15
Final level.	30.00			5736 5737 5738 5739 5740 5741 5742	D D D D D D D	20.60 22.10 23.60 [illegible] [illegible] [illegible] 29.80

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT	Marine Generating Station.		
Report No.		BOREHOLE No. 8	
Bored for	E. S. B.	Order No.	
Site Address	Cork.		97297
Boring Commenced	25.1.1975.		
Type of Boring	Percussive & Shell & Auger	Boring Completed	7.2.1975.
Ground level	4.34m O.D.	Diameter of Borehole	15 and 8
Water Struck (1)	4.80m B.G.L. (2) (3)		
Standing Water Level	1.70m B.G.L. on completion.		
Remarks	Chiselling 37 hours. Failed to recover undisturbed sample at 18.70m B.G.L. All levels are related to ground level.		

Description of Strata	Depth From	Depth To	Thickness	Samples Ref. No.	Type	Depth
Concrete. (Chiselling 1½ hours).	0	0.15	0.15			
Filling of ash, brick, silt, etc.	0.15	2.00	1.85	6551	D	1.00
Soft grey clayey silt.	2.00	4.30	2.30	6552 6553	D D	2.15 3.65
Loose coarse silty sandy gravel.	4.30	5.80	1.50	6554	D	4.45
Loose fine silty sandy gravel.	5.80	6.75	0.95	6555	D	5.95
Grey organic silt; with some gravel.	6.75	7.40	0.65	6556 6561	D U	6.90 6.90 - 7.35
Fairly compact very coarse sandy gravel with cobbles and boulders. (Chiselling 6½ hrs)	7.40	14.00	6.60	6557 6558 6559 6560 6561 6562 6533 6534 6535	D W W D D D D D D	7.55 7.80 9.30 10.50 11.65 13.00 13.90 14.15
Stiff grey/green silty clay. (Chiselling 7 hours).	14.00	18.70	4.70	6537 6536 6538	U D D	14.15 - 14.60 15.65 & 16.10 16.65 17.20
Timber. (Chiselling 5 hours).	18.70	19.05	0.35	6539 6540 6541 6542	U D D U	17.20 - 17.65 18.00 18.20 19.20 - 19.65
Stiff grey silty clay with shell fragments.	19.05	19.70	0.65			
Stiff brown silty clay with shells. (Chiselling 5 hours)	19.70	21.60	1.90	0152	D	21.50
Stiff very shelly green very silty clay. (Chiselling 3 hrs).	21.60	23.70	2.10	0165 0153	U D	21.50 - 21.95 23.15
Compact very coarse sandy gravel with cobbles and boulders. (Chiselling 4 hours).	23.70	29.00	5.30	0154 0155 0156 0157 0158 0159	D D D U D D	23.75 24.85 26.40 26.50 27.90 29.00
...al level..						

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT Marina Generating Station. BOREHOLE No. 9

Report No.

Order No. 97216

Bored for E.S.B.

Site Address Cork.

Boring Commenced 5.1.1976. Boring Completed 18.1.1976.

Type of Boring Percussive and Shell & Auger Diameter of Borehole 15 and 8 ins.

Ground level 4.33m O.D.

Water Struck (1) 4.65m B.G.L.(2) (3)

Standing Water Level 1.20m B.G.L. on completion.

Remarks Chiselling 9½ hours. Failed to recover undisturbed sample at 1.50 & 27.45m B.G.L. All levels are related to ground level.

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Type	Depth
Concrete. (Chiselling 1 hour).	0	0.15	0.15			
Filling of stones, silt, etc.	0.15	2.60	2.45	5615 5616 5617	D D D	0.30 0.70 2.30
Very soft grey/brown organic silty clay.	2.60	4.65	2.05	5618 5619 5620 5621	D U D D	2.75 2.75 - 3.20 [illegible] [illegible]
Loose coarse silty sand.	4.65	5.30	0.65	5622 5625	U D	4.20 - 4.65 4.80
Grey gravelly silt with shells.	5.30	6.00	0.70	5626 5623	D U	5.40 5.45 - 5.90
Loose fine to coarse sandy gravel.	6.00	7.00	1.00	5627	D	6.25
Grey slightly sandy silt.	7.00	7.80	0.80	5628 5624	D U	7.15 7.15 - 7.60
Compact coarse gravel with cobbles.	7.80	10.20	2.40	5629 5630	D D	8.00 9.50
Coarse sandy gravel.	10.20	11.00	0.80	5631	D	10.45
Compact very coarse gravel with cobbles and some traces of clay.	11.00	14.65	3.65	6601 6602 6603	D D U	11.50 12.60 12.70
Stiff grey clay. (Chiselling 3 hours).	14.65	16.40	1.75	5648 5649 5650 6501	D D U D	[illegible] 14.80 14.80 - 14.25 15.25
Stiff grey silty clay with shells. (Chiselling 1 hr).	16.40	17.30	0.90	6502 6503	D U	16.45 16.45 - 16.90
Very stiff light brown silty very stony clay with cobbles. (Chiselling 1 hour).	17.30	18.80	1.50	6504	D	17.45
Compact very coarse sandy gravel with cobbles & boulders. (Chiselling 2½ hours).	18.80	27.00	8.20	6505 6506 6507 6508	D D D D	18.95 20.45 21.50 [illegible]
Final level.	27.00			6509	D	24.55

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT: Marina Generating Station. **BOREHOLE No.** 6

Report No. **Order No.**

Bored for E.S.B. 97275

Site Address Cork.

Boring Commenced: 14.12.1974. **Boring Completed:** 3.1.1975.

Type of Boring Percussive and Shell & Auger **Diameter of Boreholes:** 10 and 6 ins.

Ground level 3.97m OGL O.D.

Water Struck (1) 4m B.G.L. (2) (3)

Standing Water Level

Remarks Chiselling 7 hours.
All levels are related to ground level.

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Type	Depth
Concrete. (Chiselling 1 hour).	0	0.15	0.15			
Filling of silt, brick, stones, etc.	0.15	2.00	1.85	6919 6916	D U	1.00 1.00 - 1.54
Soft, grey/brown silt.	2.00	3.15	1.15	6920 6917	D DW	2.10 2.10 - 2.55
Soft, grey very sandy silt.	3.15	4.00	0.85	6918 6921	U D	3.25 @ 3.70 3.50
Loose coarse sandy gravel.	4.00	4.90	0.90	6922	D	4.10
Soft grey silt.	4.90	5.50	0.60	6923	D	4.90
Fairly compact fine gravel with sand.	5.50	6.50	1.00	6925	D	5.65
Soft grey organic silt.	6.50	8.00	1.50	6926 6924	D U	6.70 6.70 - 7.15
Compact sand and coarse gravel.	8.00	12.00	4.00	6927 6928 6929	D D D	8.15 9.15 10.65
Compact very coarse gravel with cobbles and boulders.	12.00	13.30	1.30	6930	D	12.15
Very stiff brown very stony clay with cobbles and boulders. (Chiselling 3½ hours).	13.30	15.00	1.70	6932	D	13.45
Very coarse gravel with cobbles and traces of clay. (Chiselling 1½ hours).	15.00	15.60	0.60	6989	D	15.15
Very compact coarse sandy gravel with cobbles & boulders. (Chiselling 1 hour).	15.60	27.00	11.40	6990 6991 6992 6993	D D D D	15.75 17.25 18.30 [illegible]
Final level.	27.00			6994 6995 6996 6997	D D D D	20.00 21.50 22.25 [illegible]
				6998 5612 5613 5614	D D D U	24.00 25.70 27.00 [illegible]

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT	Marina Generating Station.	BOREHOLE No.	5 4
Report No.		Order No.	97273
Bored for	E.S.B.		
Site Address	Cork.		
Boring Commenced	19.1.1975.	Boring Completed	27.1.1975.
Type of Boring	Percussive and Shell & Auger	Diameter of Borehole	15 and 8 ins.
Ground level	4.20m O.D.		
Water Struck (1)	3.05m B.G.L.(2) (3)		
Water Level	1.40m B.G.L. on 23.1.1975.		
Remarks	Chiselling 12½ hours. Failed to recover undisturbed sample at 6.30m B.G.L. All levels are related to ground level. Borehole blowing back approximately 0.60m. Between 13.50 & 14.50m B.G.L.		

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Samples Type	Samples Depth
Concrete. (Chiselling 1 hour)	0	0.15	0.15			
Filling of silt, gravel, brick, etc.	0.15	2.00	1.85	6627 6532	D W	1.00 1.20
Soft grey clayey silt with shells.	2.00	3.50	1.50	6628 6624 6625	D U U	2.15 1.55 - 2.10 2.60 - 2.95
Loose fine clayey sandy gravel.	3.50	5.00	1.50	6634 6629	W D	3.50 3.65
Soft grey clayey silt.	5.00	5.80	0.80	6630 6626	D U	5.15 5.25 - 5.70
Medium to coarse sandy gravel.	5.80	6.20	0.40	6631	D	5.95
Soft gravelly silt.	6.20	7.15	0.95	6632	U	6.35
Dark grey silty stony clay.	7.15	8.00	0.85	6633	D	7.30
Fairly compact medium to coarse sandy gravel with cobbles and boulders. (Chiselling 1½ hrs)	8.00	10.35	2.35	6635 6636	D D	8.15 9.65
Fine to medium sand.	10.35	15.70	4.35	6637 6638 6639	D D D	10.50 12.00 13.50
Compact coarse sandy gravel with cobbles and boulders. (Chiselling 10 hours).	15.70	27.00	11.30	6640 6523 6524 6525	D D D D	13.75 15.35 15.85 17.00
Final level.	27.00			6526 6527 6528 6530 6531	D D D D D	18.50 20.20 21.70 24.30 26.30

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT: Marina Generating Station. BOREHOLE No. 2

Report No.

Order No. 97271

Bored for: E. S. B.

Site Address: Cork.

Boring Commenced: 12.11.1974. Boring Completed: 28.11.1974.

Type of Boring: Percussive and Shell & Auger. Diameter of Borehole: 10 and 8 ins.

Ground level: 4.19m O.D.

Water Struck (1) 4.30M BGL (2) (3)

Standing Water Level: 1.80m B.G.L. on 20.11.1974.

Remarks: Chiselling 10½ hours. All levels are related to ground level. Borehole blowing back approx .30m between 10.90 & 14.15m B.G.L.

Description of Strata	Depth From	Depth To	Thickness	Sample Ref No.	Sample Type	Sample Depth
Concrete.	0	0.15	0.15			
Filling of stony clay, traces of brick, etc.	0.15	2.30	2.15	5681 5682 5683 [illegible]	D U D [illegible]	0.75 0.75 - 1.20 1.70 [illegible]
Soft brown and grey silt with some shell fragments.	2.30	3.70	1.40	5684 5685	D U	2.45 2.45 - 2.90
Soft grey sandy silt.	3.70	4.15	0.45	5686	D	3.90
Soft grey silty clay.	4.15	4.30	0.15	5687	U	3.85 - 4.30
Loose sandy gravel with silt.	4.30	5.55	1.25	5688	D	4.80
Soft grey organic silty clay.	5.55	6.10	0.55	5689 5690	D U	5.65 5.65 - 6.10
Fairly compact sandy gravel.	6.10	7.70	1.60	5691	D	6.25
Fairly compact coarse gravel with cobbles.	7.70	10.90	3.20	5692 5693	D D	7.85 9.65
Coarse sand with some gravel.	10.90	16.30	5.40	5694 5695 5696	D D D	11.15 12.65 14.15
Compact coarse sandy gravel with cobbles, boulders and a little clay. (Chiselling 10½ hrs).	16.30	30.50	14.20	5697 5698 5701	D D D	15.65 16.45 [illegible]
Final level.	30.50			5702 5703 5704	D D D	19.50 21.50 23.00
				5705 5706 5707 5708	D D D D	24.50 26.00 26.85 28.50
				5709 5710	D W	30.30 30.00

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

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT [illegible] Generating Station. — BOREHOLE No. 1

Report No.

Order No. 97270

Bored for C.E.G.B.

Site Address [illegible]

Boring Commenced 31.10.1974.

Boring Completed 20.11.1974.

Type of Boring Percussion & Shell and Auger.

Diameter of Borehole 10 and 8 ins.

Ground level 4.23m O.D.

Water Struck (1) 5.00m B.G.L.(2) (3)

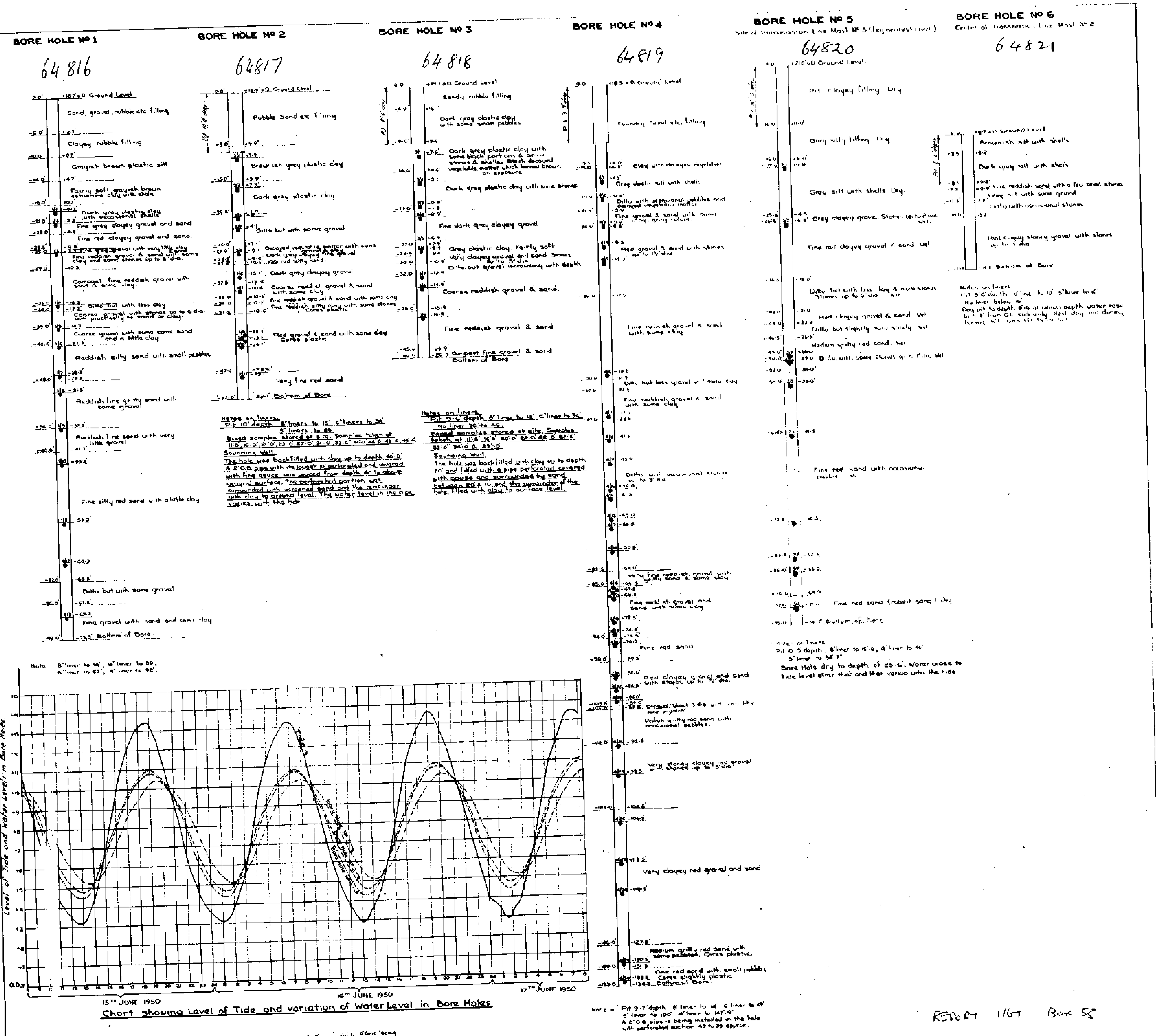
Water Level 2.00m B.G.L. on 10.11.1974.

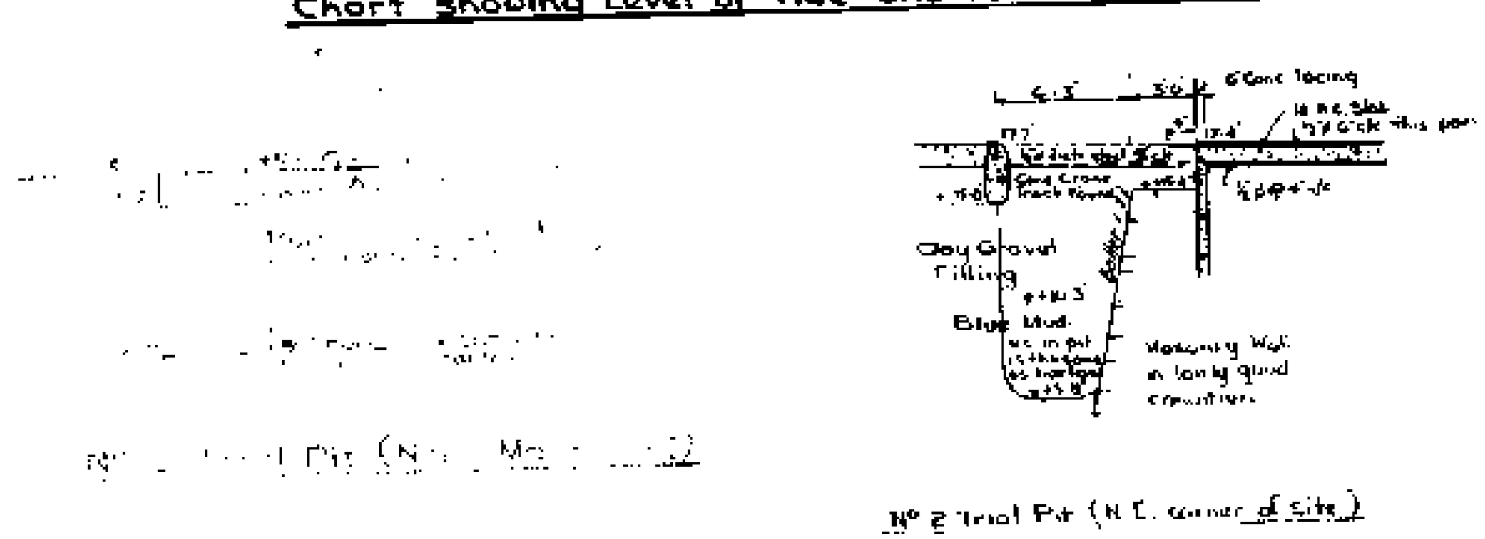
Remarks Chiselling 6 hrs. All levels are related to ground level. Borehole blowing back approx. .60m between 16.90 and 20.60m B.G.

Description of Strata	Depth From	Depth To	Thickness	Samples Ref No.	Type	Depth
Concrete.	0	0.15	0.15			
Filling of silt with stones and some ashes.	0.15	2.00	1.85	5651 5652	D D	0.45 1.00
Soft grey silty clay.	2.00	4.90	2.90	5653 5654 5655 5656	D U D U	2.90 2.95 - 3.35 4.25 4.25 - 4.70
Soft grey organic silt.	4.90	5.05	0.10	5657	D	4.95
Coarse very clayey gravel.	5.05	5.20	0.15	5658	D	5.10
Soft grey silt.	5.20	5.80	0.60	5659	D	5.35
Loose slightly clayey sandy gravel.	5.80	7.10	1.30	5660 5661	D D	5.95 7.25
Soft black organic clay.	7.10	8.90	1.80	5699 5662	D U	8.25 8.25 - 8.70
Fairly compact coarse gravel.	8.90	11.00	2.10	5663 5664	D D	9.00 10.75
Fairly compact medium sand with some gravel.	11.00	16.90	5.90	5666 5667 5668	D D D	12.65 14.15 15.70
Medium to coarse gravel with some sand and cobbles.	16.90	20.50	3.60	5669 5670 5671	D D D	17.05 18.60 20.10
Compact coarse sandy gravel with cobbles, boulders and a little clay.	20.50	30.80	10.30	5672 5673 5674	D D D	21.40 21.55 23.10
Final level.	30.80			5675 5676 5677	D D D	24.70 26.20 27.70
				5678 5679	D D	29.25 30.50

REPORT 1/G1 BOX 55

...mple J — Jar Sample W — Water Sample





REPORT 1167 Box 55

Note
Materials denoted above are as described on site.

Disturbed Sample ●
Undisturbed Sample ■

REVISIONS		
(A) Chart of W.Ls added 7.4.5	P. Healy	DUBLIN CORK STEAM STATION Logs of Bore Holes 1 to 6 Logs of Trial Pits 1 & 2 Chart showing variation of W.Ls in Bore[illegible]
	1/100	4811 A

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION

BORING RECORD

CONTRACT	Marina Generating Station.	BOREHOLE No.	8
Report No.		Order No.	
Bored for	E.S.B.		97274
Site Address	Cork.		
Boring Commenced	10.12.1975.	Boring Completed	13.1.1976.
Type of Boring	Percussion and Shell & Auger	Diameter of Borehole	16 and 8 ins.
Ground level	3.90m O.D.		
Water Struck (1)	4.60m B.G.L. (2)	(3)	
Standing Water Level	1.20m B.G.L.		
Remarks	Chiselling 29 hours. All levels are related to ground level.		

Description of Strata	Depth From	Depth To	Thickness	Sample Ref. No.	Sample Type	Sample Depth
Concrete. (Chiselling 1 hour)	0	0.15	0.15			
Filling of gravel, silt, cinders, etc.	0.15	2.00	1.85	6935	D	1.00
Grey organic silt.	2.00	4.00	2.00	6936 6933 6937 6934	D U D U	2.15 2.15 - 2.60 2.75 2.95 - 3.40
Dark grey very silty gravel.	4.00	4.60	0.60	6938	D	4.15
Medium to coarse sandy gravel.	4.60	6.00	1.40	6939	D	4.75
Soft grey silt.	6.00	6.60	0.60	6941 6940	D U	6.15 6.15 - 6.60
Coarse sandy gravel with cobbles and boulders. (Chiselling 1 hour)	6.60	13.70	7.10	6942 6948 [illegible] [illegible]	D W D D	6.75 7.00 [illegible] [illegible]
Stiff grey/green silty clay. (Chiselling 6 hours).	13.70	17.50	3.80	6945 6946 [illegible] [illegible]	D D D D	10.25 10.75 11.60 [illegible]
Compact coarse sandy gravel with cobbles and boulders. (Chiselling 18 hours).	17.50	27.30	9.80	5634 5632 5635 5633	D U D U	14.00 14.60 - 14.95 15.50 16.00 - 16.45
Final level.	27.30			5637 5638 5639 5640	D D D D	16.50 17.85 18.95 19.75
				5641 5642 5644	D D D	20.05 21.55 22.15
				5645 5646 5647	D D D	23.00 24.50 26.00

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

NOTES:-

1. FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O/D., 1⅜" I/D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED.
2. "BOILING UP" OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No 12 AT DEPTH 35'-0" – 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
3. BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (¾). BOTTOM OF SOUNDING PIPE WAS SET AT –4.5' O.D.
4. BOREHOLE No. 12 WAS BACKFILLED THUS:-
   –52.0' O.D. TO –13.0' O.D., CLEAN GRAVEL.
   –13.0' O.D. TO +2.0' O.D., DENSE BLUE CLAY WELL RAMMED.
   +2.0' O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL.
   THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2.0' O.D.
5. THE SOUNDING PIPES CONSISTED OF ¾" DIA. HARD P.V.C. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
6. (S) DENOTES TEST DONE WITH SOLID CONE
   (H) DENOTES TEST DONE WITH HOLLOW SHOE
   • DENOTES DISTURBED SAMPLE.
   Δ DENOTES WATER SAMPLE.

REPORT 1167 BOX 51

REVISIONS		
	28.10.65	BOARD
		MARINA POWER STATION LOGS OF BOREHOLES 11-15 INCL. (COMPILED FROM RECORDS OF MESSRS. SOIL MECHANICS LTD).
	1" = 10'-0"	62016

64822

BOREHOLE NO 7 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19 feet above O.D. DATE: July 14 – August 16, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
MADE GROUND : consisting of cobble & gravel sized pieces of black slag; light brown and black fine sand, occasional vegetable matter and pieces of metal.	+19.0		1–6	0' 0"	15' 0"	
ALLUVIUM : consisting of soft dark grey sandy silt with occasional lenses of compact silty sand with fine, medium and coarse gravel. At the base of stratum were well rounded cobbles, chiefly of sandstone, with a little sandy gravelly matrix.	+4.0		7–14	15' 0"	17' 0"	N = 43
FLUVIO – GLACIAL DEPOSITS consisting of dense becoming very dense, reddish-brown, sometimes silty, fine, medium and coarse sand with fine medium and coarse gravel: from a depth of about 75ft. cobbles were present.	-13.0		15–42	32' 0"	68' 0" Penetrated	N = 36; N = 69; N = 78; N = 88 for 6 inches; N = 87 for 6 inches; N = 53 for 3 inches; N = 56 for 6 inches; N = 57 for 6 inches; N = 61 for first 6 inches; N = 66 for 6 inches; N = 56 for 6 inches; N = 48 for 3 inches; N = 63 for first 6 inches; N = 56 for 3 inches
END OF BOREHOLE	-81.0			100' 0"		

N is the number of blows for the Standard Penetration Test.

Readings of ground water are recorded separately in Appendix.

SCALE: 1in. = 10 feet. • Disturbed Sample ‡ Core Sample Water Sample

64823

BOREHOLE NO. 8 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19.0 feet above O.D. DATE: August 3 – 24th. 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
MADE GROUND : consisting of topsoil with rootlets dark-brown sand with gravel, gravel & cobble-sized pieces of black slag	+19.0		1–5	0' 0"	12' 0"	N = 18; N = 40
ALLUVIUM : consisting of very soft and soft grey (weathering to brown), clayey silt containing some silt shells changing at depth of 15' 0" to reddish-brown and grey, fine, medium & coarse sand with fine, medium & coarse gravel containing occasional cobbles; at base of stratum were well-rounded cobbles in a sandy-gravelly matrix.	+7.0		6–18	12' 0"	19' 6"	N = 6; N = 21; N = 24
FLUVIO – GLACIAL DEPOSITS : consisting of dense becoming very dense, reddish-brown, sometimes silty, fine, medium and coarse sand with fine medium and coarse gravel and cobbles; at a depth of 65' there was a layer of firm to stiff, greenish-brown silty laminated clay	-12.5	clayey	19–46	31' 6"	68' 6" Penetrated	N = 57 for 3 inches; N = 61 for 6 inches; N = 41; N = 50; N = 57 for 3 inches; N = 50 for 4 inches; N = 41 for 6ins (refusal); N = 56 for 4 inches; N = 57 for 3in. (refusal); N = 53 for 6 inches; N = 65 for 6in (refusal)
END OF BOREHOLE	-81.0			100' 0"		

N is the number of blows for the standard Penetration Test.

Readings of ground water level are given in Appendix A

SCALE: 1in. = 10 feet. • Disturbed Sample ‡ Core Sample △ Water Sample

64824

BOREHOLE NO. 9 DIAMETER: 10, 8, & 6 inch.

GROUND LEVEL: 19.0 feet above O.D. DATE August 25 – September 10, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
MADE GROUND : consisting of topsoil with rootlets, dark brown sandy clay with gravel, gravel and cobble-sized pieces of black slag; some broken brick and debris	+19.0		1–5	0' 0"	12' 6"	N = 54; N = 13
ALLUVIUM consisting of soft dark grey (weathering to brown), clayey, sandy, organic silt with occasional shells and occasional gravel; at a depth of 19 ft ... dense reddish-brown, fine, medium and coarse, sometimes silty and clayey, sand with fine medium & coarse gravel and cobbles; at base of stratum were well-rounded cobbles	+6.5		6–18	12' 6"	27' 6"	N = 10; N = 10; N = 37; N = 34
FLUVIO – GLACIAL DEPOSITS consisting of medium dense becoming dense, reddish-brown, fine, medium and coarse, sometimes silty, sometimes clayey sand with fine, medium and coarse gravel and cobbles	-21.0	clayey	19–43	40' 0"	55' 9" Penetrated	N = 10; N = 36; N = 35; N = 60; N = 45 for 6 inches; N = 57; N = 60 for first 6 inches (refusal); N = 67 for 3 inches
END OF BOREHOLE	-76.7			95' 9"		

N is the number of blows for the standard penetration test.

Readings of ground water levels are given in Appendix.

SCALE: 1in. = 10 ft. • Disturbed Sample ‡ Core Sample △ Water Sample

64825

BOREHOLE NO. 10 DIAMETER: 10, 8 & 6 inch.

GROUND LEVEL: 19.0 feet above O.D. DATE: September 13 – October 13, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
MADE GROUND : consisting of topsoil with rootlets; soft, dark brown, sandy, gravelly clay with organic matter; pieces of broken brick & slag	+19.0		1–5	0' 0"	5' 6"	N = 5
ALLUVIUM : consisting of soft, dark grey (weathering to brown) silty, sometimes sandy, clay and clayey silt containing occasional shells and fine gravel also containing occasional traces of vegetable matter; at base of stratum was reddish brown silty sand with gravel and some cobbles.	+13.5		6–13	5' 6"	26' 0"	N = 6; N = 27; N = 57
FLUVIO – GLACIAL DEPOSITS : consisting of medium dense becoming dense, fine, medium and coarse sands and gravels with occasional cobbles; at top of stratum the gravels and cobbles had a matrix of soft to firm, reddish-brown, silty sandy clay.	-12.5	clayey	14–42	31' 6"	68' 6" Penetrated	N = 56 for first 3 inches (refusal); N = 48; N = 25; N = 83; N = 81; N = 18; N = 6 for first 4 inches (refusal); N = 56 for 3 inches; N = 30; N = 65 for 3 inches; N = 60; N = 46; N = 58
END OF BOREHOLE	-81.0			100' 0"		

N is the number of blows for the standard Penetration Test.

Readings of ground water level are given in Appendix.

Note: On completion of a standard penetration test at a depth of 31' 0" the borehole was abandoned due to loss & non-recovery of testing gear. Borehole recommended in an adjacent position, 4 ft away on an extension of the line joining Boreholes 9 & 10: sampling & testing recommenced at 31' 0"

* Sample 35 was a water sample broken in transit to laboratory

SCALE: 1in. = 10ft. • Disturbed Sample ‡ Core Sample △ Water Sample

REPORT 1167 Box 55

Note: For description of logs by R.E. see File E.5101.

Revisions		
A Revised to agree with Report. by Soil Mechanics	Drawn	ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT
	Traced	MARINA POWER STATION Logs of Bore Holes 7 to 10 incl (Traced from Records of Messrs Soil Mechanics Ltd)
	Checked: [signature]	
	Scale 1/120	43139 A

64822

BOREHOLE NO 7 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19 feet above I.O.D. DATE: July 14 – August 16, 1960

+19.0 — 0'0"

MADE GROUND : consisting of cobble & gravel sized pieces of black slag; light brown and black fine sand, occasional vegetable matter and pieces of metal.

+4.0 — 15'0" (thickness 15'0")

ALLUVIUM : consisting of soft dark grey sandy silt with occasional lenses of compact silty sand with fine, medium and coarse gravel. At the base of stratum were well rounded cobbles, chiefly of sandstone, with a little sandy gravelly matrix.

-13.0 — 32'0" (thickness 17'0")

FLUVIO – GLACIAL DEPOSITS : consisting of dense becoming very dense, reddish-brown, sometimes silty, fine medium and coarse sand with fine medium and coarse gravel: from a depth of about 75 ft. cobbles were present.

-81.0 — 100'0" (thickness 68'0" Penetrated)

N = 43; N = 36; N = 67; N = 72; N = 86 for 6 inches; N = 87 for 6 inches; N = 53 for 3 inches; N = 56 for 6 inches; N = 57 for 6 inches; N = 61 for first 6 inches; N = 55 for 6 inches; N = 56 for 6 inches; N = 40 for 3 inches; N = 65 for first 6 inches; N = 36 for 9 inches.

END OF BOREHOLE

N is the number of blows for the Standard Penetration Test.

Readings of ground water are recorded separately in Appendix.

SCALE: 1in. = 10 feet. + Disturbed Sample ▮ Core Sample Water Sample

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64823

BOREHOLE NO. 8 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 9 – 24th, 1960

+19.0 — 0'0"

MADE GROUND : consisting of topsoil with rootlets, dark brown sand with gravel, gravel- & cobble-sized pieces of black slag

+7.0 — 12'0" (thickness 12'0")

ALLUVIUM : consisting of very soft and soft grey (weathering to brown), clayey silt containing some ... shells, changing at depth of 15'0" to reddish-brown and grey, fine, medium & coarse sand with fine, medium & coarse gravel containing occasional cobbles; at base of stratum were well-rounded cobbles in a sandy-gravelly matrix.

-12.5 — 31'6" (thickness 19'6")

FLUVIO – GLACIAL DEPOSITS : consisting of ... becoming very dense, reddish-brown, sometimes silty, fine, medium and coarse sand with fine, medium and coarse gravel and cobbles: at a depth of 65' there was a layer of firm to stiff, greenish-brown silty laminated clay.

clayey; clayey; clayey; clayey

-81.0 — 100'0" (thickness 68'6" Penetrated)

N = 18; N = 40; N = 6; N = 31; N = 24; N = 87 for 3 inches; N = 61 for 6 inches; N = 44; N = 50; N = 87 for 3 inches; N = 20 for 3 inches; N = 41 for 6 ins (refusal); N = 36 for 3 inches; N = 37 for 3in. (refusal); N = 55 for 6 inches; N = 65 for 6in (refusal).

END OF BOREHOLE

N is the number of blows for the standard Penetration Test.

Readings of ground water level are given in Appendix A

SCALE: 1in. = 10 feet. + Disturbed Sample ▮ Core Sample △ Water Sample

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64824

BOREHOLE NO. 9 DIAMETER: 10, 8, & 6 inch.

GROUND LEVEL: 19.0 feet above I.O.D. DATE August 25 – September 10, 1960

+19.0 — 0'0"

MADE GROUND : consisting of topsoil with rootlets, dark brown sandy clay with gravel, gravel- and cobble-sized pieces of black slag; some broken brick and stones.

+0.6 — 18'6" (thickness 18'6")

ALLUVIUM : consisting of soft dark grey (weathering to brown) clayey, sandy, organic silt with occasional shells and occasional gravel; at 19 ft ... dense reddish-brown, fine, medium and coarse, sometimes silty and clayey, sand with fine, medium & coarse gravel and cobbles; at base of stratum were well-rounded cobbles.

-21.0 — 40'0" (thickness 21'6")

FLUVIO – GLACIAL DEPOSITS : consisting of medium dense becoming dense, reddish-brown, fine, medium and coarse, sometimes clayey sand with fine, medium and coarse gravel and cobbles

clayey; clayey

-74.7 — 93'6" (thickness 55'6" Penetrated)

N = 25; N = 13; N = 10; N = 10; N = 37; N = 34; N = 10; N = 36; N = 35; N = 60; N = 45 for 6 inches; N = 87; N = 60 for first 4 inches (refusal); N = 67 for 8 inches.

END OF BOREHOLE

N is the number of blows for the standard penetration test.

Readings of ground water levels are given in Appendix.

SCALE: 1in. = 10 ft. + Disturbed Sample ▮ Core Sample △ Water Sample

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64825

BOREHOLE NO. 10 DIAMETER: 10, 8 & 6 inch.

GROUND LEVEL: 19.0 feet above I.O.D. DATE: September 13 – October 13, 1960

+19.0 — 0'0"

MADE GROUND : consisting of topsoil with rootlets: soft, dark brown, sandy, gravelly clay with organic matter; pieces of brick & slag

+3.5 — 15'6" (thickness 15'6")

ALLUVIUM : consisting of soft, dark grey (weathering to brown) silty, sometimes sandy, clay and clayey silt containing occasional shells and fine gravel; also containing occasional traces of vegetable matter; at base of stratum was reddish brown silty sand with gravel and some cobbles.

-16.5 — 35'6" (thickness 20'0")

FLUVIO – GLACIAL DEPOSITS : consisting of medium dense becoming dense, fine, medium and coarse sands and gravels with occasional cobbles; at top of stratum the gravels and cobbles had a matrix of soft to firm, reddish-brown, silty sandy clay.

clayey

-81.0 — 100'0" (thickness 64'6" Penetrated)

N = 5; N = 6; N = 27; N = 37; N = 56 for first 3 inches (refusal); N = 48; N = 25; N = 83; N = 81; N = 18; N = 0 for first 4 inches (refusal); N = 5 for 3 inches; N = 30; N = 65 for 8 inches; N = 60; N = 46; N = 59.

END OF BOREHOLE

N is the number of blows for the standard Penetration Test.

Readings of ground water level are given in Appendix.

Note: On completion of a standard penetration test at a depth of 31'0" the borehole was abandoned due to loss & non-recovery of testing gear. Borehole recommenced in an adjacent position, 4 ft away on an extension of the line joining Boreholes 9 & 10: sampling & testing recommenced at 31'0"

* Sample 35 was a water sample broken in transit to laboratory

SCALE: 1in. = 10 ft. + Disturbed Sample ▮ Core Sample △ Water Sample

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REPORT 1167 Box 55

Note: For description of logs by R.E. see File E 5101.

Revisions		
A Revised to agree with Report by Soil Mechanics	Drawn .... Traced .... Checked: [signature]	ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT **MARINA POWER STATION** **Logs of Bore Holes 7 to 10 incl (Traced from Records of Messrs Soil Mechanics Ltd)**
	Scale 1/120	43139 A

64822

BOREHOLE NO. 7 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19 feet above O.D. DATE: July 14 – August 16, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
	+19.0		1	0'0"		
MADE GROUND – consisting of cobble & gravel sized pieces of black slag; light brown and black fine sand, occasional vegetable matter and pieces of metal.			2, 3, Δ23, 4, 5, 6		15'0"	
	+4.0		7	15'0"		
ALLUVIUM: consisting of soft dark grey sandy silt with occasional lenses of compact silty sand with fine medium and coarse gravel. At the base of stratum were well-rounded cobbles, chiefly of sandstone, with a little sandy gravelly matrix.			8, 9, 10, 11, 12, 13		17'0"	N = 43
	−13.0		14	32'0"		N = 36
FLUVIO – GLACIAL DEPOSITS consisting of dense becoming very dense, reddish-brown, sometimes silty, fine medium and coarse sand with fine medium and coarse gravel: from a depth of about 75 ft. cobbles were present.			15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41		68'0" Penetrated	N = 69; N = 78; N = 88 for 6 inches; N = 31 for 6 inches; N = 33 for 3 inches; N = 56 for 6 inches; N = 37 for 6 inches; N = 61 for first 6 inches; N = 56 for 6 inches; N = 36 for 6 inches; N = 40 for 8 inches; N = 68 for first 6 inches
	−81.0		42	100'0"		N = 36 for 9 inches
END OF BOREHOLE						

N is the number of blows for the Standard Penetration Test.

Readings of ground water are recorded separately in Appendix.

SCALE: 1 in. = 10 feet. + Disturbed Sample ▮ Core Sample Water Sample

64823

BOREHOLE NO. 8 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19.0 feet above O.D. DATE: August 9 – 24th, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
	+19.0			0'0"		
MADE GROUND – consisting of topsoil with rootlets, dark brown sand with gravel, gravel & cobble-sized pieces of black slag			1, 2, 3, 4, 5, 6		12'0"	N = 12; N = 40
	+7.0		7	12'0"		
ALLUVIUM: consisting of very soft and soft grey (weathering to brown), clayey silt containing some [illegible] shells, changing at depth of 15'0" to reddish-brown and grey, fine, medium & coarse sand with fine, medium & coarse gravel containing occasional cobbles; at base of stratum were well-rounded cobbles in a sandy-gravelly matrix.			8, 9, 10, 11, 12, 13, 14, 15, 16, 17		19'6"	N = 6; N = 31
	−12.5		18	31'6"		N = 24
FLUVIO-GLACIAL DEPOSITS: consisting of [illegible] becoming very dense, reddish-brown, sometimes silty, fine, medium and coarse sand with fine medium and coarse gravel and cobbles: at a depth of 65' there was a layer of firm to stiff, greenish-brown silty laminated clay	clayey; clayey; clayey; clayey		19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46		68'6" Penetrated	N = 87 for 3 inches; N = 61 for 6 inches; N = 44; N = 50; N = 37 for 3 inches; N = 50 for 4 inches; N = 41 for 6 ins (refusal); N = 36 for 4 inches; N = 37 for 3 in. (refusal); N = 53 for 6 inches; N = 65 for 6 in (refusal)
	−81.0			100'0"		
END OF BOREHOLE						

N is the number of blows for the standard Penetration Test.

Readings of ground water level are given in Appendix A

SCALE: 1 in. = 10 feet. + Disturbed Sample ▮ Core Sample Δ Water Sample

64824

BOREHOLE NO. 9 DIAMETER: 10, 8, & 6 inch

GROUND LEVEL: 19.0 feet above O.D. DATE August 25 – September 10, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
	+19.0			0'0"		
MADE GROUND: consisting of topsoil with rootlets, dark brown sandy clay with gravel, gravel- and cobble-sized pieces of black slag; some broken brick and dense.			1, 2, 3, 4, 5		18'6"	N = 25; N = 13
	+.6			18'6"		
ALLUVIUM: consisting of soft dark grey (weathering to brown) clayey, sandy, organic silt with [illegible]; [illegible] dense reddish-brown, fine, medium and coarse, sometimes silty and clayey, sand with fine medium and coarse gravel and cobbles – at base of stratum were well-rounded cobbles.			6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20		21'6"	N = 10; N = 10; N = 37; N = 34
	−21.0			40'0"		N = 10
FLUVIO-GLACIAL DEPOSITS consisting of medium dense becoming dense, reddish-brown, fine, medium and coarse, sometimes silty, sometimes clayey sand with fine, medium and coarse gravel and cobbles	clayey; clayey		21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, Δ41, 42, 43		55'6" Penetrated.	N = 36; N = 35; N = 60; N = 45 for 6 inches; N = 87; N = 40 for first 4 inches (refusal); N = 67 for 8 inches.
	−76.7			95'6"		
END OF BOREHOLE						

N is the number of blows for the standard penetration test.

Readings of ground water levels are given in Appendix.

SCALE: 1 in. = 10 ft. + Disturbed Sample ▮ Core Sample Δ Water Sample

64825

BOREHOLE NO. 10 DIAMETER: 10, 8 & 6 inch.

GROUND LEVEL: 19.0 feet above O.D. DATE: September 13 – October 13, 1960

Description	Reduced Level	Legend	Samples	Depth	Thickness	
	+19.0		1	0'0"		
MADE GROUND: consisting of topsoil with rootlets; soft, dark brown, sandy, gravelly clay with organic matter; pieces of brick & slag			2, 3, 4, 5		15'6"	N = 5
	+3.5		6	15'6"		N = 6
ALLUVIUM: consisting of soft, dark grey (weathering to brown) silty, sometimes sandy, clay and clayey silt containing occasional shells and fine gravel; also containing occasional traces of vegetable matter; at base of stratum was reddish brown silty sand with gravel and some cobbles.			7, 8, 9, 10, 11, 12, 13, 14		20'0"	N = 27; N = 57
	−16.5		15	35'6"		N = 56 for first 6 inches (refusal)
FLUVIO-GLACIAL DEPOSITS: consisting of medium dense becoming dense, fine, medium and coarse sands and gravels with occasional cobbles: at top of stratum the gravels and cobbles had a matrix of soft to firm, reddish-brown, silty sandy clay.	clayey		16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41		64'6" Penetrated.	N = 46; N = 25; N = 53; N = 31; N = 18; N = 6 for first 4 inches (refusal); N = 56 for 3 inches; N = 30; N = 65 for 8 inches; N = 60; N = 46
	−81.0		42	100'0"		N = 50
END OF BOREHOLE						

N is the number of blows for the standard Penetration Test.

Readings of ground water level are given in Appendix.

Note: On completion of a standard penetration test at a depth of 31'0" the borehole was abandoned due to loss & non-recovery of testing gear. Borehole recommended in an adjacent position, 4 ft away on an extension of the line joining Boreholes 9 & 10: sampling & testing recommenced at 31'0".

* Sample 35 was a water sample broken in transit to laboratory

SCALE: 1 in. = 10 ft. + Disturbed Sample ▮ Core Sample Δ Water Sample

REPORT 1167 Box 55

Note: For description of logs by R.E. see File E.5101.

Revisions		
A Revised to agree with Report by Soil Mechanics	Drawn	ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT
	Traced [illegible]	MARINA POWER STATION
	Checked: [signature]	Logs of Bore Holes 7 to 10 incl (Traced from Records of Messrs Soil Mechanics Ltd)
	Scale 1/120	43139 A

64822

BOREHOLE NO 7 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19 feet above O.D. DATE: July 14 – August 16, 1960

MADE GROUND : consisting of cobble & gravel sized pieces of black slag; light brown and black fine sand, occasional vegetable matter and pieces of metal.

+19·0 — 0' 0" — 15' 0"

ALLUVIUM : consisting of soft dark grey sandy silt with occasional lenses of compact silty sand with fine, medium and coarse gravel. At the base of stratum were well rounded cobbles, chiefly of sandstone, with a little sandy gravelly matrix.

+4·0 — 15' 0" — 17' 0"

FLUVIO – GLACIAL DEPOSITS consisting of dense becoming very dense, reddish-brown, sometimes silty, fine, medium and coarse sand with fine medium and coarse gravel: from a depth of about 75 ft. cobbles were present.

−13·0 — 32' 0" — 68' 0" Penetrated

−81·0 — 100' 0"

END OF BOREHOLE

N = 43
N = 36
N = 67
N = 78
N = 78 for 6 inches.
N = 51 for 6 inches
N = 33 for 3 inches
N = 56 for 6 inches
N = 57 for 6 inches
N = 61 for final 6 inches
N = 56 for 6 inches
N = 56 for 6 inches
N = 40 for 3 inches.
N = 55 for first 6 inches
N = 36 for 9 inches.

N is the number of blows for the Standard Penetration Test.

Readings of ground water are recorded separately in Appendix

SCALE: 1 in. = 10 feet. + Disturbed Sample ▮ Core Sample Water Sample

64823

BOREHOLE NO. 8 DIAMETER: 10, 8 & 6 inch

GROUND LEVEL: 19·0 feet above O.D. DATE: August 9 – 24th, 1960

MADE GROUND : consisting of topsoil with rootlets dark-brown sand with gravel, gravel & cobble-sized pieces of black slag

+19·0 — 0' 0" — 12' 0"

ALLUVIUM : consisting of very soft and soft grey (weathering to brown), clayey silt containing some ... at depth of 15' 0" to reddish-brown and grey, fine medium & coarse sand with fine, medium & coarse gravel containing occasional cobbles, at base of stratum were well-rounded cobbles in a sandy-gravelly matrix.

+7·0 — 12' 0" — 19' 6"

FLUVIO – GLACIAL DEPOSITS : consisting ... becoming very dense, reddish-brown, sometimes silty, fine, medium and coarse sand with fine medium and coarse gravel and cobbles: at a depth of 65' there was a layer of firm to stiff, greenish-brown silty laminated clay

−12·5 — 31' 6" — 68' 6" Penetrated

clayey

clayey

clayey

clayey

−81·0 — 100' 0"

END OF BOREHOLE

N = 12
N = 40
N = 6
N = 11
N = 24
N = 87 for 3 inches.
N = 61 for 6 inches
N = 44
N = 50
N = 87 for 9 inches
N = 80 for 4 inches
N = 41 for 6 ins (refusal)
N = 36 for 4 inches
N = 87 for 3 in. (refusal)
N = 63 for 6 inches
N = 65 for 6 in (refusal)

N is the number of blows for the standard Penetration test.

Readings of ground water level are given in Appendix A

SCALE: 1 in. = 10 feet. + Disturbed Sample ▮ Core Sample △ Water Sample

64824

BOREHOLE NO. 9 DIAMETER: 10, 8 & 6 inch.

GROUND LEVEL: 19·0 feet above O.D. DATE August 25 – September 10, 1960

MADE GROUND : consisting of topsoil with rootlets, dark brown sandy clay with gravel-gravel and cobble-sized pieces of black slag; some broken brick and ashes

+19·0 — 0' 0" — 12' 6"

ALLUVIUM consisting of soft dark grey (weathering to brown) clayey, sandy, organic silt with ... and occasional gravel: at a depth of 19 ft ... dense reddish-brown fine medium and coarse, sometimes silty and clayey sand with fine medium & coarse gravel and cobbles: at base of stratum were well-rounded cobbles

+6·5 — 12' 6" — 27' 6"

FLUVIO – GLACIAL DEPOSITS consisting of medium dense becoming dense, reddish-brown, fine medium and coarse, sometimes silty, sometimes clayey sand with fine, medium and coarse gravel and cobbles

−21·0 — 40' 0" — 35' 6" Penetrated

clayey

clayey −74·7 — 93' 8"

END OF BOREHOLE

N = 54
N = 13
N = 10
N = 10
N = 37
N = 34
N = 18
N = 36
N = 35
N = 60
N = 46 for 6 inches
N = 87
N = 40 for first 4 inches (refusal)
N = 67 for 9 inches.

N is the number of blows for the standard penetration test.

Readings of ground water levels are given in Appendix.

SCALE: 1 in. = 10 ft. + Disturbed Sample ▮ Core Sample △ Water Sample

64825

BOREHOLE NO. 10 DIAMETER: 10, 8 & 6 inch.

GROUND LEVEL: 19·0 feet above O.D. DATE: September 13 – October 13, 1960

MADE GROUND : consisting of topsoil with rootlets; soft, dark brown, sandy, gravelly clay with organic matter; pieces of broken brick & slag

+13·0 — 0' 0" — 5' 6"

ALLUVIUM : consisting of soft, dark grey (weathering to brown) silty, sometimes sandy, clay and clayey silt containing occasional shells and fine gravel also containing occasional traces of vegetable matter; at base of stratum was reddish brown silty sand with gravel and some cobbles.

+5·5 — 5' 6" — 26' 0"

FLUVIO – GLACIAL DEPOSITS : consisting of medium dense becoming dense, fine, medium and coarse sands and gravels with occasional cobbles: at top of stratum the gravels and cobbles had a matrix of soft to firm, reddish-brown, silty sandy clay.

−16·5 — 35' 6" — 64' 6" Penetrated

clayey

−81·0 — 100' 0"

END OF BOREHOLE

N = 5
N = 4
N = 27
N = 57
N = 56 for first 3 inches (refusal)
N = 48
N = 25
N = 83
N = 81
N = 18
N = 15 for first 4 inches (refusal)
N = 54 for 3 inches
N = 30
N = 65 for 8 inches
N = 60
N = 46
N = 58

N is the number of blows for the standard Penetration test.

Readings of ground water level are given in Appendix.

Note: On completion of a standard penetration test at a depth of 31' 0" the borehole was abandoned due to loss & non-recovery of testing gear. Borehole recommenced in an adjacent position, 4 ft away on an extension of the line joining Boreholes 9 & 10: sampling & testing recommenced at 31' 0"

* Sample 35 was a water sample broken in transit to laboratory

SCALE: 1 in. = 10 ft. + Disturbed Sample ▮ Core Sample △ Water Sample

REPORT 1167 Box 55

Note: For description of logs by R.E. see File E 5101.

Revisions		
A Revised to agree with Report by Soil Mechanics	Drawn ... Traced ... Checked: [signature] ...	ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT **MARINA POWER STATION** **Logs of Bore Holes 7 to 10 incl** **(Traced from Records of Messrs Soil Mechanics Ltd)**
	Scale 1/120	43139 A

BOREHOLE No. 11 64826

DIAMETER:-

GROUND LEVEL:- +17·43' O.D. 5·31M

DATE:- 1·6·65 TO 4·6·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+17·43'	0·0		
LOOSE CLAYEY GRAVEL ETC. FILLING	+12·4'	5·0'	5'-0"	3 (S)
FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE.	+1·4'	16·0'	6'-0"	2 (S)
				0 (S)
FINE DARK GREY COHESIVE SILT WITH SOME CLAY. FINE SAND NEAR BOTTOM	-1·6'	19·0'	3'-0"	8 (S)
COARSE AND MEDIUM GRAVEL UP TO 1½" WITH SOME SAND AND VERY LITTLE SILT	-6·6'	24·0'	5'-0"	10 (S)
FINE, MEDIUM AND COARSE RED GRAVEL; SOME SAND; COBBLES UP TO 4"	-12·6'	30·0'	6'-0"	10 (S)
AS ABOVE	-17·6'	35·0'	5'-0"	3 (S)
AS ABOVE BUT WITH MORE FINE RED SAND.	-22·6'	40·0'	5'-0"	6 (S)
AS ABOVE WITH LESS FINE RED SAND; BIGGER COBBLES	-27·6'	45·0'	5'-0"	13 (S)
AS ABOVE WITH COBBLES UP TO 6"	-37·6'	55·0'	10'-0"	23 (S)
				22 (H)
AS ABOVE WITH INCREASED FINE SAND.	-47·6'	65·0'	10'-0"	16 (H)
				73 (H)
AS ABOVE BUT MORE COBBLES UP TO 4"	-52·6'	70·0' 21·33M	5'-0	20 (H)

BOREHOLE No. 12 64827

DIAMETER:-

GROUND LEVEL:- +18·04' O.D. 5·49M

DATE:- 8·6·65 TO 11·6·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+18·04'	0'-0"		
BROWN CLAY GRAVEL FILLING	+13·0'	5'-0"	5'-0"	10 (H)
BLACK FOUNDRY SAND	+8·0'	10'-0"	5'-0"	5 (H)
FINE DARK GREY SILT WITH SOME VERY FINE SAND AND CLAY COHESIVE.	+3·0'	15'-0"	5'-0"	3 (H)
AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND	-4·5'	22'-6"	7'-6"	6 (H)
6" LAYER OF VEGETATION COMPRESSED LEAVES FERN ETC.	-5·0'	23'-0"		
FINE, MEDIUM & COARSE GRAVEL, SOME FINE RED SAND; COBBLES UP TO 3".	-7·0'	25'-0"	2'-0"	2 (H)
AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND	-17·0'	35'-0"	10'-0"	28 (H)
				25 (H)
AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2½"	-22·0'	40'-0"	5'-0"	54 (H)
				49 (S)
AS ABOVE WITH LESS FINES AND MORE COBBLES UP TO 6"	-30·0'	48'-0"	8'-0"	41 (H)
ONE BOULDER 10"×8"×7" (SANDSTONE)	-31·0'	49'-0"	1'-0"	
FINE MED. & COARSE GRAVEL AND SOME FINE RED SAND BUT FEWER COBBLES	-37·0'	55'-0"	6'-0"	19 (H)
				13 (H)
AS ABOVE WITH MORE COBBLES UP TO 4"	-42·0'	60'-0"	5'-0"	16 (H)
AS ABOVE BUT WITH COBBLES UP TO 6"	-52·0'	70'-0" 21·33M	10'-0"	9 (H)
				15 (H)

BOREHOLE No. 13 64828

DIAMETER:- 10" & 8"

GROUND LEVEL:- +18·1' O.D. 5·51M

DATE:- 6·8·65 TO 17·8·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+18·1'	0'-0"		
MADE GROUND PREDOMINANTLY SAND AND SILT WITH SOME BRICK RUBBLE			13'-0"	
GREY SANDY SILT	+5·1'	13'-0"	2'-0"	4 (H) W.L.
GREY SILT AND FINE AND MEDIUM GRAVEL	+3·1'	15'-0"	3'-0"	6 (H)
GREY ORGANIC SILT BECOMING SANDY WITH DEPTH	+0·1'	18'-0"	5'-0"	4 (H)
COARSE, MEDIUM AND FINE GRAVEL AND A LITTLE COARSE SAND AND OCCASIONAL COBBLES	[illegible]	23'-0"	9'-6"	10 (H)
				18 (H)
				16 (H)
COBBLES AND COARSE, MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH	-14·4'	32'-6"	8'-0"	21 (S)
				65 (S)
				24 (S)
COARSE, MEDIUM AND FINE GRAVEL, AND COARSE AND MEDIUM SAND GRADING TO GRAVEL WITH A LITTLE COARSE SAND. OCCASIONAL COBBLES.	-22·4'	40'-6"	25'-6"	20 (S)
				16 (S)
				20 (S)
				22 (S)
				21
COARSE GRAVEL AND COBBLES	-47·9'	66'-0"	10'-6"	30 (S)
				28 (S)
COARSE, MEDIUM AND FINE GRAVEL, COARSE BROWN SAND AND COBBLES.	-58·?	76'-6"	5'-6"	30 (S)
	-63·9'	82'-0" 24·99M		29 (S)

BOREHOLE No. 14 64829

DIAMETER:- 10" & 8"

GROUND LEVEL:- +17·5' O.D. 5·33M

DATE:- 18·8·65 TO 24·8·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+17·5'	0'-0"		
MADE UP GROUND; DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC.			9'-0"	
AS ABOVE, CHANGING TO GREY SILT	+8·5'	9'-0"	1'-0"	4 (H)
VERY SOFT GREY SILT WITH SOME TRACES OF SAND.	+7·5'	10'-0"	7'-0"	4 (H)
SOFT GREY SANDY SILT	+0·5'	17'-0"	2'-0"	2 (H)
SILT AND SMALL GRAVEL, SOME FINE SAND.	-1·5'	19'-0"	3'-0"	
VERY SMALL GRAVEL WITH SOME FINE SAND.	-4·5'	22'-0"	2'-0"	19 (H)
[illegible]	-6·5'	24'-0"	2'-0"	20 (S)
AS ABOVE, CHANGING TO MEDIUM GRAVEL & SOME COARSE SAND	-7·5'	25'-0"	1'-0"	
MEDIUM GRAVEL & COARSE SAND.	-9·5'	27'-0"	2'-0"	19 (S)
MEDIUM GRAVEL WITH SOME COBBLES 3"-4".	-11·5'	29'-0"	2'-0"	
			4'-0"	35 (S)
MEDIUM AND SMALL GRAVEL WITH SOME COBBLES AND COARSE SAND	-15·5'	33'-0"	2'-0"	
MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND	-17·5'	35'-0"	3'-0"	29 (S)
MEDIUM GRAVEL AND COARSE SAND WITH COBBLES 4"-5".	-20·5'	38'-0"	2'-0"	33 (S)
MEDIUM GRAVEL, FINE SAND AND SOME COBBLES 3"-4".	-22·5'	40'-0"	2'-0"	
COMPACT MED. GRAVEL & FINE SAND	-24·5'	42'-0"	1'-0"	30 (S)
SOME 4" COBBLES WITH COARSE SAND	-25·5'	43'-0"	2'-0"	
COMPACT FINE & COARSE SAND WITH MEDIUM GRAVEL	-27·5'	45'-0"	5'-0"	22 (S)
MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3"-4"	-32·5'	50'-0"	3'-0"	24 (S)
MEDIUM GRAVEL WITH FINE TO COARSE SAND	-35·5'	53'-0"	2'-0"	22 (S)
MEDIUM GRAVEL WITH 50% FINE BROWN SAND	-37·5'	55'-0"	3'-0"	20 (S)
ONE 8" SANDSTONE BOULDER	-40·5'	58'-0"	2'-0"	25 (S)
MEDIUM GRAVEL WITH COARSE SAND	-42·5'	60'-0"	2'-0"	23 (S)
MEDIUM GRAVEL WITH SOME COBBLES	-44·5'	62'-0"	2'-0"	
MEDIUM GRAVEL WITH COARSE SAND	-46·5'	64'-0"	2'-0"	25 (S)
MEDIUM GRAVEL WITH SOME COARSE SAND AND SOME COBBLES	-49·5'	67'-0"	3'-0"	
MEDIUM GRAVEL AND COARSE SAND WITH SOME 3"-4" COBBLES	-52·5'	70'-0"	2'-0"	27 (S)
MEDIUM GRAVEL AND COARSE SAND.	-54·5'	72'-0"	3'-0"	26 (S)
COMPACT MEDIUM GRAVEL	-57·5'	75'-0"	6'-0"	23 (S)
VERY SMALL GRAVEL.	-63·5'	81'-0"	1'-0"	24 (S)
COMPACT MEDIUM GRAVEL WITH SOME SMALL GRAVEL.	-64·5'	82'-0"	1'-0"	
	-65·5'	83'-0"	4'-0"	31 (S)
VERY SMALL COMPACT GRAVEL.	-69·5'	87'-0"	8'-0"	27 (S)
COMPACT MEDIUM GRAVEL AND SOME COARSE SAND.	-77·5'	95'-0" 28·96M		29 (S)
BORING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING.				

BOREHOLE No. 15 64830

DIAMETER:- 10" & 8"

GROUND LEVEL:- +19·0' O.D. 5·79M

DATE:- 26·8·65 TO 1·9·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+19·0'	0'-0"		
TARMAC AND CONCRETE.	+18·0'	1'-0"	1'-0"	
MADE UP GROUND CONSISTING OF DARK SOIL, SOME STONES AND SAND, SCRAP METAL ETC	+13·0'	6'-0"	5'-0"	
MADE UP GROUND CONSISTING OF FOUNDRY SLAG, STONES, SCRAP METAL, ETC.	+5·0'	14'-0"	8'-0"	
VERY SOFT GREY SILT WITH SOME SHELLS.	+4·0'	15'-0"	1'-0"	4 (H)
VERY SOFT GREY SANDY SILT	-2·0'	21'-0"	6'-0"	4 (H)
				15 (H)
VERY SMALL GRAVEL, VERY SILTY.	-4·0'	23'-0"	2'-0"	
SMALL GRAVEL	-6·0'	25'-0"	2'-0"	19 (H)
VERY SMALL GRAVEL WITH SOME SILT	[illegible]	[illegible]	1'-0"	
SMALL GRAVEL	[illegible]	[illegible]	1'-0"	
VERY SMALL GRAVEL TRACES OF SILT	[illegible]	[illegible]	1'-0"	16 (H)
GREY SILT	[illegible]	[illegible]	0'-6"	
SMALL GRAVEL	-12·0'	31'-0"	2'-6"	
GRAVEL ¼" TO 1" SOME COARSE SAND.	-14·0'	33'-0"	2'-0"	24 (S)
				24 (S)
MEDIUM GRAVEL AND SOME COARSE SAND	-20·0'	39'-0"	6'-0"	81 (S)
COMPACT MEDIUM GRAVEL WITH 4" COBBLES.	-22·0'	41'-0"	2'-0"	
MEDIUM GRAVEL WITH SOME COBBLES	-24·0'	43'-0"	2'-0"	26 (S)
MEDIUM TO LARGE GRAVEL WITH SOME COARSE SAND.	-25·5'	44'-6"	1'-6"	
COMPACT MEDIUM GRAVEL WITH SOME COBBLES.	-31·0'	50'-0"	5'-6"	30 (S)
				26 (S)
MEDIUM GRAVEL	-33·0'	52'-0"	2'-0"	
MEDIUM GRAVEL AND COARSE SAND	-36·5'	55'-6"	3'-6"	28 (S)
	-37·0'	56'-0"	0'-6"	
SMALL GRAVEL AND COARSE SAND	-39·0'	58'-0"	2'-0"	30 (S)
VERY COMPACT MEDIUM GRAVEL	-43·0'	62'-0"	4'-0"	27 (S)
AS ABOVE, WITH 4" COBBLES.	-44·0'	63'-0"	1'-0"	
COBBLES TO VERY SMALL GRAVEL	-45·0'	64'-0"	1'-0"	32 (S)
COMPACT SMALL TO MEDIUM GRAVEL	-48·0'	67'-0"	3'-0"	33 (S)
VERY SMALL COMPACT GRAVEL	-56·0'	75'-0"	8'-0"	28 (S)
MEDIUM GRAVEL.	-58·0'	77'-0"	2'-0"	27 (S)
VERY COMPACT SMALL GRAVEL WITH SOME COARSE SAND.	-62·5'	81'-6"	4'-6"	
MEDIUM GRAVEL AND COARSE SAND.	-67·0'	86'-0"	4'-6"	39 (S)
AS ABOVE; ONE LARGE COBBLE	-67·5'	86'-6"	0'-6"	
SMALL GRAVEL WITH SOME FINE SAND VERY COMPACT.	-69·5'	88'-6"	2'-0"	25 (S)
COARSE SAND AND SMALL GRAVEL	-71·0'	90'-0"	1'-6"	
MEDIUM GRAVEL WITH COARSE SAND. VERY COMPACT.	-76·0'	95'-0" 28·95M	5'-0"	26 (S)
BORING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING.				

BOREHOLE No.

DIAMETER:-

GROUND LEVEL:-

DATE:-

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST

NOTES:-

1. FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O/D, 1⅜" I/D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED.
2. 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No 12 AT DEPTH 35'-0" – 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
3. BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (¾"). BOTTOM OF SOUNDING PIPE WAS SET AT -4·5' O.D.
4. BOREHOLE No 12 WAS BACKFILLED THUS:-
   - 52·0' O.D. TO -13·0' O.D., CLEAN GRAVEL
   - 13·0' O.D. TO +2·0' O.D., DENSE BLUE CLAY WELL RAMMED.
   - +2·0' O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL.

   THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2·0' O.D.
5. THE SOUNDING PIPES CONSISTED OF ¾" DIA. HARD P.V.C. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
6. (S) DENOTES TEST DONE WITH SOLID CONE
   (H) DENOTES TEST DONE WITH HOLLOW SHOE
   • DENOTES DISTURBED SAMPLE.
   Δ DENOTES WATER SAMPLE.

REPORT 1167 Box 57

REVISIONS	... BOARD
B.A. 2·10·65	MARINA POWER STATION LOGS OF BOREHOLES 11-15 INCL. (COMPILED FROM RECORDS OF MESSRS SOIL MECHANICS LTD).
1" = 10'-0"	62016

BOREHOLE No. 11. G4826

DIAMETER:-

GROUND LEVEL:- +17.43' O.D. 5.31M

DATE:- 1-6-65 TO 4-6-65

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST: DEPTH AND PENETRATION	STANDARD PENETRATION TEST: No. OF BLOWS (N)
	+17.43'			0.0			
LOOSE CLAYEY GRAVEL ETC. FILLING	+12.4			5.0'	5'-0"		5 (S)
FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE.	+1.4			16'-0"	6'-0"		2 (S), 0 (S)
FINE DARK GREY COHESIVE SILT WITH SOME CLAY. FINE SAND NEAR BOTTOM	-1.6			19'-0"	3'-0"		8 (S)
COARSE AND MEDIUM GRAVEL UP TO 1½" WITH SOME SAND AND VERY LITTLE SILT	-6.6			24'-0"	5'-0"		10 (S)
FINE, MEDIUM AND COARSE RED GRAVEL; SOME SAND; COBBLES UP TO 4"	-12.6			30'-0"	6'-0"		10 (S)
AS ABOVE	-17.6			35'-0"	5'-0"		5 (S)
AS ABOVE BUT WITH MORE FINE RED SAND.	-22.6			40'-0"	5'-0"		6 (S)
AS ABOVE WITH LESS FINE RED SAND; BIGGER COBBLES	-27.6			45'-0"	5'-0"		33 (S)
AS ABOVE WITH COBBLES UP TO 6"	-37.6			55'-0"	10'-0"		23 (S), 22 (H)
AS ABOVE WITH INCREASED FINE SAND.	-47.6			65'-0"	10'-0"		16 (H), 73 (H)
AS ABOVE BUT MORE COBBLES UP TO 4"	-52.6			70'-0" 21.33M	5'-0		20 (H)

BOREHOLE No. 12. G4827

DIAMETER:-

GROUND LEVEL:- +18.04' O.D. 5.49M

DATE:- 8-6-65 TO 11-6-65

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST: DEPTH AND PENETRATION	STANDARD PENETRATION TEST: No. OF BLOWS (N)
	+18.04'			0'-0"			
BROWN CLAY GRAVEL FILLING	+13.0'			5'-0"	5'-0"		10 (H)
BLACK FOUNDRY SAND	+8.0'			10'-0"	5'-0"		5 (H)
FINE DARK GREY SILT WITH SOME VERY FINE SAND AND CLAY COHESIVE.	+3.0'			15'-0"	5'-0"		3 (H)
AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND	-4.5'			22'-6"	7'-6"		6 (H)
6" LAYER OF VEGETATION COMPRESSED LEAVES FERN ETC.	[illegible]			[illegible]			
FINE, MEDIUM & COARSE GRAVEL, SOME FINE RED SAND; COBBLES UP TO 3".	-7.0'			25'-0"	2'-0"		2 (H)
AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND	-17.0'			35'-0"	10'-0"		28 (H), 25 (H)
AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2½"	-22.0'			40'-0"	5'-0"		54 (H), 49 (S)
AS ABOVE WITH LESS FINES AND MORE COBBLES UP TO 6"	-30.0'			48'-0"	8'-0"		44 (H)
ONE BOULDER 10"×8"×7" (SANDSTONE)	-31.0'			49'-0"	1'-0"		
FINE MED & COARSE GRAVEL AND SOME FINE RED SAND BUT FEWER COBBLES	-37.0'			55'-0"	6'-0"		19 (H), 13 (H)
AS ABOVE WITH MORE COBBLES UP TO 4"	-42.0'			60'-0"	5'-0"		16 (H)
AS ABOVE BUT WITH COBBLES UP TO 6"	-52.0'			70'-0" 21.33M	10'-0"		9 (H), 15 (H)

BOREHOLE No. 13. G4828

DIAMETER:- 10" & 8"

GROUND LEVEL:- +18.1' O.D. 5.51M

DATE:- 6-8-65 TO 17-8-65

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST: DEPTH AND PENETRATION	STANDARD PENETRATION TEST: No. OF BLOWS (N)
	+18.1'			0'-0"			
MADE GROUND PREDOMINATELY SAND AND SILT WITH SOME BRICK RUBBLE.	+5.1'			13'-0"	13'-0"		W.L.
GREY, SANDY SILT.	+3.1'			15'-0"	2'-0"		4 (H), 6 (H)
GREY SILT AND FINE AND MEDIUM GRAVEL	+0.1'			18'-0"	3'-0"		6 (H)
GREY ORGANIC SILT BECOMING SANDY WITH DEPTH.	-5.4'			23'-0"	5'-0"		10 (H)
COARSE, MEDIUM AND FINE GRAVEL AND A LITTLE COARSE SAND AND OCCASIONAL COBBLES	-14.4'			32'-6"	9'-6"		18 (H), 14 (H)
COBBLES AND COARSE, MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH	-22.4'			40'-6"	8'-0"		26 (S), 65 (S)
COARSE, MEDIUM AND FINE GRAVEL AND COARSE AND MEDIUM SAND GRADING TO GRAVEL WITH A LITTLE COARSE SAND. OCCASIONAL COBBLES.	-47.9			66'-0"	25'-6"		24 (S), 20 (S), 16 (S), 20 (S), 22 (S), 21
COARSE GRAVEL AND COBBLES	-58.9			76'-6"	10'-6"		30 (S), 28 (S), 30 (S)
COARSE, MEDIUM AND FINE GRAVEL, COARSE BROWN SAND AND COBBLES.	-63.9'			82'-0" 24.99M	5'-6"		29 (S)

BOREHOLE No. 14. G4829

DIAMETER:- 10" & 8"

GROUND LEVEL:- +17.5' O.D. 5.33M

DATE:- 18-8-65 TO 24-8-65

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST: DEPTH AND PENETRATION	STANDARD PENETRATION TEST: No. OF BLOWS (N)
	+17.5'			0'-0"			
MADE UP GROUND; DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC.	[illegible]			[illegible]	9'-0"		
[illegible]	[illegible]			[illegible]	[illegible]		[illegible]
BORING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING.	-77.5			95'-0" 28.96M			

BOREHOLE No. 15. G4830

DIAMETER:- 10" & 8"

GROUND LEVEL:- +19.0' O.D. 5.79M

DATE:- 26-8-65 TO 1-9-65

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST: DEPTH AND PENETRATION	STANDARD PENETRATION TEST: No. OF BLOWS (N)
TARMAC AND CONCRETE	+19.0			0'-0"	1'-0"		
[illegible]	[illegible]			[illegible]	[illegible]		[illegible]
BORING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING.	-76.0			95'-0" 28.96M			

BOREHOLE No.

DIAMETER:-

GROUND LEVEL:-

DATE:-

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST: DEPTH AND PENETRATION	STANDARD PENETRATION TEST: No. OF BLOWS (N)

NOTES:-

1. FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O/D., 1⅜" I/D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED.
2. 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No 12 AT DEPTH 35'-0" – 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
3. BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (¾). BOTTOM OF SOUNDING PIPE WAS SET AT -4.5' O.D.
4. BOREHOLE No. 12 WAS BACKFILLED THUS:-
   - 52.0' O.D. TO -13.0' O.D., CLEAN GRAVEL.
   - 13.0' O.D. TO +2.0' O.D., DENSE BLUE CLAY WELL RAMMED.
   +2.0' O.D TO GROUND LEVEL, LOOSE CLEAN GRAVEL.

   THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2.0' O.D.
5. THE SOUNDING PIPES CONSISTED OF ¾" DIA. HARD P.V.C. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
6. (S) DENOTES TEST DONE WITH SOLID CONE
   (H) DENOTES TEST DONE WITH HOLLOW SHOE
   • DENOTES DISTURBED SAMPLE.
   Δ DENOTES WATER SAMPLE.

REPORT 1167 Box 55

REVISIONS

B.A. 2-10-65

... BOARD

MARINA POWER STATION

LOGS OF BOREHOLES 11-15 INCL.

(COMPILED FROM RECORDS OF MESSRS SOIL MECHANICS LTD).

1" = 10'-0"

62016

BOREHOLE No. 11 G4826 — DIAMETER:-
GROUND LEVEL:- +17·43' O.D. 5·31M — DATE:- 1·6·65 TO 4·6·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+17·43'	0·0		
LOOSE CLAYEY GRAVEL ETC. FILLING	+12·4'	5·0'	5'·0"	5 (S)
FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE.	+1·4'	16·0'	6'·0"	2 (S); 0 (S)
FINE DARK GREY COHESIVE SILT WITH SOME CLAY, FINE SAND NEAR BOTTOM	-1·6'	19·0'	3'·0"	8 (S)
COARSE AND MEDIUM GRAVEL UP TO 1½" WITH SOME SAND AND VERY LITTLE SILT	-6·6'	24·0'	5'·0"	10 (S)
FINE, MEDIUM AND COARSE RED GRAVEL; SOME SAND; COBBLES UP TO 4"	-12·6'	30·0'	6'·0"	10 (S)
AS ABOVE	-17·6'	35·0'	5'·0"	5 (S)
AS ABOVE BUT WITH MORE FINE RED SAND.	-22·6'	40·0'	5'·0"	6 (S)
AS ABOVE WITH LESS FINE RED SAND; BIGGER COBBLES	-27·6'	45·0'	5'·0"	33 (S)
AS ABOVE WITH COBBLES UP TO 6"	-37·6'	55·0'	10'·0"	23 (S); 22 (H)
AS ABOVE WITH INCREASED FINE SAND.	-47·6'	65·0'	10'·0"	16 (H); 73 (H)
AS ABOVE BUT MORE COBBLES UP TO 4"	-52·6'	70·0' 21·33M	5'·0	20 (H)

BOREHOLE No. 12 G4827 — DIAMETER:-
GROUND LEVEL:- +18·04' O.D. 5·49M — DATE:- 8·6·65 TO 11·6·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+18·04'	0·0'		
BROWN CLAY GRAVEL FILLING	+13·0'	5'·0"	5'·0"	10 (H)
BLACK FOUNDRY SAND	+8·0'	10'·0"	5'·0"	5 (H)
FINE DARK GREY SILT WITH SOME VERY FINE SAND AND CLAY COHESIVE.	+3·0'	15'·0"	5'·0"	3 (H)
AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND			7'·6"	6 (H)
6" LAYER OF VEGETATION COMPRESSED LEAVES FERN ETC.	-4·5' / -5·0'	22'·6" / 23'·0"		
FINE, MEDIUM & COARSE GRAVEL, SOME FINE RED SAND; COBBLES UP TO 3".	-7·0'	25'·0"	2'·0"	2 (H)
AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND	-17·0'	35'·0"	10'·0"	26 (H); 25 (H)
AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2½"	-22·0'	40'·0"	5'·0"	54 (H); 49 (S)
AS ABOVE WITH LESS FINES AND MORE COBBLES UP TO 6"	-30·0'	48'·0"	8'·0"	41 (H)
ONE BOULDER 10"×8"×7" (SANDSTONE)	-31·0'	49'·0"	1'·0"	19 (H)
FINE MED & COARSE GRAVEL AND SOME FINE RED SAND BUT FEWER COBBLES	-37·0'	55'·0"	6'·0"	13 (H)
AS ABOVE WITH MORE COBBLES UP TO 4"	-42·0'	60'·0"	5'·0"	16 (H)
AS ABOVE BUT WITH COBBLES UP TO 6"	-52·0'	70'·0" 21·33M	10'·0"	9 (H); 15 (H)

BOREHOLE No. 13 G4828 — DIAMETER:- 10" & 8"
GROUND LEVEL:- +18·1' O.D. 5·51M — DATE:- 6·8·65 TO 17·8·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+18·1'	0'·0"		
MADE GROUND PREDOMINANTLY SAND AND SILT WITH SOME BRICK RUBBLE.	+5·1'	13'·0"	13'·0"	4 (H) W.L.
GREY, SANDY SILT	+3·1'	15'·0"	2'·0"	6 (H)
GREY SILT AND FINE AND MEDIUM GRAVEL	+0·1'	18'·0"	3'·0"	4 (H)
GREY ORGANIC SILT BECOMING SANDY WITH DEPTH.	-5·4'	23'·0"	5'·0"	10 (H)
COARSE, MEDIUM AND FINE GRAVEL AND A LITTLE COARSE SAND AND OCCASIONAL COBBLES	-16·4'	32'·6"	9'·6"	18 (H); 16 (H)
COBBLES AND COARSE, MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH	-22·4'	40'·6"	8'·0"	25 (S); 65 (S); 24 (S)
COARSE, MEDIUM AND FINE GRAVEL AND COARSE AND MEDIUM SAND GRADING TO GRAVEL WITH A LITTLE COARSE SAND. OCCASIONAL COBBLES.	-47·9'	66'·0"	25'·6"	20 (S); 16 (S); 20 (S); 22 (S); 21
COARSE GRAVEL AND COBBLES	-58·9'	76'·6"	10'·6"	30 (S); 28 (S)
COARSE, MEDIUM AND FINE GRAVEL, COARSE BROWN SAND AND COBBLES.	-63·9'	82'·0" 24·99M	5'·6"	30 (S); 29 (S)

BOREHOLE No. 14 G4829 — DIAMETER:- 10" & 8"
GROUND LEVEL:- +17·5' O.D. 5·33M — DATE:- 18·8·65 TO 24·8·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+17·5'	0'·0"		
MADE UP GROUND: DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC.	+8·5'	9'·0"	9'·0"	
AS ABOVE, CHANGING TO GREY SILT	+7·5'	10'·0"	1'·0"	4 (H)
VERY SOFT GREY SILT WITH SOME TRACES OF SAND.	+0·5'	17'·0"	7'·0"	4 (H); 2 (H)
SOFT GREY SANDY SILT	-1·5'	19'·0"	2'·0"	
SILT AND SMALL GRAVEL; SOME FINE SAND.	-4·5'	22'·0"	3'·0"	19 (H)
VERY SMALL GRAVEL WITH SOME FINE SAND.	-6·5'	24'·0"	2'·0"	20 (S)
MEDIUM GRAVEL, CHANGING TO ...	-7·5'	25'·0"	1'·0"	
AS ABOVE, CHANGING TO MEDIUM GRAVEL & SOME COARSE SAND	-9·5'	27'·0"	2'·0"	19 (S)
MEDIUM GRAVEL & COARSE SAND.	-11·5'	29'·0"	2'·0"	
MEDIUM GRAVEL WITH SOME COBBLES 3"–4".	-15·5'	33'·0"	4'·0"	35 (S)
MEDIUM AND SMALL GRAVEL WITH SOME COBBLES AND COARSE SAND	-17·5'	35'·0"	2'·0"	
MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND	-20·5'	38'·0"	3'·0"	29 (S)
MEDIUM GRAVEL AND COARSE SAND WITH COBBLES 4"–6"	-22·5'	40'·0"	2'·0"	33 (S)
MEDIUM GRAVEL, FINE SAND AND SOME COBBLES 3"–4"	-24·5'	42'·0"	2'·0"	
COMPACT MED. GRAVEL & FINE SAND	-25·5'	43'·0"	1'·0"	30 (S)
SOME 4" COBBLES WITH COARSE SAND	-27·5'	45'·0"	2'·0"	22 (S)
COMPACT FINE & COARSE SAND WITH MEDIUM GRAVEL	-32·5'	50'·0"	5'·0"	
MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3"–4"	-35·5'	53'·0"	3'·0"	24 (S)
MEDIUM GRAVEL WITH FINE TO COARSE SAND	-37·5'	55'·0"	2'·0"	22 (S)
MEDIUM GRAVEL WITH 50% FINE BROWN SAND	-40·5'	58'·0"	3'·0"	20 (S); 23 (S)
ONE 8" SANDSTONE BOULDER.	-42·5'	60'·0"	2'·0"	
MEDIUM GRAVEL WITH COARSE SAND.	-44·5'	62'·0"	2'·0"	23 (S)
MEDIUM GRAVEL WITH SOME COBBLES.	-46·5'	64'·0"	2'·0"	
MEDIUM GRAVEL WITH COARSE SAND	-48·5'	66'·0"	2'·0"	25 (S)
MEDIUM GRAVEL WITH COARSE SAND AND SOME COBBLES.	-52·5'	70'·0"	4'·0"	27 (S)
MEDIUM GRAVEL AND COARSE SAND WITH SOME 3"–4" COBBLES	-54·5'	72'·0"	2'·0"	
MEDIUM GRAVEL AND COARSE SAND.	-55·5'	73'·0"	1'·0"	26 (S)
COMPACT MEDIUM GRAVEL.	-61·5'	79'·0"	6'·0"	23 (S)
VERY SMALL GRAVEL.	-62·5'	80'·0"	1'·0"	
COMPACT MEDIUM GRAVEL WITH SOME SMALL GRAVEL.	-65·5'	83'·0"	3'·0"	24 (S); 31 (S)
VERY SMALL COMPACT GRAVEL.	-69·5'	87'·0"	4'·0"	27 (S)
COMPACT MEDIUM GRAVEL AND SOME COARSE SAND.	-77·5'	95'·0" 28·96M	8'·0"	29 (S)

BORING TERMINATED AT DEPTH 95'·0" DUE TO DIFFICULTY IN DRIVING CASING.

BOREHOLE No. 15 G4830 — DIAMETER:- 10" & 8"
GROUND LEVEL:- +19·0' O.D. 5·79M — DATE:- 26·8·65 TO 1·9·65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+19·0'	0'·0"		
TARMAC AND CONCRETE.	+18·0'	1'·0"	1'·0"	
MADE UP GROUND CONSISTING OF DARK SOIL, SOME STONES AND SAND, SCRAP METAL ETC.	+13·0'	6'·0"	5'·0"	
MADE UP GROUND CONSISTING OF FOUNDRY SLAG, STONES, SCRAP METAL, ETC.	+5·0'	14'·0"	8'·0"	
VERY SOFT GREY SILT WITH SOME SHELLS.	+4·0'	15'·0"	1'·0"	4 (H)
VERY SOFT GREY SANDY SILT	-2·0'	21'·0"	6'·0"	4 (H); 15 (H)
VERY SMALL GRAVEL, VERY SILTY.	-4·0'	23'·0"	2'·0"	19 (H)
SMALL GRAVEL	-6·0'	25'·0"	2'·0"	
VERY SMALL GRAVEL WITH SOME SILT	-7·0'	26'·0"	1'·0"	
SMALL GRAVEL	-8·0'	27'·0"	1'·0"	
VERY SMALL GRAVEL TRACES OF SILT	-9·0'	28'·0"	1'·0"	16 (H)
GREY SILT	-9·5'	28'·6"	0'·6"	
SMALL GRAVEL.	-12·0'	31'·0"	2'·6"	24 (S)
GRAVEL ½" TO 2" SOME COARSE SAND.	-14·0'	33'·0"	2'·0"	24 (S)
MEDIUM GRAVEL AND SOME COARSE SAND	-20·0'	39'·0"	6'·0"	31 (S)
COMPACT MEDIUM GRAVEL WITH 4" COBBLES.	-22·0'	41'·0"	2'·0"	
MEDIUM GRAVEL WITH SOME COBBLES	-24·0'	43'·0"	2'·0"	26 (S)
MEDIUM TO LARGE GRAVEL WITH SOME COARSE SAND.	-25·5'	44'·6"	1'·6"	
COMPACT MEDIUM GRAVEL WITH SOME COBBLES.	-31·0'	50'·0"	5'·6"	30 (S); 26 (S)
MEDIUM GRAVEL.	-33·0'	52'·0"	2'·0"	
MEDIUM GRAVEL AND COARSE SAND	-36·5'	55'·6"	3'·6"	28 (S)
	-37·0'	56'·0"	0'·6"	
SMALL GRAVEL AND COARSE SAND	-39·0'	58'·0"	2'·0"	30 (S)
VERY COMPACT MEDIUM GRAVEL.	-43·0'	62'·0"	4'·0"	27 (S)
AS ABOVE, WITH 4" COBBLES.	-44·0'	63'·0"	1'·0"	
COBBLES TO VERY SMALL GRAVEL.	-45·0'	64'·0"	1'·0"	32 (S)
COMPACT SMALL TO MEDIUM GRAVEL.	-48·0'	67'·0"	3'·0"	33 (S)
VERY SMALL COMPACT GRAVEL	-56·0'	75'·0"	8'·0"	28 (S)
MEDIUM GRAVEL.	-58·0'	77'·0"	2'·0"	27 (S)
VERY COMPACT SMALL GRAVEL WITH SOME COARSE SAND.	-62·5'	81'·6"	4'·6"	
MEDIUM GRAVEL AND COARSE SAND.	-67·0'	86'·0"	4'·6"	39 (S)
AS ABOVE; ONE LARGE COBBLE	-67·5'	86'·6"	0'·6"	
SMALL GRAVEL WITH SOME FINE SAND VERY COMPACT.	-69·5'	88'·6"	2'·0"	25 (S)
COARSE SAND AND SMALL GRAVEL	-71·0'	90'·0"	1'·6"	
MEDIUM GRAVEL WITH COARSE SAND. VERY COMPACT.	-76·0'	95'·0" 28·95M	5'·0"	28 (S)

BORING TERMINATED AT DEPTH 95'·0" DUE TO DIFFICULTY IN DRIVING CASING.

BOREHOLE No. — DIAMETER:-
GROUND LEVEL:- — DATE:-

DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST

NOTES:-
1. FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O/D, 1⅜" I/D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED.
2. 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No. 12 AT DEPTH 35'-0" – 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
3. BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (¾"). BOTTOM OF SOUNDING PIPE WAS SET AT -4·5' O.D.
4. BOREHOLE No. 12 WAS BACKFILLED THUS:-
   -52·0' O.D. TO -13·0' O.D. CLEAN GRAVEL.
   -13·0' O.D. TO +2·0' O.D. DENSE BLUE CLAY WELL RAMMED.
   +2·0' O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL.
   THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2·0' O.D.
5. THE SOUNDING PIPES CONSISTED OF ¾" DIA. HARD P.V.C. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
6. (S) DENOTES TEST DONE WITH SOLID CONE
   (H) DENOTES TEST DONE WITH HOLLOW SHOE
   • DENOTES DISTURBED SAMPLE.
   Δ DENOTES WATER SAMPLE.

REPORT 1167 Box 55

REVISIONS

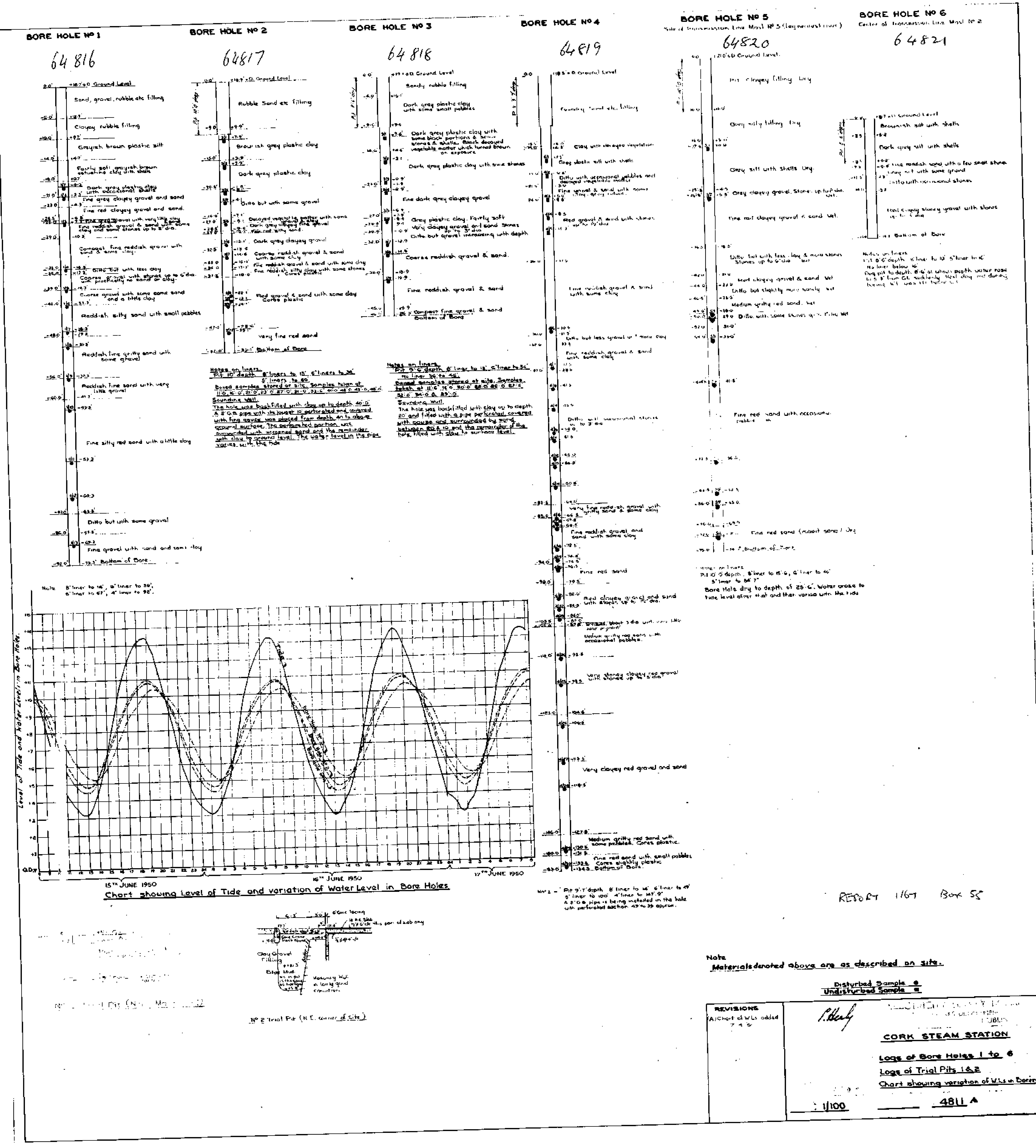
... BOARD

8.A. 2·10·65

MARINA POWER STATION
LOGS OF BOREHOLES 11-15 INCL.
(COMPILED FROM RECORDS OF MESSRS SOIL MECHANICS LTD).

1" = 10'-0"

62016



BORE HOLE No 1
64816
BORE HOLE No 2
64817
BORE HOLE No 3
64818
BORE HOLE No 4
64819
BORE HOLE No 5
64820
BORE HOLE No 6
64821
Sand, gravel, rubble etc filling
Clayey rubble filling
Grayish brown plastic silt
Reddish silty sand with small pebbles
Reddish fine gritty sand with some gravel
Fine silty red sand with a little clay
Ditto but with some gravel
Fine gravel with sand and some clay
Bottom of Bore
Rubble Sand etc filling
Brownish grey plastic clay
Dark grey plastic clay
Ditto but with some gravel
Dark grey clayey gravel
Red gravel & sand with some clay
Very fine red sand
Bottom of Bore
Sandy rubble filling
Dark grey plastic clay with some small pebbles
Dark grey plastic clay with some stones
Dark grey clayey gravel
Grey plastic clay. Fairly soft
Coarse reddish gravel & sand.
Fine reddish gravel & sand
Compact fine gravel & sand
Bottom of Bore
Clay with decayed vegetation
Grey slightly silt with shells
Red gravel & sand with stones
Fine reddish gravel & sand with some clay
Very fine reddish gravel with gritty sand & some clay
Fine reddish gravel and sand with some clay
Fine red sand
Red clayey gravel and sand
Very stoney clayey red gravel
Very clayey red gravel and sand
Medium gritty red sand with some pebbles. Cores plastic.
Fine red sand with small pebbles
Bottom of Bore
Clayey filling Dry
Grey silty filling Dry
Grey silt with shells Dry
Grey clayey gravel
Fine red clayey gravel & sand Wet
Medium gritty red sand
Fine red sand with occasional pebbles
Fine red sand
Bottom of Bore
Brownish silt with shells
Dark grey silt with shells
Bottom of Bore
Notes on liners
Note
Notes on liners
Sounding Well
Chart showing Level of Tide and variation of Water Level in Bore Holes
Level of Tide and Water Level in Bore Holes
15TH JUNE 1950
16TH JUNE 1950
17TH JUNE 1950
No 2 Trial Pit (N.E. corner of site)
Bore Hole dry to depth of 25'6". Water arose to tide level after that and then varies with the tide
REPORT 1167 BOX 55
Note
Materials denoted above are as described on site.
Disturbed Sample
Undisturbed Sample
REVISIONS
CORK STEAM STATION
Logs of Bore Holes 1 to 6
Logs of Trial Pits 1 & 2
Chart showing variation of W.Ls in Bore
1/100
4811 A

BOREHOLE No. 11 64826

DIAMETER:-

GROUND LEVEL:- +17.43' O.D. 5.31M

DATE:- 1.6.65 TO 4.6.65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+17.43'	0.0'		
LOOSE CLAYEY GRAVEL ETC. FILLING	+12.4'	5.0'	5'-0"	5 (S)
FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE.	+1.4'	16.0'	6'-0"	2 (S), 0 (S)
FINE DARK GREY COHESIVE SILT WITH SOME CLAY. FINE SAND NEAR BOTTOM	-1.6'	19.0'	3'-0"	8 (S)
COARSE AND MEDIUM GRAVEL UP TO 1½" WITH SOME SAND AND VERY LITTLE SILT	-9.6'	24.0'	5'-0"	10 (S)
FINE, MEDIUM AND COARSE RED GRAVEL; SOME SAND; COBBLES UP TO 4"	-12.6'	30.0'	6'-0"	10 (S)
AS ABOVE	-17.6'	35.0'	5'-0"	5 (S)
AS ABOVE BUT WITH MORE FINE RED SAND.	-22.6'	40.0'	5'-0"	6 (S)
AS ABOVE WITH LESS FINE RED SAND; BIGGER COBBLES	-27.6'	45.0'	5'-0"	35 (S)
AS ABOVE WITH COBBLES UP TO 6"	-37.6'	55.0'	10'-0"	23 (S), 22 (H)
AS ABOVE WITH INCREASED FINE SAND.	-47.6'	65.0'	10'-0"	16 (H), 73 (H)
AS ABOVE BUT MORE COBBLES UP TO 4"	-52.6'	70.0' 21.33M	5'-0"	20 (H)

BOREHOLE No. 12 64827

DIAMETER:-

GROUND LEVEL:- +18.04' O.D. 5.49M

DATE:- 8.6.65 TO 11.6.65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+18.04'	0.0'		
BROWN CLAY GRAVEL FILLING	+13.0'	5.0'	5'-0"	10 (H)
BLACK FOUNDRY SAND	+8.0'	10.0'	5'-0"	5 (H)
FINE DARK GREY SILT WITH SOME VERY FINE SAND AND CLAY COHESIVE.	+3.0'	15.0'	5'-0"	3 (H)
AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND	-4.5'	22.5'	7'-6"	8 (H)
½" LAYER OF VEGETATION COMPRESSED LEAVES FERN ETC.				
FINE, MEDIUM & COARSE GRAVEL, SOME FINE RED SAND; COBBLES UP TO 3"	-7.0'	25.0'	2'-0"	2 (H)
AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND	-17.0'	35.0'	10'-0"	25 (H)
AS ABOVE WITH FEWER AND SMALLER COBBLES UP TO 2½"	-22.0'	40.0'	5'-0"	84 (H), 49 (S)
AS ABOVE WITH LESS FINES AND MORE COBBLES UP TO 6"	-30.0'	48.0'	8'-0"	44 (H)
ONE BOULDER 10"×8"×7" (SANDSTONE)	-31.0'	49.0'	1'-0"	
FINE MED & COARSE GRAVEL AND SOME FINE RED SAND BUT FEWER COBBLES	-37.0'	55.0'	6'-0"	19 (H), 13 (H)
AS ABOVE WITH MORE COBBLES UP TO 4"	-42.0'	60.0'	5'-0"	16 (H)
AS ABOVE BUT WITH COBBLES UP TO 6"	-52.0'	70.0' 21.33M	10'-0"	9 (H), 15 (H)

BOREHOLE No. 13 64828

DIAMETER:- 10" & 8"

GROUND LEVEL:- +18.1' O.D. 5.51M

DATE:- 6.8.65 TO 17.8.65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+18.1'	0'-0"		
MADE GROUND PREDOMINANTLY SAND AND SILT WITH SOME BRICK RUBBLE	+5.1'	13'-0"	13'-0"	
GREY, SANDY SILT	+3.1'	15'-0"	2'-0"	4 (H)
GREY SILT AND FINE AND MEDIUM GRAVEL	+0.1'	18'-0"	3'-0"	6 (H), 4 (H)
GREY ORGANIC SILT BECOMING SANDY WITH DEPTH	-5.0'	23'-0"	5'-0"	10 (H)
COARSE, MEDIUM AND FINE GRAVEL AND A LITTLE COARSE SAND AND OCCASIONAL COBBLES	-14.4'	32'-6"	9'-6"	18 (H), 14 (H)
COBBLES AND COARSE, MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH	-22.4'	40'-6"	8'-0"	20 (S), 65 (S), 24 (S)
COARSE, MEDIUM AND FINE GRAVEL AND COARSE AND MEDIUM SAND GRADING TO GRAVEL WITH A LITTLE COARSE SAND. OCCASIONAL COBBLES.	-47.9'	66'-0"	25'-6"	20 (S), 16 (S), 20 (S), 22 (S), 21
COARSE GRAVEL AND COBBLES	-58.9'	76'-6"	10'-6"	30 (S), 28 (S)
COARSE, MEDIUM AND FINE GRAVEL, COARSE BROWN SAND AND COBBLES	-63.9'	82'-0" 24.99M	5'-6"	30 (S), 29 (S)

W.L.

BOREHOLE No. 14 64829

DIAMETER:- 10" & 8"

GROUND LEVEL:- +17.5' O.D. 5.33M

DATE:- 18.8.65 TO 24.8.65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+17.5'	0'-0"		
MADE UP GROUND: DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC.	+8.5'	9'-0"	9'-0"	
AS ABOVE, CHANGING TO GREY SILT	+7.5'	10'-0"	1'-0"	4 (H)
VERY SOFT GREY SILT WITH SOME TRACES OF SAND.	+0.5'	17'-0"	7'-0"	4 (H), 2 (H)
SOFT GREY SANDY SILT	-1.5'	19'-0"	2'-0"	
SILT AND SMALL GRAVEL, SOME FINE SAND.	-4.5'	22'-0"	3'-0"	19 (H)
VERY SMALL GRAVEL WITH SOME FINE SAND.	-6.5'	24'-0"	2'-0"	20 (S)
MEDIUM GRAVEL CHANGING TO PEAT [illegible]	-7.5'	25'-0"	1'-0"	
AS ABOVE, CHANGING TO MEDIUM GRAVEL & SOME COARSE SAND	-9.5'	27'-0"	2'-0"	19 (S)
MEDIUM GRAVEL & COARSE SAND.	-11.5'	29'-0"	2'-0"	
MEDIUM GRAVEL WITH SOME COBBLES 3"-4".	-15.5'	33'-0"	4'-0"	35 (S)
MEDIUM AND SMALL GRAVEL WITH SOME COBBLES AND COARSE SAND	-17.5'	35'-0"	2'-0"	
MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND	-20.5'	38'-0"	3'-0"	29 (S)
MEDIUM GRAVEL AND COARSE SAND WITH COBBLES 4"-6".	-22.5'	40'-0"	2'-0"	33 (S)
MEDIUM GRAVEL, FINE SAND AND SOME COBBLES 3"-5"	-24.5'	42'-0"	2'-0"	
COMPACT MED. GRAVEL & FINE SAND	-25.5'	43'-0"	1'-0"	30 (S)
SOME 4" COBBLES WITH COARSE SAND	-27.5'	45'-0"	2'-0"	
COMPACT FINE & COARSE SAND WITH MEDIUM GRAVEL	-32.5'	50'-0"	5'-0"	22 (S)
MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3"-4"	-35.5'	53'-0"	3'-0"	24 (S)
MEDIUM GRAVEL WITH FINE TO COARSE SAND	-37.5'	55'-0"	2'-0"	22 (S)
MEDIUM GRAVEL WITH 50% FINE BROWN SAND.	-40.5'	58'-0"	3'-0"	23 (S)
AS ABOVE AND SOME [illegible] COBBLES. ONE 8" SANDSTONE BOULDER.	-42.5'	60'-0"	2'-0"	
MEDIUM GRAVEL WITH COARSE SAND.	-44.5'	62'-0"	2'-0"	23 (S)
MEDIUM GRAVEL WITH SOME COBBLES.	-46.5'	64'-0"	2'-0"	
MEDIUM GRAVEL WITH COARSE SAND	-48.5'	66'-0"	2'-0"	25 (S)
MEDIUM GRAVEL WITH COARSE SAND AND SOME COBBLES.	-52.5'	70'-0"	4'-0"	27 (S)
MEDIUM GRAVEL AND COARSE SAND WITH SOME 3"-4" COBBLES	-54.5'	72'-0"	2'-0"	
MEDIUM GRAVEL AND COARSE SAND.	-55.5'	73'-0"	1'-0"	26 (S)
COMPACT MEDIUM GRAVEL	-61.5'	79'-0"	6'-0"	23 (S)
VERY SMALL GRAVEL.	-62.5'	80'-0"	1'-0"	
COMPACT MEDIUM GRAVEL WITH SOME SMALL GRAVEL	-65.5'	83'-0"	3'-0"	24 (S)
VERY SMALL COMPACT GRAVEL.	-69.5'	87'-0"	4'-0"	31 (S), 27 (S)
COMPACT MEDIUM GRAVEL AND SOME COARSE SAND.	-77.5'	95'-0" 28.95M	8'-0"	29 (S)
BORING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING.				

BOREHOLE No. 15 64830

DIAMETER:- 10" & 8"

GROUND LEVEL:- +19.0' O.D. 5.79M

DATE:- 26.8.65 TO 1.9.65

DESCRIPTION	REDUCED LEVEL	DEPTH	THICKNESS	STANDARD PENETRATION TEST No. OF BLOWS (N)
	+19.0'	0'-0"		
TARMAC AND CONCRETE.	+18.0'	1'-0"	1'-0"	
MADE UP GROUND CONSISTING OF DARK SOIL, SOME STONES AND SAND, SCRAP METAL ETC	+13.0'	6'-0"	5'-0"	
MADE UP GROUND CONSISTING OF FOUNDRY SLAG, STONES, SCRAP METAL, ETC.	+5.0'	14'-0"	8'-0"	
VERY SOFT GREY SILT WITH SOME SHELLS.	+4.0'	15'-0"	1'-0"	4 (H)
VERY SOFT GREY SANDY SILT	-2.0'	21'-0"	6'-0"	4 (H)
VERY SMALL GRAVEL, VERY SILTY.	-4.0'	23'-0"	2'-0"	15 (H)
SMALL GRAVEL	-6.0'	25'-0"	2'-0"	19 (H)
VERY SMALL GRAVEL WITH SOME SILT	-7.0'	26'-0"	1'-0"	
SMALL GRAVEL	-8.0'	27'-0"	1'-0"	
VERY SMALL GRAVEL TRACES OF SILT	-9.0'	28'-0"	1'-0"	16 (H)
GREY SILT	-9.5'	28'-6"	0'-6"	
SMALL GRAVEL	-12.0'	31'-0"	2'-6"	24 (S)
GRAVEL ¼" TO 3" SOME COARSE SAND.	-14.0'	33'-0"	2'-0"	24 (S)
MEDIUM GRAVEL AND SOME COARSE SAND	-20.0'	39'-0"	6'-0"	61 (S)
COMPACT MEDIUM GRAVEL WITH 4" COBBLES.	-22.0'	41'-0"	2'-0"	
MEDIUM GRAVEL WITH SOME COBBLES	-24.0'	43'-0"	2'-0"	26 (S)
MEDIUM TO LARGE GRAVEL WITH SOME COARSE SAND.	-25.5'	44'-6"	1'-6"	
COMPACT MEDIUM GRAVEL WITH SOME COBBLES.	-31.0'	50'-0"	5'-6"	30 (S), 26 (S)
MEDIUM GRAVEL	-33.0'	52'-0"	2'-0"	
MEDIUM GRAVEL AND COARSE SAND	-36.5'	55'-6"	3'-6"	28 (S)
	-37.0'	56'-0"	0'-6"	
SMALL GRAVEL AND COARSE SAND	-39.0'	58'-0"	2'-0"	30 (S)
VERY COMPACT MEDIUM GRAVEL	-43.0'	62'-0"	4'-0"	27 (S)
AS ABOVE, WITH 4" COBBLES.	-44.0'	63'-0"	1'-0"	
COBBLES TO VERY SMALL GRAVEL	-45.0'	64'-0"	1'-0"	32 (S)
COMPACT SMALL TO MEDIUM GRAVEL.	-48.0'	67'-0"	3'-0"	33 (S)
VERY SMALL COMPACT GRAVEL	-56.0'	75'-0"	8'-0"	28 (S)
MEDIUM GRAVEL.	-58.0'	77'-0"	2'-0"	27 (S)
VERY COMPACT SMALL GRAVEL WITH SOME COARSE SAND.	-62.5'	81'-6"	4'-6"	
MEDIUM GRAVEL AND COARSE SAND.	-67.0'	86'-0"	4'-6"	39 (S)
AS ABOVE; ONE LARGE COBBLE	-67.5'	86'-6"	0'-6"	
SMALL GRAVEL WITH SOME FINE SAND VERY COMPACT.	-69.5'	88'-6"	2'-0"	28 (S)
COARSE SAND AND SMALL GRAVEL	-71.0'	90'-0"	1'-6"	
MEDIUM GRAVEL WITH COARSE SAND. VERY COMPACT.	-76.0'	95'-0" 28.95M	5'-0"	28 (S)
BORING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING.				

BOREHOLE No.

DIAMETER:-

GROUND LEVEL:-

DATE:-

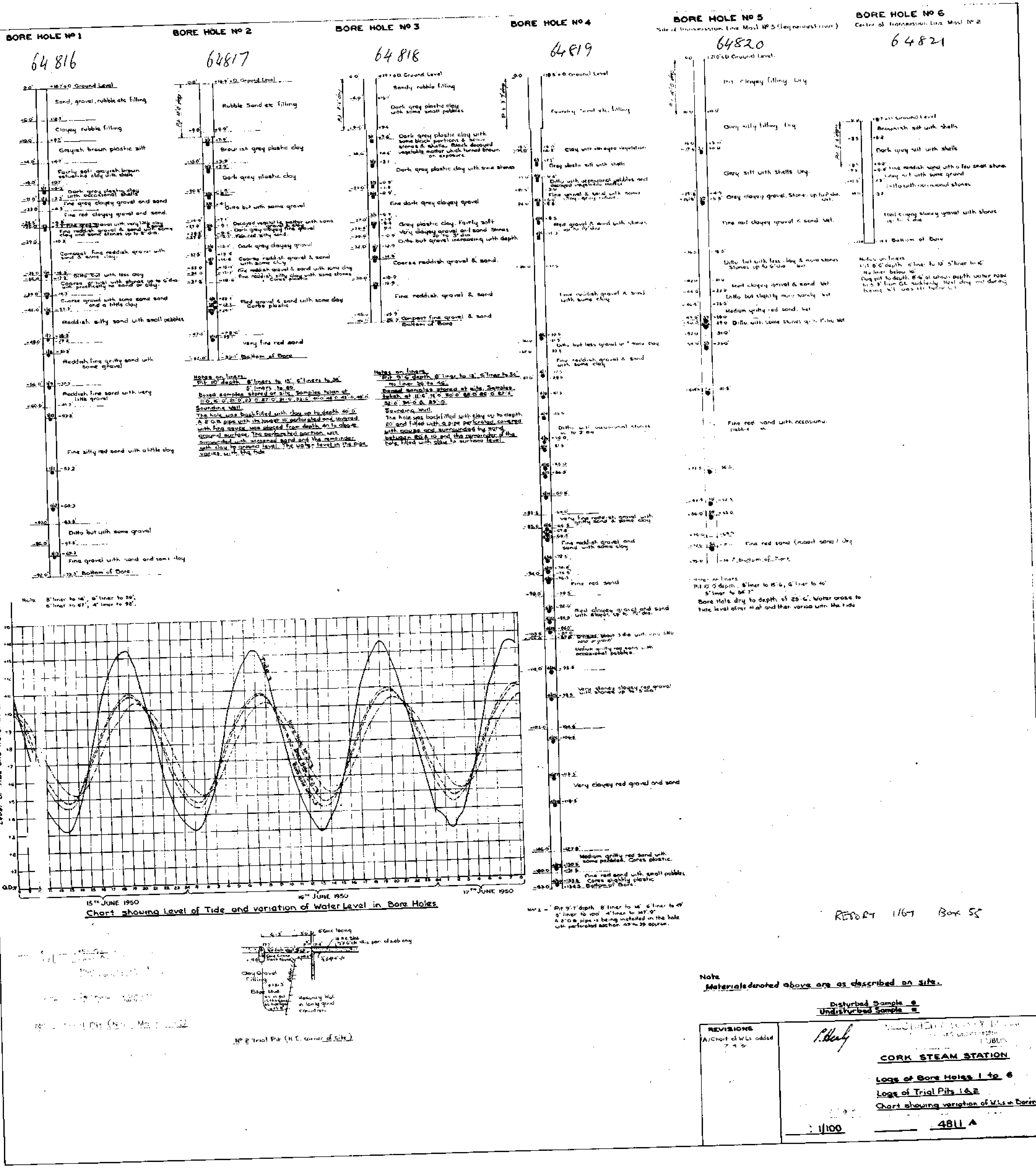
DESCRIPTION	REDUCED LEVEL	LEGEND	SAMPLE	DEPTH	THICKNESS	STANDARD PENETRATION TEST

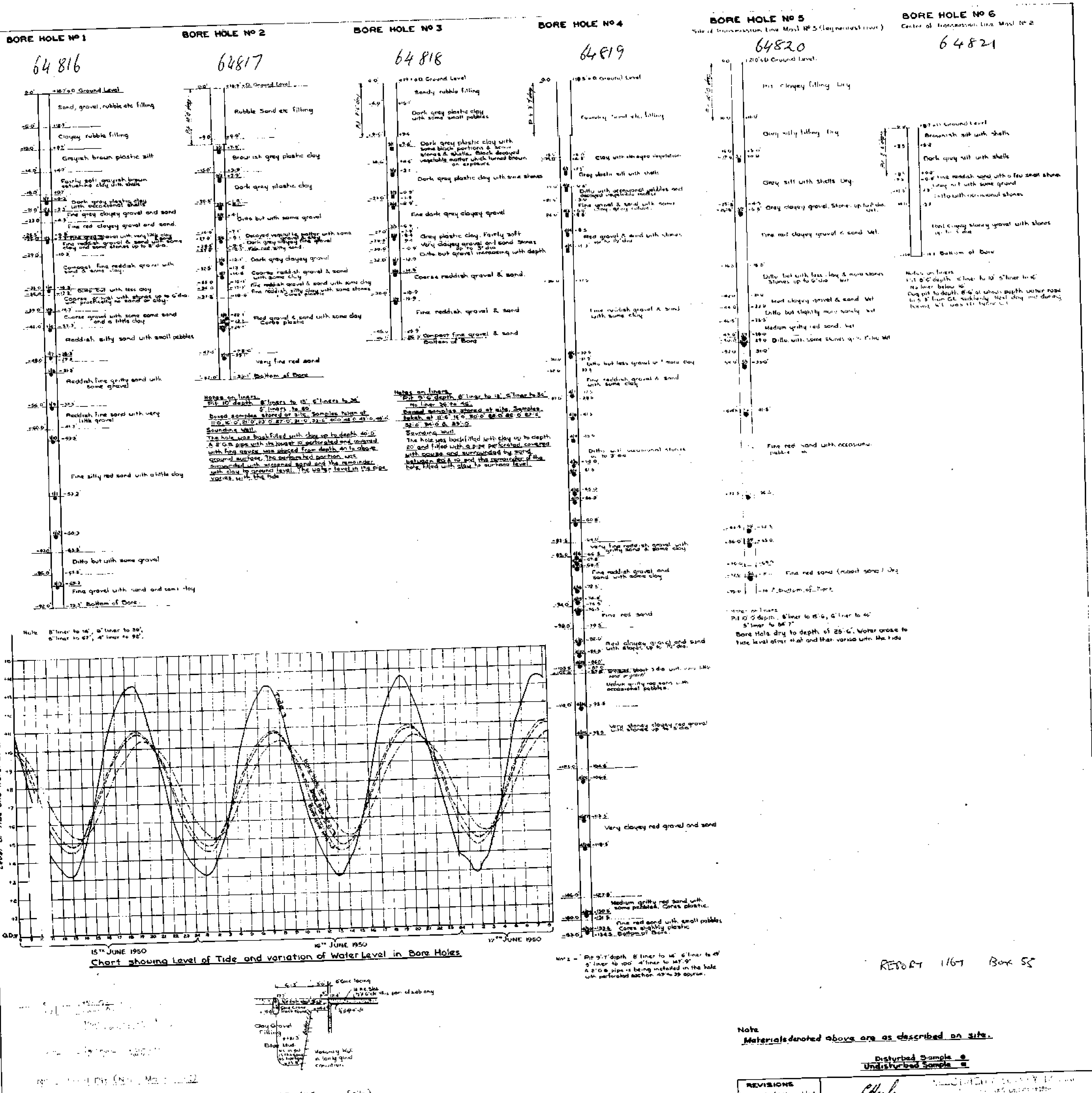
NOTES:-

1. FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O/D, 1⅜" I/D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED.
2. 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No 12 AT DEPTH 35'-0" – 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
3. BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (¾). BOTTOM OF SOUNDING PIPE WAS SET AT -4.5' O.D.
4. BOREHOLE No 12 WAS BACKFILLED THUS:-
   -52.0' O.D. TO -13.0' O.D. CLEAN GRAVEL.
   -13.0' O.D. TO +2.0' O.D. DENSE BLUE CLAY WELL RAMMED.
   +2.0' O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL.
   THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2.0' O.D.
5. THE SOUNDING PIPES CONSISTED OF ¾" DIA. HARD P.V.C. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
6. (S) DENOTES TEST DONE WITH SOLID CONE
   (H) DENOTES TEST DONE WITH HOLLOW SHOE
   • DENOTES DISTURBED SAMPLE.
   Δ DENOTES WATER SAMPLE.

REPORT 1167 Box 57

REVISIONS		
	... 6 A... 26.10.65	... BOARD ...
		MARINA POWER STATION LOGS OF BOREHOLES 11-15 INCL. (COMPILED FROM RECORDS OF MESSRS. SOIL MECHANICS LTD).
	... 1" = 10'-0"	62016


BORE HOLE No 1
64816
+16'·0 Ground Level
Sand, gravel, rubble etc filling
Clayey rubble filling
Grayish brown plastic silt
Fairly soft grayish brown estuarine clay with shells
Dark grey plastic clay with occasional shells
Fine grey clayey gravel and sand
Fine red clayey gravel and sand
Compact fine reddish gravel with sand & some clay
Ditto but with less clay
Coarse gravel with some sand and a little clay
Reddish silty sand with small pebbles
Reddish fine gritty sand with some gravel
Reddish fine sand with very little gravel
Fine silty red sand with a little clay
Ditto but with some gravel
Fine gravel with sand and some clay
Bottom of Bore
Note 8" liner to 16', 6" liner to 39', 5" liner to 67', 4" liner to 92'.
BORE HOLE No 2
64817
Rubble Sand etc filling
Brownish grey plastic clay
Dark grey plastic clay
Ditto but with some gravel
Decayed vegetable matter with some gravel & clay
Dark grey clayey fine gravel
Dark grey clayey gravel
Coarse reddish gravel & sand with some clay
Fine reddish gravel & sand with some clay
Red gravel & sand with some clay. Cores plastic
Very fine red sand
Bottom of Bore
Notes on liners
Pit 10' depth 8" liners to 15', 6" liners to 36', 5" liners to 60
Boxed samples stored at site. Samples taken at
Sounding Well.
The hole was backfilled with clay up to depth 40·0'. A 2" G.S. pipe with its lowest 10' perforated and covered with fine gauze was placed from depth 40 to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide.
BORE HOLE No 3
64818
Ground Level
Sandy rubble filling
Dark grey plastic clay with some small pebbles
Dark grey plastic clay with some black portions & some stones & shells. Black decayed vegetable matter which turned brown on exposure
Dark grey plastic clay with some stones
Fine dark grey clayey gravel
Grey plastic clay. Fairly soft
Very clayey gravel and sand Stones up to 3" dia
Ditto but gravel increasing with depth
Coarse reddish gravel & sand.
Fine reddish gravel & sand
Compact fine gravel & sand
Bottom of Bore
Notes on liners
Pit 9'6" depth, 8" liner to 18', 6" liner to 36', No liner 36' to 46'.
Boxed samples stored at site. Samples taken at
Sounding Well.
The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20 & 10 and the remainder of the hole filled with clay to surface level.
BORE HOLE No 4
64819
Ground Level
Clay with decayed vegetation
Grey plastic silt with shells
Fine gravel & sand with some clay
Red gravel & sand with stones
Ditto but less gravel
Fine reddish gravel & sand with some clay
Very fine reddish gravel with gritty sand & some clay
Fine reddish gravel and sand with some clay
Fine red sand
Red clayey gravel and sand with stones
Medium gritty red sand with occasional pebbles
Very stoney clayey red gravel with stones
Very clayey red gravel and sand
Medium gritty red sand with some pebbles. Cores plastic.
Fine red sand with small pebbles Cores slightly plastic
Bottom of Bore
Pit 9'7" depth 8" liner to 16' 6" liner to 49' 5" liner to 100' 4" liner to 147'·9". A 2" G.S. pipe is being installed in the hole with perforated section 45' to 35' approx.
BORE HOLE No 5
Site of Transmission Line Mast No 5
64820
Ground Level
Clayey filling Dry
Grey silty filling Dry
Grey silt with shells Dry
Grey clayey gravel. Stones up to 2" dia. Wet
Fine red clayey gravel & sand Wet
Ditto but with less clay & more stones Stones up to 6" dia Wet
Red clayey gravel & sand Wet
Ditto but slightly more sandy Wet
Medium gritty red sand Wet
Fine red sand with occasional pebbles
Fine red sand
Bottom of Bore
Notes on liners
Pit 10'0" depth 8" liner to 15'6", 6" liner to 46' 5" liner to 84'7"
Bore Hole dry to depth of 25'6". Water arose to tide level after that and then varied with the tide
BORE HOLE No 6
Centre of Transmission Line Mast No 2
64821
Ground Level
Brownish silt with shells
Dark grey silt with shells
Fine reddish sand with a few small stones
Ditto with occasional stones
Bottom of Bore
15TH JUNE 1950
16TH JUNE 1950
17TH JUNE 1950
Chart showing Level of Tide and variation of Water Level in Bore Holes
Level of Tide and Water Level in Bore Holes
No 2 Trial Pit (N.E. corner of site)
Grey Gravel Filling
Blue Mud
Note
Materials denoted above are as described on site.
Disturbed Sample
Undisturbed Sample
REVISIONS
A/Chart of W.Ls added
CORK STEAM STATION
Logs of Bore Holes 1 to 6
Logs of Trial Pits 1 & 2
Chart showing variation of W.Ls in Bore
1/100
4811 A
REPORT 1161 BOX 55

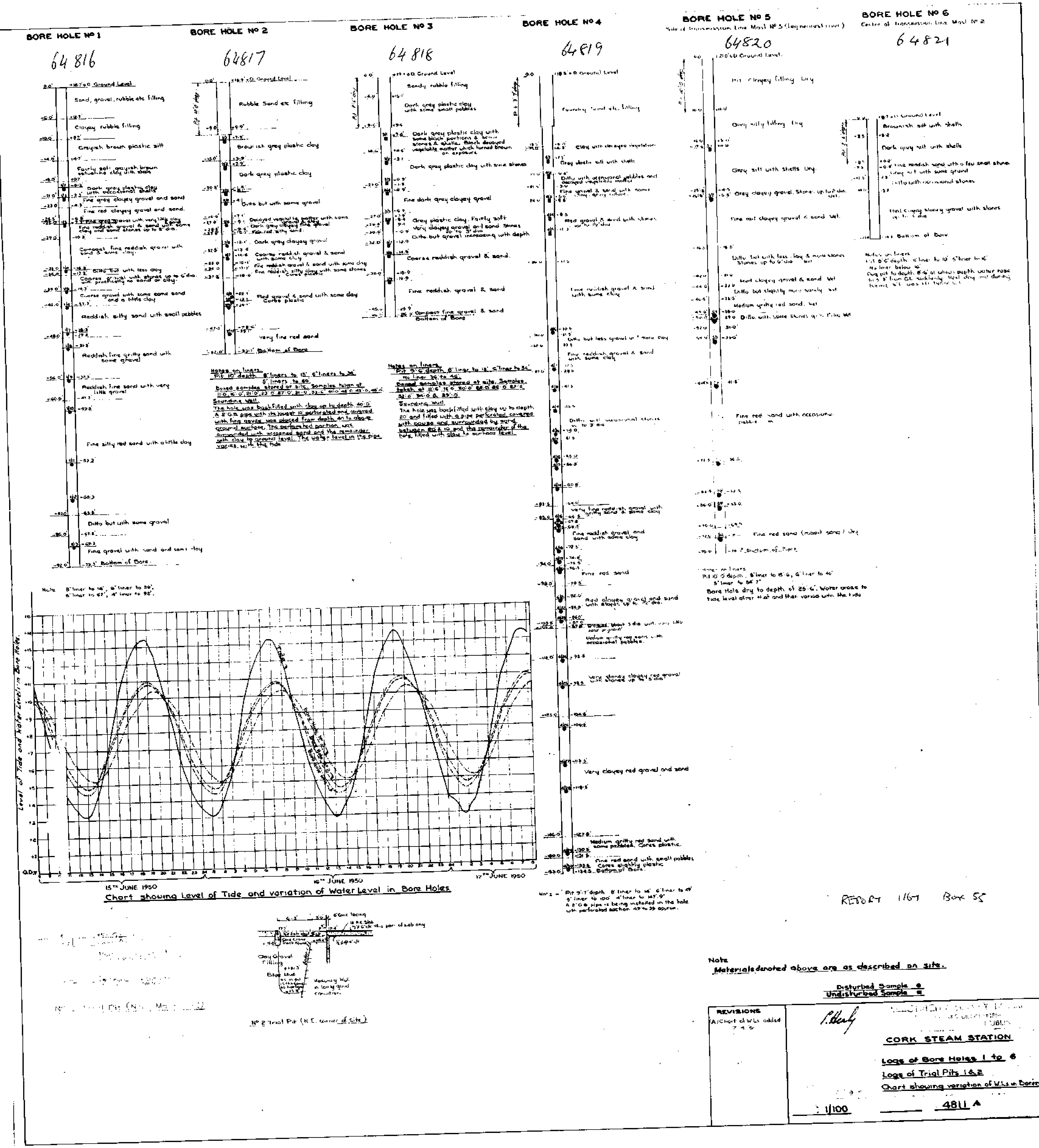


REPORT 1167 Box 55

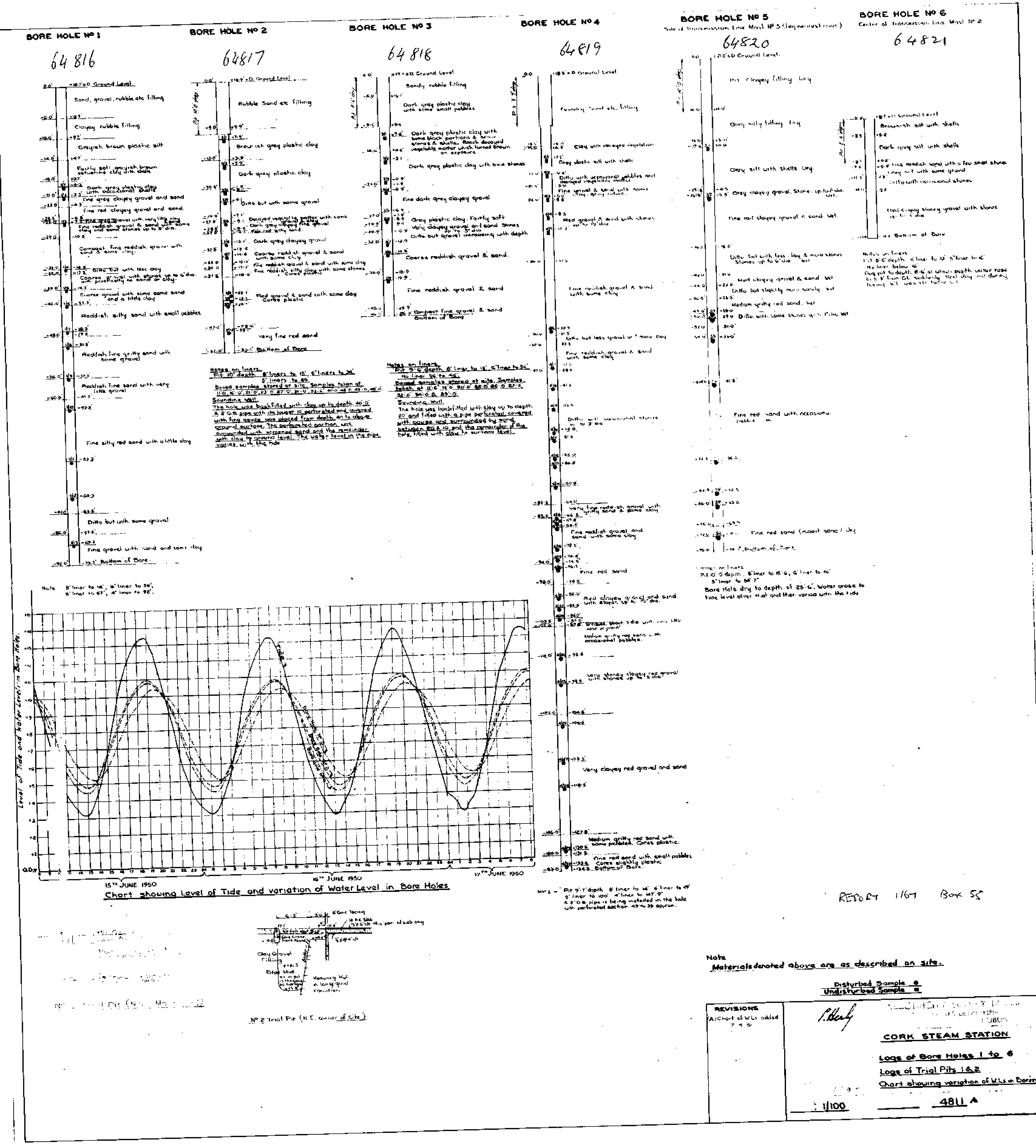
Note
Materials denoted above are as described on site.

Disturbed Sample
Undisturbed Sample

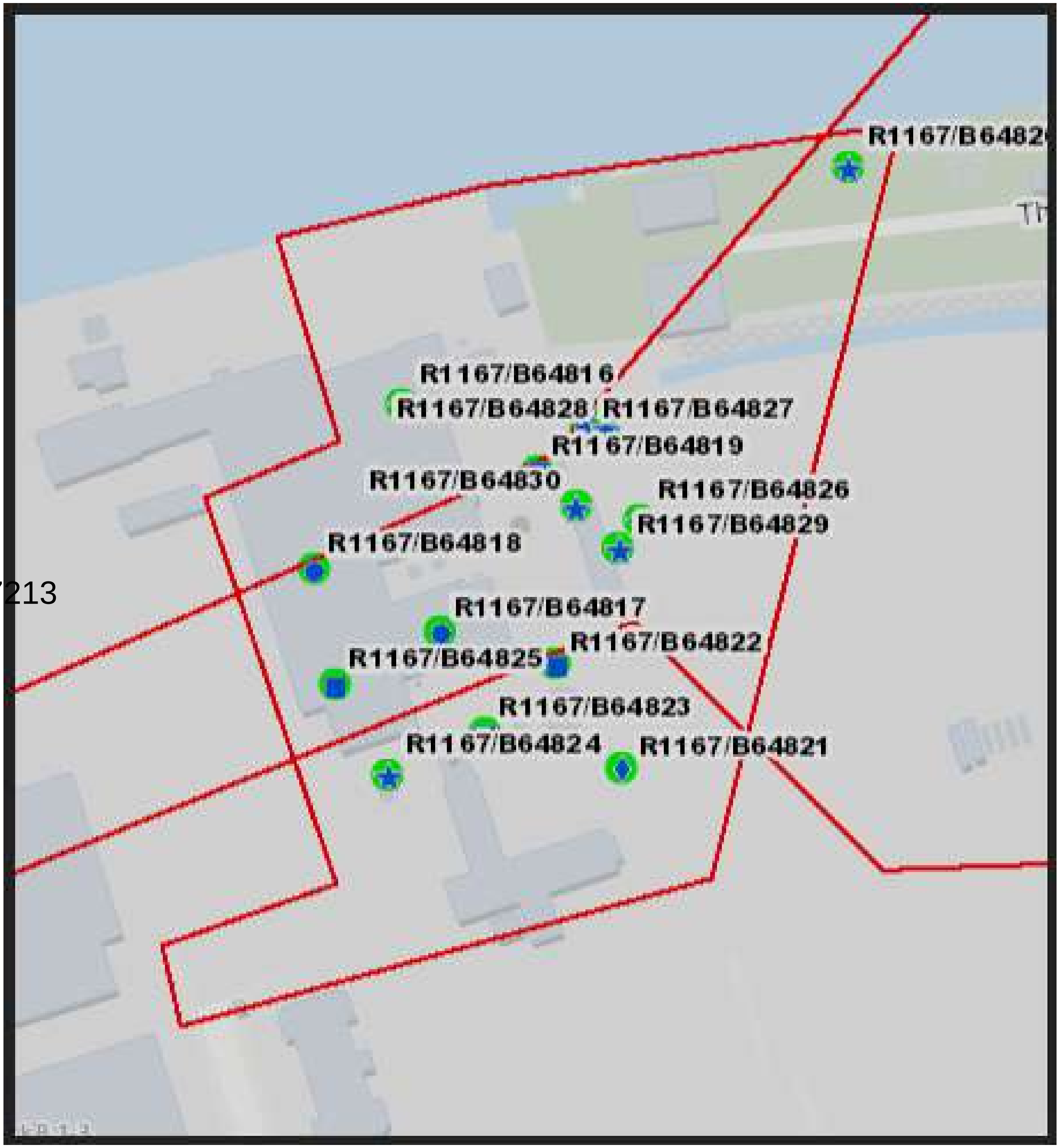
REVISIONS		
(A) Chart of W.Ls. added 7.4.5	P. Healy	CORK STEAM STATION
	1/100	Logs of Bore Holes 1 to 6
		Logs of Trial Pits 1 & 2
		Chart showing variation of W.Ls in Bore
		4811 A



BORE HOLE Nº 1
64816
+16'.0 Ground Level
Sand, gravel, rubble etc filling
Clayey rubble filling
Grayish brown plastic silt
Dark grey plastic clay with occasional shells
Fine grey clayey gravel and sand
Fine red clayey gravel and sand
Reddish silty sand with small pebbles
Reddish fine gritty sand with some gravel
Reddish fine sand with very little gravel
Fine silty red sand with a little clay
Ditto but with some gravel
Fine gravel with sand and some clay
Bottom of Bore
Note 8" liner to 16', 6" liner to 39', 5" liner to 67', 4" liner to 92'.
BORE HOLE Nº 2
64817
Ground Level
Rubble Sand etc filling
Brownish grey plastic clay
Dark grey plastic clay
Ditto but with some gravel
Dark grey clayey gravel
Coarse reddish gravel & sand with some clay
Red gravel & sand with some clay Cores plastic
Very fine red sand
Bottom of Bore
Notes on liners.
Pit 10' depth 8" liners to 15' 6" liners to 36' 5" liners to 80
Boxed samples stored at site. Samples taken at 11'0, 16'0, 21'0, 23'0, 27'0, 31'0, 33'6, 44'0, 48'0, 45'0, 46'6
Sounding Well.
The hole was backfilled with clay up to depth 40'0 & 2" G.B. pipe with its lowest 10' perforated and covered with fine gauze was placed from depth 40 to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide
BORE HOLE Nº 3
64818
Ground Level
Sandy rubble filling
Dark grey plastic clay with some small pebbles
Dark grey plastic clay
Dark dark grey clayey gravel
Grey plastic clay. Fairly soft
Very clayey gravel and sand
Dark grey clayey gravel
Coarse reddish gravel & sand
Fine reddish gravel & sand
Compact fine gravel & sand
Bottom of Bore
Notes on liners.
Pit 9'6" depth 8" liner to 12' 6" liner to 36'
No liner 36' to 46'.
Boxed samples stored at site. Samples taken at 11'6" 15'0 20'0 26'0 86'0 87'6 32'0' 36'0 & 35'0
Sounding Well.
The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20 & 10 and the remainder of the hole filled with clay to surface level.
BORE HOLE Nº 4
64819
Ground Level
Clay with decayed vegetation
Grey plastic silt with shells
Red gravel & sand with stones
Ditto but less gravel & more clay
Fine reddish gravel & sand with some clay
Very fine reddish gravel with gritty sand & some clay
Fine reddish gravel and sand with some clay
Fine red sand
Red clayey gravel and sand with stones
Medium gritty red sand with occasional pebbles
Very stoney clayey red gravel
Very clayey red gravel and sand
Medium gritty red sand with some pebbles. Cores plastic.
Fine red sand with small pebbles Cores slightly plastic
Bottom of Bore
BORE HOLE Nº 5
64820
Ground Level
Clayey filling Dry
Grey silty filling Dry
Grey silt with shells Dry
Grey clayey gravel
Fine red clayey gravel & sand Wet
Fine red sand with occasional pebbles
Fine red sand
Bottom of Bore
Bore Hole dry to depth of 25'6". Water arose to tide level after that and then varies with the tide
BORE HOLE Nº 6
64821
Ground Level
Brownish silt with shells
Dark grey silt with shells
Bottom of Bore
15TH JUNE 1950
16TH JUNE 1950
17TH JUNE 1950
Level of Tide and Water Level in Bore Holes
Chart showing Level of Tide and variation of Water Level in Bore Holes
Nº 2 Trial Pit (N.E. corner of site)
Note
Materials denoted above are as described on site.
Disturbed Sample
Undisturbed Sample
REVISIONS
(A) Chart of W.Ls added 7.4.5
DUBLIN
CORK STEAM STATION
Logs of Bore Holes 1 to 6
Logs of Trial Pits 1 & 2
Chart showing variation of W.Ls in Bore
1/100
4811 A
REPORT 1167 BOX 55


BORE HOLE Nº 1
64816
BORE HOLE Nº 2
64817
BORE HOLE Nº 3
64818
BORE HOLE Nº 4
64819
BORE HOLE Nº 5
64820
BORE HOLE Nº 6
64821
Ground Level
Sand, gravel, rubble etc filling
Clayey rubble filling
Grayish brown plastic silt
Rubble Sand etc filling
Brownish grey plastic clay
Dark grey plastic clay
Ditto but with some gravel
Very fine red sand
Bottom of Bore
Sandy rubble filling
Dark grey plastic clay with some small pebbles
Dark grey plastic clay with few stones
Fine dark grey clayey gravel
Grey plastic clay. Fairly soft
Coarse reddish gravel & sand.
Fine reddish gravel & sand
Compact fine gravel & sand
Bottom of Bore
Reddish silty sand with small pebbles
Reddish fine gritty sand with some gravel
Fine silty red sand with a little clay
Ditto but with some gravel
Fine gravel with sand and some clay
Bottom of Bore
Notes on liners
Sounding Well
Clayey filling Dry
Grey silty filling Dry
Grey silt with shells Dry
Fine red clayey gravel & sand Wet
Medium gritty red sand Wet
Fine red sand with occasional pebbles
Fine red sand
Bottom of Bore
Brownish silt with shells
Dark grey silt with shells
Bottom of Bore
Bore Hole dry to depth of 25'-6". Water arose to tide level after that and then varies with the tide
Fine red sand
Red clayey gravel and sand with stones
Very stoney clayey red gravel
Very clayey red gravel and sand
Medium gritty red sand with some pebbles. Cores plastic
Fine red sand with small pebbles. Cores slightly plastic
Bottom of Bore
Level of Tide and Water Level in Bore Holes
15TH JUNE 1950
16TH JUNE 1950
17TH JUNE 1950
Chart showing Level of Tide and variation of Water Level in Bore Holes
Nº 2 Trial Pit (N.E. corner of site)
REPORT 1167 BOX 55
Note
Materials denoted above are as described on site.
Disturbed Sample
Undisturbed Sample
REVISIONS
A/Chart of W.Ls added
CORK STEAM STATION
Logs of Bore Holes 1 to 6
Logs of Trial Pits 1 & 2
Chart showing variation of W.Ls in Bore Holes
1/100
4811 A

Overview Map for GSI Report 1167: ESB Marino Power Station
ESB Marina Power Station, Cork Harbour, Co. Cork
Points Observed: 25


R1167/B64816
R1167/B64828
R1167/B64827
R1167/B64819
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R1167/B64826
R1167/B64829
R1167/B64818
R1167/B64817
R1167/B64822
R1167/B64825
R1167/B64823
R1167/B64824
R1167/B64821

GSI REPORT 1167

ESB Marino Power Station

ESB Marina Power Station, Cork Harbour, Co. Cork

Borehole List:

Borehole	Name	Depth	DTB	ODMALIN	Easting	Northing	Description
64816	1	28.042		2.99	169351	72111	Cable Percussion (Shell and Auger)
64817	2	15.85		3	169362	72046	Cable Percussion (Shell and Auger)
64818	3	14.021		3.08	169326	72064	Cable Percussion (Shell and Auger)
64819	4	46.634		2.9	169390	72092	Cable Percussion (Shell and Auger)
64820	5	28.956		3.69	169479	72179	Cable Percussion (Shell and Auger)
64821	6	7.01		-.06	169414	72007	Cable Percussion (Shell and Auger)
64822	7	30.48		3.08	169395	72037	Cable Percussion (Shell and Auger)
64823	8	30.48		3.08	169375	72017	Cable Percussion (Shell and Auger)
64824	9	28.55		3.08	169347	72005	Cable Percussion (Shell and Auger)
64825	10	30.48		3.08	169332	72031	Cable Percussion (Shell and Auger)
64826	11	21.336		2.57	169419	72078	Cable Percussion (Shell and Auger)
64827	12	21.336		2.78	169403	72107	Cable Percussion (Shell and Auger)
64828	13	24.994		2.8	169409	72104	Cable Percussion (Shell and Auger)
64829	14	24.079		2.6	169413	72070	Cable Percussion (Shell and Auger)
64830	15	28.956		3.08	169401	72082	Cable Percussion (Shell and Auger)
97270	1	30.8		1.52			Cable Percussion (Shell and Auger)
97271	2	30.5		1.48			Cable Percussion (Shell and Auger)
97272	3	26		1.37			Cable Percussion (Shell and Auger)
97273	4	27		1.57			Cable Percussion (Shell and Auger)
97274	5	27.3		1.27			Cable Percussion (Shell and Auger)
97275	6	27		1.26			Cable Percussion (Shell and Auger)
97276	7	27		1.62			Cable Percussion (Shell and Auger)
97277	8	29		1.63			Cable Percussion (Shell and Auger)
97278	9	30		1.8			Cable Percussion (Shell and Auger)
97279	10	30		2.03			Cable Percussion (Shell and Auger)

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64816 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6481601	0	1.83			Clayey	Fill - Made Ground	Fill - Made Ground
6481602	1.83	3.05			Clayey	Fill - Made Ground	Fill - Made Ground
6481603	3.05	4.27		Grey Brown	Clayey	Silt	Silt
6481604	4.27	5.49	Soft	Grey Brown	Clayey	Clay	Clay
6481605	5.49	6.4		Dark Grey	Clayey	Clay	Clay
6481606	6.4	7.01		Grey	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481607	7.01	7.75		Red	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481608	7.75	7.92		Grey	Fine	Clay And Gravel	Clay And Gravel
6481609	7.92	8.84		Red Brown	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481610	8.84	10.67	Compact	Red Brown	Fine	Gravel And Clay	Gravel And Clay
6481611	10.67	10.97	Compact	Red	Fine	Gravel And Clay	Gravel And Clay
6481612	10.97	11.89	Coarse		Gravelly	Gravel And Clay	Gravel And Clay
6481613	11.89	12.8	Coarse		Gravelly Sandy	Gravel And Clay	Gravel And Clay
6481614	12.8	14.63		Red Brown	Silty Sandy	Silt	Silt
6481615	14.63	17.07		Red Brown	Fine	Gravel And Clay	Gravel And Clay
6481616	17.07	24.99			Fine Silty	Sand And Clay	Sand And Clay
6481617	24.99	28.04			Fine	Gravel And Clay	Gravel And Clay

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64817 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6481701	0	3.05			Clayey	Fill - Made Ground	Fill - Made Ground
6481702	3.05	4.57		Brown Grey	Clayey	Clay	Clay
6481703	4.57	7.92		Dark Grey	Clayey Gravelly	Clay	Clay
6481704	7.92	8.23			Clayey	Gravel And Clay	Gravel And Clay
6481705	8.23	8.66		Dark Grey	Fine	Clay And Gravel	Clay And Gravel
6481706	8.66	8.84		Red	Fine	Silt And Clay	Silt And Clay
6481707	8.84	9.88		Dark Grey	Clayey	Gravel	Gravel
6481708	9.88	10.67	Coarse	Red Brown	Clayey	Clay, Sand And Gravel	Clay, Sand And Gravel
6481709	10.67	10.97		Red	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481710	10.97	11.4		Red Brown	Fine Silty	Clay And Gravel	Clay And Gravel
6481711	11.4	14.45		Red	Clayey	Clay, Sand And Gravel	Clay, Sand And Gravel
6481712	14.45	15.85		Red	Very Fine	Sand	Sand

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64818 (Company Name: 3)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6481801	0	2.9		Dark Grey	Clayey	Clay And Gravel	Clay And Gravel
6481802	2.9	4.42	Friable	Dark Grey Black	Clayey	Clay	Clay
6481803	4.42	6.4	Friable	Dark Grey	Clayey	Sand And Clay	Sand And Clay
6481804	6.4	8.23		Dark Grey	Fine	Clay And Gravel	Clay And Gravel
6481805	8.23	8.66	Friable	Grey	Clayey	Clay	Clay
6481806	8.66	9.75			Very Clayey	Sand And Gravel	Sand And Gravel
6481807	9.75	11.58	Coarse	Red Brown	Clayey	Sand And Gravel	Sand And Gravel
6481808	11.58	13.72		Red Brown	Fine	Sand And Gravel	Sand And Gravel
6481809	13.72	14.02	Compact		Fine	Sand And Gravel	Sand And Gravel

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LAYERS FOR BOREHOLE 64819 (Company Name: 4)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6481901	0	4.09			Clayey	Fill - Made Ground	Fill - Made Ground
6481902	4.09	4.27			Clayey	Clay	Clay
6481903	4.27	6.53	Friable	Grey	Clayey	Silt	Silt
6481904	6.53	7.32		Grey	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481905	7.32	10.97		Red	Clayey	Sand And Gravel	Sand And Gravel
6481906	10.97	15.24		Red Brown	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481907	15.85	25.12		Red	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481908	25.12	25.91		Red Brown	Very Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481909	25.91	28.65		Red Brown	Fine	Clay, Sand And Gravel	Clay, Sand And Gravel
6481910	28.65	29.87		Red	Fine	Sand	Sand
6481911	29.87	32.13		Red	Clayey	Sand And Gravel	Sand And Gravel
6481912	32.13	34.14		Red	Medium	Sand And Gravel	Sand And Gravel
6481913	34.14	37.49		Red	Very Stony	Gravel And Clay	Gravel And Clay
6481914	37.49	44.5		Red	Very Clayey	Sand And Gravel	Sand And Gravel
6481915	44.5	45.72		Red	Medium	Gravel	Gravel
6481916	45.72	46.63		Red	Fine	Sand	Sand

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LAYERS FOR BOREHOLE 64820 (Company Name: 5)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482001	0	3.05			Clayey	Fill - Made Ground	Fill - Made Ground
6482002	3.05	4.88		Grey	Silty	Fill - Made Ground	Fill - Made Ground
6482003	4.88	7.75		Grey	Silty	Silt	Silt
6482004	7.75	8.05		Grey	Clayey	Gravel	Gravel
6482005	8.05	12.8	Dense fine	Red	Clayey	Sand And Gravel	Sand And Gravel
6482006	12.8	13.41		Red	Clayey	Sand And Gravel	Sand And Gravel
6482007	13.41	14.94		Red	Medium	Sand	Sand
6482008	14.94	28.96		Red	Fine	Sand And Gravel	Sand And Gravel

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LAYERS FOR BOREHOLE 64821 (Company Name: 6)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482101	0	1.04		Brown	Silty	Silt	Silt
6482102	1.04	2.57		Dark Grey	Clayey	Silt	Silt
6482103	2.57	2.87		Red Brown	Fine	Sand And Gravel	Sand And Gravel
6482104	2.87	3.48		Grey	Clayey	Gravel And Silt	Gravel And Silt
6482105	3.48	7.01		Red	Stony Clayey	Gravel	Gravel

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LAYERS FOR BOREHOLE 64822 (Company Name: 7)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482201	0	4.57		Light Brown	Fine Sandy	Fill - Made Ground	Fill - Made Ground
6482202	4.57	9.75	Soft	Dark Grey	Sandy Silty	Silt	Silt
6482203	9.75	30.48	Dense	Red Brown	Silty	Gravel	Gravel

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LAYERS FOR BOREHOLE 64823 (Company Name: 8)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482301	0	3.66		Dark Brown	Sandy Gravelly	Fill - Made Ground	Fill - Made Ground
6482302	3.66	9.6	Very Soft	Grey	Clayey Silty Sandy	Gravel	Gravel
6482303	9.6	30.48	Medium Dense	Red Brown	Fine to Coarse	Gravel And Cobbles	Gravel And Cobbles

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LAYERS FOR BOREHOLE 64824 (Company Name: 9)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482401	0	3.81		Dark Brown	Sandy Clayey	Fill - Made Ground	Fill - Made Ground
6482402	3.81	12.19	Soft	Dark Grey	Clayey Silty Sandy	Gravel And Cobbles	Gravel And Cobbles
6482403	12.19	28.55	Medium Dense	Red Brown	Fine to Coarse	Gravel And Cobbles	Gravel And Cobbles

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LAYERS FOR BOREHOLE 64825 (Company Name: 10)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482501	0	2.9	Soft	Dark Brown	Sandy Gravelly Silty	Fill - Made Ground	Fill - Made Ground
6482502	2.9	10.82	Soft	Dark Grey	Silty Sandy Gravelly	Clay	Clay
6482503	10.82	30.48	Medium Dense	Red Brown	Fine to Coarse	Sand And Gravel	Sand And Gravel

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LAYERS FOR BOREHOLE 64826 (Company Name: 11)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482601	0	1.52	Loose		Clayey Gravelly	Fill - Made Ground	Fill - Made Ground
6482602	1.52	4.88	Loose		Clayey Gravelly	Fill - Made Ground	Fill - Made Ground
6482603	4.88	5.79		Dark Grey	Clayey Silty	Clay	Clay
6482604	5.79	21.34		Red Brown	Fine to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders

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LAYERS FOR BOREHOLE 64827 (Company Name: 12)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482701	0	1.52		Brown	Clayey Gravelly	Clay And Gravel	Clay And Gravel
6482702	1.52	3.05		Black	Clayey	Sand	Sand
6482703	3.05	4.57		Dark Grey	Fine Silty	Silt And Clay	Silt And Clay
6482704	4.57	21.34		Red	Fine to Coarse Sandy	Sand And Cobbles	Sand And Cobbles

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LAYERS FOR BOREHOLE 64828 (Company Name: 13)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482801	0	3.96			Silty Sandy	Fill - Made Ground	Fill - Made Ground
6482802	3.96	4.57		Grey	Sandy Silty	Silt And Clay	Silt And Clay
6482803	4.57	5.49		Grey	Fine to Medium	Gravel And Silt	Gravel And Silt
6482804	5.49	7.01		Grey	Organic	Silt And Clay	Silt And Clay
6482805	7.01	9.91			Fine to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders
6482806	9.91	12.34			Fine to Coarse	Gravel And Cobbles	Gravel And Cobbles
6482807	12.34	20.12			Fine to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders
6482808	20.12	23.32	Coarse			Gravel And Cobbles	Gravel And Cobbles
6482809	23.32	24.99		Brown	Fine to Coarse	Sand And Cobbles	Sand And Cobbles

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LAYERS FOR BOREHOLE 64829 (Company Name: 14)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6482901	0	2.74		Dark Brown	Clayey	Fill - Made Ground	Fill - Made Ground
6482902	2.74	5.18	Very Soft	Grey	Silty Sandy	Silt	Silt
6482903	5.18	5.79	Soft	Grey	Sandy Silty	Silt	Silt
6482904	5.79	6.71			Fine Sandy	Gravel And Silt	Gravel And Silt
6482905	6.71	7.32			Small	Sand And Gravel	Sand And Gravel
6482906	7.32	8.84			Medium	Sand And Gravel	Sand And Gravel
6482907	8.84	10.06			Medium	Gravel And Cobbles	Gravel And Cobbles
6482908	10.06	10.67			Medium	Sand, Gravel And Boulders	Sand, Gravel And Boulders
6482909	10.67	11.58			Medium	Sand, Gravel And Boulders	Sand, Gravel And Boulders
6482910	11.58	12.19	Coarse		Medium Gravelly	Sand And Gravel	Sand And Gravel
6482911	12.19	12.8	Compact		Medium	Sand And Gravel	Sand And Gravel
6482912	12.8	15.24	Compact		Fine to Coarse	Sand And Gravel	Sand And Gravel
6482913	15.24	16.15			Medium Gravelly	Sand And Cobbles	Sand And Cobbles
6482914	16.15	18.9			Medium to Coarse	Sand And Gravel	Sand And Gravel
6482915	18.9	19.51			Medium Gravelly	Gravel And Cobbles	Gravel And Cobbles
6482916	19.51	20.12			Medium Gravelly	Sand And Gravel	Sand And Gravel
6482917	20.12	21.34			Medium Gravelly	Sand, Gravel And Boulders	Sand, Gravel And Boulders
6482918	21.34	24.08	Compact		Medium	Gravel	Gravel

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ESB Marino Power Station

LAYERS FOR BOREHOLE 64830 (Company Name: 15)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6483001	0	.3				Fill - Made Ground	Fill - Made Ground
6483002	.3	1.83		Dark Brown	Clayey	Fill - Made Ground	Fill - Made Ground
6483003	1.83	4.27			Clayey	Fill - Made Ground	Fill - Made Ground
6483004	4.27	4.57	Very Soft	Grey	Clayey	Silt	Silt
6483005	4.57	6.4	Very Soft	Grey	Silty Sandy	Silt	Silt
6483006	6.4	7.01			Clayey	Gravel And Silt	Gravel And Silt
6483007	7.01	11.89			Medium	Sand And Gravel	Sand And Gravel
6483008	11.89	12.5	Compact		Medium	Gravel And Cobbles	Gravel And Cobbles
6483009	12.5	13.11			Medium	Gravel And Cobbles	Gravel And Cobbles
6483010	13.11	15.24	Compact		Medium	Gravel And Cobbles	Gravel And Cobbles
6483011	15.24	15.85			Medium	Gravel	Gravel
6483012	15.85	16.92			Medium to Coarse	Sand And Gravel	Sand And Gravel
6483013	16.92	17.68	Coarse		Small	Sand And Gravel	Sand And Gravel
6483014	17.68	18.9	Very Compact		Medium	Gravel	Gravel
6483015	18.9	19.51	Very Compact		Medium	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders
6483016	19.51	20.42	Compact		Small	Gravel	Gravel
6483017	20.42	22.86	Compact		Small	Gravel	Gravel
6483018	22.86	23.47			Medium	Gravel	Gravel
6483019	23.47	24.84	Very Compact		Small	Sand And Gravel	Sand And Gravel
6483020	24.84	28.96	Very Compact		Medium Gravelly	Sand And Gravel	Sand And Gravel

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ESB Marino Power Station

LAYERS FOR BOREHOLE 97270 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727001	0	.15				Fill - Made Ground	Fill - Made Ground
9727002	.15	2.8			Clayey	Fill - Made Ground	Fill - Made Ground
9727003	2.8	4.9	Soft	Grey	Silty	Clay	Clay
9727004	4.9	5.05	Soft	Grey	Organic	Silt	Silt
9727005	5.05	5.2	Coarse		Very Clayey	Gravel	Gravel
9727006	5.2	5.8	Soft	Grey	Clayey	Silt	Silt
9727007	5.8	7.1	Loose		Slightly Sandy Clayey	Gravel	Gravel
9727008	7.1	8.9	Soft	Black	Organic	Clay	Clay
9727009	8.9	11	Compact		Coarse	Gravel	Gravel
9727010	11	16.9	Compact		Medium	Sand And Gravel	Sand And Gravel
9727011	16.9	20.5			Medium to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders
9727012	20.5	30.8	Compact		Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders

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LAYERS FOR BOREHOLE 97271 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727101	0	.15			Clayey	Fill - Made Ground	Fill - Made Ground
9727102	.15	2.3			Clayey Gravelly	Fill - Made Ground	Fill - Made Ground
9727103	2.3	3.7	Soft	Brown and Grey	Clayey	Silt	Silt
9727104	3.7	4.15	Soft	Grey	Sandy	Silt	Silt
9727105	4.15	4.3	Soft	Grey	Silty	Clay	Clay
9727106	4.3	5.55	Loose		Sandy	Gravel And Silt	Gravel And Silt
9727107	5.55	6.1	Soft	Grey	Organic	Silt And Clay	Silt And Clay
9727108	6.1	7.7	Compact		Sandy	Gravel	Gravel
9727109	7.7	10.9	Compact		Coarse	Gravel And Cobbles	Gravel And Cobbles
9727110	10.9	16.3	Coarse		Clayey	Sand And Gravel	Sand And Gravel
9727111	16.3	30.5	Compact		Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders

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LAYERS FOR BOREHOLE 97272 (Company Name: 3)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727201	0	.15				Fill - Made Ground	Fill - Made Ground
9727202	.15	2				Fill - Made Ground	Fill - Made Ground
9727203	2	2.7	Soft	Grey	Stony	Silt	Silt
9727204	2.7	4		Dark Grey	Organic	Silt	Silt
9727205	4	5.7	Loose		Medium to Coarse	Gravel	Gravel
9727206	5.7	6	Soft	Dark Grey	Organic gravelly	Clay	Clay
9727207	6	6.5			Fine to Medium	Sand And Gravel	Sand And Gravel
9727208	6.5	7.1		Grey	Clayey	Silt	Silt
9727209	7.1	14	Compact		Medium to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders
9727210	14	18.3	Stiff	Grey		Clay	Clay
9727211	18.3	18.8	Stiff	Grey	Shelly	Clay	Clay
9727212	18.8	26	Compact		Medium to Coarse	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders

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ESB Marino Power Station

LAYERS FOR BOREHOLE 97273 (Company Name: 4)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727301	0	.15				Fill - Made Ground	Fill - Made Ground
9727302	.15	2				Fill - Made Ground	Fill - Made Ground
9727303	2	3.5	Soft	Grey	Clayey	Silt	Silt
9727304	3.5	5	Loose		Clayey	Sand And Gravel	Sand And Gravel
9727305	5	5.8	Soft	Grey	Clayey	Silt	Silt
9727306	5.8	6.2			Medium to Coarse	Sand And Gravel	Sand And Gravel
9727307	6.2	7.15	Soft		Gravelly	Silt	Silt
9727308	7.15	8		Dark Grey	Silty Stony	Clay	Clay
9727309	8	10.35	Compact		Medium to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders
9727310	10.35	15.7			Fine to Medium	Sand	Sand
9727311	15.7	27	Compact		Coarse Sandy	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders

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LAYERS FOR BOREHOLE 97274 (Company Name: 5)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727401	0	.15				Fill - Made Ground	Fill - Made Ground
9727402	.15	2			Clayey	Fill - Made Ground	Fill - Made Ground
9727403	2	4		Grey	Organic	Silt	Silt
9727404	4	4.6		Dark Grey	Very Silty	Gravel	Gravel
9727405	4.6	6			Medium to Coarse	Sand And Gravel	Sand And Gravel
9727406	6	6.5	Soft	Grey	Clayey	Silt	Silt
9727407	6.5	13.7	Coarse		Sandy Gravelly	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders
9727408	13.7	17.5	Stiff	Grey Green	Silty Clayey	Silt And Clay	Silt And Clay
9727409	17.5	27.3	Compact		Coarse Sandy Gravelly	Sand And Gravel	Sand And Gravel

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LAYERS FOR BOREHOLE 97275 (Company Name: 6)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727501	0	.15				Fill - Made Ground	Fill - Made Ground
9727502	.15	2			Clayey	Fill - Made Ground	Fill - Made Ground
9727503	2	3.15	Soft	Grey Brown	Clayey	Silt	Silt
9727504	3.15	4	Soft	Grey	Very Sandy	Silt	Silt
9727505	4	4.9	Loose		Coarse Sandy	Gravel	Gravel
9727506	4.9	5.5	Soft	Grey	Clayey	Silt	Silt
9727507	5.5	6.5	Compact		Fine Gravelly	Sand And Gravel	Sand And Gravel
9727508	6.5	8	Soft	Grey	Organic	Silt	Silt
9727509	8	12	Compact		Coarse Sandy Gravelly	Gravel	Gravel
9727510	12	13.3	Compact		Very Coarse	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders
9727511	13.3	15	Very Stiff	Brown	Very Stony	Clay, Cobbles And Boulders	Clay, Cobbles And Boulders
9727512	15	15.6			Very Coarse Gravelly	Gravel And Cobbles	Gravel And Cobbles
9727513	15.6	27	Very Compact		Coarse Sandy	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders

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LAYERS FOR BOREHOLE 97276 (Company Name: 7)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727601	0	.15				Fill - Made Ground	Fill - Made Ground
9727602	.15	2.6			Clayey	Fill - Made Ground	Fill - Made Ground
9727603	2.6	4.65	Very Soft	Grey Brown	Organic	Silt And Clay	Silt And Clay
9727604	4.65	5.3	Loose		Coarse Sandy Silty	Silt	Silt
9727605	5.3	6		Grey	Gravelly	Silt	Silt
9727606	6	7	Loose		Fine to Coarse	Sand And Gravel	Sand And Gravel
9727607	7	7.8		Grey	Slightly Sandy Silty	Silt	Silt
9727608	7.8	10.2	Compact		Coarse	Gravel And Cobbles	Gravel And Cobbles
9727609	10.2	11	Coarse		Sandy	Gravel	Gravel
9727610	11	14.65	Compact		Very Coarse	Gravel And Cobbles	Gravel And Cobbles
9727611	14.65	16.4	Stiff	Grey	Clayey	Clay	Clay
9727612	16.4	17.3	Stiff	Grey	Silty Clayey	Clay	Clay
9727613	17.3	18.8	Very Stiff	Light Brown	Silty, Very Stony	Clay, Cobbles And Boulders	Clay, Cobbles And Boulders
9727614	18.8	27	Compact		Very Coarse Sandy	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders

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LAYERS FOR BOREHOLE 97277 (Company Name: 8)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727701	0	.15			Clayey	Fill - Made Ground	Fill - Made Ground
9727702	.15	2				Fill - Made Ground	Fill - Made Ground
9727703	2	4.3	Soft	Grey	Clayey	Silt	Silt
9727704	4.3	5.8	Loose		Coarse Silty	Sand And Gravel	Sand And Gravel
9727705	5.8	6.75	Loose		Fine Silty	Sand And Gravel	Sand And Gravel
9727706	6.75	7.4		Grey	Organic	Gravel And Silt	Gravel And Silt
9727707	7.4	14	Compact		Very Coarse Sandy	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders
9727708	14	18.7	Stiff	Grey Green	Clayey Silty	Clay And Silt	Clay And Silt
9727709	18.7	19.05				Fill - Made Ground	Fill - Made Ground
9727710	19.05	19.7	Stiff	Grey	Silty Clayey	Clay	Clay
9727711	19.7	21.6	Stiff	Brown	Silty Clayey	Silt And Clay	Silt And Clay
9727712	21.6	23.7	Stiff	Green	Very Silty	Clay	Clay
9727713	23.7	29	Compact		Very Coarse Sandy	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders

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LAYERS FOR BOREHOLE 97278 (Company Name: 9)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727801	0	.15			Clayey	Fill - Made Ground	Fill - Made Ground
9727802	.15	2.8			Clayey	Fill - Made Ground	Fill - Made Ground
9727803	2.8	3.45	Soft	Grey	Very Silty	Clay	Clay
9727804	3.45	4.9	Soft	Grey	Silty Stony	Silt And Stones	Silt And Stones
9727805	4.9	5.3	Firm	Grey	Clayey	Silt	Silt
9727806	5.3	7.45	Loose		Medium to Coarse	Sand And Gravel	Sand And Gravel
9727807	7.45	8.3	Firm	Grey	Clayey	Silt	Silt
9727808	8.3	10.8	Compact		Coarse Sandy	Gravel And Cobbles	Gravel And Cobbles
9727809	10.8	12.8	Compact		Coarse Gravelly	Gravel, Cobbles And Boulders	Gravel, Cobbles And Boulders
9727810	12.8	14.15	Very Stiff	Light Brown	Sandy Clayey	Clay, Cobbles And Boulders	Clay, Cobbles And Boulders
9727811	14.15	14.6		Grey	Silty	Gravel And Boulders	Gravel And Boulders
9727812	14.6	17	Compact		Medium to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders
9727813	17	30	Very Compact		Medium to Coarse	Sand, Gravel And Boulders	Sand, Gravel And Boulders

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LAYERS FOR BOREHOLE 97279 (Company Name: 10)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
9727901	0	.15			Clayey	Fill - Made Ground	Fill - Made Ground
9727902	.15	2.7			Clayey	Fill - Made Ground	Fill - Made Ground
9727903	2.7	4.35	Soft	Grey	Silty	Silt	Silt
9727904	4.35	6	Loose	Grey	Very Sandy	Silt	Silt
9727905	6	6.5	Loose		Medium to Coarse	Gravel	Gravel
9727906	6.5	8.1	Loose		Very Sandy Silty	Gravel	Gravel
9727907	8.1	11.25	Compact		Fine to Coarse	Gravel	Gravel
9727908	11.25	15.6	Compact		Very Coarse Sandy	Gravel And Cobbles	Gravel And Cobbles
9727909	15.6	16	Compact		Coarse Gravelly	Sand And Gravel	Sand And Gravel
9727910	16	30	Compact		Coarse Sandy Gravelly	Gravel And Cobbles	Gravel And Cobbles

Summary of Geotechnical boreholes from Marina Generating Station Report (1974)

ID	Depth (mBGL)	Geology
Borehole no. 1	0 – 3.05	Rubble sand MADE GROUND
	3.05 – 6.4	Dark grey soft greyish estuarine CLAY and SILT with shells
	6.4 – 28.04	Clayey reddish SAND & GRAVEL
Borehole no. 2	0 – 3.05	Clayey sand gravel rubble MADE GROUND
	3.05 - 7.92	Dark grey plastic greyish estuarine CLAY and SILT
	7.92 – 15.85	Clayey reddish GRAVEL and SAND
Borehole no. 3	0 – 4.42	Dark grey gravelly CLAY
	4.42 – 14.02	Reddish brown sand and GRAVEL
Borehole no. 4	0 – 4.09	Foundry sand (clinker?) and rubble MADE GROUND
	4.09 – 6.53	Grey plastic CLAY with decayed vegetation and shells
	6.53 – 46.63	Reddish brown clayey fine SAND and GRAVEL
Borehole no. 5	0 – 4.88	Grey clayey silty MADE GROUND
	4.88 – 7.75	Grey estuarine SILT with shells
	7.75 – 28.96	Red clayey fine SAND and GRAVEL
Borehole no. 6	0 – 2.57	Brownish SILT with shells
	2.57 – 7.01	Fine reddish SAND with GRAVEL
Borehole no. 7	0 – 4.57	MADE GROUND comprising gravelly clinker with light brown sand and metal pieces
	4.57 – 9.75	Soft grey sandy and

		gravelly SILT alluvium
	9.75 – 30.48	Reddish-brown silty sand and coarse GRAVEL with cobbles
Borehole no. 8	0 – 3.66	Dark brown sandy and gravelly MADE GROUND with black slag clinker
	3.66 – 9.6	Soft grey sandy and gravelly SILT alluvium with some shells
	9.6 – 30.48	Reddish-brown clayey sand and coarse GRAVEL with cobbles
Borehole no. 9	0 – 3.81	Dark brown sandy and gravelly MADE GROUND with black slag clinker and brick pieces
	3.81 – 12.19	Soft grey sandy and gravelly SILT alluvium with some cobble basal layers
	12.19 – 28.55	Reddish-brown clayey sand and coarse GRAVEL with cobbles
Borehole no. 10	0 – 2.9	Topsoil rootlets with soft dark brown gravelly MADE GROUND. Brick pieces and slag waste
	2.9 – 10.82	Soft grey sandy and gravelly SILT alluvium with some shells and vegetable matter
	10.82 – 30.48	Reddish-brown clayey sand and coarse GRAVEL with cobbles
Borehole no. 11	0 – 4.88	Dark brown sandy and gravelly MADE GROUND with clinker ash deposits
	4.88 – 5.79	Soft grey sandy and gravelly CLAY alluvium with some shells
	5.79 – 21.34	Reddish-brown clayey sand and coarse GRAVEL with cobbles
Borehole no. 12	0 – 4.57	Dark brown sandy and gravelly MADE GROUND

		with clinker ash deposits
	4.57 – 21.34	Fine, medium and coarse reddish brown SAND with GRAVEL and cobbles
Borehole no. 13	0 – 3.96	Dark brown sandy and gravelly MADE GROUND with some brick rubble
	3.96 – 7.01	Soft grey sandy and gravelly SILT
	7.01 – 24.99	Reddish-brown clayey sand and coarse GRAVEL with cobbles
Borehole no. 14	0 – 2.74	Dark brown sandy and gravelly MADE GROUND with clinker slag and metal pieces
	2.74 – 5.79	Soft grey sandy and gravelly SILT
	5.79 – 24.08	Reddish-brown clayey sand and coarse GRAVEL with cobbles
Borehole no. 15	0 – 4.27	Dark gravelly sandy MADE GROUND with scrap metal and clinker ash/slag
	4.27 – 6.4	Soft grey sandy and gravelly SILT
	6.4 – 28.96	Reddish-brown clayey sand and coarse GRAVEL with cobbles

APPENDIX H

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, Balie 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!