Appendix 5-15
Engineering Services Report - *Onshore Substation*

ORIEL WINDFARM
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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Appendix 5-15: Engineering Services Report - Onshore Substation

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Oriel 220 kV Onshore Substation

Oriel Windfarm Ltd.

Engineering Services Report

Document No.: PE605-F0027-R00-014-000

Date: 26-02-2024

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Report Title:	Engineering Services Report	
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Change History of Report

Date	New Revision	Author	Summary of Change

Executive Summary

This report covers the aspects of surface drainage, foul drainage and water supply for the proposed Oriel 220 kV substation development in Stickillin, County Louth.

Sustainability and minimising the impact of the proposed development have been key factors in formulating the proposals for the associated surface water drainage, foul water drainage and water supply services discussed in this report.

The use of Sustainable Drainage Systems (SuDS) in the surface water drainage network will be referred to throughout the report. The SuDS techniques proposed will ensure that the natural drainage patterns are replicated where possible on site and no negative impact results from the proposed substation in terms of water quality discharged in the construction or operational stage.

Most of the proposed compound will be surfaced with permeable stone and surface water generated on this area will largely infiltrate to ground as per the greenfield conditions. Surface water that does not infiltrate will be collected by a system of land drains around the perimeter of the compound. The surface water drainage is split between the GIS Building, Control Building, Statcom Building and the transformer bunds. The surface water generated from these elements will be collected in an underground drainage network and conveyed to separate attenuation and infiltration systems. The infiltration rates will be determined by soakaway tests carried out in accordance with BRE Digest 365. The soakaway tests will be carried out as part of site investigations following planning submission. Discharges from both surface water networks will be at a controlled rate to the surface watercourse which runs adjacent to the north of the site, conveyed via a grassed surface water swale which will offer a further final level of treatment.

Proposals for the treatment and disposal of the foul water generated on site were considered and discussed with the most appropriate system for the development selected. The foul water network is separated between the GIS Building and the Control Building. The foul water from these facilities will be collected in separate foul holding tanks located respectively to the north of the GIS Building and south of the carpark in the southern region of the site.

For the water supply, it is proposed to install rainwater harvesting systems which would serve the welfare facilities in the GIS and Control buildings separately. Potable water supply will be provided by drinking water containers stored onsite.

Contents

1 Introduction

1.1 Background

The site of the proposed Oriel 220 kV onshore electrical substation is in Stickillin, east of Ardee, Co. Louth adjacent to the N33. The site is bordered to the west, east and north by agricultural lands. To the south, the site is bordered by the N33.

Access to the proposed electrical substation will be via the N33. Proposed site drawings are included in Annex A.

1.2 Project Description

The onshore substation will consist of three compounds:

- Compound 1 will contain Gas Insulated Switchgear (GIS) located inside a building.
- Compound 2 will contain outdoor Air Insulated Switchgear (AIS) and will form part of the transmission system for the offshore grid.
- The entrance compound, which will include a telecommunication building, standby diesel generator and car parking.

The onshore substation equipment will be maintained by the Transmission Asset Owner (TAO) and operated by the Transmission System Operator (TSO).

Transmission cables from the GIS substation in Compound 1 will connect to the existing overhead power line through two new Line Cable Interface Masts (LCIM). An existing 220 kV ESB tower adjacent to the substation compounds will be replaced by the two LCIMs to enable this connection.

The substation will require welfare facilities for staff visiting the substation for inspections, routine maintenance and extraordinary maintenance as the need arises. The welfare facilities, including two toilets (WC) and wash hand basins (WHB), will have a water demand and will generate wastewater.

2 Surface Water

2.1 Existing Surface Water

At present it can be deduced that most of the rainfall that falls on the greenfield site is drained by –

1. Recharging to groundwater; and/or
2. Overland flow to the river running along the western perimeter of the field encompassing the site; and/or
3. Overland flow to the watercourse less than 50 m from the site red line boundary to the north.

2.2 Surface Water Drainage Proposals

Surface water proposals for the proposed electrical substation have been developed to mimic the natural drainage patterns of the site and in accordance with the Best Management Practices (BMPs) of Sustainable Drainage Systems (SuDS). The surface water proposals replicate greenfield drainage conditions of the site where possible. Where surface water runoff is being discharged from site, the proposals ensure only high quality, treated runoff leaves the site at a controlled rate.

The permeable area of the proposed site is to be finished in 50 mm single size clean compound stone. This permeable compound stone will provide a means of attenuation of runoff and will allow rainwater to infiltrate to ground as it would on a greenfield site for this portion of the site.

The proposed impermeable surfaces, i.e. GIS building roof, the Control building roof, the Statcom building roof, and transformer bunds will constitute an area of approximately 2,327 m^2. The Percentage Impermeable Area (PIMP) is 7.1% of the total area of the proposed development. The surface water generated from these elements will be collected in an underground drainage network and conveyed to one of two proprietary infiltration systems. Discharges from the infiltration systems will overflow at a controlled rate via a grassed surface water swale (incorporating check dams to capture sediment) to the surface watercourse which runs adjacent to the north of the site.

A land drain network is proposed to surround the boundary of the site. Surface water generated by the compound road will runoff directly to the compound stone except for a number of locations where gullies connected to the drainage system shall be provided to avoid the risk of surface water ponding. Gullies are placed to drain the surface water from the compound road, parking spaces and around the GIS building which is then discharged into the land drain. A Klargester Class 1 Bypass Separator will be placed in the northern region of the site connecting the land drain to the discharge from the infiltration system.

The surface water generated in the proposed impermeable transformer bunds, pumped at a rate of no greater than 1 l/s, will connect to the surface water discharge from the Control Building and Statcom Building. The surface discharge from the GIS Compound will be connected to an infiltration system in the northern region of the site. The overflow generated from both infiltration systems will discharge into the proposed grassed swale running along the internal ownership boundary before outfalling at the greenfield runoff rate of 1.8 l/s to the watercourse at the northern boundary of the site. The site drainage proposals are shown in Annex A drawing PE605-D027-038-014-003.

2.3 Surface Water Volumes

It is proposed to limit discharge from the proposed development to Greenfield runoff rates. The Greenfield runoff rate from the site has been estimated using equations in the Flood Studies Report for the estimation of the mean annual flood, more commonly known as the $Q_{BARrural}$ calculation. Discharge from the site shall be limited through the use of a vortex flow control unit and surface water will be attenuated within an appropriately sized attenuation tank (subject to site infiltration test results) at the western fringe of the substation.

The Preliminary sizing for the attenuation tanks has been conservatively calculated assuming a 100% runoff rate from the GIS, Control and Statcom buildings, car parking area and transformer bunds. The attenuation volumes have been sized to provide storage for all storms with a 1 in 100-year rainfall return period. These volumes are subject to change depending on site infiltration test results. The rainfall data for the site, obtained from Met Eireann, has been factored up by 20% to allow for climate change in accordance with best practice and guidelines. The final sizing required for attenuation will depend on the results of infiltration testing carried out in accordance to BRE Digest 365, at detailed design stage. Should infiltration rates allow it, the system shall be designed to ensure sufficient capacity for the 1:100-year storm event (as defined by Met Éireann) including an additional climate change allowance to ensure no overflow from the infiltration system shall be required. Nonetheless, an overflow from the infiltration system via a swale to the neighbouring watercourse is included in case ground conditions are less permeable than estimated from future site investigations.

2.4 Water Quality

Surface water discharge quality was a major consideration in the formulation of the proposals for the development. The drainage design has been formulated to limit the impact of the proposed development using the Best Management Practices of SuDS.

2.4.1 Construction Stage

Sediment control in the construction and post-construction stages are important considerations to ensure that only high quality, treated runoff leaves the site. Erosion control measures to prevent runoff flowing across exposed or excavated ground and

becoming polluted with sediments will be provided for on-site if required during the construction stage. Erosion control measures include:

- Minimising the area of exposed ground and ensuring excavation will not proceed faster than the rate of construction.
- Monitoring of the weather forecast prior to planning excavation works.
- Providing impermeable mats (plastic sheeting) as covers to mounded excavated material and open excavations during periods of heavy rainfall.

Other drainage runoff controls such as settlement tanks, catchpit, silt fences and silt traps will be temporarily provided adjacent to excavations and installed before starting site clearance and earthworks if deemed necessary by the supervising Engineer.

2.4.2 Operational Stage

During the operational phase of the proposed development, runoff from the proposed control buildings, access roads and transformer bunds will be treated to remove sediment and pollutants prior to discharge from site.

A land drain network will include catchpits. Catch-pit chambers will have a 300 mm sump provided which will allow for the capture of silt and sediment.

The preferred drainage solution for surface water is source control by infiltration using unlined proprietary attenuation systems. Draining predominantly or entirely to ground will improve the discharge of water as suspended solids captured in the ‘first flush’ of a storm event will be captured by this system. Any remaining contaminants should be filtered out by the grassed surface water swales and check dams between the attenuation system and watercourse.

The proposed electrical transformers in the substation are oil filled equipment and as such are placed within impermeable bunds. In order to provide for treatment of surface water generated in the transformer bunds, it is proposed to install an ‘Entexol SCS002’ or equivalent approved integrated Class 1 Full Retention Oil Separator and bund dewatering system with a 1 litre per second low shear vortex pump. This system will ensure only non-contaminated water enters the site drainage network. The bund dewatering system will be fitted with a high oil level alarm and will be connected back to the station control panel which is connected to a manned control centre via the station’s Supervisory Control and Data Acquisition (SCADA) telecom relay system. Operation and maintenance manual for the ‘Entexol SCS002’ is included in Appendix E.

The proposed Klargester Class 1 Bypass Fuel Separator will provide treatment in accordance with BS EN 858 of any contaminated runoff from compound roads and car park spaces.

It should be noted that an oil leak from an electrical transformer is an extremely rare occurrence. Such a leak will result in an electrical fault which will be notified to the transmission system operator and attended to on site by trained operatives immediately.

3 Foul Water

3.1 Existing Foul

There are currently no foul services within the site of the proposed electrical substation compound nor any public foul drainage in the vicinity of the site.

3.2 Foul Water Drainage Proposals

It is proposed to discharge foul water generated by the proposed development to two foul water holding tanks, each with the capacity of 10,000 litres. The foul water holding tank from the GIS building will be placed towards north of the GIS Compound. The foul water holding tank from the Control Building will be placed towards the south of the site.

3.2.1 Foul Water Volumes

The foul drainage proposals must cater for the wastewater generated in the welfare facilities of the proposed development. These welfare facilities include for two toilets (WC) and wash hand basin (WHB) in the GIS building and Control building on the southern region of the site. The proposed station will generate small quantities of foul waste. The station will be unmanned in normal operation so demand for the facilities which generate foul flows will be low.

There will be visits to the station for scheduled and unscheduled inspections, maintenance, and repairs as necessary. A two-man crew visiting the GIS and Control Buildings for two days a week would be the most that would be expected on the site. In such circumstances the operatives could be expected to use each of the facilities four times a day. This would result in a maximum weekly contribution of 122 litres of foul waste per week.

In the very unlikely event that such a high visitation rate would be extrapolated throughout the year, this would result in a maximum of 6,323 litres per annum. While such a consistently high visitation rate is improbable, there is the possibility of increased numbers of staff being present on site for short durations of one to two weeks for the commissioning of electrical elements of the station from time to time. It is envisaged that these exceptional occurrences would balance out with the ordinary operation of the unmanned station to produce a maximum of 6,323 litres of foul waste per annum.

It is common for much lower usage of the facilities on unmanned stations and therefore a much lower foul loading. A common problem on such unmanned stations is odours in the toilet areas due to the drying out of the water trap in the WC through evaporation resulting

from the lack of use. For this reason, it is proposed to use self-flushing toilets in the station, which would flush automatically twice per week. The station will include two 6 litre flush WCs so a minimum weekly foul flow of 24 litres can be expected. The self-flushing WCs together will therefore contribute 1,248 litres per annum.

Combining the automatic flush and maximum user demand figures would result in a maximum annual generation of 6,947 litres of foul water per foul tank. The foul water calculations are stored in Appendix C.

4 Water Supply

4.1 Existing Water Supply

There is currently no water connection within the site of the proposed electrical substation compound and no public water supply line available in the vicinity of the site.

4.2 Water Supply Proposals

It is proposed to introduce a new rainwater harvesting system to the south side of the proposed development. For potable water supply, a number of 20 litre water containers and water coolers will be available.

4.3 Water Supply Volumes

The water demand within the proposed development will be low as the proposed substation is to be unmanned and will be equivalent to the figures for the foul water generation as set out in section 3.2.1 of this report.

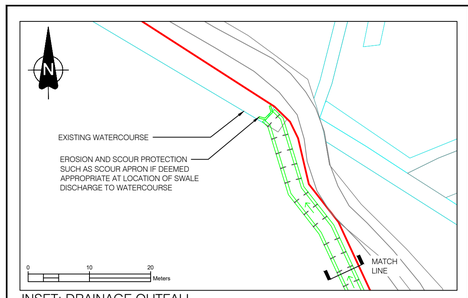
To avoid stagnation in the water supply line and problems resulting from this there will be a continual water demand of 63 litres per week from an automatically flushing WC within the station as set out in section 3.2.1.

The water demand of the welfare facilities is supplied by housing a rainwater harvesting system on the southern region of the site. The system has a storage capacity of 320 litres including ten days of reserve supply for two personnel.The expected low usage of welfare facilities should mean that potable water requirements will also be low for the site. Provision of a number of drinking water containers similar to other substations in remote areas should be sufficient for the general requirements of the compound.

Annex A: Proposed Drainage Drawings

PE605-D027-038-014-003 Proposed Drainage Plan

PE605-D027-038-015-002 Proposed Drainage Details



INSET: DRAINAGE OUTFALL
SCALE 1:500

N

EXISTING 220 kV OVERHEAD LINE CONDUCTORS

TEMPORARY STORAGE AREA

CONTRACTOR CABINS

TEMPORARY CONSTRUCTION COMPOUND

TEMPORARY FENCE

PROPOSED NEW 220 kV MAST

CABLE PULLING TEMPORARY COMPOUND

PROPOSED NEW 220 kV MAST

MATCH LINE

SEE INSET FOR CONTINUATION OF SWALE

BMS STORMBREAKER ATTENUATION TANK OR EQUIVALENT APPROVED 70.1 m³

HYDROBRAKE VORTEX FLOW CONTROL DEVICE LIMITING OUTFLOW TO GREENFIELD FLOW RATE OF 1.257 l/s

CONCRETE POST AND RAIL FENCE

OVERFLOW FROM ATTENUATION / INFILTRATION SYSTEM TO DISCHARGE TO PROPOSED GRASS SWALE RUNNING ALONG INTERNAL OWNERSHIP BOUNDARY

KLARGESTER CLASS 1 BYPASS SEPARATOR OR EQUIVALENT, TREATS THE FIRST FLUSH OF RAINFALL, DISCHARGING AT GREENFIELD RATE TO THE NEIGHBOURING WATERCOURSE

SWALE FALL @ 1:300 MINIMUM. CHECK DAMS SHOWN INDICATIVELY ONLY. TIMBER CHECK DAMS WITH V-NOTCH CUT EVERY 40 m IN SWALE MINIMUM

HARMONIC FILTER

COMPOUND 2

HOUSE TRAFO.

CONCRETE POST AND RAIL FENCE

PROPOSED NEW PALISADE FENCE

REFER TO NOTE 2 UNDER DRAINAGE NOTES

OVERFLOW FROM ATTENUATION / INFILTRATION SYSTEM TO DISCHARGE TO PROPOSED GRASS SWALE RUNNING ALONG INTERNAL OWNERSHIP BOUNDARY

HYDROBRAKE VORTEX FLOW CONTROL DEVICE LIMITING OUTFLOW TO GREENFIELD FLOW RATE OF 0.531 l/s

BMS STORMBREAKER ATTENUATION TANK OR EQUIVALENT APPROVED 45.6 m³

APPLICATION BOUNDARY / CONCRETE POST AND RAIL FENCE

COMPOUND ROAD

HARMONIC FILTER

MAIN

MSR

STATCOM BUILDING

COOLERS

10 m³ FOUL HOLDING TANK REQUIRING EMPTYING ONCE EVERY 6 MONTHS BY A LICENSED WASTE MANAGEMENT CONTRACTOR

COMPOUND 1

GIS BUILDING

CONTROL BUILDING

UNDERGROUND RAINWATER HARVESTING SYSTEM WITH 10 DAY RESERVE STORAGE CAPACITY OF 0.32 m³

ENTRANCE / COMPOUND

SITE ENTRANCE

ACCESS TRACK

SITE BOUNDARY / CONCRETE POST AND RAIL FENCE

CONCRETE POST AND RAIL FENCE

10 m³ FOUL HOLDING TANK REQUIRING EMPTYING ONCE EVERY 6 MONTHS BY A LICENSED WASTE MANAGEMENT CONTRACTOR

REFER TO NOTE 2 UNDER DRAINAGE NOTES

EXISTING BUILDING

EXISTING BUILDING

EXISTING POND

EXISTING BUILDING

EXISTING TREE LINE

EXISTING ESB POLE

EXISTING ESB POLE

EXISTING CONCRETE WALL

EXISTING LANEWAY

EXISTING FENCE

EXISTING ESB POLE

REFER TO NOTE 2 UNDER DRAINAGE NOTES

REFER TO DRAWING NUMBER PE605-D027-038-002 (LATEST REVISION) FOR CONTINUATION OF APPLICATION BOUNDARY

0 10 20 Meters

LEGEND:

APPLICATION BOUNDARY
PROPOSED LEVEL

NOTES:

1. CO-ORDINATES TO ITM GRID.
2. ALL LEVELS ARE IN METRES TO MALIN HEAD ORDNANCE DATUM.
3. ALL DIMENSIONS ARE IN mm. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS.
4. FOR SUBSTATION LAYOUT, REFER TO DRAWING PE605-D027-038-004 (LATEST REVISION)

DRAINAGE NOTES:

1. FOR DRAINAGE DETAILS, REFER TO DRAWING PE605-D027-038-015 (LATEST REVISION).
2. ALL BUNDS TO BE FITTED WITH SCS001 OR EQUIVALENT APPROVED OIL SENSITIVE BUND. DE-WATERING SYSTEM (NJS WITH LOW SHEAR VORTEX PUMP WITH OIL SEPARATION DETECTION) ENTEXOL SCS002 OR SIMILAR APPROVED INTEGRATED CLASS 1 FULL RETENTION OIL SEPARATOR WITH INDEPENDENT CERTIFICATION OF COMPLIANCE TO BS EN 858.

DRAINAGE LEGEND:

PROPOSED SURFACE WATER
PROPOSED CONCRETE ENCASED SURFACE WATER
PROPOSED SURFACE WATER MANHOLE
PROPOSED GULLY
PROPOSED SURFACE WATER AJ
PROPOSED SURFACE WATER DISCHARGE HEADWALL
PROPOSED OIL SEPARATOR
PROPOSED STORMBREAKER ATTENUATION TANK
PROPOSED GRASS SWALE
PROPOSED ROAD GULLY
PROPOSED RAIN WATER PIPE & GULLY TRAP
PROPOSED LAND DRAIN
PROPOSED CATCH PIT
PROPOSED RAINWATER HARVESTING SYSTEM
PROPOSED WATER SUPPLY
PROPOSED SLUICE VALVE
PROPOSED FOUL WATER
PROPOSED CONCRETE ENCASED FOUL WATER
PROPOSED FOUL WATER MANHOLE
PROPOSED FOUL WATER AJ
PROPOSED SOIL VENT PIPE
PROPOSED RISING MAIN
EXISTING WATERCOURSE

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
3	21.02.24	DRAINAGE OUTFALL & PROJECT TITLE REVISED	SB	HG	MV	MH
2	21.08.23	COMPOUND 1 AND COMPOUND 2 REVISED, LEVELS AND TEXT DESCRIPTIONS REVISED, PRODUCTION UNIT REVISED, EXISTING BLDGS ADDED, LAYOUT SIMPLIFIED, SCALE BAR ADDED	SB	AK	HG	MH
1	20.05.21	SURFACE WATER CAPTURE, FOUL WATER AND WATER SUPPLY SYSTEMS INDEPENDENTLY SEGREGATED BETWEEN THE TSO AND IPP COMPOUNDS.	RK	AK	HG	RMcG
0	16.12.20	INITIAL VERSION	RK	AK	HG	RMcG

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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

CLIENT: Oriel Windfarm Limited

PROJECT: Oriel Wind Farm Project

CONTRACT:

DRAWING TITLE: ONSHORE SUBSTATION PROPOSED DRAINAGE PLAN

PRODUCTION UNIT: Civil, Environmental and Renewable Engineering

Energy for generations

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DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
S.Bolton	H.Griffin	M.Vaughan	M.Hogan	23/02/2024
CLIENT REF		NO. OF SHTS	SIZE	SCALE
TC223815		1	A1	1:500

DRAWING NUMBER: PE605-D027-038-014-003
SHEET
REV

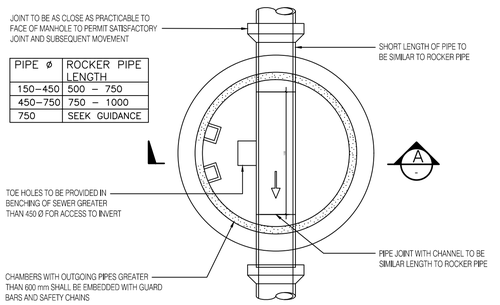
c:\bc-workspace\bolton_slm-virtapp928s,d-high voltage\drawings\pe605 design services to aertech\027 - oriel windfarm 220 kv grid connection\pe605-d027-038-014-003.dwg

TABLE 1

CHAMBER COVERS AND FRAMES TO BE:

a) SQUARE DUCTILE IRON WITH 600 mm CLEAR OPE. CLASS D400 TO I.S. EN 124:1994 BENEATH CARRIAGEWAYS, DRIVEWAYS AND FOOTWAYS.

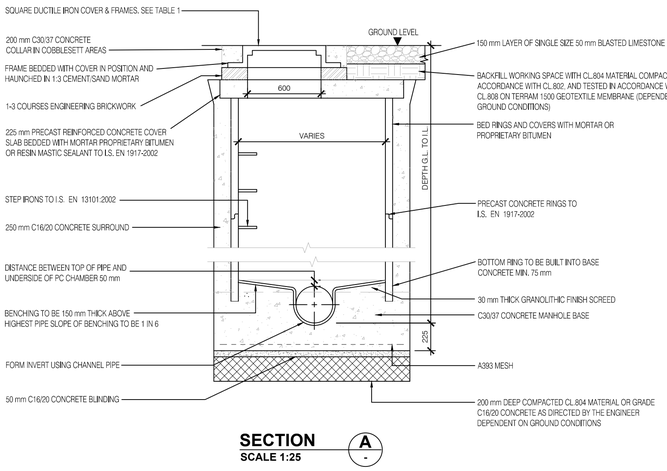
b) SQUARE DUCTILE IRON WITH 600 mm CLEAR OPE. CLASS B125 TO I.S. EN 124:1994 BENEATH GRASSED AREAS.



PIPE Ø	ROCKER PIPE LENGTH
150–450	500 – 750
450–750	750 – 1000
750	SEEK GUIDANCE

PLAN

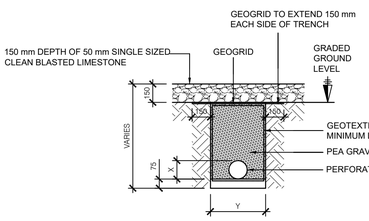
SCALE 1:25



SECTION A
SCALE 1:25

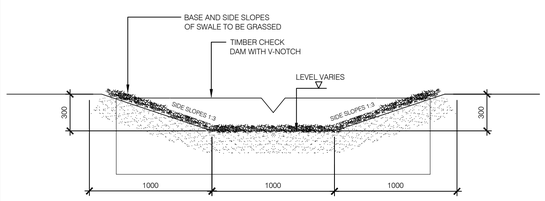
PRECAST RING MANHOLE, DEPTH TO SOFFIT 0-3 m

SCALE 1:25



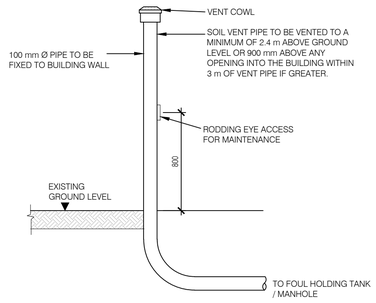
SECTION THROUGH LAND DRAIN

SCALE 1:25



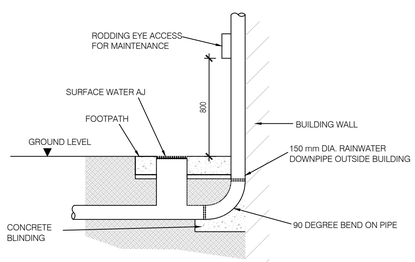
SECTION THROUGH SITE SWALE

SCALE 1:25



SOIL VENT PIPE DETAIL

SCALE 1:25

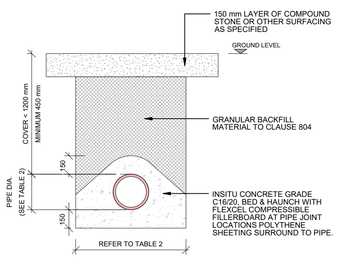


RAINWATER DOWNPIPE DETAIL

SCALE 1:25

TABLE 2

TRENCH WIDTH FOR uPVC SEWERS		
NOMINAL PIPE SIZE (mm)	WIDTH OF TRENCH (mm)	
	MINIMUM	MAXIMUM
110	450	600
160	450	600
200	600	700
225	600	700
250	600	700
315	700	850
355	750	900
400	800	950
450	850	1000

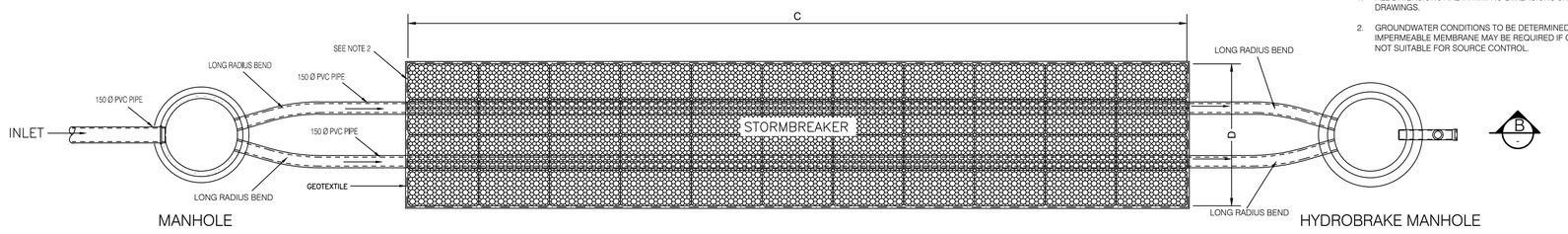


SECTION - uPVC DRAINS/SEWERS IN TRAFFIC AREAS (BEDDING CLASS C)

SCALE 1:25

NOTES:

1. ALL DIMENSIONS ARE IN mm. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS.
2. GROUNDWATER CONDITIONS TO BE DETERMINED AT DETAILED DESIGN STAGE. IMPERMEABLE MEMBRANE MAY BE REQUIRED IF GROUNDWATER CONDITIONS ARE NOT SUITABLE FOR SOURCE CONTROL.

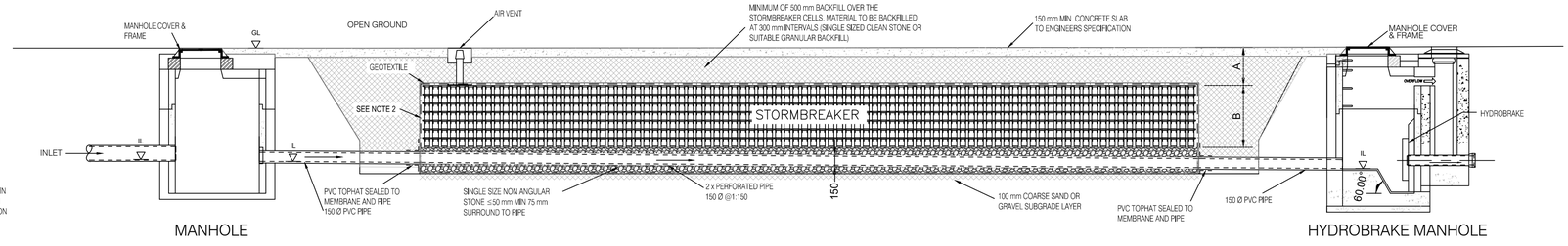


PLAN OF STORMWATER ATTENUATION SYSTEM ARRANGEMENT

SCALE 1:50

STORMBREAKER DIMENSIONS	
A	COVER TO TANK, MIN. 600 mm
B	DEPTH OF TANK; UNIT DEPTH 165 mm
C	LENGTH OF TANK; UNIT LENGTH 1160 mm
D	WIDTH OF TANK; UNIT WIDTH 580 mm

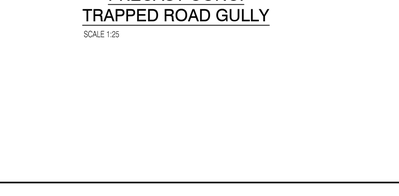
HYDROBRAKE FITTED IN PRECAST MANHOLE AS PER MANUFACTURERS SPECIFICATION



HYDROBRAKE FITTED IN PRECAST MANHOLE AS PER MANUFACTURERS SPECIFICATION

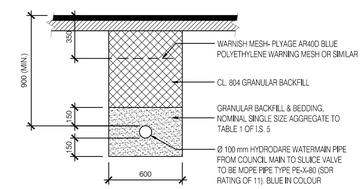
SECTION B
SCALE 1:50

STORMWATER ATTENUATION SYSTEM SECTION



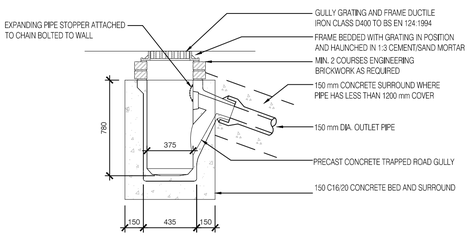
SLUICE VALVE CHAMBER

SCALE 1:25



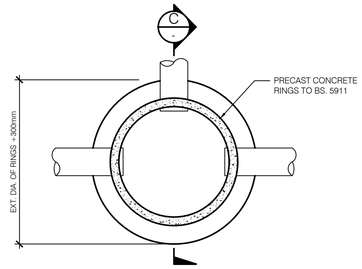
WATER MAIN

SCALE 1:25



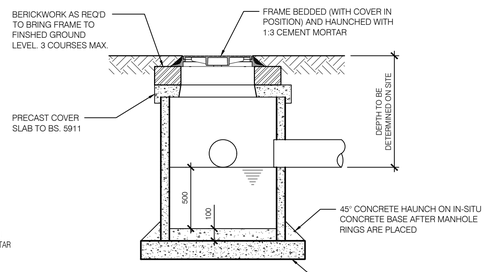
PRECAST CONC. TRAPPED ROAD GULLY

SCALE 1:25

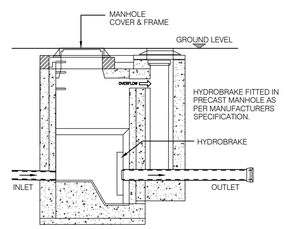


PRECAST CATCHPIT PLAN

SCALE 1:25



SECTION C
SCALE 1:25



HYDROBRAKE MANHOLE

SCALE 1:50

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
2	21.02.24	PROJECT TITLE REVISED, DETAILS ADDED	SB	HG	MV	MH
1	21.08.23	PRODUCTION UNIT REVISED, NOTES AMENDED	SB	AK	HG	MH
0	16.12.20	INITIAL VERSION	RK	AK	HG	RMcG

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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

CLIENT: Oriel Windfarm Limited

PROJECT: Oriel Wind Farm Project

CONTRACT:

DRAWING TITLE: ONSHORE SUBSTATION
PROPOSED DRAINAGE DETAILS

PRODUCTION UNIT: Civil, Environmental and Renewable Engineering

Energy for generations
Engineering and Major Projects,
One Dublin Airport Central, Dublin Airport,
Cloghran, Co. Dublin, K67 XF72, Ireland.
Tel: +353 (0)1 703 8000 Web: www.esb.ie
Engineering and Major Projects is a division of ESB.

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
S.Bolton	H.Griffin	M.Vaughan	M.Hogan	23/02/2024
CLIENT REF		NO. OF SHTS	SIZE	SCALE
TC223815		1	A1	1:25 / 1:50

DRAWING NUMBER: PE605-D027-038-015-002 | SHEET: 1 | REV:

Annex B: Surface Water Calculations

Energy for generations	PROJECT: Oril 220 Kv Onshore Substation CALCULATION TITLE: QBAR- Green Field Runoff				
Calc Sheet No. 1 of 1	Document No. PE605-F0027-C00-001-000	Calculation by Aarabhi Kadsur	Date 10/05/21	Verified by Harry Griffin	Date 10/05/21

Ref	Calculations	Output
	Green Field Runoff Calculations - Eirgrid Building	
	Design Return Period = 100 Years	
	QBARrural Calculation - mean annual flood flow from a rural catchment (assessment of greenfield runoff rate into local watercourse and factored to allowable discharge from the development site)	
	(Note: Minimum catchement size upslope of station to be 0.5 km²)	
	Area = Area of Catchment in km² (Upslope of Station)	
	= 0.50 km²	
	SAAR = Standard Average Annual Rainfall	
	975 mm	
	Value of soil index => 0.3	
	QBARrural = $QBAR\ rural = 0.00108 Area^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$	
	= 0.134 m³/s	
	F = T-Year return period growth factor (F)	
	= 1.95	
	F_D = 1901.25 mm The design flood magnitude (F_D)	
	CC = Increase in rainfall (%) due to Climate Change (CC)	
	= 20	
	E_F = A Standard factorial error is required for the IH124 method	
	= 1	
	Q_D = Design Flow $(Q_D) = QBARrural \times F_d \times CC \times E_F$	
	Q_D = 0.314 m³/s	
	Q_D = 314 l/s	
	Area of Site = 2000 m²	
	Site Area:Catchment Area = 0.002:0.5 = 1:250	Site Green field run-off =
	Site Greenfield Runoff = **1.257** l/s	1.257 l/s

Energy for generations

PROJECT

CALCULATION TITLE

Attenuation Sizing

Calc Sheet No.	Document No.	Calculation by	Date	Verified by	Date
1 of 1	PE605-F0027-C00-001-000	Aarabhi Kadsur	10/05/21	Harry Griffin	10/05/21

Ref | Calculations | Output

Attenuation Sizing - Eirgrid Building

Site Location: Ardee, Co.Louth

Storm Return Period = 100 Years

Climate Change factor (CC) = 20

Proposed Impermeable Area

		Unit	% Impermeable
Roof Areas = (GIS)	0.1482	ha	100
Stoned Area = (included in permeable area)		ha	
Road Area = (Check if the material is concrete)		ha	0
Car park area (4.8 x 2.4 x 10)		ha	100
Bunded Areas = tb1 +tb2+tb3		ha	100
Permeable Area = (the remaining)	2.7434	ha	0
Total Impermeable Area =	0.1482	ha	

Allowable Outflow = 1.257 litres/sec

Duration (min)	Rainfall 100 Year (mm)	Rainfall 100 Year with CC factor (mm)	Intensity (mm/hr)	Discharge Q (=2.78AI) (l/s)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Required (m^3)
5	12.1	14.52	174	72	22	0	21
10	16.8	20.16	121	50	30	1	29
15	19.8	23.76	95	39	35	1	34
30	24.4	29.28	59	24	43	2	41
60	30.2	36.24	36	15	54	5	49
120	37.3	44.76	22	9	66	9	57
180	42.3	50.76	17	7	75	14	62
240	46.2	55.44	14	6	82	18	64
360	52.3	62.76	10	4	93	27	66
540	59.2	71.04	8	3	105	41	65
720	64.6	77.52	6	3	115	54	61
1080	73.1	87.72	5	2	130	81	49
1440	79.9	95.88	4	2	142	109	34
2880	91.3	109.56	2	1	162	217	0
4320	101.2	121.44	2	1	180	326	0

Minimum value of storage required = 65.9 m^3

Type of Attenuation Storage: Propriety (94% void ratio)

Void Ratio: 0.94

Volume of Attenuation required for storage requirements to be satisfied

Required Storage Capacity of Propriety Attenuation =	70.1 m^3

PROJECT

Energy for generations

PROJECT

CALCULATION TITLE

Attenuation Sizing

Calc Sheet No.	Document No.	Calculation by	Date	Verified by	Date
1 of 1	PE605-F0027-C00-001-000	Aarabhi Kadsur	10/05/21	Harry Griffin	10/05/21

Ref | Calculations | Output

Attenuation Sizing - IPP and VCS Buildings, Transformer Bunds

Site Location: Ardee, Co.Louth

Storm Return Period = 100 Years

Climate Change factor (CC) = 20

Proposed Impermeable Area		Unit	% Impermeable
Roof Areas = (IPP,VCS)	0.0422	ha	100
Stoned Area = (included in permeable area)		ha	
Road Area = (Check if the material is concrete)	0.2799	ha	0
Car park area (4.8 x 2.4 x 10)	0.0115	ha	100
Bunded Areas = tb1 +tb2+tb3	0.0423	ha	100
Permeable Area = (the remaining)	2.7434	ha	0
Total Impermeable Area =	0.0845	ha	

Allowable Outflow = 0.531 litres/sec

Duration (min)	Rainfall 100 Year (mm)	Rainfall 100 Year with CC factor (mm)	Intensity (mm/hr)	Discharge Q (=2.78AI) (l/s)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Required (m^3)
5	12.1	14.52	174	41	12	0	12
10	16.8	20.16	121	28	17	0	17
15	19.8	23.76	95	22	20	0	20
30	24.4	29.28	59	14	25	1	24
60	30.2	36.24	36	9	31	2	29
120	37.3	44.76	22	5	38	4	34
180	42.3	50.76	17	4	43	6	37
240	46.2	55.44	14	3	47	8	39
360	52.3	62.76	10	2	53	11	42
540	59.2	71.04	8	2	60	17	43
720	64.6	77.52	6	2	66	23	43
1080	73.1	87.72	5	1	74	34	40
1440	79.9	95.88	4	1	81	46	35
2880	91.3	109.56	2	1	93	92	1
4320	101.2	121.44	2	0	103	138	0

Minimum value of storage required = 42.9 m^3

Type of Attenuation Storage: Propriety (94% void ratio)

Void Ratio: 0.94

Volume of Attenuation required for storage requirements to be satisfied

Required Storage Capacity of Propriety Attenuation = 45.6 m^3

Site Area:Catchment Area = 0.000845:0.5 = 1:592

Site Greenfield Runoff = 0.531 l/s

Site Greenfield run-off = 0.531 l/s

Annex C: Foul Drainage Calculations

Energy for generations

PROJECT	Oriel 220 Kv Onshore Substation
CALCULATION TITLE	Foul Water Tank Sizing

Calc Sheet No.	Document No.	Calculation by	Date	Verified by	Date
1 of 1	PE605-F0027-C00-002-000	Aarabhi Kadsur	10/05/2021	Harry Griffin	10/05/2021

Ref | Calculations | Output

Site Location **Ardee, Louth**

Foul Water Volumes Generated

Personnel Generated Foul Waste

Use	Loading (Litres)	Frequency per day	Foul Waste Generated (litres)
WC Flush	6	4	24
Wash Hand Basin	1	4	4
Sink	0.6	4	2.4
Total Foul Loading for 1 PE			30.4

Annual Water Demand (No. operatives for 5 days per wk)

No. Operatives	2
Working days per week	2
Working weeks/year	52

Total Foul Loading Per Annum (litres)	6323.2

Note: No allowance made for human consumption which would generally constitute a 10% reduction on the PE related foul loading.

Automatic Flush Generated Foul Waste

Use	Loading (Litres)	Frequency per week	Foul Waste
Auto WC Flush	6	2	12
		WC2	

Annual automatic flush demand (litres) from WC =	624

Total Foul Loading Per Annum (litres)	6947.2

Foul Holding Tank Capacity	10,000	litres

Tank Emptied once every 6 months
Note: Tank will have a high level alarm fitted

Capacity of Tank with routine emptying (litres)			20,000

Capacity >> Foul Water Generated

Tank Sufficiently Sized

Annex D: Water Supply Calculations

Energy for generations			PROJECT: Oriel 220 Kv Onshore Substation		
			CALCULATION TITLE: Foul Water Tank Sizing		
Calc Sheet No.: 1 of 1	Document No.: PE605-F0027-C00-003-000	Calculation by: Aarabhi Kadsur	Date: 10/05/2021	Verified by: Harry Griffin	Date: 10/05/2021

Ref	Calculations			Output
	Site Location Ardee, Co. Louth			
	Annual Foul loading per annum (litres)	6323.2		
	Annual automatic flush demand from 1 WC (litres)	624		
	Total annual water demand for welfare facilities (litres)	6947.2		
	Average water requirement per day (litres)	19.03342		
	Average day/peak week demand (litres)	23.79178	1.25 The average water requirement	*Souce : Irish Water Code of Practice for Water*
	Peak demand (litres)	118.9589	5 Times average day / peak week demand	
	Reserve supply to be given 10 days for 2 people (litres) =	Average daily requirement (litres) * 10 190.3342		
	Total tank capacity (litres) = Peak demand + Reserve	**309.2932**		
	Total tank capacity (litres) =	**320**		

Annex E: Entexol Bund-Sep SCS002 – Certified Class 1 Automatic Bund Dewatering System

Entexol Ltd

Environmental Technical Solutions

OPERATION AND MAINTENANCE MANUAL

MODEL: Bund-Sep SCS002

DESCRIPTION: Certified Class 1 discharge Automatic Bund Dewatering System.

SALES & SERVICE
Unit 2, Gateway Business Park, Dublin Rd, Athy, Co. Kildare, Republic of Ireland
Tel: +353 (0) 59 8640930 Fax: +353 (0) 59 8640933
Email: info@entexol.com

FOREWORD

GUIDELINES FOR THE PREVENTION OF OIL POLLUTION TO THE ENVIRONMENT HAVE BEEN SET OUT IN THE FOLLOWING:
ENVIRONMENT AGENCY POLLUTION PREVENTION GUIDELINES
PPG1, PPG2, PPG3, PPG26

THE BUND-SEP TYPE SCS002 IS AN ABOVE GROUND SEPARATOR WHICH, WHEN USED IN CONJUNCTION WITH THE AUTOMATIC BUND DEWATERING SYSTEM TYPE SCS001, PROVIDES SUPPORT FOR BUNDS/ SECONDARY CONTAINMENT TO MEET WITH THE ABOVE REQUIREMENTS.

THE BUND-SEP TYPE SCS002 IS FULLY APPROVED TO EUROPEAN STANDARDS. SEE COMPLIANCE

CONTENTS

1 GENERAL DESCRIPTION

The Bund-Sep type SCS002 is designed to accept rainwater discharge from an Automatic Bund Dewatering System type SCS001 within an external Secondary Containment Area (Bund) in order to provide a final discharge of Class 1 quality (less than 5mg/l)

The Bund-Sep type SCS002 provides Oil Storage capacity to safely contain separated hydrocarbons.

The Bund-Sep type SCS002 is fully interactive with the Automatic Bund Dewatering System type SCS001, the latter providing signal(s) to the former for automatic shutdown under High Oil condition.

The Bund-Sep type SCS002 has no moving parts and is consequently extremely reliable as well as being virtually maintenance free.

The robust construction and simple design help to sustain its function even under poor conditions provided it is installed correctly.

2 BASIC OPERATION

2.1 CONTROL PANEL

The GRP (Glass Reinforced Polyester) enclosure houses the main PCB (Printed Circuit Board) and associated terminals under IP66 conditions.

As a recommendation to the CE approval a Double Pole Isolator is supplied with the unit to be fitted external to the panel. This will be installed to provide both local isolation and a means to isolate the unit from the outside under unfavourable conditions.

The main PCB controls the operation of the complete system. It monitors liquid levels within the sump with input from the probe assembly. It operates the submersible pump to discharge water from the bund and maintain a continuous level within the sump. It accepts signal(s) from the Bund-Sep to monitor its operation and shut down the pump when the accumulated oil in the Bund-Sep reaches the storage capacity

Alarms are generated by the main PCB under conditions as shown in Section 5.

2.2 SEPARATOR

The SEPARATOR Assembly consists of the following:

1. FLOW REGULATION TRAY

The Flow Regulation Tray is a prefabricated container designed to accept and regulate sump discharge from the Automatic Bund Dewatering System type SCS001. It locates on top of the separator and forms a path for the liquid to enter the separator at the correct flow rate (Nominal Size)

2.2.2 ABOVE GROUND PREFABRICATED OIL/WATER SEPARATOR

The above ground Oil/Water Separator is prefabricated from solid HDPE (High Density Polyethylene) and extrusion welded. It consists of an entry Gravity Separation chamber, an intermediate Coalescing Separation chamber and a final Discharge chamber. The outlet pipe is 90mm with a seal designed to accept a standard 100mm soil pipe for onward connection.

2. OIL RETENTION CHAMBER

The Oil Retention chamber is an integral part of the Gravity Separation chamber and contains the Oil Detection probes. The Oil Retention chamber has a fixed capacity of approximately 30 litres. If this capacity is exceeded the Pump is inhibited (Automatic Closure/Shutoff Device)

2.2.4 OIL DETECTION PROBES

The Oil Detection probes are located in the Oil Retention chamber. They are stainless steel probes installed in the oil retention chamber. The cable for connecting the probes to the SCS001 control panel is factory fitted and may be cut to the required length and installed in flexible conduit. (Std cable length is 10 meters)

2.2.5 NON REMOVABLE COALESCERS

The Non Removable coalescers are located in the Intermediate Coalescing chamber. They are a polypropylene content and may be rinsed clean with the rest of the separator when necessary.

3 INSTALLATION

3.1 CONTROL PANEL INSTALLATION

The GRP Control Panel is normally located on the outside of the bund and close to the sump. Care should be taken when sighting the Panel so as not to impede walkways etc.

3.2 CONTROL PANEL MOUNTING

The GRP Control Panel should be attached to a wall or suitable frame using the fixings provided so as not to compromise the IP rating.

3.3 CONTROL PANEL ELECTRICAL CONNECTION

Cables entering the GRP Panel should normally be glanded into the base of the enclosure and brought up into the Main PCB where they must be terminated in the appropriate connector
The flexible cables from the Pump/Probe Assembly (SCS001) should normally be protected with a flexible conduit. This conduit along with the SWA cable from the Bund-Sep (SCS002) must be glanded into the base of the enclosure. The conductors must connect to the Main PCB at the appropriate connector.
The Double Pole Isolator provided will interface the supply cable with the Panel Din Rail connectors. It should be attached to the side of the panel via the correct size of hole and a good seal maintained.
The supply circuit-breaking device should be 10A or less.

3.4 SEPARATOR INSTALLATION

Firstly check there is no debris in the Separator.
The Separator must be installed in a suitable place within the bund as close to the sump as possible. The precise location will be risk assessed for surrounding hazards for example overhead high voltage conductors, walkways etc.
The Separator must be level across both axes and firmly placed.
The Separator must then be filled with clean water at the inlet until discharge commences.

3.5 SEPARATOR ELECTRICAL CONNECTIONS

A cable connects the Bund-Sep to the Control Panel. Flexible conduit should be used to give mechanical protection to the cable.
The flexible conduit must be glanded into the small connection box on the side panel of the Bund-Sep and into the SCS001 control panel.
This cable must then be connected at the other end to the Main PCB via the G.R.P. enclosure using similar suitable gland and connectors. (Blue wire into terminal 1, Brown wire into terminal 5 on the “Probe Input” terminal block on the main PCB)

3.6 SEPARATOR INLET AND DISCHARGE CONNECTIONS

A Discharge hose attaches to the outlet of the Submersible Pump situated in the sump via a 1.25 BSP x 1.0inch Hosetail and Hoseclip.The flow regulating plug supplied must be installed in the hose to regulate the pump flow. This flexible hose must follow a safe route along with the probe cable to the Bund-Sep where it attaches with a hoseclip to the inlet hosetail, situated on the Flow Regulation tray.
A standard 100mm soil pipe will fit over the outlet pipe seal and must be formed to fall over the bund wall and to soakaway. The final discharge pipe assembly must be adequately secured and a suitable sampling point must be introduced.

4 FUNCTIONAL TESTING

4.1 Ensure Control Panel is switched off. Check POWER FAIL alarm is output. Check no other alarms or indications are output.

4.2 Switch isolator on and check POWER FAIL alarm is not output.

4.3 With separator full of water and sump full of water check normal operation of Automatic Bund Dewatering System with class 1 discharge (SCS001 + SCS002)

4.4 Check no alarms are output.

4.5 Disconnect the brown wire from terminal 5 on the probe input terminal block on the main PCB.

4.6 Check ‘Bund-Sep Hi Oil’ is displayed on the LCD and the pump stops (Automatic shutoff)

7. Re-connect the brown wire into terminal 5 on the probe input terminal block on the main PCB.

8. Check pump remains off and ‘Bund-Sep Hi Oil’ remains active

9. Reset power to Control Panel and check normal operation is restored.

5 ALARMS AND INDICATIONS

When oil accumulates to excess in the Oil Storage section of the separator, the pump is inhibited and the alarm ‘Bund-Sep Hi Oil’ is raised.
This alarm is displayed on the LCD and Alarm Relay 7 ‘Bund-Sep High Oil’ is set.
Residual oil in the separator must now be removed and Operator intervention with a Power Reset to the Control Panel is required to resume normal operation.

6 FEATURES

6.1 BUND-SEP HI OIL CIRCUIT

The Bund-Sep Hi Oil circuit provides an extra Emergency Stop function to the System. It constantly monitors for water within the Gravity Separation chamber. If a presence of water is replaced by that of oil during normal operation then the Submersible Pump is electrically isolated and a Bund-Sep Hi Oil alarm is raised. Unlike the Deadstop 1 circuit, The Bund-Sep Hi Oil circuit requires operator intervention and a physical power reset at the Control Panel, with the Separator in a healthy condition, to revert to normal operation.

6.2 HIGH WATER ALARM TIME DELAY

Reference 8.3.2. The Dual In-line **SWITCH 3,** position #2 sets or resets the High Water Alarm Time Delay feature.
In large area bunds and under heavy rainfall conditions, it may be that the amount of water entering the bund exceeds the amount being discharged from the bund for a limited period. To withhold a (false) High Water Alarm, therefore, the High Water Time Delay may be set. The Time Delay for the High Water Alarm is pre-set to 24 Hours.

7 MAINTENANCE

The SCS002 is virtually maintenance free due to its simple design. However periodic maintenance may be carried out as follows:

1. CONTROL PANEL

1.1. Isolate power supply to main PCB.
1.2. Check for moisture ingress to the panel and correct any poor sealing surfaces if required
1.3. Check for loose connections and tighten if required.
1.4. Check for general stability of Panel and reaffix if required.

2. SEPARATOR

2.1. Lift the hinged flow regulation tray to access the oil collection chamber in the bund-sep unit. The chamber which has the probe unit installed is the mains oil collection chamber. You may find oil in the coalescing chamber. Remove oil from the collection chambers in the Bund-Sep and dispose of in accordance with relevant local environmental guidelines.
2.2. Empty the remaining water in the Bund-Sep back into the bund.
2.3. With Flow Regulation tray lifted, clean stainless steel probes with a damp cloth.
2.4. Check the coalesce filters for silt and debris and remove if required.
2.5. Check inlet hose and cables are in good condition, replace if required.
2.6. Check inlet hose and probe cable are correctly located within the bund to avoid tripping risks and damage.
2.7. Check final discharge pipe arrangement is secure and sampling point is accessible.

7.3 CARRY OUT FUNCTIONAL TEST (SECTION 4)

A TABLES

A.1 POWER CONNECTIONS

Terminal	Function	Description
L1	Live – AC supply	230 VAC
N	Neutral – AC supply	
1	Pump output live	230 VAC
2	Pump output neutral	
3	Beacon output live	230 VAC
4	Beacon output neutral	
Alarm 1 - 7	Alarm supply	220 VDC / 250VAC
Safety Earth ⏚	*All plate earth point* Safety Earths entering/exiting the panel must be connected directly to the earth point provided*	

A.2.1 PROBE CONNECTIONS CONTROL PANEL

Terminal	Function	Wire
1	Common- from pump/probe and separator assy	black/blue
2	Pump start-from pump/probe assy	yellow
3	Pump stop-from pump/probe assy	blue
4	Deadstop #1-from pump/probe assy	red
5	Deadstop #2-from separator assy	brown
6	Float #1-from pump/probe assy	white
7	Float #1-from pump/probe assy	green
8	Float #2	Not used
9	Float #2	Not used

A.2.2 PROBE CONNECTIONS SEPARATOR

Terminal	Function	Wire
1	High oil signal- from control panel	blue
5	High oil signal- from control panel	brown

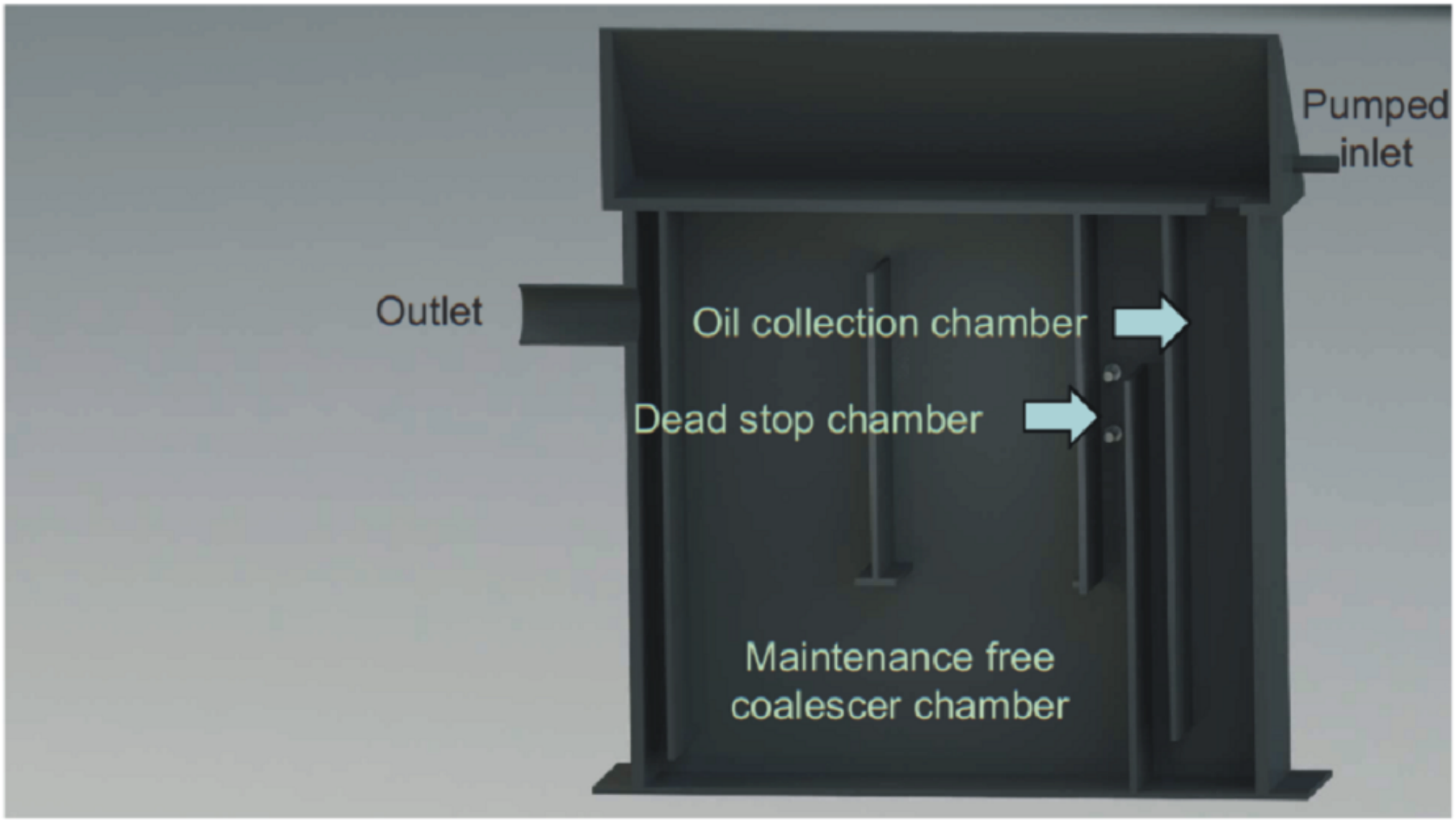
A.3 ALARM CONNECTIONS

Terminal	Relay	Function
Alarm 1	NO	Power fail / low voltage
	C	
	NC	
Alarm 2	NO	High oil
	C	
	NC	
Alarm 3	NO	High water
	C	
	NC	
Alarm 4	NO	Pump fault
	C	
	NC	
Alarm 5	NO	Probe fault
	C	
	NC	
Alarm 6	NO	Pump On
	C	
	NC	
Alarm 7	NO	Separator High Oil
	C	
	NC	

Note: Alarm relays rated at 220V DC @ 0.24A/250V AC @ 0.25A

Fuses

Number	Function	Rating
F1	Main	250V 3.15A T
F2	Transformer primary	250V 32mA T
Fused Terminal 1	Pump	250V 2A T
Fused Terminal 3	Beacon	250V 200mA T
Fused Terminal 5	Alarm	250V 200mA T


Pumped
inlet
Outlet
Oil collection chamber
Dead stop chamber
Maintenance free
coalescer chamber

C COMPLIANCE/ CE CERTIFICATION

C.1 CONTROL PANEL

C1.1 LOW VOLTAGE DIRECTIVE 2006/95EEC

C.1.2 EC DIRECTIVE 2004/108/EC

BS EN 61000-6-2: 2005
GENERIC EMC IMMUNITY STANDARD
INDUSTRIAL
BS EN 61000-6-3: 2007
GENERIC EMC EMISSIONS STANDARD
RESIDENTIAL, COMMERCIAL AND LIGHT INDUSTRY
BS EN 61000-3-2: 2006
LIMITS for HARMONIC EMISSIONS
CASS INDUSTRIES REPORT NO. CI03934
TEST DATE: 20th January 2010

C.2 SEPARATOR

CONSTRUCTION PRODUCTS DIRECTIVE
Construction Products Regulations (1991)
BS EN 858-1: 2002
BS EN 858-2: 2003
SEPARATOR SYSTEMS FOR LIGHT LIQUIDS
(E.G. OIL AND PETROL) –PART 1:
PRINCIPLES OF PRODUCT DESIGN,
PERFORMANCE AND TESTING, MARKING
AND QUALITY CONTROL
SMITHERS RAPRA TECHNOLOGY LTD REPORTS:
53186 HT0080 DATE: 15.07.2011
53240 HT0080 DATE: 28.07.2011