NeuConnect

ENVIRONMENTAL STATEMENT VOL 4 – APPENDIX 9B - 5471146

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Appendix 9.B – Drainage Strategy

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 9B: Outline Drainage Strategy

NeuConnect Britain Ltd

September 2019

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	June 2019	Draft for internal review	HJ	Helen Judd	Principal Consultant
2	July 2019	For client issue	EC	Emily Craven	Associate Director

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Figures

No table of figures entries found.

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1. Introduction

Introduction

1.1 NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks and will allow electricity to be passed in either direction. The Project will be formed by over 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.2 The components of the Project that are 'onshore' in Great Britain (the "GB Onshore Scheme") will comprise the interconnector as well as the additional works necessary to facilitate a connection to the National Electricity Transmission System (NETS). AECOM has been commissioned by NeuConnect Britain Limited (hereafter referred to as the 'Applicant') to prepare an Environmental Impact Assessment (EIA) that will support the outline planning application for the GB Onshore Scheme in the Isle of Grain, Kent.

1.3 This document presents an Outline Drainage Strategy to inform the EIA and forms Appendix 9B of the Environmental Statement. This Outline Drainage Strategy has been prepared to demonstrate that surface water arising from the GB Onshore Scheme can be managed and will not increase flood risk elsewhere. A detailed drainage strategy will be produced at a later design stage which will include information on process water and foul water drainage in addition to the surface water drainage. Process and foul water drainage is not included in the scope of this strategy.

Site Description

1.4 The GB Onshore Scheme is entirely within the boundary of Medway Council and is centred on the Isle of Grain, located at the eastern end of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The area in which the GB Onshore Scheme is proposed (the 'Project Area', land within the application boundary, as illustrated on Figure 2.1 of the Environmental Statement) is located on the fringes of industrial land (this is based on the existing 400 kV overhead line (OHL) defining the extent of industrial land) and extends north/ northeast to the coast. The Project Area is approximately 66 hectares (ha) when incorporating the land up to The Mean Low Water Springs (MLWS) level.

1.5 Land within the Project Area and in the immediate vicinity is either in agricultural use or is brownfield land which has no current discernible use. The Project Area is located approximately 0.5 km to the west of Grain; however, there are individual properties in the centre (Perry's Farm) of and to the west (Rose Court Farm) of the Project Area.

1.6 Grain Marsh, which is immediately west of the Project Area is designated a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and a RAMSAR site[1].

1.7 The topography across the Project Area peaks at approximately 16 m above ordnance datum (AOD) near Perry's Farm, and falls from east to west to approximately 1 mAOD at the western boundary with Grain Marsh. The British Geological Survey (BGS) website[2] defines the underlying geology; with superficial deposits formed from River Terrace Deposits comprising sand and gravel overlaying bedrock formed from the London Clay Formation. The River Terrace Deposits are classified as a 'Secondary A' aquifer[3]. The London Clay Formation is typically impermeable and has no aquifer classification or designation. Therefore, there is a significant risk of the

[1] https://magic.defra.gov.uk/MagicMap.aspx
[2] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[3] https://magic.defra.gov.uk/MagicMap.aspx

groundwater level being close to the ground level in this area. Groundwater levels will be confirmed on completion of the ground investigation.

1.8 Based on Environment Agency LiDAR mapping, it can be assumed that surface water runoff generated within the Project Area currently drains westwards via natural processes to Grain Marsh.

1.9 Land within the Project Area and in the wider vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill. Historic landfill sites have been capped, or infilled. However an existing permitted leachate monitoring system still operates from the historic landfill located to the east of Perry's Farm to the pond located to the northeast of Rose Court Farm.

Policy Requirements

Revised National Planning Policy Framework 2018

1.10 The Revised National Planning Policy Framework (NPPF)[4] and associated Planning Practice Guidance states that developments should not increase the risk of flooding elsewhere taking into account the impacts of climate change. To demonstrate this, it is necessary to assess the surface water runoff for the existing Project Area and compare this with the GB Onshore Scheme post development scenario. Alongside this, SuDS should be incorporated where practicable. The Outline Drainage Strategy has been designed in line with the requirements set out by Kent County Council, Medway Council, North Kent Marshes Internal Drainage Board (IDB), the Non-statutory Technical Standards for Sustainable Drainage Systems (SuDS) and the CIRIA SuDS Manual (C753)[5]. The most relevant policies have been detailed below.

Kent County Council Drainage and Planning Policy Statement 2017

1.11 Kent County Council, as the Lead Local Flood Authority and Statutory Consultee, will review drainage strategies associated with major development applications. The guidance provided by Kent County Council's Drainage and Planning Policy Statement sets out what Kent County Council expects from applicants and how drainage proposals will be assessed. The following SuDS specific policies have been set out by Kent County Council and the drainage proposals will be assessed against these:

- **SuDS Policy 1**: Follow the drainage hierarchy

  Surface runoff not collected for use must be discharged according to the following discharge hierarchy:

  – to ground,

  – to a surface water body,

  – a surface water sewer, highway drain, or another drainage system, or

  – to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewage undertaker.

  The selection of a discharge point should be clearly demonstrated and evidenced.

- **SuDS Policy 2**: Manage Flood Risk Through Design

  It is essential that the drainage scheme proposed:

[4] *National Planning Policy Framework',* available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733637/National_Planning_Policy_Framework_web_accessible_version.pdf, accessed 30th May 2019

[5] CIRIA, 2015, The SuDS Manual (C753), London.

  - protects people and property on the development site from flooding; and,
  - does not create any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.

  Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.

- **SuDS Policy 3**: Mimic Natural Flows and Drainage Flow Paths

  Drainage schemes should be designed to match greenfield discharge rates, volumes and follow natural drainage routes as far as possible.

- **SuDS Policy 4**: Seek to Reduce Existing Flood Risk

  New development should be designed to take full account of any existing flood risk, irrespective of the source of flooding.

  Where a site or its immediate surroundings have been identified to be at flood risk, all opportunities to reduce the identified risk should be investigated at the masterplanning stage of design and subsequently incorporated at the detailed design stage.

  For brownfield sites, and unless demonstrated to be reasonably impracticable, we would expect a 50% reduction in the peak runoff rate.

- **SuDS Policy 5**: Drainage Sustainability and Resilience

  The proposed drainage system must consider life-time sustainability of the drainage measures and components.

  The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case.

  A sustainable drainage approach which considers control of surface runoff at the surface and at source is preferred and should be considered prior to other design solutions.

- **SuDS Policy 6**: Design to be Maintainable

  A drainage scheme maintenance plan should be prepared which demonstrates a schedule of activities, access points, outfalls and any biodiversity considerations.

  The maintenance plan should also include an indication of the adopting or maintaining authority or organisation and may require inclusion within a register of drainage features.

- **SuDS Policy 7**: Safeguard Water Quality

  When designing a surface water management scheme, full consideration should be given to the system's capacity to remove pollutants and to the cleanliness of the water being discharged from the site, irrespective of the receiving system.

  Interception of small rainfall events should be incorporated into the design of the drainage system.

- **SuDS Policy 8**: Design for Amenity and Multi-Functionality

  Drainage design should in the first instance consider opportunities for inclusion of amenity and biodiversity objectives and thus provide multi-functional use of open space with appropriate design for drainage measures within the public realm.

- **SuDS Policy 9**: Enhance Biodiversity

  Drainage design should in the first instance consider opportunities for biodiversity enhancement, through provision of appropriately designed surface systems, consideration of connectivity to adjacent water bodies or natural habitats, and appropriate planting specification.

- **SuDS Policy 10**: Link to Wider Landscape Objectives

Drainage design should consider in the first instance opportunities to contribute to the wider landscape and ensure proposals are coherent with the surrounding landscape character area.

Kent County Council also provide a drainage strategy summary pro-forma for developers to complete, to help with the assessment of schemes. This has been completed and is presented as Annex 9B-1.

Medway Council Local Plan 2003

1.12 The policies within Medway Council's Local Plan seek to set out a strategic path for future development, with an emphasis on sustainability. The policy most relevant to this Outline Drainage Strategy is listed below:

- **POLICY CF12**: Water Supply

  Development will not be permitted where:

  i. it would have a detrimental effect on the quality or yield of water supply; or

  ii. it would prevent or reduce replenishment of groundwater aquifers; or,

  iii. it would have an adverse impact on the flora, fauna (including fisheries interests) and amenity of water courses and other habitats whose nature 296 conservation value is dependent on maintaining water levels;

  iv. it would represent an unacceptable risk to the quality of groundwater resource, unless appropriate measures are taken to adequately protect those resources.

Proposed Development

1.13 The GB Onshore Scheme will comprise the following main elements extending as far as MLWS level:

- A new sealing end compound to facilitate connection of the GB Onshore Scheme to the existing OVL.
- A new substation approximately 80 metres (m) by 80 m (or up to 0.64 ha) with a maximum height of approximately 14 m. The substation will also include down leads from the existing OHL tower.
- An underground Alternating Current (AC) cable route from the substation to the converter station.
- A converter station approximately 250 m by 250 m (or up to 5 ha) with a maximum height of approximately 26 m.
- A new permanent access track from Grain Road (B2001) to the proposed converter station and proposed substation. Access will be achieved by upgrading the existing gravel path that extends along the southern boundary of the Project Area.

2. Outline Drainage Strategy

Site Parameters

1.14 Surface water runoff arising from storm events will require management. Of the total Project Area, approximately 8.4 ha will be classified as impermeable. This impermeable area includes the sealing end compound, access road, converter station and substation platforms with 2m offset and the construction laydown area immediately adjacent to the substation platform as it may be used to expand the substation in the future. The buried DC cable route and the south most construction laydown area are not included as the ground in these areas will be reinstated to the original condition. The existing and proposed permeable and impermeable land within the Project Area has been assessed and is compared in Table 2-1.

Table 2.1 Comparison of permeable and impermeable surfaces for existing and proposed use

	Permeable Area (ha)	Impermeable Area (ha)
Existing	66	0
Proposed	57.6	8.4

Surface Water Runoff Rates

1.15 Runoff rates for a range of storm events have been estimated using Flood Estimation Handbook (FEH) methods. Revitalised Flood Hydrograph method (ReFH2) has been selected as this method is applicable in calculating both Greenfield and Post-Development runoff rates.

1.16 Catchment descriptors have been extracted from the FEH webservice[6] in the form of point data approximately at the centre of the site area. These have been imported into ReFH2 software and applied using the plot scale feature.

1.17 A climate change allowance of 20% has been used in line with guidance set out by the Environment Agency at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. The 20% climate change allowance has been derived from Table 2 of the Environment Agency guidance ('peak rainfall intensity allowance in small and urban catchments'), using the 'upper end allowance' for the 'total potential change anticipated for the 2050s (2040 to 2069)'. This has been chosen based on a Project design life of 40 years with construction taking three years starting in 2021.

1.18 The peak runoff rates and volumes arising from the undeveloped area compared to the developed GB Onshore Scheme (assuming no mitigation) are presented in Table 2-2. The critical storm duration according to the ReFH2 calculations is 5.5 hours. Therefore, the estimated volume is based on the 6-hour storm. Runoff rates and volumes for the 1% AEP + 40% climate change event and the 0.1 % AEP event have been included as exceedance events. Calculations supporting the information in Table 2-2 are presented as part of **Appendix 9C**.

[6] Centre for Ecology & Hydrology, FEH Webservice, available at: https://fehweb.ceh.ac.uk/Account/Login, accessed: Jan 2019.

Table 2.2 Comparison of runoff rates and volumes for existing and proposed use

AEP	Existing Rate (l/s/ha)	Existing Rate (8.4 ha)	Volume (m^3)	Proposed Rate (no mitigation) (l/s/ha)	Proposed Rate (No mitigation) (8.4 ha)	Volume (m^3)
50% AEP (Q_{BAR})	2.21	18.6	796	9.86	82.8	1400
3.33% AEP	4.83	40.6	1870	21.4	179.8	2820
1% AEP	6.75	56.7	2670	29.0	243.6	3990
1% AEP +20%cc	8.10	68.0	3200	34.9	293.2	4790
1% AEP +40%cc	9.45	79.4	3740	40.7	341.9	5590
0.1% AEP	13.6	114.2	5490	52.9	444.4	7170

Proposed Surface Water Drainage Strategy

Design Criteria

1.19 Sustainable Drainage Systems (SuDS) are different drainage techniques used to improve water quality, reduce discharged water quantities and provide biodiverse habitats for nature whilst increasing amenity and property values. There is a hierarchy to SuDS, with more preferable systems being above ground and including swales, infiltration basins, wetlands, and green roofs. Below ground systems including soakaways and permeable paving follow on in order of preference, with below ground storage in the form of tanks or oversized pipes towards the least favoured systems. Likewise, there is also a hierarchy to surface water discharge solutions as specified in the CIRIA SuDS Manual (C753)1, which should be adhered to in the following order:

- Infiltration to the maximum extent that is practical - where it is safe and acceptable to do so
- Discharge to surface waters
- Discharge to surface water sewer
- Discharge to combined sewer (last resort).

Proposed SuDS

1.20 Through assessing the location of the GB Onshore Scheme, alongside the LiDAR data for the Project Area, SuDS in the form of swales and attenuation ponds are proposed to be incorporated. The proposed location of the attenuation ponds and swales are adjacent to the western boundary of the Project Area, as illustrated by figures within in **Annex 9B-2**. This location has been identified as the most suitable due to the local topography falling from east to west across the Project Area, which will enable gravity drainage from the proposed impermeable areas to the SuDS features and subsequently to the receiving waterbodies (described further below).

1.21 The total volume of attenuation that will need to be provided to accommodate the 1% AEP + 20% cc event, with the discharge rate restricted to QBAR, is approximately 7,000m3. This value is likely to change as the design progresses. Storage estimate calculations are presented as Annex 9B-3.

1.22 The proposed attenuation ponds are to be located within Flood Zone 3, however this is an area protected by flood defences. As detailed in the Flood Risk Assessment the flood defences are known to protect the area up to 0.5% AEP with climate change allowances up to the year 2115.

1.23 Suitable construction phasing should be used to enable the SuDS features to be constructed at the beginning of the works. This would ensure that any rainfall events during construction of the substation and converter building would be intersected and attenuated by the SuDS before being discharged at a restricted rate into the agreed receiving waterbodies.

Outfall to Existing Waterbodies

1.24 There are numerous existing waterbodies located within Grain Marsh west of the GB Onshore Scheme. As this area is designated a SSSI, SPA and a RAMSAR site, the proposed SuDS sequence provides a treatment train that will ensure no detrimental impact from the GB Onshore Scheme to the surrounding environmentally sensitive areas. It is intended to discharge surface water at greenfield runoff rates to the existing waterbodies west of the Project Area at grid reference TQ 87570 76659.

1.25 A desktop assessment of these waterbodies, alongside correspondence with the IDB, presented as **Annex 9B-4**, has led to the following assumptions:

- Neighbouring waterbodies eventually flow to the mouth of the River Thames
- The waterbodies have the capacity to take flows from the site at greenfield runoff rates
- Waterbodies within Grain Marsh intersect the water table in places.

1.26 Table 2-3 compares the proposed surface water drainage strategy in relation to the discharge hierarchy, demonstrating that more favourable receptors have been selected.

Table 2.3 Proposed surface water drainage with respect to the discharge hierarchy

Hierarchy	Proposed Surface Water Drainage
Infiltration to the maximum extent that is practical - where it is safe and acceptable to do so	Some infiltration is likely to occur within the swales and attenuation ponds. Ground conditions and infiltration rates to be confirmed before detailed design commences
Discharge to surface waters	Surface water collected in the proposed attenuation ponds will be discharged to an existing waterbody via swales
Discharge to surface water sewer	Not required
Discharge to combined sewer (last resort)	Not required

Proposed Surface Water Pipe Network

1.27 Surface water runoff arising from areas of hardstanding will be conveyed to the proposed SuDS features via a pipe network. The pipe network will be designed to ensure no part of the site floods during the 3.33% AEP storm event, as required by Sewers for Adoption 7th Edition[7]. Indicative pipe layouts have been included in the surface water drainage strategy drawing presented as part of **Annex 9B-2**.

1.28 Surface water runoff arising from events greater than the 3.33% AEP storm event which cannot be accommodated by the pipe network will be contained within the boundary of the Project Area. The location of the hardstanding in relation to the SuDS will support surface water runoff to flow towards the SuDS features during storm events of greater intensity.

[7] Sewers for Adoption 7th Edition, August 2012, WRc plc, Wiltshire

Design for Exceedance

1.29 The Site falls from east to west, towards Grain Marsh. During storm events greater than a 0.5% AEP including a 20% allowance for climate change, exceedance flows will be directed away from the buildings within the Project Area and towards Grain Marsh due to the local topography. The proposed exceedance routes have been presented as part of **Annex 9B-2**.

1.30 In the event that the coastal defences are breached, the proposed attenuation may be unable to accommodate runoff arising from the development due to its location and the standard of protection afforded by the existing flood defences protecting this part of the Project Area.

Future Operation and Maintenance

1.31 During operation, the GB Onshore Scheme will generate stormwater runoff, process waste and foul waste from sanitary facilities. Process and foul water management will be addressed as information about the sources of these flows becomes available and the design progresses.

1.32 All surface water will be collected by rainwater pipes, gullies and linear drainage channels from all areas of hardstanding including building roofs, carparks and access roads. Runoff will be attenuated onsite by the proposed SuDS features, prior to being conveyed via swales to discharge at greenfield runoff rates to the agreed receiving waterbodies.

1.33 The operation and maintenance of above ground SuDS is inherently favourable to that of below ground SuDS features. Activities are likely to include periodic vegetation management and inspection of control structures used to restrict flows to the receiving waterbodies.

1.34 In order to ensure the proposed SuDS and associated drainage infrastructure remain operational throughout the design life, an operation and maintenance manual should be included as part of the detailed design for the Applicant to understand the scale of future obligations of the site owner with regard to managing surface water arising from the GB Onshore Scheme.

Annex 9B-1

Kent County Council Drainage Strategy Pro-forma

Drainage Strategy Summary

1. Site details	
Site/development name	NeuConnect
Address including post code	
Grid reference	E N
LPA reference	
Type of application	Outline ☐ Full ☐ Discharge of Conditions ☐ Other ☑
Has pre-application advice been sought from KCC? Yes ☐ No ☑ If so, KCC Reference Number: Pre-application Meeting Date:	
Site condition	Greenfield ☑ Brownfield ☐

2. Existing drainage			Document/Plan where information is stated:
Total site area (ha)			
Impermeable area (ha)			
Final discharge location	Infiltration ☐ Watercourse ☑ Sewer ☐ Tidal reach/sea ☐		
Where applicable specify catchment runoff rates:	Greenfield runoff rates (l/s)	Existing brownfield runoff rates (l/s)	
QBAR (l/s)	18.6		
1 in 1 year (l/s)	—		
1 in 30 year (l/s)	40.6		
1 in 100 year (l/s)	56.7		

3. Proposed drainage areas			Document/Plan where information is stated:
Impermeable area (ha)	Roof	7.763	
	Highway/road	0.55	
	Other paved areas	0.087	
	Total	8.4	
Permeable area (ha)	Open space	57.6	
	Other permeable areas	—	
	Total	57.6	
Final discharge location	Infiltration ☐ Infiltration rate _____ m/s Watercourse ☑ Sewer ☐ Tidal reach/sea ☐		
Climate change allowance included in design	20% ☑ 30% ☐ 40% ☐		

4. Post-Development Discharge rates, with mitigation			Document/Plan where information is stated:
Describe development drainage strategy in general terms: Runoff from hardstanding areas will be directed, via piped network, to attenuation ponds & swales before discharging to the ordinary watercourse on the western boundary of the site. Discharge rate to be restricted to Qbar			
(a) Soil type and discharge	Permeable ☐ No off-site discharge i.e. infiltration ☐	Semi-permeable ☐ Infiltration maximised, QBAR off-site ☑	Impermeable ☐ Staged discharge ☐
(b) Controlled developed discharge rates (l/s)	Qbar ~~1 in 1 year~~	18.6	
	1 in 30 year	18.6	
	1 in 100 year	18.6	
	1 in 100 year + CC	18.6	

5. Discharge Volumes			Document/Plan where information is stated:
	Existing volume (m^3)	Proposed volume (m^3)	
1 in 1 year	796	1400	
1 in 30 year	1870	2820	
1 in 100 year	2670	3990	
1 in 100 year + CC	3200	4790	

6. Plans/Drawings	Document/Plan where information is stated:
A schematic of the drainage strategy has been included? Yes ☑ No ☐	
A schematic of the drainage network model has been included? Yes ☐ No ☑	

All information presented above should be contained within the attached Flood Risk Assessment, Drainage Strategy or Statement and be substantiated through plans and appropriate calculations.

Form completed by	Stephanie Wood
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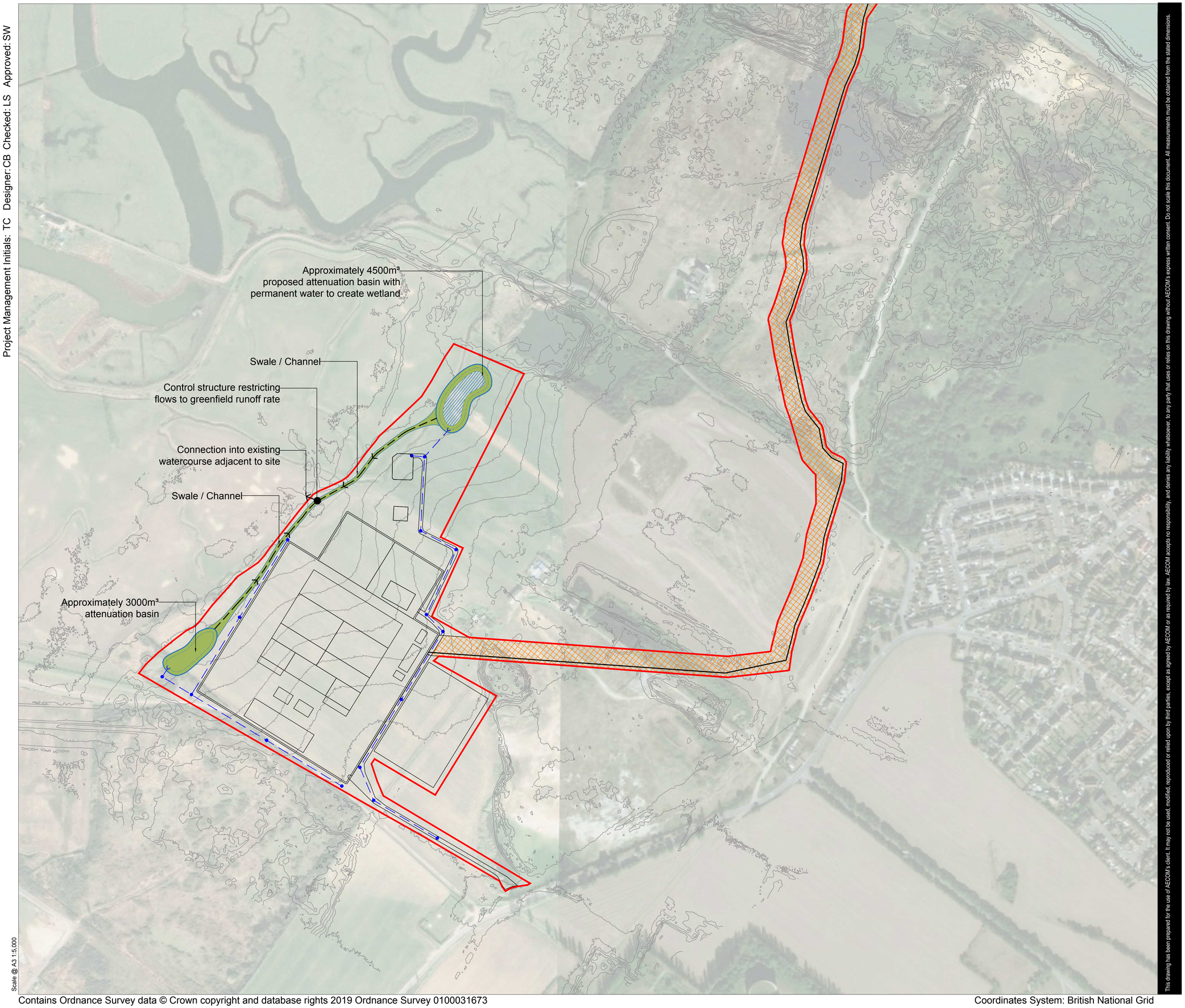
Annex 9B-2

Drawings

Project Management Initials: TC Designer: CB Checked: LS Approved: SW



Scale @ A3 1:5,000

Coordinates System: British National Grid

AECOM

PROJECT
NEUCONNECT

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NeuConnect Britain Ltd.

KEY

- Application Boundary
- Attenuation Basin
- Swale / Channel
- Indicative Surface Water Pipe Network
- DC Cable Route

TITLE
FIGURE 9B.2a
CONCEPT DRAINAGE STRATEGY

REFERENCE
NC_190719_UKON_ESA_9B.2a_V1

SHEET NUMBER 1 of 1

DATE 19/07/19

Project Management Initials: TC Designer: CB Checked: LS Approved: SW

AECOM

PROJECT
NEUCONNECT

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KEY

- Application Boundary
- Attenuation Basin
- Swale / Channel
- Exceedance Surface Water Flow Routes

TITLE
FIGURE 9B.2b
EXCEEDANCE FLOW ROUTES

REFERENCE
NC_190719_UKON_ESA_9B.2b_V1

SHEET NUMBER 1 of 1

DATE 19/07/19

Scale @ A3 1:5,000

Coordinates System: British National Grid

Annex 9B-3

MicroDrainage Storage Estimate

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.775	0.275	18.5	1951.0	O K
30 min Summer	0.855	0.355	18.6	2522.4	O K
60 min Summer	0.936	0.436	18.6	3096.0	O K
120 min Summer	1.045	0.545	18.6	3867.2	O K
180 min Summer	1.115	0.615	18.6	4368.1	O K
240 min Summer	1.167	0.667	18.6	4734.6	O K
360 min Summer	1.238	0.738	18.6	5242.0	Flood Risk
480 min Summer	1.284	0.784	18.6	5568.7	Flood Risk
600 min Summer	1.315	0.815	18.6	5787.1	Flood Risk
720 min Summer	1.336	0.836	18.6	5937.1	Flood Risk
960 min Summer	1.360	0.860	18.6	6104.1	Flood Risk
1440 min Summer	1.372	0.872	18.6	6193.4	Flood Risk
2160 min Summer	1.355	0.855	18.6	6072.7	Flood Risk
2880 min Summer	1.328	0.828	18.6	5879.1	Flood Risk
4320 min Summer	1.288	0.788	18.6	5592.6	Flood Risk
5760 min Summer	1.257	0.757	18.6	5374.3	Flood Risk
7200 min Summer	1.236	0.736	18.6	5224.2	Flood Risk
8640 min Summer	1.219	0.719	18.6	5106.8	Flood Risk
10080 min Summer	1.206	0.706	18.6	5014.0	Flood Risk
15 min Winter	0.808	0.308	18.6	2186.0	O K
30 min Winter	0.898	0.398	18.6	2826.6	O K
60 min Winter	0.989	0.489	18.6	3470.6	O K
120 min Winter	1.111	0.611	18.6	4338.7	O K
180 min Winter	1.191	0.691	18.6	4905.2	O K
240 min Winter	1.249	0.749	18.6	5320.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.582	0.0	1217.3	19
30 min Summer	80.757	0.0	1493.8	34
60 min Summer	49.815	0.0	2527.6	64
120 min Summer	31.372	0.0	2991.1	124
180 min Summer	23.797	0.0	3077.7	184
240 min Summer	19.474	0.0	3033.3	244
360 min Summer	14.549	0.0	2911.4	364
480 min Summer	11.736	0.0	2824.4	482
600 min Summer	9.881	0.0	2764.4	602
720 min Summer	8.555	0.0	2717.4	722
960 min Summer	6.767	0.0	2641.7	962
1440 min Summer	4.817	0.0	2519.4	1442
2160 min Summer	3.400	0.0	5404.8	2160
2880 min Summer	2.658	0.0	5158.3	2624
4320 min Summer	1.895	0.0	4672.2	3328
5760 min Summer	1.504	0.0	8732.0	4096
7200 min Summer	1.273	0.0	9109.0	4904
8640 min Summer	1.120	0.0	9333.0	5792
10080 min Summer	1.011	0.0	9139.1	6648
15 min Winter	124.582	0.0	1350.2	19
30 min Winter	80.757	0.0	1564.6	34
60 min Winter	49.815	0.0	2780.3	64
120 min Winter	31.372	0.0	3099.1	122
180 min Winter	23.797	0.0	3041.0	182
240 min Winter	19.474	0.0	2953.1	242

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	1.330	0.830	18.6	5891.1	Flood Risk
480 min Winter	1.382	0.882	18.6	6260.1	Flood Risk
600 min Winter	1.417	0.917	18.6	6509.7	Flood Risk
720 min Winter	1.441	0.941	18.6	6683.2	Flood Risk
960 min Winter	1.469	0.969	18.6	6883.0	Flood Risk
1440 min Winter	1.488	0.988	18.6	7011.5	Flood Risk
2160 min Winter	1.475	0.975	18.6	6922.5	Flood Risk
2880 min Winter	1.449	0.949	18.6	6738.9	Flood Risk
4320 min Winter	1.395	0.895	18.6	6353.0	Flood Risk
5760 min Winter	1.355	0.855	18.6	6073.9	Flood Risk
7200 min Winter	1.325	0.825	18.6	5855.7	Flood Risk
8640 min Winter	1.299	0.799	18.6	5669.4	Flood Risk
10080 min Winter	1.276	0.776	18.6	5512.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.549	0.0	2852.1	360
480 min Winter	11.736	0.0	2801.5	478
600 min Winter	9.881	0.0	2771.1	596
720 min Winter	8.555	0.0	2750.5	714
960 min Winter	6.767	0.0	2723.3	944
1440 min Winter	4.817	0.0	2671.6	1412
2160 min Winter	3.400	0.0	5488.2	2080
2880 min Winter	2.658	0.0	5281.9	2736
4320 min Winter	1.895	0.0	4893.2	3460
5760 min Winter	1.504	0.0	9700.7	4384
7200 min Winter	1.273	0.0	9985.4	5328
8640 min Winter	1.120	0.0	9810.5	6232
10080 min Winter	1.011	0.0	9369.6	7168

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 587559 176472	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 8.400

Time (mins) From:	To:	Area (ha)
0	4	8.400

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	7100.0	1.000	7100.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0192-1860-1000-1860
Design Head (m)	1.000
Design Flow (l/s)	18.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	192
Invert Level (m)	0.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	18.6	Kick-Flo®	0.713	15.8
Flush-Flo™	0.333	18.6	Mean Flow over Head Range	-	15.7

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)	Depth (m)	Flow (l/s)
0.100	6.7	0.800	16.7	2.000	25.9	4.000	36.1	7.000	47.4
0.200	17.8	1.000	18.6	2.200	27.1	4.500	38.2	7.500	49.0
0.300	18.6	1.200	20.3	2.400	28.3	5.000	40.2	8.000	50.5
0.400	18.5	1.400	21.8	2.600	29.4	5.500	42.1	8.500	52.0
0.500	18.1	1.600	23.3	3.000	31.5	6.000	44.0	9.000	53.5
0.600	17.5	1.800	24.6	3.500	33.9	6.500	45.7	9.500	54.9

Annex 9B-4

Internal Drainage Board Correspondence

Wood, Stephanie

From: atkinson, daniel <daniel.atkinson@medway.gov.uk>
Sent: 03 May 2019 15:38
To: Wood, Stephanie
Subject: RE: Isle of Grain proposed development

Hi Steph,

No problem.

Following the SuDS hierarchy is what we encourage, ideally we would like to see ponds and swales where possible and if possible permeable paving for an additional means of water quality but I appreciate this is not possible on all sites, especially industrial use.

It will be myself who deal with the application when it comes in so if what you submit meets what I sent previously, we should be all good.

Kind regards,

Dan Atkinson | Flood Risk Officer
Gun Wharf**,** Dock Road**,** Chatham, ME4 4TR
Direct dial: 01634 331607 | **Web:** medway.gov.uk | **Twitter**: @medway_council | **Facebook:** Medway Council

From: Wood, Stephanie <stephanie.wood@aecom.com>
Sent: 03 May 2019 15:32
To: atkinson, daniel <daniel.atkinson@medway.gov.uk>
Subject: RE: Isle of Grain proposed development

Hello Daniel,

Thank you for your email and the information provided.

We are in the process of drafting the Environmental Statement, and water management forms a part of that document. Therefore, I am keen to make sure the SuDS element, including the discharge point, is as high up the SuDS hierarchy as is achievable on this site.

Thanks again.

Steph

Stephanie Wood, BSc (Hons) MSc
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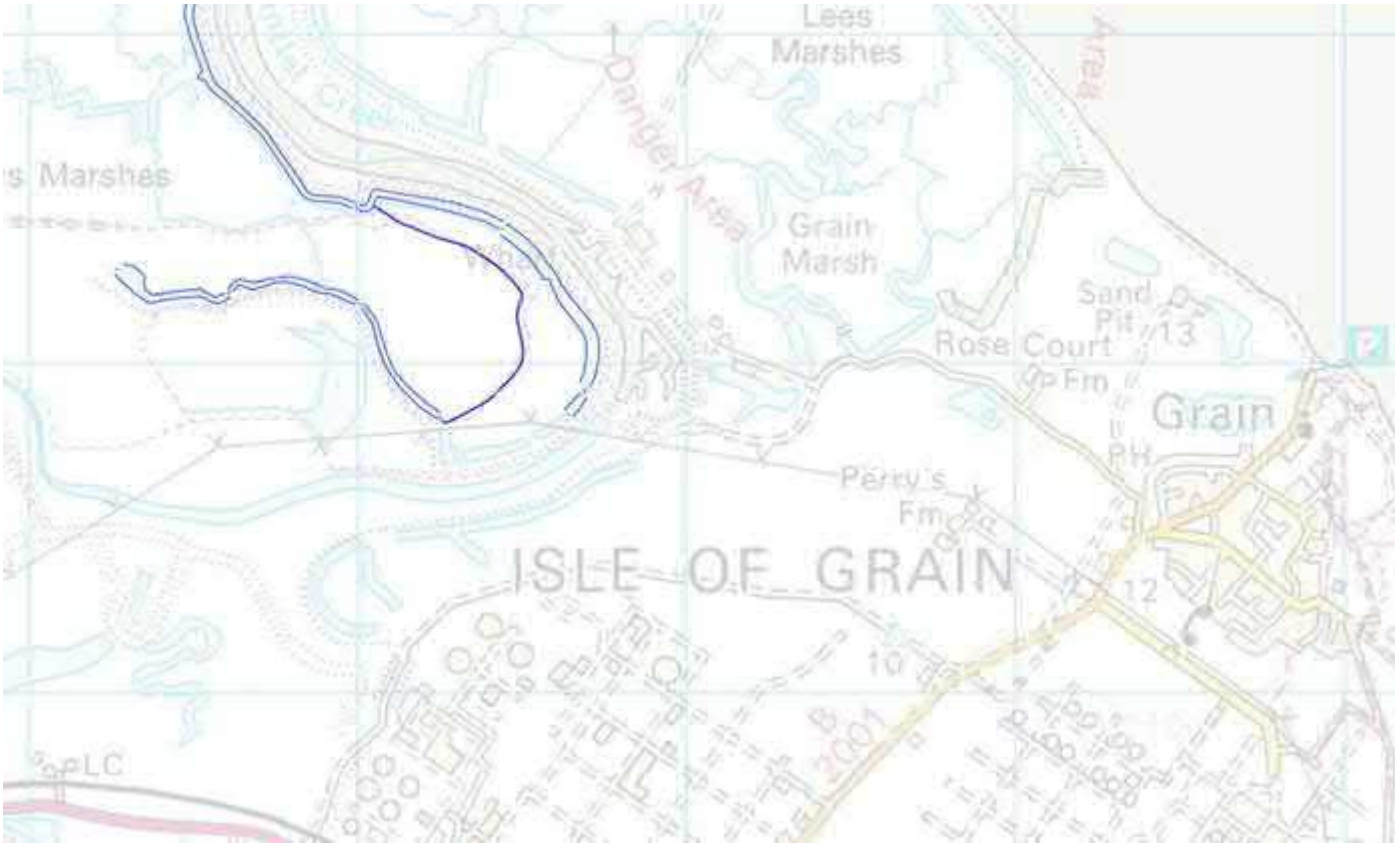
stephanie.wood@aecom.com

From: atkinson, daniel [mailto:daniel.atkinson@medway.gov.uk]
Sent: 03 May 2019 15:06
To: Wood, Stephanie
Subject: RE: Isle of Grain proposed development

Good afternoon Stephanie,

Thank you for the email. Firstly, has this come through as a planning application to the council as generally that is how it would be dealt with?

Fortunately, the LLFA at the council also manage the IDB so I can provide some guidance etc. for you at this stage. In terms of assets, the closest asset that is managed by us is the Allhallows ordinary watercourse (part of the IDB);



As you can see, it is not particularly close to the site, however, there is the opportunity to discharge in to one of the nearby watercourses, which would eventually end up either in this watercourse or the Thames Estuary. This is something we would also highly encourage. As long as the discharge rate is limited to QBar and flood risk is not increase on or off site, we are fairly happy. In terms of a planning application, the following would be the expectations for this particular site based on the information in your email;

Paragraph 079 of National Planning Policy Guidance Flood and Coastal Change states that when considering major development, sustainable drainage systems (SuDs) should be provided unless demonstrated to be inappropriate.

The SuDs scheme should be designed in accordance with SuDs Management Train principles including the prevention of runoff by reducing impermeable areas and utilising source, site and regional controls where necessary.

It should be ensured that there is a maintenance schedule in place for the lifetime of the development to maintain any SuDs, which serve it. All SuDS should be located in publicly accessible areas, unless deemed inappropriate or not possible, to allow for suitable access for maintenance. We will need to see a plan of the frequency of maintenance

for each SuDS feature on site based on guidance in the CIRIA SuDS Manual as well as details of who will carrying out the maintenance.

The receiving watercourse is classified as an 'ordinary watercourse' and under the jurisdiction of the North Kent Marshes Internal Drainage Board for the purposes of its land drainage functions. Any works within the channel of the watercourse including for example construction of a culvert or flow control structure requires prior consent from the North Kent Marshes Internal Drainage Board under the Land Drainage Act 1991.

At a detailed design stage, the Flood Estimation Handbook (FEH) should be used for the design storms, opposed to FSR. For runoff, outputs from both FEH and ICP SuDS should be submitted with the most conservative of the two, being selected.

MicroDrainage outputs (or other industry appropriate software) should be provided for the critical duration for a 2 year, 30 year and 1 in 100 year + 40% intensity climate change scenarios.

I hope this helps but please feel free to contact me with any further queries and I will be happy to help.

Kind regards,

Dan Atkinson | Flood Risk Officer
Gun Wharf**,** Dock Road**,** Chatham, ME4 4TR
Direct dial: 01634 331607 | **Web:** medway.gov.uk | **Twitter**: @medway_council | **Facebook:** Medway Council

From: Wood, Stephanie <stephanie.wood@aecom.com>
Sent: 02 May 2019 11:10
To: northkentmarshesidb <northkentmarshesidb@medway.gov.uk>
Subject: Isle of Grain proposed development

Dear Sir/Madam,

I am currently working on a proposed development for an electricity interconnector near the Isle of Grain. I am specifically working on the SuDS design for this scheme, and would like to find out about your assets in the area and the potential to connect the SuDS to one of the existing land drains in the vicinity of the site. The SuDS will likely take the form of wetlands and swales, with the discharge rate restricted to QBAR.

For your information I have included the draft site layout to give you an idea of the site location and constraints. There is an ordinary watercourse adjacent to the red line boundary (to the west of the site) which currently appears to be a suitable receiving watercourse, however your advice on the matter would be greatly appreciated.

Kind regards

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