



Licence Reference No.	Risk Assessment Methodology Stage and Step	Report Version
N/A	Stage 1 (PSA)	A.6 Final for Client

REPORT

Site 14 Deansgrange to Sallynoggin 38 kV: Preliminary Site Assessment Report for Historic Fluid Filled Cable Loss

ESB Engineering and Major Projects

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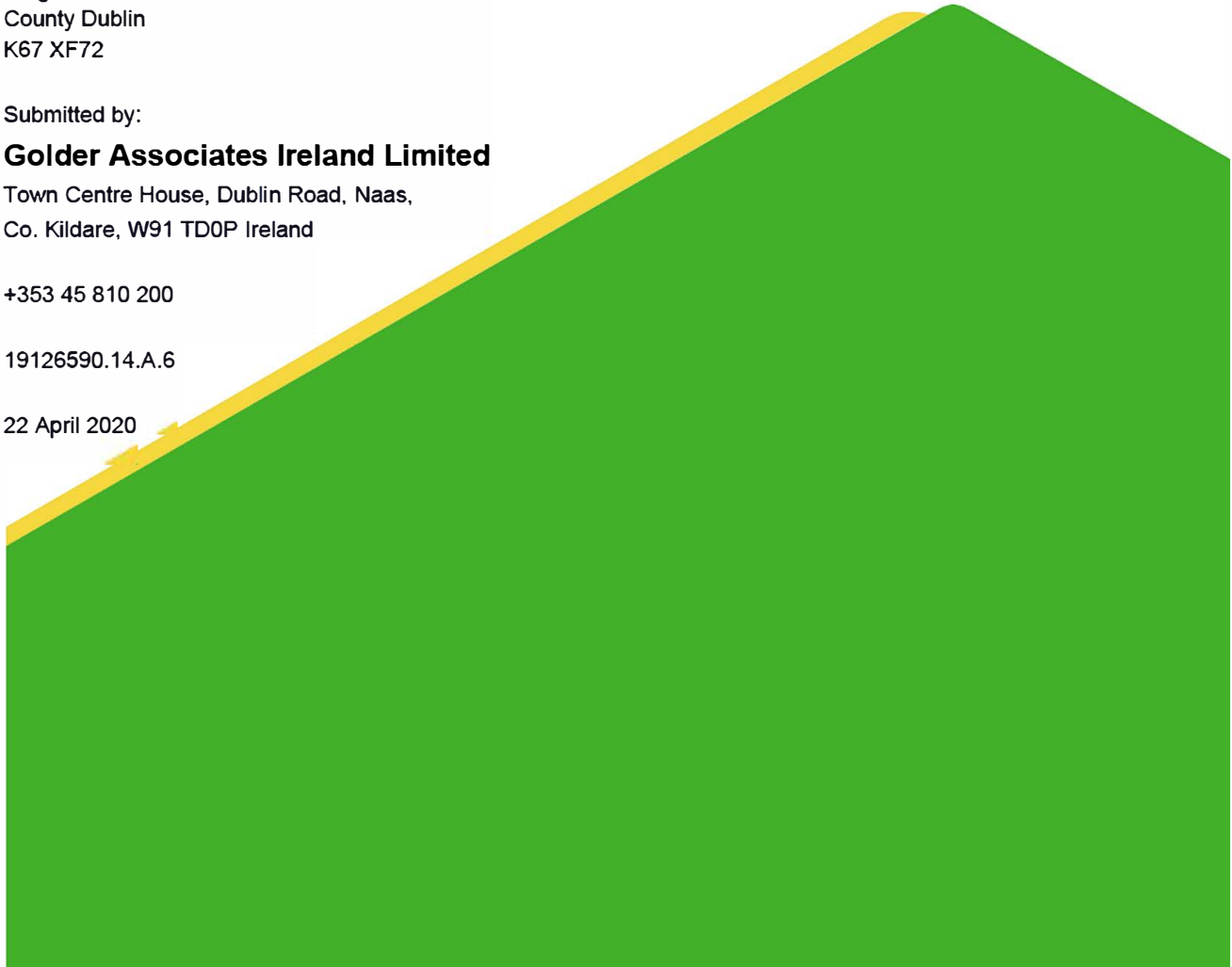
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19126590.14.A.6

22 April 2020



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Executive Summary

ESB operates and maintains a large network of fluid insulated electrical cables across Ireland, with the majority (of fluid filled cables) located in urban settings across Dublin City and Cork City. Due to the location and age of the cables, they are often subject to third party interference and damage and/or corrosion and defects, which can potentially cause the cable fluid to leak into adjacent soil, groundwater, and/or surface water. This report focuses on a leak of approximately 3,812 L of cable fluid (linear alkyl benzene and mineral oil mix) from a 38 kV section of cable between Deansgrange and Sallynoggin (Site 14). The indicative leak location is on Sallynoggin Road outside of the retailer 'Woodies'.

The objective of the work was as follows:

- To assess the environmental and human health impact associated with legacy cable fluid loss.

This has been completed in a risk-based staged approach, consistent with the process described in "*Guidance on the Management of Contaminated Land and Groundwater at EPA Licenced Sites*" (EPA, 2013). We note that the section of cable assessed in this report does not form part of an EPA licenced site.

In order to provide ESB with this Preliminary Site Assessment report, Golder has completed the following:

- A Site walkover (200 m each way along the cable length from the indicative leak location, and laterally as required);
- A desk study of publicly available information; and
- A preliminary Conceptual Site Model (CSM).

The work has been completed in accordance with the scope provided in the proposal P19126590.P1.V0, dated 28 June 2019. No significant variations from this scope were required to complete the work.

The Preliminary Site Assessment approach is considered conservative as it seeks to identify the potential source, and a broad range of initially theoretical pathway and receptor linkages present for each Site. The preliminary CSM identified potential source, pathway, and receptor linkages that may be present at the Site or caused by the leak. A qualitative risk analysis and evaluation was completed on each potential pollutant linkage identified. It is noted that where a potential risk is identified at this stage it does not necessarily mean a risk is present but that further investigation is required to either confirm the presence or absence of the risk. Where a potential linkage has been classified as either low or very low in the risk assessment no further action has been recommended to address this linkage as the actual risks identified in the low and very low risks have been sufficiently assessed in the PSA.

Further investigation and analysis will be required to assess potential pollutant linkages identified in this report. A summary of the findings is given below. Golder will produce a letter under separate cover recommending actions to address the below findings:

Summary of Findings

Potential pollutant linkages have been identified that could impact human health and/or controlled waters receptors as follows:

Summary of Findings

- There is a potential moderate risk that groundwater in the bedrock could be impacted if the Till thickness is not significant enough to provide protection from migration of contaminants; and
- There is a potential moderate/low risk that residents or workers in basement apartments or offices could be impacted by vapours.

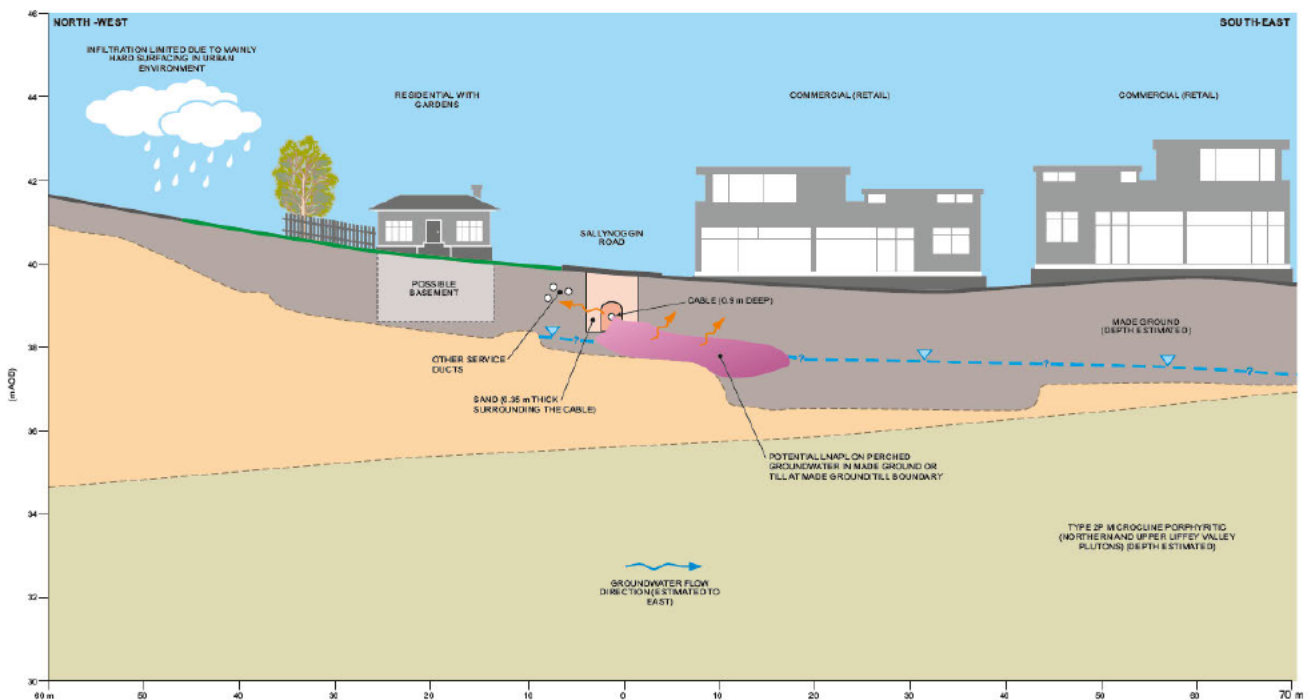


Figure 1: Preliminary CSM for Site 14 (Deansgrange to Sallynoggin).

Summary of Report Status within the Overall Context of the Contaminated Land and Groundwater Site Assessment

EPA Contaminated Land and Groundwater Risk Assessment Methodology		Report Reference	Report Date	Status
Stage 1: Site Characterisation and Assessment				
1.1	Preliminary Site Assessment	19126590.14.A.6	22 April 2020	A.6 Final for Client
1.2	Detailed Site Assessment			
1.3	Quantitative Risk Assessment			
Stage 2: Corrective Action Feasibility and Design				
2.1	Outline Corrective Action Strategy			
2.2	Feasibility Study and Design			

EPA Contaminated Land and Groundwater Risk Assessment Methodology		Report Reference	Report Date	Status
2.3	Detailed Design			
2.4	Final Strategy and Implementation Plan			
Stage 3: Corrective Action and Implementation and Aftercare				
3.1	Enabling Works			
3.2	Corrective Action Implementation and Verification			
3.3	Aftercare			

Study Limitations

IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations or conclusions herein set out.

- a) This report has been prepared for and at the request of ESB Engineering and Major Projects (the Client) for undertaking activities pursuant to its appointment of Golder Associates Ireland Ltd (Golder) to act as Consultant.
- b) Save for the Client, no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations, or conclusions herein set out.
- c) Regard should be had to the agreement between Golder and the Client which is taken to be the Golder proposal P19126590.P1.V0 dated 28 June 2019 and the revision P19126590.P1.V1 dated 3 July 2019, when considering this report and reliance to be placed on it.
- d) All work carried out in preparing this report has used, and is based upon, Golder's professional knowledge and understanding of the current (July 2019) relevant Irish and European Community legislation, and assumptions set out in this report. Changes in the legislation or assumptions may cause the screening and methodology set out in this report to become inappropriate or incorrect. However, in writing this report, Golder has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, Golder will have no obligation to advise the Client of any such changes, or of their repercussions.
- e) Golder acknowledges that it is being retained, in part, because of its knowledge and experience with respect to environmental matters. Golder will consider and analyse all information provided to it in the context of Golder's knowledge and experience and all other relevant information known to Golder. To the extent that the information provided to Golder is not inconsistent or incompatible therewith, Golder shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of all such information and Golder shall have no obligation to verify the accuracy and completeness of such information. Golder has relied on the Client to provide information on spills, leaks, and other releases of materials to inform potential sources.
- f) The content of this report represents the professional opinion of experienced environmental consultants. Golder does not provide specialist legal advice and the advice of lawyers will be required.
- g) The scope of work includes interpretation of information from borings and test pits. Attention is drawn to the fact that special risks occur whenever engineering and related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with a professional Standard of Care may fail to detect certain conditions. The environmental, geologic, geotechnical, geochemical and hydrogeological conditions that Golder interprets to exist between sampling points may differ from those that actually exist. Passage of time, natural occurrences, and activities near the Site may substantially alter discovered conditions.
- h) In the Conclusions section of this report and in the Executive Summary, Golder has set out its key findings and provided a summary and overview of its opinions. However, other parts of this report will often indicate the limitations of the information obtained by Golder and therefore any opinions set out in the Conclusions section and in the Executive Summary ought not to be relied upon until considered in the context of the whole report.

Table of Contents

1.0	INTRODUCTION	1
1.1	Background	1
1.1.1	Site Location	1
1.1.2	Leak Information	1
1.2	Objectives.....	2
1.3	Scope of Works.....	3
2.0	SITE DESCRIPTION	3
2.1	Description of Leak Event	3
2.2	Current Site Conditions	3
2.2.1	Leak Location.....	3
2.2.2	Cable and Area in Proximity to Leak.....	3
3.0	SITE HISTORY.....	3
3.1.1	Information Sources	3
3.1.2	Potential Historical Sources	4
4.0	CHEMICALS OF CONCERN	5
4.1	Review of Material Safety Data Sheet	6
4.1.1	Linear Alkyl Benzene	6
4.1.2	Blended Mineral Oil and Additives	7
5.0	ENVIRONMENTAL SETTING	8
5.1.1	Information Sources	8
5.1.2	Topography	8
5.1.3	Current Surrounding Land Use	8
5.1.4	Current Waste Permits, IPC and IE Licences in Area of Site	8
5.1.5	Sensitive Ecological Receptors.....	9
5.1.6	Hydrology	9
5.1.6.1	Surface Water Features	9
5.1.6.2	Surface Water Quality	9
5.1.6.3	Surface Water Abstraction	9
5.1.6.4	Discharges to Surface Water	9

5.1.6.5	Surface Water Flooding	9
5.1.6.6	Pollution Releases to Land, Air and Water	9
5.1.7	Geology	9
5.1.7.1	Artificial Ground.....	9
5.1.7.2	Superficial and Bedrock Geology.....	9
5.1.7.3	Faulting	10
5.1.8	GSI Borehole Logs.....	10
5.1.9	Hydrogeology	10
5.1.9.1	Groundwater Vulnerability.....	10
5.1.9.2	Discharges to Groundwater	10
5.1.9.3	Groundwater Group Water Scheme Abstraction Points	10
5.1.9.4	Groundwater Flow Directions.....	10
5.1.9.5	Groundwater Quality	10
6.0	PREVIOUS SITE SAMPLING AND MONITORING DATA	10
7.0	PRELIMINARY CONCEPTUAL SITE MODEL	10
7.1	Context of the PSA.....	11
7.2	Development of the Preliminary CSM.....	11
7.3	Description of the Source.....	11
7.4	Description of the Pathways.....	11
7.5	Description of the Receptors.....	12
7.6	Preliminary Conceptual Site Model Risk Analysis	12
8.0	RISK EVALUATION.....	21
8.1	Conclusions.....	22
9.0	REFERENCES	22
TABLES		
	Summary of Report Status within the Overall Context of the Contaminated Land and Groundwater Site Assessment	iii
	Table 1: Site Location	1
	Table 2: Summary of Leak Information	1
	Table 3: Historical Activities within 500 m of the Site Boundary.....	4
	Table 4: Summary of Current Surrounding Land Use	8
	Table 5: Risk Matrix – Consequence versus Probability	12
	Table 6: Summary of the Preliminary Source, Pathway, Receptor Linkages (CSM).....	13

Table 7: Summary of Incomplete Source, Pathway, Receptor Linkages Considered	19
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FIGURES

Figure 1: Preliminary CSM for Site 14 (Deansgrange to Sallynoggin).....	iii
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DRAWINGS

Drawing 1

Site Location – Site 14

Drawing 2

Preliminary Source – Pathways – Receptors Identified

Drawing 3

Preliminary CSM (Identifying Pollutant Linkages) Deansgrange to Sallynoggin (Site 14)

APPENDICES

APPENDIX A

Photographic record of site walkover

APPENDIX B

MSDS for T3788 (LAB) and Mineral Oil

APPENDIX C

CIRIA C522 Risk Analysis Definitions

1.0 INTRODUCTION

ESB Engineering and Major Projects (ESB) has commissioned Golder Associates Ireland Limited (Golder) to complete a Preliminary Site Assessment (PSA) for historical loss of fluid from a high voltage (38 kV) cable run located between Deansgrange and Sallynoggin ('Site 14') (hereafter referred to as the 'Site').

The work has been completed by suitably qualified and experienced Golder (Ireland and UK) consultants. The curriculum vitae of the Golder consultants who worked on this report are available on request.

1.1 Background

ESB operates and maintains a large network of fluid insulated electrical cables across Ireland, with the majority (of fluid filled cables) located in urban settings across Dublin City and Cork City. Due to the location and age of the cables, they are potentially subject to third party interference and damage and/or corrosion and defects, which can potentially cause the cable fluid to leak into adjacent soil, groundwater, and/or surface water. ESB has requested that Golder complete a preliminary risk assessment in accordance with the EPA document "*Guidance on the Management of Contaminated Land and Groundwater at EPA Licenced Sites*" (EPA, 2013).

The Preliminary Site Assessment approach is considered conservative as it seeks to identify the potential source, and a broad range of initially theoretical pathway and receptor linkages present for each Site. The preliminary CSM identified potential source, pathway, and receptor linkages that may be present at the Site or caused by the leak. A qualitative risk analysis and evaluation was completed on each potential pollutant linkage identified. It is noted that where a potential risk is identified at this stage it does not necessarily mean a risk is present but that further investigation is required to either confirm the presence or absence of the risk. Where a potential linkage has been classified as either low or very low in the risk assessment no further action has been recommended to address this linkage as the actual risks identified in the low and very low risks have been sufficiently assessed in the PSA.

1.1.1 Site Location

The location of the cable leak, and 200 m Site limits (200 m each way along the cable length from the cable leak) are summarised in Table 1 and shown on Drawing 1.

Table 1: Site Location

	Leak Co-ordinates	200 m Cable Length Limit	200 m Cable Length Limit
Easting	324097	323920	226765
Northing	226858	324245	226928

The Site is located in Monkstown southeast of Dublin city centre. The leak occurred on Sallynoggin Road to the front of Woodies retailer.

1.1.2 Leak Information

The following information regarding the leak has been provided to Golder by ESB.

Table 2: Summary of Leak Information

Site ID	14
Incident Title	14 Deansgrange to Sallynoggin – August 2015
Circuit	Deansgrange - Sallynoggin 38 kV

Leak Start Date	March 2011
Leak Repair Date	March 2015
Leak Duration (months)	48
Total Leakage (litres)	3,812
Leakage Rate (litres/month)	80
Volume of Circuit (litres)	3,457
Year Circuit Installed	1950
Voltage (kV)	38
Cable Length (km)	1.9
Leak Size Minus Circuit Volume (litres)	335
Assumed Fluid	Linear alkyl benzene (LAB) / Mineral Oil Mix
Comment	Pre 1970 circuit. Leak size greater than circuit volume. Assume original fluid replace.
Local Authority	Dun Laoghaire Rathdown Council
Leak Location	On Sallynoggin road outside Woodies
Fluid/Oil Type	Cable fluid
Chemical Information	Linear Alkyl Benzene
Brand Name	T 3788
CAS Number	67774-74-7
Chemical Information	Blend of highly refined mineral oils and additives
Brand Name	F&G Masse 106 cable mineral oil
CAS Number	No CAS given on MSDS

No further historical reports or observations made at the time of the leak discovery or repair were available for review as part of this PSA.

1.2 Objectives

The objective of the work is as follows:

- To assess the environmental and human health impact associated with legacy cable fluid loss.

This has been completed in a risk-based staged approach, consistent with the process described in “*Guidance on the Management of Contaminated Land and Groundwater at EPA Licenced Sites*” (EPA, 2013).

1.3 Scope of Works

A summary of the scope of works proposed, which was developed following best practice guidance and relevant Irish legislation, is as follows:

- Desk study – summary of current and historical publicly available information and site-specific data (where available). This included a visit to Trinity College Dublin map library to collect relevant information;
- Site walkover – a walkover of the site was conducted by a suitably qualified Golder engineer, to identify visual or olfactory evidence of potential contamination or areas of concern. The Site walkover extended a minimum of 200 m along the cable length in each direction, and an appropriate lateral distance from the cable leak was determined following the presence of potential human health and/or environmental receptors and/or alternative potential contaminant sources; and
- Preliminary Risk Assessment – this includes the information gathered as part of the desk study and site walkover, which has been used to determine a preliminary Conceptual Site Model (CSM) identifying the potential source, pathway, and receptor linkages, and next stage recommendations.

More details on the proposed scope of work task summarised are included in proposal (P19126590.P1/V.1).

The Site walkover was conducted with no significant deviations from the proposed methodology. The length of the cable run was accessible 200 m each way from the indicative leak location.

2.0 SITE DESCRIPTION

The Site walkover was completed on 5 July 2019. The Golder engineer walked along the length of the cable; 200 m from the leak location in each direction (shown on Drawing 1). Whilst it is not expected that significant impacts will be observed at ground level above the leak location, a walkover was carried out for completeness.

2.1 Description of Leak Event

The ESB has provided Golder with information on the estimated quantities and types of fluid lost as presented in Section 1.1.2 above.

2.2 Current Site Conditions

2.2.1 Leak Location

No evidence of potential contamination from cable fluid/oily substances was observed at the indicative leak location during the Site walkover. Selected photographs of potentially relevant observations made during the Site walkover are provided in APPENDIX A with commentary.

2.2.2 Cable and Area in Proximity to Leak

No evidence of potential contamination from cable fluid/oily substances was observed along the 400 m cable length (200 m each way from the leak location) that we examined during the Site walkover. Selected photographs of potentially relevant observations made during the Site walkover are provided in APPENDIX A with commentary.

3.0 SITE HISTORY

3.1.1 Information Sources

- The Geological Survey of Ireland (GSI) online map viewer – dcenr.maps.arcgis.com, accessed 9 July 2019;

- The Geological Society of Ireland (GSI) Groundwater Bodies Summary for Dublin: http://spatial.dcenr.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/GWB/KilcullenGWB.pdf, accessed on 9 July 2019;
- Environmental Protection Agency (EPA) online map viewer - <https://gis.epa.ie/EPAMaps/>, accessed 9 July 2019;
- The National Monuments Service's Historic Environment Mapping Viewer - <http://webgis.archaeology.ie/historicenvironment/>, accessed 9 July 2019;
- The National Parks and Wildlife Service (NPWS) map data - <https://www.npws.ie/maps-and-data>, accessed 9 July 2019;
- The European Pollutant Release and Transfer Registers (E-PRTR) – <http://prtr.ec.europa.eu>, accessed 9 July 2019;
- The Geohive by Ordnance Survey Ireland – <https://geohive.ie/>, accessed 9 July 2019; and
- The Ireland Grid Reference - <http://gridreference.ie/>, accessed 9 July 2019.

Trinity Map Library was visited on 4 July 2019 to consult available historical maps relating to the indicative leak location, the 400 m cable length, and areas of interest located laterally from the cable run.

3.1.2 Potential Historical Sources

Historical activities that may have resulted in contamination sources are summarised in Table 3.

Table 3: Historical Activities within 500 m of the Site Boundary

Date	Detail
1869 (1:10,000)	<ul style="list-style-type: none"> ■ Less detailed than 1:2,500. ■ Sallynoggin Road present. ■ Agricultural land uses south of Sallynoggin Road. ■ Residential land uses directly north of Sallynoggin Road.
1907- 1909 (1:10,000)	<ul style="list-style-type: none"> ■ Less detailed than 1:2,500 maps. ■ Agricultural land uses south of Sallynoggin Road. ■ Residential land uses directly north of Sallynoggin Road.
1908 (1:2,500)	<ul style="list-style-type: none"> ■ Large dwelling located to the southwest of the Site. ■ Gate lodge located at park to southwest.
1936 (1:2,500)	<ul style="list-style-type: none"> ■ Agricultural land use south of Sallynoggin Road. ■ Residential land use directly north of Sallynoggin Road. ■ Large dwelling located southwest of the Site. ■ Gate lodge located at park to southwest.

Date	Detail
	<ul style="list-style-type: none"> ■ 'Tanks' indicated to the northeast of the park (park is located southwest of the indicative leak location).
1936-1937 (1:10,000)	<ul style="list-style-type: none"> ■ Less detailed than 1:2,500 maps. ■ Agricultural land uses south of Sallynoggin Road. ■ Residential land uses directly north of Sallynoggin Road. ■ 10 kV electrical line indicated south of the Site.
1974 (1:1,000)	<ul style="list-style-type: none"> ■ Residential land uses directly north of Sallynoggin Road. ■ Development present south of Sallynoggin Road. ■ Current Davies/Aldi site is identified as a 'Factory'. ■ Current Woodies site is identified as a 'Warehouse'. ■ 'ES' electrical substation indicated on northeast of the Site. ■ 'Tank' indicated northeast of the Site at the sorting office (close to new roundabout), (approximately 80 m northeast of 'ES'). ■ School indicated approximately 215 m to south of Site.
1986 (1:1,000)	<ul style="list-style-type: none"> ■ Similar layout to 1974. ■ More 'Tanks' indicated to the south of the Site.

4.0 CHEMICALS OF CONCERN

The information provided by ESB (summarised in Table 2) defines the chemicals present in the cable fluid are Linear Alkyl Benzene (LAB) present in cable fluid T 3788 (CAS 67774-74-7) and a blend of highly refined mineral oils and additives (CAS unknown). LAB and blended mineral oils and additives are the Chemicals of Potential Concern (COPC) discussed further in this PSA.

The European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. 9 of 2010) establish a new strengthened regime for the protection of groundwater in line with the requirements of the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC). Regulations 9(c)–(f) requires the Environmental Protection Agency to identify and publish a list of substances which are to be considered hazardous or non-hazardous and which the Agency considers to present an existing or potential risk of pollution.

The EPA published such a list of such substances in their guidance document "*Classification of Hazardous and Non-Hazardous Substances in groundwater*" (2010). In this document the EPA has classified four Linear Alkyl Benzene compounds as hazardous (CAS numbers 134211-53-3, 115963-94-5, 115733-08-9 and 96792-49-3) in groundwater. The LAB compound used by the ESB identified with CAS number 6777-74-7 is not classified in this list. It is noted that the EPA document referenced above states that only substances that have been reviewed may be classified as hazardous or non-hazardous. If a substance is yet to be reviewed, then it cannot be classified as non-hazardous. There may be several reasons that a substance has not been reviewed, such

as a lack of data on toxicity or bioaccumulation. In this instance Golder consider that the LAB used by ESB is not classified by the EPA with respect to being hazardous or non-hazardous in groundwater.

Mineral oil is listed as a hazardous substance in groundwater in the 2010 EPA guidance document.

The European Chemicals Bureau 1st Priority List (Volume 3) "Union Risk Assessment Report CAS No 67774-74-7" (1999) completed a risk assessment for LAB. The following conclusions about LAB were made in the report:

- In relation to incidental contact of workers with LAB there is no need for additional risk reduction measures beyond normal precautions for this material (such as correct use of PPE);
- It degrades aerobically;
- It is moderately volatile from water with a Henry's Law constant of 95 Pa.m³/mol;
- It is highly adsorptive to soil particles;
- It was not classified as toxic or hazardous under the EU legislation at the time of report issue;
- It was not classified as a skin irritant under EU legislation at the time of report issue;
- It was not classifiable as an eye irritant under EU legislation at the time of the report issue; and
- It was not classified as a skin sensitiser under EU legislation at the time of the report issue.

4.1 Review of Material Safety Data Sheet

4.1.1 Linear Alkyl Benzene

The Material Safety Data Sheet (MSDS) provided by ESB (H&R ESP, undated) to Golder identified the cable fluid as T 3788 which is a "low viscosity compound based on a blend of linear alkyl benzenes that have side alkyl chains of 10 – 13 carbon atoms in length." The MSDS is provided in APPENDIX B. A summary of the chemical properties for LAB as listed in the MSDS are as follows:

- Concentration range is 100%;
- Not classified as a dangerous substance in accordance with The Chemical (Hazard Information and Packaging for Supply) Regulations 2002;
- Clear, colourless liquid;
- Mild petroleum odour;
- pH not determined;
- Boiling point of 280 °C;
- Flash point of >135 °C;
- Not flammable (but will burn);
- Not explosive;
- Vapour pressure is low at 20 °C is <0.02 kPa;
- Density of 0.86 g/cm³ at 20 °C;
- Insoluble in water, a solubility value of 0.041 mg/l has been reported in the literature;
- Low volatility;

- Vapour density is >1 (air = 1);
- Evaporation rate is not determined;
- Human effects include skin and eye irritant, nausea and vomiting following ingestion, and irritant of the mucous membranes, cause dizziness, headaches, and nausea if inhaled; and
- No specific environmental hazards under normal use conditions.

LAB is used and manufactured extensively, most commonly in the production of linear alkyl benzene sulphonates (LAS), which are used in household and industrial cleaners and detergents. LAB has minor uses as a solvent and binder in speciality applications namely, cable oil, paint, insulation, electricity, and printing. Up to 1 % of LAS is expected to be LAB as the consequence of incomplete conversion during manufacture (Fernandez et al., 2002). Due to the wide use of LAS as a detergent and the discharge of LAS into the domestic sewer, the ultimate receiving environment for LAS and LAB is often the aquatic ecosystem. Concentrations of 0.001 – 2.2 mg/l of LAB has been reported in effluent discharge waters from municipal sewage treatment plants (Europe) (Fernandez et al., 2002).

LAB is produced from petroleum derivatives: benzene and linear paraffins and forms a mixture of long-alkyl chain LAB, with the alkyl group in various ranges (EC, 1997). The LAB used by ESB contains an alkyl chain group restricted to the range of C₁₀ – C₁₃ carbon atoms, and which are produced under the Chemical Abstract Service (CAS) registration number: 67774-74-7.

The “LAB and Derivatives” REACH Consortia (ReachCentrum, 2012) list LAB as a “*substance of unknown variable composition, complex reaction products or biological materials*”, or ‘UVCB’, for the purpose of chemical classification, labelling, and registration in the information for suggested entry into the International Uniform Chemical Information Database (IUCLID).

LAB is less dense than water, and due to its insolubility, it is likely to act as a Light Non-Aqueous Phase Liquid (LNAPL) when in contact with water (e.g. groundwater or surface water).

4.1.2 Blended Mineral Oil and Additives

The Material Safety Data Sheet (MSDS) provided by ESB (F&G, 1995) to Golder identified the cable fluid as Masse 106 which is a “*blend of highly refined mineral oils and additives.*” The MSDS is provided in APPENDIX B. A summary of the chemical properties for the blended mineral oil as listed in the MSDS are as follows:

- Yellow liquid (under most environmental conditions);
- Pourpoint of < -60°C;
- Flashpoint of 145°C;
- Flammability lower limit 0.6 vol %, and higher limit of 6.5 vol%;
- Vapour pressure at 20°C is <0.01 hPa;
- Density of 888 kg/m³ (floats on water);
- Negligible solubility;
- N-octane/water partition coefficient is not applicable;
- Stable under normal conditions;
- Readily adsorbed to soil particles (limited mobility);
- May bioaccumulate;

- Expected to be practically non-toxic to aquatic organisms, LC/EC50 >100 mg/l;
- Not readily biodegradable; and
- Human health effects include aspiration to lungs may cause chemical pneumonitis from inhalation or ingestion, and dermatitis through skin contact.

At present without further information identifying the mineral oil (no CAS number is available for the product) it is not possible to make specific comments about this product. Golder notes that mineral oils are typically aliphatic range hydrocarbons with chain lengths of between 11 and 40 carbon atoms. The additives to these mineral oils are unknown. The vapour pressure indicates that the product is not volatile.

It is noted that the EPA classifies mineral oil as a hazardous substance in groundwater as per the EPA (2010) guidance on this issue.

5.0 ENVIRONMENTAL SETTING

5.1.1 Information Sources

Information regarding geology, hydrology, hydrogeology and environmentally sensitive areas for the Site and surrounding area has been primarily obtained from publicly available sources outlined in Section 3.1.1.

5.1.2 Topography

The Site lies at an elevation of approximately 40 m above Ordnance Datum (m AOD) according to Ireland Grid Reference. The local topography falls to the north towards the Dublin Bay.

5.1.3 Current Surrounding Land Use

A summary of land use surrounding the leak location is provided in Table 4.

Table 4: Summary of Current Surrounding Land Use

Direction from Leak Location	Description of Current Land Use
North	To the north lies residential and commercial areas. Sallynoggin Health Centre lies approximately 363 m to the northeast. Honeypark playground lies approximately 470 m to the northwest of the Site.
East	To the east lies primarily commercial and residential areas beyond.
South	To the south lies residential areas. Approximately 188 m and 298 m to the southeast of the Site lies two schools.
West	To the west lies primarily residential and some commercial areas.

Overall the Site is generally surrounded by commercial and residential areas. The indicative leak location lies within an area of commercial properties primarily to the south and residential to the north. The majority of the cable length to the southwest of the leak is primarily surrounded by residential properties.

5.1.4 Current Waste Permits, IPC and IE Licences in Area of Site

A review of the data available on the EPA online maps shows that there are no Integrated Pollution Control (IPC) licenced facilities, or Industrial Emission licenses (IE) within 500 m of the Site. There are no registered waste permit holders for processing of mineral oil or LAB containing fluids within 500 m of the Site.

5.1.5 Sensitive Ecological Receptors

A review of the data available on the National Parks and Wildlife Service (NPWS) map viewer shows that there are no special protection areas (SPAs), natural heritage areas (NHAs), or special areas of conservation (SAC) within 500 m of the Site. The nearest protected sites are the South Dublin Bay SAC (000210) and South Dublin Bay and River Tolka Estuary SPA (004024) located approximately 2.15 km north of the site. This location is also a proposed Natural Heritage Area (pNHA). At this distance from the indicative leak location, these sites are not considered a potential receptor as there is no viable pathway present. We note that this report does not represent an ecological assessment and that if such assessments are required will be completed separately by a suitably qualified ecologist as appropriate.

5.1.6 Hydrology

5.1.6.1 Surface Water Features

The Site lies within the “Liffey and Dublin Bay” Water Framework Directive catchment. The nearest surface water feature is Monkstown Stream (also known as Brewery Stream) located approximately 390 m northwest of the Site. A small pond in Honeypark playground lies approximately 470 m northwest of the Site.

5.1.6.2 Surface Water Quality

The WFD catchment area is known as the “Liffey and Dublin Bay” catchment. According to the EPA River Waterbodies Risk map, the Monkstown Stream (also known as Brewery Stream) located approximately 390 m northwest of Site is under review by the Water Framework Directive. The Monkstown Stream (Brewery Stream) Waterbody WFD status is unassigned at present.

5.1.6.3 Surface Water Abstraction

The GSI online map viewer did not show any Group Water Scheme Abstraction points within a 500 m radius of the Site.

5.1.6.4 Discharges to Surface Water

A review of the data available on the EPA map register shows there are no Section 4 Discharges within a 500 m radius of the Site.

5.1.6.5 Surface Water Flooding

Rainfall flood extents data was not available for this Site. Two past flood events are indicated approximately 225 m northeast of site, but these could not be queried.

5.1.6.6 Pollution Releases to Land, Air and Water

The European Pollutant Release and Transfer Register (E-PRTR), compiles data on releases of pollutants and transfer of wastes for specified industries across the EU for 91 pollutants. LAB and mineral oil are not listed as specified pollutants in this register.

5.1.7 Geology

5.1.7.1 Artificial Ground

The EPA National soils map shows that Made Ground deposits are present beneath the site, the depth of which deposits are unknown.

5.1.7.2 Superficial and Bedrock Geology

The GSI Subsoils (Quaternary Sediments) maps shows the subsoil to be Till derived from granites. A review of the Bedrock Geology 1:100,000 map (GSI) shows that the underlying bedrock geology to be Type 2p Microcline Porphyritic (Northern and Upper Liffey Valley Plutons). This is described as being granite with microcline phenocrysts. These form part of the Granites and Other Igneous Intrusive rocks.

5.1.7.3 *Faulting*

The Bedrock Geology 1:500,000 map (GSI) Faults map indicates that there are no faults within a 1 km radius of the Site.

5.1.8 *GSI Borehole Logs*

The nearest registered well or spring is a cluster of multiple wells located approximately 820 m southwest of Site, but these are not considered a receptor at that distance from the Site. The GSI geotechnical viewer showed a borehole located approximately 385 m northeast from Site which was drilled to a depth of 8.5 m below Ground Level (bGL) (GSI reference R5839/136808). The geology encountered was recorded as Made Ground to 1.5 m bGL, underlain by brown slightly sandy gravelly clay to 2.2 m bGL, black slightly sandy clay to 3.2 m bGL, stiff brown gravelly clay to 4 m bGL and brown gravelly clay to 8.2 m bGL. Boulders were encountered at 8.5 m bGL. A depth to groundwater was not recorded.

5.1.9 *Hydrogeology*

5.1.9.1 *Groundwater Vulnerability*

The GSI Bedrock Aquifer map shows the Site to have moderate vulnerability to groundwater contamination. Approximately 100 m east of the Site the groundwater vulnerability is high. Approximately 110 m west of the Site the groundwater vulnerability is low. The bedrock aquifer is described as a poor aquifer. According to GSI, this is bedrock which is generally unproductive except for local zones.

5.1.9.2 *Discharges to Groundwater*

A review of the data available on the EPA map register shows there are no known Section 4 discharges to within 500 m.

5.1.9.3 *Groundwater Group Water Scheme Abstraction Points*

The GSI online map viewer did not show any Group Water Scheme Abstraction points within a 500 m radius of the Site. The Site does not lie within a groundwater source protection zone.

5.1.9.4 *Groundwater Flow Directions*

There is no published information on groundwater levels or flow direction for the area of the Site. It is anticipated that groundwater beneath the Site will flow in a generally easterly direction towards the coast. However, this has not been confirmed at this time, with Site-specific data.

5.1.9.5 *Groundwater Quality*

The Groundwater Body (GWB) underlying the site is known as the Kilcullen GWB. The Kilcullen GWB is approximately 642 km² in areal extent. The GSI classifies this GWB as poorly productive bedrock. According to the EPA Ground Waterbody Water Framework Directive (WFD) map, the groundwater waterbody status is classified as good. The groundwater is also listed as flowing through SAC species areas and habitats, and SPA habitats. This statement applies to the entire GWB and is not specific to the leak location.

6.0 *PREVIOUS SITE SAMPLING AND MONITORING DATA*

ESB has confirmed that there is no Site sampling and monitoring data, or observation reports available for the Site.

7.0 *PRELIMINARY CONCEPTUAL SITE MODEL*

The PSA is the first tier of a risk assessment; the purpose of the PSA is to develop a preliminary Conceptual Site Model (CSM) for the Site and establish whether or not there are potentially unacceptable risks. The outcome of the PSA is a decision as to whether or not further action is needed.

7.1 Context of the PSA

This PSA is being conducted to assist ESB with managing its potential liabilities associated with the Site.

7.2 Development of the Preliminary CSM

A preliminary CSM has been established from the data obtained from the following sources:

- Publicly available data;
- Trinity College Dublin Map library;
- ESB provided data; and
- Site walkover observations.

In the definition that has become accepted by the environmental industries and regulators (and discussed in the EPA (2013) “*Guidance on the management of contaminated land*”), there are three components to consider when developing a CSM:

- The *source* is the COPC identified, specifically it is the leak of the known cable fluid;
- The *pathways* are any routes linking the source with the receptors (in which degradation processes may also occur); and
- The *receptors* are humans and controlled waters that are connected to the source by the pathways, such as soils, vapours, aquifers, surface watercourses, local supply boreholes, or springs. Whilst ecological receptors are not normally considered in preliminary risk assessment protected species/habitats are considered here to flag any potential issues that may require further detailed assessment.

These three components are linked within a conceptual model for a site. Should either one of the source, pathway, or receptor be absent from the site setting, the pollutant linkage is deemed not to be present therefore negligible risk will be posed to human health and/or controlled water environments.

7.3 Description of the Source

The source is the indicative leak location of the fluid filled cable (Eastings: 324097, Northing: 226858) (locations obtained from georeferenced ESB provided drawing, reference QD-354120-01-D460-001-018-001, dated 26 June 2019 (provided in Drawing 1). ESB estimate the total loss of cable fluid over the leak period as approximately 3,812 L. The ESB has stated that the leak was repaired in March 2015.

A summary of the source (LAB and mixed mineral oil) is provided in Section 4.0.

7.4 Description of the Pathways

A description and summary of the potential pathways identified is provided in Table 6.

The trenches for the cable runs are likely to be the primary potential pathway for the cable fluid migrate away from the indicative leak location. Details of a typical cable trench construction (provided by ESB) is as follows:

- Depth to the base of trench 1,200 mm;
- Depth to top of cable 900 mm – 1,000 mm;
- Thickness of sand surrounding cables 350 mm;
- Width of trench 1,100 mm; and
- Backfill is either arisings or Clause 804 (gravel up to 75 mm diameter).

7.5 Description of the Receptors

A description and summary of the potential receptors identified is provided in Table 6.

Drawing 2 provides an overview of the source and potential sensitive receptors located within 1 km of the Site. Sensitive receptors comprise of human health risks (e.g. schools or hospitals), or risks to controlled waters (e.g. rivers or lakes). Groundwater receptors (unless a potable borehole abstraction point is identified) are not shown on Drawing 2.

7.6 Preliminary Conceptual Site Model Risk Analysis

The potentially significant source-pathway-receptor linkages present at the Site and surrounding area (200 m along the cable length from the indicative leak location each way, and up to 500 m laterally from the cable run) are summarised in Table 6.

The level of potential risk of the identified pollutant linkage to human health and/or controlled waters and protected species and natural habitats has been completed with reference to CIRIA guidance document C522 “Contaminated Land Risk Assessment a Guide to Good Practice” (2002). This document presents a qualitative framework for evaluating risk which is useful at the PSA stage, prior to intrusive investigations being completed. C522 presents a risk matrix that allows a qualitative expression of:

- Magnitude of a potential consequence (severity) of a risk occurring; and
- Magnitude of the probability (likelihood) of the risk occurring.

Table 5: Risk Matrix – Consequence versus Probability.

		Consequence (of risk being realised)			
		Severe	Medium	Mild	Minor
Probability (of risk being realised)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

A detailed description of the probability and consequence definitions is provided in CIRIA guidance document C522. These definitions are also provided in APPENDIX C. Golder has applied this methodology to the identified pollutant linkages for this Site and presented the findings in Table 6. Each identified pollutant linkage has been numbered and a qualitative risk rating applied to the linkage. Comments are provided for consideration of the risk evaluation for each linkage.

Table 6: Summary of the Preliminary Source, Pathway, Receptor Linkages (CSM)

Linkage Number	Source	Pathway	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Comments
1	Free-phase LAB and blended mineral oil from the cable leak	Migration along the cable trench through the permeable infill materials	1a) Groundwater and/or 1b) surface water: direct contact or adjacent to the trench, likely to act as a LNAPL	1a) Medium 1b) Medium	1a) Likely 1b) Unlikely	1a) Groundwater - Moderate 1b) Surface water - Low Risk (for the Monkstown Stream)	<p>1a) The thickness of the Till at the Site is unknown, and as groundwater vulnerability status' changes from 'high' to 'low' within 100 to 150 m of the Site ('moderate' at the Site location), this indicates that there may be variability in the thickness in this location. The bedrock groundwater body is designated as 'poorly productive', but quality is 'good'. Shallow/perched groundwater may be present in the Made Ground. Mineral oil is classified as hazardous in groundwater. Considering the relative geology there may be shallow groundwater at the spill location which could be impacted. This needs to be confirmed.</p> <p>1b) The nearest surface water receptor is Monkstown Stream (also known as Brewery Stream) approximately 390 m northwest of the Site. Migration in the cable trench will be gradient driven and the surface water receptor is upgradient of the trench and so surface water is considered to be a low risk.</p>

Linkage Number	Source	Pathway	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Comments
2		Migration along other service trenches/pipes	2a) Groundwater and/or 2b) Surface water: direct contact or adjacent to the trench, likely to act as a LNAPL	2a) Medium 2b) Medium	2a) Likely 2b) Unlikely	2a) Groundwater - Moderate Risk 2b) Surface water – Low Risk (for the Monkstown Stream)	<p>2a) The thickness of the Till at the Site is unknown, and as groundwater vulnerability status' changes from 'high' to 'low' within 100 to 150 m of the Site ('moderate' at the Site location), this indicates that there may be variability in the thickness in this location. The bedrock groundwater body is designated as 'poorly productive', but quality is 'good'. Shallow/perched groundwater may be present in the Made Ground. Mineral oil is classified as hazardous in groundwater. Considering the relative geology there may be shallow groundwater at the spill location which could be impacted. This needs to be confirmed.</p> <p>2b) The nearest surface water receptor is Monkstown Stream (also known as Brewery Stream) approximately 390 m northwest of the Site. Migration in the cable trench will be gradient driven and the surface water receptor is upgradient of the trench and so surface water is considered to be a low risk.</p>

Linkage Number	Source	Pathway	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Comments
3			Mains water pipes	Mild (due to presence of mineral oil)	Unlikely	Very Low Risk	Mains water pipes remain in positive pressure, ensuring that any water in areas of damaged pipework/leaks is forced out from the pipe, rather than allowing ingress into the water pipes. At this time, LAB and mineral oil is not known to be aggressive to plastic or metal pipework, or cause leaching from plastic pipework.
4		Volatilisation and migration of vapours, accumulation in subsurface ducts, services, cellars, basements etc via inhalation	Residents or workers in basement apartments or offices	Medium	Low likelihood	Moderate / Low Risk	At this time, it is not known if LAB and blended mineral oil has migrated to building footings adjacent to the spill location or into possible building basements. LAB is not considered toxic. Mineral oil may aspirate to lungs and may cause chemical pneumonitis from inhalation. Due to the low vapour pressure of the cable fluids, the probability of the risk is classified as low, giving an overall risk ranking of moderate / low risk.
5	LAB and blended mineral oil in unsaturated soils from the cable leak	Vertical and lateral migration of LAB and blended mineral oil	Local residents with gardens: direct ingestion and dermal	Mild (due to the presence of Mineral Oil)	Low likelihood	Low Risk	No surface outbreaks of the COPC was observed and are not considered likely. Considering that LAB is not classified as toxic, or hazardous to health, or a skin or eye irritant, the consequence of incidental contact is considered low. The mild

Linkage Number	Source	Pathway	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Comments
		through the unsaturated zone	contact with soils; Plant uptake				consequence is related to mineral oil which can be a skin irritant. Mineral oil may aspirate to lungs and may cause chemical pneumonitis from inhalation and ingestion. Residential housing is some distance from the leak location and COPCs are likely to stay at a depth greater than 0.9 m making the potential for plant uptake highly unlikely.
6		Infiltration of rain, leaching of contaminants, and vertical/horizontal migration of dissolved contaminants	Groundwater	Medium	Likely	Moderate Risk	The thickness of the Till at the Site is unknown, and as groundwater vulnerability status' changes from 'high' to 'low' within 100 to 150 m of the Site ('moderate' at the Site location), this indicates that there may be variability in the thickness in this location. The bedrock groundwater body is designated as 'poorly productive', but quality is 'good'. Shallow/perched groundwater may be present in the Made Ground. Mineral oil is classified as hazardous in groundwater. Considering the relative geology there may be shallow groundwater at the spill location which could be impacted. This needs to be confirmed.

Linkage Number	Source	Pathway	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Comments
7		Volatilisation (low volatilisation) and migration of vapours, accumulation in subsurface ducts, services, cellars and basements etc via inhalation	Residents or workers in basement apartments or offices	Medium	Low likelihood	Moderate / Low Risk	At this time, it is not known if LAB and blended mineral oil has migrated to building footings adjacent to the spill location or into possible building basements. LAB is not considered toxic. Mineral oil may aspirate to lungs and may cause chemical pneumonitis from inhalation. Due to the low vapour pressure of the cable fluids, the probability of the risk is classified as low, giving an overall risk ranking of moderate / low risk.
8	LAB and blended mineral oil in groundwater from the cable leak (low solubility)	Dissolution of contaminants, vertical and lateral migration of dissolved contaminants in groundwater	8a) Groundwater Impacts to the groundwater body beneath the Site which has currently "Good" status and/or 8b) surface	8a) Medium 8b) Medium	8a) Likely 8b) Unlikely	8a) Groundwater - Moderate Risk 8b) Surface water – Low Risk (for the	8a) The thickness of the Till at the Site is unknown, and as groundwater vulnerability status' changes from 'high' to 'low' within 100 to 150 m of the Site ('moderate' at the Site location), this indicates that there may be variability in the thickness in this location. The bedrock groundwater body is designated as 'poorly productive', but quality is 'good'. Shallow/perched groundwater may be present in the Made Ground. Mineral oil is classified as hazardous in groundwater. Considering the relative geology there may

Linkage Number	Source	Pathway	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Comments
			water: direct contact or adjacent to the trench. Impacts to the groundwater body beneath the Site which has currently "Good" status			Monkstown Stream)	<p>be shallow groundwater at the spill location which could be impacted. This needs to be confirmed.</p> <p>8b) The nearest surface water receptor is Monkstown Stream (also known as Brewery Stream) approximately 390 m northwest of the Site. Although not proven the surface water receptor is considered to be up gradient of the trench and so surface water is considered to be a low risk.</p>
9		Volatilisation (low volatilisation) and migration of vapours, accumulation in subsurface ducts, services, cellars and basements etc via inhalation	Residents or workers in basement apartments or offices	Medium	Low likelihood	Moderate / Low Risk	At this time, it is not known if LAB and blended mineral oil has migrated to building footings adjacent to the spill location or into possible building basements. LAB is not considered toxic. Mineral oil may aspirate to lungs and may cause chemical pneumonitis from inhalation. Due to the low vapour pressure of the cable fluids, the probability of the risk is classified as low, giving an overall risk ranking of moderate / low risk.

Notes: PPE = Personal Protective Equipment.

Drawing 3 provides a visual representation of Table 6, and highlights the potential pollutant linkages identified in the preliminary CSM assessment.

As defined in the guidance, risk is only realised when a linkage is proven between the source, pathway, and receptor. The linkage must be present between all three elements for a risk to be realised. Risk due to short term exposure, for example ground workers, are not considered here as they should be managed by appropriate use of PPE or other measures identified in a contractors Risk Assessment and Method Statement (RAMS) documents. During the risk analysis, Golder reviewed several relevant source, pathways, and receptors, and subsequently discounted the risks shown in Table 7, as there are incomplete linkages i.e. a potential risk not possible for a given scenario.

Table 7: Summary of Incomplete Source, Pathway, Receptor Linkages Considered

Source	Pathway	Receptor	Pollutant Linkage Identified?
3,812 L LAB and blended mineral oil from cable approximately 0.9 m deep under Sallynoggin Road	Dust and soil (from near surface soils) ingestion – area covered by hardstanding and leak occurring approximately 0.9 m from surface.	Short-term Public (i.e. passers-by, not workers)	Pathway linkage not viable
3,812 L LAB and blended mineral oil from cable approximately 0.9 m deep under Sallynoggin Road	Dermal contact (from near surface soils) – area covered by hardstanding and leak occurring approximately 0.9 m from surface (not in contact with surface soils).	Short-term Public (i.e. passers-by, not workers)	Pathway linkage not viable
3,812 L LAB and blended mineral oil from cable approximately 0.9 m deep under Sallynoggin Road	Dust (from near surface soils) inhalation – area covered by hardstanding and leak occurring approximately 0.9 m from surface.	Short-term Public (i.e. passers-by, not workers)	Pathway linkage not viable
3,812 L LAB and blended mineral oil from cable approximately 0.9 m deep under Sallynoggin Road	Migration in groundwater - the closest protected species/habitats are the South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA. The groundwater flow direction is not defined for the Site; however, the	Protected Species or habitats; South Dublin Bay SAC / pNHA and South Dublin Bay and River Tolka Estuary SPA	Pathway linkage not viable

Source	Pathway	Receptor	Pollutant Linkage Identified?
	distance from the source to the SAC/SPA is 2.15 km.		
3,812 L LAB and blended mineral oil from cable approximately 0.9 m deep under Sallynoggin Road	Volatisation and migration of vapours, accumulation in underground ducts, services, cellars and basements.	Ground workers – Short term exposure risk is not assessed in the PSA as it is outside the scope of this report. Short term exposure risks to workers are assessed as part of the Health and Safety Risk assessment (RAMS). Standard PPE measures apply for workers engaged in groundworks in Made Ground to minimise contact with potential contaminants and additional measures are not considered necessary.	Short term exposure risks not examined in the PSA which deals with long term (chronic) risks to receptors.

8.0 RISK EVALUATION

Potential pollutant linkages that could impact the identified receptors have been identified in the Preliminary CSM assessment. These linkages have been identified where the source, pathway, and receptor are all present and potentially viable, and the source is therefore considered to pose a theoretical risk to the identified receptors.

As discussed in the CSM, the closest protected habitats or species are the South Dublin Bay SAC and the South Dublin Bay and River Tolka Estuary SPA. These sites are located approximately 2.15 km from the leak location and are not considered viable receptors at this location as no pathway exists over this distance in soil or groundwater to impact these sites.

Golder recognises that at present the ability of LAB and mineral oil to penetrate water pipes is not a fully understood risk, albeit likely to be a low risk. In the event that LAB was able to penetrate water pipes, then it is possible to examine the potential for LAB to dissolve in the water in the pipes and compare this to potential toxicity and drinking water limits (if available).

The WHO drinking water guideline value for EC₁₀–EC₁₂, EC₁₂–EC₁₆ aromatic fraction (*Petroleum Products in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, 2008*) is 0.09 mg/l. The solubility limit of LAB is 0.041 mg/L (OECD). Therefore, it is not possible for LAB to dissolve into water in supply pipes above the drinking water limit i.e. the drinking water guidance cannot be exceeded. Furthermore, presuming permeation of LAB through the pipe is occurring, the maximum solubility limit (0.041mg/l) could potentially be reached if water within the pipe was stagnant and allowed to fully dissolve or equilibrate over time; however, Golder understands that water will be moving in the pipe making it difficult for LAB to reach its solubility limit.

Accordingly, the probability of the risk would be considered unlikely i.e. pollutant linkage may be present in such a scenario, but the circumstances under which harm would occur are improbable. Therefore, along with a medium potential hazard, this would result in an overall rating of 'Low Risk'.

At present Golder consider that the potential vertical migration of LAB and blended mineral oil through the Till to be low; however, the thickness is unknown and may be variable; therefore the risks to the groundwater body from this leak has been classified as a Moderate Risk. There may also be shallow/perched groundwater present in the Made Ground adjacent to the indicative leak location, which are not protected from migration of LNAPL/dissolved phase LAB by the Till. Migration of COPCs into shallow groundwater presents a Moderate Risk.

In addition, volatilisation and migration of vapours and subsequent accumulation in basement apartments or offices has been identified as a risk to residents and workers. At this time, it is not known if LAB and blended mineral oil has migrated to building footings adjacent to the spill location or into possible building basements. LAB is not considered toxic, however mineral oil may aspirate to lungs and may cause chemical pneumonitis from inhalation; therefore, this has been classified as a Moderate/Low Risk.

The availability of lateral preferential pathways along ducting routes is most likely to be the primary migration pathway for this Site due to the likely presence of industrial and residential properties within close proximity of the indicative leak location.

8.1 Conclusions

Due to the known leak of cable fluid into the permeable cable trench material, and the unknown characteristics (e.g. permeability) of the Made Ground likely to be surrounding the trench, there is the potential for lateral migration of contaminants along ducting routes and vertically towards shallow groundwater. These are considered to be the primary risk drivers for this Site at present.

Golder will present recommendations to address the potential risks under separate cover.

9.0 REFERENCES

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Signature Page

Golder Associates Ireland Limited

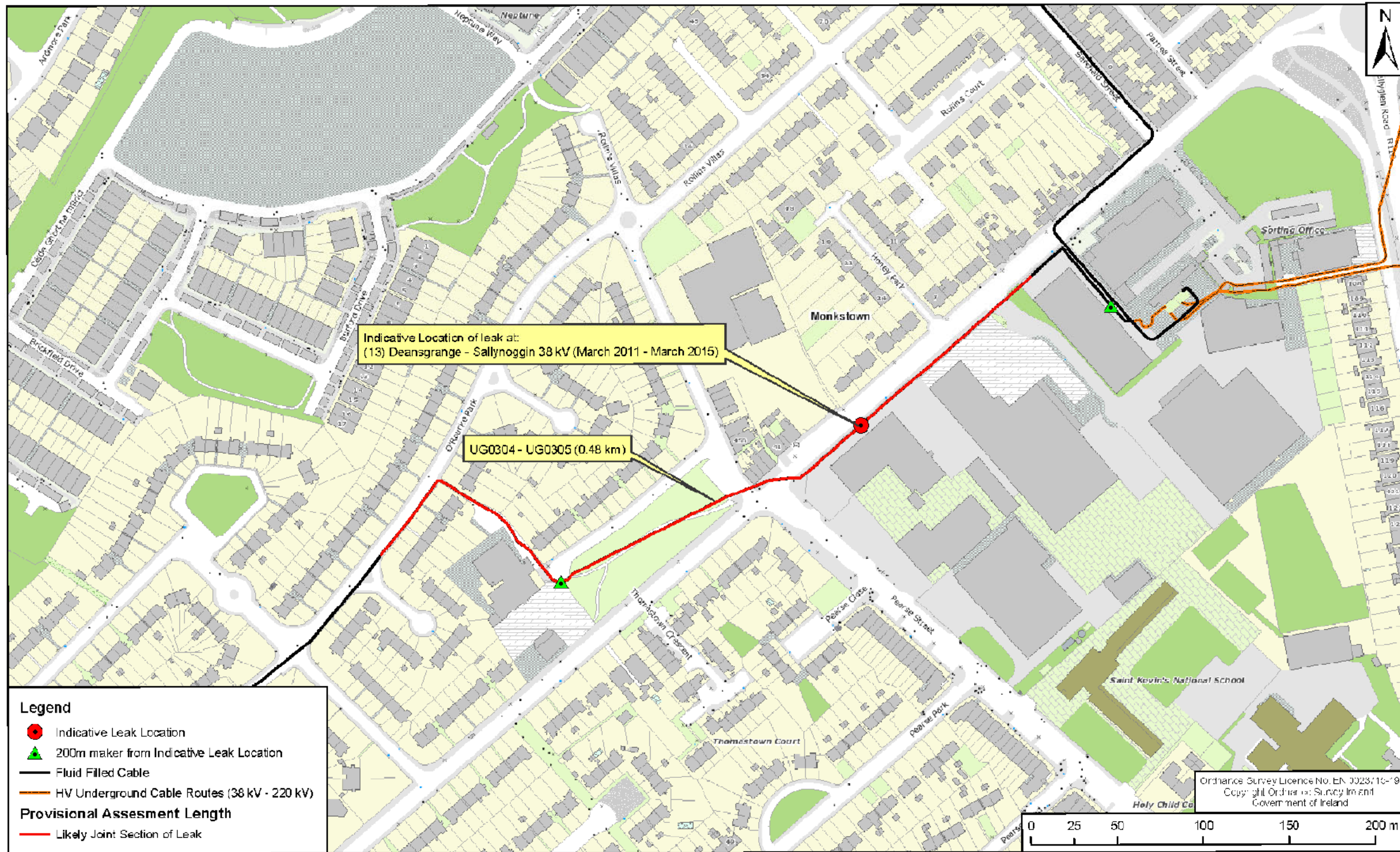

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Drawings



Legend

- Indicative Leak Location
- ▲ 200m marker from Indicative Leak Location
- Fluid Filled Cable
- HV Underground Cable Routes (38 kV - 220 kV)

Provisional Assessment Length

- Likely Joint Section of Leak

NO.	DESCRIPTION	DATE	BY	CHKD BY

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Energy for generations

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CLIENT: **ESB Networks**

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

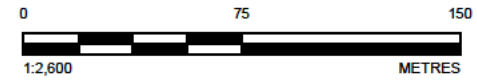
PRODUCTION UNIT: **Civil & Environmental Engineering**

DRAWING TITLE: **Indicative Cable Fluid Leakage Locations & Cable Sections (13) Deansgrange - Sallynoggin 38 kV (March 2011 - March 2015)**

DESIGN	PRODUCED	CHKD BY	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	26/08/2019
DRAWING NUMBER: 00-00		NO. OF SHEETS: 1	SHEET: 1 of 1	SCALE: A3 1:2,000

QD-354120-01-D460-001-018-001

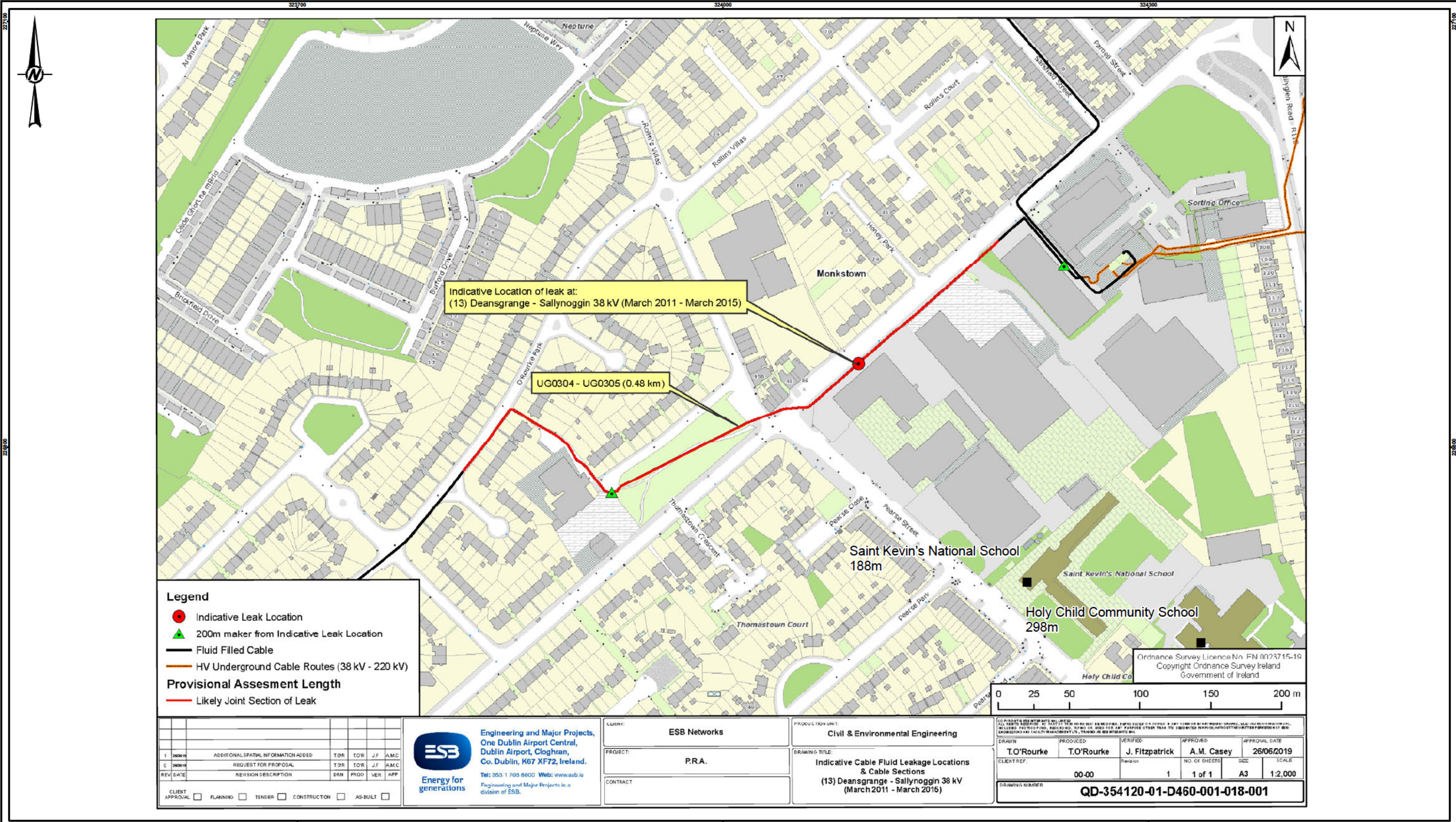
DRAFT FOR ISSUE



REFERENCE(S)
1. COORDINATE SYSTEM: TM65 IRISH GRID

CLIENT ESB	PROJECT ENVIRONMENTAL ASSESSMENTS OF ESB NETWORKS HISTORIC FLUID FILLED CABLE LOSS																		
CONSULTANT GOLDER	TITLE SITE LOCATION - SITE 14																		
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Legend

- Indicative Leak Location
- ▲ 200m marker from Indicative Leak Location
- Fluid Filled Cable
- HV Underground Cable Routes (38 kV - 220 kV)

Provisional Assessment Length

- Likely Joint Section of Leak

REV	DATE	DESCRIPTION	DRN	PRG	VER	APP
1	26/06/19	ADDITIONAL SPATIAL INFORMATION ADDED	TOR	TOR	J.F.	A.M.C.
0	26/06/19	REQUEST FOR PROPOSAL	TOR	TOR	J.F.	A.M.C.

CLIENT APPROVAL PLANNING TENDER CONSTRUCTION AS-BUILT

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CLIENT: **ESB Networks**

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

CONTRACT:

PRODUCTION UNIT: **Civil & Environmental Engineering**

DRAWING TITLE: **Indicative Cable Fluid Leakage Locations & Cable Sections (13) Deansgrange - Sallynoggin 38 kV (March 2011 - March 2015)**

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DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	26/06/2019
CLIENT REF.	00-00	Revision	NO. OF SHEETS	SHEET
		1	1 of 1	A3
DRAWING NUMBER	QD-354120-01-D460-001-018-001			

LEGEND

- Receptor

Receptors 500 - 1000 m from Leak Location

Distance in Metres	Direction from Leak Location	Receptor Description
658	SE	Rathdown School
580	SE	Dalkey School Project
610	SW	National Rehabilitation Hospital
748	NW	Dun Laoghaire Institute Art and Design
748	NW	Monkstown National School
390	NW	Monkspath Stream (Brewery Stream)
470	NW	Small Pond in Park (Honey Park)
960	N	Saint Joseph's National School
365	NE	Sallynoggin Health Centre

DRAFT FOR ISSUE

0 75 150
1:2,600 METRES

REFERENCE(S)
1. COORDINATE SYSTEM: TM65 IRISH GRID

CLIENT: **ESB**

PROJECT: **ENVIRONMENTAL ASSESSMENTS OF ESB NETWORKS HISTORIC FLUID FILLED CABLE LOSS**

CONSULTANT: **GOLDER**

YYYY-MM-DD: **2019 JUL 11**

DESIGNED: **KP**

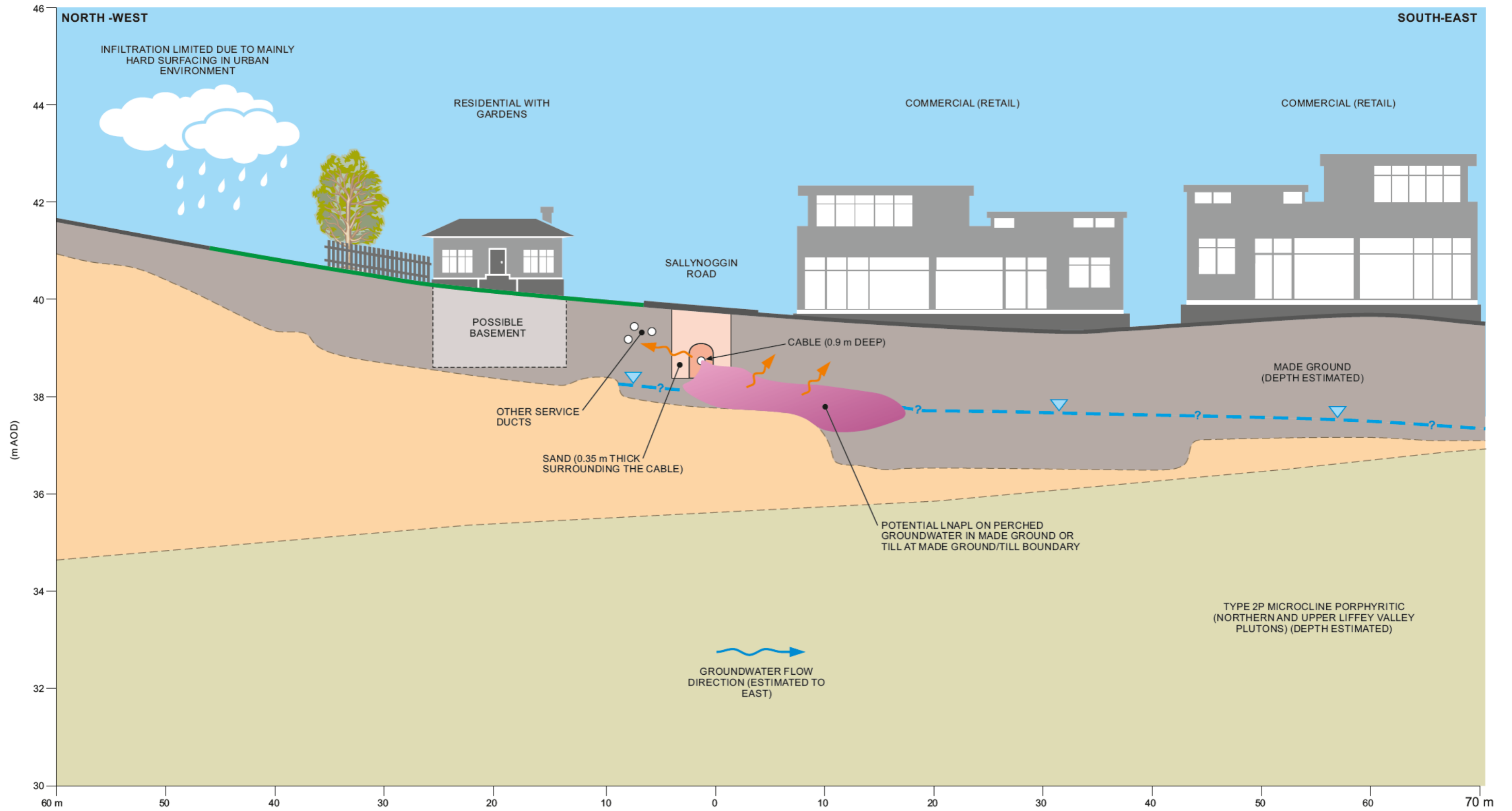
PREPARED: **KP**

REVIEWED: **TM**

APPROVED: **EMCA**

TITLE: **PRELIMINARY SOURCE - PATHWAYS - RECEPTORS IDENTIFIED**

PROJECT NO. **19126590** CONTROL **600-SW-033** REV. **B.0** DRAWING **2**



LEGEND

- POTENTIAL PERCHED GROUNDWATER IN MADE GROUND
- VAPOUR MIGRATION

CLIENT
ESB

CONSULTANT



YYYY MM DD	2019 08 12
PREPARED	ECS
DESIGN	EMcA
REVIEW	EMcA
APPROVED	TM

PROJECT
ENVIRONMENTAL ASSESSMENTS OF ESB NETWORKS HISTORIC
FLUID FILLED CABLE LOSS

SHEET TITLE
PRELIMINARY CSM (IDENTIFYING POLLUTANT LINKAGES)
DEANSGRANGE TO SALLYNOGGIN (SITE 14)

PROJECT NO	CONTROL	REV	DRAWING
19126590	1001 EA 0013	A	3

APPENDIX A

**Relevant Photographs Recorded
During the Site Walkover**



14-01 – Different concrete present at indicative leak location, suggesting more recent works in that area.



14-02 – Damage / repair works to wall adjacent to indicative leak location.



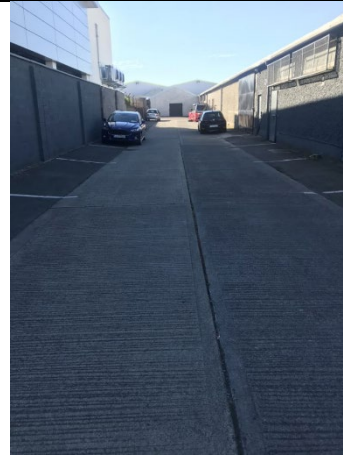
14-03 – Conduit covers on Sallynoggin Road adjacent to indicative leak location.



14-04 – Road surfacing in generally good condition on Sallynoggin Road.



14-05 – Road surfacing in generally good condition on Sallynoggin Road. With shallow surface water runoff drainage channels.



14-06 – Cabling turns southeast from Sallynoggin Road towards the electrical substation (at northeast of the Site). The access lane above the line is composed of concrete which was in a good condition.



14-07 – No evidence of surface works, surface staining or dieback to the southwest of the Site within the park between O'Rourke Park and Sallynoggin Road.



14-08 – No evidence of surface works, surface staining or dieback to the southwest of the Site at O'Rourke Park.

APPENDIX B

**MSDS for T 3788 (LAB) and
Masse 106 Mineral Oil**



MATERIAL SAFETY DATA SHEET

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

Product Name: T 3788
Application: Hollow-core Energy Cable Saturant
Company: H&R ESP Ltd.
Address: Matrix House
North 4th Street
Milton Keynes, MK9 1NJ
United Kingdom

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

2: COMPOSITION / INFORMATION ON INGREDIENTS

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

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

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

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

3: HAZARDS IDENTIFICATION

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

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

Health Effects

<u>Skin:</u>	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.
<u>Eyes:</u>	Contact with the eyes may cause irritation. Symptoms may include reddening, swelling and impaired vision.
<u>Ingestion:</u>	Ingestion of small amounts may cause nausea and vomiting.
<u>Inhalation:</u>	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

<u>Inhalation:</u>	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.
<u>Skin contact:</u>	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.
<u>Eye contact:</u>	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
<u>Ingestion:</u>	Wash out mouth with water and obtain medical attention. DO NOT INDUCE VOMITING.

5: FIRE FIGHTING MEASURES

<u>Suitable extinguishing media:</u>	Carbon dioxide (CO ₂), dry chemical, foam or water spray.
<u>Unsuitable extinguishing media:</u>	Do not use water jets.
<u>Special exposure hazards:</u>	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.
<u>Special protective equipment:</u>	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6: ACCIDENTAL RELEASE MEASURES

<u>Personal Precautions:</u>	Spilt product presents a significant slip hazard. Remove any sources of heat.
<u>Environmental Precautions:</u>	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.
<u>Methods for cleaning up:</u>	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

<u>Handling:</u>	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.
<u>Storage:</u>	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

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

8: EXPOSURE CONTROLS / PERSONAL PROTECTION

<u>Occupational Exposure Limits:</u>	Not established.
<u>Engineering control measures:</u>	Use of local exhaust ventilation is recommended whenever this product is used in a confined space, is heated above ambient temperatures, or is agitated.
<u>Hygiene measures:</u>	Wash hands before eating, drinking, smoking and using the toilet. Gloves should be washed before being removed.
<u>Respiratory Protection:</u>	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.
<u>Hand Protection:</u>	When handling this product it is recommended to wear chemical resistant gloves. Suggested materials for protective gloves include: PVC, Neoprene or similar.
<u>Eye Protection:</u>	Wear eye protection such as safety glasses, chemical goggles, or face shield if engineering controls or work practices are not adequate to prevent eye contact. Have suitable eye wash water available.

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

9: PHYSICAL AND CHEMICAL PROPERTIES

General Information

Appearance: Clear, colourless liquid
Odour: Mild petroleum odour

Health, safety and environmental information

pH: Not determined
Boiling point/range: 280 °C
Flash point: >135 °C
Flammability: Non flammable
Explosive properties: Not explosive
Oxidising properties: Not applicable
Vapour pressure at 20 °C: <0.02 kPa
Density: 0.86 g/cm³ at 20 °C typical
Solubility in water: Insoluble
Kinematic Viscosity at 20 °C: 4.0 – 4.5 cSt (4.0 – 4.5 mm²/s) typical
Vapour density (Air=1): >1
Evaporation rate: Not determined

Other information

Pour point: -60 °C typical
Expansion coefficient: 0.0007 /°C typical
Neutralisation value: 0.03 mg KOH g⁻¹ maximum

10: STABILITY AND REACTIVITY

Chemical stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure and will not polymerise.

Conditions to avoid: Temperatures above 140 °C

Materials to avoid: Strong oxidising agents, such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, peroxides etc, as this may present an explosion hazard.

Hazardous decomposition products: Carbon monoxide and irritant fumes may be generated if this product is burned in an enclosed space.

11: TOXICOLOGICAL INFORMATION

<u>Basis for assessment:</u>	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.
<u>Acute toxicity:</u>	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)
<u>Corrosivity/irritation:</u>	
<u>Eye:</u>	May be slightly irritant
<u>Skin:</u>	May be slightly irritant
<u>Respiratory tract:</u>	If mists are inhaled, slight irritation of the respiratory tract may occur
<u>Skin sensitisation:</u>	Not expected to be a skin sensitiser
<u>Repeated-dose toxicity:</u>	Prolonged and/or repeated contact may lead to irritation and possibly dermatitis, especially under conditions of poor personal hygiene.
<u>Mutagenicity:</u>	Not expected to be a mutagen.
<u>Carcinogenicity:</u>	Not expected to be a carcinogen.
<u>Reproductive toxicity:</u>	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

<u>Basis for assessment:</u>	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.
<u>Ecotoxicity:</u>	Poorly soluble mixture. Product is not expected to be ecotoxic to fish/daphnia/algae, or sewage bacteria. This preparation is expected to be removed in a wastewater treatment facility
<u>Mobility:</u>	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
<u>Persistence and degradability:</u>	Readily biodegradable. Soils degradation – half life approx. 15 days. Natural waters degradation – half life approx. 4 – 9 days.
<u>Bioaccumulative potential:</u>	May have the potential to bioaccumulate

13: DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.

<u>Unused Product:</u>	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
<u>Used/Contaminated Product:</u>	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
<u>Packaging:</u>	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/EC and 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 product 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 at 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/m ³	ACGIH
	10 min STEL	10 mg/m ³	ACGIH

Respiratory Protection

Not normally required.

If oil mist cannot be controlled, a respirator fitted with an organic vapour cartridge 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/m ³	DIN 51757
solubility in water (20°C)	negligible	
n-octanol/water partition coeff.	na	
kinematic viscosity (40°C)	8,5 mm ² /s	DIN 51562

10. Stability/Reactivity

Stability

stable under normal use conditions

Materials to avoid

strong oxidising agents

Hazardous decomposition products

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

11. Toxicological Information

Toxicological Data:

Acute toxicity - oral

LD₅₀ 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.

Recommended 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.

APPENDIX C

**CIRIA C522 Risk Analysis
Definitions**

6.3

RISK EVALUATION

The purpose of risk evaluation is to decide whether or not risks are acceptable and to determine the need for remedial action. The acceptability of identified risks may depend on who is considering the risks (see Chapter 7). Ultimately, the decision on acceptability of a risk is a balance of the technical reasoning, practicality, perception and cost-benefit.

This stage involves:

- collation and review of the risk-based information for the site
- addressing uncertainty and its effect on judgements regarding risk estimates
- identification of those risks that are considered unacceptable.

6.3.1

Collating and reviewing risk-based information

At this stage it is useful to summarise all the risk-based information for the site and relate the receptors to the relevant contaminants. In effect, this involves a re-examination of the conceptual model in light of new information. For large sites it may be that the site is subdivided into several zones for clarity and ease of assessment.

6.3.2

Addressing uncertainty

Uncertainty should be considered in terms of:

- whether enough data exists to estimate the risks with an acceptable level of confidence
- identification of assumptions and safety factors used in the assessment.

The assumptions and safety factors incorporated into a risk estimation should be examined, and if uncertainty is considered unacceptable then the risk estimation stage is repeated (ie the collection of more site investigation data, see Section 5.3). The cost and benefit of additional risk estimation needs to be balanced against the need for certainty. For some sites, uncertainty may be acceptable, and the costs of additional risk estimation deemed unnecessary. However, further site investigation data and risk assessment may be necessary to achieve a cost-effective remediation strategy.

6.3.3

Identification of unacceptable risks

The following methodology has been developed from an in-house procedure used by Envirospire (not published), submitted during the course of this research. This methodology was in turn developed from the "Guide to Risk Assessment and Risk Management for Environmental Protection" (DoE, 1995) and *Draft Statutory Guidance on Contaminated Land* (DoE, 1996). The method presented is an updated and modified version of the Envirospire procedure and represents one possible methodology for presenting and evaluation the results of risk estimation.

This method for risk evaluation is a qualitative method of interpreting the output from the risk estimation stage of the assessment. It involves the classification of the:

- magnitude of the potential **consequence** (severity) of risk occurring (Table 6.3)
- magnitude of the **probability** (likelihood) of the risk occurring (Table 6.4).

Table 6.3 Classification of consequence

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health (“significant harm” as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR , 2000).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services (“significant harm” as defined in the <i>Draft Circular on Contaminated Land</i> , DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (eg foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Table 6.4 Classification of probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term

These classifications are then compared to indicate the risk presented by each pollutant linkage. It is important that this classification is only applied where there is a possibility (which can range from high likelihood to unlikely) of a pollutant linkage existing.

This method can be applied with or without site investigation data and can be used to assess the results of either qualitative or quantitative assessment. **It is recommended that the amount of data and basis of classifications are made clear when reporting such an assessment.** It is often possible to undertake this risk evaluation following the Phase 1 stage of the risk assessment. If site investigation and further risk estimation are then undertaken the evaluation can be revised.

Once the consequence and probability have been classified, these can then be compared (see Table 6.5) to produce a risk category, ranging from “very high risk” to “very low risk”. The actions corresponding with this classification is given in Table 6.6. A worked example is presented in Box 6.10.

Table 6.3 shows the classification of consequence. To classify the consequence it is important to bear in mind that the classification does not take into account the probability of the consequence being realised (this is considered in Table 6.4). Therefore, for a particular pollutant linkage it may be necessary to classify more than one consequence. For example, the risk from methane build-up in a building presents a risk of harm both to the building and to human health. Both would be classified as *severe*, but the probability, addressed in the next stage of this methodology, may vary (for example, the building may be unoccupied for most of the time, with only occasional visits – eg a pumping station).

The classification of *severe* relates to short-term (acute) risks only. The *medium* classification relates to chronic harm, which can be classed as “significant harm” (if the assessment is carried out for Part IIA purposes. The *mild* classification also relates to significant chronic harm but applies to less-sensitive receptors. The *minor* classification relates to harm which, while not considered “significant”, may have a financial implication (eg phytotoxic effects of contaminants on development landscaping).

It is worth noting that, in theory, both a *severe* and *medium* classification can result in death. The differentiation between the two categories is that *severe* relates to a short-term risk whilst *medium* relates to a long-term risk. Therefore the classification of *severe* should indicate that urgent action is required (urgent action may also be required under the *medium* classification, but usually longer-term actions are sufficient).

The classification gives a guide as to the severity and consequence of identified risks when compared with other risk presented on the site. It is not possible to classify an identified risk as presenting “no-risk”, rather “very low risk”. This is important, as the acceptability of risk may depend on the viewpoint of the stakeholder concerned. It may be necessary to take action to deal with a risk even if classified as “very low”, although these actions may not necessarily be required urgently.

Table 6.5 Comparison of consequence against probability

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table 6.6 Description of the classified risks and likely action required

Very high risk	<p>There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening.</p> <p>This risk, if realised, is likely to result in a substantial liability.</p> <p>Urgent investigation (if not undertaken already) and remediation are likely to be required.</p>
High risk	<p>Harm is likely to arise to a designated receptor from an identified hazard.</p> <p>Realisation of the risk is likely to present a substantial liability.</p> <p>Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term</p>
Moderate risk	<p>It is possible that harm could arise to a designated receptor from an identified hazard. However, if is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild</p> <p>Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term</p>
Low risk	<p>It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.</p>
Very low risk	<p>There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.</p>

Box 6.10 *Example of risk evaluation*

A site is used for car parking. The surface is mainly hardstanding, but the quality is not sufficient to prevent infiltration of rainwater. Site investigation has shown that, underlying the hardstanding, the made ground and groundwater (minor aquifer) beneath the made ground contain raised concentrations of toxic metals. The site investigation also encountered several areas of fly-tipped wastes with very high cyanide content (enough to present short-term risks to human health). One such area, bordered by housing, is used for informal recreation, mainly by children. Therefore the contaminant-pathway-receptor relationship can be summarised as below.

Contaminant	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk classification	Risk management action taken
Fly-tipped material with high cyanide content	Direct contact	Humans, mainly children playing on site	Severe	High likelihood	Very high	Immediate removal of fly-tipped material to suitable landfill facility
Toxic metals, for example arsenic and cadmium	Leaching to groundwater (minor aquifer)	Minor aquifer, no local abstractions	Medium	High likelihood	High	Further groundwater monitoring, including perimeter and removal of hotspots of contamination.
Toxic metals, for example arsenic and cadmium	Direct contact	Site workers and visitors during remediation	Medium	Likely	Moderate	Site health and safety plan made allowance for contamination. Site workers were supplied with personal protective equipment and damping down of the site during dry periods was undertaken during remediation.
Toxic metals, for example arsenic and cadmium	Dust	Site workers Residential properties next door to site Site workers and visitors during remediation	Medium	Likely	Moderate	It was considered that damping down of site was sufficient to break this pollutant linkage. Dust monitoring was undertaken on site and at site boundaries to prove this.

Note

The pollutant linkage for residential properties was not assessed in detail, as the measures to address the risk to site workers from contaminated dust were considered sufficient to protect nearby residents.



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