



BREXIT INFRASTRUCTURE AT DUBLIN PORT

ENGINEERING REPORT

PART 1 – GEOTECHNICAL

PART 2 – FLOOD RISK ASSESSMENT

PART 3 – CIVIL & STRUCTURAL



OPW

Oifig na
nOibreacha Poiblí
Office of Public Works

PART 1 - GEOTECHNICAL

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APPENDIX 1 – SITE INVESTIGATION FACTUAL REPORT.

1.0 INTRODUCTION

1.1 Introduction

The purpose of this report is to provide preliminary engineering information to inform the EIA report.

1.2 Site Location

The site is located within the existing port area in an area known as the Northern Port lands. The location of the site is shown in figure 1.1 below.

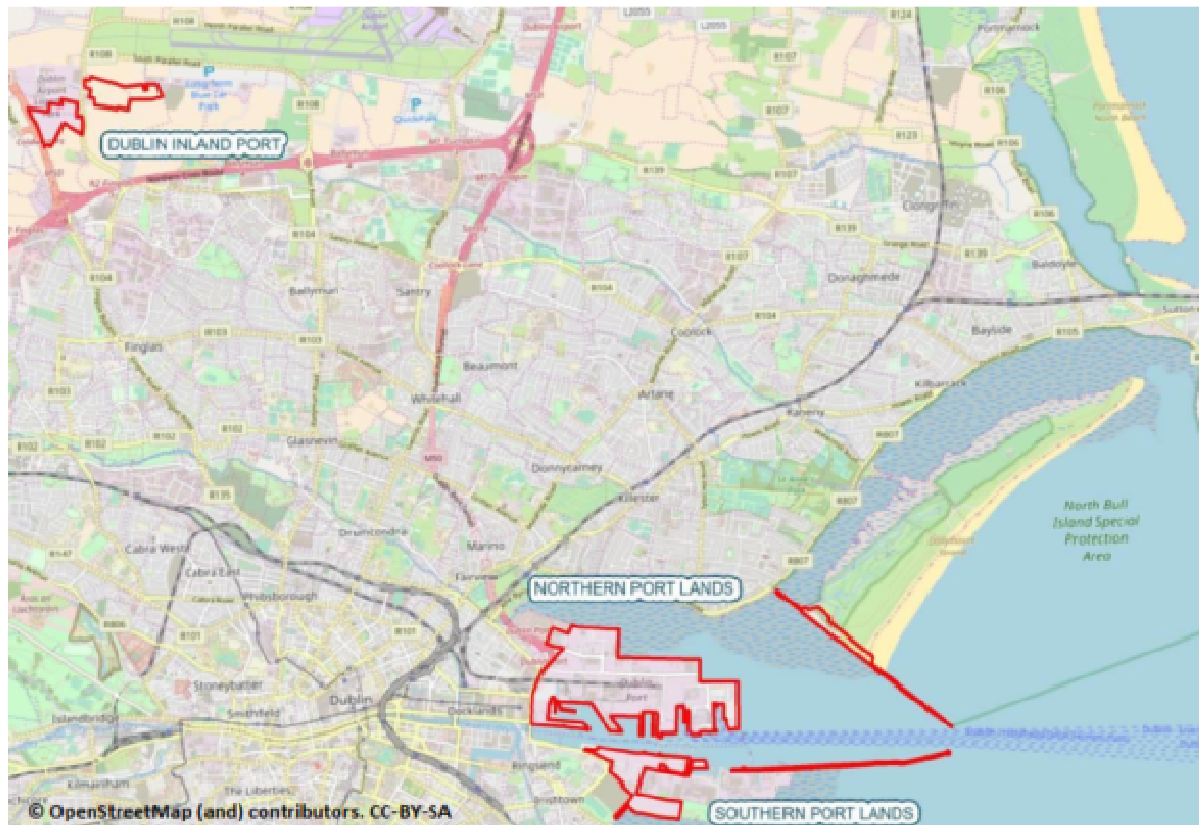


Figure 1.1

1.3 Project Description

The proposed development in Dublin Port will be spread over two different sites in close proximity as shown in figure 1.0. The proposed developments within these sites are as follows:

Bond Drive

The Bond Drive Site is north of Bond Drive Extension. There are a number of temporary structures on this site, all of which are to be removed. The site will be provided with approximately five new single storey prefabricated structures providing office and welfare facilities. A bike store will also be provided. Landscaping will be provided where possible. The remainder of the site will be utilised for staff parking, HGV parking and circulation.

Yard 3 & 4

Yard 3 & 4 is south of Bond Drive Extension. The permanent structure on the south end of the site will be retained and extended. The temporary and permanent structures at the north end of the site will be demolished and removed. Two new single storey prefabricated structures providing office and welfare facilities will be provided at the north end of the site. Landscaping will be provided where possible. The remainder of the site will be utilised for staff parking, HGV parking and circulation.



Figure 1.0

2.0 SITE HISTORY

The sites were formerly part of the Liffey Estuary prior to being reclaimed. A review of the historic mapping for the site was carried out. These maps, which date from 1833, 1888 and 1913 demonstrate that the sites were located in the sea beyond the city quay wall.



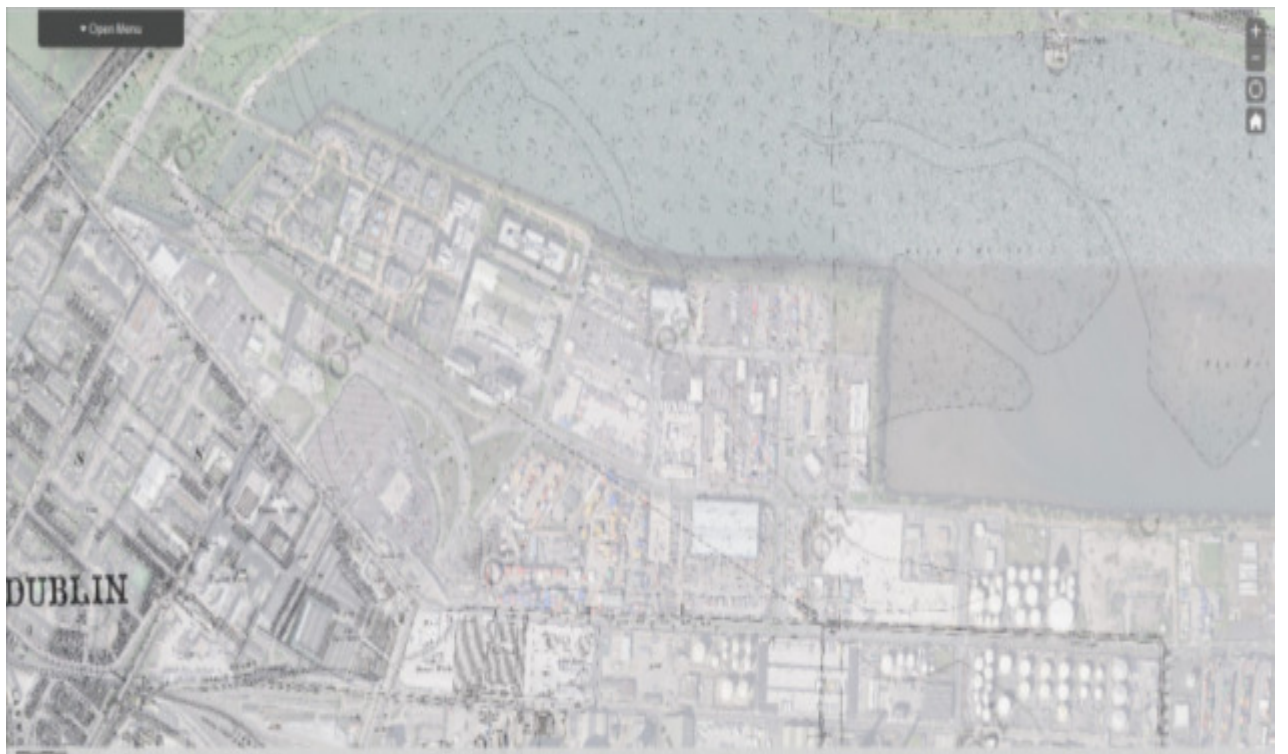
1833 OS 6inch MAP



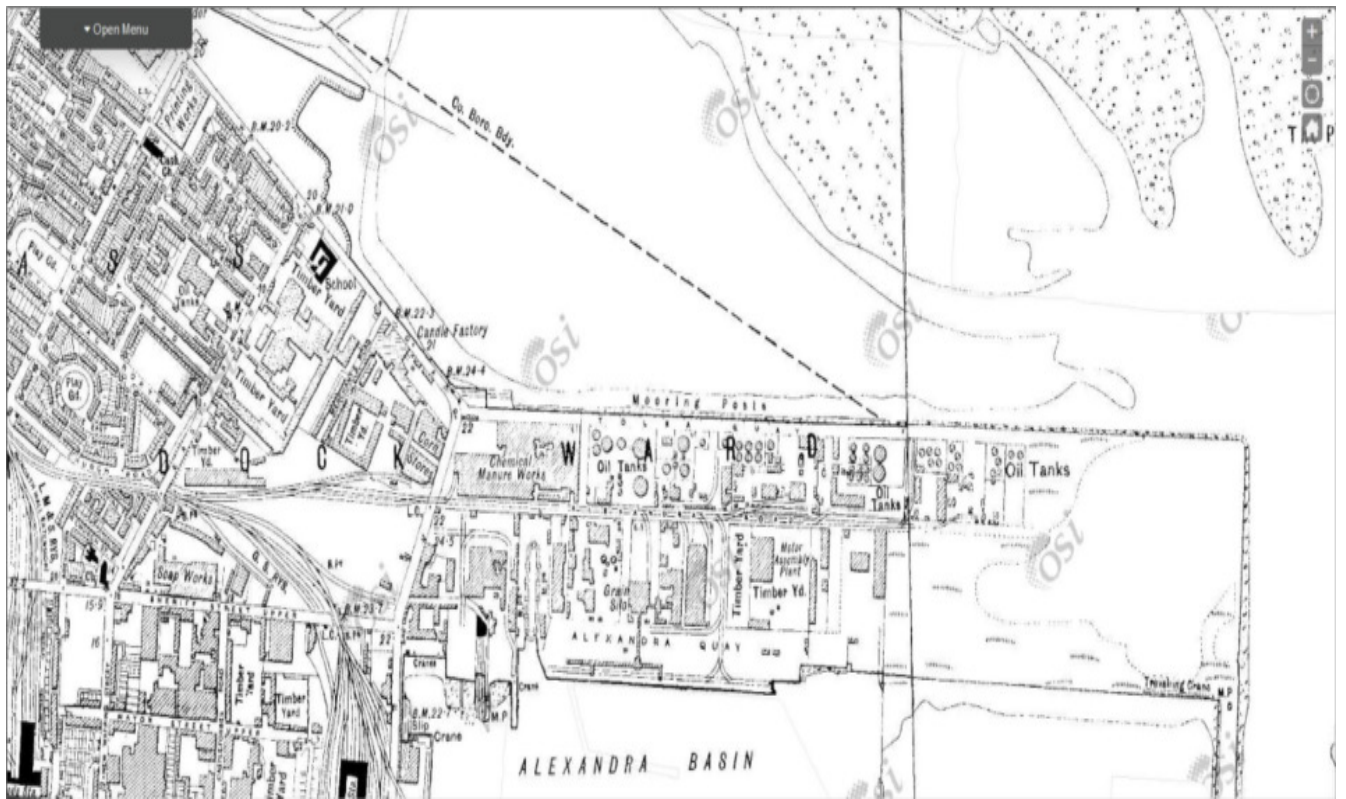
1833 OS 6inch MAP AERIAL OVERLAY



1888 OS 25inch MAP



1888 OS 25inch MAP AERIAL OVERLAY



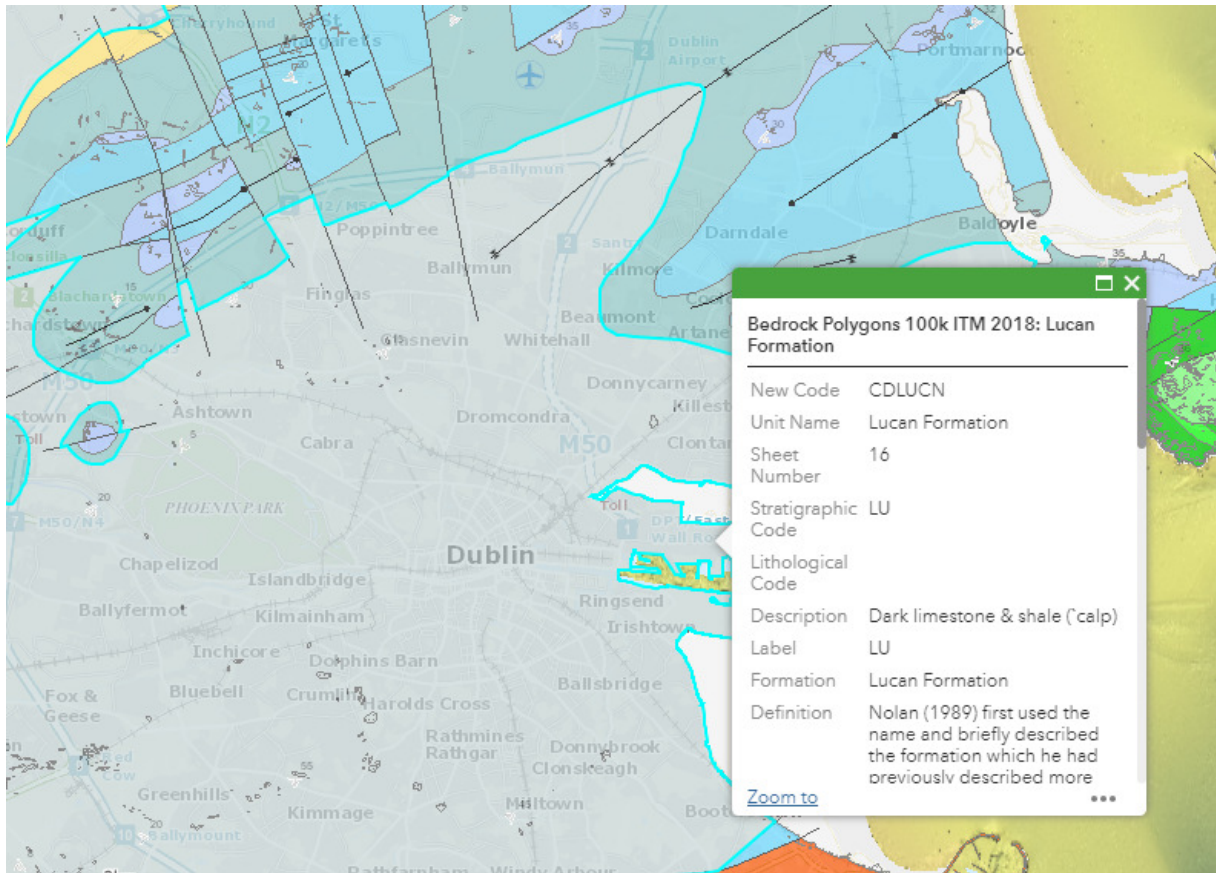
1913 OS 6inch MAP



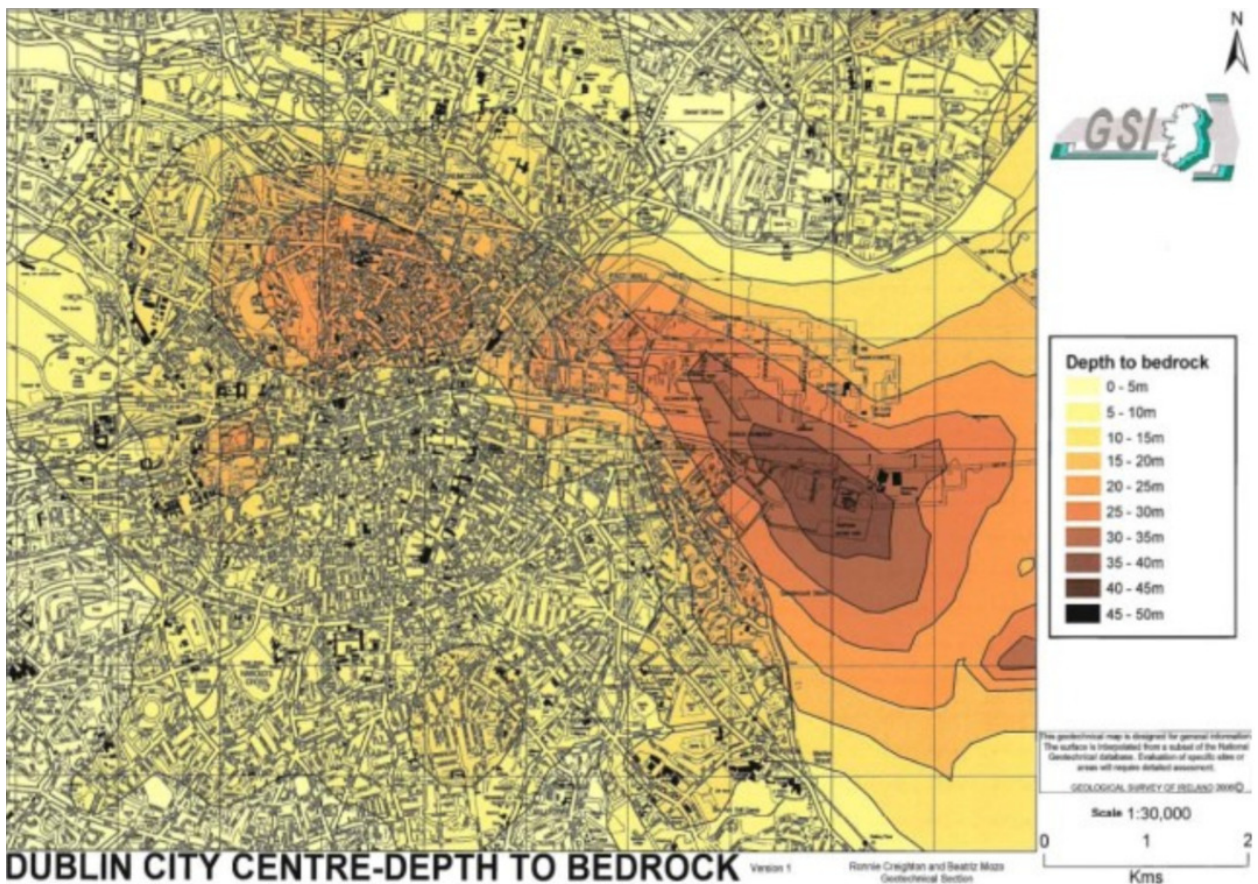
1913 OS 6inch MAP AERIAL OVERLAY

3.0 GEOTECHNICAL

3.1 Bedrock

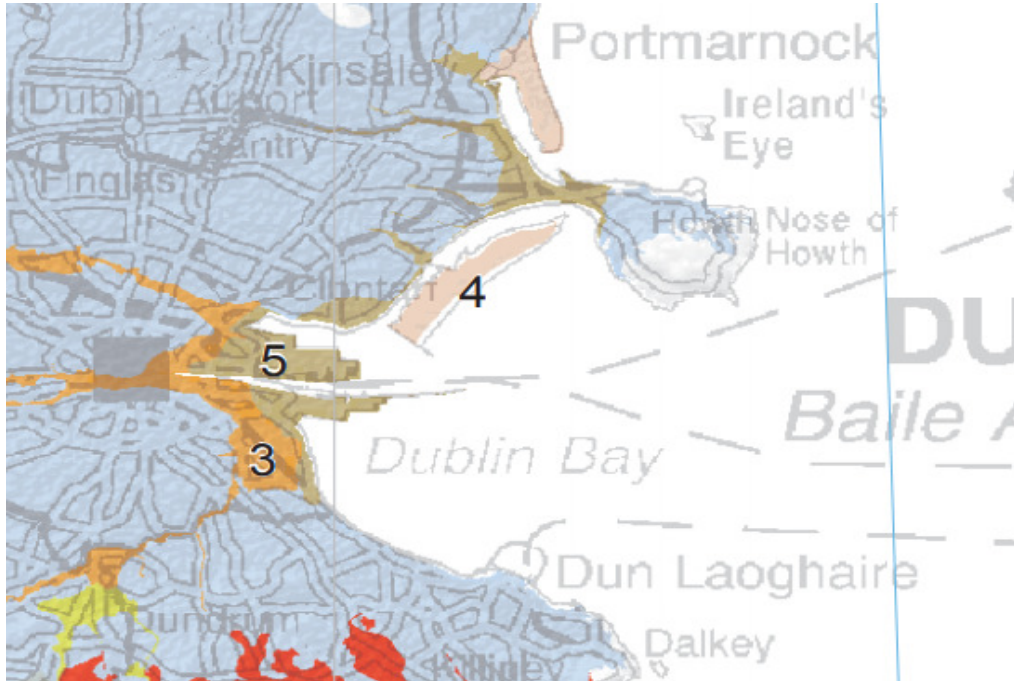


GSI Bedrock Geology (1:100,000)



3.2 Quaternary Geology (Soils)

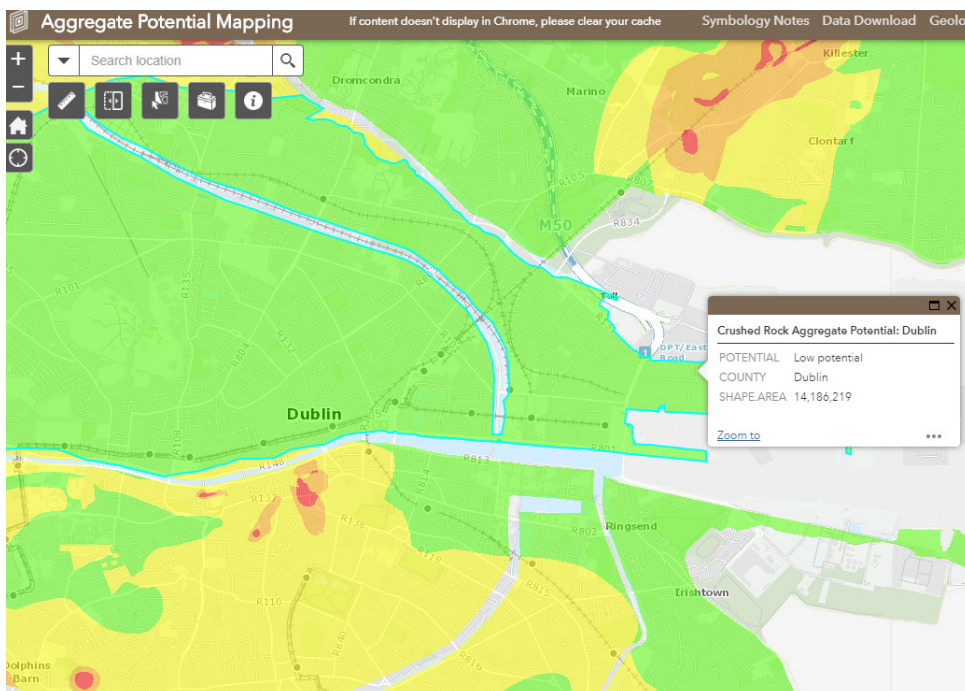
Marine and estuarine deposits Slope deposits Marine and estuarine deposits comprise sand and gravel beach sediments, raised beaches, tidal marsh deposits and estuarine silt and clay. These have been deposited as the ice sheet retreated from the continental shelf and sea levels rose



GSI Quaternary Geological Map of Ireland

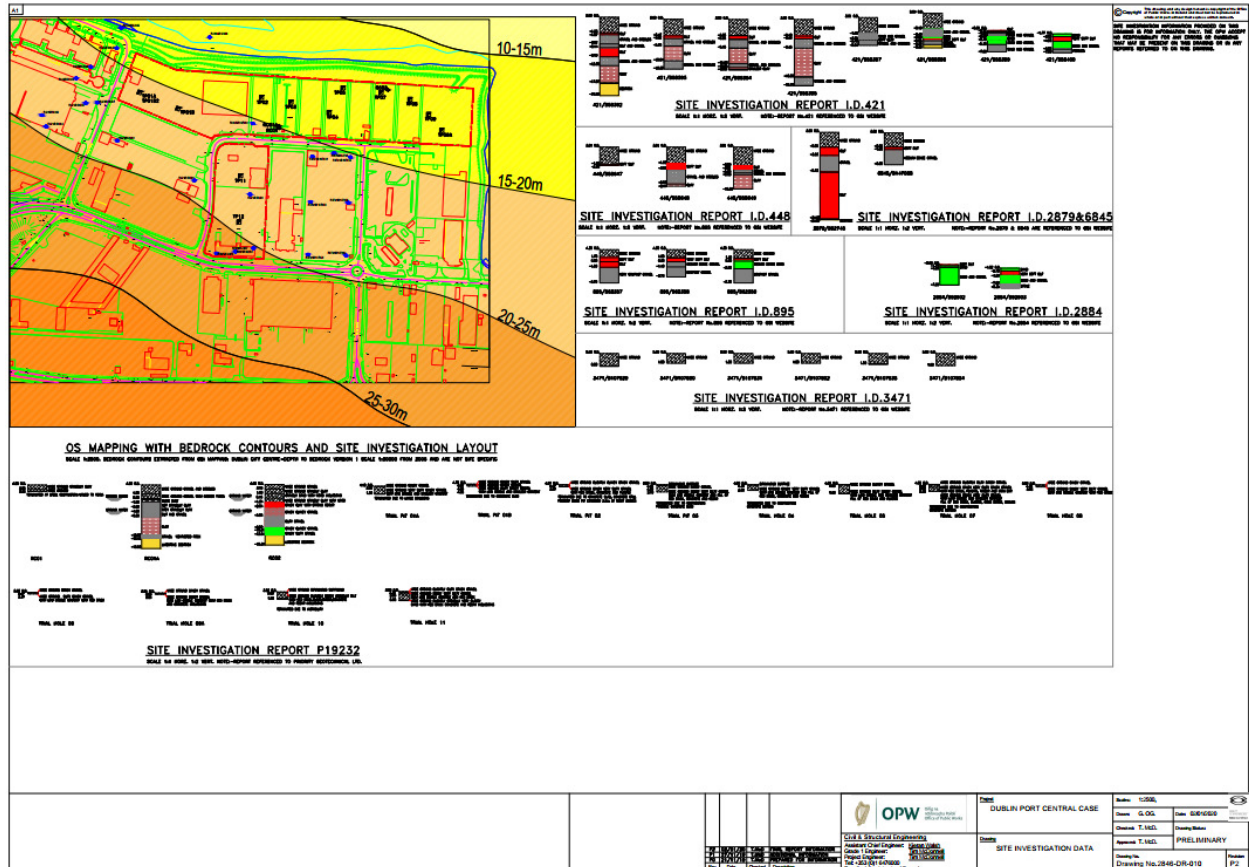
3.3 Aggregate Potential

There is no available information for the proposed site. However, other areas of the port shown in green below have been classed as low potential for crushed rock aggregate.



3.4 Ground Investigation - Desktop

A desktop study was carried out to obtain previous ground investigation data using information sources such as the GSI website and web searches. The information gathered from these sources is illustrated on the following drawing:



3.5 Geotechnical Investigation - Site

A Geotechnical Investigation was carried out in November 2019 by Priority Geotechnical Ltd. The report from this investigation is included in Appendix A.

APPENDIX A – GEOTECHNICAL INVESTIGATION REPORT BY PRIORITY GEOTECHNICAL LTD.



Our Ref: JMS/Rp/P19232 (*.pdf)

18th December, 2019

Messrs. The Office of Public Works
Civil & Structural Engineering Services,
52 St Stephens Green,
Dublin 2.

Re: Stage 1 – Geotechnical Investigation at Dublin Port – Factual report.

Introduction

In November 2019, Priority Geotechnical were requested by The Office of Public Works (OPW) to undertake an investigation as part of the Dublin Port – Stage 1 Preliminary Geotechnical Investigation, Dublin.

Objectives

The purpose of this investigation is to provide suitable geotechnical and environmental data in order to inform the engineering design solutions for potential future development.

Scope

The scope of the ground investigation, which was specified by the OPW, comprised of the following:

- 02Nr. Rotary boreholes;
- 12Nr. Trial pits;
- All associated sampling;
- Laboratory testing and
- All associated reporting.

The final works as completed are outlined hereafter.

This report presents a summary of the factual records, data obtained with regard to the geotechnical investigation at Dublin Port. This factual report should be read in conjunction with the accompanying exploratory logs and laboratory test data.

Site Works

This investigation was carried out in accordance with the contract specification: Specification and Related Documents for Ground Investigation in Ireland (Engineers Ireland, October 2006), Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests.

The investigation fieldworks were undertaken between the 14th and the 21st November, 2019 under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this factual report.

Rotary Boreholes

Three (03) rotary boreholes were advanced to depths 2.2m below existing ground level (bgl) to 21.0m bgl using PGL's Deltabase 500 7t rotary rig. The exploratory records are attached, herein.

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC01	2.2	20/11/2019
RC01A	21.0	20/11/2019
RC02	20.0	21/11/2019

Trial Pits

Twelve (12) trial pit excavations were dug to depths 0.5m bgl to 3.0m bgl using a JCB Back-hoe excavator. The exploratory records are attached, herein.

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP01A	2.6	15/11/2019
TP01B	0.7	15/11/2019
TP02	0.7	14/11/2019
TP03	2.4	14/11/2019
TP04	1.9	14/11/2019

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP05	3.0	15/11/2019
TP07	2.3	15/11/2019
TP08	0.5	15/11/2019
TP09	0.5	15/11/2019
TP09A	0.5	15/11/2019
TP10	2.3	14/11/2019
TP11	3.0	14/11/2019

Sampling

Nineteen (19) environmental samples (ENV) were taken between 0.5m bgl and 2.0m bgl at trial pit locations. These were placed immediately in air-tight containers, which were filled to the top of the sample container. The sample suite consisted of: 2No. small disturbed samples (D) not less than 1.0kg, 2No. 250g amber glass sample containers and 2No. 60g amber glass sample containers.

The preparation for and methods of taking environmental samples, together with their size, preservation and handling was in accordance with British Standard BS 5930: 1981- Code of Practice for Site investigation, the contract documents and the Association of Geotechnical and Geo-environmental Specialists (AGS) guide to environmental sampling, September 2010.

Survey and Drawings

The exploratory locations were set out subject to work space restrictions and available access. The 'as built' exploration locations were subsequently surveyed using Trimble 5700/5800 GPS equipment to the Ordinance Survey Irish Transverse Mercator (ITM) system of co-ordinates and elevations to Malin Head datum. The 'as built' exploratory locations plans (P19232_SI_A and P19232_SI_01) accompany this report.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC01	718777.0	735455.0	4.5	2.2	20/11/2019
RC01A	718777.0	735457.0	4.5	21.0	20/11/2019
RC02	718949.2	735514.2	4.66	20.0	21/11/2019
TP01A	718522.9	735508.7	4.1	2.6	15/11/2019
TP01B	718575.2	735493.0	4.78	0.7	15/11/2019
TP02	718737.1	735499.9	4.57	0.7	14/11/2019

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP03	718800.0	735495.0	4.59	2.4	14/11/2019
TP04	718870.0	735490.0	4.59	1.9	14/11/2019
TP05	718883.7	735516.8	4.6	3.0	15/11/2019
TP07	718939.7	735512.4	4.68	2.3	15/11/2019
TP08	718988.5	735496.4	4.53	0.5	15/11/2019
TP09	719028.8	735476.0	3.67	0.5	15/11/2019
TP09A	719049.1	735436.8	3.51	0.5	15/11/2019
TP10	718677.5	735387.2	3.83	2.3	14/11/2019
TP11	718749.5	735341.6	3.66	3.0	14/11/2019

Laboratory Testing

Laboratory testing was scheduled by the OPW and carried out by Chemtest Ltd. (UK) on behalf of PGL in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes and the ISRM suggested methods for rock characterisation, testing and monitoring.

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outline above. Laboratory testing will result in a reduction of sample quantity and in some cases the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

The laboratory data is attached and summarised as follows;

SUMMARY OF LABORATORY TESTING

Type	Nr.	Remarks
Environmental Suite D	19	See attached results
Environmental Suite E	19	See attached results
Environmental Suite H	19	See attached results

Published Geology

The geology of the study area (GSI 1:100,000 mapping Sheet 16) is characterised by the Lucan Formation (LU), described as dark Limestone & Shale Calp.

Teagasc subsoil mapping indicates that the area is underlain by Made Ground deposits. The national groundwater vulnerability mapping indicated the area is of low vulnerability.

Ground Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002)– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the site investigation.

Groundwater conditions

Groundwater is recorded when encountered during boring over a period of 20 minutes, noting any changes that may occur.

Groundwater conditions observed in the excavations are those appertaining to the period of the investigation. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions or tidal variations etc.

Groundwater was encountered between 4.5m bgl and 16.5m bgl during the period of works. The groundwater regime should be assessed from monitoring standpipes where available.

Excavations were backfilled with arisings.



ARISINGS Backfill

Should you have any queries in relation to the data presented, please do not hesitate to contact our office.

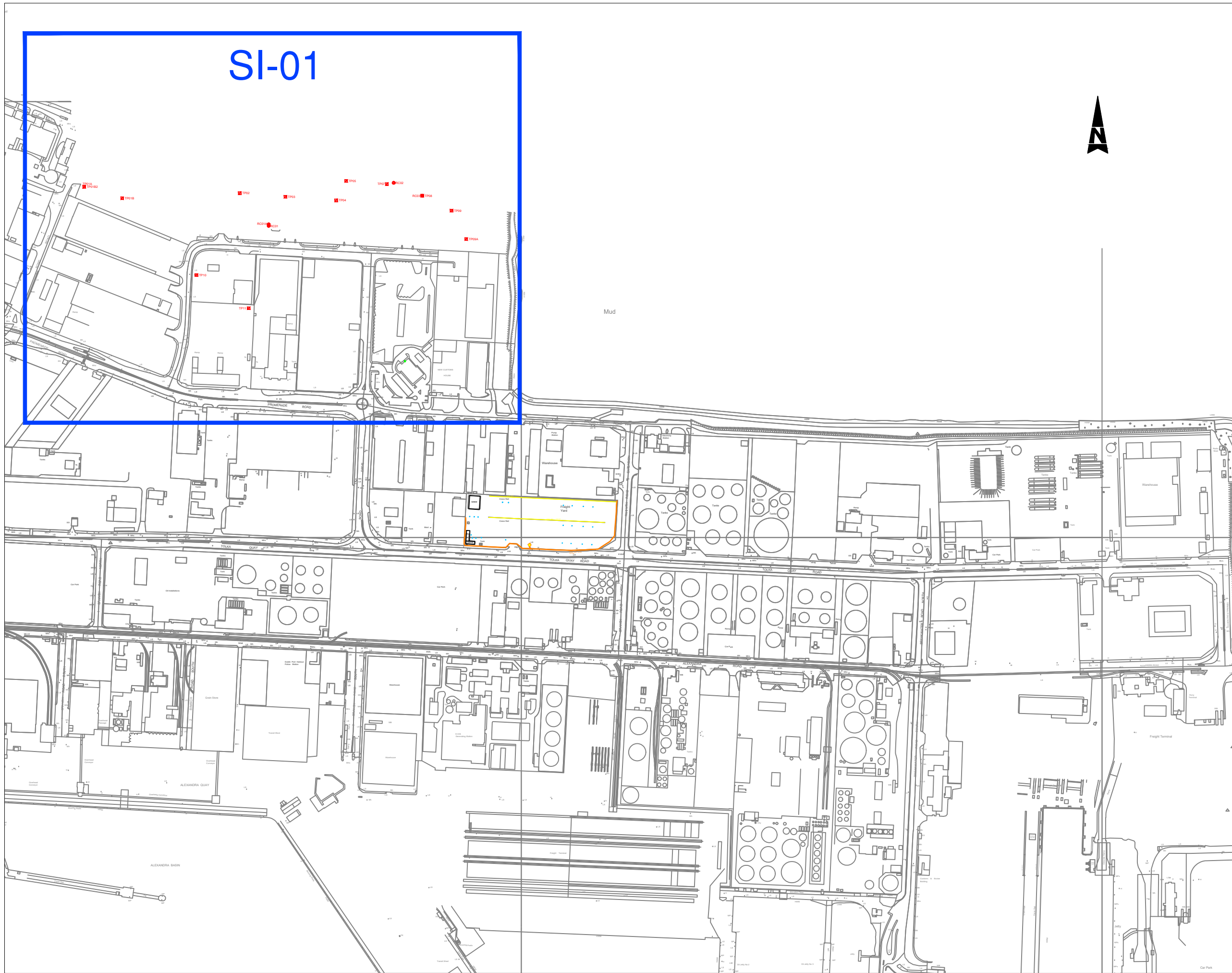
Yours sincerely,
For **Priority Geotechnical**,



James McSweeney BSc
Engineering Geologist

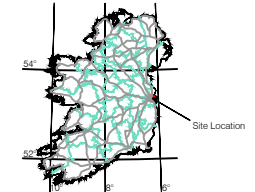
No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations. Where additional information becomes available any assessment may be subject to review and change.

This report has been prepared for the employer Ireland and their Representative(s) as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.



SI-01

Priority Geotechnical Site



JOB NAME:
DUBLIN PORT OPW

Sheet Title:
EXPLORATORY LOCATION
LAYOUT

JOB NUMBER:
P19232

DRAWING NUMBER:
P19232-SI-A

DRAWN BY:
Gary Curtin

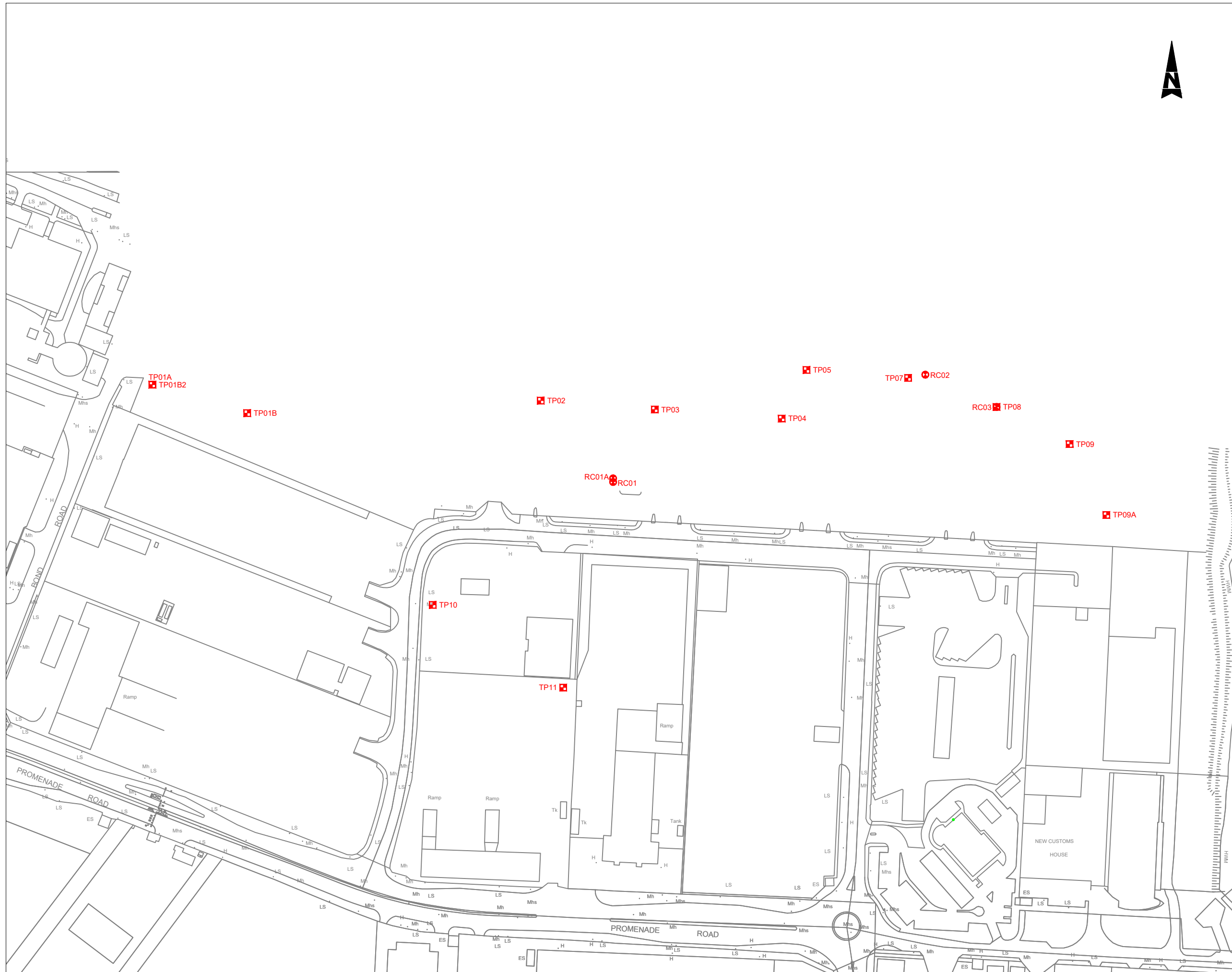
DATE:
12/12/2019

SCALE:
1:5000 ON A3

APPROVED:
GH

REVISION:
D01





- KEY:
- TP00 Denotes Trial Pit location
 - RC00 Denotes Rotary Core location

JOB NAME:
DUBLIN PORT OPW

Sheet Title:
EXPLORATION LOCATION
PLAN

JOB NUMBER:
P19232

DRAWING NUMBER:
P19232-SI-01

DRAWN BY:
Gary Curtin

DATE:
12/12/2019

SCALE: 1:2000 ON A3	APPROVED: GH
------------------------	-----------------

REVISION:
D01



KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

** Drillers Description
Friable Easily crumbled

SAMPLES

U() Undisturbed 102mm diameter sample, () denotes number of blows to drive sampler
U()F, U()P F- not recovered, P-partially recovered
U38 Undisturbed 38mm diameter sample
P(F), (P) Piston sample - disturbed
B Bulk sample - disturbed
D Jar Sample - disturbed
W Water Sample
CBR California Bearing Ratio mould sample
ES Chemical Sample for Contamination Analysis
SPTLS Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR Total Core Recovery (% of Core Run)
SCR Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD Rock Quality Designation (length of solid core greater than 100mm as % of core run)
Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column
lf Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL Assumed Zone of Core Loss
NI Non intact

GROUNDWATER

▽ Groundwater strike
▼ Groundwater level after standing period
Date/Water Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S Standard Penetration Test - split barrel sampler
C Standard Penetration Test - solid 60° cone
SW Self Weight Penetration
Ivp, HVp (R) In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P) Permeability Test
HP Hand Penetrometer Test

MEASURED PROPERTIES

N Standard Penetration Test - blows required to drive 300mm after seating drive
x/y Denotes x blows for y mm within the Standard Penetration Test
x*/y Denotes x blows for y mm within the seating drive
 c_u Undrained Shear Strength (kN/m^2)
CBR California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113



Priority Geotechnical Ltd.
 Tel: 021 4631600
 Fax: 021 4638690
 www.prioritygeotechnical.ie

Drilled By:
 AK
 Logged By:

Borehole No.
RC01
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI Project No. P19232 Co-ords: 718777E - 735455N Hole Type: Rotary cored

Location: Dublin Level: 4.50m OD Scale: 1:50

Client: Office of Public Works (OPW) Dates: 20/11/2019 20/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
							1.50	3.00		Open hole boring. Driller described: (MADE GROUND) 'Dry' gravelly Clay.	1
							2.20	2.30		Open hole boring. Driller described: (MADE GROUND) Steel obstruction.	2
										End of Borehole at 2.200m	3
											4
											5
											6
											7
											8
											9

Groundwater:				Hole Information:			Equipment:	Deltabase 520	
Struck (m bgl)	Rose to	After (min)	Sealed	Comment	Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)	Method:	Compressed air
				None encountered.	2.20	131	131		

Remarks: Borehole terminated at 2.20m bgl due to steel obstruction. Borehole relocated to RC01A.	Shift Data:	Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
		Dry	20/11/2019 08:00 20/11/2019 18:00	0.00 2.20	Start of shift. End of borehole.



Priority Geotechnical Ltd.
 Tel: 021 4631600
 Fax: 021 4638690
 www.prioritygeotechnical.ie

Drilled By: AK
 Logged By:
 Borehole No. RC01A
 Sheet 1 of 3

Project Name: Stage 1 - Dublin Port SI Project No. P19232 Co-ords: 718777E - 735457N Hole Type: Rotary cored
 Location: Dublin Level: 4.50m OD Scale: 1:50
 Client: Office of Public Works (OPW) Dates: 20/11/2019 20/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
										Open hole boring. Driller described: (MADE GROUND) Gravel with cobble content.	1
							3.00	1.50		Open hole boring. Driller described: (MADE GROUND) Gravel with rubber tyre inclusions.	2
	▼						4.50	0.00		Open hole boring. Driller described: White, Clay.	3
							6.00	-1.50		Open hole boring. Driller described: 'Wet' gravelly Clay.	4
							7.50	-3.00		Open hole boring. Driller described: Grey, gravelly Clay.	5
	▼						9.00	-4.50			6

Groundwater:				Hole Information:			Equipment: Deltabase 520
Struck (m bgl)	Rose to	After (min)	Sealed	Comment	Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.50				See shift data.	21.00	102	131
9.00							
				Method: Compressed air			

Remarks: Borehole terminated at 21.00m bgl.	Shift Data:	Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
		4.5	20/11/2019 08:00 20/11/2019 18:00	0.00 21.00	Start of shift. End of borehole.



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 Tel: 021 4631600
 Fax: 021 4638690
 www.prioritygeotechnical.ie

Drilled By:
 AK
 Logged By:

Borehole No.
RC01A
 Sheet 3 of 3

Project Name: Stage 1 - Dublin Port SI Project No. P19232 Co-ords: 718777E - 735457N Hole Type: Rotary cored

Location: Dublin Level: 4.50m OD Scale: 1:50

Client: Office of Public Works (OPW) Dates: 20/11/2019 20/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
							21.00	-16.50		Down the hole hammer. Driller described: Limestone.	19
										End of Borehole at 21.000m	21
											22
											23
											24
											25
											26
											27

Groundwater:				Hole Information:			Equipment:	
Struck (m bgl)	Rose to	After (min)	Sealed	Comment	Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)	Deltabase 520
4.50				See shift data.	21.00	102	131	Compressed air
9.00								

Remarks: Borehole terminated at 21.00m bgl.	Shift Data:	Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
		4.5	20/11/2019 08:00 20/11/2019 18:00	0.00 21.00	Start of shift. End of borehole.



Priority Geotechnical Ltd.
 Tel: 021 4631600
 Fax: 021 4638690
 www.prioritygeotechnical.ie

Drilled By:
 AK
 Logged By:
 OD

Borehole No.
RC02
 Sheet 1 of 3

Project Name: Stage 1 - Dublin Port SI Project No. P19232 Co-ords: 718949E - 735514N Hole Type: Rotary cored

Location: Dublin Level: 4.66m OD Scale: 1:50

Client: Office of Public Works (OPW) Dates: 21/11/2019 22/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
▼							1.50	3.16		Open hole boring. Driller described: (MADE GROUND) Gravel.	1
							3.00	1.66		Open hole boring. Driller described: (MADE GROUND) Gravely Clay.	2
							4.50	0.16		Open hole boring. Driller described: (MADE GROUND) Gravely Sand with timber inclusions.	3
							6.00	-1.34		Open hole boring. Driller described: (MADE GROUND) Sandy Clay with strong odour.	4
							7.50	-2.84		Open hole boring. Driller described: (MADE GROUND) Sandy clayey Gravel.	5
											6

Groundwater:				Hole Information:			Equipment: Deltabase 520
Struck (m bgl)	Rose to	After (min)	Sealed	Comment	Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.50				See shift data.	20.00	76	131
11.00							
							Method: Compressed air

Remarks: Borehole terminated at 20.00m bgl, required depth.	Shift Data:		Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
			4.5	21/11/2019 08:00	0.00	Start of shift.
			4.0	21/11/2019 18:00	16.70	End of shift.
			4.0	22/11/2019 08:00	16.70	Start of shift.
			4.0	22/11/2019 18:00	20.00	End of borehole.



Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By: AK
Logged By: OD
Borehole No. RC02
Sheet 2 of 3

Project Name: Stage 1 - Dublin Port SI Project No. P19232 Co-ords: 718949E - 735514N Hole Type Rotary cored
Location: Dublin Level: 4.66m OD Scale 1:50
Client: Office of Public Works (OPW) Dates: 21/11/2019 22/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
Well							10.50	-5.84	Open hole boring. Driller described: Sandy clayey Gravel.		10
	▼						14.25	-9.59		Open hole boring. Driller described: Silty Gravel.	
							15.00	-10.34	Open hole boring. Driller described: Sandy Silty Gravel.		
							16.70	-12.04		Open hole boring. Driller described: Sandy clayey Gravel.	
		▼							Down the hole hammer. Driller described: Bedrock. Assumed Limestone lithology. High volume of water noted.		
											15
											16
											17
											18

Groundwater:				Hole Information:			Equipment: Deltabase 520
Struck (m bgl)	Rose to	After (min)	Sealed	Comment	Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.50				See shift data.	20.00	76	131
11.00							
							Method: Compressed air

Remarks: Borehole terminated at 20.00m bgl, required depth.	Shift Data:		Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
			4.5	21/11/2019 08:00	0.00	Start of shift.
			4.0	21/11/2019 18:00	16.70	End of shift.
			4.0	22/11/2019 08:00	16.70	Start of shift.
			4.0	22/11/2019 18:00	20.00	End of borehole.



Priority Geotechnical Ltd.
 Tel: 021 4631600
 Fax: 021 4638690
 www.prioritygeotechnical.ie

Drilled By: AK
 Logged By: OD

Borehole No. RC02
 Sheet 3 of 3

Project Name: Stage 1 - Dublin Port SI Project No. P19232 Co-ords: 718949E - 735514N Hole Type Rotary cored

Location: Dublin Level: 4.66m OD Scale 1:50

Client: Office of Public Works (OPW) Dates: 21/11/2019 22/11/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
							20.00	-15.34		Down the hole hammer. Driller described: Bedrock. Assumed Limestone lithology. High volume of water noted.	19
										End of Borehole at 20.000m	20
											21
											22
											23
											24
											25
											26
											27

Groundwater:				Hole Information:			Equipment: Deltabase 520
Struck (m bgl)	Rose to	After (min)	Sealed	Comment	Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.50				See shift data.	20.00	76	131
11.00							
							Method: Compressed air

Remarks: Borehole terminated at 20.00m bgl, required depth.	Shift Data:		Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
			4.5	21/11/2019 08:00	0.00	Start of shift.
			4.0	21/11/2019 18:00	16.70	End of shift.
			4.0	22/11/2019 08:00	16.70	Start of shift.
			4.0	22/11/2019 18:00	20.00	End of borehole.



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 Tel: 021 4631600
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Trial Pit No
TP01A
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 718523E - 735509N
Level: 4.10m OD **Date:** 15/11/2019

Location: Dublin **Dimensions (m):** 0.70 x 3.10

Client: Office of Public Works (OPW) **Depth:** 2.60m BGL **Logged PH**

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.15			0.15	3.95		(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
	0.50	ENV					(MADE GROUND) Brown, very silty sandy GRAVEL with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 600mm dia, sub-angular to sub-rounded.
	2.00	ENV					
				2.60	1.50		End of Pit at 2.600m

Stability: Poor **Plant:** JCB **Groundwater:** None encountered.
Backfill: Arisings.

Remarks: Trial pit terminated at 2.60m bgl due to large boulders.



Number: TP01A	Project Dublin Port OPW Project No P19232 Client OPW	
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Number:

TP01A

Project
Project No
Client

Dublin Port OPW
P19232
OPW



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Trial Pit No
TP01B
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	Project No.: P19232	Co-ords: 718575E - 735493N Level: 4.78m OD	Date: 15/11/2019
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Location: Dublin	Dimensions (m): 5.00	Scale: 1:25
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Client: Office of Public Works (OPW)	Depth: 0.70m BGL	Logged: PH
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Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.50	ENV		0.20	4.58		(MADE GROUND) Grey, sandy silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
				0.25	4.53		(MADE GROUND) Brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
				0.70	4.08		(MADE GROUND) Grey, silty sandy GRAVEL with low cobble content and low boulder content with fill (red brick, concrete, metal sheets, cables). Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 500mm dia, sub-angular to sub-rounded. Very hard strata - Concrete. End of Pit at 0.700m
							1
							2
							3
							4
							5

Stability: Moderate	Groundwater: None encountered.
Plant: JCB	
Backfill: Arisings.	

Remarks: Trial pit terminated at 0.70m bgl, refusal on concrete.



<p>Number: TP01B</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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Number: TP01B

Project Dublin Port OPW
Project No P19232
Client OPW



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Trial Pit No
TP02
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 718737E - 735500N
Level: 4.57m OD **Date:** 14/11/2019

Location: Dublin **Dimensions (m):** 3.30
 0.70

Client: Office of Public Works (OPW) **Depth:** 0.70m BGL **Logged PH**

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.10			0.10	4.47		(MADE GROUND) Grey, slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
	0.50	ENV		0.70	3.87		(MADE GROUND) Grey brown, sandy very silty GRAVEL with red brick, concrete, plastic inclusions.
							Concrete obstruction. End of Pit at 0.700m

Stability: Moderate. **Groundwater:** None encountered.
Plant: JCB
Backfill: Arisings.

Remarks: Trial pit terminated at 0.70m bgl due to concrete. Pit extended at right angle for 2.00m in attempt to avoid concrete., still present.



<p>Number: TP02</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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<p>Number: TP02</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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Trial Pit No
TP03
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	Project No.: P19232	Co-ords: 718800E - 735495N Level: 4.59m OD	Date: 14/11/2019
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Location: Dublin	Dimensions (m): 3.20	Scale: 1:25
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Client: Office of Public Works (OPW)	Depth: 2.40m BGL	Logged: PH
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Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.15			0.15	4.44		Bituminous surfacing.
	0.30			0.30	4.29		(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
	0.50	ENV					(MADE GROUND) Brown grey, sandy very silty GRAVEL with low cobble content and red brick, concrete and re-bar inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
	2.00	ENV					
				2.40	2.19		End of Pit at 2.40m

Stability: Moderate	Groundwater: None encountered.
Plant: JCB	
Backfill: Arisings.	

Remarks: Trial pit terminated at 2.40m bgl due to obstruction, possible concrete.



Number:

TP03

**Project
Project No
Client**

Dublin Port OPW
P19232
OPW



Number:

TP03

Project
Project No
Client

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Trial Pit No
TP04
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 718870E - 735490N
Level: 4.59m OD **Date:** 14/11/2019

Location: Dublin **Dimensions (m):** **Scale:** 1:25

Client: Office of Public Works (OPW) **Depth:** 1.90m BGL **Logged:** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.20	4.39		Bituminous surfacing.
	0.50	ENV					(MADE GROUND) Brown, sandy very silty GRAVEL with low cobble content and red brick, concrete, re-bar inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
	1.90	ENV		1.90	2.69		End of Pit at 1.900m

Stability: **Groundwater:** None encountered.
Plant: JCB
Backfill: Arisings.

Remarks: Trial pit terminated at 1.90m bgl due to concrete blocks.



Number:

TP04

**Project
Project No
Client**

Dublin Port OPW
P19232
OPW



Number:

TP04

Project
Project No
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 Fax: 021 4638690
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Trial Pit No
TP05
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 718884E - 735517N
Level: 4.60m OD **Date:** 15/11/2019

Location: Dublin **Dimensions (m):** 0.70 x 3.30 **Scale:** 1:25

Client: Office of Public Works (OPW) **Depth:** 3.00m BGL **Logged:** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
Water Strike & Backfill	0.10			0.10	4.50	Legend	(MADE GROUND) Grey, clayey GRAVEL. Gravel is fine to coarse.
	0.50	ENV					(MADE GROUND) Grey, silty sandy GRAVEL with low cobble content, low boulder content and plastic, red brick inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 500mm dia, sub-angular to sub-rounded.
	2.00	ENV					
				3.00	1.60		End of Pit at 3.000m

Stability: Moderate **Plant:** JCB **Groundwater:** None encountered.
Backfill: Arisings.

Remarks: Trial pit terminated at 3.00m bgl, required depth.



Number:

TP05

**Project
Project No
Client**

Dublin Port OPW
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OPW



Number:

TP05

**Project
Project No
Client**

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 Fax: 021 4638690
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Trial Pit No
TP07
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI	Project No.: P19232	Co-ords: 718940E - 735512N Level: 4.68m OD	Date: 15/11/2019
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Location: Dublin	Dimensions (m): 0.70 x 3.20	Scale: 1:25
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Client: Office of Public Works (OPW)	Depth: 2.30m BGL	Logged: PH
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Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.20	4.48		(MADE GROUND) Grey, slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
	0.50	ENV					(MADE GROUND) Grey, sandy very silty GRAVEL with plastic, red brick, timber and iron bar inclusions. <i>0.20m to 1.00m: Engineer noted 'damp' layer.</i>
				1.00	3.68		(MADE GROUND) Brown, sandy very silty GRAVEL with low cobble content, low boulder content and red brick, concrete blocks, steel, cables and plastic. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 500mm dia, sub-angular to sub-rounded.
	2.00	ENV					
				2.30	2.38		End of Pit at 2.300m

Stability: Very poor	Groundwater: None encountered.
Plant: JCB	
Backfill: Arisings.	

Remarks: Trial pit terminated at 2.30m bgl due to obstruction of concrete blocks.



<p>Number: TP07</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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Number:

TP07

Project
Project No
Client

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OPW



Number:

TP08

Project
Project No
Client

Dublin Port OPW
P19232
OPW



Number: TP08	Project Dublin Port OPW Project No P19232 Client OPW	
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Trial Pit No
TP09
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 719029E - 735476N
Level: 3.67m OD **Date:** 15/11/2019

Location: Dublin **Dimensions (m):** 0.30 x 0.40 **Scale:** 1:25

Client: Office of Public Works (OPW) **Depth:** 0.50m BGL **Logged:** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.20	3.47		(MADE GROUND) Grey, sandy GRAVEL.
	0.50	ENV		0.50	3.17		(MADE GROUND) Grey brown, silty sandy GRAVEL with low cobble content and red brick inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. End of Pit at 0.500m
							1
							2
							3
							4
							5

Stability: Moderate **Plant:** Hand dug **Groundwater:** None encountered.
Backfill: Arisings.

Remarks: Trial pit terminated at 0.50m bgl, required depth.



Number:

TP09

Project
Project No
Client

Dublin Port OPW
P19232
OPW



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Trial Pit No
TP09A
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 719049E - 735437N
Level: 3.51m OD **Date:** 15/11/2019

Location: Dublin **Dimensions (m):** 0.40 x 0.40 **Scale:** 1:25

Client: Office of Public Works (OPW) **Depth:** 0.50m BGL **Logged:** PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.15	3.36		(MADE GROUND) Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
	0.50	ENV		0.50	3.01		(MADE GROUND) Grey, sandy GRAVEL with low cobble content and red brick, concrete inclusions. Sand is fine to coarse. gravel is fine to coarse, angular to sub-angular. Cobbles are 63mm to 200mm dia, angular to sub-angular. End of Pit at 0.500m

Stability: Moderate **Plant:** Hand dug **Groundwater:** None encountered.
Backfill: Arisings.

Remarks: Trial pit terminated at 0.50m bgl, required depth.



Number: TP09A	Project Dublin Port OPW Project No P19232 Client OPW	
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Number:

TP09A

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Trial Pit No
TP10
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 718678E - 735387N
Level: 3.83m OD **Date:** 14/11/2019

Location: Dublin **Dimensions (m):** 2.60
 0.70

Client: Office of Public Works (OPW) **Depth:** 2.30m BGL **Scale:** 1:25
Logged: PH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
Water Strike & Backfill	0.20			0.20	3.63		Bituminous surfacing.
	0.50	ENV					(MADE GROUND) Brown, slightly sandy gravelly SILT with red brick, glass, timber, concrete and re-bar inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
	2.00	ENV					
				2.30	1.53		End of Pit at 2.300m

Stability: Very poor **Groundwater:** None encountered.
Plant: JCB
Backfill: Arisings.

Remarks: Trial pit terminated at 2.30m bgl due to instability.



<p>Number: TP10</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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<p>Number: TP10</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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Trial Pit No
TP11
 Sheet 1 of 1

Project Name: Stage 1 - Dublin Port SI **Project No.:** P19232 **Co-ords:** 718750E - 735342N
Level: 3.66m OD **Date:** 14/11/2019

Location: Dublin **Dimensions (m):** 0.70 x 3.30

Client: Office of Public Works (OPW) **Depth:** 3.00m BGL **Logged PH**

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
Water Strike & Backfill	0.50	ENV		0.30	3.36		(MADE GROUND) Grey, slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is fin to coarse, angular to sub-rounded.
				0.80	2.86		(MADE GROUND) Brown, sandy very silty GRAVEL with low cobble content and red brick. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded.
	2.00	ENV					(MADE GROUND) Brown, slightly gravelly very clayey SAND with red brick, concrete and re-bar inclusions.
				3.00	0.66		End of Pit at 3.000m

Stability: Poor **Groundwater:** None encountered.
Plant: JCB
Backfill: Arisings.

Remarks: Trial pit terminated at 3.00m bgl, required depth.



Number:

TP11

**Project
Project No
Client**

Dublin Port OPW
P19232
OPW



<p>Number: TP11</p>	<p>Project Dublin Port OPW Project No P19232 Client OPW</p>	
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KEY TO SYMBOLS - LABORATORY TEST RESULT

U	Undisturbed Sample	
P	Piston Sample	
TWS	Thin Wall Sample	
B	Bulk Sample - Disturbed	
D	Jar Sample - Disturbed	
W	Water Sample	
pH	Acidity/Alkalinity Index	
SO ₃	% - Total Sulphate Content (acid soluble)	
SO ₃	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)	
+	Calcareous Reaction	
Cl	Chloride Content	
PI	Plasticity Index	
<425	% of material in sample passing 425 micron sieve	
LL	Liquid Limit	
PL	Plastic Limit	
MC	Water Content	
NP	Non Plastic	
Y _b	Bulk Density	
Y _d	Dry Density	
Ps	Particle Density	
U/D	Undrained/Drained Triaxial	
U/C	Unconsolidated/Consolidated Triaxial	
T/M	Single Stage/Multistage Triaxial	
100/38	Sample Diameter (mm)	
REM	Remoulded Triaxial Test Specimen	
TST	Triaxial Suction Test	
V	Vane Test	
DSB	Drained Shear Box	
RSB	Residual Shear Box	
RS	Ring Shear	
σ ₃	Cell Pressure	
σ ₁ -σ ₃	Deviator Stress	
c	Cohesion	
c _e	Effective Cohesion Intercept	
φ	Angle of Shearing Resistance - Degrees	
φ _e	Effective Angle of Shearing Resistance	
ε _f	Strain at Failure	
*	Failed under 1 st Load	
**	Failed under 2 nd Load	
#	Unstable	
##	Excessive Strain	
p _o	Effective Overburden Pressure	
m _v	Coefficient of Volume Decrease	
c _v	Coefficient of Consolidation	
Opt	Optimum	
Nat	Natural	
Std	Standard Compaction - 2.5kg Rammer	(¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer	(§ CBR)
Vib	Vibratory Compaction	
CBR	California Bearing Ratio	
Sat m.c.	Saturation Moisture Content	
MCV	Moisture Condition Value	

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	Chemtest Job No.:		19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616
Quotation No.: Q17-09116	Chemtest Sample ID.:		927205	927206	927207	927208	927209	927210	927211	927212	927213		
Order No.: 12334	Client Sample Ref.:		ENV.1	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2		
	Sample Location:		TP02	TP03	TP03	TP10	TP10	TP11	TP11	TP04	TP04		
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
	Top Depth (m):		0.50	0.50	2.00	0.50	2.00	0.50	2.00	0.50	1.90		
	Date Sampled (\$):		14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019		
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	IN-TRAN-C	COVENTRY	COVENTRY	COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	5.7	10	13	15	12	9.4	14	6.1	13
pH	U	2010		N/A	8.4	11.0	10.7	8.6	9.3	8.8	8.1	9.7	10.2
pH (2.5:1)	N	2010		N/A	8.5	10.8	10.3	8.6	9.4	8.9	8.2	9.6	10.2
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.015	< 0.010	< 0.010	< 0.010	0.018	< 0.010	0.013	< 0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.34	0.72	1.3	0.21	1.1	0.13	0.91	0.63	1.2
Total Sulphur	U	2175	%	0.010	0.20	0.26	0.52	0.23	0.30	0.13	0.30	0.30	0.40
Chloride (Water Soluble)	U	2220	g/l	0.010	0.068	0.064	0.015	0.011	0.026	0.020	0.049	0.030	0.043
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	1.3	< 0.50	3.0	< 0.50	< 0.50	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.13	0.54	0.99	0.15	0.48	0.097	0.70	0.32	0.73
Arsenic	U	2450	mg/kg	1.0	37	27	26	45	29	32	13	27	26
Boron	N	2450	mg/kg	0.40	4.0	6.7	5.8	8.5	8.0	4.4	3.8	6.9	9.8
Cadmium	U	2450	mg/kg	0.10	0.72	0.85	1.2	1.9	1.2	1.1	0.30	1.0	1.4
Chromium	U	2450	mg/kg	1.0	32	20	28	33	23	16	13	18	26
Copper	U	2450	mg/kg	0.50	53	43	63	160	60	45	13	54	56
Mercury	U	2450	mg/kg	0.10	0.30	0.82	3.9	1.6	1.3	0.56	0.18	0.47	1.1
Nickel	U	2450	mg/kg	0.50	37	28	38	43	37	33	17	30	37
Lead	U	2450	mg/kg	0.50	180	170	1100	660	380	300	38	210	490
Zinc	U	2450	mg/kg	0.50	160	190	300	600	290	180	43	150	260
Organic Matter	U	2625	%	0.40	3.8	2.2	4.0	7.6	4.7	2.4	0.84	3.5	5.5
Total TPH >C6-C40	U	2670	mg/kg	10	580	170	340	140	160	120	< 10	230	160
Naphthalene	U	2700	mg/kg	0.10	< 0.10	2.4	1.8	0.72	0.33	0.29	< 0.10	0.90	0.17
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	1.0	1.2	1.7	1.0	0.60	< 0.10	0.88	0.24
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	1.3	0.47	0.64	0.41	0.69	< 0.10	0.21	0.45
Fluorene	U	2700	mg/kg	0.10	< 0.10	4.7	0.52	2.8	2.2	0.16	< 0.10	0.91	0.56
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	3.3	0.95	2.6	3.3	0.80	< 0.10	6.6	3.9
Anthracene	U	2700	mg/kg	0.10	< 0.10	0.81	0.12	0.62	0.75	0.21	< 0.10	2.2	0.69
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	3.4	1.1	4.1	5.1	1.3	< 0.10	8.4	6.0
Pyrene	U	2700	mg/kg	0.10	< 0.10	4.8	2.1	5.7	6.6	2.4	< 0.10	8.1	6.2
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	1.3	0.41	2.3	2.5	< 0.10	< 0.10	3.7	3.0
Chrysene	U	2700	mg/kg	0.10	< 0.10	2.1	0.97	3.3	3.5	< 0.10	< 0.10	4.6	3.7
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	2.6	< 0.10	5.5	4.1	< 0.10	< 0.10	3.9	3.5
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	0.60	< 0.10	1.3	1.2	< 0.10	< 0.10	1.4	1.4
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	1.6	< 0.10	2.7	2.5	0.13	< 0.10	3.3	3.1

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Client: Priority Geotechnical Ltd	Chemtest Job No.:		19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	
Quotation No.: Q17-09116	Chemtest Sample ID.:		927205	927206	927207	927208	927209	927210	927211	927212	927213	927213	
Order No.: 12334	Client Sample Ref.:		ENV.1	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2	ENV.1	ENV.2	ENV.2	
	Sample Location:		TP02	TP03	TP03	TP10	TP10	TP11	TP11	TP04	TP04	TP04	
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
	Top Depth (m):		0.50	0.50	2.00	0.50	2.00	0.50	2.00	0.50	1.90	1.90	
	Date Sampled (\$):		14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	14-Nov-2019	
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	IN-TRAN-C	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD									
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	0.78	< 0.10	1.9	1.7	< 0.10	< 0.10	2.0	1.9
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.7	0.92	18	< 0.10	0.80	0.90
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	1.7	< 0.10	2.0	1.9	23	< 0.10	2.1	2.1
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	32	9.6	40	38	48	< 2.0	50	38
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	Chemtest Job No.:		19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616
Quotation No.: Q17-09116	Chemtest Sample ID.:		927214	927215	927216	927217	927218	927219	927220	927221	927222		
Order No.: 12334	Client Sample Ref.:		ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1	ENV.1	ENV.1
	Sample Location:		TP05	TP05	TP08	TP07	TP07	TP9A	TP1A	TP1A	TP1A	TP1B	
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
	Top Depth (m):		0.50	2.00	0.50	0.50	2.00	0.50	0.50	2.00	0.50		
	Date Sampled (\$):		15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	5.7	12	7.9	7.5	11	6.6	14	24	9.1
pH	U	2010		N/A	8.7	8.1	9.6	9.8	10.4	9.0	8.5	8.1	8.2
pH (2.5:1)	N	2010		N/A	8.8	8.1	9.5	9.8	10.4	9.0	8.6	8.1	8.2
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.010	0.026	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.034	0.017
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.39	1.4	0.91	0.30	0.36	0.12	0.10	1.6	1.4
Total Sulphur	U	2175	%	0.010	0.25	1.8	0.40	0.25	0.18	0.17	0.11	0.56	0.52
Chloride (Water Soluble)	U	2220	g/l	0.010	0.010	0.021	0.019	0.014	0.038	< 0.010	< 0.010	0.059	0.022
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	1.5	1.8	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.13	7.7	0.48	0.19	0.24	0.11	0.091	0.36	0.60
Arsenic	U	2450	mg/kg	1.0	39	22	35	32	35	38	69	32	30
Boron	N	2450	mg/kg	0.40	2.8	7.4	6.9	5.9	9.5	2.8	5.6	13	4.8
Cadmium	U	2450	mg/kg	0.10	0.94	1.0	1.6	0.92	3.2	1.0	1.5	1.5	1.2
Chromium	U	2450	mg/kg	1.0	11	19	25	17	29	14	33	52	11
Copper	U	2450	mg/kg	0.50	28	46	130	62	360	33	110	150	140
Mercury	U	2450	mg/kg	0.10	0.25	0.87	0.95	0.49	1.3	0.27	0.78	1.3	0.48
Nickel	U	2450	mg/kg	0.50	24	31	47	38	56	24	48	45	18
Lead	U	2450	mg/kg	0.50	120	310	450	210	690	150	700	920	270
Zinc	U	2450	mg/kg	0.50	140	220	370	170	990	170	500	650	290
Organic Matter	U	2625	%	0.40	2.8	4.1	4.5	3.6	4.5	2.4	5.3	14	3.8
Total TPH >C6-C40	U	2670	mg/kg	10	140	160	320	420	360	230	290	310	740
Naphthalene	U	2700	mg/kg	0.10	< 0.10	0.32	0.44	0.42	0.42	0.31	0.95	3.4	1.1
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	0.34	0.31	0.30	0.27	0.23	1.0	0.60	0.90
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	0.84	0.39	0.42	< 0.10	0.28	0.24	1.2	1.2
Fluorene	U	2700	mg/kg	0.10	< 0.10	0.43	0.34	0.27	0.22	0.27	1.4	1.3	1.7
Phenanthrene	U	2700	mg/kg	0.10	0.66	1.8	2.4	1.5	2.3	2.5	6.3	4.6	7.3
Anthracene	U	2700	mg/kg	0.10	0.22	0.45	0.62	0.50	0.65	0.62	1.8	2.4	2.8
Fluoranthene	U	2700	mg/kg	0.10	1.6	2.8	5.0	3.4	4.1	3.0	10	8.5	15
Pyrene	U	2700	mg/kg	0.10	1.7	2.7	4.9	3.9	4.7	2.8	12	8.4	16
Benzo[a]anthracene	U	2700	mg/kg	0.10	0.62	1.1	2.3	1.5	2.3	1.1	5.9	3.5	7.6
Chrysene	U	2700	mg/kg	0.10	0.70	1.4	3.0	1.9	2.9	1.5	7.6	4.0	8.0
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	1.2	1.4	3.1	2.8	3.1	1.3	8.7	2.7	9.0
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	0.47	0.54	1.2	1.1	1.4	0.45	3.1	2.3	3.1
Benzo[a]pyrene	U	2700	mg/kg	0.10	1.3	1.4	2.9	2.4	3.0	1.3	7.0	5.1	7.9

Results - Soil

Project: P19232 Dublin port OPW

Client: Priority Geotechnical Ltd	Chemtest Job No.:		19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	19-38616	
Quotation No.: Q17-09116	Chemtest Sample ID.:		927214	927215	927216	927217	927218	927219	927220	927221	927222	927222	
Order No.: 12334	Client Sample Ref.:		ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1	ENV.1	ENV.2	ENV.1	ENV.1	
	Sample Location:		TP05	TP05	TP08	TP07	TP07	TP9A	TP1A	TP1A	TP1A	TP1B	
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
	Top Depth (m):		0.50	2.00	0.50	0.50	2.00	0.50	0.50	2.00	0.50	0.50	
	Date Sampled (\$):		15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	15-Nov-2019	
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD									
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	0.76	0.87	1.9	1.8	3.0	1.3	4.7	3.1	4.3
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.57	0.69	1.1	0.81	2.4	1.4	2.2	2.1	3.5
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	0.99	0.94	2.2	1.9	3.3	1.3	5.2	3.9	5.5
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	11	18	32	25	34	20	78	57	95
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Client: Priority Geotechnical Ltd		Chemtest Job No.:		19-38616	
Quotation No.: Q17-09116		Chemtest Sample ID.:		927223	
Order No.: 12334		Client Sample Ref.:		ENV.1	
		Sample Location:		TP09	
		Sample Type:		SOIL	
		Top Depth (m):		0.50	
		Date Sampled (\$):		15-Nov-2019	
		Asbestos Lab:		COVENTRY	
Determinand	Accred.	SOP	Units	LOD	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	9.3
pH	U	2010		N/A	8.5
pH (2.5:1)	N	2010		N/A	8.6
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.015
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.81
Total Sulphur	U	2175	%	0.010	0.30
Chloride (Water Soluble)	U	2220	g/l	0.010	0.052
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.39
Arsenic	U	2450	mg/kg	1.0	27
Boron	N	2450	mg/kg	0.40	5.0
Cadmium	U	2450	mg/kg	0.10	1.0
Chromium	U	2450	mg/kg	1.0	15
Copper	U	2450	mg/kg	0.50	52
Mercury	U	2450	mg/kg	0.10	0.44
Nickel	U	2450	mg/kg	0.50	27
Lead	U	2450	mg/kg	0.50	250
Zinc	U	2450	mg/kg	0.50	190
Organic Matter	U	2625	%	0.40	2.6
Total TPH >C6-C40	U	2670	mg/kg	10	830
Naphthalene	U	2700	mg/kg	0.10	0.10
Acenaphthylene	U	2700	mg/kg	0.10	0.74
Acenaphthene	U	2700	mg/kg	0.10	0.19
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	1.1
Anthracene	U	2700	mg/kg	0.10	0.42
Fluoranthene	U	2700	mg/kg	0.10	3.0
Pyrene	U	2700	mg/kg	0.10	3.7
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.8
Chrysene	U	2700	mg/kg	0.10	2.6
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	2.7
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	1.0
Benzo[a]pyrene	U	2700	mg/kg	0.10	2.8

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Results - Soil

Client: Priority Geotechnical Ltd	Chemtest Job No.:		19-38616		
Quotation No.: Q17-09116	Chemtest Sample ID.:		927223		
Order No.: 12334	Client Sample Ref.:		ENV.1		
	Sample Location:		TP09		
	Sample Type:		SOIL		
	Top Depth (m):		0.50		
	Date Sampled (\$):		15-Nov-2019		
	Asbestos Lab:		COVENTRY		
Determinand	Accred.	SOP	Units	LOD	
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	1.5
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.79
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.8
Coronene	N	2700	mg/kg	0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	24
Total Phenols	U	2920	mg/kg	0.30	< 0.30

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927205				Limits			
Sample Ref: ENV.1					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: TP02							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 14-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.2	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	580	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.011	0.11	0.5	2	25
Barium	1450	U	0.024	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.024	0.24	0.5	10	70
Copper	1450	U	0.0037	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.049	0.49	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0058	0.058	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.012	< 0.50	4	50	200
Chloride	1220	U	6.0	60	800	15000	25000
Fluoride	1220	U	0.32	3.2	10	150	500
Sulphate	1220	U	71	710	1000	20000	50000
Total Dissolved Solids	1020	N	210	2100	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	9.1	91	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	5.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927206				Limits			
Sample Ref: ENV.1					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: TP03							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 14-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	1.3	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	170	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0080	0.080	0.5	2	25
Barium	1450	U	0.021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	0.0027	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0093	0.093	0.5	10	30
Nickel	1450	U	0.043	0.43	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0031	0.031	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.017	< 0.50	4	50	200
Chloride	1220	U	1.3	13	800	15000	25000
Fluoride	1220	U	0.34	3.4	10	150	500
Sulphate	1220	U	110	1100	1000	20000	50000
Total Dissolved Solids	1020	N	270	2700	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.2	62	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927207 Sample Ref: ENV.2 Sample ID: Sample Location: TP03 Top Depth(m): 2.00 Bottom Depth(m): Sampling Date (\$): 14-Nov-2019				Landfill Waste Acceptance Criteria Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.3	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	340	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0078	0.078	0.5	2	25
Barium	1450	U	0.045	< 0.50	20	100	300
Cadmium	1450	U	0.00023	< 0.010	0.04	1	5
Chromium	1450	U	0.024	0.24	0.5	10	70
Copper	1450	U	0.0031	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.013	0.13	0.5	10	30
Nickel	1450	U	0.038	0.38	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0043	0.043	0.06	0.7	5
Selenium	1450	U	0.0021	0.021	0.1	0.5	7
Zinc	1450	U	0.12	1.2	4	50	200
Chloride	1220	U	2.8	28	800	15000	25000
Fluoride	1220	U	0.19	1.9	10	150	500
Sulphate	1220	U	780	7800	1000	20000	50000
Total Dissolved Solids	1020	N	780	7800	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927208 Sample Ref: ENV.1 Sample ID: Sample Location: TP10 Top Depth(m): 0.50 Bottom Depth(m): Sampling Date (\$): 14-Nov-2019				Landfill Waste Acceptance Criteria			
				Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	4.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	140	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0078	0.078	0.5	2	25
Barium	1450	U	0.037	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.027	0.27	0.5	10	70
Copper	1450	U	0.0067	0.067	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.025	0.25	0.4	10	40
Lead	1450	U	0.0030	0.030	0.5	10	50
Antimony	1450	U	0.011	0.11	0.06	0.7	5
Selenium	1450	U	0.0015	0.015	0.1	0.5	7
Zinc	1450	U	0.018	< 0.50	4	50	200
Chloride	1220	U	1.3	13	800	15000	25000
Fluoride	1220	U	1.4	14	10	150	500
Sulphate	1220	U	74	740	1000	20000	50000
Total Dissolved Solids	1020	N	190	1900	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	9.4	94	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927209 Sample Ref: ENV.2 Sample ID: Sample Location: TP10 Top Depth(m): 2.00 Bottom Depth(m): Sampling Date (\$): 14-Nov-2019				Landfill Waste Acceptance Criteria			
				Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.7	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	160	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0059	0.059	0.5	2	25
Barium	1450	U	0.021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	0.0025	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0092	0.092	0.5	10	30
Nickel	1450	U	0.021	0.21	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0093	0.093	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.042	< 0.50	4	50	200
Chloride	1220	U	2.8	28	800	15000	25000
Fluoride	1220	U	0.44	4.4	10	150	500
Sulphate	1220	U	400	4000	1000	20000	50000
Total Dissolved Solids	1020	N	450	4500	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.8	68	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927210				Limits			
Sample Ref: ENV.1				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Sample ID:							
Sample Location: TP11							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 14-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	1.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	120	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0062	0.062	0.5	2	25
Barium	1450	U	0.024	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	0.0031	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.013	0.13	0.5	10	30
Nickel	1450	U	0.019	0.19	0.4	10	40
Lead	1450	U	0.0073	0.073	0.5	10	50
Antimony	1450	U	0.0064	0.064	0.06	0.7	5
Selenium	1450	U	0.0010	0.010	0.1	0.5	7
Zinc	1450	U	0.0069	< 0.50	4	50	200
Chloride	1220	U	27	270	800	15000	25000
Fluoride	1220	U	0.73	7.3	10	150	500
Sulphate	1220	U	35	350	1000	20000	50000
Total Dissolved Solids	1020	N	120	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	11	110	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	9.4

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927211				Limits			
Sample Ref: ENV.2							
Sample ID:							
Sample Location: TP11							
Top Depth(m): 2.00							
Bottom Depth(m):							
Sampling Date (\$): 14-Nov-2019							
Determinand	SOP	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	U	%	0.49	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0037	< 0.050	0.5	2	25
Barium	1450	U	0.021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.022	0.22	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0077	0.077	0.5	10	30
Nickel	1450	U	0.019	0.19	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.062	0.62	4	50	200
Chloride	1220	U	11	110	800	15000	25000
Fluoride	1220	U	0.37	3.7	10	150	500
Sulphate	1220	U	560	5600	1000	20000	50000
Total Dissolved Solids	1020	N	630	6300	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.7	57	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927212				Limits			
Sample Ref: ENV.1					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: TP04							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 14-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.0	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	230	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0081	0.081	0.5	2	25
Barium	1450	U	0.018	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.025	0.25	0.5	10	70
Copper	1450	U	0.0095	0.095	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.013	0.13	0.5	10	30
Nickel	1450	U	0.018	0.18	0.4	10	40
Lead	1450	U	0.0018	0.018	0.5	10	50
Antimony	1450	U	0.0044	0.044	0.06	0.7	5
Selenium	1450	U	0.0029	0.029	0.1	0.5	7
Zinc	1450	U	0.014	< 0.50	4	50	200
Chloride	1220	U	4.5	45	800	15000	25000
Fluoride	1220	U	0.27	2.7	10	150	500
Sulphate	1220	U	74	740	1000	20000	50000
Total Dissolved Solids	1020	N	200	2000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	12	120	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.1

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927213				Limits			
Sample Ref: ENV.2				3.2	3	5	6
Sample ID:							
Sample Location: TP04				< 0.010	6	--	--
Sample Depth(m): 1.90							
Bottom Depth(m):				< 0.10	1	--	--
Sampling Date (\$): 14-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%				
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg				
Total PCBs (7 Congeners)	2815	U	mg/kg				
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	160	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0059	0.059	0.5	2	25
Barium	1450	U	0.013	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.020	0.20	0.5	10	70
Copper	1450	U	0.0028	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.015	0.15	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0023	0.023	0.06	0.7	5
Selenium	1450	U	0.0011	0.011	0.1	0.5	7
Zinc	1450	U	0.018	< 0.50	4	50	200
Chloride	1220	U	4.3	43	800	15000	25000
Fluoride	1220	U	0.39	3.9	10	150	500
Sulphate	1220	U	160	1600	1000	20000	50000
Total Dissolved Solids	1020	N	270	2700	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	12	120	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927214				Limits			
Sample Ref: ENV.1							
Sample ID:							
Sample Location: TP05							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 15-Nov-2019							
Determinand	SOP	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	U	%	1.6	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	140	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0064	0.064	0.5	2	25
Barium	1450	U	0.020	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.026	0.26	0.5	10	70
Copper	1450	U	0.0033	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0063	0.063	0.5	10	30
Nickel	1450	U	0.021	0.21	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0025	0.025	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0061	< 0.50	4	50	200
Chloride	1220	U	4.0	40	800	15000	25000
Fluoride	1220	U	0.35	3.5	10	150	500
Sulphate	1220	U	25	250	1000	20000	50000
Total Dissolved Solids	1020	N	85	850	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.7	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	5.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927215				Limits			
Sample Ref: ENV.2							
Sample ID:							
Sample Location: TP05							
Top Depth(m): 2.00							
Bottom Depth(m):							
Sampling Date (\$): 15-Nov-2019							
Determinand	SOP	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	U	%	2.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	160	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0054	0.054	0.5	2	25
Barium	1450	U	0.040	< 0.50	20	100	300
Cadmium	1450	U	0.00019	< 0.010	0.04	1	5
Chromium	1450	U	0.029	0.29	0.5	10	70
Copper	1450	U	0.0055	0.055	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	0.020	0.20	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0030	0.030	0.06	0.7	5
Selenium	1450	U	0.0012	0.012	0.1	0.5	7
Zinc	1450	U	0.22	2.2	4	50	200
Chloride	1220	U	3.5	35	800	15000	25000
Fluoride	1220	U	0.17	1.7	10	150	500
Sulphate	1220	U	1700	17000	1000	20000	50000
Total Dissolved Solids	1020	N	1400	14000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	8.2	82	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927216				Limits			
Sample Ref: ENV.1					Inert Waste Landfill	Stable, Non- reactive hazardous waste in non- hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: TP08							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 15-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.6	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	320	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0055	0.055	0.5	2	25
Barium	1450	U	0.027	< 0.50	20	100	300
Cadmium	1450	U	0.0018	0.018	0.04	1	5
Chromium	1450	U	0.033	0.33	0.5	10	70
Copper	1450	U	0.0053	0.053	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.010	0.10	0.5	10	30
Nickel	1450	U	0.0097	0.097	0.4	10	40
Lead	1450	U	0.0021	0.021	0.5	10	50
Antimony	1450	U	0.015	0.15	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.060	0.60	4	50	200
Chloride	1220	U	12	120	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	450	4500	1000	20000	50000
Total Dissolved Solids	1020	N	530	5300	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	14	140	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927217 Sample Ref: ENV.1 Sample ID: Sample Location: TP07 Top Depth(m): 0.50 Bottom Depth(m): Sampling Date (\$): 15-Nov-2019				Landfill Waste Acceptance Criteria			
				Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.1	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	420	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0084	0.084	0.5	2	25
Barium	1450	U	0.0073	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.029	0.29	0.5	10	70
Copper	1450	U	0.0043	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0066	0.066	0.5	10	30
Nickel	1450	U	0.0092	0.092	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0016	0.016	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0071	< 0.50	4	50	200
Chloride	1220	U	2.3	23	800	15000	25000
Fluoride	1220	U	0.11	1.1	10	150	500
Sulphate	1220	U	32	320	1000	20000	50000
Total Dissolved Solids	1020	N	160	1600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.5	65	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.5

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927218				Limits			
Sample Ref: ENV.2					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: TP07							
Top Depth(m): 2.00							
Bottom Depth(m):							
Sampling Date (\$): 15-Nov-2019							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	2.6	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	360	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0045	< 0.050	0.5	2	25
Barium	1450	U	0.015	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.027	0.27	0.5	10	70
Copper	1450	U	0.0026	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0051	0.051	0.5	10	30
Nickel	1450	U	0.012	0.12	0.4	10	40
Lead	1450	U	0.0014	0.014	0.5	10	50
Antimony	1450	U	0.0011	0.011	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.012	< 0.50	4	50	200
Chloride	1220	U	4.8	48	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	44	440	1000	20000	50000
Total Dissolved Solids	1020	N	120	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.6	56	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927219 Sample Ref: ENV.1 Sample ID: Sample Location: TP9A Top Depth(m): 0.50 Bottom Depth(m): Sampling Date (\$): 15-Nov-2019				Landfill Waste Acceptance Criteria			
				Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	1.4	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	230	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0045	< 0.050	0.5	2	25
Barium	1450	U	0.0089	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.026	0.26	0.5	10	70
Copper	1450	U	0.0015	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0037	< 0.050	0.5	10	30
Nickel	1450	U	0.013	0.13	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0054	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.14	1.4	10	150	500
Sulphate	1220	U	14	140	1000	20000	50000
Total Dissolved Solids	1020	N	49	490	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.3	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.6

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927220 Sample Ref: ENV.1 Sample ID: Sample Location: TP1A Top Depth(m): 0.50 Bottom Depth(m): Sampling Date (\$): 15-Nov-2019				Landfill Waste Acceptance Criteria			
				Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	3.1	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	290	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0059	0.059	0.5	2	25
Barium	1450	U	0.012	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.021	0.21	0.5	10	70
Copper	1450	U	0.0018	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0045	< 0.050	0.5	10	30
Nickel	1450	U	0.012	0.12	0.4	10	40
Lead	1450	U	0.0014	0.014	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0052	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.43	4.3	10	150	500
Sulphate	1220	U	13	130	1000	20000	50000
Total Dissolved Solids	1020	N	51	510	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	7.1	71	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927221				Limits			
Sample Ref: ENV.2							
Sample ID:							
Sample Location: TP1A							
Top Depth(m): 2.00							
Bottom Depth(m):							
Sampling Date (\$): 15-Nov-2019							
Determinand	SOP	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	U	%	7.9	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	310	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0035	< 0.050	0.5	2	25
Barium	1450	U	0.022	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.021	0.21	0.5	10	70
Copper	1450	U	0.0012	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0085	0.085	0.5	10	30
Nickel	1450	U	0.013	0.13	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0030	0.030	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.017	< 0.50	4	50	200
Chloride	1220	U	1.5	15	800	15000	25000
Fluoride	1220	U	3.2	32	10	150	500
Sulphate	1220	U	110	1100	1000	20000	50000
Total Dissolved Solids	1020	N	200	1900	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.4	54	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	24

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616				Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 927222				Limits			
Sample Ref: ENV.1							
Sample ID:							
Sample Location: TP1B							
Top Depth(m): 0.50							
Bottom Depth(m):							
Sampling Date (\$): 15-Nov-2019							
Determinand	SOP	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	U	%	2.2	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	740	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0060	0.060	0.5	2	25
Barium	1450	U	0.019	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.017	0.17	0.5	10	70
Copper	1450	U	0.0023	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0051	0.051	0.5	10	30
Nickel	1450	U	0.011	0.11	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0019	0.019	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.012	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	89	890	1000	20000	50000
Total Dissolved Solids	1020	N	160	1600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.6	56	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	9.1

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P19232 Dublin port OPW

Chemtest Job No: 19-38616 Chemtest Sample ID: 927223 Sample Ref: ENV.1 Sample ID: Sample Location: TP09 Top Depth(m): 0.50 Bottom Depth(m): Sampling Date (\$): 15-Nov-2019				Landfill Waste Acceptance Criteria			
				Limits			
				Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	U	%	1.5	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	830	500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0047	< 0.050	0.5	2	25
Barium	1450	U	0.012	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.019	0.19	0.5	10	70
Copper	1450	U	0.0016	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0038	< 0.050	0.5	10	30
Nickel	1450	U	0.013	0.13	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0069	< 0.50	4	50	200
Chloride	1220	U	5.7	57	800	15000	25000
Fluoride	1220	U	0.11	1.1	10	150	500
Sulphate	1220	U	42	420	1000	20000	50000
Total Dissolved Solids	1020	N	100	1000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.9	69	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	9.3

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurement by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

SOP	Title	Parameters included	Method summary
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"
- \$ This information has been supplied by the client and can affect the integrity of test data.

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



OPW

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nOibreacha Poiblí
Office of Public Works

PART 2 - FLOOD RISK ASSESSMENT REPORT

CONTENTS

1.0	INTRODUCTION
2.0	METHODOLOGY
3.0	PROJECT SCOPE
4.0	FLOOD RISK IDENTIFICATION
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6.0	COMPLIANCE WITH FLOOD RISK MANAGEMENT GUIDELINES AND PROPOSED MITIGATION MEASURES
7.0	CLIMATE CHANGE
8.0	FLOOD RISK ASSESSMENT CONCLUSIONS
APPENDIX A	OPW FLOOD MAPS
APPENDIX B	PLUVIAL FLOOD EXTENT MAPS
APPENDIX C	CFRAM MAPS
APPENDIX D	OPW FLOOD RECORDS
APPENDIX E	ICPSS MAPS

1.1 INTRODUCTION

As part of the preliminary design process, OPW C&S Services carried out a Flood Risk Assessment of the Bond Drive Extension and Yard 3/4 brownfield sites within Dublin Port. This report has been prepared to assess the flood risk to the sites and adjacent lands as a result of the proposed developments.

1.2 METHODOLOGY

1.2.1 Introduction

This report has been prepared in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' herein referred to as 'The Guidelines' as published by the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DoH LG) in 2009.

1.2.2 Definition of Flood Risk

Flood risk is a combination of the likelihood of a flood event occurring and the potential consequences arising from that flood event and is then normally expressed in terms of the following relationship:

Flood risk = Likelihood of flooding x Consequences of flooding.

The principal sources of flooding are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors can include people, their property and the environment. All three elements as well as the vulnerability and exposure of receptors must be examined to determine the potential consequences.

1.2.3 Likelihood of Flooding

The Guidelines define the likelihood of flooding as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is generally expressed as a return period or annual exceedance probability (AEP). A 1% AEP flood indicates a flood event that will be equalled or exceeded on average once every hundred years and has a return period of 1 in 100 years. Annual Exceedance Probability is the inverse of return period as shown in Table 2.1 below.

Table 2.1 Correlation between return period and AEP

Return Period (years)	Annual Exceedance Probability (%)
1	100
10	10
50	2
100	1
200	0.5
1000	0.1

1.2.4 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and are split into three categories in The Guidelines:

Flood Zone A

Flood Zone A where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B

Flood Zone B where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding);

Flood Zone C

Flood Zone C where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding. Flood Zone C covers all plan areas which are not in zones A or B.

It is important to note that when determining flood zones the presence of flood protection structures should be ignored. This is because areas protected by flood defences still carry a residual risk from overtopping or breach of defences and the fact that there is no guarantee that the defences will be maintained in perpetuity.

1.2.5 Objectives and Principles of the Planning Guidelines

The principle actions when considering flood risk are set out in the planning guidelines and are summarised below:

- *“Flood hazard and potential risk should be determined at the earliest stage of the planning process...”*
- *“Development should preferentially be located in areas with little or no flood hazard thereby avoiding or minimising the risk...”*
- *“Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available...”*
- *“Where development is necessary in areas at risk of flooding an appropriate land use should be selected”*
- *A precautionary approach should be applied, where necessary, to reflect uncertainties in flooding datasets and risk assessment techniques...”*
- *“Land required for current and future flood management... should be proactively identified...”*
- *“Flood risk to, and arising from, new development should be managed through location, layout and design incorporating Sustainable Drainage Systems (SuDS) and compensation for any loss of floodplain...”*
- *Strategic environmental assessment (SEA) of regional planning guidelines, development plans and local area plans should include flood risk as one of the key environmental criteria...”*

1.2.6 The Sequential Approach and Justification Test

The Guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 2.2 below. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach. However, this is not always possible as many town and city centres are within flood zones and are targeted for development.

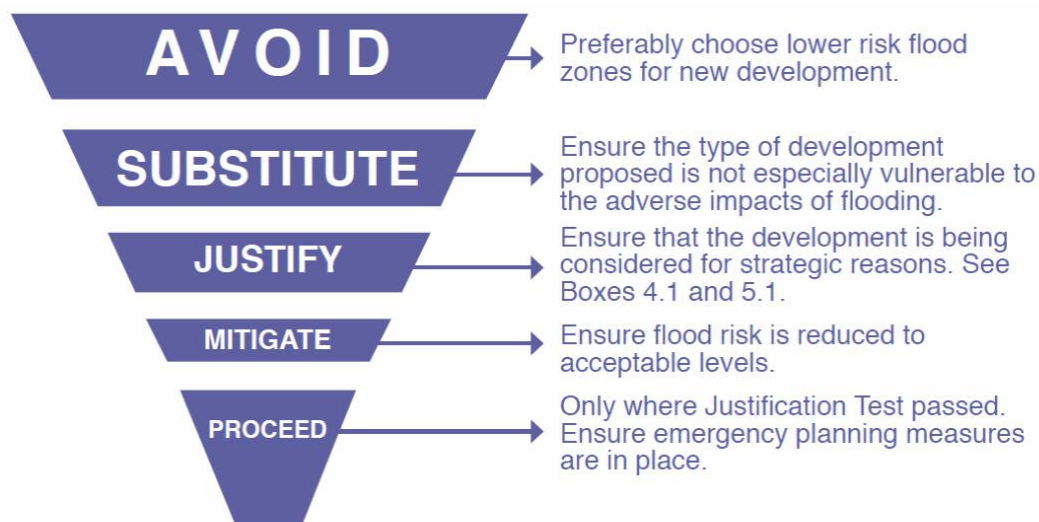


Figure 2.2 Sequential Approach (Source: The Planning System and Flood Risk Management)

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 2.2 below illustrates the types of development that would be required to meet the Justification Test.

Table 2.2 Matrix of Vulnerability versus Flood Zone to Illustrate Appropriate Development and that Required to Meet the Justification Test (Source: The Planning System and Flood Risk Management)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

1.3 PROJECT SCOPE

This flood risk assessment covers a number of different sites which will merge to form two separate sites in close proximity within Dublin Port Operational Zone. Site locations are shown in figure 3.1. The proposed developments within these sites are as follows.



Figure 3.1

Bond Drive Extension

The Bond Drive site is north of Bond Drive Extension. There are a number of temporary structures on this site, all of which are to be removed. The site will be provided with approximately five new single storey prefabricated structures providing office and welfare facilities. A bike store will also be provided. Landscaping will be provided where possible. The remainder of the site will be utilised for staff parking, HGV parking and circulation.

Yards 3 & 4

Yard 3 & 4 is south of Bond Drive Extension. The permanent structure on the south end of the site will be retained and extended. The temporary and permanent structures at the north end of the site will be demolished and removed. Two new single storey prefabricated structures providing office and welfare facilities will be provided at the north end of the site. Landscaping will be provided where possible. The remainder of the site will be utilised for staff parking, HGV parking and circulation.

1.4 FLOOD RISK IDENTIFICATION

1.4.1 General

This Flood Risk Identification includes a review of the existing information and the identification of any flooding or surface water management issues in the vicinity of the proposed site that may warrant further investigation.

1.4.2 Information Sources Consulted

The following information sources were consulted as part of the Flood Risk Identification:

Table 4.1 Information Sources Consulted

Source	Comments
OPW National Flood information portal consulted	Fluvial, Pluvial and Coastal flooding examined; www.floodinfo.ie
Catchment Flood Risk Assessment and Management Study (CFRAM)	OPW draft mapping scrutinized
Irish Coastal Protection Strategy Study	OPW Coastal flood Maps

1.4.2.1 Predictive Flood Maps and Flood Hazard Records

(i) OPW National Flood Information Portal

The flood extent maps on the national flood records for the proposed development sites indicates that there are no recorded flood events on the site.

An extract of these maps are reproduced in Appendix A.

(ii) OPW Fluvial and Pluvial Study

Generally for a site to be considered at risk from surface water flow it characteristically has steep gradients either within or above the site and a reasonably large contributing catchment area. The Bond Drive and Yard 3 & 4 site and the surrounding land are flat and do not have a contributing catchment area above the sites. The risk of significant flooding from surface water is therefore considered low.

Surface water originating from Dublin Port lands and port estate roads is discharged to the surface water drainage system. The majority of run-off from the surface water system is passed through interceptors prior to discharging to Dublin Bay in a number of locations. There is no history of flooding from the existing storm drainage system.

The sites are not at risk from fluvial flooding.

An extract of these maps are reproduced in Appendix B.

(iii) Catchment Flood Risk Assessment and Management Study

The Project area is covered within the Eastern CFRAM study areas. The CFRAM programme led by the OPW, provides a detailed assessment of flooding in areas identified as AFA's during the PFRA study. Catchment wide Flood Risk Management Plans were also developed as part of the programme.

The Final CFRAM mapping indicates that the Bond Drive and Yard 3 & 4 site are not subject to flooding in 1 in 1000 year or greater frequency events.

The published CFRAM flood maps are reproduced in Appendix C.

(iv) OPW National Flood Hazard Mapping

The OPW National Flood Hazard Mapping Web Site, www.floodmaps.ie, was examined to identify any recorded flood events within the vicinity of the proposed development sites. There are no records of flooding in the vicinity of the proposed development on the OPW flood hazard website.

The OPW Flood Hazard Mapping is reproduced in Appendix D.

(v) Irish Coastal Protection Strategy Study

The Irish Coastal Protection Strategy Study (ICPSS) Phase 3, undertaken by the OPW, covers coastal flooding throughout Ireland. The aims of the ICPSS were to establish extreme coastal flood extents, produce coastal flood extent and flood depth maps and assess and quantify the hazard and potential risk associated with coastal erosion.

The ICPSS flood maps indicates that there is minor flooding in the Yard 3 & 4 site for 1 in 1000 year (0.1%AEP) events. The closest modelling node (Point 22) indicates that the 0.5% & 0.1% AEP water levels are 3.07mOD & 3.28mOD respectively.

The ICPSS mapping indicates that the Bond Drive site is not subject to flooding in 1 in 1000 year or greater frequency events.

The published ICPSS flood maps are reproduced in Appendix E.

1.5 FLOOD RISK IDENTIFICATION SUMMARY

In accordance with “The Planning System and Flood Risk Management Guidelines for Planning Authorities” the possible sources of flooding associated with this development have been identified. These are summarised in Table 5.1 (taken from Appendix A of the Guidelines).

Table 5.1 Possible Sources of Flooding Associated within the Dublin Port Sites

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Tidal	Overland flow, out of bank	Dublin Port Sites	High Possibility	High (Sites are flat low lying in close proximity to the sea)	High (due to relative elevation of site above nearest tidal waterbody.)
Fluvial	Overland flow, out of bank	Dublin Port Sites	Low Possibility	Low (no watercourses are located within or directly adjacent to the sites)	Low (due to the lack of watercourses in close proximity to the sites)
Surface Water	Overland flow	Dublin Port Sites	Possible	Medium (no reported surface water flooding on site)	Low (if appropriate drainage system is incorporated in development and maintained appropriately)
Ground Water	Rising levels	Dublin Port Sites	Possible	Medium (proposed sites are built on reclaimed ground within Dublin bay. Water table is close to surface throughout port complex.	Low (due to low permeability of soil cover)

The information provided in this section identifies that there is potentially elevated levels of tidal flood risk arising along the northern boundary of Dublin Port. CFRAMs and ICPSS flood extent mapping indicates minor flooding in a 1 in 1000 year event at Yard 3 & 4. Yard 3 & 4 site is predominantly within flood zone C and partially within flood zone B as per the OPW Guidelines. No flooding is indicated at the Bond Drive site in a 1 in 1000 year coastal or fluvial flood event. Bond Drive site is therefore in flood zone C as per the OPW Guidelines.

1.6 COMPLIANCE WITH FLOOD RISK MANAGEMENT GUIDELINES AND PROPOSED MITIGATION MEASURES

Bond Drive

The OPW Guidelines identifies that docks and activities requiring a waterside location are “water comparable developments”. The proposed development within Bond Drive is therefore appropriate within all flood zone designations. As per the risk based sequential approach, a justification test is not required for this site.

Yard 3 & 4

The OPW Guidelines identifies that docks and activities requiring a waterside location are “water comparable developments”. The proposed development within Yard 3 & 4 is therefore appropriate within all flood zone designations. As per the risk based sequential approach, a justification test is not required for Yard 3 & 4.

1.7 CLIMATE CHANGE

Consideration of the site for the mid-range and high end futures scenarios indicates that some flooding will occur in Bond Drive and more extensive flooding will occur in Yard 3 & 4 for the high end future scenario.

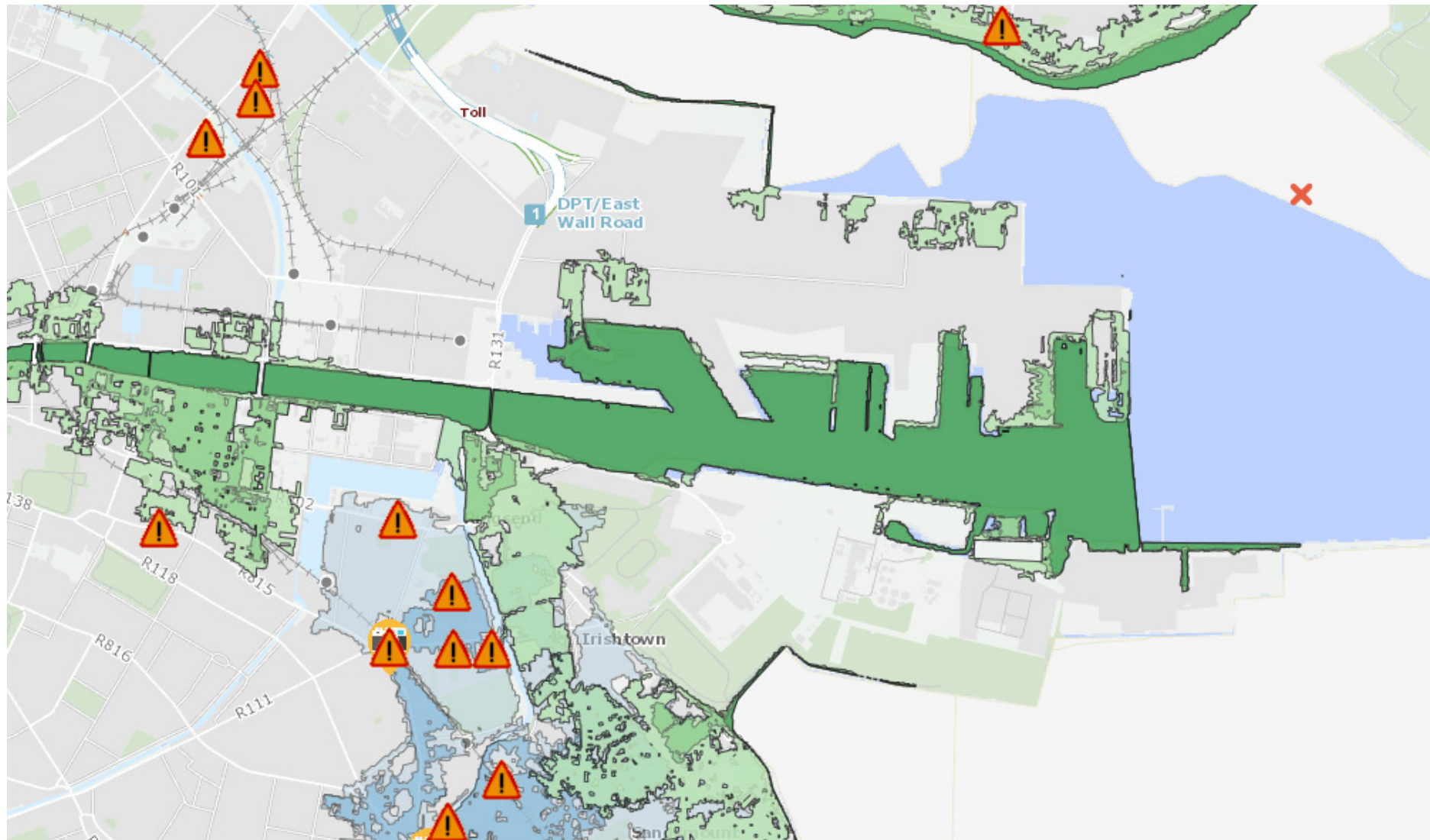
In order to mitigate potential flooding, where possible, a minimum floor or site level of 4.1m OD will be set, which takes into account a 0.5m rise due to climate change plus 0.3m freeboard for the present day 0.1% AEP water level. Alternatively, flood protection measures such as perimeter bunding may be provided in lieu of raising site levels.

The Dublin Port Masterplan recommends that minimum floor levels should be set at the present day 0.5% AEP tidal event with a suitable allowance for climate change and a suitable freeboard. For most developments a 0.5m increase in sea level is deemed appropriate. This would result in a minimum floor level of 3.86m.

1.8 FLOOD RISK ASSESSMENT CONCLUSIONS

Two adjacent sites (Bond Drive and Yard 3 & 4) within Dublin port have been assessed for existing and future sources of flood risk. The primary source of flood risk identified for the sites is from coastal flooding from the adjacent Dublin Bay. The proposed development on both sites is suitable for the associated flood risk as per the current guidelines “The Planning System & Flood Risk Management”.

APPENDIX A - FLOOD MAPS



Extract from floodmaps.ie

APPENDIX B - FLUVIAL & PLUVIAL FLOOD EXTENT MAP



- LEGEND**
- 10% AEP Pluvial
 - 1% AEP Pluvial
 - 0.5% AEP Pluvial

IMPORTANT USER NOTE:
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 Trim
 Co. Meath



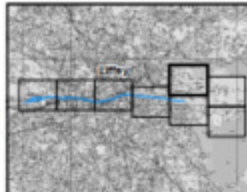
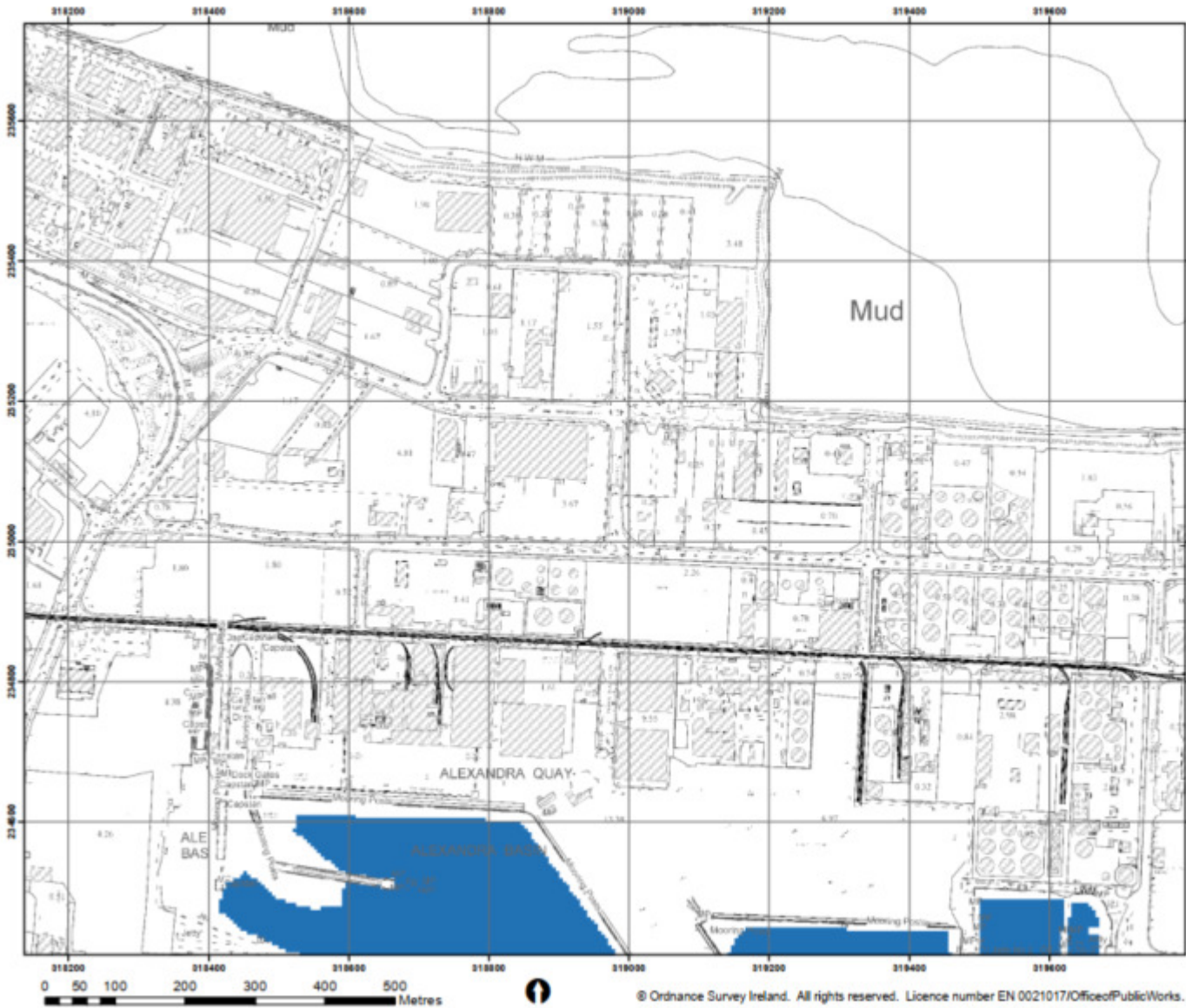
Comhairle Cathrach
 Éilís Áine Closh
 Dublin City Council

Dublin City Council
 Civic Offices
 Wood Quay
 Dublin 8

Project:
 DUBLIN PLUVIAL STUDY (FloodResilientCity)

Map:
 DUBLIN CITY - PLUVIAL
 FLOOD EXTENT MAP

Map Type:	EXTENT - 180min Rainfall		
Source:	PLUVIAL		
Map Area:	URBAN		
Scenario:	CURRENT		
Drawn by:	JH	Date:	Aug - 2016
Checked by:	MC	Date:	Aug - 2016
Approved by:	JM	Date:	Aug - 2016
Map No:	ENRDCO_EXPCO_FD_02		
Revision:	FD		
Map Scale:	1:50,000	Plot Scale:	1:1 @ A3



IMPORTANT USER NOTE:
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- Legend**
- 10% Flood AEP Event
 - 1% Flood AEP Event
 - 0.1% Flood AEP Event
 - Minimum River Centreline
 - AFA Extents
 - Node Point
 - Node Label

FINAL

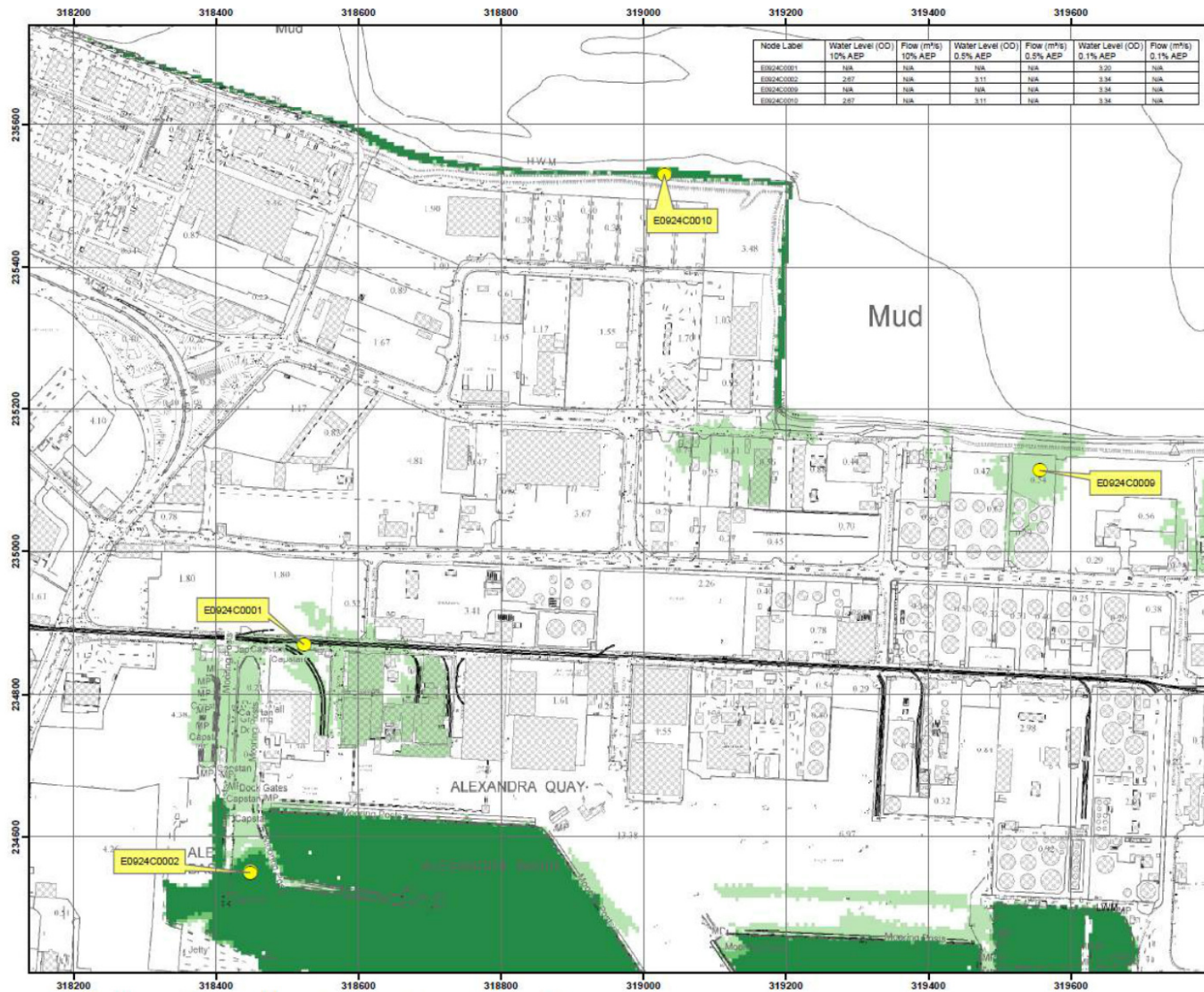
REV	DATE	BY
01	05/05/2017	01/01/01



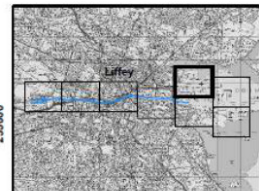
The Office of Public Works
 27, South Circular Road, Dublin 8
 Tel: 01 454 4444
 Fax: 01 454 4444
 Email: opw@opw.ie

Map:	
Liffey Fluvial Flood Extents	
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	RPW
Scale:	CURRENT
Drawn By:	C.C. Date: 9 May 2017
Checked By:	A.S. Date: 9 May 2017
Approved By:	I.S.P. Date: 9 May 2017
Drawing No.: EDSLIF_EXPCD_F1_07	
Map Series: Page 7 of 8	
Drawing Scale: 1:5,000 @ A3	

APPENDIX C - CFRAM MAPS



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m³/s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
ED024C0001	N/A	N/A	N/A	N/A	3.20	N/A
ED024C0002	2.87	N/A	3.11	N/A	3.34	N/A
ED024C0006	N/A	N/A	3.11	N/A	3.34	N/A
ED024C0010	2.87	N/A	3.11	N/A	3.34	N/A



IMPORTANT USER NOTE:
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- Legend**
- 10% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID

FINAL

REV:	NOTE:	DATE:
------	-------	-------



The Office of Public Works
Jonathan Gault Street
Newry
Co. Down
BT12 6RZ
E: newry@opw.gov.uk

Erasmus House
74 Boucher Road
Belfast
BT12 6RZ
E: newry@opw.gov.uk

T: +44(0) 28 90 85294
F: +44(0) 28 90 89839

Map:
Liffey Tidal Flood Extents

Map Type:	EXTENT
Source:	TIDAL
Map Area:	COASTAL
Scenario:	CURRENT
Drawn By:	C.C. Date: 28 July 2016
Checked By:	A.S. Date: 28 July 2016
Approved By:	S.P. Date: 28 July 2016
Drawing No.:	E09LIF_EKCCD_F0_07
Map Series:	Page 7 of 8
Drawing Scale:	1:5,000 @ A3

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Future Mid-Range Scenario Tidal Flooding



Future High End Scenario Tidal Flooding

APPENDIX D - OPW FLOOD RECORDS

Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 195 349

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:26,862

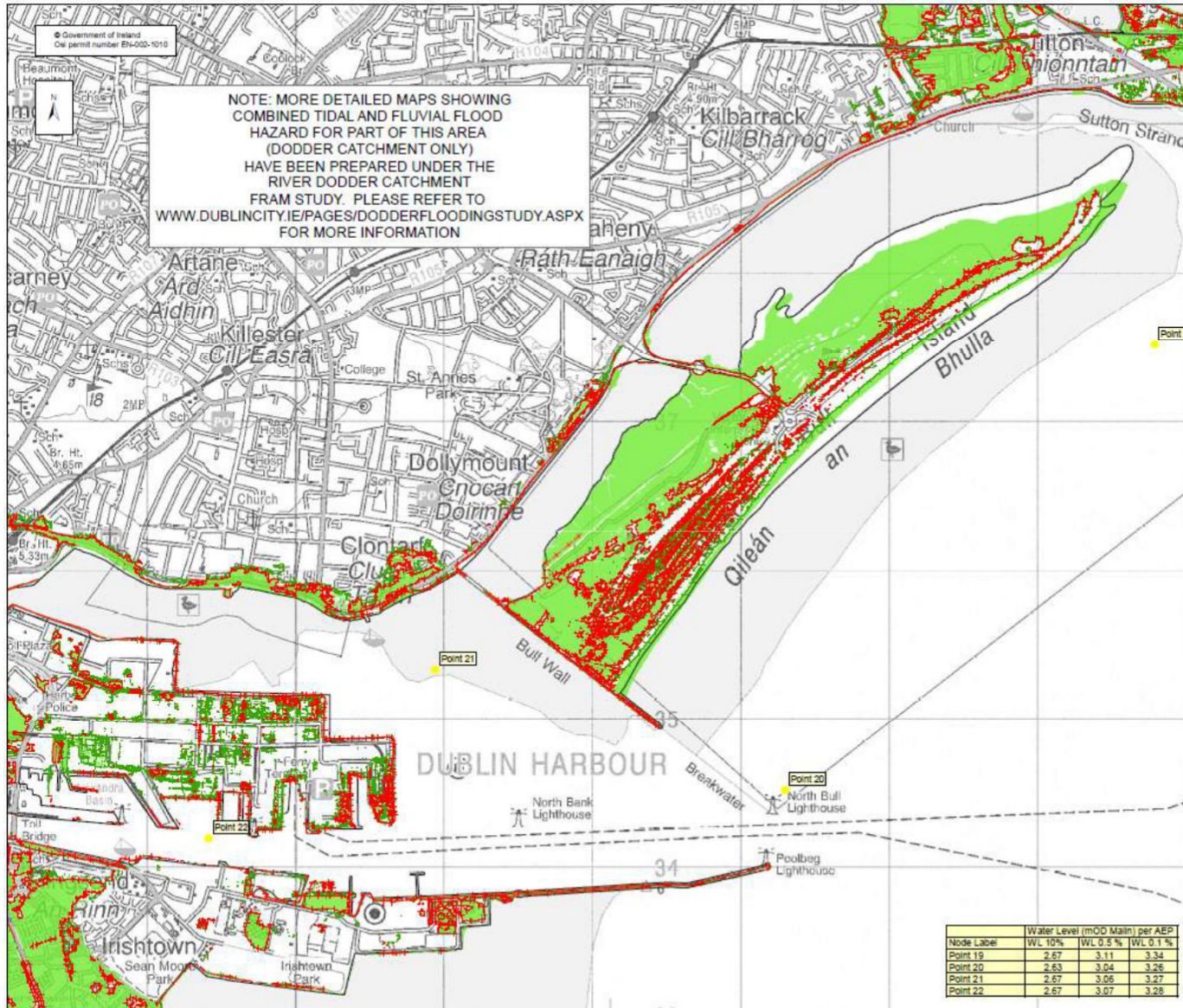
Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained in the Glossary.

20 Results

	1. Flooding at Bessborough Avenue, North Strand, Dublin 3 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information		
	2. Flooding at Clanmoyle Road, Donnycamey, Dublin 5 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information		
	3. Tolka December 1954 County: Dublin	Start Date: 08/Dec/1954 Flood Quality Code:1
Additional Information: Photos (2) Reports (13) Press Archive (9) More Mapped Information		
	4. Tolka November 2002 County: Meath, Dublin	Start Date: 13/Nov/2002 Flood Quality Code:1
Additional Information: Photos (126) Reports (9) Videos (3) Press Archive (13) More Mapped Information		
	5. Dublin City Tidal Feb 2002 County: Dublin	Start Date: 01/Feb/2002 Flood Quality Code:1

APPENDIX E - ICPSS FLOOD EXTENT MAPPING



Location Plan:

EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- Very High Confidence (0.1% AEP)
- High Confidence (0.1% AEP)
- Medium Confidence (0.1% AEP)
- Low Confidence (0.1% AEP)
- Very Low Confidence (0.1% AEP)
- Very High Confidence (0.5% AEP)
- High Confidence (0.5% AEP)
- Medium Confidence (0.5% AEP)
- Low Confidence (0.5% AEP)
- Very Low Confidence (0.5% AEP)
- High Water Mark (HWM)
- Node Point
- Node Label (refer to table)

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RPS
 Elmwood House
 74 Boucher Road
 Belfast
 BT 12 6RZ
 Northern Ireland

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

Project:
 IRISH COASTAL PROTECTION STRATEGY
 STUDY - PHASE III

Map:
 NORTH EAST COAST FLOOD EXTENT MAP

Map Type: FLOOD EXTENT
 Source: TIDAL FLOODING
 Map area: RURAL AREA
 Scenario: CURRENT

Figure By: P.W. Date: Jan 2010
 Checked By: J.M.C. Date: Jan 2010

Node Label	Water Level (mOD Mean) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 19	2.67	3.11	3.34
Point 20	2.63	3.04	3.26
Point 21	2.67	3.06	3.27
Point 22	2.67	3.07	3.28

Figure No:
 NE / RA / EXT / 18

Revision:
 1

Drawing Scale: 1:25,000 Plot Scale: 1:1 @ A3



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PART 3 – CIVIL & STRUCTURAL

CONTENTS

1.0 FOUNDATIONS & SUBSTRUCTURE

2.0 FOUL WATER DRAINAGE

3.0 SURFACE WATER DRAINAGE

4.0 WATER SUPPLY

5.0 EARTHWORKS

APPENDIX A FOUL WATER CALCULATIONS
APPENDIX B SURFACE WATER CALCULATIONS
APPENDIX C` DRAWINGS

1.0 FOUNDATIONS & SUBSTRUCTURE

Yard 3 & 4

The bearing capacity of the made ground and underlying strata is considered to be low. Historic borehole data from 3no. boreholes taken across the existing building footprint show the ground profile to consist of 2.75m of compacted fill, overlying up to 1.5m of very soft white silt. Below this lie medium dense sands or silty sandy gravels, with very compact coarse gravels observed below 6m.

A piled foundation solution will, therefore, be implemented for the new building extension to transfer the building loads from the superstructure overhead through the low-capacity strata, to bear on the stiffer ground material below.

The superstructure will consist of a lightweight double-height steel frame, with bays at approximately 7.4m centres and wrapped in a proprietary cladding system carried by purlins spanning between the primary steel frames. This new frame will be offset from the existing PC concrete framed building, with a movement joint at the interface, and will be braced in two directions to provide lateral stability.

Works to introduce a mezzanine floor within the existing building footprint will follow a similar principle, with vertical support elements introduced along the central gridline to be founded on piled foundations. The mezzanine structure will be a lightweight single-storey steel frame with composite metal deck flooring.

Bond Drive

Ground investigation works undertaken across the site area show up to 6m of made ground fill of varying makeup, overlying up to 1.5m of white sandy clay. Below this lie gravelly clays or silty gravels with bedrock encountered below approximately 16.5m.

The site area is currently divided into 8 no. discrete plots with approximately 60% of the total site area topped with tarmacadam surfacing or hardstanding. There are existing offices and welfare facilities located on a number of these sites, provided in prefabricated units.

The proposed works will increase the provision of tarmacadam surfacing to incorporate the total extents of the site area, with additional areas of permeable surfacing provided across the site footprint.

The design intent is to maintain site levels with minor interventions to existing surfacing as required. The existing topographical levels surveyed in the current Kilwex site at the eastern end of the site area, however, are considerably lower than in the adjacent lot and will need to be raised to match the neighbouring areas in order to facilitate the site wide drainage scheme. Similar prefabricated office and welfare facilities will be provided at two discrete locations on the site, which will require small and shallow foundations with minimal excavation works.

2.0 FOUL WATER DRAINAGE

There is an existing foul sewer running adjacent to the site as part of the network of drainage in Dublin Port. Currently all existing foul drainage from each site is connected into this network.

Within the proposed site all foul drains will be drained on a separate system. If possible existing connections within the site which are connected to the main sewer in the road will be utilised. Where this is not possible additional connections will be made by agreement with the Dublin Port Authority. It is intended to use a gravity drainage system.

The flowing preliminary figures have been used:

STAFF NUMBERS:

YARD 3 & 4:

EHS: 34 staff at all times. [Figure assumed to comprise 136 shift work staff (over 4 shifts) = $136 \times 6/8 = 102$ staff @ 8hours each/day].

REVENUE: 24 staff at all times [Figure assumed to comprise 96 shift work staff (over 4 shifts) = $96 \times 6/8 = 72$ Staff @ 8 hours each/day].

EXPORT OFFICE: Included for in the above figures

VISITORS: 10 x part time

DRIVERS: 40 drivers x 4 times daily

BOND DRIVE:

IMPORT OFFICE: 10 staff at all times. [Figure assumed to comprise 30 shift work staff (over 3 x 8 hour shifts)].

DRIVERS: 170 drivers x 4 times daily

DAILY FOUL FLOW:

Flow rate for staff = 100 litres/person/day*

Flow rate for drivers = 10 litres / driver visit*

Flow rate for visitors = 45 litres/person/day*

(* Reference Irish Water Code of Practice for Wastewater Infrastructure).

YARD 3 & 4 SITE:

Daily Foul flow = $(102+72) \times 100 + (40 \times 4) \times 10 + (10) \times 45 = 19450$ l/d = 0.225 l/s

Peak foul flow = $6 \times 0.225 = 1.35$ l/s.

Therefore a 150mm dia pipe @ 1:150 is adequate.

Capacity = 11.3 l/s

Velocity = 0.8m/s.

BOND DRIVE SITE:

Daily Foul flow = $(30) \times 100 + (170 \times 4) \times 10 = 9800 \text{ l/d} = 0.113 \text{ l/s}$

Peak foul flow = $6 \times 0.113 = 0.68 \text{ l/s}$.

Therefore a 150mm dia pipe @ 1:150 is adequate.

Capacity = 11.3 l/s

Velocity = 0.8m/s.

Pipe layout and routing will be established as part of the detailed design. All design will be in compliance with the Building Regulations.

3.0 SURFACE WATER DRAINAGE

The drainage proposal is to attenuate the outflows to Greenfield rates to ensure that there are no adverse effects on the Dublin Port network.

The proposed surface water drainage system has been designed for a 2 year storm return period, and with no surface flooding at any part of the site for storms up to and including the 1:100 year return period plus 20% for climate change. If the current scenario is that run-off from currently developed/hardstanding/roofs sites enters the receiving system, then there should be a dramatic future reduction in discharge volumes when all flows are reduced to Greenfield rates. Interceptors will be provided on all discharges from site which will improve the quality of run off entering the sewer. All restricted discharges will have a sump unit as well which will reduce the amount of silt entering the receiving system.

The existing networks and connections for a portion of the Bond Drive site will be utilised. The proposed layouts have the addition of a notable portion of soft landscaping in comparison to the existing sites. This will further reduce the level of run off entering the system in comparison to the existing arrangement. All flows will be discharging from the sites through restricted outlets, this will reduce the impact on the receiving system in comparison to the previously unrestricted discharge arrangement across the existing sites.

The Bond Drive site is currently divided into eight sites, which for reference purposes, are numbered 1 – 8 from west to east. Discharge for the Bond Drive site, based on the greenfield rate of 5.1l/s/ha, is 2.35l/s for site 1 and 11.8l/s for sites 4 to 8. Site 2 and 3 will utilise existing connections and discharge as they currently do (note the proposed scheme will have less hardstanding contributing to these outfalls due to the increased coverage of green spaces compared to the existing). Attenuation for Bond drive will be 1970m³ total. This will be achieved using 4 no. tanks; 180m³ (180m² x 1m deep) for site 1, c.220m³ for site 2 and 3, and 1350m³ (1350m² x 1m deep) for sites 4 to 8. There will be 5 no. new interceptors for the Bond Drive site.

Discharge for O'Tooles Yard, based on Greenfield rate of 5.1l/s/ha, will be 8.5l/s. This will discharge to Dublin Port Company sewer in Promenade Road. Attenuation will be circa 1000m³ for the site. There will be 1 no. new interceptor for this site.

Along Bond Drive, the attenuated flow from the sites will total approx. 19 l/s. This represents roughly 6% of the capacity of the 600mm diameter sewer exiting Bond Drive. The receiving sewers are currently taking flows from the proposed sites. The future scheme will reduce and improve the quality of those discharges.

The calculations have been revised to take account of a potential future scenario where landscaping could be replaced with impermeable surfacing. The network and tanks have all been sized to accommodate this potential future requirement.

The anticipated discharge rates and the approximate total capacity of the receiving sewer for the Bond Drive and O'Tooles sites have been marked on the drawings for reference. Refer to Appendix A for details.

4.0 WATER SUPPLY

The proposed O'Tooles Yard and the proposed Bond Drive site are being served by existing watermains. Watermains are located in Bond Drive Road and in Promenade Road, records show these are 150mm diameter.

The proposed developments will take metered connections from the watermain, utilising existing connections where possible. The anticipated usage for the proposed development is consistent with the existing scenario.

Yard 3 & 4 Site:

Water Demand.

As per foul calculations, average flows are 19,450l/d

Allowing for small percentage of consumption on site take 20,000 l/d

Average flow = 0.231l/s

Average day/peak week = $0.231 \times 1.25 = 0.289$

Peak flow = $0.289 \times 5 = 1.5\text{l/s}$

Bond Drive Site:

Water Demand

As per foul calculations, average flows are 9,800l/d

Allowing for small percentage of consumption on site take 10,000 l/d


Average flow = $9800 \rightarrow 10,000 = 0.116$

Average day/peak week = $0.116 \times 1.25 = 0.145$

Peak flow = $0.145 \times 5 = 0.75\text{l/s}$

5.0 EARTHWORKS

EARTHWORKS	
ESTIMATED EXCAVATION VOLUMES	
The estimated excavation volumes are as follows: (Note: All volumes are indicative only. Exact volumes to be established as part of the detailed design.)	
ITEM	ESTIMATED VOLUME
1. Piles.	
Length of pile assumed to be 20m including socket into rock. Diameter of pile assumed to be 350mm. Estimated No of piles = 50.	100m ³
2. Foundations	
Pilecaps: Estimated No = 25.	100m ³
Strips under walls:	290m ³
Pads (prefabs):	12m ³
Ground Floor slab:	900m ³
3. Drainage	
Pipework trenches:	1107m ³
Manholes:	60m ³
Interceptors:	210m ³
Attenuation Tanks:	5730m ³
4. Remediation/obstructions/soft spots	
Allowance	200m ³
5. Temporary Works	
Contractor items such as cranes etc.	300m ³
6. Fencing	
Assume posts at 3m centres, pad sizes 350x350x800. Top of pad 200mm b.g.l.	128m ³
7. Roads/paving	
Assume that roads are built up above existing levels but that 450mm depth of existing material will require removal.	17800m ³
8. Raised Landscaped Areas	
Allowance	500m ³
9. Utility Trenches	
e.g. Electricity, water etc.	500m ³
10. Miscellaneous	
e.g. Lighting/Flagpoles/Signage.	70m ³
Totals:	
Excavated Soil Volume (Unbulked)	28007m³
Excavated Soil Volume (bulked)	32208m³

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	15.900	Add Flow / Climate Change (%)	20
Ratio R	0.278	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.004)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.166	4-8	0.060

Total Area Contributing (ha) = 0.226

Total Pipe Volume (m³) = 2.879


Time Area Diagram at outfall S (pipe S2.007)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.172	4-8	1.018	8-12	0.020

Total Area Contributing (ha) = 2.210


Total Pipe Volume (m³) = 67.772

Network Design Table for Storm
















PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	37.205	0.372	100.0	0.060	5.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	45.99	5.62	3.700	0.060	0.0	0.0	1.5	1.00	17.8	8.9


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Network Design Table for Storm












PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	37.205	0.248	150.0	0.117	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	5.805	0.039	150.0	0.049	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	6.875	0.034	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	5.983	0.039	153.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	48.999	0.327	150.0	0.086	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	31.217	0.156	200.0	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.002	39.982	0.200	200.0	0.084	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	48.999	0.245	200.0	0.120	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	31.312	0.157	200.0	0.109	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.003	39.997	0.133	300.0	0.119	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.000	48.999	0.245	200.0	0.118	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	31.217	0.156	200.0	0.107	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.004	39.766	0.158	251.9	0.117	0.00	0.0	0.600	o	525	Pipe/Conduit	
S5.000	49.000	0.327	150.0	0.124	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	31.217	0.156	200.0	0.113	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	44.23	6.20	3.253	0.176	0.0	0.0	4.2	1.07	42.4	25.4
S1.002	43.97	6.29	3.005	0.226	0.0	0.0	5.4	1.07	42.4	32.3
S1.003	43.62	6.41	2.966	0.226	0.0	0.0	5.4	0.92	36.6	32.3
S1.004	43.36	6.51	2.932	0.226	0.0	0.0	5.4	1.05	41.9	32.3
S2.000	45.52	5.77	3.938	0.086	0.0	0.0	2.1	1.07	42.4	12.7
S2.001	44.12	6.24	3.536	0.164	0.0	0.0	3.9	1.11	78.3	23.5
S2.002	42.48	6.84	3.380	0.247	0.0	0.0	5.7	1.11	78.3	34.1
S3.000	45.15	5.89	3.656	0.120	0.0	0.0	2.9	0.92	36.6	17.6
S3.001	43.51	6.45	3.411	0.229	0.0	0.0	5.4	0.92	36.6	32.4
S2.003	41.18	7.36	2.954	0.595	0.0	0.0	13.3	1.29	278.8	79.6
S4.000	45.15	5.89	3.524	0.118	0.0	0.0	2.9	0.92	36.6	17.3
S4.001	43.78	6.36	3.204	0.225	0.0	0.0	5.3	1.11	78.3	32.0
S2.004	40.08	7.83	2.821	0.937	0.0	0.0	20.3	1.41	304.5	122.0
S5.000	45.52	5.77	3.446	0.124	0.0	0.0	3.1	1.07	42.4	18.3
S5.001	44.12	6.24	3.044	0.237	0.0	0.0	5.7	1.11	78.3	34.0


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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.005	41.663	0.139	300.0	0.123	0.00	0.0	0.600	o	525	Pipe/Conduit	
S6.000	49.000	0.245	200.0	0.124	5.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	31.217	0.156	200.0	0.113	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.006	14.085	0.047	300.0	0.123	0.00	0.0	0.600	o	525	Pipe/Conduit	
S7.000	48.999	0.245	200.0	0.106	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	31.228	0.156	200.2	0.096	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.000	36.333	0.182	200.0	0.077	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	43.963	0.220	199.8	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.002	34.169	0.171	199.8	0.106	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.002	27.129	0.243	111.5	0.088	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.007	12.737	0.042	300.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.005	38.91	8.37	2.663	1.296	0.0	0.0	27.3	1.29	278.8	163.9
S6.000	45.15	5.89	3.307	0.124	0.0	0.0	3.0	0.92	36.6	18.2
S6.001	43.78	6.36	2.987	0.237	0.0	0.0	5.6	1.11	78.3	33.7
S2.006	38.54	8.55	2.523	1.657	0.0	0.0	34.6	1.29	278.8	207.5
S7.000	45.15	5.89	3.427	0.106	0.0	0.0	2.6	0.92	36.6	15.6
S7.001	43.78	6.36	3.107	0.202	0.0	0.0	4.8	1.11	78.3	28.7
S8.000	45.86	5.66	3.592	0.077	0.0	0.0	1.9	0.92	36.6	11.5
S8.001	43.89	6.32	3.335	0.157	0.0	0.0	3.7	1.11	78.4	22.4
S8.002	42.49	6.83	3.115	0.263	0.0	0.0	6.1	1.11	78.4	36.4
S7.002	41.72	7.14	2.944	0.553	0.0	0.0	12.5	1.49	105.2	75.0
S2.007	38.20	8.71	2.476	2.210	0.0	0.0	45.7	1.29	278.8	274.4


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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.060	0.060	0.060
1.001	Classification	Default	100	0.117	0.117	0.117
1.002	Classification	Default	100	0.049	0.049	0.049
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
2.000	Classification	Default	100	0.086	0.086	0.086
2.001	Classification	Default	100	0.078	0.078	0.078
2.002	Classification	Default	100	0.084	0.084	0.084
3.000	Classification	Default	100	0.115	0.115	0.115
	Classification	Default	100	0.005	0.005	0.120
3.001	Classification	Default	100	0.104	0.104	0.104
	Classification	Default	100	0.005	0.005	0.109
2.003	Classification	Default	100	0.114	0.114	0.114
	Classification	Default	100	0.005	0.005	0.119
4.000	Classification	Default	100	0.118	0.118	0.118
4.001	Classification	Default	100	0.107	0.107	0.107
2.004	Classification	Default	100	0.117	0.117	0.117
5.000	Classification	Default	100	0.119	0.119	0.119
	Classification	Default	100	0.005	0.005	0.124
5.001	Classification	Default	100	0.108	0.108	0.108
	Classification	Default	100	0.005	0.005	0.113
2.005	Classification	Default	100	0.118	0.118	0.118
	Classification	Default	100	0.005	0.005	0.123
6.000	Classification	Default	100	0.120	0.120	0.120
	Classification	Default	100	0.005	0.005	0.124
6.001	Classification	Default	100	0.108	0.108	0.108
	Classification	Default	100	0.005	0.005	0.113
2.006	Classification	Default	100	0.119	0.119	0.119
	Classification	Default	100	0.005	0.005	0.123
7.000	Classification	Default	100	0.106	0.106	0.106
7.001	Classification	Default	100	0.096	0.096	0.096
8.000	Classification	Default	100	0.050	0.050	0.050
	Classification	Default	100	0.027	0.027	0.077
8.001	Classification	Default	100	0.054	0.054	0.054
	Classification	Default	100	0.026	0.026	0.080
8.002	Classification	Default	100	0.027	0.027	0.027
	Classification	Default	100	0.079	0.079	0.106
7.002	Classification	Default	100	0.088	0.088	0.088
2.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.436	2.436	2.436

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	4.040	2.893	0.000	0	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S2.007	S	3.900	2.434	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.900	Storm Duration (mins)	30
Ratio R	0.278		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.004, Volume (m³): 1.8

Unit Reference	MD-SHE-0074-2400-1000-2400
Design Head (m)	1.000
Design Flow (l/s)	2.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	74
Invert Level (m)	2.932
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.4
Flush-Flo™	0.309	2.4
Kick-Flo®	0.630	1.9
Mean Flow over Head Range	-	2.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	2.6	3.000	4.0	7.000	5.9
0.200	2.3	1.400	2.8	3.500	4.3	7.500	6.1
0.300	2.4	1.600	3.0	4.000	4.6	8.000	6.3
0.400	2.4	1.800	3.1	4.500	4.8	8.500	6.5
0.500	2.3	2.000	3.3	5.000	5.1	9.000	6.7
0.600	2.1	2.200	3.4	5.500	5.3	9.500	6.8
0.800	2.2	2.400	3.6	6.000	5.5		
1.000	2.4	2.600	3.7	6.500	5.7		

Hydro-Brake® Optimum Manhole: S26, DS/PN: S2.007, Volume (m³): 7.6

Unit Reference	MD-SHE-0150-1180-1500-1180
Design Head (m)	1.500
Design Flow (l/s)	11.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	150
Invert Level (m)	2.476
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500


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Hydro-Brake® Optimum Manhole: S26, DS/PN: S2.007, Volume (m³): 7.6

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	11.8
Flush-Flo™	0.438	11.8
Kick-Flo®	0.939	9.5
Mean Flow over Head Range	-	10.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.4	1.200	10.6	3.000	16.4	7.000	24.6
0.200	10.7	1.400	11.4	3.500	17.6	7.500	25.4
0.300	11.5	1.600	12.2	4.000	18.8	8.000	26.2
0.400	11.8	1.800	12.9	4.500	19.9	8.500	27.0
0.500	11.8	2.000	13.5	5.000	20.9	9.000	27.8
0.600	11.6	2.200	14.1	5.500	21.9	9.500	28.5
0.800	10.8	2.400	14.7	6.000	22.8		
1.000	9.7	2.600	15.3	6.500	23.7		

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Storage Structures for Storm

Tank or Pond Manhole: S4, DS/PN: S1.004


Invert Level (m) 2.932

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	180.0	1.000	180.0	1.001	0.0

Tank or Pond Manhole: S26, DS/PN: S2.007

Invert Level (m) 2.476

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1450.0	1.000	1450.0	1.200	1450.0	1.201	0.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 20.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.278
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 15.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF


Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	2	+0%	30/15 Summer				3.779
S1.001	S2	15 Winter	2	+0%	30/15 Summer				3.381
S1.002	S3	15 Winter	2	+0%	30/15 Summer				3.208
S1.003	S4	15 Winter	2	+0%	30/15 Summer				3.164
S1.004	S4	360 Winter	2	+0%	30/60 Summer				3.111
S2.000	S5	15 Winter	2	+0%					4.028
S2.001	S6	15 Winter	2	+0%	100/15 Summer				3.654
S2.002	S7	15 Winter	2	+0%	100/15 Summer				3.523
S3.000	S8	15 Winter	2	+0%	30/15 Summer				3.774
S3.001	S9	15 Winter	2	+0%	30/15 Summer				3.582
S2.003	S10	15 Winter	2	+0%	30/15 Summer				3.175
S4.000	S11	15 Winter	2	+0%	100/15 Summer				3.641
S4.001	S12	15 Winter	2	+0%	30/15 Winter				3.344
S2.004	S13	15 Winter	2	+0%	30/15 Summer				3.090
S5.000	S14	15 Winter	2	+0%	100/15 Summer				3.556
S5.001	S15	15 Winter	2	+0%	30/15 Summer				3.189
S2.005	S16	15 Winter	2	+0%	30/15 Summer				3.011
S6.000	S17	15 Winter	2	+0%	100/15 Summer				3.428
S6.001	S18	15 Winter	2	+0%	100/15 Summer				3.131

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm


PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe	Level Exceeded
		Depth (m)	Volume (m ³)			Flow (l/s)	
S1.000	S1	-0.071	0.000	0.53		9.1	OK
S1.001	S2	-0.097	0.000	0.60		24.1	OK
S1.002	S3	-0.022	0.000	0.97		29.1	OK
S1.003	S4	-0.027	0.000	1.00		28.6	OK
S1.004	S4	-0.046	0.000	0.08		2.3	OK
S2.000	S5	-0.135	0.000	0.32		13.1	OK
S2.001	S6	-0.183	0.000	0.32		22.9	OK
S2.002	S7	-0.157	0.000	0.46		33.4	OK
S3.000	S8	-0.107	0.000	0.52		18.1	OK
S3.001	S9	-0.054	0.000	0.93		31.8	OK
S2.003	S10	-0.304	0.000	0.32		77.5	OK
S4.000	S11	-0.108	0.000	0.51		17.8	OK
S4.001	S12	-0.160	0.000	0.44		31.4	OK
S2.004	S13	-0.256	0.000	0.44		117.5	OK
S5.000	S14	-0.115	0.000	0.47		18.9	OK
S5.001	S15	-0.155	0.000	0.47		33.2	OK
S2.005	S16	-0.177	0.000	0.64		155.1	OK
S6.000	S17	-0.104	0.000	0.54		18.8	OK
S6.001	S18	-0.156	0.000	0.46		33.2	OK

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
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PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water
									Level (m)
S2.006	S19	15 Winter	2	+0%	30/15 Summer				2.932
S7.000	S23	15 Winter	2	+0%	100/15 Summer				3.537
S7.001	S24	15 Winter	2	+0%	30/15 Summer				3.238
S8.000	S20	15 Winter	2	+0%	100/15 Summer				3.684
S8.001	S21	15 Winter	2	+0%	100/15 Summer				3.448
S8.002	S22	15 Winter	2	+0%	30/15 Summer				3.263
S7.002	S25	15 Winter	2	+0%	30/15 Summer				3.142
S2.007	S26	960 Winter	2	+0%	30/360 Winter				2.798

PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	
S2.006	S19	-0.116	0.000	0.96		194.0	OK	
S7.000	S23	-0.115	0.000	0.46		16.0	OK	
S7.001	S24	-0.169	0.000	0.39		27.9	OK	
S8.000	S20	-0.133	0.000	0.34		11.8	OK	
S8.001	S21	-0.187	0.000	0.30		21.7	OK	
S8.002	S22	-0.152	0.000	0.48		34.6	OK	
S7.002	S25	-0.102	0.000	0.76		72.1	OK	
S2.007	S26	-0.203	0.000	0.06		11.5	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 20.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.278
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 15.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF


Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	30/15 Summer				3.996
S1.001	S2	15 Winter	30	+0%	30/15 Summer				3.731
S1.002	S3	15 Winter	30	+0%	30/15 Summer				3.448
S1.003	S4	15 Winter	30	+0%	30/15 Summer				3.296
S1.004	S4	480 Winter	30	+0%	30/60 Summer				3.280
S2.000	S5	15 Winter	30	+0%					4.066
S2.001	S6	15 Winter	30	+0%	100/15 Summer				3.715
S2.002	S7	15 Winter	30	+0%	100/15 Summer				3.625
S3.000	S8	15 Winter	30	+0%	30/15 Summer				4.061
S3.001	S9	15 Winter	30	+0%	30/15 Summer				3.882
S2.003	S10	15 Winter	30	+0%	30/15 Summer				3.500
S4.000	S11	15 Winter	30	+0%	100/15 Summer				3.701
S4.001	S12	15 Winter	30	+0%	30/15 Winter				3.525
S2.004	S13	15 Winter	30	+0%	30/15 Summer				3.445
S5.000	S14	15 Winter	30	+0%	100/15 Summer				3.611
S5.001	S15	15 Winter	30	+0%	30/15 Summer				3.413
S2.005	S16	15 Winter	30	+0%	30/15 Summer				3.329
S6.000	S17	15 Winter	30	+0%	100/15 Summer				3.505
S6.001	S18	15 Winter	30	+0%	100/15 Summer				3.263

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm


PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)					
S1.000	S1	0.146	0.000	0.87		14.9	SURCHARGED	
S1.001	S2	0.253	0.000	1.05		42.2	SURCHARGED	
S1.002	S3	0.218	0.000	1.79		53.6	SURCHARGED	
S1.003	S4	0.105	0.000	1.88		53.9	SURCHARGED	
S1.004	S4	0.123	0.000	0.08		2.4	SURCHARGED	
S2.000	S5	-0.097	0.000	0.59		24.0	OK	
S2.001	S6	-0.121	0.000	0.64		45.7	OK	
S2.002	S7	-0.055	0.000	0.91		65.9	OK	
S3.000	S8	0.180	0.000	0.84		29.3	SURCHARGED	
S3.001	S9	0.246	0.000	1.55		53.1	SURCHARGED	
S2.003	S10	0.020	0.000	0.53		128.8	SURCHARGED	
S4.000	S11	-0.048	0.000	0.93		32.6	OK	
S4.001	S12	0.021	0.000	0.82		58.8	SURCHARGED	
S2.004	S13	0.098	0.000	0.72		191.5	SURCHARGED	
S5.000	S14	-0.060	0.000	0.85		34.6	OK	
S5.001	S15	0.069	0.000	0.83		59.2	SURCHARGED	
S2.005	S16	0.141	0.000	1.06		257.2	SURCHARGED	
S6.000	S17	-0.027	0.000	0.97		34.1	OK	
S6.001	S18	-0.024	0.000	0.85		60.4	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S2.006	S19	15 Winter	30	+0%	30/15 Summer				3.165
S7.000	S23	15 Winter	30	+0%	100/15 Summer				3.603
S7.001	S24	15 Winter	30	+0%	30/15 Summer				3.471
S8.000	S20	15 Winter	30	+0%	100/15 Summer				3.724
S8.001	S21	15 Winter	30	+0%	100/15 Summer				3.548
S8.002	S22	15 Winter	30	+0%	30/15 Summer				3.495
S7.002	S25	15 Winter	30	+0%	30/15 Summer				3.391
S2.007	S26	960 Winter	30	+0%	30/360 Winter				3.064

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap.	Pipe Flow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S2.006	S19	0.117	0.000	1.63	329.2		SURCHARGED	
S7.000	S23	-0.049	0.000	0.83	29.0		OK	
S7.001	S24	0.064	0.000	0.63	44.9		SURCHARGED	
S8.000	S20	-0.093	0.000	0.62	21.6		OK	
S8.001	S21	-0.087	0.000	0.56	41.2		OK	
S8.002	S22	0.080	0.000	0.81	58.0		SURCHARGED	
S7.002	S25	0.146	0.000	1.27	120.3		SURCHARGED	
S2.007	S26	0.063	0.000	0.06	11.8		SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 20.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.278
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 15.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF


Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+0%	30/15 Summer				4.389
S1.001	S2	15 Winter	100	+0%	30/15 Summer				4.031
S1.002	S3	15 Winter	100	+0%	30/15 Summer				3.604
S1.003	S4	480 Winter	100	+0%	30/15 Summer				3.406
S1.004	S4	480 Winter	100	+0%	30/60 Summer				3.404
S2.000	S5	15 Winter	100	+0%					4.091
S2.001	S6	15 Winter	100	+0%	100/15 Summer				3.966
S2.002	S7	15 Winter	100	+0%	100/15 Summer				3.879
S3.000	S8	15 Winter	100	+0%	30/15 Summer				4.468
S3.001	S9	15 Winter	100	+0%	30/15 Summer				4.227
S2.003	S10	15 Winter	100	+0%	30/15 Summer				3.745
S4.000	S11	15 Winter	100	+0%	100/15 Summer				4.019
S4.001	S12	15 Winter	100	+0%	30/15 Winter				3.793
S2.004	S13	15 Winter	100	+0%	30/15 Summer				3.679
S5.000	S14	15 Winter	100	+0%	100/15 Summer				3.950
S5.001	S15	15 Winter	100	+0%	30/15 Summer				3.680
S2.005	S16	15 Winter	100	+0%	30/15 Summer				3.549
S6.000	S17	15 Winter	100	+0%	100/15 Summer				3.770
S6.001	S18	15 Winter	100	+0%	100/15 Summer				3.438

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm


PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)					
S1.000	S1	0.539	0.000	1.07		18.4	SURCHARGED	
S1.001	S2	0.553	0.000	1.29		51.6	SURCHARGED	
S1.002	S3	0.374	0.000	2.21		66.0	SURCHARGED	
S1.003	S4	0.215	0.000	0.41		11.6	SURCHARGED	
S1.004	S4	0.247	0.000	0.08		2.4	SURCHARGED	
S2.000	S5	-0.072	0.000	0.77		31.1	OK	
S2.001	S6	0.130	0.000	0.74		52.6	SURCHARGED	
S2.002	S7	0.199	0.000	0.96		70.0	FLOOD RISK	
S3.000	S8	0.587	0.000	0.98		34.2	FLOOD RISK	
S3.001	S9	0.591	0.000	1.79		61.3	FLOOD RISK	
S2.003	S10	0.265	0.000	0.63		151.8	SURCHARGED	
S4.000	S11	0.270	0.000	1.05		36.9	SURCHARGED	
S4.001	S12	0.289	0.000	0.88		63.0	SURCHARGED	
S2.004	S13	0.333	0.000	0.89		235.3	SURCHARGED	
S5.000	S14	0.279	0.000	0.94		38.3	SURCHARGED	
S5.001	S15	0.335	0.000	0.93		66.5	SURCHARGED	
S2.005	S16	0.361	0.000	1.34		327.1	SURCHARGED	
S6.000	S17	0.238	0.000	1.16		40.7	SURCHARGED	
S6.001	S18	0.151	0.000	0.99		70.8	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S2.006	S19	15 Winter	100	+0%	30/15 Summer				3.288
S7.000	S23	15 Winter	100	+0%	100/15 Summer				3.910
S7.001	S24	15 Winter	100	+0%	30/15 Summer				3.703
S8.000	S20	15 Winter	100	+0%	100/15 Summer				3.908
S8.001	S21	15 Winter	100	+0%	100/15 Summer				3.828
S8.002	S22	15 Winter	100	+0%	30/15 Summer				3.744
S7.002	S25	15 Winter	100	+0%	30/15 Summer				3.595
S2.007	S26	960 Winter	100	+0%	30/360 Winter				3.249

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap.	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)				
S2.006	S19	0.240	0.000	2.08	419.1	SURCHARGED	
S7.000	S23	0.258	0.000	0.91	32.1	SURCHARGED	
S7.001	S24	0.296	0.000	0.81	58.0	SURCHARGED	
S8.000	S20	0.091	0.000	0.76	26.2	SURCHARGED	
S8.001	S21	0.193	0.000	0.60	44.0	FLOOD RISK	
S8.002	S22	0.329	0.000	0.93	67.2	FLOOD RISK	
S7.002	S25	0.350	0.000	1.56	148.1	SURCHARGED	
S2.007	S26	0.247	0.000	0.06	11.8	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	15.900	Add Flow / Climate Change (%)	20
Ratio R	0.278	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm





Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.713	4-8	0.778	8-12	0.074

Total Area Contributing (ha) = 1.565

Total Pipe Volume (m³) = 47.638


Network Design Table for Storm

« - Indicates pipe capacity < flow
















PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	40.052	0.267	150.0	0.031	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	31.154	0.208	150.0	0.055	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	18.188	0.117	155.5	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	24.702	0.119	207.6	0.080	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	45.96	5.63	3.000	0.031	0.0	0.0	0.8	1.07	42.4	4.6
S1.001	44.48	6.11	2.733	0.086	0.0	0.0	2.1	1.07	42.4	12.4
S1.002	43.65	6.40	2.525	0.125	0.0	0.0	2.9	1.05	41.6	17.7
S1.003	42.76	6.73	2.258	0.205	0.0	0.0	4.7	1.25	138.5	28.4


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Network Design Table for Storm









PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	39.830	0.266	150.0	0.062	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	31.375	0.209	150.0	0.107	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	17.487	0.117	149.5	0.057	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	28.166	0.106	265.7	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit	
S3.000	39.572	0.264	149.9	0.066	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	31.633	0.211	150.0	0.117	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	17.231	0.116	148.5	0.081	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	18.844	0.068	275.7	0.068	0.00	0.0	0.600	o	450	Pipe/Conduit	
S4.000	38.565	0.257	150.1	0.045	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	32.640	0.218	150.0	0.084	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	18.108	0.121	149.7	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	21.087	0.070	301.2	0.048	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	17.348	0.200	86.7	0.054	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.001	26.297	-2.379	-11.1	0.048	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.000	27.857	0.075	371.4	0.074	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	45.97	5.62	2.881	0.062	0.0	0.0	1.6	1.07	42.4	9.3
S2.001	44.48	6.11	2.615	0.169	0.0	0.0	4.1	1.07	42.4	24.4
S2.002	43.70	6.39	2.406	0.226	0.0	0.0	5.3	1.07	42.4	32.1
S1.004	41.78	7.11	2.064	0.487	0.0	0.0	11.0	1.24	197.6	66.1
S3.000	45.99	5.62	2.774	0.066	0.0	0.0	1.6	1.07	42.4	9.9
S3.001	44.48	6.11	2.510	0.183	0.0	0.0	4.4	1.07	42.4	26.5
S3.002	43.71	6.38	2.299	0.264	0.0	0.0	6.2	1.07	42.6	37.5
S1.005	41.15	7.37	1.958	0.818	0.0	0.0	18.2	1.22	194.0	109.5
S4.000	46.04	5.60	2.706	0.045	0.0	0.0	1.1	1.07	42.3	6.7
S4.001	44.48	6.11	2.449	0.128	0.0	0.0	3.1	1.07	42.4	18.6
S4.002	43.67	6.40	2.231	0.162	0.0	0.0	3.8	1.07	42.4	22.9
S1.006	40.44	7.67	1.885	1.028	0.0	0.0	22.5	1.17	185.5	135.2
S5.000	47.14	5.27	0.600	0.054	0.0	0.0	1.4	1.08	19.1	8.2
S5.001	35.83	10.00	0.400	0.102	0.0	0.0	2.0	0.09	1.6«	11.9
S6.000	45.76	5.69	2.350	0.074	0.0	0.0	1.8	0.67	26.7	11.1


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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
S6.001	27.857	0.075	371.4	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit		
S6.002	53.641	0.150	357.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
S5.002	10.462	0.035	300.0	0.049	0.00	0.0	0.600	o	450	Pipe/Conduit		
S1.007	34.702	0.099	350.5	0.048	0.00	0.0	0.600	o	450	Pipe/Conduit		
S7.000	28.732	0.144	199.5	0.050	5.00	0.0	0.600	o	225	Pipe/Conduit		
S7.001	6.423	0.032	200.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
S1.008	20.934	0.060	348.9	0.193	0.00	0.0	0.600	o	525	Pipe/Conduit		
S1.009	7.850	0.022	350.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.001	43.71	6.38	2.275	0.094	0.0	0.0	2.2	0.67	26.7	13.4
S6.002	40.41	7.68	2.200	0.094	0.0	0.0	2.2	0.69	27.3	13.4
S5.002	35.58	10.15	2.000	0.245	0.0	0.0	4.7	1.17	185.8	28.4
S1.007	34.71	10.68	1.815	1.322	0.0	0.0	24.9	1.08	171.8	149.1
S7.000	46.31	5.52	2.400	0.050	0.0	0.0	1.3	0.92	36.7	7.5
S7.001	45.93	5.64	2.256	0.050	0.0	0.0	1.3	0.92	36.5	7.5
S1.008	34.26	10.97	1.641	1.565	0.0	0.0	29.0	1.19	258.3	174.2
S1.009	34.10	11.08	1.581	1.565	0.0	0.0	29.0	1.19	257.9	174.2


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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.031	0.031	0.031
1.001	Classification	Default	100	0.055	0.055	0.055
1.002	Classification	Default	100	0.039	0.039	0.039
1.003	-	-	100	0.080	0.080	0.080
2.000	Classification	Default	100	0.062	0.062	0.062
2.001	Classification	Default	100	0.027	0.027	0.027
	Classification	Default	100	0.080	0.080	0.107
2.002	Classification	Default	100	0.057	0.057	0.057
1.004	Classification	Default	100	0.017	0.017	0.017
	Classification	Default	100	0.039	0.039	0.056
3.000	Classification	Default	100	0.066	0.066	0.066
3.001	Classification	Default	100	0.027	0.027	0.027
	Classification	Default	100	0.091	0.091	0.117
3.002	Classification	Default	100	0.081	0.081	0.081
1.005	Classification	Default	100	0.017	0.017	0.017
	Classification	Default	100	0.051	0.051	0.068
4.000	Classification	Default	100	0.040	0.040	0.040
	Classification	Default	100	0.005	0.005	0.045
4.001	Classification	Default	100	0.027	0.027	0.027
	Classification	Default	100	0.057	0.057	0.084
4.002	Classification	Default	100	0.033	0.033	0.033
1.006	Classification	Default	100	0.017	0.017	0.017
	Classification	Default	100	0.031	0.031	0.048
5.000	User	-	100	0.054	0.054	0.054
5.001	Classification	Default	100	0.048	0.048	0.048
6.000	User	-	100	0.074	0.074	0.074
6.001	User	-	100	0.020	0.020	0.020
6.002	-	-	100	0.000	0.000	0.000
5.002	Classification	Default	100	0.049	0.049	0.049
1.007	Classification	Default	100	0.048	0.048	0.048
7.000	-	-	100	0.050	0.050	0.050
7.001	-	-	100	0.000	0.000	0.000
1.008	Classification	Default	100	0.057	0.057	0.057
	Classification	Default	100	0.136	0.136	0.193
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.565	1.565	1.565

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.009	S	3.000	1.559	0.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.900	Storm Duration (mins)	30
Ratio R	0.278		

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Online Controls for Storm

Pump Manhole: S18, DS/PN: S5.001, Volume (m³): 1.9

Invert Level (m) 0.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	20.0000	0.900	20.0000	1.700	20.0000	2.500	20.0000
0.200	20.0000	1.000	20.0000	1.800	20.0000	2.600	20.0000
0.300	20.0000	1.100	20.0000	1.900	20.0000	2.700	20.0000
0.400	20.0000	1.200	20.0000	2.000	20.0000	2.800	20.0000
0.500	20.0000	1.300	20.0000	2.100	20.0000	2.900	20.0000
0.600	20.0000	1.400	20.0000	2.200	20.0000	3.000	20.0000
0.700	20.0000	1.500	20.0000	2.300	20.0000		
0.800	20.0000	1.600	20.0000	2.400	20.0000		


Hydro-Brake® Optimum Manhole: S25, DS/PN: S1.008, Volume (m³): 8.3

Unit Reference MD-SHE-0132-8500-1200-8500
 Design Head (m) 1.200
 Design Flow (l/s) 8.5
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 132
 Invert Level (m) 1.716
 Minimum Outlet Pipe Diameter (mm) 150
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	8.5
Flush-Flo™	0.351	8.5
Kick-Flo®	0.765	6.9
Mean Flow over Head Range	-	7.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	8.5	3.000	13.1	7.000	19.6
0.200	8.0	1.400	9.1	3.500	14.1	7.500	20.3
0.300	8.5	1.600	9.7	4.000	15.0	8.000	20.9
0.400	8.5	1.800	10.3	4.500	15.9	8.500	21.6
0.500	8.3	2.000	10.8	5.000	16.7	9.000	22.2
0.600	8.1	2.200	11.3	5.500	17.5	9.500	22.7
0.800	7.0	2.400	11.8	6.000	18.2		
1.000	7.8	2.600	12.2	6.500	19.0		


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Storage Structures for Storm

Tank or Pond Manhole: S21, DS/PN: S5.002

Invert Level (m) 2.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1000.0	1.000	1000.0	1.001	0.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 20.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 2 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.278
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 15.900 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF


Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	2	+0%	100/15 Summer			
S1.001	S2	15 Winter	2	+0%	30/15 Summer			
S1.002	S3	30 Winter	2	+0%	2/15 Winter			
S1.003	S4	30 Winter	2	+0%	2/15 Summer			
S2.000	S5	15 Winter	2	+0%	30/15 Summer			
S2.001	S6	30 Winter	2	+0%	30/15 Summer			
S2.002	S7	30 Winter	2	+0%	2/15 Summer			
S1.004	S8	30 Winter	2	+0%	2/15 Summer		2/15 Summer	45
S3.000	S9	15 Winter	2	+0%	30/15 Summer			
S3.001	S10	30 Winter	2	+0%	2/15 Winter			
S3.002	S11	30 Winter	2	+0%	2/15 Summer			
S1.005	S12	30 Winter	2	+0%	2/15 Summer			
S4.000	S13	15 Winter	2	+0%	30/15 Summer			
S4.001	S14	30 Winter	2	+0%	30/15 Summer			
S4.002	S15	30 Winter	2	+0%	2/15 Summer			
S1.006	S16	30 Winter	2	+0%	2/15 Summer		30/15 Summer	39
S5.000	S17	15 Winter	2	+0%	30/15 Summer			
S5.001	S18	15 Winter	2	+0%	30/15 Summer			
S6.000	S19	15 Winter	2	+0%	100/15 Summer			

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm


PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	3.052	-0.173	0.000	0.12		4.8	OK	
S1.001	S2	2.818	-0.140	0.000	0.30		12.0	OK	
S1.002	S3	2.776	0.026	0.000	0.36		13.4	SURCHARGED	
S1.003	S4	2.750	0.117	0.000	0.17		20.2	SURCHARGED	
S2.000	S5	2.957	-0.149	0.000	0.24		9.6	OK	
S2.001	S6	2.835	-0.005	0.000	0.50		19.9	OK	
S2.002	S7	2.795	0.164	0.000	0.54		20.7	SURCHARGED	
S1.004	S8	2.737	0.223	0.000	0.25	3.1	41.6	SURCHARGED	
S3.000	S9	2.852	-0.147	0.000	0.25		10.2	OK	
S3.001	S10	2.802	0.067	0.000	0.51		20.1	SURCHARGED	
S3.002	S11	2.756	0.232	0.000	0.66		25.0	SURCHARGED	
S1.005	S12	2.673	0.265	0.000	0.46		72.0	SURCHARGED	
S4.000	S13	2.770	-0.161	0.000	0.17		6.9	OK	
S4.001	S14	2.648	-0.026	0.000	0.36		14.2	OK	
S4.002	S15	2.611	0.155	0.000	0.46		17.4	SURCHARGED	
S1.006	S16	2.577	0.242	0.000	0.61	0.0	92.0	SURCHARGED	
S5.000	S17	0.673	-0.077	0.000	0.47		8.3	OK	
S5.001	S18	0.475	-0.075	0.000	3.22		14.9	OK	
S6.000	S19	2.459	-0.116	0.000	0.46		11.5	OK	

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The Arup Campus Blyth Gate Solihull B90 8AE	Dublin Port O'Tooles Yard	
Date 28/04/2020 17:36 File Scheme O'Tooles Yard.MDX	Designed by AN Checked by KD	
XP Solutions	Network 2019.1	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S6.001	S20	15	Winter	2	+0%	30/480	Winter		2.395
S6.002	S20	15	Winter	2	+0%	30/180	Winter		2.315
S5.002	S21	480	Winter	2	+0%	30/240	Winter		2.225
S1.007	S22	30	Winter	2	+0%	2/15	Summer		2.485
S7.000	S23	15	Winter	2	+0%	30/15	Summer		2.534
S7.001	S24	15	Winter	2	+0%	2/15	Summer		2.516
S1.008	S25	30	Summer	2	+0%	2/15	Summer		2.511
S1.009	S26	120	Summer	2	+0%				1.662

PN	US/MH Name	Surcharged Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)		
S6.001	S20	-0.105	0.000	0.55	13.7	OK	
S6.002	S20	-0.110	0.000	0.51	13.4	OK	
S5.002	S21	-0.225	0.000	0.07	8.8	OK	
S1.007	S22	0.220	0.000	0.11	17.1	SURCHARGED	
S7.000	S23	-0.091	0.000	0.22	7.5	OK	
S7.001	S24	0.035	0.000	0.27	7.5	SURCHARGED	
S1.008	S25	0.345	0.000	0.04	8.5	SURCHARGED	
S1.009	S26	-0.444	0.000	0.06	8.5	OK	

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The Arup Campus Blyth Gate Solihull B90 8AE	Dublin Port O'Tooles Yard	
Date 28/04/2020 17:36 File Scheme O'Tooles Yard.MDX	Designed by AN Checked by KD	
XP Solutions	Network 2019.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 20.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 2 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.278
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 15.900 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF


Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	100/15 Summer			
S1.001	S2	15 Winter	30	+0%	30/15 Summer			
S1.002	S3	15 Winter	30	+0%	2/15 Winter			
S1.003	S4	15 Winter	30	+0%	2/15 Summer			
S2.000	S5	15 Winter	30	+0%	30/15 Summer			
S2.001	S6	15 Winter	30	+0%	30/15 Summer			
S2.002	S7	15 Winter	30	+0%	2/15 Summer			
S1.004	S8	15 Winter	30	+0%	2/15 Summer		2/15 Summer	45
S3.000	S9	15 Winter	30	+0%	30/15 Summer			
S3.001	S10	15 Winter	30	+0%	2/15 Winter			
S3.002	S11	15 Winter	30	+0%	2/15 Summer			
S1.005	S12	15 Winter	30	+0%	2/15 Summer			
S4.000	S13	15 Winter	30	+0%	30/15 Summer			
S4.001	S14	15 Winter	30	+0%	30/15 Summer			
S4.002	S15	15 Winter	30	+0%	2/15 Summer			
S1.006	S16	15 Winter	30	+0%	2/15 Summer		30/15 Summer	39
S5.000	S17	15 Winter	30	+0%	30/15 Summer			
S5.001	S18	15 Winter	30	+0%	30/15 Summer			
S6.000	S19	15 Winter	30	+0%	100/15 Summer			

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XP Solutions	Network 2019.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm


PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	3.100	-0.125	0.000	0.21		8.4	OK	
S1.001	S2	3.078	0.120	0.000	0.50		19.6	SURCHARGED	
S1.002	S3	3.026	0.276	0.000	0.73		27.2	SURCHARGED	
S1.003	S4	2.937	0.303	0.000	0.37		44.4	FLOOD RISK	
S2.000	S5	3.290	0.184	0.000	0.39		15.6	SURCHARGED	
S2.001	S6	3.248	0.408	0.000	0.96		38.2	SURCHARGED	
S2.002	S7	3.047	0.415	0.000	1.34		50.7	SURCHARGED	
S1.004	S8	2.834	0.319	0.000	0.48	29.2	80.7	SURCHARGED	
S3.000	S9	3.355	0.356	0.000	0.41		16.6	SURCHARGED	
S3.001	S10	3.312	0.577	0.000	1.03		40.8	SURCHARGED	
S3.002	S11	3.082	0.558	0.000	1.54		58.5	SURCHARGED	
S1.005	S12	2.800	0.392	0.000	0.97		150.8	SURCHARGED	
S4.000	S13	2.995	0.064	0.000	0.29		11.5	SURCHARGED	
S4.001	S14	2.964	0.290	0.000	0.77		30.5	SURCHARGED	
S4.002	S15	2.830	0.373	0.000	1.00		38.2	SURCHARGED	
S1.006	S16	2.707	0.372	0.000	1.22	18.3	184.7	SURCHARGED	
S5.000	S17	1.034	0.284	0.000	0.70		12.4	SURCHARGED	
S5.001	S18	0.951	0.401	0.000	4.31		20.0	SURCHARGED	
S6.000	S19	2.519	-0.056	0.000	0.83		20.7	OK	

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The Arup Campus Blyth Gate Solihull B90 8AE	Dublin Port O'Tooles Yard	
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S6.001	S20	480	Winter	30	+0%	30/480	Winter		2.511
S6.002	S20	480	Winter	30	+0%	30/180	Winter		2.509
S5.002	S21	480	Winter	30	+0%	30/240	Winter		2.508
S1.007	S22	15	Winter	30	+0%	2/15	Summer		2.607
S7.000	S23	30	Summer	30	+0%	30/15	Summer		2.705
S7.001	S24	30	Summer	30	+0%	2/15	Summer		2.674
S1.008	S25	30	Summer	30	+0%	2/15	Summer		2.664
S1.009	S26	5760	Winter	30	+0%				1.662

PN	US/MH Name	Surcharged		Flooded	Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		
S6.001	S20	0.011	0.000	0.16	4.0		SURCHARGED	
S6.002	S20	0.084	0.000	0.15	3.9		SURCHARGED	
S5.002	S21	0.058	0.000	0.08	10.1		SURCHARGED	
S1.007	S22	0.342	0.000	0.17	26.0		SURCHARGED	
S7.000	S23	0.080	0.000	0.39	13.2		SURCHARGED	
S7.001	S24	0.193	0.000	0.49	13.9		SURCHARGED	
S1.008	S25	0.498	0.000	0.04	8.4		SURCHARGED	
S1.009	S26	-0.444	0.000	0.06	8.5		OK	

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The Arup Campus Blyth Gate Solihull B90 8AE	Dublin Port O'Tooles Yard	
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 20.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 2 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.278
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 15.900 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF


Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	100	+0%	100/15 Summer			
S1.001	S2	15 Winter	100	+0%	30/15 Summer			
S1.002	S3	15 Winter	100	+0%	2/15 Winter			
S1.003	S4	15 Winter	100	+0%	2/15 Summer			
S2.000	S5	15 Winter	100	+0%	30/15 Summer			
S2.001	S6	15 Winter	100	+0%	30/15 Summer			
S2.002	S7	15 Winter	100	+0%	2/15 Summer			
S1.004	S8	15 Winter	100	+0%	2/15 Summer		2/15 Summer	45
S3.000	S9	15 Winter	100	+0%	30/15 Summer			
S3.001	S10	15 Winter	100	+0%	2/15 Winter			
S3.002	S11	15 Winter	100	+0%	2/15 Summer			
S1.005	S12	15 Winter	100	+0%	2/15 Summer			
S4.000	S13	15 Winter	100	+0%	30/15 Summer			
S4.001	S14	15 Winter	100	+0%	30/15 Summer			
S4.002	S15	15 Winter	100	+0%	2/15 Summer			
S1.006	S16	1440 Winter	100	+0%	2/15 Summer		30/15 Summer	39
S5.000	S17	15 Winter	100	+0%	30/15 Summer			
S5.001	S18	15 Winter	100	+0%	30/15 Summer			
S6.000	S19	720 Winter	100	+0%	100/15 Summer			

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XP Solutions	Network 2019.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	3.270	0.045	0.000	0.25		9.9	SURCHARGED	
S1.001	S2	3.242	0.284	0.000	0.65		25.8	SURCHARGED	
S1.002	S3	3.149	0.398	0.000	0.99		36.9	FLOOD RISK	
S1.003	S4	3.029	0.396	0.000	0.51		60.5	FLOOD RISK	
S2.000	S5	3.651	0.545	0.000	0.50		20.2	SURCHARGED	
S2.001	S6	3.595	0.754	0.000	1.22		48.5	FLOOD RISK	
S2.002	S7	3.271	0.640	0.000	1.70		64.5	FLOOD RISK	
S1.004	S8	2.927	0.413	0.000	0.53	50.4	90.0	FLOOD RISK	
S3.000	S9	3.771	0.772	0.000	0.53		21.3	FLOOD RISK	
S3.001	S10	3.710	0.975	0.000	1.30		51.6	FLOOD RISK	
S3.002	S11	3.342	0.818	0.000	1.96		74.3	FLOOD RISK	
S1.005	S12	2.891	0.483	0.000	1.18		183.3	SURCHARGED	
S4.000	S13	3.259	0.328	0.000	0.37		15.0	SURCHARGED	
S4.001	S14	3.217	0.543	0.000	1.00		39.6	SURCHARGED	
S4.002	S15	2.989	0.532	0.000	1.30		49.4	SURCHARGED	
S1.006	S16	2.793	0.458	0.000	0.16	6.9	24.6	SURCHARGED	
S5.000	S17	1.618	0.868	0.000	0.71		12.7	FLOOD RISK	
S5.001	S18	1.530	0.980	0.000	4.31		20.0	FLOOD RISK	
S6.000	S19	2.703	0.128	0.000	0.12		3.0	SURCHARGED	

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The Arup Campus Blyth Gate Solihull B90 8AE	Dublin Port O'Tooles Yard	
Date 28/04/2020 17:36 File Scheme O'Tooles Yard.MDX	Designed by AN Checked by KD	
XP Solutions	Network 2019.1	

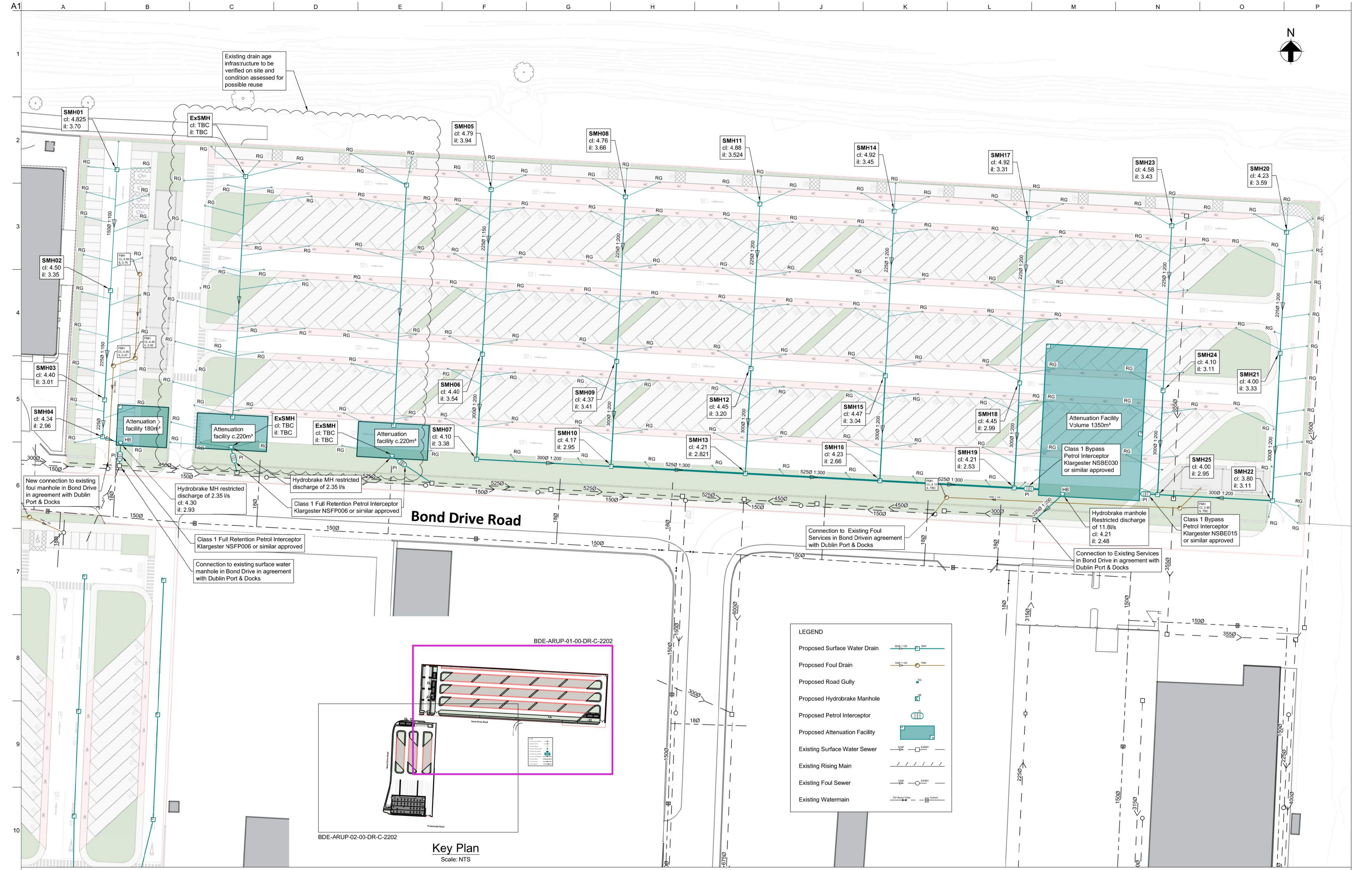
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S6.001	S20	720 Winter	100	+0%	30/480 Winter			
S6.002	S20	720 Winter	100	+0%	30/180 Winter			
S5.002	S21	720 Winter	100	+0%	30/240 Winter			
S1.007	S22	1440 Winter	100	+0%	2/15 Summer			
S7.000	S23	1440 Winter	100	+0%	30/15 Summer			
S7.001	S24	1440 Winter	100	+0%	2/15 Summer			
S1.008	S25	1440 Winter	100	+0%	2/15 Summer			
S1.009	S26	10080 Summer	100	+0%				

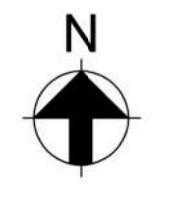
PN	US/MH Name	Water			Surcharged		Flooded		Pipe		Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status			
S6.001	S20	2.702	0.202	0.000	0.15		3.7	SURCHARGED			
S6.002	S20	2.701	0.276	0.000	0.13		3.5	SURCHARGED			
S5.002	S21	2.699	0.249	0.000	0.06		8.3	SURCHARGED			
S1.007	S22	2.879	0.614	0.000	0.06		9.3	SURCHARGED			
S7.000	S23	2.845	0.220	0.000	0.04		1.2	SURCHARGED			
S7.001	S24	2.936	0.455	0.000	0.06		1.6	FLOOD RISK			
S1.008	S25	2.938	0.772	0.000	0.04		8.5	FLOOD RISK			
S1.009	S26	1.662	-0.444	0.000	0.06		8.5		OK		

APPENDIX B

DRAWINGS



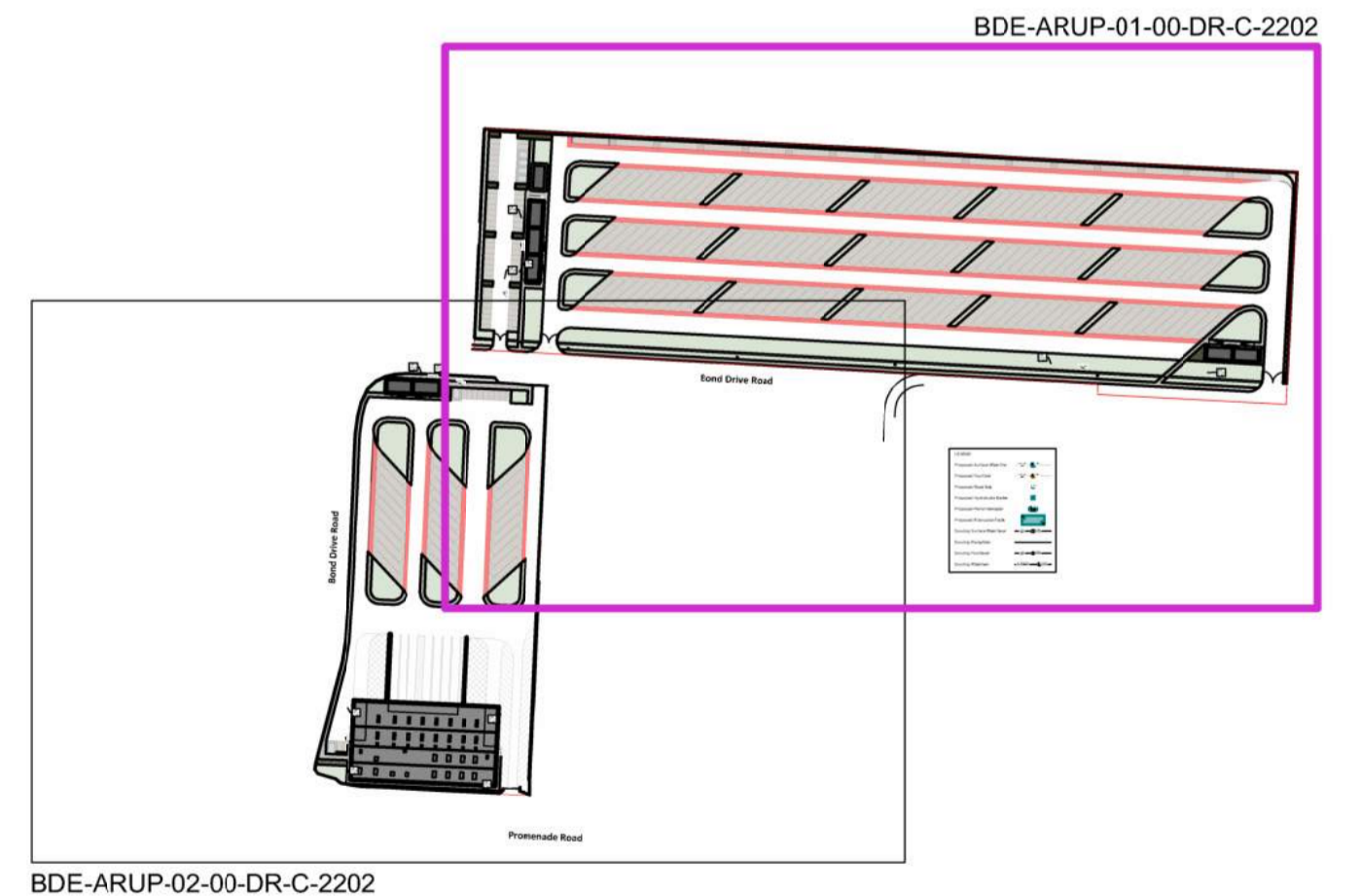
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Bond Drive Road

LEGEND

- Proposed Surface Water Drain
- Proposed Foul Drain
- Proposed Road Gully
- Proposed Hydrobrake Manhole
- Proposed Petrol Interceptor
- Proposed Attenuation Facility
- Existing Surface Water Sewer
- Existing Rising Main
- Existing Foul Sewer
- Existing Watermain



P03	28/04/20	AN	AN	PF
Issued for Information (Status S2)				
P02	24/04/20	NK	AN	PF
Issued for Information (Status S2)				
P01	20/03/20	ND	AN	PF
Issued for Information (Status S2)				
Rev	Date	By	Chkd	Appd

ARUP

Arup, 50 Ringsend Road
Dublin, D04 T6X0
www.arup.ie
Tel +353(0)1 233 4455 Fax +353(0)1 668 3169

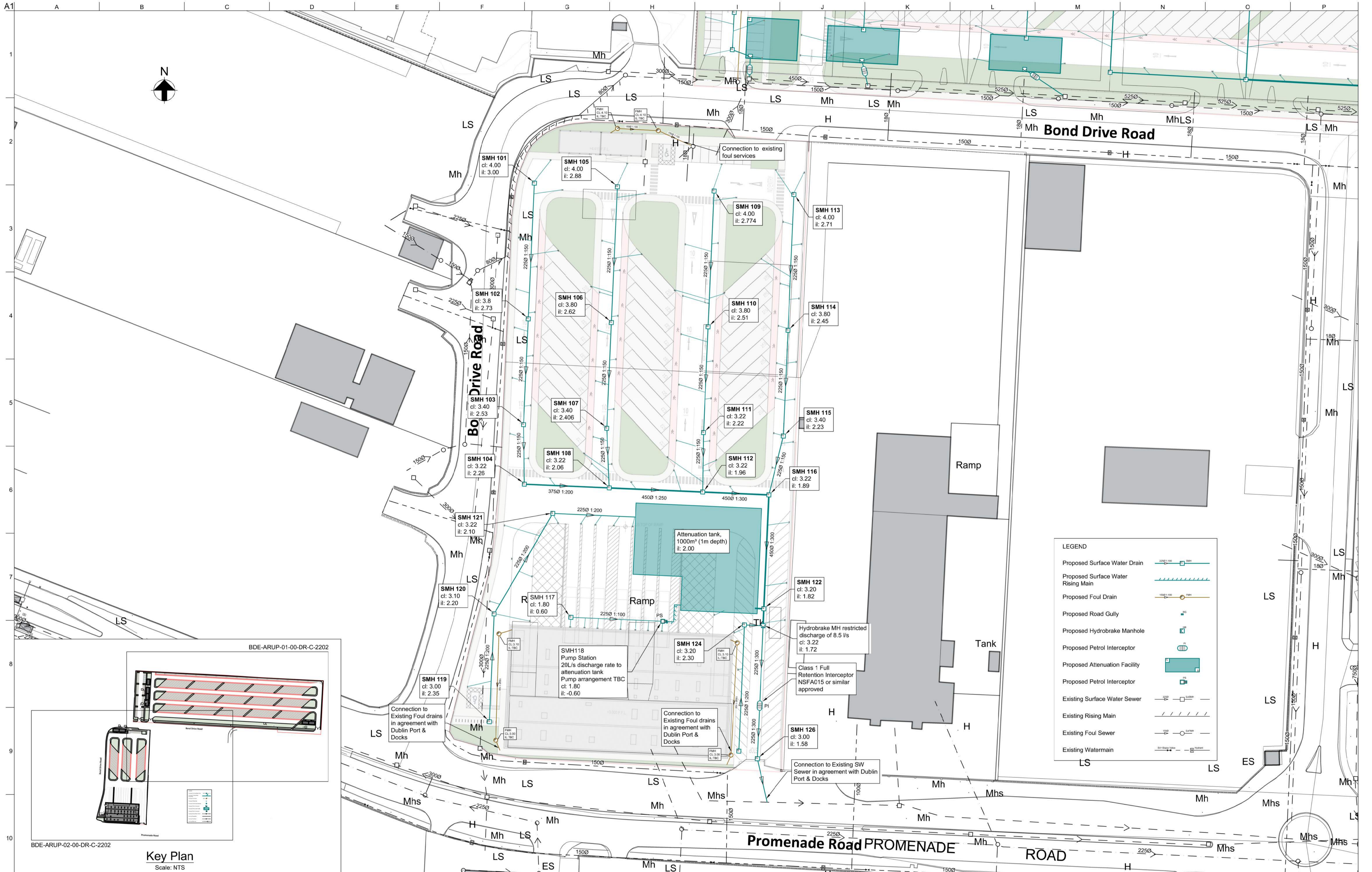
Client
Office of Public Works

Project Title
BCP Interim

Drawing Title
Proposed Drainage Layout for Bond Drive

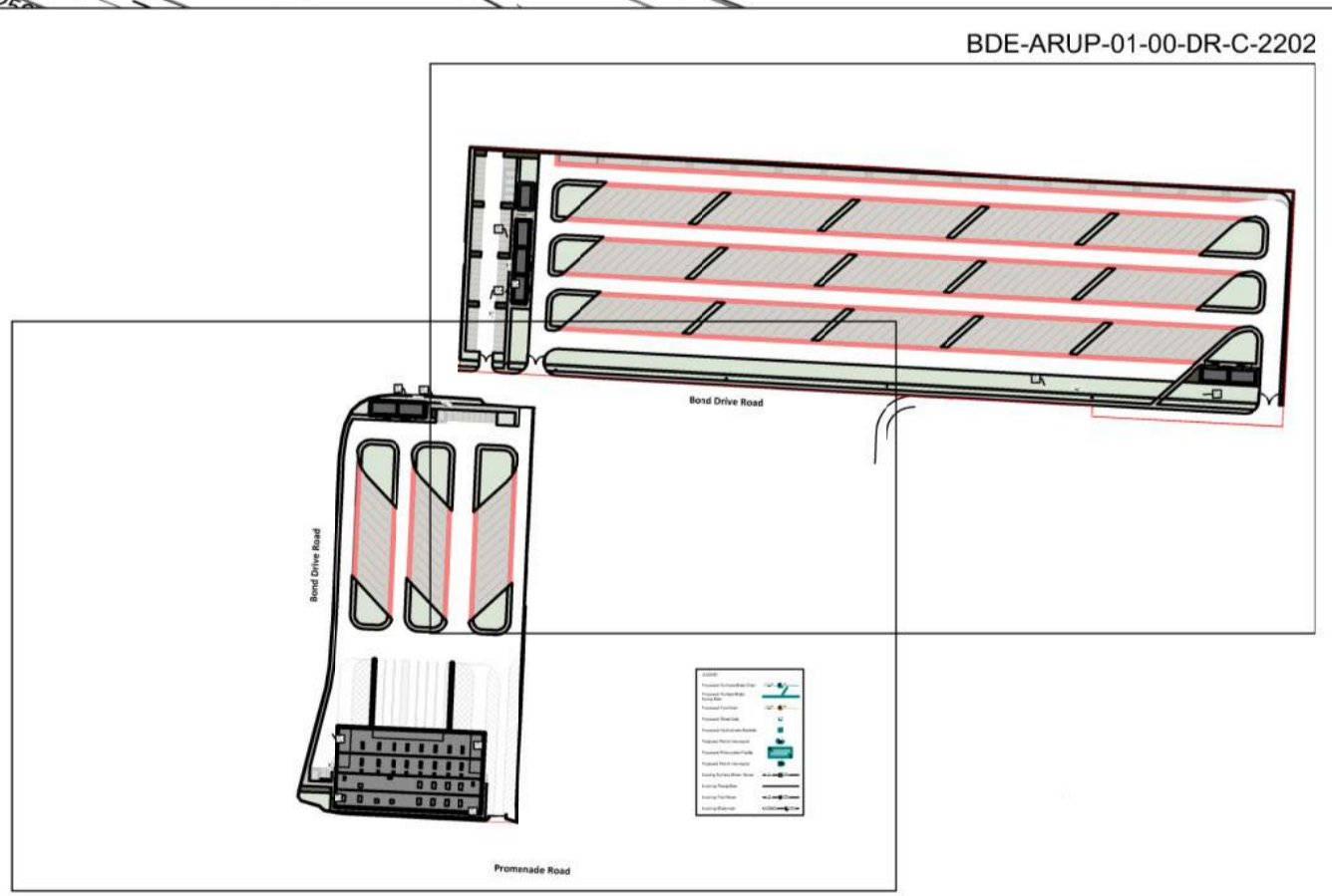
Scale at A1 1:500

Role	Civil
Suitability	S2 - Suitable for Information
Arup Job No	268843-40
Name	BDE-ARUP-01-00-DR-C-2202
Rev	P03



LEGEND

- Proposed Surface Water Drain
- Proposed Surface Water Rising Main
- Proposed Foul Drain
- Proposed Road Gully
- Proposed Hydrobrake Manhole
- Proposed Petrol Interceptor
- Proposed Attenuation Facility
- Proposed Petrol Interceptor
- Existing Surface Water Sewer
- Existing Rising Main
- Existing Foul Sewer
- Existing Watermain



Key Plan
Scale: NTS

P03	28/04/20	AN	AN	PF
Issued for Information (Status S2)				
P02	24/04/20	NK	AN	PF
Issued for Information (Status S2)				
P01	20/03/20	ND	AN	PF
Issued for Information (Status S2)				
Rev	Date	By	Chkd	Appd

ARUP

Arup, 50 Ringsend Road
Dublin, D04 T6X0
www.arup.ie
Tel +353(0)1 233 4455 Fax +353(0)1 668 3169

Client
Office of Public Works

Project Title
BCP Interim

Drawing Title
Proposed Drainage Layout for
O'Toole's Yard

Scale at A1 1:500

Role Civil

Suitability S2 - Suitable for Information

Arup Job No 268843-40 Rev P03

Name BDE-ARUP-02-00-DR-C-2202