VikingCCS

Viking CCS Pipeline

Environmental Statement Volume IV – Appendix 11-3: Drainage Strategy - Revision A - Clean

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1 Introduction

1.1 Project Introduction

1.1.1 The Viking CCS Project intends to transport compressed and conditioned CO_2 from the Immingham Facility to store in depleted gas reservoirs in the Southern North Sea. The Oil and Gas Authority (OGA) awarded the Applicant a CO_2 appraisal and storage licence in 2021. The Viking CCS Project aims to transport and store up to 10 million tonnes of CO_2 annually by 2030, rising to 15 million tonnes by 2035.

1.1.2 Further information on the wider Viking CCS Project and the wider Humber region is contained within the report entitled *"Viking CCS – Transforming the Humber into a net zero Super Place"* (Ref 1).

1.1.3 This surface water drainage strategy report has been prepared on behalf of Chrysaor Production (U.K.) Limited, a Harbour Energy Company for the Viking CCS Pipeline. The report specifically covers six sites situated along the length of the proposed Viking CCS Pipeline (hereafter the Proposed Development). The sites considered include:

- Immingham Facility – X 516986 Y 416781;
- Washingdales Lane Block Valve Station – X 519460 Y 407048;
- Thoroughfare Block Valve Station – X 526248 Y 400236;
- Louth Road Block Valve Station – X 535809 Y 390543;
- Theddlethorpe Facility Option 1 – X 548623 Y 387508; and
- Theddlethorpe Facility Option 2 – X 548175 Y 387586.

1.1.4 This report is appended to the Viking CCS Environmental Statement (ES) and forms *ES Volume IV Appendix 11-3 Drainage Strategy (Application Document 6.4.11.3).*

1.1.5 The drainage design within this report has been developed against available site information and design details at the time of writing to provide a surface water drainage strategy. As part of further Front-End Engineering Design, this drainage design will be further developed and concluded in tandem with the overall scheme design development. Additional work will include a review of findings from investigations recommended in this report.

1.2 Legislation, Policy and Guidance

Introduction

1.2.1 The Legislation, Policy and Guidance section of this chapter provides an overview of the relevant legislation, planning policy and technical guidance relevant to the Surface Water Drainage Strategy.

Local and National Planning Policy

1.2.2 **National Planning Policy Framework** – National Planning Policy Framework (NPPF) (Ref 3) requires that new developments should not increase flood risk both on the Site and in the area surrounding it, meaning that surface water runoff should not exceed the peak volumes already generated on the Site and that betterment should be provided, where possible.

1.2.3 **North Lincolnshire Council SuDS and Flood Risk Guidance Document** (Ref 2) - The works that fall within the North Lincolnshire Council (NLS) district includes the Immingham Facility. The NLC are the Lead Local Flood Authority (LLFA).

1.2.4 NLC has a SuDS and Flood Risk Guidance Document to provide developers and designers with guidance on Sustainable urban Drainage Systems (SuDS) expected to be submitted with planning applications to NLC. The document also provides a checklist for Lead Local Flood Authority (LLFA) requirements to accompany a planning application.

1.2.5 The guidance provides criteria to be met by developers. Notable criteria that relate to the proposed Viking CCS developments are listed below:

- SuDS are required for all developments;
- No water should be stored above ground up to and including the 1 in 100 year event unless stored in a SuDS component;
- Surface water runoff should be limited for all new developments to greenfield runoff rate;
- Infiltration should only be viable for areas where the infiltration rate of the soils are above 1×10^{-6} m/s. Infiltration testing should be undertaken over a period of time, preferably over various seasons to obtain a range of infiltration rates; and
- The level of betterment will be considered on a site-by-site basis for all brownfield sites.

1.2.6 **North East Lincolnshire Council** – The works that fall within the North East Lincolnshire Council (NELC) jurisdiction includes the Washingdales Lane Block Valve Station and Thoroughfare Block Valve Station. The NELC are the LLFA. NELC were contacted and confirmed they do not have specific guidance with regards to SUDs and drainage design development.

1.2.7 **East Lindsey District Council** – The works that fall within the East Lindsey District Council (ELDC) jurisdiction includes Louth Road Block Valve Station and the Theddlethorpe Facility Option 1 and Option 2. Lincolnshire County Council (LCC) are the LLFA for East Lindsey. LCC have produced a Sustainable Drainage Design and Evaluation Guide (2018) (Ref 4) which includes criteria to be covered at the concept design stage. This includes the following points which are addressed in this report:

- Data gathering (geology topography, flood risk, utilities, landscape, community and wildlife);
- Existing site and modified site flow route analysis;
- SuDs Design Elements; and
- Quantity, Quality, Amenity and biodiversity.

1.2.8 **Non-Statutory Technical Standards for Sustainable Drainage Systems (2015) –** The Non-Statutory Technical Standards for Sustainable Drainage Systems produced by Department for Environment, Food & Rural Affairs (DEFRA) (Ref 5) represent the current guidance for the design, maintenance and operation of SuDS.

1.2.9 The standards set out that peak runoff rates from development sites should be as close as is reasonably practicable to the greenfield rate but should never exceed the pre-development runoff rate. The standards also set out that drainage systems should be designed so that flooding does not occur on any part of a site for a 1 in 30-year rainfall event, and that no flooding of a building (including basement) would occur during a 1 in 100-year rainfall event. It is also noted within the standards that pumping should only be used when it is not reasonably practicable to discharge by gravity.

1.2.10 The following guidance has been adopted for each of the sites considered within this drainage strategy:

- **Immingham Facility** – NLC SuDS and Flood Risk Guidance Document (Ref 2);
- **Washingdales Lane Block Valve Station** – Non-Statutory Technical Standards for Sustainable Drainage Systems (Ref 5);
- **Thoroughfare Block Valve Station** – Non-Statutory Technical Standards for Sustainable Drainage Systems (Ref 5);
- **Louth Road Block Valve Station** – LCC Sustainable Drainage Design and Evaluation Guide (Ref 4);
- **Theddlethorpe Facility Option 1** – LCC Sustainable Drainage Design and Evaluation Guide (Ref 4); and
- **Theddlethorpe Facility Option 2** – LCC Sustainable Drainage Design and Evaluation Guide (Ref 4).

Stakeholder Consultation

1.2.11 A summary of stakeholder engagement specific to the surface water drainage strategy has been provided in **Table 1**.

Table 1: Surface Water Drainage Strategy Stakeholder Consultation

Stakeholder	Date of communication	Summary of discussions
North East Lindsey IDB	5 June 2023	A request for information regarding the Immingham Facility
Lindsey Marsh IDB	5 June 2023	A request for information regarding the Theddlethorpe Facility

1.2.12 Communication with the Head of Technical & Engineering Services from the North East Lindsey Drainage Board (IDB) is included in **Annex D** and summarised below:

- The existing drainage channel between the railway line and Rosper Road is known as South Killingholme Drain Branch 1. The drainage channel running adjacent to Rosper Road is known as South Killingholme Drain. Both channels are maintained by North-East Lindsey IDB;
- South Killingholme Drain Branch 1 drainage is gravity and can be tide locked, Rosper Road Pits acts as attenuation in the system, but water levels may affect discharge. The site is at risk of flood, primarily from over topping or breach of the Humber flood banks;

- Any works within 9m of the top of the bank requires consent from the Board under the Byelaws;
- Consent to discharge into IDB maintained drainage is required; and
- Greenfield discharge rates are acceptable.

1.2.13 A meeting was undertaken with the IDB 19 June 2023. The communication with the Lindsey Marsh IDB is included in **Annex D** and summarised below:

- The Cut and other drainage channels in the Theddlethorpe area are IDB maintained as shown on plan in **Annex D**;
- There are no known concerning flood issues in the area. However, this query will be relayed to the local agent/surveyor for confirmation;
- The IDB confirmed a 9m easement is standard for maintenance access requirements;
- Consent is required for discharge into IDB controlled assets; and
- Greenfield discharge rates are preferred, however other rates and outlet sizes are considered on a mitigated, rational and evidential basis. 1.4l/s/ha is a rate considered by the IDB.

1.2.14 **Internal Drainage Board** – The six sites considered within this surface water drainage strategy are situated within IDB districts as listed below:

- **Immingham Facility** – North-East Lindsey IDB;
- **Washingdales Lane Block Valve Station** – Not situated within an IDB catchment;
- **Thoroughfare Block Valve Station** – Not situated within an IDB catchment;
- **Louth Road Block Valve Station** – Not situated within an IDB catchment;
- **Theddlethorpe Facility Option 1** – Lindsey Marsh IDB; and
- **Theddlethorpe Facility Option 2** – Lindsey Marsh IDB.

Existing Studies and Guidance

1.2.15 Land Drainage Consultancy Ltd undertook a desk study (Ref 6) considering soils and land drainage impacted by the proposed pipeline. Recommendations from the report with regards to drainage include:

- Landowners and/or tenants contacted and details of existing land drainage systems obtained;
- Site surveys completed to observe and record key drainage features and to undertake a detailed drainage topographical survey;
- Conceptual pre-construction drainage designs produced to ensure offsite land drainage systems continue to function during the construction phase of the Proposed Development; Conceptual designs also required to highlight key crossing drains where coincidence with the proposed pipeline is possible; and
- Conceptual post-construction drainage schemes are designed to replace drains damaged within the Proposed Development construction areas and to alleviate soil structural degradation.

1.2.16 The report undertook an assessment to understand if the pipeline route passes through arable land drained via land drainage. A review of the “Known Drainage” drawing suggests the following for the sites considered within this report:

- **Immingham Facility** – Non-Agricultural;

- **Washingdales Lane Block Valve Station** – Unknown Drainage;
- **Thoroughfare Block Valve Station** – Suspected Drainage;
- **Louth Road Block Valve Station** – Suspected Drainage;
- **Theddlethorpe Facility Option 1** – Non-Agricultural; and
- **Theddlethorpe Facility Option 2** – Unknown Drainage.

1.2.17 **CIRIA, SuDs Manual (C753), 2015** – Guidance has been taken from The SuDs Manual (Ref 7) for the development of SuDs infrastructure recommended as part this strategy. As per C753, the established discharge hierarchy for surface water is:

- infiltration to the ground;
- discharge to surface waters;
- discharge to a surface water, highway drain or another drainage system; and
- discharge to a combined sewer.

1.2.18 **Environment Agency, Rainfall Runoff Management for Developments (SC030219), 2013 (Ref 8)** – The report provides guidance on the management of stormwater drainage for developments for regulators, developers and local authorities.

2 Immingham Facility

2.1 Desktop Study – Immingham Facility

Introduction

2.1.1 The first component of the Proposed Development will consist of the Immingham Facility (X 516986 Y 416781) to be located in a currently unused section of brownfield land to the south of the VPI Immingham site. This facility would require an area of approximately 10,900m^2. The existing land is shown in **Figure 1** and comprises a grassed field to the west of Rosper Road, which was formerly used as a construction laydown for the Immingham power station.

2.1.2 An indicative layout of the Immingham Facility is shown on **Figure 7** in **Annex C**. In summary, the Immingham Facility would consist of the following key components:

- Inlet manifold with valve access platform;
- Permanent pig launcher and receiver to allow the onshore CO_2 pipeline to be cleaned and inspected during commissioning and operation and be suitable for intelligent pigging;
- Common pig handling area for the pig receiver and launcher, which includes a projectile blast wall;
- High-integrity pressure protection system (HIPPS);
- Emergency Shutdown Valve (ESDV) for each pipeline and Isolation valves;
- Venting system including vent pipework, valves and vent stack. Permanent vent stack to be a maximum of 24” diameter and 25 metres high;
- Various instruments installed on the pipework, including temperature and pressure measurement and ultrasonic flowmeter;
- Central control room (CCR);
- Local equipment room (LER);
- Analyser house; and
- Supporting utilities.

2.1.3 See **Annex A** for **Figure 1 – Site Overview and Topography**.

Site Topography

2.1.4 A detailed topographical survey has not yet been undertaken for the Immingham Facility. A review of available LiDAR information has been undertaken and indicates the site is relatively flat with land falling north/north east. Ground elevations range from approximately 2.8m Above Ordnance Datum (AOD) at the northern edge to around 4.5m AOD in the south. The site topography is shown on **Figure 1**, **Annex A**.

Local Hydrology

2.1.5 Two main river watercourse that are situated closest to the site location are Skitter Beck (approx.. 4.8km west) and North Beck Drain (6pprox.. 4.6km south).

2.1.6 A drainage channel (South Killingholme Drain Branch 1) to the north of the proposed site is assumed to collect and convey surface water to the east and connect into the South Killingholme Main Drain via a culvert beneath Rosper Road, ultimately discharging into the North Sea.

2.1.7 The Environment Agency flood maps (Ref 8) indicates the site has a very low risk of flooding (1 in 1000 year/0.1% AEP each year) from rivers or the sea. The site also has a very low risk of flooding from surface water.

Ground Conditions, Ground water and Infiltration

2.1.8 A review of the BGS Geology Viewer (Ref 10) indicates the bedrock geology is Burnham Chalk Formation with possibly two types of superficial deposits including Tidal Flat Deposits and Till, Devensian – Diamicton.

2.1.9 The site's underlaying strata is classified as Principal Bedrock Aquifer and a secondary (undifferentiated) Superficial Drift Aquifer. The site sits in a medium ground water vulnerability area.

2.1.10 The BGS borehole records (Ref 12) from holes drilled near the site indicate made ground or warp above various layers of differing strata including clays sands silts and gravels. A chalk bedrock is noted 18-20m below ground level.

2.1.11 A review of the Soil-Scapes layer on Magic Maps (Ref 11) indicates the site is situated on the border between two types of shallow strata. North is loamy and clayey soils of coastal flats with naturally high groundwater and a naturally wet drainage type. South is slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage. The site is located in Zone III Source Protection Zone (regarding the safeguarding of drinking water quality).

2.1.12 Following the description of surface geology above it is not recommended to discharge surface water via infiltrating methods.

Existing Utilities

2.1.13 A desktop study was undertaken by GroundSure to gather available utility information from providers. This was submitted to AECOM as an AutoCAD DWG file covering the pipeline alignment and a buffer area either side. The DWG information indicates there is no known utilities within the site boundary.

2.2 Surface Water Drainage Strategy – Immingham Facility

Contributing Areas and Runoff Calculation

2.2.1 The contributing area has been measured from a scheme layout drawing produced by Kent Energies Ltd (drawing number: EN070008/APP/4.6). The proposed impermeable and permeable areas are summarised in **Table 2**.

2.2.2 The site will be predominantly permeable with unpaved areas to be graded to natural ground levels overlain with weed control membrane and 75 mm of 20mm single size gravel.

2.2.3 Impermeable areas will consist of a 6m wide access road spurring from Rosper Road and from an onsite Primary Access Road to the north. Within the fence line boundary, a splayed road is proposed to allow access to the Pig Launch area. Both the pig launch area and high-integrity pressure protection system area will sit upon concrete pads. Three kiosks with flat roofs will also be situated within the site boundary sat upon concrete bases.

2.2.4 The sites will be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces will be constructed to falls so that rainwater can drain to the appropriate drainage system where required. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. The majority of the site will be permeable surface to minimise runoff. A cut-off drainage channel maybe required at the site entrance gate to control runoff offsite.

Table 2: Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment
Total Site Area	N/A	6530	Area within fence line
Stone area	Permeable	5835	The majority of ground surface within the fence line is to be stone aggregate
Roads Inside Immingham Facility Fence line	Impermeable	143	Access turning and parking is proposed to access the pig handling area and site
Roads Outside Immingham Facility Fence line	Impermeable	3636	Roads to enable access to the Immingham Facility
Roofs	Impermeable	363	3 buildings are proposed including Central Control Room, Local Equipment Room and Analyser House
Concrete Pad	Impermeable	189	High-integrity pressure protection system and pig handling area are assumed to be sited on concrete pads or similar impermeable ground
Totals		**m^2**	**ha**
Total Impermeable Area		4331	0.433
Total Permeable Area		5835	0.583
Total Contributing Area		4331	0.433

Greenfield Runoff

2.2.5 The greenfield runoff rates for the proposed Immingham Facility have been calculated based on the IH124 method using the HR Wallingford UK SuDS website (Ref 13). The greenfield runoff rates for a 50ha area were calculated using this method. A summary of the results can be seen in calculation report found in **Annex B**, with the peak greenfield runoff rates for the total contributing area interpolated from the results shown in **Table 3**.

Table 3: Peak Greenfield Runoff Rate

Rainfall Event Frequency	Runoff (l/s/ha)	Site Contributing Area (0.410ha discounting the access bridge area) GF Runoff l/s
1 in 1 Year (Approx. 99% AEP)	2.16	0.89
Qbar	2.49	1.02
1 in 30 Year (3.33% AEP)	6.08	2.49
1 in 100 Year (1% AEP)	8.86	3.64

Proposed Surface Water Runoff Rates

2.2.6 **Table 4** below shows the unrestricted surface water runoff rate post-development based on the Modified Rational Method. This method estimates runoff based on the nature of the ground surface (hardstanding, vegetation etc.) and rainfall depth, duration and frequency information for the immediate area, as follows:

- C (Coefficient of impermeability) = 1.0;
- A (area) = ha; 0.433; and
- I (Rainfall intensity based on FEH data (Ref 15)).

Table 4: Proposed Peak Runoff Rate

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	33.22	21.40	13.23	9.39	7.46	5.42	2.93	1.72	1.01
5 (20%)	55.47	35.70	22.02	14.31	10.95	7.67	3.98	2.31	1.34
10 (10%)	71.26	45.74	28.41	17.81	13.38	9.21	4.70	2.71	1.58
30 (3.3%)	95.91	62.31	38.66	23.30	17.22	11.67	5.86	3.37	1.97
50 (2%)	106.84	69.99	43.55	25.93	19.06	12.85	6.43	3.72	2.17
100 (1%)	122.69	80.60	50.41	59.25	21.66	14.53	7.28	4.24	2.17
100 +20% CC	147.22	96.72	60.50	35.55	25.99	17.44	8.73	5.09	2.61
100 +40% CC	171.76	112.84	70.58	41.47	30.32	20.34	10.19	5.94	3.04

Surface Water Drainage Concept

2.2.7 The existing ground conditions suggest infiltration of surface water is not recommended and, following the drainage hierarchy for discharge of surface water, the next favourable point of discharge is into a surface water body. An existing drainage channel situated to the north of the site known as South Killingholme Drain Branch 1 is likely to already receive a proportion of runoff from this area. A development extension of a facility north of the site

(VPI Carbon Capture Plant) is proposed as part of a separate scheme. As part of the works South Killingholme Drain Branch 1 is to be re-aligned further south and reconnected to the culvert beneath Rosper Road.

2.2.8 It is proposed to formally drain the hardstanding sections of the site including the access road and roof elements of kiosks via downpipes. There will be no change to the permanent land use or drained area within permeable gravel sections so the existing drainage principles will be maintained. Consequently, no formal drainage is proposed and gravel sections have not been considered as part of the contributing area.

2.2.9 Hardstanding areas are proposed to drain onto proposed filter drains. The filter drains are to be installed with an impermeable membrane to prevent the collection of ground water. A solid pipe branch will collect flows and convey them north for outfall into a swale.

2.2.10 Swale channels aligned adjacent to the proposed access roads will collect surface water runoff and convey flow for connection into the detention basin. The proposed road bridge crossing over the re-aligned drainage channel will be drained via swale channels with a restricted discharge into the realigned channel.

2.2.11 The detention basin will have a pipe outlet discharging to the realigned drainage channel through a flow control device. Any restricted flow will be attenuated within the detention basin and swales. An indicative drainage layout is shown on **Figure 7** in **Annex C**.

2.2.12 The components should be designed as shallow as possible to maintain an invert level above the local ground water level. The lifting of ground levels or implementing impermeable lining in some sections of drainage may be required to ensure this is possible. However, further investigation at a future design stage is recommended to monitor local ground water levels across the site to understand any impact on proposed SuDs components.

Climate Change

2.2.13 A climate change allowance for the 30 year and 100 year events have been applied based on the Environment Agency Flood Risk Assessments: climate change allowances (2022) (Ref 14). The Immingham Facility site falls within the Louth Grimsby and Ancholme Management Catchment. It is noted a 25 year design life is proposed for the overall project. However, for this preliminary assessment it is assumed the civil engineering elements of the site will remain in place beyond 25 years (estimated 2026 construction date) with onsite equipment being refurbished or replaced to continue operation. This would bring the expected lifetime of the development (not necessarily the operational life) beyond the year 2100 and consequently, a robust upper end climate change allowance has been adopted. This equates to a 35% uplift for a 30 year return period and 40% uplift for a 100 year return period as shown on **Table 5**.

Table 5: Louth Grimsby and Ancholme Management Catchment Peak Rainfall Allowances (values used highlighted green)

Epoch	Central Allowance	Upper End Allowance
3.3% Annual Exceedance Rainfall Event		
2050s	20%	35%
2070s	25%	**35%**
1% Annual Exceedance Rainfall Event		
2050s	20%	40%
2070s	25%	**40%**

*Use''2050'' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

Design Parameters

2.2.14 Swale channels are proposed to capture and convey runoff from the proposed site access roads. Swales have not been sized as part of this study. The channel side slope is to be 1:3 or 1:4 with a 0.5m base width and a minimum of 400mm deep. It may be possible to integrate mini swales with a reduced depth and base width considering the small area of hardstanding to be drained.

2.2.15 The surface water discharge rate is to ideally be controlled to Qbar for events between Qbar (approximately 1 in 2 year event) and 1 in 100 year event.

2.2.16 Discussions with local IDB have confirmed a greenfield discharge rate will be acceptable for the outfalling of runoff from the site into the re-aligned drainage channel. However, the greenfield discharge rates calculated for the site will likely result in outlet diameters smaller than 50-75mm. The blockage risk is discussed further in the Hydraulic Calculation section below. A check at a future design stage is required to confirm the outlet size required for the necessary flow control and the risk of blockage.

2.2.17 The proposed surface water attenuation is to be designed to accommodate a 1 in 100 year design storm event (1% AEP) plus a 40% climate change allowance with no surface water flooding on the site. Complying with NLC design requirement, no water will be stored above ground up to and including the 1 in 100 year event unless stored in a SuDs component.

2.2.18 Catchment descriptors and rainfall data has been downloaded from the Flood Estimation Handbook (FEH) web service (Ref 15) for use in calculations within this report.

Hydraulic Calculations

2.2.19 An InfoDrainage quick storage estimate calculation has been undertaken to understand attenuation requirements against a 1 in 100-year storm event. The calculation is based on a 1.02l/s Qbar discharge rate as calculated in **Table 3**, a 0.410ha drained area and includes a 40% climate change uplift. The default Summer/Winter Cv values in InfoDrainage have been used (0.750/0.840). The results predict a total attenuation storage volume of 322m^3 to 417m^3 is required (these results are estimates only and should not be used for design purposes). An average of the two values (370m^3) has been used for the purposes of this concept strategy but it should be noted that there is space on site to accommodate the larger volume.

2.2.20 A flow control outlet diameter to restrict flow to a 1l/s outflow will likely be under 50-75mm and could be at risk of blockage without protection. To prevent blockage a granular fill could be placed around the outlet to filter out sediment and debris and also prevent vegetation growth. Alternatively, a Hydrobrake arrangement could be used. However, preliminary calculations using Hydro-Internationals online Hydrobrake design tool suggests the outlet diameter will be approximately 50mm with a 0.5m head. The risk of blockage could be deemed reduced by using a Hydrobrake with the device being contained within a chamber with a sump in comparison with a standard orifice.

2.2.21 It is proposed to control the discharge rate as close to Qbar as reasonably practicable to prevent maintenance issues. This may require a discharge rate above the proposed greenfield rate but still controlled to a rate where detrimental flows are unlikely to be passed off site. Further investigation is recommended to understand an acceptable allowable discharge rate and flow control device.

2.2.22 The attenuation storage serving the Immingham Facility and access roads is proposed to be within a detention basin and swales as shown in **Table 6** before discharging from site at the greenfield rate. The connecting swales serving the access road from Rosper Road provide storage area with an assumed 250mm depth of water. The values shown are preliminary and should be updated at a future design stage.

Table 6: Proposed Surface Water Attenuation 1 in 100 Year Event + CC

Swale Length m	Swale Area (250mm depth of water)	Storage Volume within Swale m^3
240	0.38	90
Detention Basin m^2	**Depth m**	**Total Basin Storage Volume m^3**
560	0.5	280
Total Attenuation Storage m^3		370

2.2.23 The swales serving the roads leading up to a bridge crossing the re-aligned drainage channel are proposed to act as attenuation storage with a restricted flow discharge. The available storage volume will likely accommodate the predicted water volume for a 1 in 100 year storm event + climate change as shown in **Table 7**. The corresponding outlet size to control the flow at a greenfield rate would likely be below 50-75mm and be at risk of blockage. Alternatively, it is proposed to use permeable check dams along the swales length and end to slow the flow rate entering the watercourse. A Darcy's Law calculation was undertaken to understand horizontal flow through a granular check dam. A 0.2l/s flow is predicted for a 400 deep, 0.5m base width, 1:4 Side slope channel with a 1 in 250 fall. This method of flow control should be investigated in further detail at a future design stage. It is proposed to reduce the discharge rate as close to Qbar as reasonably practicable to prevent maintenance issues.

Table 7: Proposed Surface Water Attenuation Bridge Crossing Swales 1 in 100 Year Event + CC

Post construction Runoff. 15 min 100 yr +40%cc Rational Method (l/s)	Greenfield Runoff Bridge Area North /Qbar Restriction Rate	Contributing Area (ha)	Restriction Rate via Granular Check Dam (l/s)	Storage Vol Req (m^3)
6	0.03	0.014	0.2	9
Post construction Runoff. 15 min 100 yr +40%cc Rational Method (l/s)	**Greenfield Runoff Bridge Area South/Qbar Restriction Rate**	**Contributing Area (ha)**	**Restriction Rate via Granular Check Dam (l/s)**	**Storage Vol Req (m3)**
4	0.02	0.009	0.2	5

Sustainable Drainage Systems and Water Quality

2.2.24 CIRIA C753 The SuDS Manual (**Ref 7**) outlays a simple index method to account for water quality in the design of SuDS. It indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment) that equals or exceeds the pollution hazard index.

2.2.25 The site is considered to have a low pollution hazard level as per Table 26.2 in The SuDS Manual (**Ref 7**).

2.2.26 The pollution hazard indices for a low pollution hazard level and the mitigating indices relating to the selected SuDs component are listed in **Table 8**. The results indicate the use of swales will provide adequate treatment of surface water runoff. As unlined swales are proposed some informal infiltration of runoff may occur. A check of mitigating indices based on the filtration capabilities of the chosen SuDs component and underlying soil properties indicate runoff should be adequately treated before entering ground water systems.

Table 8: Pollution Hazard and Mitigation Indices

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Immingham Facility	Low	0.5	0.4	0.4
SuDs Mitigation Indices for Discharge to Surface Water				
SuDs Component		**TSS**	**Metals**	**Hydrocarbons**
Swale		0.5	0.6	0.6
Attenuation storage		0.5	0.5	0.6
Total SuDs Mitigation–- Index Access Roads[1]		**0.75**	**0.85**	**0.9**
Filter Drain		0.4	0.4	0.4
Attenuation storage		0.5	0.5	0.6
Total SuDs Mitigation Index - Immingham Facility[1]		**0.65**	**0.65**	**0.7**
SuDs Mitigation Indices for Discharge to Ground Water				
Characteristics of material overlaying SuDs		**TSS**	**Metals**	**Hydrocarbons**
Layer of dense vegetation underlain by a soil with good contamination attenuation potential of at least 300mm in depth		**0.6**	**0.5**	**0.6**

[1] Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required:

Total SuDs Mitigation Index = mitigation index $_1$ + 0.5 (mitigation index $_2$)

Operation and Maintenance

2.2.27 An adopting party is to be agreed with the relevant the LLFA and any relevant stakeholders. It is likely the asset owner(s) will be responsible for the maintenance of drainage components.

2.2.28 A key objective of the adoption process is to ensure that any installed SuDS can be maintained easily over the development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out details on the constructed SuDs and the inspection and maintenance required. This document should be developed at full detailed design but considered throughout the design process. The Operation and Maintenance details considered at this concept design stage are noted below.

2.2.29 Maintenance activities should be conducted in accordance with industry best practice e.g. CIRIA SuDS Manual. The drainage system proposed at Immingham Facility should be inspected at defined intervals and before and after major storm events. The proposed SuDs will require a maintenance regime including grass cutting, removal of sediment build up and clearance of the outfalls at defined intervals. The proposed SuDs features are to be shallow and allow easy access. The filter drains and permeable gravel sections of the site are deemed to have a low risk of sediment build up. The proposed system design life will likely meet the site design life with an adequate inspection and maintenance regime.

3 Washingdales Lane Block Valve Station

3.1 Desktop Study – Washingdales Lane Block Valve Station

Introduction

3.1.1 Three Block Valve Stations are required along the pipeline route to enable pipeline sections to be isolated for operational and maintenance reasons. This section considers Washingdales Lane Block Valve Station located X 519460 Y 407048.

3.1.2 The block valve would be buried with a valve actuator extended above ground (circa 1.5m), include a kiosk, between 2-3m in height and include a local vent to ensure that bypass pipework maintenance activities can be performed safely.

3.1.3 The Block Valve Stations would require security fencing, typically 3.2m high with double-leaf gates for vehicles with access from the adjacent road network, access tracks or similar. The ground surface within the fenced area will predominantly comprise stone with minimal tarmac/concrete internal access roads.

3.1.4 The Block Valve Stations would include associated landscaping such as planting or bunds to provide screening.

3.1.5 Washingdales Lane Block Valve Station is located in an agricultural field adjacent to the Washing Dales Farm access track signposted as Washingdales Lane. A covered reservoir is situated to the south west. See **Annex A** for **Figure 2 – Site Overview and Topography**.

Site Topography

3.1.6 A topographical survey has not yet been undertaken for the Washingdales Lane Block Valve Station. However, a review of available LiDAR information has been undertaken and indicates the site falls to the north east (towards the A18). Ground elevations range from approximately 35mAoD) at the western corner to around 32.5mAoD to the east. The site topography is shown on **Figure 2**, **Annex A**.

Local Hydrology

3.1.7 The main river watercourse situated closest to the site location is Laceby Beck (approx. 2.3km east).

3.1.8 A ditch drain is located 570m to the south of the site, which is assumed to take runoff from the field, discharging into Laceby Beck to the east and ultimately the North Sea via River Freshney.

3.1.9 The Environment Agency flood maps indicates the site has a very low risk of flooding (1 in 1000 year/0.1% AEP each year) from rivers or the sea. The site also has a very low risk of flooding from surface water.

Ground Conditions, Ground water and Infiltration

3.1.10 A review of the BGS Geology Viewer indicates the bedrock geology is Burnham Chalk Formation. with superficial deposits classed as Till, Devensian – Diamicton.

3.1.11 The site underlaying strata is classified as Principal Bedrock Aquifer and a secondary (undifferentiated) Superficial Drift Aquifer. The site sits in a medium-high ground water vulnerability area with a Soluble Rock Risk.

3.1.12 The BGS borehole records of holes drilled nearby indicate a silty topsoil overlaying silty clay with scattered chalk gravel. The two logs indicate a bedrock of chalk at shallow and deep levels.

3.1.13 A review of the Soil-Scapes layer on Magic maps indicates the site is situated in an area of freely draining lime-rich loamy soils on arable ground and grassland. The site is located in Zone II Source Protection Zone (outer protection zone regarding the safeguarding of drinking water quality).

3.1.14 Following the description of surface geology above, and the site location being situated on higher ground, it may be possible to discharge surface water via infiltrating methods.

Existing Utilities

3.1.15 A desktop study was undertaken by GroundSure to gather available utility information from providers. This was submitted to AECOM as an AutoCAD DWG file covering the pipeline alignment and a buffer area either side. The DWG information indicates there are High Voltage Northern Power Grid cables and an Openreach duct aligned with Washingdales Lane. No utilities were shown within the site boundary.

3.2 Surface Water Drainage Strategy – Washingdales Lane Block Valve Station

Contributing Areas and Runoff Calculation

3.2.1 The contributing area has been measured from a scheme layout drawing produced by Penspen (drawing number: EN070008/APP/4.14). The proposed impermeable and permeable areas are summarised in **Table 9**.

3.2.2 The site will be predominantly permeable with unpaved areas to be graded to natural ground levels overlain with weed control membrane and 75 mm of 20mm single size gravel.

3.2.3 Impermeable areas will consist of a 5m wide facility access road spurring from Washingdales Lane. The site will have two fenceline boundaries including a timber fenceline around a planting strip and a security fenceline between the planting strip and Washingdales Lane Block Valve Station. Within the security fence line boundary a 4m wide splayed road and turning head is proposed to allow access to the car park. 1No. 3 x 3.5m kiosk with a flat roof will also be situated within the site boundary sat upon a concrete base.

3.2.4 The sites will be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces will be constructed to falls so that rainwater can drain to the proposed drainage system. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. Most of the site will be permeable surfacing to minimise runoff. A cut-off drainage channel maybe required at the site entrance gate to control runoff onto site.

Table 9: Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment
Total Site Area	N/A	1681	Access road and area within fence line
Stone area	Permeable	329	The majority of ground surface within the fence line is to be stone aggregate
Planting Strip	Permeable	1046	A planting strip is proposed around the Washingdales Lane Block Valve Station perimeter to hide proposed infrastructure

Ref	Surface Type	Area (m^2)	Comment
Roads Inside Washingdales Lane Block Valve Station Fence line	Impermeable	75	Access turning and parking is proposed to access site
Roads Outside Washingdales Lane Block Valve Station Fence line	Impermeable	221	Roads to enable access to the Washingdales Lane Block Valve Station
Roofs	Impermeable	11	1 site kiosk is proposed
Totals		**m^2**	**ha**
Total Impermeable Area		306	0.031
Total Permeable Area		1375	0.138
Total Contributing area (impermeable area)		306	0.031

Greenfield Runoff

3.2.5 The greenfield runoff rates for the proposed Washingdales Lane Block Valve Station have been calculated based on the IH124 method using the HR Wallingford UK SuDS website (Ref 13). The greenfield runoff rates for a 50ha area were calculated using this method. A summary of the results can be seen in the calculation report found in **Annex B**, with the peak greenfield runoff rates for the total contributing area interpolated from the results shown in **Table 10**.

Table 10: Peak Greenfield Runoff Rate

Rainfall Event Frequency	Runoff (l/s/ha)	Site Contributing Area (0.031ha) GF Runoff l/s
1 in 1 Year (Approx. 99% AEP)	3.82	0.12
Qbar	4.39	0.13
1 in 30 Year (3.33% AEP)	10.75	0.33
1 in 100 Year (1% AEP)	15.62	0.48

Proposed Surface Water Runoff Rates

3.2.6 **Table 11** below shows the unrestricted surface water runoff rate post-development based on the Modified Rational Method. This method estimates runoff based on the nature of the ground surface (hardstanding, vegetation etc.) and rainfall depth, duration and frequency information for the immediate area, as follows:

- C (Coefficient of impermeability) = 1.0;
- A (area) = ha; 0.031; and
- i (Rainfall intensity based on FEH data (Ref 15)).

Table 11: Proposed Peak Runoff Rate

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	2.48	1.60	0.99	0.69	0.54	0.39	0.21	0.12	0.07
5 (20%)	4.14	2.66	1.64	1.06	0.80	0.56	0.29	0.16	0.10
10 (10%)	5.28	3.41	2.11	1.31	0.98	0.67	0.34	0.19	0.11
30 (3.3%)	7.12	4.63	2.87	1.72	1.26	0.85	0.42	0.24	0.14
50 (2%)	7.95	5.20	3.24	1.91	1.40	0.94	0.47	0.27	0.16
100 (1%)	9.10	6.00	3.75	4.37	1.59	1.06	0.53	0.31	0.16
100 +20% CC	10.92	7.20	4.50	2.62	1.91	1.27	0.63	0.37	0.19
100 +40% CC	12.74	8.40	5.25	3.06	2.22	1.48	0.74	0.43	0.22

Surface Water Drainage Concept

3.2.7 Based on an evaluation of local ground conditions it is recommended to infiltrate runoff using an infiltration trench or similar if site conditions deem this possible through site testing (trial holes, infiltration tests to BRE365 and ground water level monitoring). Site investigation is recommended to understand the site infiltration rate, assess ground conditions/ inspect for contamination and check any potential adverse ground water that would impact upon infiltration SuDs components.

3.2.8 It is proposed to formally drain the hardstanding sections of the site including the access road and roof elements of kiosks via downpipes. Consideration of runoff from the permeable section of the site has been included as a percentage of the total area. The remaining area is to be constructed from permeable material and consequently these areas can continue to drain informally as per existing conditions with limited risk of increasing runoff or flood risk. An infiltration trench is proposed to be aligned adjacent to the access road and splayed Washingdales Lane Block Valve Station access to capture runoff from the carriageways. The roof downpipes will connect into a piped drainage branch connecting into the infiltration trench. An indicative drainage layout is shown on **Figure 8** in **Annex C**.

3.2.9 A site survey will be undertaken to understand if any land drainage systems exist beneath the site or within the vicinity before any onsite activities commence. Consideration of land drainage is required to ensure it is not disrupted by the construction of the facility. This will allow the facility and surrounding land to continue to drain as per the existing drainage regime with the incorporation of infiltration trenches. Further investigation is recommended to understand local ground water levels across the site to understand any impact on proposed infiltration SuDs components.

Climate Change

3.2.10 A climate change allowance for the 30 year and 100 year events have been applied based on the Environment Agency Flood Risk Assessments: climate change allowances (2022) (**Ref 14**). The Washingdales Lane Block Valve Station site falls within the Louth Grimsby and Ancholme Management Catchment. It is noted a 25 year design life is proposed for the overall scheme. However, for this preliminary assessment it is assumed the civil engineering elements of the site will remain in place beyond 25 years (estimated 2026 construction date) with onsite equipment being refurbished or replaced to continue operation. This would bring the expected lifetime of the development (not necessarily the

operational life) beyond the year 2100 and consequently, a robust upper end climate change allowance has been adopted. This equates to a 35% uplift for a 30 year return period and 40% uplift for a 100 year return period as shown on **Table 12**.

Table 12: Louth Grimsby and Ancholme Management Catchment Peak Rainfall Allowances (values used highlighted green)

Epoch	Central Allowance	Upper End Allowance
3.3% Annual Exceedance Rainfall Event		
2050s	20%	35%
2070s	25%	**35%**
1% Annual Exceedance Rainfall Event		
2050s	20%	40%
2070s	25%	**40%**

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

Design Parameters

3.2.11 Infiltration trenches are proposed to capture and attenuate runoff from the proposed site. Trenches are to be approximately 1m wide with a 0.3 void ratio.

3.2.12 The proposed surface water infiltration trench is to be designed to accommodate a 1 in 100 year design storm event (1% AEP) plus a 40% climate change allowance with no surface water flooding on the site. The trench is to have a half drain down time within 24 hours.

3.2.13 Catchment descriptors and rainfall data has been downloaded from the Flood Estimation Handbook (FEH) web service (Ref 15) for use in calculations within this report.

Hydraulic Calculations

3.2.14 A MicroDrainage Quick Design Infiltration Systems calculation was undertaken to understand component sizes. A nominal infiltration rate of 0.036m/hr (Table 25.1 The SuDs Manual (**Ref 7**)) has been selected to represent infiltration at the site based on loamy soils and the potential of land drainage in the vicinity. The infiltration rate will require confirmation through site testing to ensure it is feasible to discharge runoff to ground. Simulations were run for the drained area shown in **Table 9** and 40% climate change against the 1 in 100 year storm event. Results predict runoff could be infiltrated in a 1m wide x 40m long infiltration trench with a half drain down time under 24 hours. The predicted length of trench could fit adjacent to the proposed access roads and car park.

3.2.15 A MicroDrainage Quick Design Infiltration Systems calculation against a silty clay loam has also been undertaken using a 0.0036m/hr infiltration rate. When testing against a factor of safety equal to 2, the results suggested a 0.4 wide 136m long infiltration trench which would not fit within the proposed site.

3.2.16 There is little risk to infrastructure or the surrounding area if the infiltration performance is uncertain. Consequently, the factor of safety can be reduced from 2 to 1.5 in the calculation complying with The SuDs Manual Table 25.2 (**Ref 7**). Suggested Factors of Safety for Infiltration Systems. Results predict runoff could be infiltrated in a 0.6m wide x 80.5m long infiltration trench with a half drain down time under 24 hours. The predicted length of trench can fit adjacent to the proposed access roads and car park.

Sustainable Drainage Systems and Water Quality

3.2.17 CIRIA C753 The SuDS Manual (**Ref 7**) outlays a simple index method to account for water quality in the design of SuDS. It indicates the minimum treatment indices appropriate for

contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment) that equals or exceeds the pollution hazard index.

3.2.18 The Washingdales Lane Block Valve Station will be unmanned and will therefore have infrequent vehicle movements and no polluting activities are expected. Consequently, the site is considered to have a low pollution hazard level as per Table 26.2 in The SuDS Manual (**Ref 7**). The pollution hazard indices for a low pollution hazard level and the mitigating indices relating to the selected SuDs component are listed in **Table 13**. The results indicate the use of infiltration will provide adequate treatment of surface water runoff for Metals and Hydrocarbons but not Total Suspended Solids. The site is unlikely to produce harmful levels of suspended solids from the drained surfaces. Also, the movement of runoff through the remaining ground towards land drainage or in natural ground water movements would likely allow suspended solids to drop out. This treatment approach is therefore considered to be appropriate for the site.

Table 13: Pollution Hazard and Mitigation Indices

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Block Valve 1	Low	0.5	0.4	0.4
SuDs Mitigation Indices for Discharge to Surface Water				
SuDs Component		**TSS**	**Metals**	**Hydrocarbons**
N/A				
SuDs Mitigation Indices for Discharge to Ground Water				
Characteristics of material overlaying SuDs		**TSS**	**Metals**	**Hydrocarbons**
Infiltration trench underlain by a soil with good contamination attenuation potential of at least 300mm in depth		0.4	0.4	0.4

[1] Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required:

Total SuDs Mitigation Index = mitigation index $_1$ + 0.5 (mitigation index $_2$)

Operation and Maintenance

3.2.19 An adopting party is to be agreed with the relevant the LLFA and any relevant stakeholders. It is likely the asset owner will be responsible for the maintenance of drainage components.

3.2.20 A key objective of the adoption process is to ensure that any installed SuDS can be maintained easily over the development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out details on the constructed SuDs and the inspection and maintenance required. This document should be developed at full detailed design but considered throughout the design process. The Operation and Maintenance details considered at this concept design stage are noted below.

3.2.21 Maintenance activities should be conducted in accordance with industry best practice e.g. CIRIA SuDS Manual. The drainage system proposed at Block Valve 1 should be inspected at defined intervals and before and after major storm events. The proposed SuDs will require a maintenance regime including vegetation control around infiltration components and

aggregate removal and cleaning/sediment removal at defined intervals. The proposed SuDs features are proposed to be shallow and allow easy access. The proposed system design life will likely meet the site design life with an adequate inspection and maintenance regime.

4 Thoroughfare Block Valve

4.1 Desktop Study – Thoroughfare Block Valve

Introduction

4.1.1 Three Block Valve Stations are required along the pipeline route to enable pipeline sections to be isolated for operational and maintenance reasons. This section considers Thoroughfare Block Valve located at X 526248 Y 400236.

4.1.2 The Block Valve Station would be buried with a valve actuator extended above ground (circa 1.5m), housed in a kiosk, between 2-3m in height and include a local vent to ensure that bypass pipework maintenance activities can be performed safely.

4.1.3 The Block Valve Stations would require security fencing, typically 2.4m high with double-leaf gates for vehicles with access from the adjacent road network, access tracks or similar. The ground surface within the fenced area will predominantly comprise stone with minimal tarmac/concrete internal access roads.

4.1.4 The Block Valve Stations would include associated landscaping such as planting or bunds to provide screening.

4.1.5 Thoroughfare Block Valve Station is located in an agricultural field adjacent to a single track lane known as Thoroughfare which is lined with trees in the vicinity of the site. A farm track cuts through the fields to the east of the site. See **Annex A** for **Figure 3 – Site Overview and Topography**.

Site Topography

4.1.6 A topographical survey has not yet been undertaken for Thoroughfare Block Valve Station. However, a review of available LiDAR information has been undertaken and indicates the site relatively flat with an easterly fall (towards the access track). Ground elevations range from approximately 22.5mAoD at the western corner to around 22.3mAoD in the east. The site topography is shown on **Figure 3**, **Annex A**.

Local Hydrology

4.1.7 The Waithe Beck main river watercourse is situated 1.14km to the north east of the site.

4.1.8 OS mapping suggests a short length of drain exists in the north east corner of the site. A drain is also noted to exist 140m to the south.

4.1.9 The Environment Agency flood maps indicate the site has a very low risk of flooding (1 in 1000 year/0.1% AEP each year) from rivers.

4.1.10 The surface water flood maps indicate the site has low risk of flooding (1 in 100 year/1% AEP to 1 in 1000 year/0.1% AEP each year). The mapping suggests runoff collects at a low lying section of the field at the farm track/Thoroughfare road junction where low-lying ground levels allows surface water to flow north east towards Waithe Beck (see **Figure 3**, **Annex A**).

Ground Conditions, Ground water and Infiltration

4.1.11 A review of the BGS Geology Viewer indicates the bedrock geology is Welton Chalk Formation with superficial deposits classed as Till, Devensian – Diamicton.

4.1.12 The site underlaying strata is classified as Principal Bedrock Aquifer and a secondary (undifferentiated) Superficial Drift Aquifer. The site sits in a medium ground water vulnerability area.

4.1.13 The BGS borehole records of holes drilled in the site vicinity indicate clay with layers of sands and gravels. The bedrock found is noted to be Chalk at 108ft below ground level (33m).

4.1.14 A review of the Soil-Scapes layer on Magic maps indicates the site is situated in an area of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. The drainage type is described as impeded drainage. The site is located in Zone III Source Protection Zone (regarding the safeguarding of drinking water quality).

4.1.15 Following the description of surface geology above it is not recommended to discharge surface water via infiltrating methods.

Existing Utilities

4.1.16 A desktop study was undertaken by GroundSure to gather available utility information from providers. This was submitted to AECOM as an AutoCAD DWG file covering the pipeline alignment and a buffer area either side. The DWG information indicates there is a 33kv Northern Power Grid cable north of the site. No utilities were shown within the site boundary.

4.2 Surface Water Drainage Strategy – Thoroughfare Block Valve Station

Contributing Areas and Runoff Calculation

4.2.1 The contributing area has been measured from a scheme layout drawing produced by Penspen (drawing number: EN070008/APP/4.15). The proposed impermeable and permeable areas are summarised in **Table 14**.

4.2.2 The site will be predominantly permeable with unpaved areas to be graded to natural ground levels overlain with weed control membrane and 75 mm of 20mm single size gravel.

4.2.3 Impermeable areas will consist of a 5m wide facility access road spurring from the Thoroughfare single track road. The site will have two fenceline boundaries including a timber fenceline around a planting strip and a security fenceline between the planting strip and Thoroughfare Block Valve Station. Within the security fence line boundary a 4m wide splayed road access and turning head is proposed to allow access to the car park. 1 No. 3 x 3.5m kiosk with a flat roof will also be situated within the site boundary sat upon a concrete base.

4.2.4 The sites will be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces will be constructed to falls so that rainwater can drain to any proposed drainage system. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. Most of the site will be permeable surfacing to minimise runoff. A cut-off drainage channel maybe required at the site entrance gate to control runoff onto site.

Table 14: Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment
Total Site Area	N/A	1693	Access road and area within fence line
Stone Area	Permeable	329	The majority of ground surface within the fence line is to be stone aggregate
Planting Strip	Permeable	1046	A planting strip is proposed around the Thoroughfare Block Valve Station perimeter to hide proposed infrastructure
Roads Inside Thoroughfare Block Valve Station Fence line	Impermeable	75	Access turning and parking is proposed to access the site
Roads Outside Thoroughfare Block Valve Station Fence line	Impermeable	233	Roads to enable access to the Thoroughfare Block Valve Station
Roofs	Impermeable	11	1 site kiosk is proposed
Totals		**m^2**	**ha**
Total Impermeable Area		318	0.032
Total Permeable Area		1375	0.137
Total Contributing area (impermeable area)		318	0.032

Greenfield Runoff

4.2.5 The greenfield runoff rates for the proposed Thoroughfare Block Valve Station have been calculated based on the IH124 method using the HR Wallingford UK SuDS website. The greenfield runoff rates for a 50ha area were calculated using this method. A summary of the results can be seen in the calculation report found in **Annex B**, with the peak greenfield runoff rates for the total contributing area interpolated from the results shown in **Table 15**.

Table 15: Peak Greenfield Runoff Rate

Rainfall Event Frequency	Runoff (l/s/ha)	Site Contributing Area (0.032ha) GF Runoff l/s
1 in 1 Year (Approx. 99% AEP)	3.82	0.12
Qbar	4.40	0.14
1 in 30 Year (3.33% AEP)	10.77	0.34
1 in 100 Year (1% AEP)	15.65	0.50

Proposed Surface Water Runoff Rates

4.2.6 **Table 16** below shows the unrestricted surface water runoff rate post-development based on the Modified Rational Method. This method estimates runoff based on the nature of the

ground surface (hardstanding, vegetation etc.) and rainfall depth, duration and frequency information for the immediate area, as follows:

- C (Coefficient of impermeability) = 1.0;
- A (area) = ha; 0.032; and
- I (Rainfall intensity based on FEH data (Ref 15)).

Table 16: Proposed Peak Runoff Rate

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	2.70	1.74	1.07	0.75	0.59	0.42	0.22	0.13	0.08
5 (20%)	4.55	2.92	1.81	1.16	0.88	0.60	0.30	0.17	0.10
10 (10%)	5.86	3.77	2.34	1.45	1.08	0.73	0.36	0.20	0.12
30 (3.3%)	7.90	5.13	3.19	1.90	1.39	0.93	0.46	0.26	0.15
50 (2%)	8.82	5.77	3.59	2.12	1.54	1.03	0.50	0.29	0.16
100 (1%)	10.10	6.65	4.16	4.84	1.75	1.16	0.57	0.33	0.16
100 +20% CC	12.12	7.98	4.99	2.90	2.10	1.40	0.69	0.40	0.20
100 +40% CC	14.14	9.31	5.82	3.39	2.46	1.63	0.80	0.46	0.23

Surface Water Drainage Concept

4.2.7 Existing ground conditions suggests infiltration of surface water is not recommended and, following the drainage hierarchy for discharge of surface water, the next favourable point of discharge is into a surface water body. An existing drainage ditch situated to the north of the site will receive runoff from the existing road and some field area. The ditch falls northeast towards a low point in the field which is suspected to be culverted beneath Thorough Road or the field access track for connection with low lying surface water ditches.

4.2.8 It is proposed to formally drain the hardstanding sections of the site including the access road and roof elements of kiosks via downpipes. Swale channels aligned adjacent to the proposed access road will collect surface water runoff and convey flow for connection into the field edge drainage ditch. The connection into the existing ditch will include a control to restrict flow to a set discharge rate. Any restricted flow will be attenuated within a detention basin in the planting strip. The outfall location has been positioned in the north eastern corner to allow connection into suspected deeper sections of the existing field edge drainage ditch. The remaining area is to be constructed from permeable material and consequently these areas can continue to drain informally as per existing conditions with limited risk of increasing runoff or flood risk to the detriment of the site and its surroundings. An indicative drainage layout is shown on **Figure 9** in **Annex C**.

4.2.9 A site survey will be undertaken to understand if any land drainage systems exist beneath the site or within the vicinity before any on-site activities commence. Consideration of land drainage is required to ensure it is not disrupted by the construction of the facility. This will allow the facility and surrounding land to continue to drain as per the existing drainage regime with the incorporation of sustainable drainage. Further investigation is recommended to understand local ground water levels across the site to understand any impact on proposed SuDs components.

4.2.10 The components should be designed as shallow as possible to maintain an invert level above the local ground water level. The lifting of ground levels or implementing impermeable lining in some sections of drainage may be required to ensure this is possible. However, if existing land drainage exists the ground water level will be artificially lowered. Further investigation is recommended to understand local ground water levels across the site to understand any impact on proposed SuDs components.

Climate Change

4.2.11 A climate change allowance for the 30 year and 100 year events have been applied based on the Environment Agency Flood Risk Assessments: climate change allowances (2022) (Ref 14). The Block Valve 2 Facility site falls within the Louth Grimsby and Ancholme Management Catchment. It is noted a 25 year design life is proposed for the overall scheme. However, for this preliminary assessment it is assumed the civil engineering elements of the site will remain in place beyond 25 years potentially up to 75-100 years (estimated 2026 construction date) with onsite equipment being refurbished or replaced to continue operation. This would bring the expected lifetime of the development (not necessarily the operational life) beyond the year 2100 and consequently, a robust upper end climate change allowance has been adopted. This equates to a 35% uplift for a 30 year return period and 40% uplift for a 100 year return period as shown on **Table 17**.

Table 17: Louth Grimsby and Ancholme Management Catchment Peak Rainfall Allowances (values used highlighted green)

Epoch	Central Allowance	Upper End Allowance
3.3% Annual Exceedance Rainfall Event		
2050s	20%	35%
2070s	25%	**35%**
1% Annual Exceedance Rainfall Event		
2050s	20%	40%
2070s	25%	**40%**

*Use''2050'' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

Design Parameters

4.2.12 Swale channels are proposed to capture and convey runoff from the proposed site. Swales have not been sized as part of this study. The channel side slope is to be 1:3 or 1:4 with a 0.5m base width and a minimum of 400mm deep. It may be possible to integrate mini swales with a reduced depth and base width considering the small area of hardstanding to be drained.

4.2.13 The surface water discharge rate is to ideally be controlled to Qbar for events between Qbar (approximately 1 in 2 year event) and 1 in 100 year event.

4.2.14 Discussions with local IDB have confirmed greenfield discharge rates are preferred, however other rates and outlet sizes are considered on a mitigated, rational and evidential basis. The greenfield discharge rates calculated for the site will likely result in outlet diameters smaller than 50-75mm. The blockage risk is discussed further in the Hydraulic Calculation section below. A check at a future design stage is required to confirm the outlet size required for the necessary flow control and the risk of blockage.

4.2.15 The proposed surface water attenuation is to be designed to accommodate a 1 in 100 year design storm event (1% AEP) plus a 40% climate change allowance with no surface water flooding on the site. No water will be stored above ground up to and including the 1 in 100 year event unless stored in a SuDs component.

4.2.16 Catchment descriptors and rainfall data has been downloaded from the Flood Estimation Handbook (FEH) web service (Ref 15) for use in calculations within this report.

Hydraulic Calculations

4.2.17 An InfoDrainage quick storage estimate calculation has been undertaken to understand attenuation requirements against a 1 in 100-year storm event. The calculation is based on a 0.14l/s Qbar discharge rate as calculated in **Table 15**, a 0.032ha drained area and includes a 40% climate change uplift. The default Summer Winter Cv values in InfoDrainage have been used (0.750/0.840). The results predict an attenuation storage volume of 24m^3 to 31m^3 is required (these results are estimates only and should not be used for design purposes). An average of the two values (28m^3) has been used for the purposes of this concept strategy.

4.2.18 To meet greenfield rates the flow discharge control device would likely have a small opening and be at risk of blockage. It is proposed to control the discharge rate as close to Qbar as reasonably practicable to prevent maintenance issues. This may require a discharge rate above the proposed greenfield rate but still controlled to a rate where detrimental flows are unlikely to be passed off site. Further investigation is recommended to understand an acceptable allowable discharge rate and flow control device.

Sustainable Drainage Systems and Water Quality

4.2.19 CIRIA C753 The SuDS Manual (**Ref 7**) outlays a simple index method to account for water quality in the design of SuDS. It indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment) that equals or exceeds the pollution hazard index.

4.2.20 The Block Valve Station will be unmanned and will therefore have infrequent vehicle movements and no polluting activities are expected. Consequently, the site is considered to have a low pollution hazard level as per Table 26.2 in The SuDS Manual (**Ref 7**).

4.2.21 The pollution hazard indices for a low pollution hazard level and the mitigating indices relating to the selected SuDs component are listed in **Table 18**. The results indicate the use of swales will provide adequate treatment of surface water runoff. As unlined swales are proposed some informal infiltration of runoff may occur. A check of mitigating indices based on the filtration capabilities of the chosen SuDs component and underlying soil properties indicate runoff should be adequately treated before entering ground water systems.

Table 18: Pollution Hazard and Mitigation Indices

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Block Valve 2	Low	0.5	0.4	0.4
SuDs Mitigation Indices for Discharge to Surface Water				
SuDs Component		**TSS**	**Metals**	**Hydrocarbons**
Swale		0.5	0.6	0.6
Attenuation storage		0.5	0.5	0.6
Total SuDs Mitigation Index[1]		0.75	0.85	0.9
SuDs Mitigation Indices for Discharge to Ground Water				

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Characteristics of material overlaying SuDs		**TSS**	**Metals**	**Hydrocarbons**
Layer of dense vegetation underlain by a soil with good contamination attenuation potential of at least 300mm in depth		0.6	0.5	0.6

[1] Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required:

Total SuDs Mitigation Index = mitigation index $_1$ + 0.5 (mitigation index $_2$)

Operation and Maintenance

4.2.22 An adopting party is to be agreed with the LLFA and any relevant stakeholders. It is likely the asset owner will be responsible for the maintenance of drainage components.

4.2.23 A key objective of the adoption process is to ensure that any installed SuDS can be maintained easily over the Proposed Development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out details on the constructed SuDs and the inspection and maintenance required. This document should be developed at full detailed design but considered throughout the design process. The Operation and Maintenance details considered at this concept design stage are noted below.

4.2.24 Maintenance activities should be conducted in accordance with industry best practice e.g. CIRIA SuDS Manual. The drainage system proposed at Block Valve 2 should be inspected at defined intervals and before and after major storm events. The proposed SuDs will require a maintenance regime including grass cutting, removal of sediment build up and clearance of the outfalls at defined intervals. The proposed SuDs features are to be shallow and allow easy access. The proposed system design life will likely meet the site design life with an adequate inspection and maintenance regime.

5 Louth Road Block Valve Station

5.1 Desktop Study – Louth Road Block Valve Station

Introduction

5.1.1 Three Block Valve Stations are required along the pipeline route to enable pipeline sections to be isolated for operational and maintenance reasons. This section considers Louth Road Block Valve Station located at X 535809 Y 390543.

5.1.2 The Block Valve Station would be buried with a valve actuator extended above ground (circa 1.5m), housed in a kiosk, between 2-3m in height and include a local vent to ensure that bypass pipework maintenance activities can be performed safely.

5.1.3 The Block Valve Stations would require security fencing, typically 2.4m high with double-leaf gates for vehicles with access from the adjacent road network, access tracks or similar. The ground surface within the fenced area will predominantly comprise stone with minimal tarmac/concrete internal access roads.

5.1.4 The Block Valve Stations would include associated landscaping such as planting or bunds to provide screening.

5.1.5 Louth Road Block Valve Station is located in an agricultural field adjacent to Alvingham Road which is lined with bushes along the field boundaries. An existing twin farm gate acts as access to the field in the vicinity of the proposed Louth Road Block Valve Station. See **Annex A** for **Figure 4 – Site Overview and Topography**.

Site Topography

5.1.6 A topographical survey has not yet been undertaken for the Louth Road Block Valve Station. However, a review of available LiDAR information has been undertaken and indicates the site falls to the south (towards Alvingham Road). Ground elevations range from approximately 14mAOD at the northern edge to around 13mAOD in the south. The road adjacent crests with the carriageway falling in both directions from this point. The site topography is shown on **Figure 4, Annex A**.

Local Hydrology

5.1.7 The River Lud main river watercourse is situated 420m to the south east of the site. Also to the southeast is the Louth Canal which runs between the site and River Lud at a distance of approximately 250m. It is understood the Louth Canal is a canalisation of the River Lud and is maintained for the continuation of land drainage and water supply.

5.1.8 A visible ditch drain runs adjacent to the southern edge of Alvingham Road east of the site. The drain continues for approximately 180m before changing direction to the southeast and connecting into the Louth Canal. Runoff from the current site area is assumed to be collected by land drainage following the fall of the land south and to the southwest. Field/road edge ditches are assumed to exist but are not visible on available online street maps, hidden by field boundary hedges. Another ditch drain falling towards the Louth Canal following a field boundary is situated approximately 200m south west of the site.

Ground Conditions, Ground water and Infiltration

5.1.9 A review of the BGS Geology Viewer indicates the bedrock geology is Welton Chalk Formation with superficial deposits classed as Till, Devensian – Diamicton.

5.1.10 The site underlaying strata is classified as Principal Bedrock Aquifer and a secondary (undifferentiated) Superficial Drift Aquifer. The site sits in a medium ground water vulnerability area.

5.1.11 The BGS borehole records of holes drilled in the site vicinity indicate clay above a layer of sand. The bedrock found is noted to be Chalk at 171ft below ground level (52m).

5.1.12 A review of the Soil-Scapes layer on Magic maps indicates the site is situated in an area of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. The drainage type is described as impeded drainage. The site is not located in a Source Protection Zone but is noted to be in a Drinking Water Protected Area under Anglian Water.

5.1.13 Following the description of surface geology above it is not recommended to discharge surface water via infiltrating methods.

Existing Utilities

5.1.14 A desktop study was undertaken by GroundSure to gather available utility information from providers. This was submitted to AECOM as an AutoCAD DWG file covering the pipeline alignment and a buffer area either side. The DWG information indicates there is an Anglian Water foul water pipeline aligned with Alvingham Road south of the site. No utilities were shown within the site boundary.

5.2 Surface Water Drainage Strategy – Louth Road Block Valve Station

Contributing Areas and Runoff Calculation

5.2.1 The contributing area has been measured from a scheme layout drawing produced by Penspen (drawing number: EN070008/APP/4.16). The proposed impermeable and permeable areas are summarised in **Table 19**.

5.2.2 The site will be predominantly permeable with unpaved areas to be graded to natural ground levels overlain with weed control membrane and 75 mm of 20mm single size gravel.

5.2.3 Impermeable areas will consist of a 5m wide facility access road spurring from the Alvingham Road. The site will have two fenceline boundaries including a timber fenceline around a planting strip and a security fenceline between the planting strip and Louth Road Block Valve Station. Within the security fence line boundary a 4m wide splayed road access and turning head is proposed to allow access to the car park. 1No. 3 x 3.5m kiosk with a flat roof will also be situated within the site boundary sat upon a concrete base.

5.2.4 The sites will be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces will be constructed to falls so that rainwater can drain to any proposed drainage system. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. Most of the site will be permeable surfacing to minimise runoff. A cut-off drainage channel maybe required at the site entrance gate to control runoff offsite.

Table 19: Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment
Total Site Area	N/A	1681	Access road and area within fence line
Stone area	Permeable	329	The majority of ground surface within the fence line is to be stone aggregate

Ref	Surface Type	Area (m^2)	Comment
Planting Strip	Permeable	1046	A planting strip is proposed around the Louth Road Block Valve Station perimeter to hide proposed infrastructure
Roads Inside Louth Road Block Valve Station Fence line	Impermeable	75	Access turning and parking is proposed to access site
Roads Outside Louth Road Block Valve Station Fence line	Impermeable	221	Roads to enable access to the Louth Road Block Valve Station
Roofs	Impermeable	11	1 site kiosk is proposed
Totals		**m^2**	**ha**
Total Impermeable Area		306	0.031
Total Permeable Area		1375	0.137
Total Contributing area (impermeable area)		306	0.031

Greenfield Runoff

5.2.5 The greenfield runoff rates for the proposed Louth Road Block Valve Station have been calculated based on the IH124 method using the HR Wallingford UK SuDS website. The greenfield runoff rates for a 50ha area were calculated using this method. A summary of the results can be seen in the calculation report found in **Annex B**, with the peak greenfield runoff rates for the total contributing area interpolated from the results shown in **Table 20**.

Table 20: Peak Greenfield Runoff Rate

Rainfall Event Frequency	Runoff (l/s/ha)	Site Contributing Area (0.031ha) GF Runoff l/s
1 in 1 Year (Approx. 99% AEP)	3.78	0.12
Qbar	4.35	0.13
1 in 30 Year (3.33% AEP)	10.65	0.33
1 in 100 Year (1% AEP)	15.48	0.47

Proposed Surface Water Runoff Rates

5.2.6

5.2.7 **Table** 21 below shows the unrestricted surface water runoff rate post-development based on the Modified Rational Method. This method estimates runoff based on the nature of the ground surface (hardstanding, vegetation etc.) and rainfall depth, duration and frequency information for the immediate area, as follows:

- C (Coefficient of impermeability) = 1.0;
- A (area) = ha; 0.031; and
- i (Rainfall intensity based on FEH data (Ref 15)).

Table 21: Proposed Peak Runoff Rate

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	2.67	1.72	1.06	0.74	0.58	0.41	0.21	0.12	0.07
5 (20%)	4.55	2.92	1.81	1.16	0.87	0.60	0.30	0.17	0.10
10 (10%)	5.87	3.78	2.35	1.45	1.08	0.73	0.36	0.20	0.12
30 (3.3%)	7.94	5.16	3.21	1.91	1.40	0.93	0.46	0.26	0.15
50 (2%)	8.89	5.81	3.62	2.13	1.56	1.04	0.51	0.29	0.17
100 (1%)	10.19	6.71	4.19	4.89	1.77	1.18	0.59	0.34	0.17
100 +20% CC	12.23	8.05	5.03	2.94	2.13	1.42	0.70	0.41	0.20
100 +40% CC	14.27	9.40	5.87	3.42	2.48	1.65	0.82	0.48	0.23

Surface Water Drainage Concept

5.2.8 Existing ground conditions suggest infiltration of surface water is not recommended and, following the drainage hierarchy for discharge of surface water, the next favourable point of discharge is into a surface water body. An existing drainage ditch is situated to the south of the site, likely receiving runoff from the existing road and field. The ditch falls south west towards a perpendicular drainage channel connecting into the canal. Further investigation will be required to confirm the field drainage connectivity and to understand the impact the proposed site will have upon any existing land drainage.

5.2.9 It is proposed to formally drain the hardstanding sections of the site, including; the access road, and roof elements of kiosks via downpipes. Swale channels aligned adjacent to the proposed access road will collect surface water runoff and convey flow for connection into the field edge drainage ditch. The connection into the existing ditch will include a control to restrict flow to a set discharge rate. Any restricted flow will be attenuated within a detention basin in the planting strip. The connection into the existing ditch will include a control to restrict flow to a set discharge rate. The remaining area is to be constructed from permeable material and consequently these areas can continue to drain informally as per existing conditions with limited risk of increasing runoff or flood risk to the detriment of the site and its surroundings. An indicative drainage layout is shown on **Figure 10** in **Annex C**.

5.2.10 A site survey will be undertaken to understand if any land drainage systems exist beneath the site or within the vicinity before any on-site activities commence. Consideration of land drainage is required to ensure it is not disrupted by the construction of the facility. This will allow the facility and surrounding land to continue to drain as per the existing drainage regime with the incorporation of sustainable drainage.

5.2.11 The components should be designed as shallow as possible to maintain an invert level above the local ground water level. The lifting of ground levels or implementing impermeable lining in some sections of drainage may be required to ensure this is possible. However, if existing land drainage exists the ground water level will be artificially lowered.

Further investigation is recommended to understand local ground water levels across the site to understand any impact on proposed SuDs components.

Climate Change

5.2.12 A climate change allowance for the 30 year and 100 year events have been applied based on the Environment Agency Flood Risk Assessments: climate change allowances (2022) (Ref 14). The Louth Road Block Valve Station site falls within the Louth Grimsby and Ancholme Management Catchment. It is noted a 25 year design life is proposed for the overall scheme. However, for this preliminary assessment it is assumed the civil engineering elements of the site will remain in place beyond 25 years potentially up to 75-100 years (estimated 2026 construction date) with onsite equipment being refurbished or replaced to continue operation. This would bring the expected lifetime of the development (not necessarily the operational life) beyond the year 2100 and consequently, a robust upper end climate change allowance has been adopted. This equates to a 35% uplift for a 30 year return period and 40% uplift for a 100 year return period as shown on **Table 22**.

Table 22: Louth Grimsby and Ancholme Management Catchment Peak Rainfall Allowances (values used highlighted green)

Epoch	Central Allowance	Upper End Allowance
3.3% Annual Exceedance Rainfall Event		
2050s	20%	35%
2070s	25%	**35%**
1% Annual Exceedance Rainfall Event		
2050s	20%	40%
2070s	25%	**40%**

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

Design Parameters

5.2.13 Swale channels are proposed to capture and convey runoff from the proposed site. Swales have not been sized as part of this study. The channel side slope is to be 1:3 or 1:4 with a 0.5m base width and a minimum of 400mm deep. It may be possible to integrate mini swales with a reduced depth and base width considering the small area of hardstanding to be drained.

5.2.14 Discussions with local IDB have confirmed greenfield discharge rates are preferred, however other rates and outlet sizes are considered on a mitigated, rational and evidential basis. The greenfield discharge rates calculated for the site will likely result in outlet diameters smaller than 50-75mm. The blockage risk is discussed further in the Hydraulic Calculation section below. A check at a future design stage is required to confirm the outlet size required for the necessary flow control and the risk of blockage.

5.2.15 The proposed surface water attenuation is to be designed to accommodate a 1 in 100 year design storm event (1% AEP) plus a 40% climate change allowance with no surface water flooding on the site. No water will be stored above ground up to and including the 1 in 100 year event unless stored in a SuDs component.

5.2.16 Catchment descriptors and rainfall data has been downloaded from the Flood Estimation Handbook (FEH) web service (Ref 15) for use in calculations within this report.

Hydraulic Calculations

5.2.17 An InfoDrainage quick storage estimate calculation has been undertaken to understand attenuation requirements against a 1 in 100-year storm event. The calculation is based on

a 0.13l/s Qbar discharge rate as calculated in **Table 20**, a 0.031ha drained area and includes a 40% climate change uplift. The default Summer Winter Cv values in InfoDrainage have been used (0.750/0.840). The results predict an attenuation storage volume of 26m^3 to 35m^3 is required (these results are estimates only and should not be used for design purposes). An average of the two values (31m^3) has been used for the purposes of this concept strategy.

5.2.18 To meet greenfield rates the flow discharge control device would likely have a small opening and be at risk of blockage. It is proposed to control the discharge rate as close to Qbar as reasonably practicable to prevent maintenance issues. This may require a discharge rate above the proposed greenfield rate but still controlled to a rate where detrimental flows are unlikely to be passed off site. Further investigation is recommended to understand an acceptable allowable discharge rate and flow control device.

Sustainable Drainage Systems and Water Quality

5.2.19 CIRIA C753 The SuDS Manual (**Ref 7**) outlays a simple index method to account for water quality in the design of SuDS. It indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment) that equals or exceeds the pollution hazard index.

5.2.20 The Block Valve Station will be unmanned and will therefore have infrequent vehicle movements and no polluting activities are expected. Consequently, the site is considered to have a low pollution hazard level as per Table 26.2 in The SuDS Manual (**Ref 7**).

5.2.21 The pollution hazard indices for a low pollution hazard level and the mitigating indices relating to the selected SuDs component are listed in **Table 23**. The results indicate the use of swales will provide adequate treatment of surface water runoff. As unlined swales are proposed some informal infiltration of runoff may occur. A check of mitigating indices based on the filtration capabilities of the chosen SuDs component and underlying soil properties indicate runoff should be adequately treated before entering ground water systems.

Table 23: Pollution Hazard and Mitigation Indices

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Block Valve 3	Low	0.5	0.4	0.4
SuDs Mitigation Indices for Discharge to Surface Water				
SuDs Component		**TSS**	**Metals**	**Hydrocarbons**
Swale		0.5	0.6	0.6
Attenuation storage		0.5	0.5	0.6
Total SuDs Mitigation Index[1]		0.75	0.85	0.9
SuDs Mitigation Indices for Discharge to Ground Water				
Characteristics of material overlaying SuDs		**TSS**	**Metals**	**Hydrocarbons**
Layer of dense vegetation underlain by a soil with good contamination attenuation potential of at least 300mm in depth		0.6	0.5	0.6

[1] Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required:

Total SuDs Mitigation Index = mitigation index $_1$ + 0.5 (mitigation index $_2$)

Operation and Maintenance

5.2.22 An adopting party is to be agreed with the relevant the LLFA and any relevant stakeholders. It is likely the asset owner will be responsible for the maintenance of drainage components.

5.2.23 A key objective of the adoption process is to ensure that any installed SuDS can be maintained easily over the development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out details on the constructed SuDs and the inspection and maintenance required. This document should be developed at full detailed design but considered throughout the design process. The Operation and Maintenance details considered at this concept design stage are noted below.

5.2.24 Maintenance activities should be conducted in accordance with industry best practice e.g. CIRIA SuDS Manual. The drainage system proposed at Block Valve 3 should be inspected at defined intervals and before and after major storm events. The proposed SuDs will require a maintenance regime including grass cutting, removal of sediment build up and clearance of the outfalls at defined intervals. The proposed SuDs features are to be shallow and allow easy access. The proposed system design life will likely meet the site design life with an adequate inspection and maintenance regime.

6 Theddlethorpe Facility Option 1

6.1 Desktop Study – Theddlethorpe Facility Option 1

Introduction

6.1.1 There are currently two options considered for the location of the Theddlethorpe Facility. This section considers Option 1:

- Theddlethorpe Facility Option 1: new facility at the former Theddlethorpe Gas Terminal (TGT) site. Demolition of the former TGT was completed in 2021 but as the site was previously an operational facility, existing security fencing and road infrastructure remain in place. The site is currently clear with a mixture of hard standing, stoned areas and pipeline stubs. Access to the site would be via an existing gate at the south west corner of the site (X 548623 Y 387508).

6.1.2 For Option 1, the onshore pipeline would enter the repurposed TGT site from the west and terminate at new facilities built next to the existing LOGGS Pipeline, which enters the site from the east. The CO_2 would enter the site via the 24'' onshore pipeline and would be routed into the 36'' LOGGS pipeline. An additional connection would be provided to allow for future carbon capture projects to connect to the Theddlethorpe Facility.

6.1.3 The Theddlethorpe Facility is required to enable the CO_2 to flow from the new 24" pipeline into the existing LOGGS (36") pipeline.

6.1.4 The Theddlethorpe Facility would comprise the following key components:

- LOGGS pipeline tie-in;
- Emergency Shutdown Valves;
- Pig receiver and launcher;
- High-integrity Pressure Protection System;
- Venting system including vent pipework, valves, and vent stack; and
- Local equipment room (LER); and
- Supporting Infrastructure.

6.1.5 The Theddlethorpe Facility would be secured by a single palisade security fence 3.2 m high.

6.1.6 The ground surface within the boundary of the Theddlethorpe Facility will be predominantly stone with a minimal number of internal tarmac/concrete access roads.

6.1.7 The Theddlethorpe Facility Option 1 is located within the existing TGT north of Mablethorpe. The site is accessed from the A1031 and is situated 670m from the coastline and the Saltfleetby/Theddlethorpe Dunes. A grazing marsh is sited between the terminal and sand dunes to the east. A Gas Transmission Terminal exists to the south. See **Annex A** for **Figure 5 – Site Overview and Topography**.

Site Topography

6.1.8 A topographical survey has not yet been undertaken for the Theddlethorpe Option 1. However, a review of available LiDAR information has been undertaken and indicates the site is relatively flat. Levels on site range between approximately 2.1 and 2.3mAoD. The site topography is shown on **Figure 5**, **Annex A**.

Local Hydrology

6.1.9 The main river watercourse that is situated closest to the site location is the Great Eau (approx. 4.8km west).

6.1.10 Ditches spurring from the existing complex boundary connect into a drain known as The Cut running west and south of the site. To the east a drain known as Crook Bank runs between Sand Hills Farm towards Bleak house also connecting with The Cut drain. The Cut ultimately discharges to the North Sea via an outfall adjacent Quebec Road Car Park. The proposed site area currently drains formally via a land drainage system serving permeable areas discharging from the site to the south and east. A closed drainage system serving hardstanding discharging to the North Sea by pumping. A plan of IDB maintained assets in the site vicinity has been provided in **Annex D**.

6.1.11 The Environment Agency flood maps indicates the site has a medium risk of flooding (between 1 in 100 year/0.1% AEP and 1 in 30 year/3.3% AEP each year) from rivers or the sea. The site has a low risk of flooding from surface water (between 1 in 1000 year /0.1% and 1 in 100 year/1% AEP each year).

Ground Conditions, Ground water and Infiltration

6.1.12 A review of the BGS Geology Viewer indicates the bedrock geology is Burnham Chalk Formation with superficial deposits classed as Tidal Flat Deposits of clay and silt.

6.1.13 The site underlying strata is classified as Principal Bedrock Aquifer and an unproductive Superficial Drift Aquifer. The site sits in a low ground water vulnerability area.

6.1.14 The BGS borehole records of holes drilled within the site boundary or immediately adjacent indicate the geological sequence from ground level is a thin layer of made ground, above silty clay before peat traces encountered at approximately 1.5m depth. Beyond this are varying layers of sandy silty clay with a bedrock of Chalk at approximately 25m depth.

6.1.15 A review of the Soil-Scapes layer on Magic maps indicates the site is situated in an area of loamy and clayey soils of coastal flats with naturally high groundwater. The drainage type is described as naturally wet. The site is not located in a Source Protection Zone.

6.1.16 Following the description of surface geology above it is not recommended to discharge surface water via infiltrating methods.

Existing Utilities

6.1.17 A desktop study was undertaken by GroundSure to gather available utility information from providers. This was submitted to AECOM as an AutoCAD DWG file covering the pipeline alignment and a buffer area either side. The DWG information indicates no utilities within the site boundary. However, the site may have on site services serving past infrastructure within the terminal.

6.1.18 Two existing surface water systems exist as listed below. The plans showing the surface water systems are included in **Annex E**.

- A closed surface water system serves hardstanding sections of the site. Water is conveyed to a central east section of site before a pumping station discharges surface water into the North Sea; and
- A surface water land drainage system serves the permeable gravel sections of the site and runoff from existing access roads. Outfalls are located on the southern and eastern site boundaries discharging into The Cut and Crook Bank.

6.2 Surface Water Drainage Strategy – Theddlethorpe Facility Option 1

Contributing Areas and Runoff Calculation

6.2.1 The existing contributing area has been measured from the scheme layout referenced above and available OS background mapping. The catchment areas will require re-calculation at a future design stage against detailed topographic surveys. The existing impermeable and impermeable areas are summarised in **Table 24**.

Table 24: Existing Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment	Existing Outfall
Total Area Site Boundary	N/A	16500	Access road and area within fenceline	N/A
Stone area	Permeable	8599	Existing Permeable Area	Land drainage/The Cut
Roads	Impermeable	2138	Existing Access Roads	Land drainage/The Cut
Concrete Pad	Impermeable	5763	Existing Drained Infrastructure Hardstanding	Sea pump
Totals		m2	ha	
Total Impermeable Area		7901	0.790	
Total Permeable Area		8599	0.860	
Area Draining to Land Drainage/ The Cut		10737	1.074	

6.2.2 The existing drainage catchment is shown in **1.**

6.2.3 The proposed contributing area has been measured from a scheme layout drawing produced by Kent Energies Ltd (drawing number: EN070008/APP/4.7). The proposed impermeable and permeable areas are summarised in **Table 25**. The proposed drainage catchments are shown in **igure 2.**

Figure 1: Existing Drainage Catchment

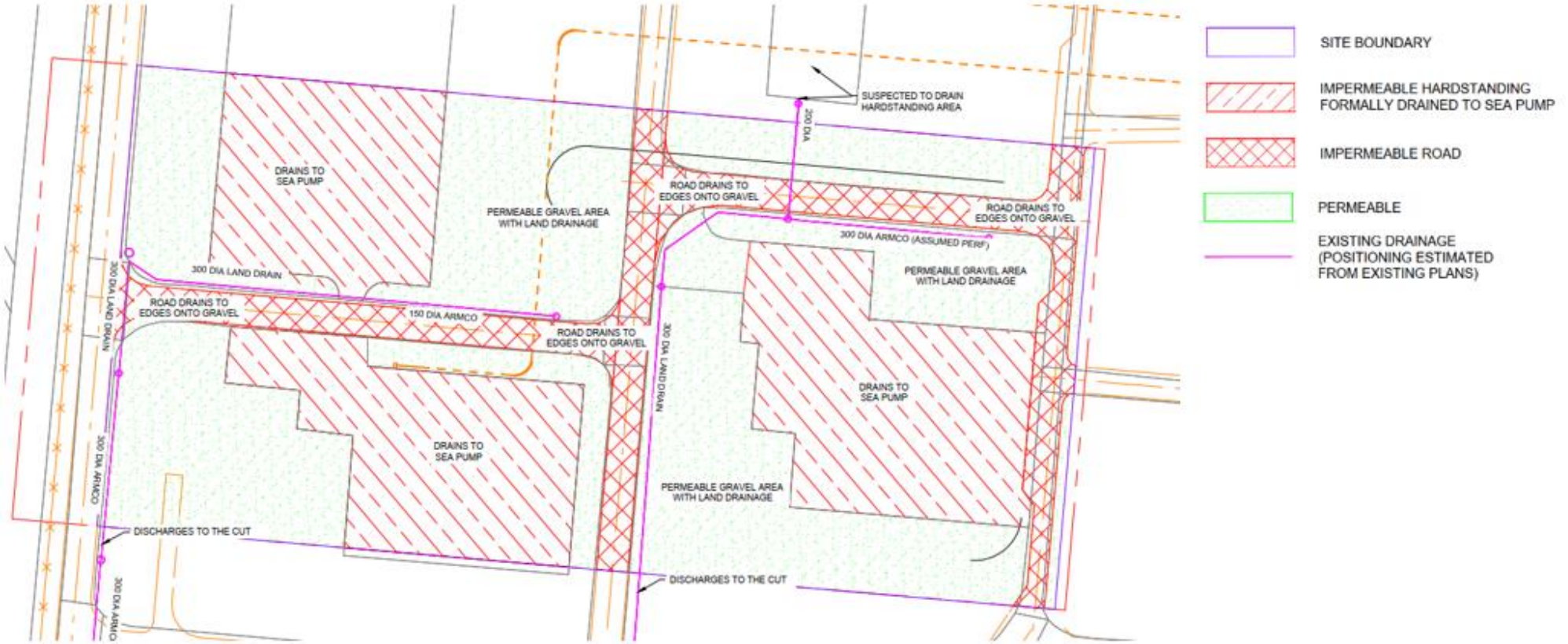
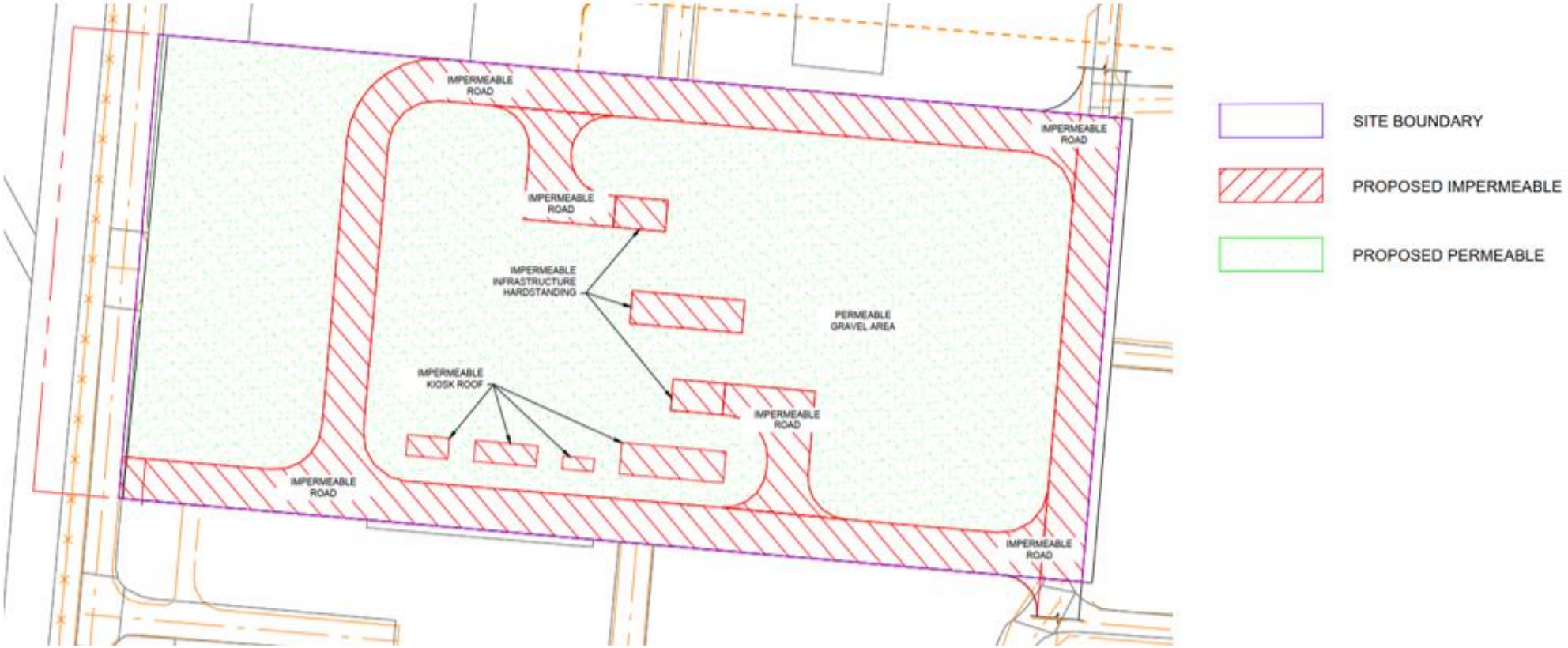


Figure 2: Proposed Drainage Catchment



6.2.4 The site will be predominantly permeable with unpaved areas to be graded to natural ground levels overlain with weed control membrane and 75mm of 20mm single size gravel.

6.2.5 Access roads are proposed to surround the site area spurring from the existing concrete access road in the terminal. Within the site boundary two splayed roads are proposed to allow access to the Pig Launch areas. Both the pig launch areas and high-integrity pressure protection system area will sit upon concrete pads. Four kiosks with flat roofs will also be situated within the site boundary sat upon concrete bases.

6.2.6 The sites will be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces will be constructed to falls so that rainwater can drain to any proposed drainage system. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. Most of the site will be permeable surfacing to minimise runoff.

Table 25: Proposed Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment	Proposed Outfall
Total Area Site Boundary	N/A	16500	Access road and area within fenceline	N/A
Stone area	Permeable	11606	The majority of ground surface is to be stone aggregate	Land drainage/The Cut
Roads	Impermeable	4428	Access Roads, Access turning and parking is proposed to access the pig handling area and site	Land drainage/The Cut via attenuation and discharge control
Roofs	Impermeable	215	4 buildings are proposed including Central Control Room, Local Equipment Room, Analyser House and Metering Package Hold	Land drainage/The Cut via attenuation and discharge control
Concrete Pad	Impermeable	255	High-integrity pressure protection system and pig handling area are assumed to be sited on concrete pads or similar impermeable ground	Land drainage/The Cut via attenuation and discharge control
Totals		**m^2**	**ha**	
Total Impermeable Area		**4898**	0.490	
Total Permeable Area		**11606**	1.161	

Greenfield Runoff

6.2.7 The greenfield runoff rates for the proposed Louth Road Block Valve Station have been calculated based on the IH124 method using the HR Wallingford UK SuDS website. The greenfield runoff rates for a 50ha area were calculated using this method. A summary of the results can be seen in the calculation report found in **Annex B**, with the peak greenfield runoff rates for the total contributing area interpolated from the results shown in **Table 26**.

Table 26: Peak Greenfield Runoff Rate

Rainfall Event Frequency	Runoff (l/s/ha)	Site Contributing Area (0.640ha) GF Runoff l/s
1 in 1 Year (Approx. 99% AEP)	2.15	1.38
Qbar	2.47	1.58
1 in 30 Year (3.33% AEP)	6.05	3.87
1 in 100 Year (1% AEP)	8.79	5.63

Existing and Proposed Surface Water Runoff Rates

6.2.8 **Table 27** and **Table 28** below shows the unrestricted surface water runoff rate pre-development and post development based on the Modified Rational Method. This method estimates runoff based on the nature of the ground surface (hardstanding, vegetation etc.) and rainfall depth, duration and frequency information for the immediate area, as follows:

- C (Coefficient of impermeability) = 1.0;
- A (area) = ha; 0.644 (existing including 100% impermeable road area and 50% permeable area) and 0.490 (proposed); and
- i (Rainfall intensity based on FEH data (Ref 15)).

Table 27: Existing Peak Runoff Rates

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	68.25	38.67	23.49	15.98	12.34	8.69	4.47	2.56	1.48
5 (20%)	118.02	66.92	39.48	24.73	18.51	12.62	6.26	3.52	2.00
10 (10%)	151.89	86.47	50.88	30.84	22.77	15.31	7.51	4.20	2.36
30 (3.3%)	207.61	118.55	68.95	40.43	29.46	19.60	9.54	5.36	3.01
50 (2%)	233.10	133.52	77.52	44.98	32.65	21.68	10.59	5.99	3.38
100 (1%)	269.05	153.97	89.59	102.80	37.21	24.70	12.21	7.05	3.38
100 +20% CC	322.86	184.76	107.51	61.68	44.65	29.63	14.66	8.46	4.06
100 +40% CC	376.67	215.55	125.42	71.96	52.09	34.57	17.10	9.87	4.73

Table 28: Proposed Peak Runoff Rates

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	51.93	29.42	17.87	12.16	9.39	6.61	3.40	1.95	1.13
5 (20%)	89.80	50.92	30.04	18.82	14.08	9.60	4.76	2.68	1.52
10 (10%)	115.57	65.79	38.71	23.46	17.32	11.65	5.71	3.19	1.80
30 (3.3%)	157.96	90.20	52.46	30.77	22.41	14.92	7.26	4.08	2.29
50 (2%)	177.36	101.59	58.98	34.23	24.84	16.49	8.06	4.56	2.57
100 (1%)	204.71	117.15	68.16	78.22	28.31	18.79	9.29	5.36	2.57
100 +20% CC	245.65	140.58	81.80	46.93	33.97	22.55	11.15	6.43	3.09
100 +40% CC	286.60	164.01	95.43	54.75	39.64	26.31	13.01	7.51	3.60

Surface Water Drainage Concept

6.2.9 As existing ground conditions suggests infiltration of surface water is not recommended, following the drainage hierarchy for discharge of surface water, the next favourable point of discharge is into a surface water body.

6.2.10 It is proposed to formally drain the hardstanding sections of the site including the access roads and roof elements of kiosks via downpipes.

6.2.11 Two options could be considered for the drainage of the site. This is dependent on the proposed redevelopment of the remaining TGT and the retention of the existing drainage systems. The options include:

- **Drainage Option A SW Sea Pump in Service** – drain surface water from all proposed roads and hardstanding (located within the proposed site boundary) to the pumping station utilising the existing closed system. There is an increase in permeable area drained (located within the proposed site boundary) to the existing land drainage and consequently The Cut. Runoff from the additional permeable area may require controlling to ensure the existing system capacity is not overwhelmed and check the existing discharge rate at outfall is not exceeded; and
- **Drainage Option B SW Sea Pump Out of Service** - The proposed impermeable area (located within the proposed site boundary) runoff is to be attenuated and discharged into the existing land drainage system. The catchment area also accounts for an increase of permeable area runoff (located within the proposed site boundary) that would have previously discharged to sea via pump from former hardstanding areas. The existing and proposed catchment areas are shown in **Table 24** and **Table 25**.

6.2.12 This report considers Option B which is deemed the worst case, described in further detail below. The report only considers draining the proposed site area under development and does not consider the remaining area of the former TGT site. It should be noted the remaining part of the former TGT may be re-developed but details were not available at the time of writing.

6.2.13 Hardstanding areas are proposed to drain into a filter drainage conveyance system around the site perimeter. The system will collect runoff and convey flows west to outfall in an attenuation basin. The basin will have a piped outlet connecting into the existing drainage system with a flow control device controlling the discharge rate. An indicative drainage layout is shown on **Figure 11** in **Annex C**. Further information on the existing system is

required to understand its depth to enable a connection with the proposed drainage and its drainage capacity.

6.2.14 The majority of runoff from permeable sections of the site is to continue to be drained as per the existing drainage regime. Review of existing site plans indicates the site is served by a land drainage system for permeable sections of the site which discharges collected flows to The Cut along the southern perimeter or Crook Bank channel to the east. The proposed site location is likely to discharge into the system outfalling into The Cut. Further investigation is required to understand existing land drainage catchments and if adjustment of the system is required to account for the proposed site.

6.2.15 **Table 29** outlines the contributing drainage catchment area. The removal of large concrete infrastructure pads that previously drained to the Sea Pump increases the permeable area discharging to The Cut. The impermeable area discharging to the cut is also shown to increase compared to the existing site. It is proposed to formally drain and control the discharge rate from the total proposed impermeable area and the additional permeable area. The former permeable area is to continue to drain as per the existing drainage regime. The large spacings between existing land drainage serving the former permeable area slows runoff and allows some storage within the gravel voids.

6.2.16 The additional permeable area and total proposed impermeable area will be captured and discharged into an attenuation basin as described above. This method will allow a controlled discharge of runoff into the existing drainage system at greenfield discharge rates.

Table 29: Option B – Catchment Makeup and Areas Contributing to the Proposed Drainage System

Scenario	**Option B**				
Existing	**Catchment Makeup**	**Surface Type**	**Area (m^2)**	**Assumed Positively Drained Area (m^2)**	**ha**
	Total Area discharging via The Cut	Permeable Gravel	8599	4300	0.430
		Impermeable Roads	2138	2138	0.214
	Total Area to the Cut			6438	0.644
Proposed	**Catchment Makeup**	**Surface Type**	**Area (m^2)**	**Assumed Positively Drained Area (m^2)**	**ha**
	Total Area discharging via The Cut	Permeable Gravel	11606	5803	0.580
		Impermeable Roads/Roofs/ Concrete	4898	4898	0.490
	Total Area to the Cut			10701	1.070
Catchment Areas to Drainage System			**Area (m^2)**	**Assumed Positively Drained Area (m^2)**	**ha**

Scenario	Option B		
Permeable area contributing to proposed drainage system	3007	1504	0.15
Impermeable area contributing to proposed drainage system	4898	4898	0.49
Total Area Contributing to the Proposed Drainage System	7905	6402	0.64

6.2.17 The components should be designed as shallow as possible to maintain an invert level above the local ground water level. The lifting of ground levels or implementing impermeable lining in some sections of drainage may be required to ensure this is possible. However, if existing land drainage exists the ground water level may be artificially lowered. Further investigation is recommended to understand local ground water levels across the site to understand any impact on proposed SuDs components.

Climate Change

6.2.18 A climate change allowance for the 30 year and 100 year events have been applied based on the Environment Agency Flood Risk Assessments: climate change allowances (2022) (Ref 14). The Theddlethorpe Facility Option 1 site falls within the Witham Management Catchment. It is noted a 25 year design life is proposed for the overall scheme. However, for this preliminary assessment it is assumed the civil engineering elements of the site will remain in place beyond 25 years potentially up to 75-100 years (estimated 2026 construction date) with onsite equipment being refurbished or replaced to continue operation. This would bring the expected lifetime of the development (not necessarily the operational life) beyond the year 2100 and consequently, a robust upper end climate change allowance has been adopted. This equates to a 35% uplift for a 30 year return period and 40% uplift for a 100 year return period as shown on **Table 30**.

Table 30: Witham Management Catchment Peak Rainfall Allowances (values used highlighted green)

Epoch	Central Allowance	Upper End Allowance
3.3% Annual Exceedance Rainfall Event		
2050s	20%	35%
2070s	25%	**35%**
1% Annual Exceedance Rainfall Event		
2050s	20%	40%
2070s	25%	**40%**

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

Design Parameters

6.2.19 The surface water discharge rate is to ideally be controlled to Qbar for events between Qbar (approximately 1 in 2 year event) and 1 in 100 year event.

6.2.20 Discussions with local IDB have confirmed greenfield discharge rates are preferred, however other rates and outlet sizes are considered on a mitigated, rational and evidential basis. The greenfield discharge rates calculated for the site will likely result in outlet diameters smaller than 50-75mm. The blockage risk is discussed further in the Hydraulic Calculation section below. A check at a future design stage is required to confirm the outlet size required for the necessary flow control and the risk of blockage.

6.2.21 The proposed surface water attenuation is to be designed to accommodate a 1 in 100 year design storm event (1% AEP) plus a 40% climate change allowance with no surface water flooding on the site. No water will be stored above ground up to and including the 1 in 100 year event unless stored in a SuDs component.

6.2.22 Catchment descriptors and rainfall data has been downloaded from the Flood Estimation Handbook (FEH) web service (Ref 15) for use in calculations within this report.

Hydraulic Calculations

6.2.23 An InfoDrainage quick storage estimate calculation has been undertaken to understand attenuation requirements against a 1 in 100-year storm event. The calculation is based on a 1.58l/s Qbar discharge rate as calculated in **Table 25**, a 0.640ha drained area and includes a 40% climate change uplift. The default Summer Winter Cv values in InfoDrainage have been used (0.750/0.840). The results predict an attenuation storage volume of 611m^3 to 749m^3 is required (these results are estimates only and should not be used for design purposes). An average of the two values (680m^3) has been used for the purposes of this concept strategy.

6.2.24 To meet greenfield rates the flow discharge control device will likely have a small opening and be at risk of blockage. To minimise the risk of blockage it is proposed to use a Hydrobrake device within a chamber for flow control. Preliminary calculations using the Hydro-International online design tool predicts the device will have a 65mm diameter outlet with 0.6m head and 1.58l/s discharge rate. Whilst this diameter does not meet a nationally recognised 75mm minimum outlet size, the risk of blockage for the proposed outlet arrangement is deemed low based on existing site conditions.

Sustainable Drainage Systems and Water Quality

6.2.25 CIRIA C753 The SuDS Manual (**Ref 7**) outlays a simple index method to account for water quality in the design of SuDS. It indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment) that equals or exceeds the pollution hazard index.

6.2.26 The proposed development will be unmanned and will therefore have infrequent vehicle movements and no polluting activities are expected. Consequently, the site is considered to have a low pollution hazard level as per Table 26.2 in The SuDS Manual (**Ref 7**).

6.2.27 The pollution hazard indices for a low pollution hazard level and the mitigating indices relating to the selected SuDs component are listed in **Table 31**. The results indicate the use of filter drainage combined with a detention basin will provide adequate treatment of surface water runoff. As lined filter drains are proposed infiltration of runoff will not occur, consequently the hazard to groundwater has not been assessed for this component. The detention basin could be unlined, and some informal infiltration of runoff may occur. A check of mitigating indices based on the filtration capabilities of a detention basin SuDs component and underlying soil properties indicate runoff should be adequately treated before entering ground water systems.

Table 31: Pollution Hazard and Mitigation Indices

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Theddlethorpe Facility	Low	0.5	0.4	0.4
SuDs Mitigation Indices for Discharge to Surface Water				
SuDs Component		**TSS**	**Metals**	**Hydrocarbons**
Filter Drain		0.4	0.4	0.4
Detention Basin		0.5	0.5	0.6
Total SuDs Mitigation Index[1]		0.65	0.65	0.7
SuDs Mitigation Indices for Discharge to Ground Water				
Characteristics of material overlaying SuDs		**TSS**	**Metals**	**Hydrocarbons**
Layer of dense vegetation underlain by a soil with good contamination attenuation potential of at least 300mm in depth		0.6	0.4	0.6

[1] Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required:

Total SuDs Mitigation Index = mitigation index $_1$ + 0.5 (mitigation index $_2$)

Operation and Maintenance

6.2.28 An adopting party is to be agreed with the relevant the LLFA and any relevant stakeholders. It is likely the asset owner will be responsible for the maintenance of drainage components.

6.2.29 A key objective of the adoption process is to ensure that any installed SuDS can be maintained easily over the development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out details on the constructed SuDs and the inspection and maintenance required. This document should be developed at full detailed design but considered throughout the design process. The Operation and Maintenance details considered at this concept design stage are noted below.

6.2.30 Maintenance activities should be conducted in accordance with industry best practice e.g. CIRIA SuDS Manual. The drainage system proposed at Theddlethorpe Facility should be inspected at defined intervals and before and after major storm events. The proposed SuDs will require a maintenance regime including grass cutting, removal of sediment build up at and clearance of the outfalls at defined intervals. The proposed SuDs features are proposed to be shallow and allow easy access. The filter drains and permeable gravel sections of the site are deemed to have a low risk of sediment build up. The proposed system design life will likely meet the site design life with an adequate inspection and maintenance regime.

7 Theddlethorpe Facility Option 2

7.1 Desktop Study – Theddlethorpe Facility Option 2

Introduction

7.1.1 There are currently two options considered for the location of the Theddlethorpe Facility. This section considers Option 2:

- **Theddlethorpe Facility Option 2**: new facility to the west of the former TGT site, located on arable land directly west of The Cut (an ordinary watercourse). This facility would be accessed from the north off the A1031 Mablethorpe Road. (X 548175 Y 387586).

7.1.2 For Option 2 the existing LOGGS pipeline would be extended to the new site to the west using sections of 36" pipeline.

7.1.3 The Theddlethorpe Facility is required to enable the CO_2 to flow from the new 24" pipeline into the existing LOGGS (36") pipeline.

7.1.4 An indicative layout of the Theddlethorpe Facility would comprise the following key components:

- LOGGS pipeline tie-in;
- Emergency Shutdown Valves;
- Pig receiver and launcher;
- High-integrity Pressure Protection System;
- Venting system including vent pipework, valves, and vent stack; and
- Local equipment room (LER); and
- Supporting Infrastructure.

7.1.5 The Theddlethorpe Facility would be secured by a single palisade security fence 3.2 m high.

7.1.6 The ground surface within the boundary of the Theddlethorpe Facility will be predominantly stone with a minimal number of internal tarmac/concrete access roads.

7.1.7 The Theddlethorpe Facility Option 2 is located within an agricultural field west of the Viking Gas Terminal. The field is bounded by the A1031, The Cut drainage channel and unnamed drainage channels to the south. See **Annex A** for **Figure 6 – Site Overview and Topography**.

Site Topography

7.1.8 A topographical survey has not yet been undertaken for the Theddlethorpe Option 2. However, a review of available LiDAR information has been undertaken and indicates the site is relatively flat. Levels on site sit at approximately 1.5 mAoD. The site topography is shown on **Figure 6, Annex A**.

Local Hydrology

7.1.9 The main river watercourse that is situated closest to the site location is the Great Eau (approx. 2.5km west).

7.1.10 Drainage ditches follow most of the field boundary including The Cut running to the north and east of the site. The current site is likely to drain surface water informally or via land

drainage into the cut or other field boundary drainage ditches. A plan of IDB maintained assets in the site vicinity has been provided in **Annex D**.

7.1.11 The Environment Agency flood maps indicates the site has a medium risk of flooding (between 1 in 100 year/0.1% AEP and 1 in 30 year/3.3% AEP each year) from rivers or the sea. The site has a very low risk of flooding from surface water (1 in 1000 year /0.1% each year).

Ground Conditions, Ground water and Infiltration

7.1.12 A review of the BGS Geology Viewer indicates the bedrock geology is Burnham Chalk Formation with superficial deposits classed as Tidal Flat Deposits of clay and silt.

7.1.13 The site underlaying strata is classified as Principal Bedrock Aquifer and an unproductive Superficial Drift Aquifer. The site sits in a low ground water vulnerability area.

7.1.14 The BGS borehole records of holes drilled within the field boundary indicates the geological sequence from ground level is varying descriptions of silty clay. A bedrock of Chalk was hit at approximately 129 feet (39m) below ground level.

7.1.15 A review of the Soil-Scapes layer on Magic maps indicates the site is situated in an area of loamy and clayey soils of coastal flats with naturally high groundwater. The drainage type is described as naturally wet. The site is not located in a Source Protection Zone.

7.1.16 Following the description of surface geology above it is not recommended to discharge surface water via infiltrating methods.

Existing Utilities

7.1.17 A desktop study was undertaken by GroundSure to gather available utility information from providers. This was submitted to AECOM as an AutoCAD DWG file covering the pipeline alignment and a buffer area either side. The DWG information indicates there is no known utilities within the site boundary.

7.2 Surface Water Drainage Strategy – Theddlethorpe Facility Option 2

Contributing Areas and Runoff Calculation

7.2.1 The contributing area has been measured from a scheme layout drawing produced by Kent Energies Ltd (drawing number: EN070008/APP/4.8). The proposed impermeable and permeable areas are summarised in

7.2.2 **Table** 32.

7.2.3 The site will be predominantly permeable with unpaved areas to be graded to natural ground levels overlain with weed control membrane and 75 mm of 20mm single size gravel.

7.2.4 A facility access road spurring from the Mablethorpe Road will be constructed to enable construction access to the site. The access track is to be retained post construction and will be constructed with an impermeable surface. For this study it is assumed the track will be 8m wide, to be confirmed at a future design stage.

7.2.5 Access roads are proposed to surround the site area. Within the fence line boundary two splayed roads are proposed to allow access to the Pig Launch areas. Both the pig launch areas and high-integrity pressure protection system area will sit upon concrete pads. Four kiosks with flat roofs will also be situated within the site boundary sat upon concrete bases. A 10m planting strip is proposed around the Theddlethorpe Facility Option 2 perimeter which will continue to drain naturally and is not included in the drainage catchment area.

7.2.6 The sites will be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces will be constructed to falls so that rainwater can drain to any proposed drainage system. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. Most of the site will be permeable surfacing to minimise runoff. A cut-off drainage channel maybe required at the site entrance gate to control runoff onto site.

Table 32: Drainage Catchment Area Take-Off

Ref	Surface Type	Area (m^2)	Comment
Total Site Area	N/A	20345	Access road and area within fenceline
Stone area	Permeable	12385	The majority of ground surface within the fenceline is to be stone aggregate within the access roads
Roads Inside Theddlethorpe Facility Option 2 Fenceline	Impermeable	3310	Access turning and parking is proposed to access the pig handling area and site
Road Access from Mablethorpe Road	Impermeable	4180	8m Wide access between the Theddlethorpe Facility Option 2 and Mablethorpe Road
Roofs	Impermeable	215	4 buildings are proposed including Central Control Room, Local Equipment Room, Analyser House and Metering Package Hold
Concrete Pad	Impermeable	255	High-integrity pressure protection system and pig handling area are assumed to be sited on concrete pads or similar impermeable ground
Totals		**m^2**	**ha**
Total Impermeable Area		7960	0.796
Total Permeable Area		12385	1.238
Total Contributing area (impermeable area)		7960	0.796

Greenfield Runoff

7.2.7 The greenfield runoff rates for the proposed Theddlethorpe Facility have been calculated based on the IH124 method using the HR Wallingford UK SuDS website. The greenfield runoff rates for a 50ha area were calculated using this method. A summary of the results can be seen in the calculation report found in **Annex B**, with the peak greenfield runoff rates for the total contributing area interpolated from the results shown in **Table 33**.

Table 33: Peak Greenfield Runoff Rate

Rainfall Event Frequency	Runoff (l/s/ha)	Site Contributing Area (0.378ha, discounting the access road) GF Runoff l/s	Site Contributing Area (0.796ha, including the access road) GF Runoff l/s

1 in 1 Year (Approx. 99% AEP)	2.15	0.81	1.71
Qbar	2.47	0.93	1.97
1 in 30 Year (3.33% AEP)	6.05	2.29	4.82
1 in 100 Year (1% AEP)	8.79	3.32	7

Proposed Surface Water Runoff Rates

7.2.8 **Table 34** below shows the unrestricted surface water runoff rate post-development based on the Modified Rational Method. This method estimates runoff based on the nature of the ground surface (hardstanding, vegetation etc.) and rainfall depth, duration and frequency information for the immediate area, as follows:

- C (Coefficient of impermeability) = 1.0;
- A (area) = ha; 0.796; and
- i (Rainfall intensity based on FEH data (Ref 15)).

Table 34: Proposed Peak Runoff Rate

Rainfall Event Frequency	Duration								
	15 min	30 min	1 h	2 h	3 h	5 h	12 h	24 h	48 h
2 (50%)	95.60	52.22	32.00	20.64	15.66	10.90	5.54	3.17	1.83
5 (20%)	165.52	89.84	52.42	31.64	23.36	15.77	7.76	4.36	2.47
10 (10%)	213.68	116.57	66.90	39.29	28.68	19.11	9.31	5.19	2.92
30 (3.3%)	293.16	159.73	89.73	51.31	37.03	24.46	11.84	6.63	3.72
50 (2%)	330.16	180.08	100.53	56.99	41.02	27.04	13.14	7.42	4.18
100 (1%)	380.62	208.81	115.78	130.14	46.73	30.82	15.16	8.73	4.18
100 +20% CC	456.74	250.57	138.93	78.08	56.07	36.98	18.19	10.47	5.02
100 +40% CC	532.86	292.33	162.09	91.10	65.42	43.14	21.22	12.22	5.86

Surface Water Drainage Concept

7.2.9 As existing ground conditions suggests infiltration of surface water is not recommended, following the drainage hierarchy for discharge of surface water, the next favourable point of discharge is into a surface water body. An existing drainage channel (The Cut) runs to the east of the site and likely receives runoff from the existing field.

7.2.10 It is proposed to formally drain the hardstanding sections of the site including the access road and roof elements of kiosks via downpipes. There will be no change to the permanent land use or drained area within permeable gravel sections so the existing drainage principles will be maintained. Consequently, no formal drainage is proposed and gravel sections have not been considered as part of the contributing area.

7.2.11 Hardstanding areas (infrastructure foundations) are proposed to drain into proposed filter drains. The filter drains are to be installed with impermeable membrane to prevent the collection of ground water. A solid pipe branch will collect flows and convey them north and south for connection into a swale.

7.2.12 Swale channels aligned adjacent to the proposed access roads will collect surface water runoff and convey flow for connection into the detention basin. The basin will have a piped outlet connecting into The Cut with a flow control device controlling the discharge rate. Any restricted volume will be attenuated within the detention basin. An indicative drainage layout is shown on **Figure 12** in **Annex C**.

7.2.13 A site survey will be undertaken to understand if any land drainage systems exist beneath the site or within the vicinity before any on-site activities commence. Consideration of land drainage is required to ensure it is not disrupted by the construction of the facility. This will allow the facility and surrounding land to continue to drain as per the existing drainage regime with the incorporation of sustainable drainage.

7.2.14 A review of available water level records for The Cut should be undertaken to understand any impact on the proposed surface water system and local hydrology.

7.2.15 The components should be designed as shallow as possible to maintain an invert level above the local ground water level. The lifting of ground levels or implementing impermeable lining in some sections of drainage may be required to ensure this is possible. However, if existing land drainage exists the ground water level will be artificially lowered. Further investigation is recommended to understand local ground water levels across the site to understand any impact on proposed SuDs components.

Climate Change

7.2.16 A climate change allowance for the 30 year and 100 year events have been applied based on the Environment Agency Flood Risk Assessments: climate change allowances (2022) (Ref 14). The Theddlethorpe Facility Option 2 site falls within the Witham Management Catchment. It is noted a 25 year design life is proposed for the overall scheme. However, for this preliminary assessment it is assumed the civil engineering elements of the site will remain in place beyond 25 years potentially up to 75-100 years (estimated 2026 construction date) with onsite equipment being refurbished or replaced to continue operation. This would bring the expected lifetime of the development (not necessarily the operational life) beyond the year 2100 and consequently, a robust upper end climate change allowance has been adopted. This equates to a 35% uplift for a 30 year return period and 40% uplift for a 100 year return period as shown on Table 35.

Table 35: Witham Management Catchment Peak Rainfall Allowances (values used highlighted green)

Epoch	Central Allowance	Upper End Allowance
3.3% Annual Exceedance Rainfall Event		
2050s	20%	35%
2070s	25%	**35%**
1% Annual Exceedance Rainfall Event		
2050s	20%	40%
2070s	25%	**40%**

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

Design Parameters

7.2.17 The surface water discharge rate is to ideally be controlled to Qbar for events between Qbar (approximately 1 in 2 year event) and 1 in 100 year event.

7.2.18 Discussions with local IDB have confirmed greenfield discharge rates are preferred, however other rates and outlet sizes are considered on a mitigated, rational and evidential basis. The greenfield discharge rates calculated for the site will likely result in outlet diameters smaller than 50-75mm. The blockage risk is discussed further in the Hydraulic Calculation section below. A check at a future design stage is required to confirm the outlet size required for the necessary flow control and the risk of blockage.

7.2.19 The proposed surface water attenuation is to be designed to accommodate a 1 in 100 year design storm event (1% AEP) plus a 40% climate change allowance with no surface water flooding on the site. No water will be stored above ground up to and including the 1 in 100 year event unless stored in a SuDs component.

7.2.20 Catchment descriptors and rainfall data has been downloaded from the Flood Estimation Handbook (FEH) web service (Ref 15) for use in calculations within this report.

Hydraulic Calculations

7.2.21 An InfoDrainage quick storage estimate calculation has been undertaken to understand attenuation requirements against a 1 in 100-year storm event. The calculation is based on a 0.93l/s Qbar discharge rate, a 0.378ha drained area (excluding the access road served by swale conveyance and attenuation) and includes a 40% climate change uplift. The default Summer Winter Cv values in InfoDrainage have been used (0.750/0.840). The results predict an attenuation storage volume of 361m^3 to 442m^3 is required (these results are estimates only and should not be used for design purposes). An average of the two values (401m^3) has been used for the purposes of this concept strategy.

7.2.22 An orifice flow control outlet diameter to restrict flow to a 0.93l/s outflow will likely be under 50-75mm and could be at risk of blockage without protection. To prevent blockage a granular fill could be placed around the outlet to filter out sediment and debris and also prevent vegetation growth. Alternatively, a Hydrobrake arrangement could be used. However, preliminary calculations using Hydro-International's online Hydrobrake design tool suggests the outlet diameter will be approximately 52mm with a 0.5m head and a Qbar discharge rate. The risk of blockage could be deemed reduced by using a Hydrobrake with the device being contained within a chamber with a sump in comparison with a standard orifice.

7.2.23 It is proposed to control the discharge rate as close to Qbar as reasonably practicable to prevent maintenance issues. This may require a discharge rate above the proposed greenfield rate but still controlled to a rate where detrimental flows are unlikely to be passed off site. Further investigation at a future design stage is recommended to understand an acceptable allowable discharge rate and flow control device.

7.2.24 The swales serving the access track from Mablethorpe Road (A1031) are proposed to act as attenuation storage with a restricted flow discharge. The available storage volume will likely accommodate the predicted water volume for a 1 in 100 year storm event + climate change as shown in **Table 36**, but may require some minor shallow storage/ground lowering in land adjacent (to be confirmed at a future design stage). The corresponding outlet size to control the flow at a greenfield rate would likely be below 50-75mm and be at risk of blockage. Alternatively, it is proposed to use permeable check dams along the swales length and end to slow the flow rate entering the watercourse. A Darcy's Law calculation was undertaken to understand horizontal flow through a granular check dam. A 0.2l/s flow is predicted for a 400 deep, 0.5m base width, 1:4 Side slope channel with a 1 in 250 fall. This method of flow control should be investigated in further detail at a future design stage. It is

proposed to reduce the discharge rate as close to Qbar as reasonably practicable to prevent maintenance issues. As the local ground levels are flat one long continuous channel would result in a deep and wide channel to maintain a gradient capable of conveyance. Alternatively, the channel should be split into segments to keep the channel depth shallow and discharge at multiple small channel outlets. If it is possible to remove the need for an impermeable road access surface, it is recommended to use a permeable surface and remove the need for proposed formal drainage.

Table 36: Proposed Surface Water Access Road Swales 1 in 100 Year Event + CC

Post construction Runoff. 15 min 100 yr +40%cc Rational Method (l/s)	Greenfield Runoff Bridge Area North /Qbar Restriction Rate	Contributing Area (ha)	Restriction Rate via Granular Check Dam (l/s)	Storage Vol Req (m3)
92	0.34	0.137	0.20	159

Sustainable Drainage Systems and Water Quality

7.2.25 CIRIA C753 The SuDS Manual (**Ref 7**) outlays a simple index method to account for water quality in the design of SuDS. It indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment) that equals or exceeds the pollution hazard index.

7.2.26 The proposed development will be unmanned and will therefore have infrequent vehicle movements and no polluting activities are expected. Consequently, the site is considered to have a low pollution hazard level as per **Table 37** in The SuDS Manual (**Ref 7**).

7.2.27 The pollution hazard indices for a low pollution hazard level and the mitigating indices relating to the selected SuDs component are listed in **Table 37**. The results indicate the use of swales will provide adequate treatment of surface water runoff. As unlined swales are proposed some informal infiltration of runoff may occur. A check of mitigating indices based on the filtration capabilities of the chosen SuDs component and underlying soil properties indicate runoff should be adequately treated before entering ground water systems.

Table 37: Pollution Hazard and Mitigation Indices

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Theddlethorpe Option 2	Low	0.5	0.4	0.4
SuDs Mitigation Indices for Discharge to Surface Water				
SuDs Component		**TSS**	**Metals**	**Hydrocarbons**
Swale		0.5	0.6	0.6
Attenuation storage		0.5	0.5	0.6
Total SuDs Mitigation - Index Access Roads[1]		**0.75**	**0.85**	**0.9**
Filter Drain		0.4	0.4	0.4
Attenuation storage		0.5	0.5	0.6

Pollution Hazard Indices				
Location	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Total SuDs Mitigation Index - Theddlethorpe Option 2[1]		**0.65**	**0.65**	**0.7**
SuDs Mitigation Indices for Discharge to Ground Water				
Characteristics of material overlaying SuDs		**TSS**	**Metals**	**Hydrocarbons**
Layer of dense vegetation underlain by a soil with good contamination attenuation potential of at least 300mm in depth		**0.6**	**0.5**	**0.6**

[1] Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required:

Total SuDs Mitigation Index = mitigation index $_1$ + 0.5 (mitigation index $_2$)

Operation and Maintenance

7.2.28 An adopting party is to be agreed with the relevant the LLFA and any relevant stakeholders. It is likely the asset owner will be responsible for the maintenance of drainage components.

7.2.29 A key objective of the adoption process is to ensure that any installed SuDS can be maintained easily over the development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out details on the constructed SuDs and the inspection and maintenance required. This document should be developed at full detailed design but considered throughout the design process. The Operation and Maintenance details considered at this concept design stage are noted below.

7.2.30 Maintenance activities should be conducted in accordance with industry best practice e.g. CIRIA SuDS Manual. The drainage system proposed at Theddlethorpe Facility should be inspected at defined intervals and before and after major storm events. The proposed SuDs will require a maintenance regime including grass cutting, removal of sediment build up at and clearance of the outfalls at defined intervals. The proposed SuDs features are proposed to be shallow and allow easy access. The filter drains and permeable gravel sections of the site are deemed to have a low risk of sediment build up. The proposed system design life will likely meet the site design life with an adequate inspection and maintenance regime.

8 Drainage Strategy Conclusion

Immingham Facility

8.1.1 Infiltration of surface water runoff is not deemed achievable based on a review of available geological information. Consequently, runoff from the site will be discharged to the re-aligned existing drainage channel via swales, filter drains and a detention basin. Discharge rates from attenuation areas should be restricted to greenfield runoff rates where possible.

8.1.2 Further investigation is recommended to understand the impact of ground water on the site and proposed drainage systems to ensure SuDs components are not detrimentally impacted. Testing could include ground water level monitoring.

8.1.3 A review of any available water level records for existing IDB drainage channels should be undertaken to understand any impact on the proposed surface water system and local hydrology.

Washingdales Lane Block Valve Station

8.1.4 Infiltration of surface water runoff could be possible based on a review of available geological information. Consequently, runoff from the site is proposed to be discharged via an infiltration trench.

8.1.5 The suitability of infiltration should be confirmed through site testing (trial holes, infiltration tests to BRE365 and ground water level monitoring). Site investigation is recommended to understand the site infiltration rate, assess ground conditions/ inspect for contamination and check any potential adverse ground water that would impact upon infiltration SuDs components.

8.1.6 Further investigation is recommended to understand the impact of ground water on the site and proposed drainage systems to ensure SuDs components are not detrimentally impacted. Testing could include ground water level monitoring.

8.1.7 A site survey would be undertaken prior to the commencement of any on-site works to understand if any land drainage systems exist beneath the site or within the vicinity. Consideration of land drainage is required to ensure it is not disrupted by the construction of the Washingdales Lane Block Valve Station.

Thoroughfare Block Valve Station

8.1.8 Infiltration of surface water runoff is not deemed achievable based on a review of available geological information. Consequently, runoff from the site will be discharged to field edge drainage channels. Discharge rates from detention basin areas should be restricted to greenfield runoff rates where possible.

8.1.9 Further investigation is recommended to understand the impact of ground water on the site and proposed drainage systems to ensure SuDs components are not detrimentally impacted. Testing could include ground water level monitoring.

8.1.10 A site survey would be undertaken prior to the commencement of any on-site works to understand if any land drainage systems exist beneath the site or within the vicinity. Consideration of land drainage is required to ensure it is not disrupted by the construction of Thoroughfare Block Valve Station.

Louth Road Block Valve Station

8.1.11 Infiltration of surface water runoff is not deemed achievable based on a review of available geological information. Consequently, runoff from the site will be discharged to field edge

drainage channels. Discharge rates from detention basin areas should be restricted to greenfield runoff rates where possible.

8.1.12 Further investigation is recommended to understand the impact of ground water on the site and proposed drainage systems to ensure SuDs components are not detrimentally impacted. Testing could include ground water level monitoring.

8.1.13 A site survey would be undertaken prior to the commencement of any on-site works to understand if any land drainage systems exist beneath the site or within the vicinity. Consideration of land drainage is required to ensure it is not disrupted by the construction of the Louth Road Block Valve Station.

Theddlethorpe Facility Option 1

8.1.14 Infiltration of surface water runoff is deemed to be unachievable based on a review of available geological information. Two options have been considered for the control and discharge of surface water from site including:

- **Drainage Option A SW Sea Pump in Service** – drain surface water from all proposed roads and hardstanding to the pumping station utilising the existing closed system. There is an increase in permeable area drained to the existing land drainage system and consequently The Cut. The additional permeable area may require controlling to ensure the existing system capacity is not overwhelmed and check the existing discharge rate at outfall is not exceeded.
- **Drainage Option B SW Sea Pump Out of Service** - The proposed impermeable area runoff is to be attenuated to a greenfield runoff rate and discharged into the existing land drainage system. The catchment area also accounts for an increase of permeable area runoff that would have discharged to sea via pump from previously hardstanding areas.

8.1.15 A site survey would be undertaken prior to the commencement of any on-site works to understand the existing drainage systems on site to allow either of the options above to be taken forward. This information is also required to understand its depth to enable a connection with the proposed drainage and its drainage capacity.

8.1.16 Future site development proposals for the wider TGT should be confirmed. This will allow a combined drainage design for the whole site to be developed including the Theddlethorpe Facility Option 1 considered in this report.

8.1.17 Further investigation is recommended to understand the impact of ground water on the site and proposed drainage systems to ensure SuDs components are not detrimentally impacted. Testing could include ground water level monitoring.

Theddlethorpe Facility Option 2

8.1.18 Infiltration of surface water runoff is deemed to be unachievable based on a review of available geological information. Consequently, runoff from the site will be discharged to an existing drainage channel known as The Cut via swales, filter drains and a detention basin. Discharge rates from detention basin areas should be restricted to greenfield runoff rates where possible.

8.1.19 Further investigation is recommended to understand the impact of ground water on the site and proposed drainage systems to ensure SuDs components are not detrimentally impacted. Testing could include ground water level monitoring.

8.1.20 A site survey would be undertaken prior to the commencement of any on-site works to understand if any land drainage systems exist beneath the site or within the vicinity. Consideration of land drainage is required to ensure it is not disrupted by the construction of the facility.

8.1.21 A review of available water level records for The Cut should be undertaken to understand any impact on the proposed surface water system and local hydrology.

Flow Discharge Rates

8.1.22 Discharge rates from the sites should be restricted to greenfield runoff rates. Where greenfield discharge rates are low and create a small flow control outlet diameter under 50-75mm there could be an unacceptable risk of blockage. Consequently, further investigation and liaison with the LLFA and IDB is required at a future design stage to determine acceptable flow controls and either protect small outlets or potentially increase discharge rates higher than greenfield but still controlled to a rate where detrimental flows are unlikely to be passed off site.

Assumptions and Limitations

The drainage design within this report has been developed against available site information and design details at the time of writing to provide a surface water drainage strategy. As part of further Front-End Engineering Design, this drainage design will be further developed and concluded in tandem with the overall scheme design development. Additional work will include a review of findings from investigations recommended in this report.

9 References

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Ref 2 *North Lincolnshire Council (2017).* SUDS and Flood Risk Guidance Document, Revision 1 [Online]. Available: https://www.northlincs.gov.uk/wp-content/uploads/2020/11/NLC-SuDS-Guidance-Published-document-aa.pdf [Accessed May 2023]

Ref 3 *UK Government (2021)*. National Planning Policy Framework. Available: https://www.gov.uk/guidance/national-planning-policy-framework [Accessed May 2023].

Ref 4 *Lincolnshire County Council (2018)*. Sustainable Drainage Design and Evaluation Guide [Online]. Available: https://www.lincolnshire.gov.uk/downloads/file/1951/sustainable-drainage-design-and-evaluation-guide-pdfa [Accessed May 2023].

Ref 5 *DEFRA (2015).* Sustainable Drainage Systems, Non Statutory Technical Standards for Sustainable Drainage Systems, [Online]. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf [Accessed May 2023].

Ref 6 *Land Drainage Consultancy Ltd (2023)*. Desk Study of Soils and Land Drainage, Viking Carbon Capture and Storage, LDC-UKOS-P-XX-P-EN-02-00001-A1.

Ref 7 *B. Woods Ballard, S. Wilson, H. Udale-Clarke, S. Illman, T. Scott, R. Ashley and R. Kellagher, CIRIA (2015).* "The SuDs Manual, C753".

Ref 8 *Environment Agency (2013).* Rainfall Runoff Management for Developments SC030219.

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Ref 10 *British Geological Survey (BGS) Geology Viewer (2023)*. [Online]. Available: [redacted] [Accessed May 2023].

Ref 11 *DEFRA (2023)* Magic Map [Online]. Available: https://magic.defra.gov.uk/MagicMap.aspx. [Accessed May 2023].

Ref 12 British Geological Survey (BGS) Borehole Records Viewer, [Online]. Available: [redacted] [Accessed May 2023].

Ref 13 HR Wallingford, "Greenfield runoff rate estimation - members," [Online]. Available: [redacted] [Accessed May 2023]

Ref 14 Environment Agency, "Flood risk assessments: climate change allowances," 2022. [Online]. Available: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-rainfall-intensity-allowance. [Accessed May 2023]

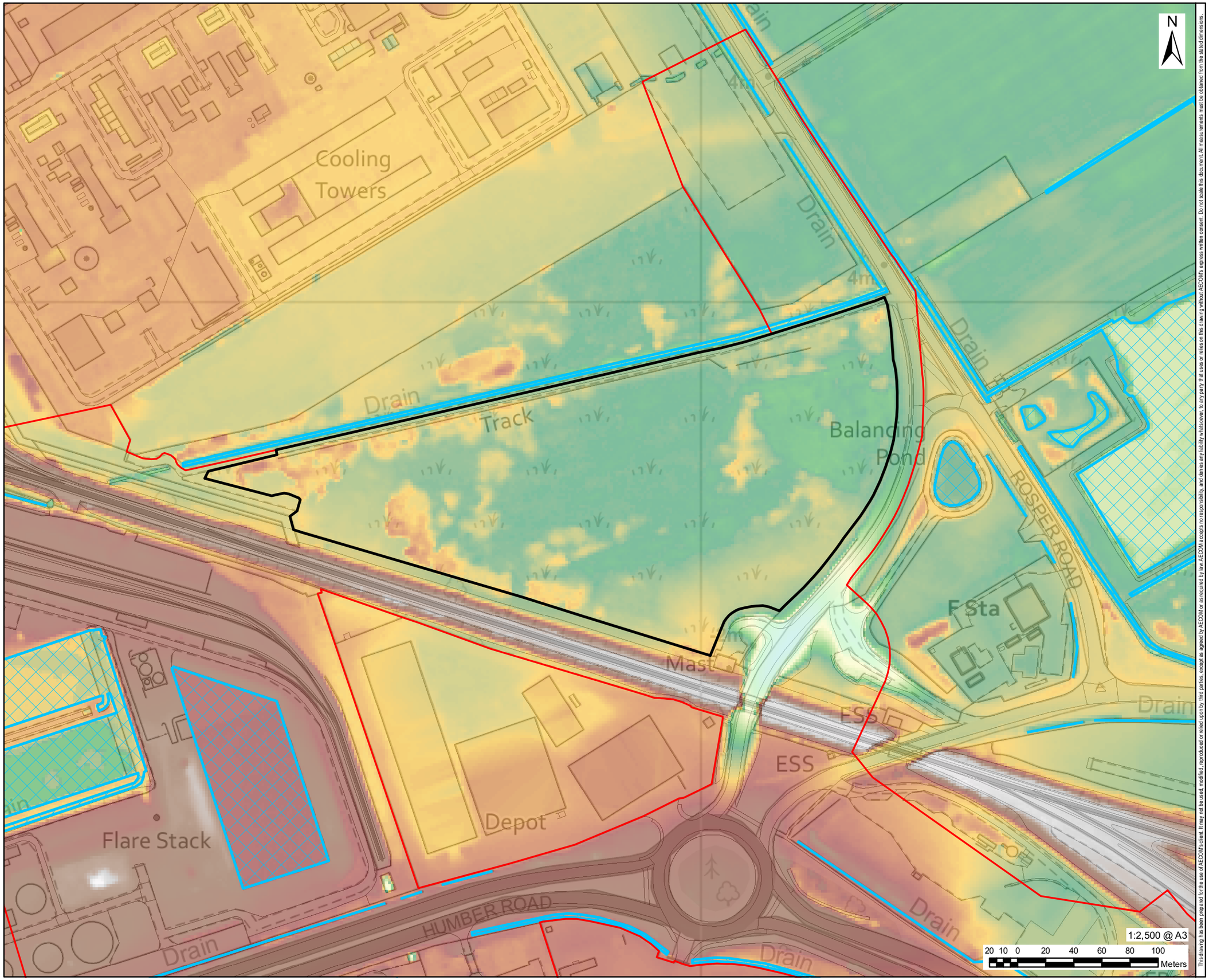
Ref 15 UK Centre for Ecology & Hydrology, "Flood Estimation Handbook Web Service," [Online]. Available: [redacted]. [Accessed May 2023]

Ref 16 Inland Waterways Association, "Louth Navigation", [Online]. Available: [redacted]. [Accessed May 2023]

Annex A – Site Plans

Revision: 1 Drawn: LC Checked: RS Approved: MW Date: 2023-06-01

Filename:\\eu.aecomnet.com\EMA\UK\UKNCL2\Jobs\60668955\V_Net_Zero_Project\900_CAD_GIS\920_GIS\02_Maps\Surface Water Drainage Strategy\VCCS_SWDS_1_Drainage_Plans_v1_20230601_LC.mxd



VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Reception Pipeline Facility
- Watercourse / Waterbody

Ground Elevation (m)
EA 2m Lidar DTM 2022
High : 10.17
Low : -0.05

NOTES:

FIGURE TITLE

Figure 1
Immingham Facility
Site Overview and Topography

ISSUE PURPOSE

SURFACE WATER DRAINAGE

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230601_SWDS_1

Revision: 1 Drawn: LC Checked: RS Approved: MW Date: 2023-06-01

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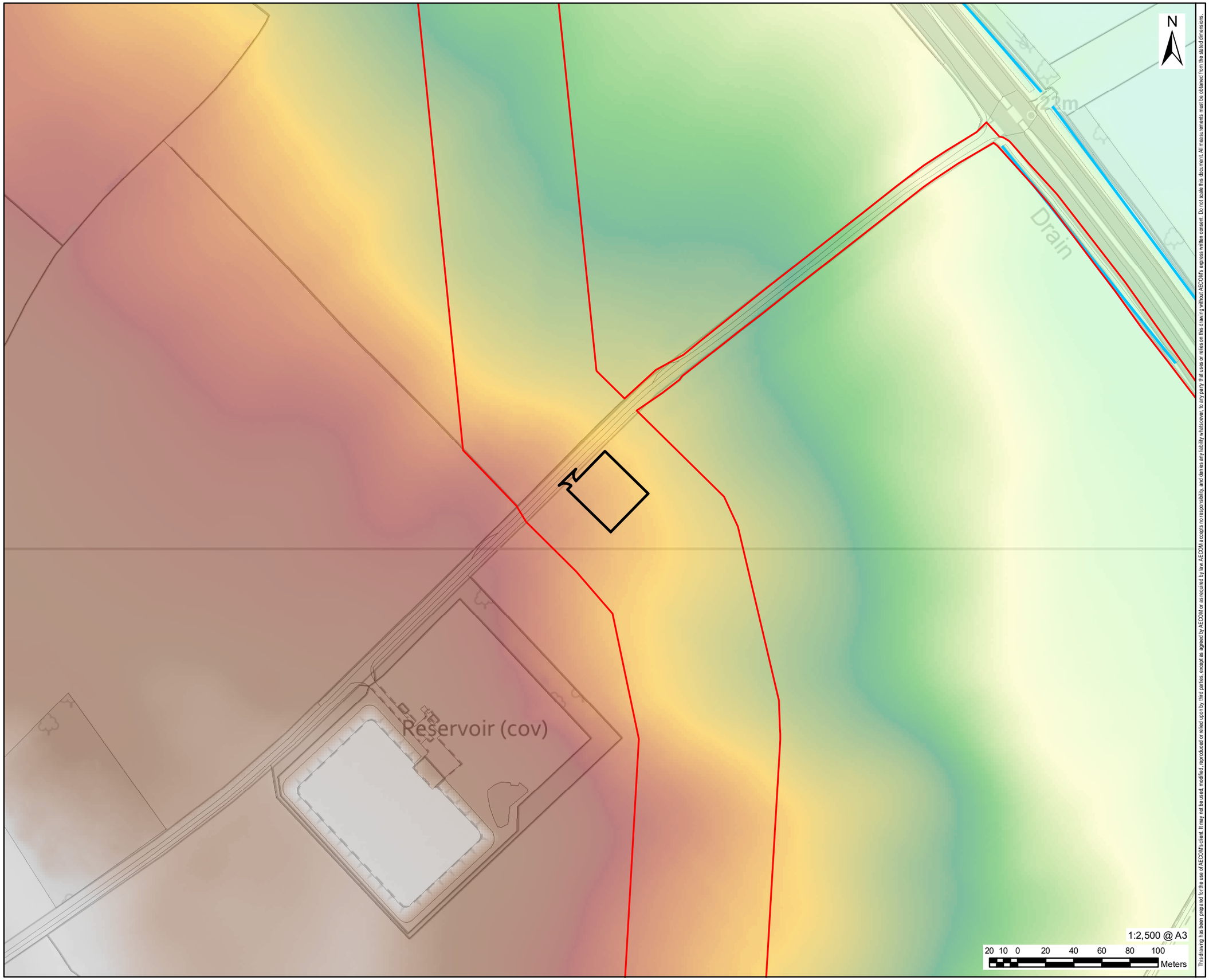

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Block Valve Station
- Watercourse / Waterbody

Ground Elevation (m)
EA 2m Lidar DTM 2022
High : 51.12
Low : 18.50

NOTES:

FIGURE TITLE

Figure 2
Washingdales Lane Block Valve Station
Site Overview and Topography

ISSUE PURPOSE

SURFACE WATER DRAINAGE

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230601_SWDS_2

Revision: 1 Drawn: LC Checked: RS Approved: MW Date: 2023-06-01

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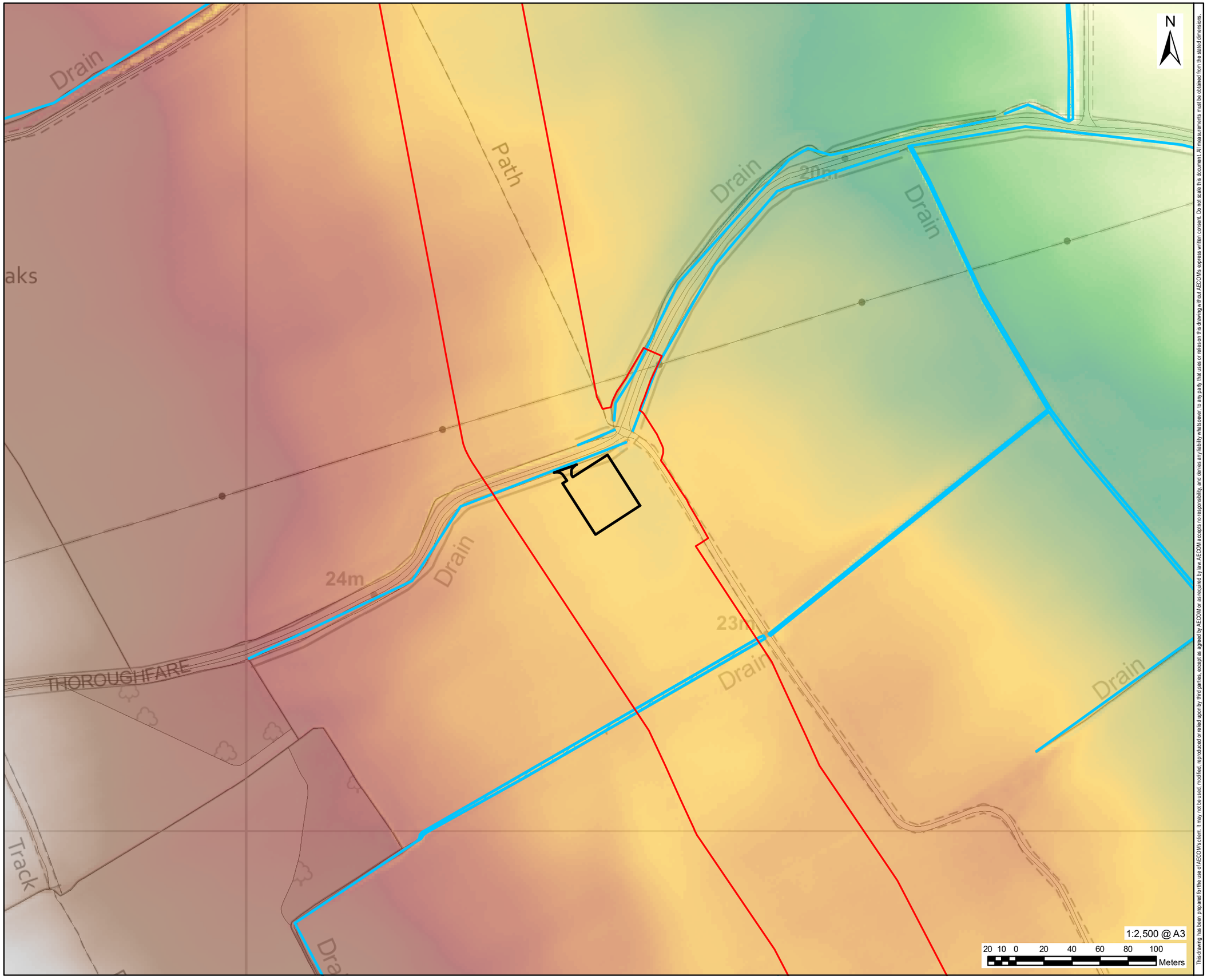

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Block Valve Station
- Watercourse / Waterbody

Ground Elevation (m)
EA 2m Lidar DTM 2022
High : 34.37
Low : 13.314

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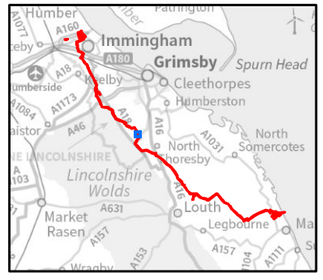

FIGURE TITLE

Figure 3
Thoroughfare Block Valve Station
Site Overview and Topography

ISSUE PURPOSE

SURFACE WATER DRAINAGE

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230601_SWDS_3

Revision: 1 Drawn: LC Checked: RS Approved: MW Date: 2023-06-01

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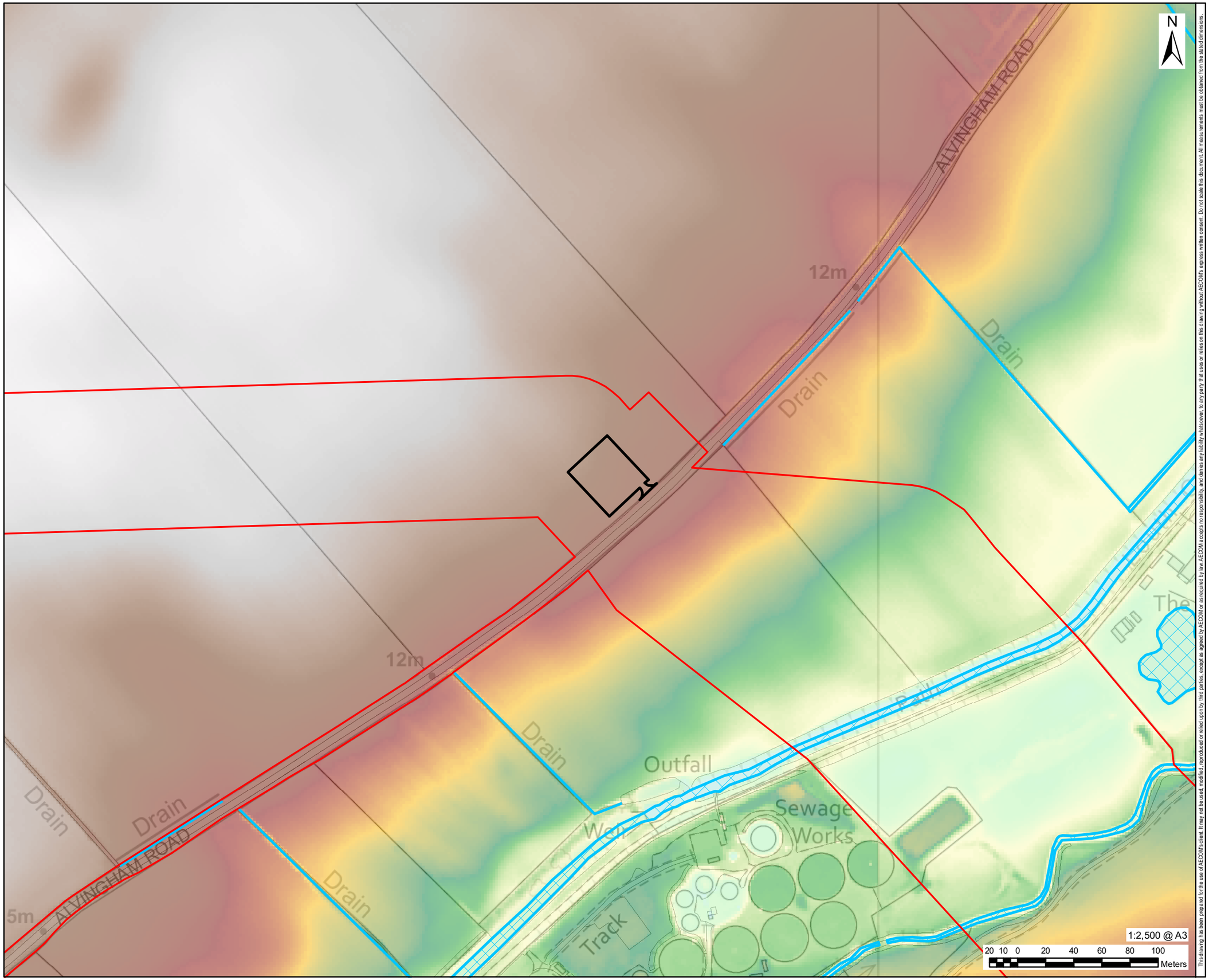

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Block Valve Station
- Watercourse / Waterbody

Ground Elevation (m)
EA 2m Lidar DTM 2022
High : 18.07
Low : 3.58

NOTES:

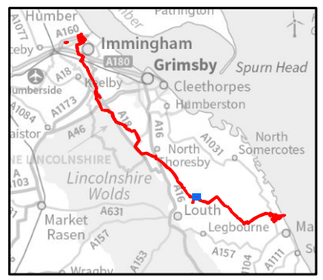

FIGURE TITLE

Figure 4
Louth Road Block Valve Station
Site Overview and Topography

ISSUE PURPOSE

SURFACE WATER DRAINAGE

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230601_SWDS_4

Revision: 1 Drawn: LC Checked: RS Approved: MW Date: 2023-06-01

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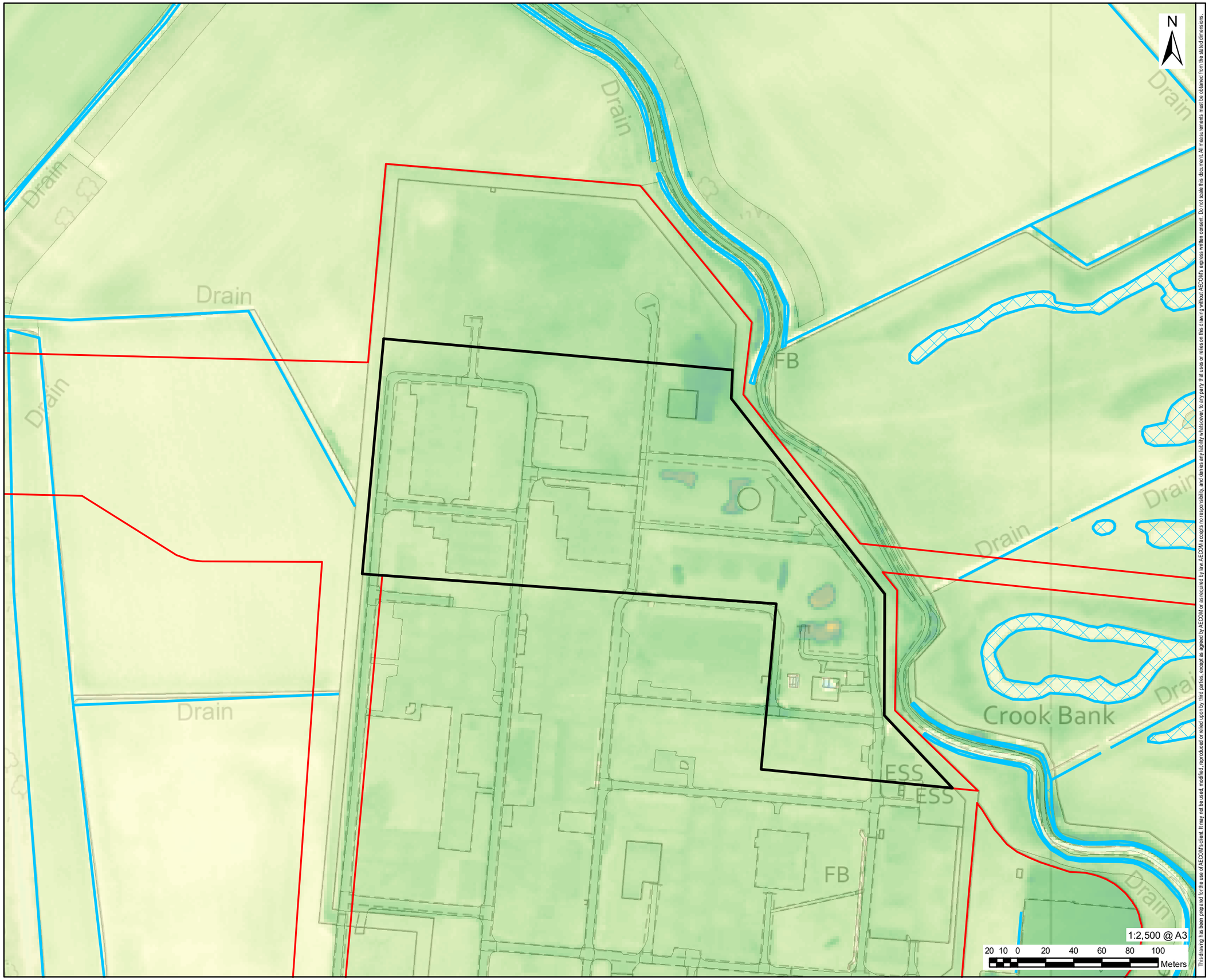

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Reception Pipeline Facility
- Watercourse / Waterbody

Ground Elevation (m)
EA 2m Lidar DTM 2022
High : 12.72
Low : -0.67

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FIGURE TITLE

Figure 5
Theddlethorpe Facility Option 1
Site Overview and Topography

ISSUE PURPOSE

SURFACE WATER DRAINAGE

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230601_SWDS_5

Revision: 1 Drawn: LC Checked: RS Approved: MW Date: 2023-06-01

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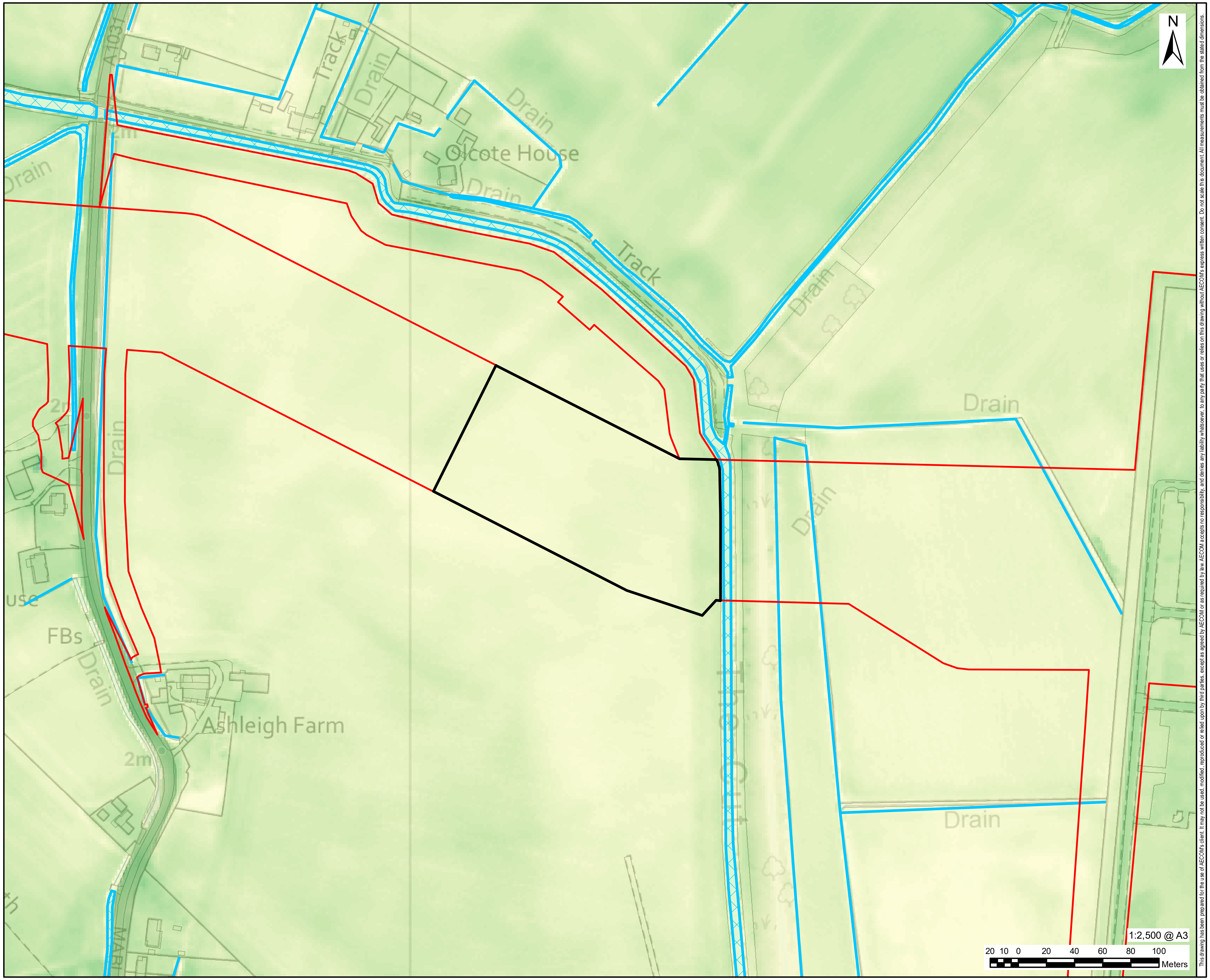

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Reception Pipeline Facility
- Watercourse / Waterbody

Ground Elevation (m)
EA 2m Lidar DTM 2022
High : 12.72
Low : -0.67

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FIGURE TITLE

Figure 6
Theddlethorpe Facility Option 2
Site Overview and Topography

ISSUE PURPOSE

SURFACE WATER DRAINAGE

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230601_SWDS_6

Annex B – GF Calculations

hr wallingford

Greenfield runoff
estimation for s

www.uksuds.com | Greenfield runc

Calculated by:	Robert Stansfield
Site name:	Immingham Facility
Site location:	Immingham

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.63439°
Longitude:	0.23223°
Reference:	3674750
Date:	May 25 2023 10:

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	50

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	619	619
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	124.39	124.39
1 in 1 year (l/s):	108.22	108.22
1 in 30 years (l/s):	304.75	304.75
1 in 100 year (l/s):	442.83	442.83
1 in 200 years (l/s):	523.68	523.68

hr wallingford

Greenfield runoff
estimation for s

www.uksuds.com | Greenfield runc

Calculated by:	Robert Stansfield
Site name:	Block Valve 1
Site location:	Aylesby

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.54693°
Longitude:	0.19801°
Reference:	37049085
Date:	May 25 2023 16:

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	50

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	645	645
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	219.35	219.35
1 in 1 year (l/s):	190.84	190.84
1 in 30 years (l/s):	537.42	537.42
1 in 100 year (l/s):	780.9	780.9
1 in 200 years (l/s):	923.48	923.48

hr wallingford

Greenfield runoff
estimation for s

www.uksuds.com | Greenfield runc

Calculated by:	Robert Stansfield
Site name:	Block Valve 2
Site location:	Ashby cum Fenby

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.48373°
Longitude:	0.09924°
Reference:	9895532
Date:	May 26 2023 15

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	50

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	646	646
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	219.75	219.75
1 in 1 year (l/s):	191.18	191.18
1 in 30 years (l/s):	538.39	538.39
1 in 100 year (l/s):	782.31	782.31
1 in 200 years (l/s):	925.15	925.15

hr wallingford

Greenfield runoff
estimation for s

Calculated by:	Robert Stansfield
Site name:	Block Valve 3
Site location:	Alvingham

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.39445
Longitude:	0.04107
Reference:	19164351
Date:	May 26 2023 15:

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	50

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	640	640
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	217.37	217.37
1 in 1 year (l/s):	189.11	189.11
1 in 30 years (l/s):	532.54	532.54
1 in 100 year (l/s):	773.82	773.82
1 in 200 years (l/s):	915.11	915.11

hr wallingford

Greenfield runoff
estimation for s

Calculated by:	Robert Stansfield
Site name:	Theddlethorpe Op 1
Site location:	Theddlethorpe

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.36379
Longitude:	0.23215
Reference:	7074267
Date:	May 26 2023 16:

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	50

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	615	615
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	123.45	123.45
1 in 1 year (l/s):	107.4	107.4
1 in 30 years (l/s):	302.45	302.45
1 in 100 year (l/s):	439.48	439.48
1 in 200 years (l/s):	519.72	519.72

hr wallingford

Greenfield runoff
estimation for s

Calculated by:	Robert Stansfield
Site name:	Theddlethorpe Op 2
Site location:	Theddlethorpe

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.36460
Longitude:	0.22490
Reference:	7252092
Date:	May 26 2023 16:

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	50

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	615	615
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

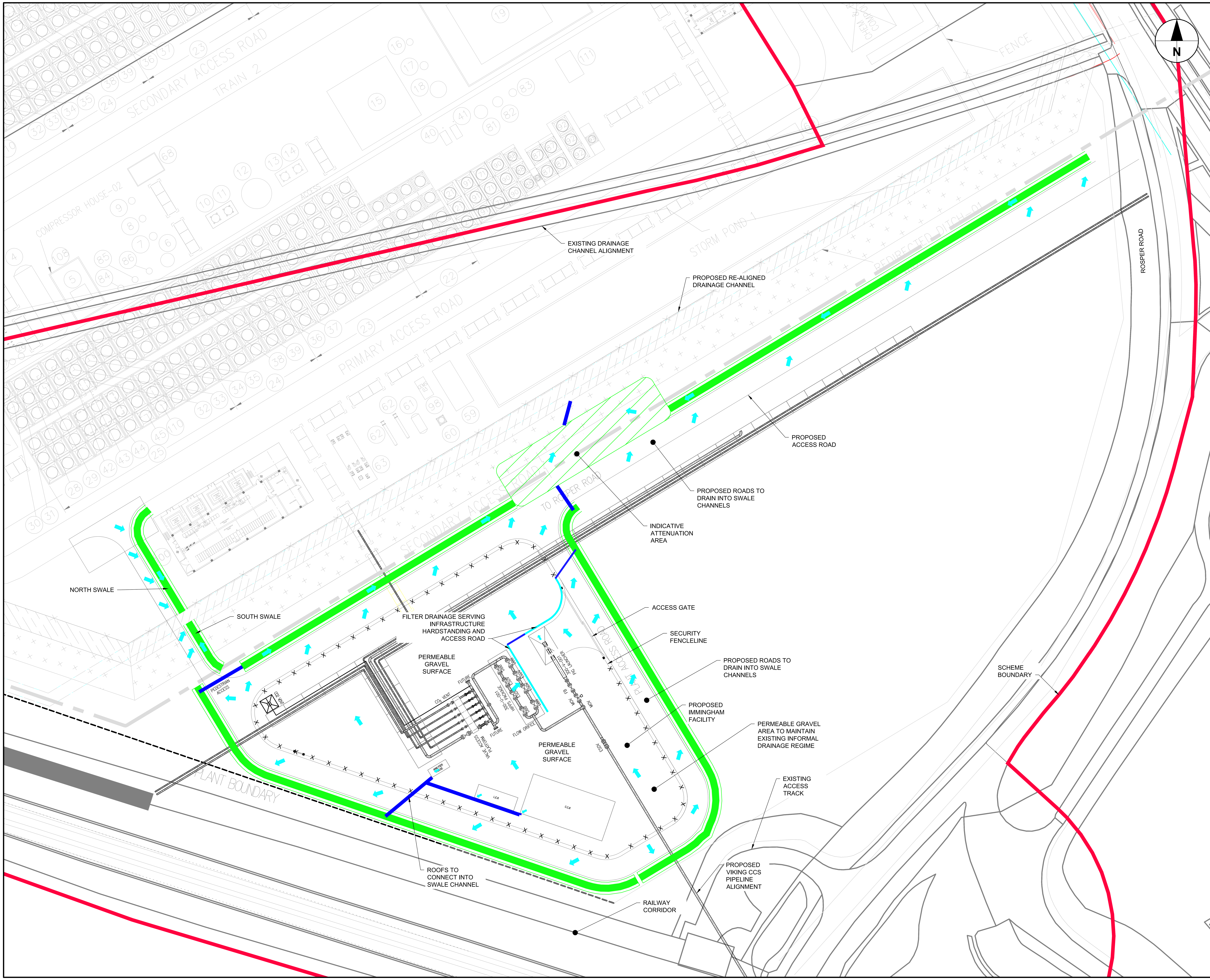
(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	123.45	123.45
1 in 1 year (l/s):	107.4	107.4
1 in 30 years (l/s):	302.45	302.45
1 in 100 year (l/s):	439.48	439.48
1 in 200 years (l/s):	519.72	519.72

Annex C - Proposed Drainage Plans



Project Management Initials: Designer: RS Checked: DAB Approved: NM Drawn: RS ISO A1 594mm x 841mm
Revision: A

Last saved by: STANSFIELDR(2023-07-19) Last Plotted: 2023-07-19
Filename:

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PROJECT

VIKING CCS PIPELINE

NOTES

1. DO NOT SCALE FROM DRAWING
2. DRAWING PRELIMINARY SKETCH FOR INFORMATION ONLY

LEGEND

- SWALE
- PIPE
- FILTER DRAINAGE
- ATTENUATION AREA
- FLOW DIRECTION
- KIOSK

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P1	30/05/2023	FOR INFORMATION

ISSUE PURPOSE / SUITABILITY

FOR INFORMATION ONLY

PROJECT NUMBER

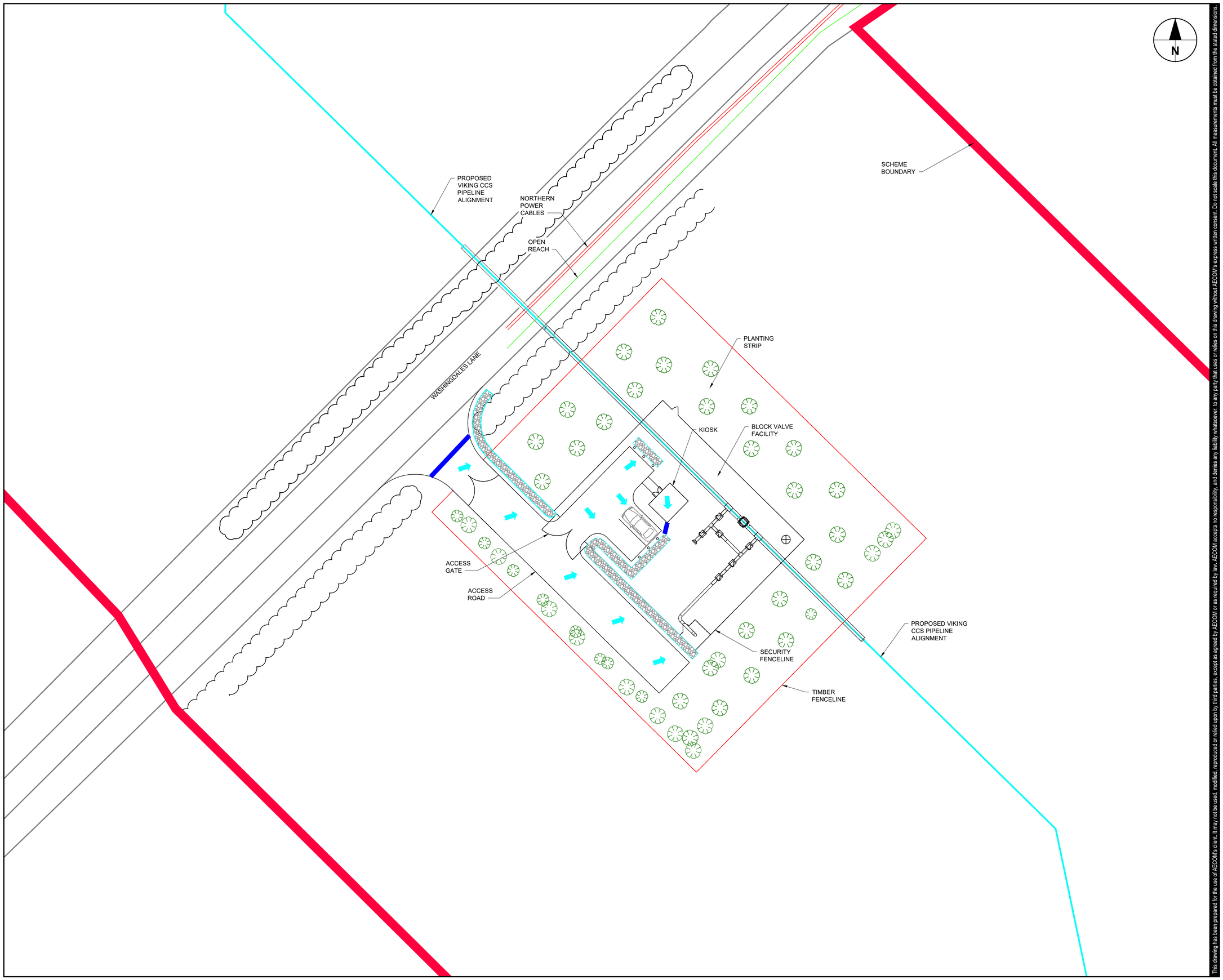
60668955

SHEET TITLE

VIKING CCS PIPELINE
SURFACE WATER DRAINAGE STRATEGY
IMMINGHAM FACILITY
DRAINAGE LAYOUT

FIGURE NUMBER

FIGURE 7



Project Management Initials:
Designer: RS
Checked: DAB
Approved: NM
Drawn: RS
ISO A1 594mm x 841mm
Revision: A

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Filename:

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PROJECT

VIKING CCS PIPELINE

NOTES

1. DO NOT SCALE FROM DRAWING
2. DRAWING PRELIMINARY SKETCH FOR INFORMATION ONLY

LEGEND

- LINEAR DRAIN
- INFILTRATION TRENCH
- OVERLAND FLOW DIRECTION

ISSUE/REVISION

P1	30/05/2023	FOR INFORMATION
I/R	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

FOR INFORMATION ONLY

PROJECT NUMBER

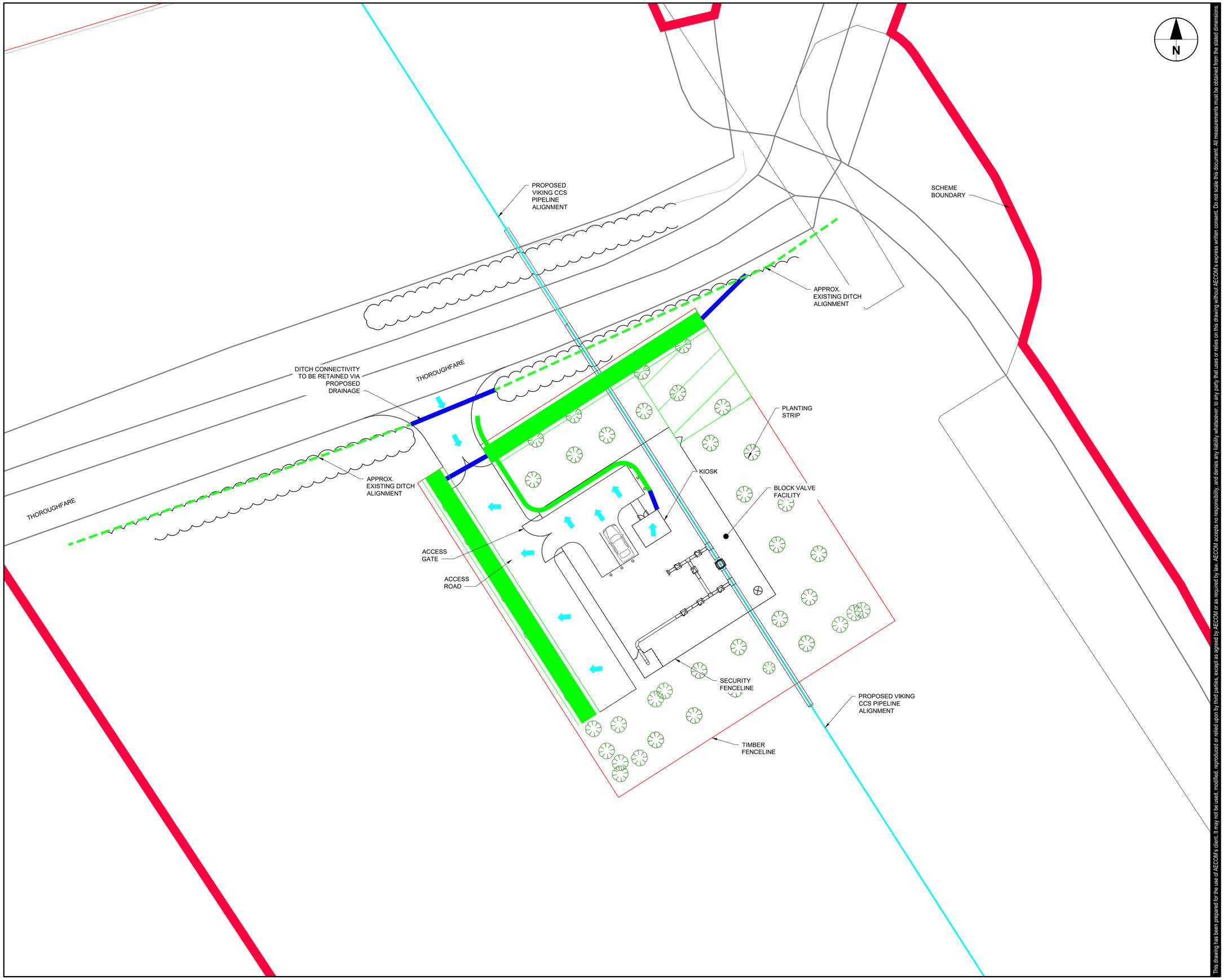
60668955

SHEET TITLE

VIKING CCS PIPELINE
SURFACE WATER DRAINAGE STRATEGY
WASHINGDALES LANE BLOCK VALVE 1
DRAINAGE LAYOUT

FIGURE NUMBER

FIGURE 8



Project Management Initials:
Revision: A
Designer: RS
Checked: DAB
Approved: NM
Drawn: RS
ISO A1 594mm x 841mm

Last saved by: STANSFIELDR(2023-07-19) Last Plotted: 2023-07-19
Filename:

AECOM

PROJECT

VIKING CCS PIPELINE

NOTES

1. DO NOT SCALE FROM DRAWING
2. DRAWING PRELIMINARY SKETCH FOR INFORMATION ONLY

LEGEND

- SWALE
- APPROX. EXISTING DITCH ALIGNMENT
- PIPE/LINEAR DRAIN
- ATTENUATION AREA
- OVERLAND FLOW DIRECTION

ISSUE/REVISION

P1	30/05/2023	FOR INFORMATION
I/R	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

FOR INFORMATION ONLY

PROJECT NUMBER

60668955

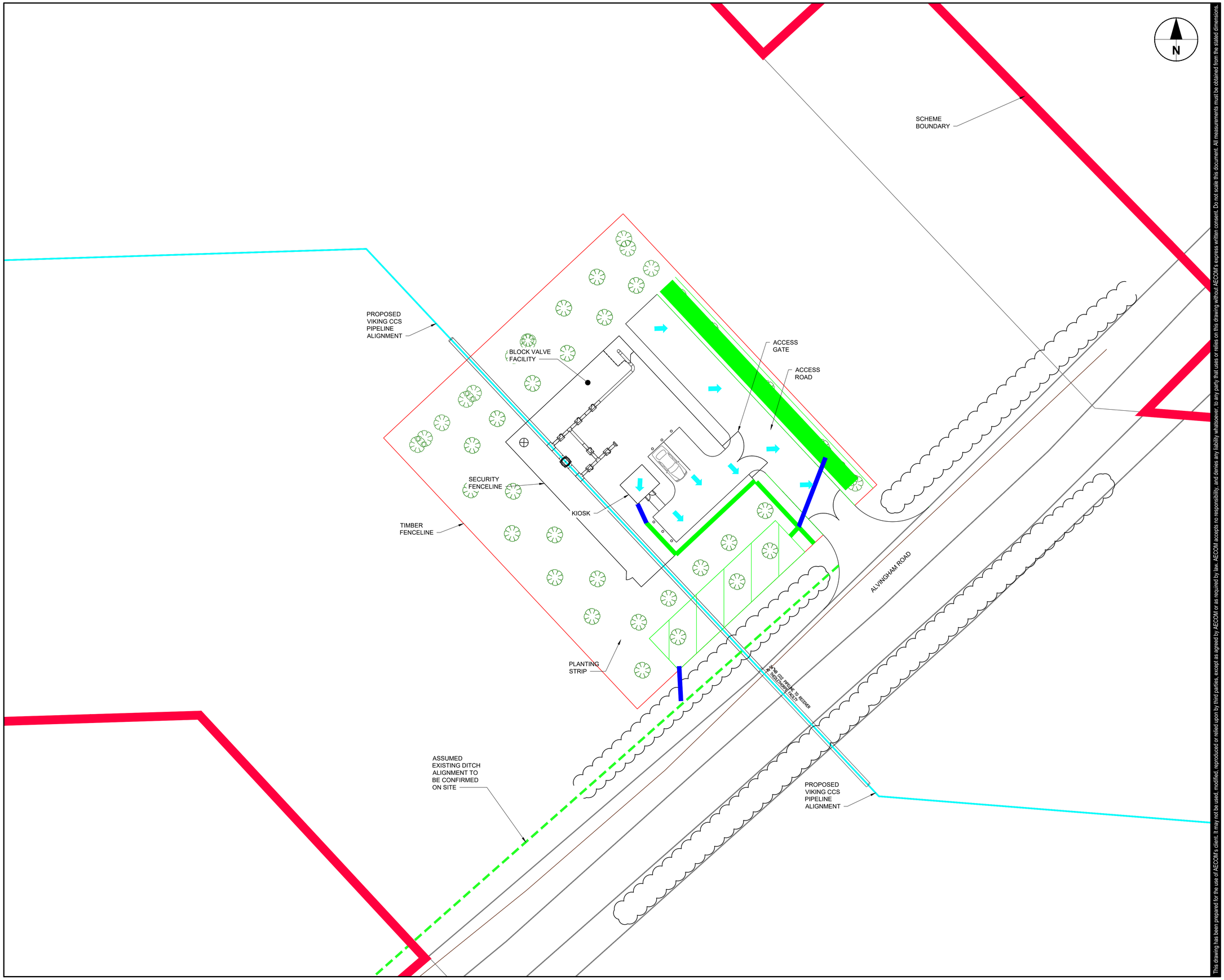
SHEET TITLE

VIKING CCS PIPELINE
SURFACE WATER DRAINAGE STRATEGY
THOROUGHFARE BLOCK VALVE 2
DRAINAGE LAYOUT

FIGURE NUMBER

FIGURE 9

Project Management Initials:
Designer: RS
Checked: DAB
Approved: NM
Drawn: RS
ISO A1 594mm x 841mm
Revision: A



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PROJECT

VIKING CCS PIPELINE

NOTES

1. DO NOT SCALE FROM DRAWING
2. DRAWING PRELIMINARY SKETCH FOR INFORMATION ONLY

LEGEND

- SWALE
- APPROX. EXISTING DITCH ALIGNMENT
- PIPE/LINEAR DRAIN
- ATTENUATION AREA
- OVERLAND FLOW DIRECTION

ISSUE/REVISION

P1	30/05/2023	FOR INFORMATION
I/R	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

FOR INFORMATION ONLY

PROJECT NUMBER

60668955

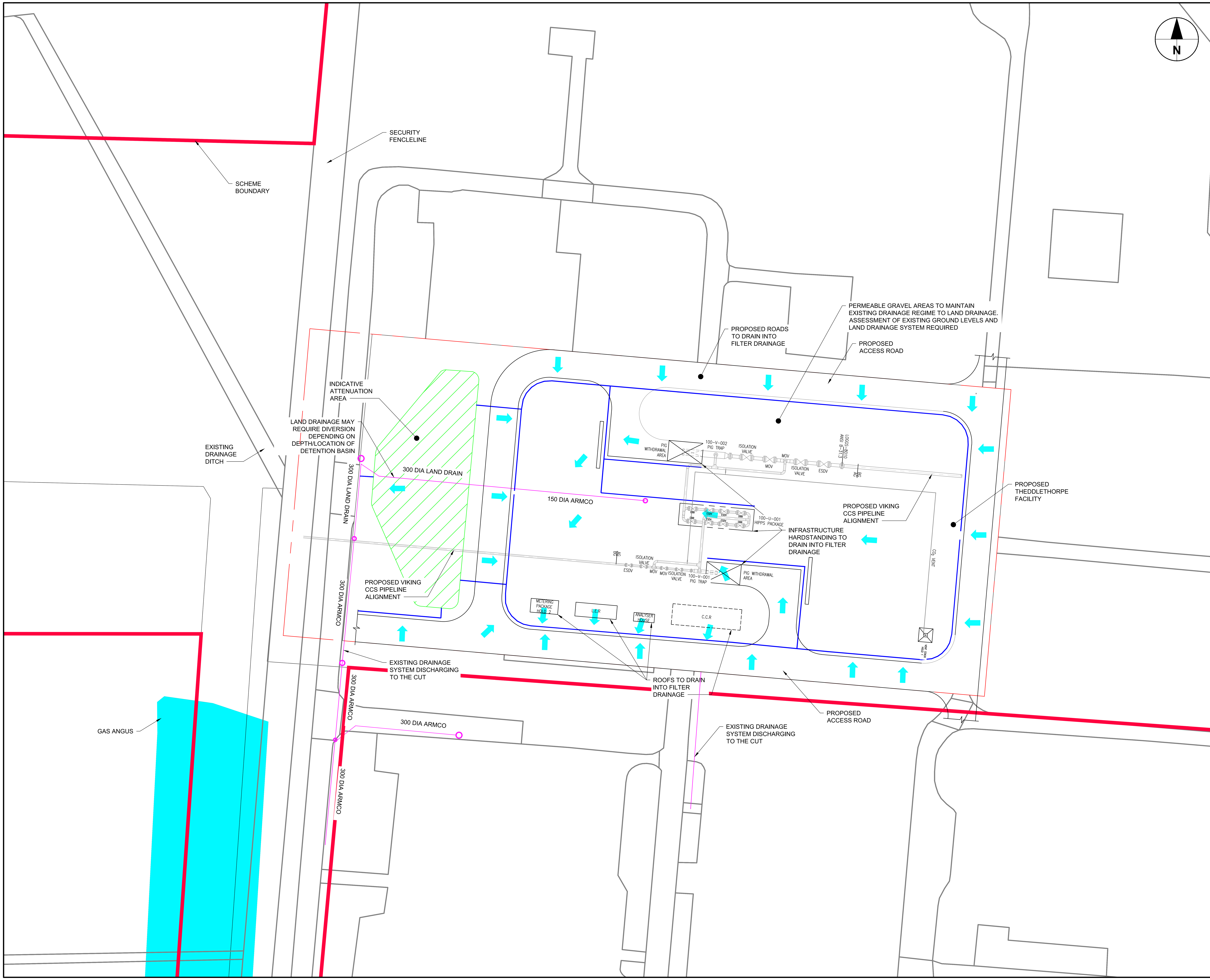
SHEET TITLE

VIKING CCS PIPELINE
SURFACE WATER DRAINAGE STRATEGY
ALVINGHAM ROAD BLOCK VALVE 3
DRAINAGE LAYOUT

FIGURE NUMBER

FIGURE 10

Last saved by: STANSFIELDR(2023-07-19) Last Plotted: 2023-07-19
Filename:



Project Management Initials: Designer: RS Checked: DAB Approved: NM Drawn: RS ISO A1 594mm x 841mm
Revision: A

Last saved by: STANSFIELDR(2023-07-19) Last Plotted: 2023-07-19
Filename:

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PROJECT

VIKING CCS PIPELINE

NOTES

1. DO NOT SCALE FROM DRAWING
2. DRAWING PRELIMINARY SKETCH FOR INFORMATION ONLY

LEGEND

FILTER DRAIN CONVEYANCE SYSTEM

EXISTING LAND DRAINAGE (INDICATIVE LOCATION)

ATTENUATION AREA

OVERLAND FLOW DIRECTION

ISSUE/REVISION

P1	30/05/2023	FOR INFORMATION
I/R	DATE	DESCRIPTION

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PROJECT NUMBER

60668955

SHEET TITLE

VIKING CCS PIPELINE
SURFACE WATER DRAINAGE STRATEGY
THEDDLETHORPE OPTION 1
DRAINAGE LAYOUT

FIGURE NUMBER

FIGURE 11

Project Management Initials:
Designer: RS
Checked: DAB
Approved: NM
Drawn: RS
ISO A1 594mm x 841mm
Revision: A

PROPOSED THEDDLETHORPE FACILITY

PROPOSED ROADS TO DRAIN INTO SWALE CHANNELS

PERMEABLE GRAVEL AREA TO MAINTAIN EXISTING INFORMAL DRAINAGE REGIME

PROPOSED CONSTRUCTION PHASE ACCESS TRACK (WIDTH AND ALIGNMENT ASSUMED)

8m

PROPOSED VIKING CCS PIPELINE ALIGNMENT

PERMEABLE GRAVEL SURFACE

PROPOSED ACCESS ROAD

SWALES SERVING ACCESS ROAD TO BE SEGMENTED WITH ASSOCIATED OUTFALL

THE CUT DRAINAGE CHANNEL

PIG WITHDRAWAL AREA

ISOLATION VALVE

MOV

ESDV

100-U-001 HIPPS PACKAGE

100-U-001 PIG RECEIVER

PIG WITHDRAWAL AREA

FILER DRAINAGE SERVING INFRASTRUCTURE HARDSTANDING AND ACCESS ROAD

PROPOSED VIKING CCS PIPELINE ALIGNMENT

C.C.R

PERMEABLE GRAVEL SURFACE

FENCELINE BOUNDARY

PROPOSED ACCESS ROAD

EXISTING TREES AND HEDGEROW

INDICATIVE ATTENUATION AREA

9

9m MIN EASEMENT

THE CUT DRAINAGE CHANNEL

N

MABLETHORPE ROAD

SITE ACCESS ROAD

PROPOSED THEDDLETHORPE COMPOUND

ACCESS ROAD OVERVIEW

Scale NTS

Last saved by: STANSFIELDR(2023-07-19) Last Plotted: 2023-07-19
Filename:

AECOM

PROJECT

VIKING CCS PIPELINE

NOTES

1. DO NOT SCALE FROM DRAWING
2. DRAWING PRELIMINARY SKETCH FOR INFORMATION ONLY

LEGEND

- SWALE
- PIPE
- FILTER DRAINAGE
- ATTENUATION AREA
- OVERLAND FLOW DIRECTION
- ACCESS ROAD

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P1	30/05/2023	FOR INFORMATION

ISSUE PURPOSE / SUITABILITY

FOR INFORMATION ONLY

PROJECT NUMBER

60668955

SHEET TITLE

VIKING CCS PIPELINE
SURFACE WATER DRAINAGE STRATEGY
THEDDLETHORPE OPTION 2
DRAINAGE LAYOUT

FIGURE NUMBER

FIGURE 12

Annex D - Consultations

Stansfield, Robert (Leeds)

From:	Guy Hird [redacted]
Sent:	06 June 2023 08:14
To:	Stansfield, Robert (Leeds)
Cc:	Maynard, Nick; Asensio Barrowclough, David; Travers, Helen; Lee, Frances
Subject:	RE: Viking CCS - Immingham and BV1 - North East Lindsey IDB
Attachments:	VCCS_SWDS_1_Drainage_Plans_v1_20230601_LC IM.pdf

ND-6278-2022-PLN

Rob

I have added comments in blue below.

Regards

Guy Hird
Head of Technical & Engineering Services

We have Engineering vacancies: https://witham3idb.gov.uk/notices-ads/

enquiries@witham3idb.gov.uk
accounts@witham3idb.gov.uk
planning@witham3idb.gov.uk
consents@witham3idb.gov.uk

Witham First District Internal Drainage Board
Witham Third District Internal Drainage Board
Upper Witham Internal Drainage Board
North East Lindsey Drainage Board

Witham House,
Meadow Lane
North Hykeham,
LINCOLN,
LN6 9QU (*for sat nav use LN6 9TP*)
Tel: 01522 697123

Four independent statutory Land Drainage and Flood Risk Management Authorities working in partnership.

[redacted]

From: Stansfield, Robert (Leeds) [redacted]
Sent: 05 June 2023 1:50 PM
To: Guy Hird [redacted]>; Enquiries <Enquiries@witham3idb.gov.uk>
Cc: Maynard, Nick [redacted]>; Asensio Barrowclough, David [redacted]>; Travers, Helen <[redacted]>; Lee, Frances <[redacted]>
Subject: Viking CCS - Immingham and BV1 - North East Lindsey IDB

FAO North East Lindsey IDB.

Dear Mr Hird,

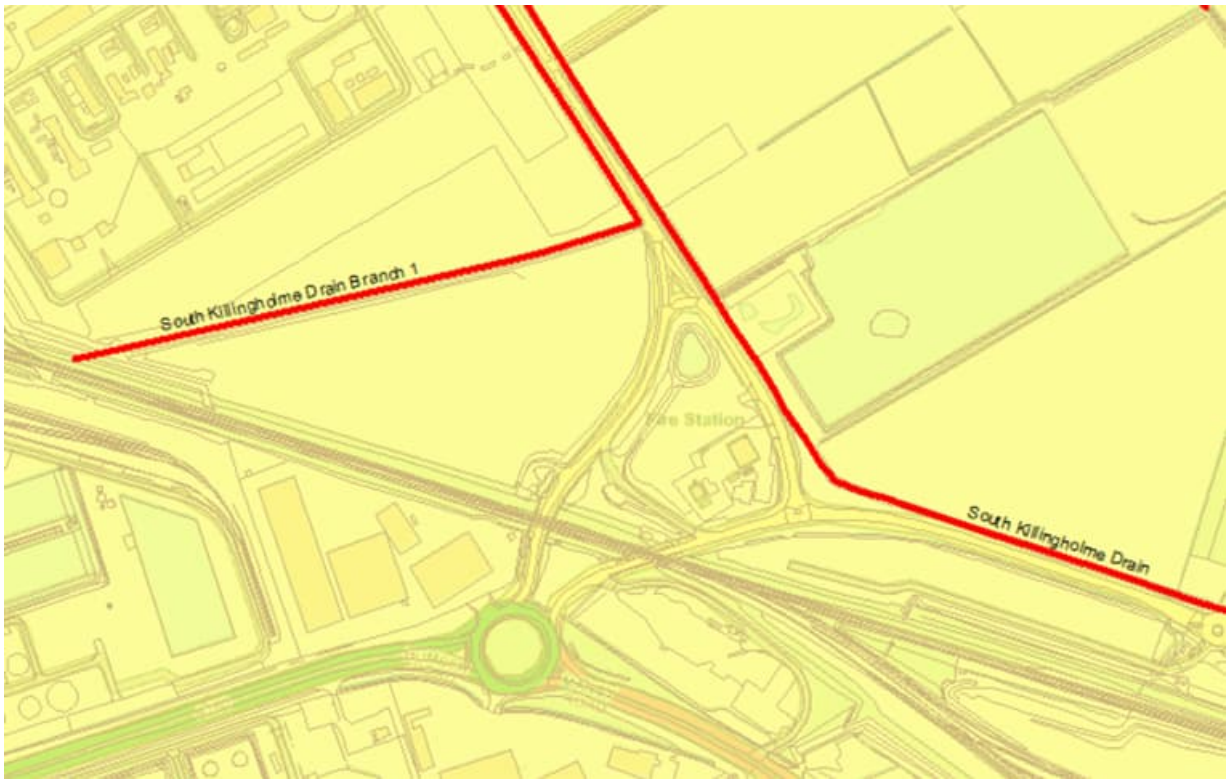
AECOM are producing an Environmental Statement covering the Viking CCS Pipeline project between Immingham and Theddlethorpe. As part the statement a concept drainage strategy is to be developed for 2No. compounds situated within the North East Lindsey IDB that will serve the pipeline. The sites and strategy are described below and in the attached plans:

> Theddlethorpe Facility (X 516986 Y 416781) Approx. 1ha – The Proposed Development will consist of the Immingham Facility to be located in a currently unused section of brownfield land to the south of the VPI Immingham site. A channel drain to the north of the proposed site is assumed to collect and convey surface water to the east and connect into the South Killingholme Main Drain via a culvert beneath Rosper Road, ultimately discharging into the North Sea. The existing channel is proposed to be re-aligned to the south as part of works to extend the existing VPI site. The proposed site facility will largely be permeable gravel with roads allowing access to Viking infrastructure, including x3 kiosk buildings. Noted and correct. The only further comment would be that the drainage is gravity and can be tide locked, Rosper Road Pits acts as attenuation in the system but water levels may affect discharge.
>
> The existing ground conditions suggest infiltration of surface water is not recommended and, following the drainage hierarchy for discharge of surface water, the next favourable point of discharge is into a surface water body. The drainage strategy proposed is to collect runoff from the site and discharge to the re-aligned drainage channel via a flow discharge restriction and attenuating SuDs. The storge will likely be a detention basin and may use any storage available within the gravel area. Noted.
>
> Block Valve 1 (X 519460 Y 407048) Approx. 0.17ha – This site falls outside the IDB boundary but is within the North East Lindsey extended rainfall catchment. It is assumed this site does not require comment from the IDB. Correct North East Lindsey only acts as the consenting authority in the extended area within Lincolnshire. The location is in the North East Lincolnshire Council ara and they are the consenting authority.

Please can you provide comment on the concept proposals described above and assist with the following queries:

1. Please identify drainage the IDB inspects and maintains within the vicinity of the proposed sites.

   Theddlethorpe Facility Board maintained watercourses in red.



Block Valve 1 - none

2. Confirm the catchment and drainage connectivity of the drainage identified in point 1. I would assume it would discharge to South Killingholme Drain Branch 1

3. Confirm any existing known flood risk or/and drainage issues within the vicinity of the proposed sites. The site is at risk of flood, primarily over topping or breach of the Humber flood banks. Information available from the EA.

4. Confirm easements required relating to drains/ watercourses maintained by the IDB. Any works within 9m of the top of the bank requires consent from the Board under the Byelaws.

5. Confirm if consent is required from the IDB for surface water discharge into existing drainage as described above. Correct.

6. Preliminary calculations suggest the Qbar greenfield runoff rate at the Immingham Facility is under 2l/s which will likely result in small flow control outlet diameters. Does the IDB promote specific criteria with regards to low/acceptable discharge rates and small orifice restriction diameters? Acceptable.

7. Provide any other information or comment with regards the proposed concept drainage strategies described above.

A response this week would be greatly appreciated. Please let us know If you require any further details.

Thanks for your time,

Rob

Robert Stansfield, BSc (Hons) GMICE
Senior Engineer, Water
M [redacted]

[redacted]

AECOM
5th Floor
2 City Walk
Leeds, LS11 9AR, UK
T +44-(0)113-391-6800
[redacted]

Delivering a better world

[redacted]

Stansfield, Robert (Leeds)

From:	Stansfield, Robert (Leeds)
Sent:	19 June 2023 14:29
To:	Planning LMDB
Cc:	Maynard, Nick; Asensio Barrowclough, David; Travers, Helen; Lee, Frances; Stephen Dearden; Darren Cowling
Subject:	RE: Viking CCS - BV2, BV3 and Theddlethorpe - Lindsey Marsh IDB

- Provide mapping showing IDB maintained drainage and assets
- Provide any recorded water levels in The Cut/Crook Bank adjacent to Theddlethorpe Option 1 and Option 2 locations. (winter and summer levels thought to be available)
- Confirm any known flooding issues in the Theddlethorpe area
- Confirm any known tidal influence in channels adjacent the Theddlethorpe gas terminal

Hi Emily,

Thanks for organising the meeting, I've included a brief summary below. Please can you help with the requests and queries above?

1. Please identify drainage the IDB inspects and maintains within the vicinity of the proposed sites.

   The Cut and other channels in the Theddlethorpe area are IDB maintained. To be confirmed on plan.

2. Confirm the catchment and drainage connectivity of the drainage identified in point 1.

   Please confirm if the IDB has a drainage catchment area delineated upstream of the Theddlethorpe locations.

3. Confirm any existing known flood risk or/and drainage issues within the vicinity of the proposed sites.

   No known concerning flood issues in the area. However, this query can be relayed to the local agent/surveyor.

4. Confirm easements required relating to drains/ watercourses maintained by the IDB.

   The IDB confirmed a 9m easement is standard for maintenance access requirements.

5. Confirm if consent is required from the IDB for surface water discharge into existing drainage as described above.

   Consent is required for discharge into IDB controlled assets.

6. Preliminary calculations suggest the Qbar greenfield runoff rate is under 2l/s for Theddlethorpe which will likely result in small flow control outlet diameters. Does the IDB promote specific criteria with regards to low/acceptable discharge rates and small orifice restriction diameters?

   Greenfield discharge rates are preferred, however other rates and orifice sizes are considered on a mitigated, rational and evidential basis. 1.4l/s/ha is a rate considered by the IDB.

7. Provide any other information or comment with regards the proposed concept drainage strategies described above.

- The Cut outfalls to the North Sea via a pumping station. A failure of the PS is unlikely to cause upstream issues but not ruled out as a risk.
- RS to liaise with the FRA team regarding pipe crossings to ensure IDB criteria/constraints have been noted
- The low discharge rates from the proposed site will unlikely be a concern to the IDB (regarding impact from volume discharged). Option 1 in the Terminal will likely maintain existing discharge rates at existing outfalls. Option 2 will have a controlled rate.
- The Block Valves may need riparian consents to discharge
- The IDB act as agents to the local planning authority within the extended IDB catchment area

Thanks,

Rob

From: Planning LMDB <planning@lmdb.co.uk>
Sent: 15 June 2023 13:48
To: Stansfield, Robert (Leeds) <[redacted]>
Cc: Maynard, Nick <n[redacted]>; Asensio Barrowclough, David <[redacted]>; Travers, Helen <[redacted]>; Lee, Frances <[redacted]>; Stephen Dearden <[redacted]k>; Darren Cowling <[redacted]>
Subject: RE: Viking CCS - BV2, BV3 and Theddlethorpe - Lindsey Marsh IDB

Hi Rob

Please can we go with 19th June, 1-2 pm. I can book this in now

Kind regards

[redacted]

Emily Jackson
Admin Assistant (Planning and Consenting)

Water Management Consortium

Wellington House, Manby Park, Manby, LOUTH, Lincolnshire, LN11 8UU.
Telephone: 01507 328095

Millfield Drain Branch No 1

Crook Bank Drain East

Millfield Drain

Crook Bank Drain West

Mablethorpe Lower Cut

KEY

LMDB Maintained Watercourse

LMDB Piped Length

Lindsey Marsh Drainage Board

Water Management Consortium

Senior Engineer - Mr R. Brown, BEng (Hons), GMICE

N

Viking CCS IDB assets former Theddlethorpe Gas Terminal

Drawing No:	Overview		
Drawn By:	E. Jackson	Checked:	D. Cowling
Date:	27/06/2023	Scale:	1:5,000
Dept:	Engineering		

Wellington House
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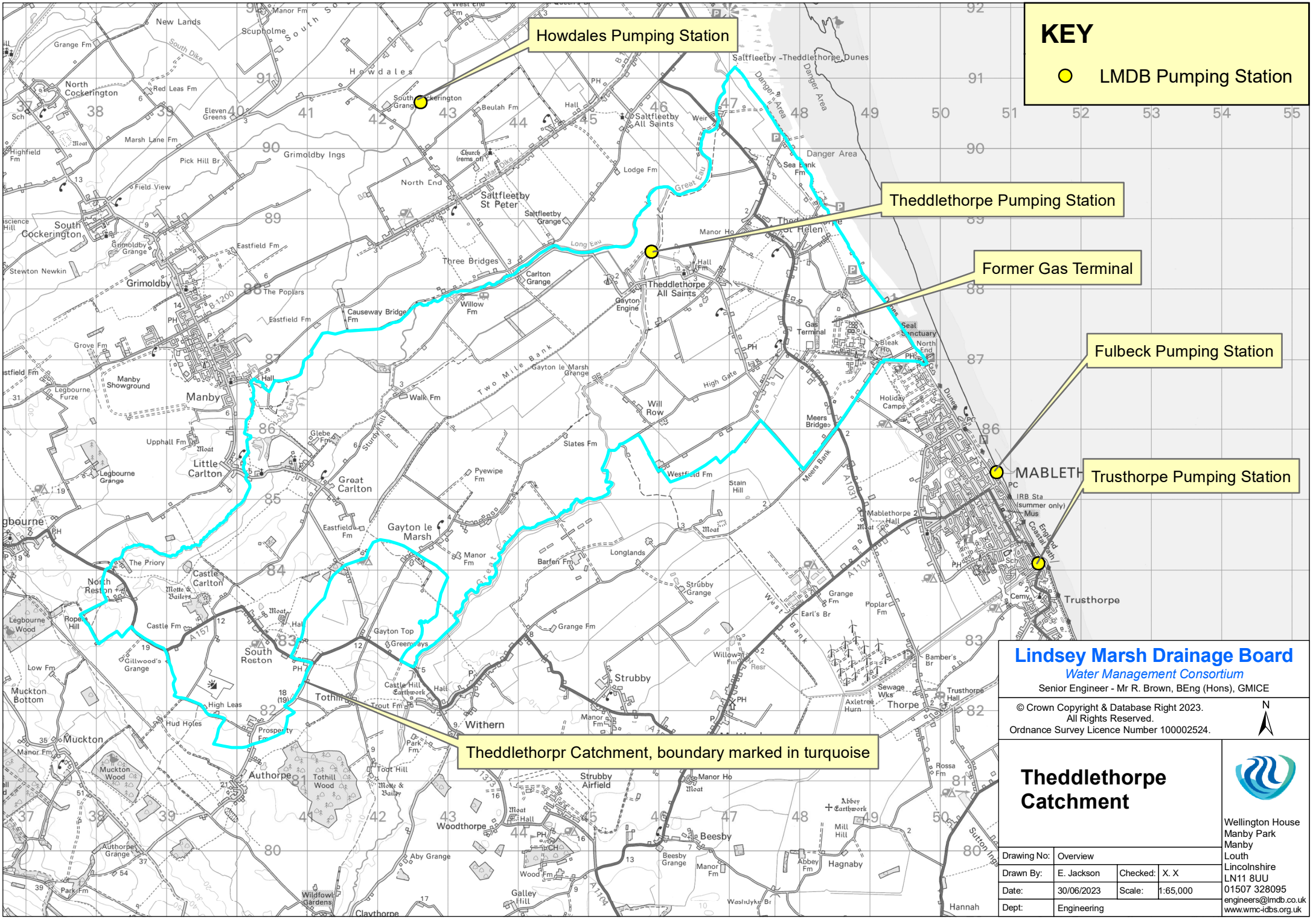

Lindsey Marsh Drainage Board

Water Management Consortium

Senior Engineer - Mr R. Brown, BEng (Hons), GMICE

N

Theddlethorpe Catchment

Drawing No:	Overview		
Drawn By:	E. Jackson	Checked:	X. X
Date:	30/06/2023	Scale:	1:65,000
Dept:	Engineering		

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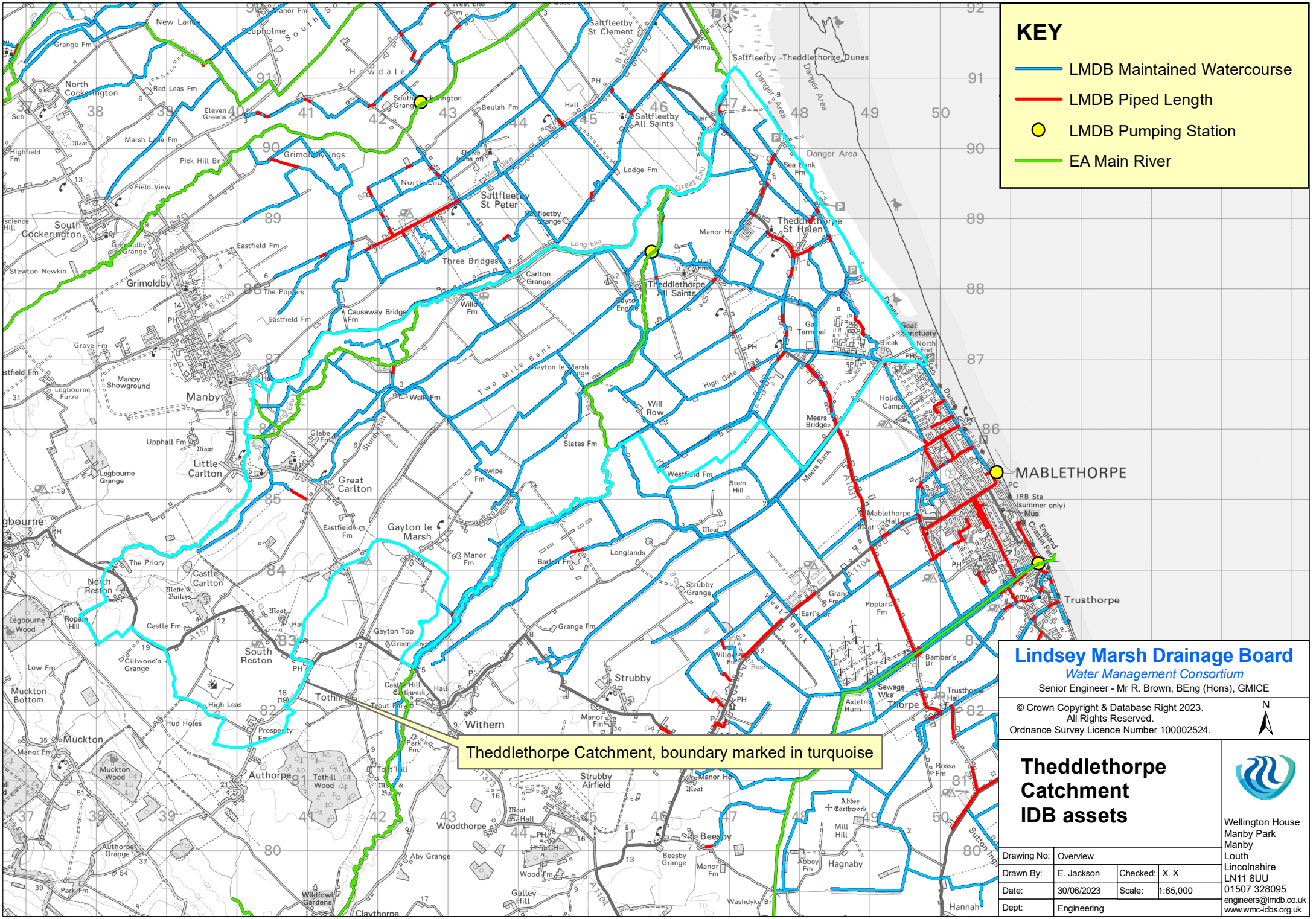
KEY
LMDB Maintained Watercourse
LMDB Piped Length
LMDB Pumping Station
EA Main River
Theddlethorpe Catchment, boundary marked in turquoise
MABLETHORPE
Trusthorpe
Saltfleetby -Theddlethorpe Dunes
Saltfleetby St Clement
Saltfleetby All Saints
Saltfleetby St Peter
Theddlethorpe St Helen
Theddlethorpe All Saints
North Cockerington
South Cockerington
Grimoldby
Manby
Little Carlton
Great Carlton
Gayton le Marsh
South Reston
North Reston
Castle Carlton
Withern
Strubby
Strubby Airfield
Woodthorpe
Beesby
Hagnaby
Authorpe
Tothill
Muckton
Tothill Wood
Muckton Wood
Legbourne Wood
Three Bridges
Two Mile Bank
Great Eau
Long Eau
Danger Area
Meers Bridge
Will Row
Slates Fm
Stain Hill
Longlands
Strubby Grange
Gayton Top
Castle Hill Earthwork
Abbey Earthwork
Wildfowl Gardens
Claythorpe
Hannah
Lindsey Marsh Drainage Board
Water Management Consortium
Senior Engineer - Mr R. Brown, BEng (Hons), GMICE
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Ordnance Survey Licence Number 100002524.
N
Theddlethorpe Catchment IDB assets
Drawing No: Overview
Drawn By: E. Jackson
Checked: X. X
Date: 30/06/2023
Scale: 1:65,000
Dept: Engineering
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Water Management Consortium

PLANNING AND BYELAW POLICY

Including Development Control Charges and Fees

WELLINGTON HOUSE
MANBY PARK MANBY
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Lindsey Marsh Drainage Board
Isle of Axholme and North Nottinghamshire Water Level Management Board
Trent Valley Internal Drainage Board
Doncaster East Internal Drainage Board

CONTENTS

REVISION RECORD				
Version	**Date**	**Description**	**Originator**	**Checked**
	09.08.11	DRAFT	AMD	--
1	27.09.11	FINAL – BOARD APPROVED	AMD	DJS
2	09.07.13	New logo added	LSQ	DJS
3	29.02.16	Amendment to card payment fees	LSQ	AD
4	16.07.18	New Model Byelaws & card payments	LSQ	DJS
5	29.09.20	Combining individual Planning and Byelaw Policy Into single document and updating the fee structure.	RAB	NK
6	29.04.21	Final Amendments	RB	NK
7	21.04.22	Updated Fees	DC	RB

The Water Management Consortium Boards reserve the right to update or change this living document at any time without notice.

1 INTRODUCTION

The **Lindsey Marsh Drainage Board**, the **Isle of Axholme and North Nottinghamshire Water Level Management Board**, the **Trent Valley Internal Drainage Board** and the **Doncaster East Internal Drainage Board** (the Boards) each have permissive powers under the Land Drainage Act 1991 to exercise a general supervision over all matters relating to the drainage of land within the respective Board's District. The Boards work to ensure that water levels are maintained at an appropriate and safe level, the Boards also have a duty to conserve and enhance the natural environment. The Boards have such other powers to perform such other duties as are conferred or imposed on internal drainage boards by this Act.

The purpose of this document is to set out the Boards' policy and approach in relation to development within the Boards' Districts.

2 BYELAWS RELATING TO BOARD MAINTAINED WATERCOURSES

2.1 Lindsey Marsh Drainage Board

Is the largest drainage board in England, the Board is responsible for the maintenance of 973km of arterial watercourse of which 75km is culverted and 30 pumping stations, draining a catchment of 86,550 hectares with a Board area of 52,757 hectares on the East Coast of Lincolnshire. The **Lindsey Marsh Drainage Board's** Byelaws were made by the Board on 24th January 2018 under the powers vested in it by the Land Drainage Act 1991. The Byelaws were confirmed by the Department of Environment, Food and Rural Affairs (Defra) on the 29th June 2018.

2.2 Isle of Axholme and North Nottinghamshire Water Level Management Board

The Board is located on the western Bank of the River Trent extending from the River Ouse down to Markham Moor. The Board is responsible for the maintenance of 457km of arterial watercourse and 21 pumping stations, with a Board area of 28,950 hectares. The **Isle of Axholme and North Nottinghamshire Water Level Management Board's** Byelaws were made by the Board on 25th January 2018 under the powers vested in it by the Land Drainage Act 1991. The Byelaws were confirmed by the Department of Environment, Food and Rural Affairs (Defra) on the 29th June 2018.

2.3 Trent Valley Internal Drainage Board

The Board covers an area of low lying land from the west of Gainsborough, straddling the River Trent and its tributaries, down to the south of Nottingham. The Board is responsible for the maintenance of 778km of arterial watercourse and 18 pumping stations, with a Board area of 44,093 hectares.

The **Trent Valley Internal Drainage Board's** Byelaws were made by the Board on 25th January 2018 under the powers vested in it by the Land Drainage Act 1991. The Byelaws were confirmed by the Department of Environment, Food and Rural Affairs (Defra) on the 29th June 2018.

2.4 Doncaster East Internal Drainage Board

The Board covers an area of low lying land from the east of Doncaster predominantly within the River Torne catchment. The Board is responsible for the maintenance of 457km of arterial watercourse and 25 pumping stations, with a Board area of 28,950 hectares. The **Doncaster East Internal Drainage Board's** Byelaws were made by the Board on 27th April 2012 under the powers vested in it by the Land Drainage Act 1991. The Byelaws were confirmed by the Department of Environment, Food and Rural Affairs (Defra) on the 20th December 2012.

2.5 Background

The primary purpose of these Byelaws is to ensure efficient drainage within each Boards' District. Byelaws seek to guarantee that the Boards' maintained watercourses can be accessed for maintenance or improvement in the future and ensure the unimpeded flow of water on all watercourses within the respective Board's District at all times.

To ensure those proposing developments are aware of the Byelaws, the Boards take the opportunity to provide comments on Planning Applications within, or affecting, its District. It must be noted that the granting of Planning Permission does not override the need for the respective Boards' formal consent to be obtained.

A full copy of the Boards' Byelaws can be obtained from the Consortium's offices during normal working hours or alternatively, downloaded electronically from the website, www.wmc-idbs.org.uk

Any person wishing to carry out works covered by the Boards' Byelaws must make a Byelaw consent application to the respective Board. Works must not commence until the Boards have issued consent.

The Boards welcome the opportunity to comment on proposals in advance of formal Byelaw consent applications being made. Early involvement will help to minimise delays and reduce amendments to development proposals. Persons wishing to discuss proposals should contact the Boards' Planning and Development Control Officers in the first instance.

3 PRIVATE WATERCOURSES

Section 23 (1) of the Land Drainage Act 1991 states that:

"No person shall-
(a) erect any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or
(b) erect any culvert that would be likely to affect the flow of any ordinary watercourse or alter any culvert in a manner that would be likely to affect any such flow, without the consent in writing of the drainage board concerned."

Persons wishing to carry out works described above must receive the Boards' consent prior to works commencing.

4 APPLICATIONS FOR THE BOARDS' CONSENT

Applications for Byelaw consent and/or consent under Section 23 (1) of the Land Drainage Act 1991 should be made to the Boards in writing, using the appropriate section(s) of the application form.

Application Forms and Advice Notes are available from the Consortium's office during normal working hours or alternatively, can be downloaded electronically from [redacted]

Under normal circumstances the consent application process will take between four and six weeks. However, this timescale will be dependent on the scale and nature of the proposals.

The Boards have delegated their powers for determining certain consent applications to the Chief Executive and Engineer to the Boards. The following types of consent application can be determined using delegated powers:

- Applications complying with guidance in the advice notes referred to in Section 9 of this document.
- Applications to culvert up to 25 metres of Board maintained watercourse.
- All applications under Section 23 (1) of the Land Drainage Act 1991.

All other consent applications will be referred to the respective Board for determination at the next appropriate Board meeting.

In all cases consent will not be withheld unless the grounds for doing so are reasonable.

If consent is granted, it should not be regarded as an approval of the design and integrity of the proposals. Consent will only be granted in relation to the impact the proposals may have upon the watercourse and effect on the Boards' maintenance activities.

Consent may be refused if the proposed works could increase flood risk. Similarly, consent may be refused if it is considered a detriment to the environment. This is in accordance with the Boards' environmental and sustainability duties.

Applicants should be aware that the Boards' consent does not override the need for any other consent or approval that may be required under any other statutory provision, byelaw, order, regulation or landowners' permission.

Applicants have the right to appeal if they believe consent has been withheld unreasonably or unreasonable conditions have been imposed. Representations should be made in writing for consideration at the next available Board meeting.

5 FEES

5.1 Consent Application Fees

The charges associated with consent application fees are set out in table 1 below.

Description	Reason for the charge being levied	Fee Due[1]
Application to alter a riparian watercourse	Application under Section 23 of the Land Drainage Act 1991	£50.00
Application for relaxation for one of the Boards' Byelaws (not Byelaw 3)	Application for a relaxation of Boards' Byelaws (usually Byelaw 10 and 17).	£100.00
Application to install land tile outfalls into a Board maintained watercourse	Application for a relaxation of Boards' Byelaws (per watercourse).	£100.00
Application to discharge surface water to a watercourse	Application for a relaxation of Byelaw 3 (and possibly other Byelaws).	£200.00
Application to discharge treated foul water to a watercourse	Application for a relaxation of Byelaw 3 (and possibly other Byelaws).	£200.00

Table 1 – Consent Application Fees

[1] Application fees will be reviewed in 2023 and then on a 5 year basis.

Where an application is submitted without payment of the relevant fee due, the application is not deemed valid and may not be considered by the Boards.

5.2 Inspection Fees

The fees associated with inspection of works within 9m of a Board maintained watercourse or within the channel of an ordinary watercourse to ensure compliance with the consent issued by the Boards.

Description	Reason for the charge being levied	Fee Due[1]
Application to alter a riparian watercourse	Application under Section 23 of the Land Drainage Act 1991. To confirm the conditions of consent are complied[2] with.	£250.00 per visit.+ £100.00 per additional structure
Application for relaxation for one of the Boards' Byelaws (usually Byelaw 10 or 17 not Byelaw 3)	Application for consent under Boards' Byelaws. To confirm the conditions of consent are complied[2] with.	£250.00 per visit. + £100.00 per additional structure
Application to install land tile outfalls into Board maintained watercourse	Application for consent under Boards' Byelaws (per watercourse). To confirm the conditions of consent are complied[2] with.	£100.00 per visit + £10.00 per outfall
Application to discharge surface water to a watercourse	Application for a consent under Byelaw 3 (and possibly other Byelaws). To confirm the conditions of consent are complied[2] with.	£250.00 per visit
Application to discharge treated foul water to a watercourse	Application for a consent under Byelaw 3 (and possibly other Byelaws). To confirm the conditions of consent are complied[2] with.	£250.00 per visit

Table 2 – Inspection of consented works Fees

Multiple inspections may be required for large, staged or complex projects.

[1]Inspection of consented works fees are index linked and will increase in April each year.

[2] Where conditions of the consent are not met the applicant will be notified in writing with the steps required to resolve the issues. Any additional visits will be charged at the above fees

The relevant inspection fees will be stipulated as part of a notification of intent to consent, including the number of inspections required.

The applicant will be given three months to accept the Inspection Fees as a condition of consent. The fee is payable when formal consent is issued following the applicant's confirmed acceptance of the conditions of consent and prior to any works commencing.

Should significant increases in volumetric discharge into Board maintained watercourses or alteration of Board catchments be granted they would be subject to detailed further assessment on an individual basis to account for potential watercourse and pumping plant upgrades that may be required to facilitate the additional volumetric discharge. All costs are to be met by the developer.

5.3 Consultation Fees

5.3.1 Application Advice

The Boards offer guidance documents for the completion of the application for consent forms and the Boards' Planning and Development Control Officers are available to clarify minor queries where the aggregate consultation time does not exceed 1 hour. Where this is insufficient, and a more detailed technical consultation is required this can be offered on a recharge basis.

5.3.2 Flood Risk Assessments

Consultations for information to support Flood Risk Assessments where a plan of the Boards' assets, pumping station operational data and where available any flood data we hold will be charged at **£180**. Where this is insufficient (eg. multiple catchments) and a more detailed technical consultation is required this can be offered on a recharge basis.

5.3.3 Significant Development

Where the development is of such a size or complexity that regular technical advice from the Boards' officers is required, work will be undertaken on a recharge basis.

5.3.4 The Boards are not profit-making entities. Costs charged will be actual cost. As a guide the charge rate will be around £60/hour with any disbursements recharged at actual cost. A detailed cost estimate breakdown of hours charged can be provided.

Consultation Fees are baselined in April 2021 and index linked in line with CPI with an annual review.

5.4 Surface Water Development Contribution (SWDC) Rates

Prior written consent is required from the Boards where a development will result in an increase in the rate or volume of flows in any watercourse and, one of the conditions imposed as part of any such approval is the payment of a development contribution to the Boards. The charge is made to help fund the cost of improvements to the drainage network that are required to cater for increases in the rate and/or volume of surface water flows.

The charge also reflects projected long term increases in the Boards' power costs for pumping. Where substantial changes to infrastructure are made that increase pumping capacity, new equipment will necessarily comply with current legislation which could lead to charges associated with environmental improvements. Some of the Boards' infrastructure means that water can pass through more than one pumping installation before discharge. Where this is the case the full impact to point of discharge will be evaluated.

The relevant fee will be stipulated as part of a notification of intent to consent, including the number of inspections required. Applicants will be given three months to accept the development charge as a condition of consent.

Where a developer's point of discharge is into a third party system (highway drainage, Water Authority network or riparian system) but ultimately increases the run-off to the Boards' network, the development charge will apply and the Boards' consent will be required.

The fee is due when the applicant confirms acceptance of the development charge. Formal consent will be issued following payment of the development charge and prior to any works commencing. *The SWDC is not due at the point of the application*.

The contribution is calculated by;

- Determining the impermeable area of the site to be positively drained (in square metres, m^2)
- Establishing the charging band based on the impermeable area (in hectares) of the site that is to be positively drained will fall into (see table 3 below)
- Establishing the charging band based on the proposed discharge rate (in litres/second/impermeable hectare) will fall into (see table 4 below)

The Surface Water Development Contribution equation is therefore;
SWDC = Impermeable Area Band Contribution Rate x Impermeable Area (m^2) x SWDC Rate Band

Banding	Impermeable area, A discharging (ha)		Surface Water Development Contribution Rate (£/m^2)
	Is greater than (>)	And is less than or equal to (≤)	
1	0	5	13.26
2	5	10	11.09
3	10	15	9.52
4	15	20	7.97
5	20	25	6.41
6	25	N/A	4.24

Table 3 : Impermeable Area Bandings

Banding	Equivalent run-off rate (litres/second/hectare)		SWDC rate (as a % of full contribution rate)
	Is greater than (>)	And is less than or equal to (≤)	
1	0	1.4	3
	Is greater than (>)	And is less than (<)	
2	1.4	5	10
	Is greater than or equal to (≥)	And is less than (<)	
3	5	10	15
4	10	15	20
5	15	20	25
6	20	25	30
7	25	30	35
8	30	35	40
9	35	40	45
10	40	45	50
11	45	50	55
12	50	55	59
13	55	60	63
14	60	65	67
15	65	70	71
16	70	75	75
17	75	80	79
18	80	85	83
19	85	90	87
20	90	95	91
21	95	100	95
22	100	N/A	100

Table 4 : Discharge Rate Bandings

- The current maximum charge applicable is £123,500 per impermeable hectare for sites with less than 5ha of impermeable area proposing to discharge at an un-attenuated rate.
- The Surface Water Development Contribution rates stated within this document are increased by inflation annually and will be reviewed in detail on a 5 yearly basis.
- The next detailed review is scheduled for Q2 2023. CPI will be used for inflationary calculations. The impermeable area of the site to be positively drained (in square metres, m2) should only reflect the additional impermeable area that is positively drained post development. It is therefore determined by taking away the area of the proved/demonstrated impermeable surface positively drained to the watercourse prior to development from the proposed area of impermeable surface to be positively drained to the watercourse post development.
- Where developments do not contain all of the surface water on site and the Boards' systems receive the excess then development charges will apply as follows;
    - Where high level overflows to watercourses are proposed from retention/soakaway systems that exceed the 1 in 100 year plus climate change design event (*) then these proposals will be charged at the 10% discharge rate banding (band 2)
    - Where high level overflows to watercourses are proposed from retention/soakaway systems that exceed at return events below the 1 in 100 year plus climate change design event (*) then these proposals will be charged at the applicable discharge rate banding obtained from Table 3 (with the minimum charge being 10% band 2).
- Surface Water Development Charges are payable at the rate applicable when the consent application is granted by the Board but prior to the issue of the formal document.
- Although the table does indicate free discharge or increased discharge rates are available, discharges into pumped catchments will be restricted to 1.4l/s/ha where practical with the SWDC paid at the appropriate Band rate to account for the additional volume from impermeable areas.
    - All developments and requests for discharge into the land drainage network will have to demonstrate that the discharge hierarchy has been followed (1, Infiltration, 2, Surface Water Body, 3, Culverts – (Surface Water, Highway or other), or 4, combined sewer.)
    - Where small developments are unable to restrict to 1.4l/s/ha due to flow control practicalities the discharge rate will be factored up to reflect the site area and the appropriate banding in Table 4 will be applied.

Example SWDC calculations are available should they be requested.

5.5 Commuted Maintenance Fee (CMF) Rates

A Commuted Maintenance Fee (CMF) is a one-off charge, payable where the Boards will become responsible for the future maintenance costs associated with a new culvert, bridge,

weir, outfall, watercourse, pumping station or other structure within their internal Drainage District.

The relevant fee will be stipulated as part of a notification of intent to consent, at which point the applicant will be given three months to accept the CMF as a condition of the consent. The fee is due when the applicant confirms acceptance of the CMF.

Formal consent will be issued following payment of the CMF and prior to any works commencing. **The method of calculation will be provided as part of the consent conditions.**

The Boards will not seek to abandon the commuted responsibilities relating to any adopted structure for which a commuted sum has been paid and recorded in the commuted obligations register. Once the defined timeline of adoption has elapsed, the Boards will be at liberty to operate or relinquish the asset in line with prevailing Boards' policies and circumstances.

5.5.1 Culverts in Board Watercourses

Any consent granted to install a culvert within a watercourse maintained by the Boards will be subject to the payment of a CMF.

In such instances the Boards will be responsible for maintaining the clear flow of water through the structure (Including desilting and vegetation clearance at a frequency necessary to meet water level management requirements) and in some specific cases the structural integrity* of the culvert. The total CMF is derived from the costs that will be incurred by the Boards in maintaining both the clear flow of water through the structure as well as the structural integrity* where appropriate.

The CMF for culverts in watercourses owned by the Boards can be calculated by adding the relevant figure from table 5 below to the cost of replacement as determined by the Boards' Officers. For culverts over 150 metres in length the Boards' Officers will determine the commuted maintenance fee on a case by case basis.

**Structural Integrity*

- *Where the applicant does not wish the Boards to maintain the structural integrity of the culvert the relevant charge in table 5 below will apply and appropriate conditions will be included within the consent.*
- *The Boards reserve the right to decline the responsibility for the structural integrity of the culvert. In such instances the relevant charge in table 5 below will apply and appropriate conditions will be included within the consent.*

	Internal Diameter of Pipe (Ø)	
Length of Culvert	**Ø < 750mm**	**Ø ≥ 750mm**
< 18 metres	£2,011.08	£4,453.10
19 – 48 metres	£11,210.10	£19,735.08
49 – 96 metres	£26,121.90	£31,646.84
97 – 150 metres	£38,608.26	£55,183.07

Table 5 : Culvert Maintenance Fees for culverts within Board Watercourses

The CMF can be negated where redundant access (of a length in excess of the proposed culvert), within the applicant's ownership is identified which can be removed from the drainage network. i.e. where the Boards have no net gain in maintenance liability.

5.6 Biodiversity and Habitat Mitigation

Most developments within the Boards' areas will impact or alter the local biodiversity and habitat. Where impacts cannot be avoided, mitigation must be provided with either restoration or biodiversity offsetting taking place to deliver a neutral or overall net gain position. In most cases measures to restore or offset the impact of any works must be undertaken in close proximity to the development. Where the site constraints or local land holdings do not permit this, the Boards will seek a developer contribution to undertake biodiversity improvements within their districts.

5.7 Payment of Fees

The Boards accept payment via cheque, credit / debit card or BACS transfer. Please note for all card payments made using a Commercial (Business) card there will be a non-refundable surcharge of 1.8% added to the charge. There is no surcharge payable for payments made by personal Debit Card or by personal Credit Card.

6 DEEDS OF INDEMNITY

In certain cases, applicants will be required to enter into a Deed of Indemnity with the Boards to protect the Boards and their future operation and costs thereof.

The Deed of Indemnity will be drawn up by the respective Board at the applicant's expense. It will then be lodged with Land Registry to ensure the Board is consulted prior to the property being sold. This allows subsequent owners to be made aware of the restrictions that apply to the property.

7 ENFORCEMENT

Wherever possible the Boards will seek to ensure drainage issues are rectified without the need for formal action. When aware of a drainage issue the Boards' Officers will conduct an investigation which will consist of:

- A site inspection to establish the cause and extent of the problem
- Consideration of possible remedial actions
- Making reasonable attempts to contact the responsible person(s) to discuss the issues
- If the person(s) responsible is/are willing to cooperate, a letter will be sent detailing the works that are required within a specified time period. If the persons(s) responsible is/are uncooperative, the Boards will take formal action as detailed in paragraphs 7.1, 7.2 and 7.3.

The Boards will undertake action where there is evidence of a significant drainage problem and persons affected are not the cause of the drainage issue and where there is evidence of a breach of the Boards' Byelaws or contraventions under Section 23 of the Act (further details below). The Boards will endeavour to resolve identified issues in a reasonable timescale, with priority given to flooding, risk of flooding of critical infrastructure or internal flooding of properties.

7.1 Byelaws

The Boards may serve notice under Section 66 (6) of the Land Drainage Act 1991 requiring any contravention of their Byelaws to be remedied within a period not exceeding 28 days.

If the breach is not remedied within the specified time scale the Boards may use Section 66 (7) of the Land Drainage Act 1991 to undertake the necessary works and recharge the costs of such works to the offender. Such action will be without prejudice to any proceedings under Section 66 (6) of the Land Drainage Act 1991.

Where the applicant fails to follow the Boards' application and consenting processes the relevant fees and charges will apply before the Board will consider the retention of any asset.

7.2 Section 23 (1) of the Land Drainage Act 1991

Where a contravention of Section 23 (1) of the Land Drainage Act 1991 occurs the Boards may serve notice under Section 24 (1) of the Act requiring the nuisance to be abated within a period not exceeding 28 days.

If the breach is not remedied within the specified time scale the Board may use Section 24 (4) of the Land Drainage Act 1991 to undertake the necessary works and recharge the costs of such works to the offender or landowner / occupier. Such action will be without prejudice to any proceedings under Section 24 (3) of the Land Drainage Act 1991.

Where the applicant fails to follow the Boards' application and consenting processes the relevant fees and charges will apply before the Boards will consider the retention of any asset.

7.3 Maintaining Flows on a Private Watercourse

The Boards may serve notice on the riparian owner(s) or person(s) responsible for the impediment under Section 25 of the Land Drainage Act 1991. This notice will identify the works that are required to restore proper flow within a specified period of time.

Subject to the right of appeal, if the proper flow is not restored within the specified period the Boards may undertake the necessary works and recharge the costs of the works to those responsible.

In many instances, landowners will be unaware of their riparian rights and responsibilities. If someone owns land or property alongside a watercourse they are known as the riparian owner (https://www.gov.uk/guidance/owning-a-watercourse). Those owning land abutting a watercourse do not necessarily need to own the watercourse itself to be held responsible. This means that many different landowners or occupiers on either bank can be responsible for ensuring the free flow of water along a watercourse.

8 PLANNING APPLICATIONS

The Boards provide comments to Local Planning Authorities (LPAs) on Planning Applications that are within, or impact upon, the Boards' Districts. This provides an opportunity for the Boards to advise the LPAs, landowners and their agents of the Boards' Byelaw requirements prior to development commencing.

When Planning Applications comply with the Boards' Byelaws, a letter will be issued to the LPA which details the Boards' position. Advisory comments will be included as appropriate.

If Planning Applications indicate the Boards' Byelaws may be contravened, a letter of objection will be sent to the LPA. The letter will provide reasons for the objection and give guidance on how the proposals may be revised to comply with the Boards' Byelaws.

The Boards strongly recommend that applicants or their agents liaise with the Boards' Officers at the earliest opportunity to ensure proposals are acceptable to the Boards.

9 FURTHER GUIDANCE

The Water Management Consortium Boards have the following documents available:

- Consent Application Form
- Technical Guidance Notes
- Lindsey Marsh Drainage Board Byelaws
- Isle of Axholme and North Nottinghamshire Water Level Management Board Byelaws
- Trent Valley Internal Drainage Board Byelaws
- Doncaster East Internal Drainage Board Byelaws

Guidance published by the Environment Agency on responsibilities and rules to follow for watercourses on or near your property, and permissions you need to do work around them can be obtained from https://www.gov.uk/guidance/owning-a-watercourse

The Water Management Consortium Boards have also produced a series of other advice notes including:

- AN01: Buildings, Structures, Planting and Fencing
- AN02: Culverts and Bridges
- AN03: Environmental Considerations
- AN04: Stability of Garden Fences Close to Board Maintained Watercourses
- AN05: Service Crossings
- AN06: Surface Water

The above documents are available from the Consortium's office during normal working hours or alternatively, can be downloaded electronically from http://www.wmc-idbs.org.uk/

If you would like to discuss any of the information in this document or associated advice notes, please do not hesitate to contact the Boards' Officers using the details provided below.

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	DEIDB	**planning@deidb.co.uk**

Water Management Consortium

ADVICE NOTE
AN01:
BUILDINGS, STRUCTURES, PLANTING AND FENCING

Version	Date	Description	Originator	Checked
	09.08.11	DRAFT	AMD	--
1	27.09.11	FINAL – BOARD APPROVED	AMD	DJS
2	09.07.13	New Logo Added	LSQ	DJS
3	23/04/2018	Amendments	TR	DJS
4	29/04/2021	Updated for WMC	LSQ	RB/DC

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BUILDINGS, STRUCTURES, OR PLANTING

The Boards' Byelaw No. 10 states:

> *"No person without the previous consent of the Board shall erect any building or structure, whether temporary or permanent, or plant any tree, shrub, willow or other similar growth within nine metres of the landward toe of the bank where there is an embankment or wall or within nine metres of the top of the batter where there is no embankment or wall, or where the watercourse is enclosed within nine metres of the enclosing structure."*

No trees will be allowed within 9.0 metres of a Board maintained open watercourse or culvert.

The Boards may be prepared in exceptional circumstances to allow buildings, structures or planting of approved hedges and shallow rooted bushes within the 9.0 metre protected strip on one side of any Board maintained open watercourse, provided that there is an adequate continuous and guaranteed access strip on the opposite side. Such development will not normally be allowed any closer than 6.0 metres from the bank top of the watercourse.

The Boards may be prepared in exceptional circumstances to allow buildings, structures or planting of approved hedges and shallow rooted bushes within the 9.0 metre protected strip on one side of any Board maintained culverted watercourse, provided that there is an adequate continuous and guaranteed access strip either side of the culvert after the development is completed.

The following table indicates relaxations that may be appropriate for Board maintained culverted watercourses; **however formal applications to the Boards will be required to determine any relaxation**. All applications will be judged on their own merit.

Pipe Diameter	**Depth to Pipe Invert**		
	<3.0 m	**3.0 – 4.0 m**	**Over 4.0 m**
≤300 mm	3.0	3.0	4.0
450 mm – 600 mm	3.5	4.0	5.0
750mm – 900 mm	4.0	5.0	5.0
1.0 m	5.0	5.0	6.0
≥1.2 m	5.0	5.0	6.5

Note: The above clearances must be measured from the outside edge of the pipe and are required each side of the culvert.

The Boards will not allow any buildings, structures or planting of approved hedges and shallow rooted bushes over the top of a Board maintained culvert unless exceptional circumstances apply. Such applications may be referred to the Boards for determination at the next appropriate Board meeting and may require a Deed of Indemnity to be agreed. All associated costs are to be borne by the applicant.

Careful consideration must be given to the area required for gardens or public open space and the structures that are likely to be erected. This is because structures such as fences, sheds and greenhouses must comply with the Byelaw requirements.

Replacement structures will be determined on a case by case basis. Developers should take all reasonable steps to improve access for the Boards' machinery. An increase in the structure's footprint is unlikely to be acceptable unless significant access improvements for the Boards' machinery can be demonstrated.

PLANTING

The following is a selected list of approved hedges / shallow rooted bushes:

Dogwood	Cornus Sanguinea
Hawthorn	Crataegus Monogyna
Holly	Ilex Aquifolium
Wild Privet	Ligustrum Vulgare
Guelder Rose	Viburnum Opulus
Dog Rose	Rosa Canina
Spindle	Euonymus Europeans
Sweet Briar	Rosa Rubiginosa
Wayfaring Tree	Viburnum Lantana
Field Rose	Rosa Arvensis
Cherries	Prunus Spp. (urban locations)
Crabapples	Malus Spp.

Note: This is not a definitive list. The Boards will consider other indigenous species that are shallow rooting and are expected to have limited height and spread.

FENCING

The Boards' Byelaw No. 17 states:

> *No person shall without the previous consent of the Board -*
>
> *(d) erect or construct or cause or permit to be erected or constructed any fence, post, pylon, wall, wharf, jetty, pier, quay, bridge, loading stage, piling, groyne, revetment or any other building or structure whatsoever in, over or across any watercourse or in or on any bank thereof;*

For typical domestic or commercial fencing developers should follow advice given earlier in this document for 'structures'.

Stock proof fencing within 9.0 metres may be acceptable. In such cases fencing must:

- be of post and rail or post and wire construction
- be sited between 0.5 and 1.0 metre from the bank top
- not exceed 0.9 metres in height

Where fencing is required to be perpendicular to a watercourse, the Boards will require access for machinery to be maintained. This can be achieved via the inclusion of access gates with a minimum opening of 4.25 metres at both the upstream and downstream boundary.

Where possible, any fence erected within Byelaw distance must be of a temporary or demountable nature.

Compliance with the above requirements will allow the Boards to continue maintenance by working over the proposed fence.

A typical cross section is included in Appendix A.

Where, in exceptional circumstances, fencing is permitted in close proximity to a watercourse, the Boards may require the applicant to enter into a Deed of Indemnity with the Boards.

Consideration should also be given to the Boards' advice note *AN04: Stability of garden fences close to Board maintained watercourses*.

FURTHER GUIDANCE

The Water Management Consortium Boards have the following documents available:

- Consent Application Form
- Technical Guidance Notes
- Byelaws
- Planning and Byelaw Policy

The Water Management Consortium Boards have also produced a series of other advice notes including:

- AN02: Culverts and Bridges
- AN03: Environmental Considerations
- AN04: Stability of Garden Fences Close to Board Maintained Watercourses
- AN05: Service Crossings
- AN06: Surface Water

The above documents are available from the Consortium's office during normal working hours or alternatively, can be downloaded electronically from [redacted]

If you would like to discuss any of the information in this document or associated advice notes, please do not hesitate to contact the Consortium's offices using the details provided below.

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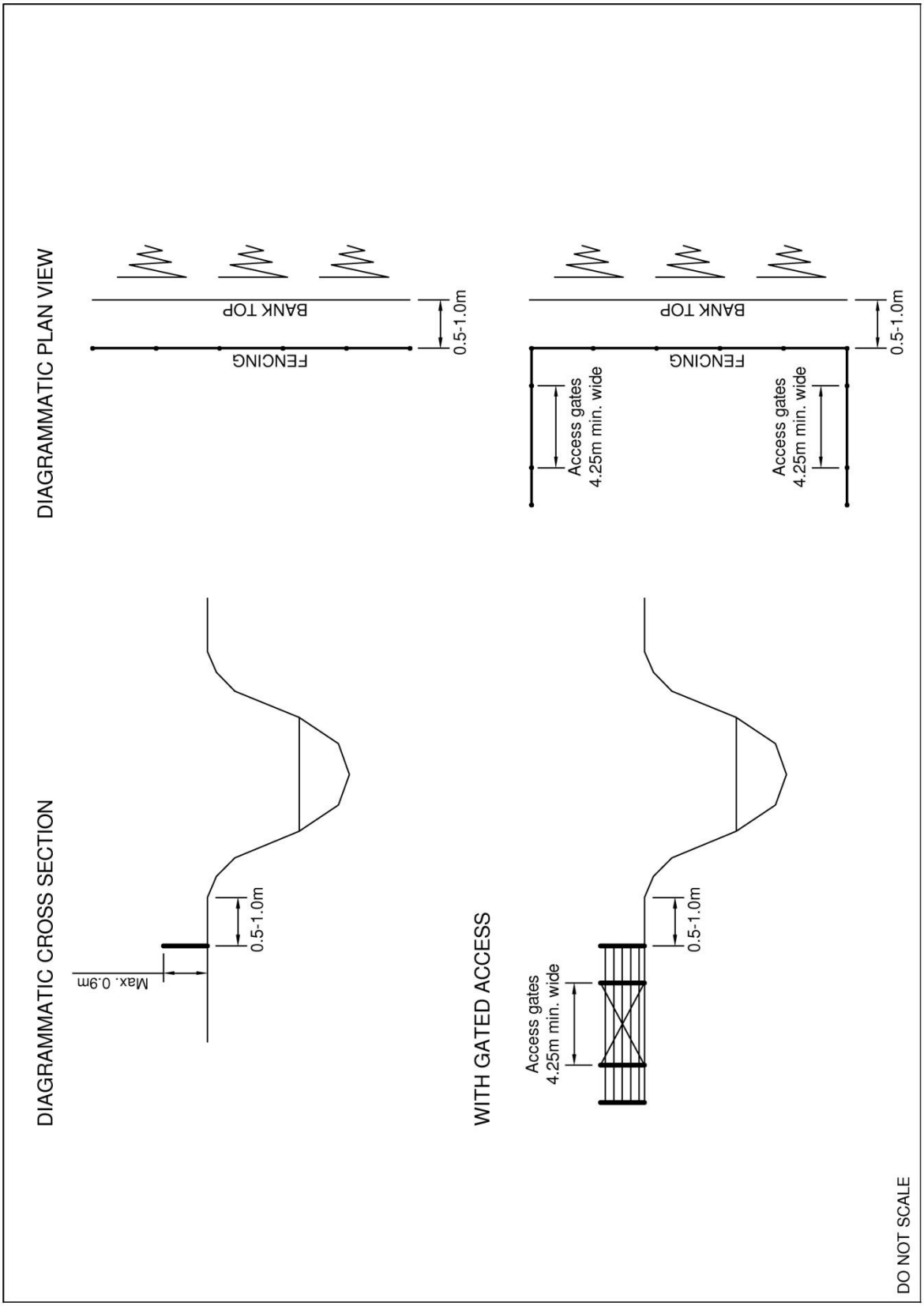
Trent Valley Internal Drainage Board – planning@tvidb.co.uk
Doncaster East Internal Drainage Board – planning@deidb.co.uk

APPENDIX A – TYPICAL FENCING CROSS SECTION



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Water Management Consortium

ADVICE NOTE
AN02:
CULVERTS AND BRIDGES

REVISION RECORD				
Version	**Date**	**Description**	**Originator**	**Checked**
	09.08.11	DRAFT	AMD	--
1	27.09.11	FINAL – BOARD APPROVED	AMD	DJS
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4	29/04/2021	Updated for WMC	LSQ	RB/DC

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BRIDGES

The Boards' Byelaw No. 17 (d) states:

No person shall without the previous consent of the Board –

(d) erect or construct or cause or permit to be erected or constructed any fence, post, pylon, wall, wharf, jetty, pier, quay, bridge, loading stage, piling, groyne, revetment or any other building or structure whatsoever in, over or across any watercourse or in or on any bank thereof;

Therefore, any person wishing to install or alter a bridge on a Board maintained watercourse will require the Boards' prior consent.

ADVICE FOR PERSONS WISHING TO BRIDGE A BOARD MAINTAINED WATERCOURSE

Clear span bridges are generally acceptable, subject to the Boards' formal consent.

The channel beneath a bridge crossing may need to be lined to prevent vegetation growth from blocking the watercourse as this area will no longer be accessible to the Boards' machinery. The bank slopes must also be protected against erosion. Full channel lining on larger watercourses may not be required as toe line protection may be acceptable.

The environmental impact of this requirement will need to be considered with mitigation for loss of habitat provided where appropriate.

A typical example is given in Appendix A.

CULVERTING OF BOARD MAINTAINED WATERCOURSES

The Boards' Byelaw No. 17 (c) states:

No person shall without the previous consent of the Board –

(c) make or cut or cause or permit to be made or cut any excavation or any tunnel or any drain, culvert or other passage for water in, into or out of any watercourse or in or through any bank of any watercourse;

CULVERTING OF RIPARIAN WATERCOURSES

Section 23 (1) of the Land Drainage Act 1991 states that:

"No person shall-

(a) erect any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or
(b) erect any culvert that would be likely to affect the flow of any ordinary watercourse or alter any culvert in a manner that would be likely to affect any such flow, without the consent in writing of the drainage board concerned."

Further guidance on ownership and responsibilities of riparian watercourses can be found on the Environment Agency's website https://www.gov.uk/guidance/owning-a-watercourse

ADVICE FOR PERSONS WISHING TO CULVERT

The Boards consider it beneficial for watercourses to remain open wherever possible for both flood risk management and environmental purposes. Culverting can exacerbate the risk of flooding and increase the maintenance requirements for a watercourse. It also destroys wildlife habitats, damages a natural amenity and disrupts watercourse connectivity for wildlife. It is therefore important that watercourses and their associated habitats are protected and enhanced for the benefit of present and future generations.

The Boards will therefore only approve an application to culvert a watercourse if there is no reasonably practicable alternative, or if the detrimental effects of culverting would be so minor that they would not justify a more costly alternative.

The Boards consider that culverting can have the following detrimental effects, which should be addressed when making an application:

- increased impact of flooding
- loss of floodwater storage
- increased likelihood of flooding due to blockage
- increased difficulties in providing for drainage connections
- difficulties in the repair, maintenance and replacement of culverts
- increased health and safety hazards

- loss of wildlife habitat and adverse effects on connectivity and wildlife habitat
- reduced groundwater recharge
- increased difficulty in detecting the origins of pollution and in monitoring water quality

The potential loss of floodwater storage, conveyance and habitats must be fully considered. Where proposals are likely to result in a loss of floodwater storage, conveyance or habitat the Boards expect appropriate mitigation measures to be provided at the applicant's expense.

Culvert pipe diameters should be as large as is reasonably practicable when considering the size of the watercourse and other nearby hydraulic structures. Larger culverts promote connectivity and are an alternative to the creation of mammal passage. Pipe diameters, lengths and invert levels should, where practical, be agreed with the Boards' Officers prior to making a formal consent application.

The culvert pipe should be bedded upon and backfilled with a granular material. A suitable upstream and downstream headwall should also be provided. Typical culvert and headwall construction details are provided in Appendix B.

The culverting of longer sections of a watercourse may require the provision of manholes to ensure accessibility. Where required, manholes should be provided:

- at changes in pipe direction
- at changes in pipe size
- at significant changes in pipe gradient
- at appropriate intervals
- with an access point with a minimum clear opening measuring 600mm square or diameter
- that are labelled with Board identification markings as agreed on Board maintained watercourses.

The Boards expect that where a culvert application is approved, the riparian owner(s) will retain ownership and responsibility for future maintenance costs. The Boards may consider adopting culverts on Board maintained watercourses subject to the payment of a commuted sum of money calculated to fund the whole life costs of the structure.

FURTHER GUIDANCE

The Water Management Consortium Boards have the following documents available:

- Consent Application Form
- Technical Guidance Notes
- Byelaws
- Planning and Byelaw Policy

The Water Management Consortium Boards have also produced a series of other advice notes including:

- AN01: Buildings, Structures, Planting and Fencing
- AN03: Environmental Considerations
- AN04: Stability of Garden Fences Close to Board Maintained Watercourses
- AN05: Service Crossings
- AN06: Surface Water

The above documents are available from the Consortium's office during normal working hours or alternatively, can be downloaded electronically from http://www.wmc-idbs.org.uk

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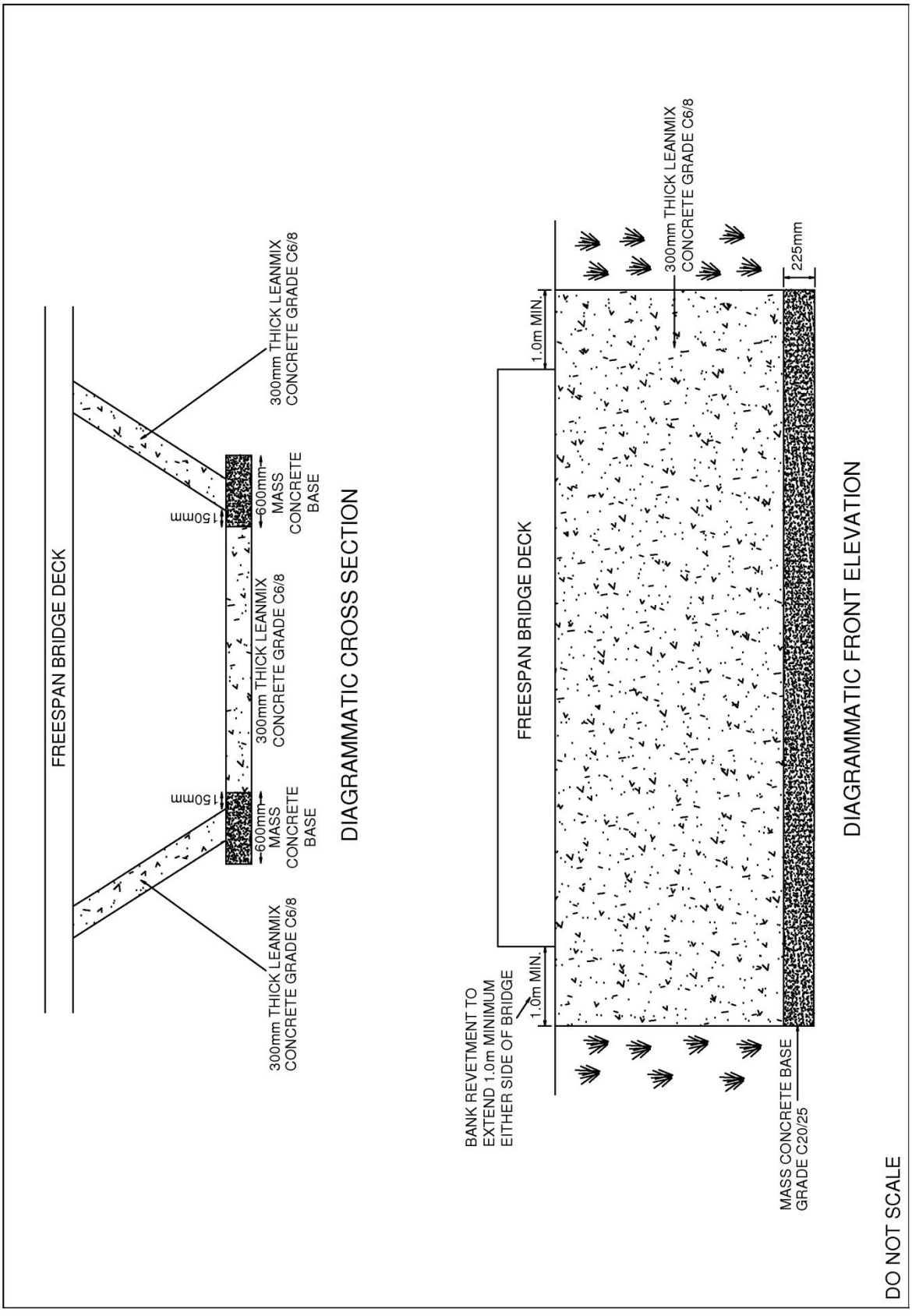
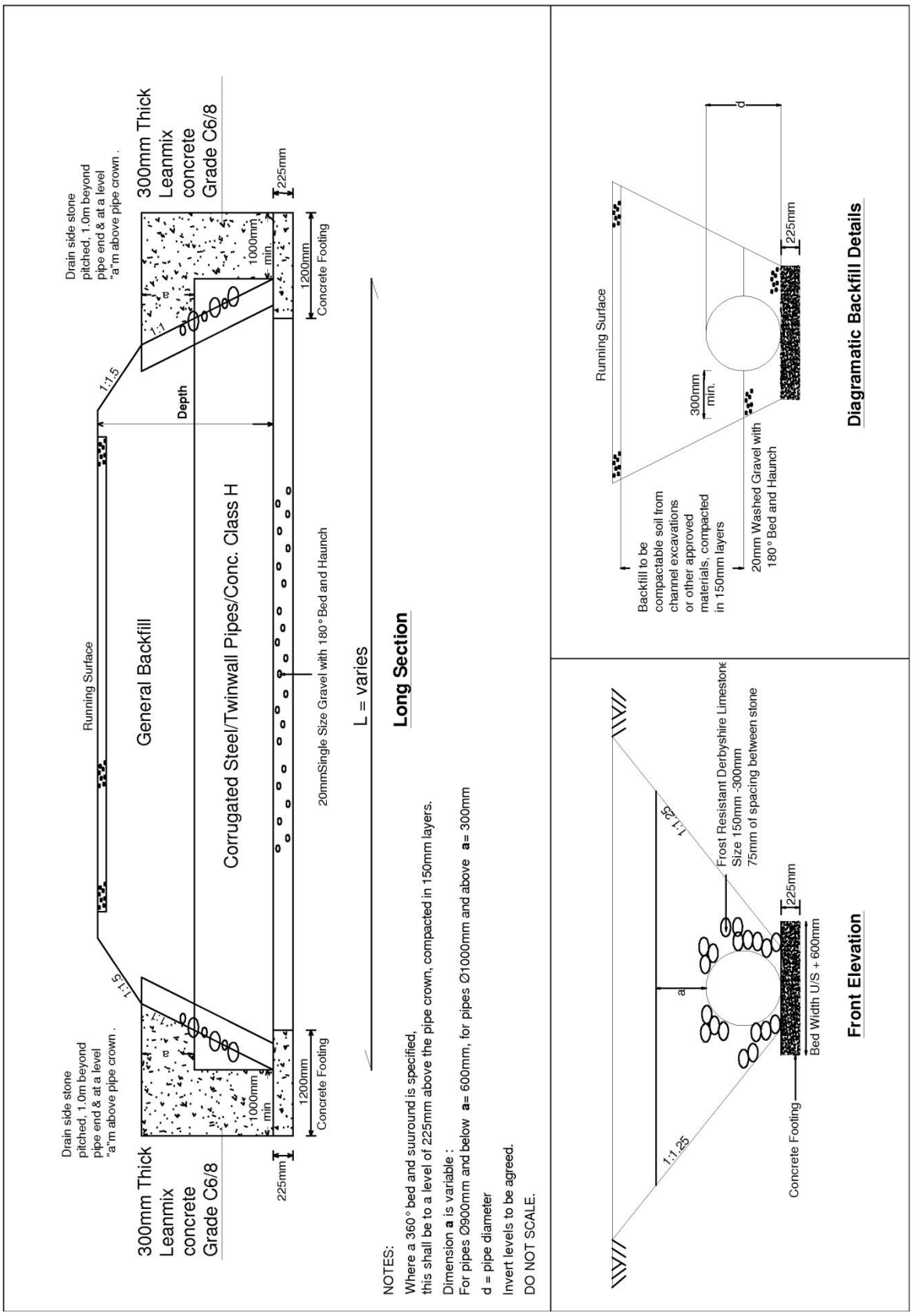
APPENDIX A – LINING OF WATERCOURSE BENEATH BRIDGES



APPENDIX B – CULVERT CONSTRUCTION DETAILS



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Water Management Consortium

ADVICE NOTE
AN05:
SERVICE CROSSINGS

REVISION RECORD				
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	09.08.11	DRAFT	AMD	--
1	27.09.11	FINAL – BOARD APPROVAL	AMD	DJS
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3	23.04.18	Amendments	TR	DJS
4	29.04.21	Updated for WMC	LSQ	RB/DC

Lindsey Marsh Drainage Board
Isle of Axholme and North Nottinghamshire Water Level Management Board
Trent Valley Internal Drainage Board
Doncaster East Internal Drainage Board

BYELAW 17 - FENCES, EXCAVATIONS, PIPES ETC

The Boards' Byelaw No. 17 states:

No person shall without the previous consent of the Board –

(a) place or affix or cause or permit to be placed or affixed any gas or water main or any pipe or appliance whatsoever or any electrical main or cable or wire in, under or over any watercourse or in, over or through any bank of any watercourse;

(b) cut, pare, damage or remove or cause or permit to be cut, pared, damaged or removed any turf forming part of any bank of any watercourse, or dig for or remove or cause or permit to be dug for or removed any stone, gravel, clay, earth, timber or other material whatsoever forming part of any bank of any watercourse or do or cause or permit to be done anything in, to or upon such bank or any land adjoining such bank of such a nature as to cause damage to or endanger the stability of the bank;

(c) make or cut or cause or permit to be made or cut any excavation or any tunnel or any drain, culvert or other passage for water in, into or out of any watercourse or in or through any bank of any watercourse;

(d) erect or construct or cause or permit to be erected or constructed any fence, post, pylon, wall, wharf, jetty, pier, quay, bridge, loading stage, piling, groyne, revetment or any other building or structure whatsoever in, over or across any watercourse or in or on any bank thereof;

(e) place or fix or cause or permit to be placed or fixed any engine or mechanical contrivance whatsoever in, under or over any watercourse or in, over or on any bank of any watercourse in such a manner or for such length of time as to cause damage to the watercourse or banks thereof or obstruct the flow of water in, into or out of such watercourse;

Provided that this Byelaw shall not apply to any temporary work executed in an emergency but a person executing any work so expected shall, as soon as practicable, inform the Boards in writing of the execution and of the circumstances in which it was executed and comply with any reasonable directions the Boards may give with regard thereto.

SERVICE CROSSINGS

Subject to the Boards' formal consent, service crossings under the bed of a watercourse may be acceptable if:

- the crossing is installed using directional drilling techniques (or similar)
- the crossing is perpendicular to the watercourse
- a minimum of 1.5 metres of cover is maintained between hard bed level and the uppermost part of the duct or protective cover. This depth should be maintained 9.0 metres each side of the watercourse
- marker posts indicating the type and depth of crossing along with emergency contact details are installed at the top edge of each bank. Marker posts must be visible at all stages of vegetation growth.

The Boards' preference is for crossings to be constructed below the bed of the watercourse and installation by directional drilling; other techniques or arrangements will be considered where directional drilling is technically or environmentally unfeasible. Crossing underneath the bed of a watercourse is preferred as;

- It avoids any impediment to flows,
- It avoids the introduction of potential hazards which may endanger the Boards' operatives and maintenance operations, and,
- It avoids disturbance to water voles and their habitat, which may require licensing by Natural England.

A typical cross section drawing showing the Boards' requirements for under crossings is provided in Appendix A.

Applications not complying with the above criteria will only be considered in exceptional circumstances. Such applications must be supported by a full written justification statement.

Overhead crossings must:

- ensure all support structures are a minimum of 9.0 metres from the bank top
- provide a minimum 10 metres vertical clearance (further details in Appendices B and C)
- ensure the crossing is perpendicular to the watercourse
- consider the use of Bird Flight Deflectors for electrical crossings

Applications for in channel crossings and where the relevant height for overhead crossings **cannot** be met must ensure the watercourse beneath the crossing is lined with concrete or provided with a culvert with low level backfill. For hazardous installations the lining or backfill must extend a minimum of 6.0 metres upstream and downstream of the crossing. For less hazardous installations a minimum of 1.0 metre upstream and downstream may be appropriate. Applicants should note this requirement may result in the loss of wildlife habitat, which would require the provision of appropriate environmental mitigation. Please see the Boards' advice note *AN03: Environmental Considerations* for further details

A typical cross section drawing showing the Boards' requirements for overhead crossings is provided in Appendices B and C.

FURTHER GUIDANCE

The Water Management Consortium Boards have the following documents available:

- Consent Application Form
- Technical Guidance Notes
- Byelaws
- Planning and Byelaw Policy

The Water Management Consortium Boards have also produced a series of other advice notes including:

- AN01: Buildings, Structures, Planting and Fencing
- AN02: Culverts and Bridges
- AN03: Environmental Considerations
- AN04: Stability of Garden Fences Close to Board Maintained Watercourses
- AN06: Surface Water

The above documents are available from the Consortium's office during normal working hours or alternatively, can be downloaded electronically from [redacted]

If you would like to discuss any of the information in this document or associated advice notes, please do not hesitate to contact the Consortium's offices using the details provided below.

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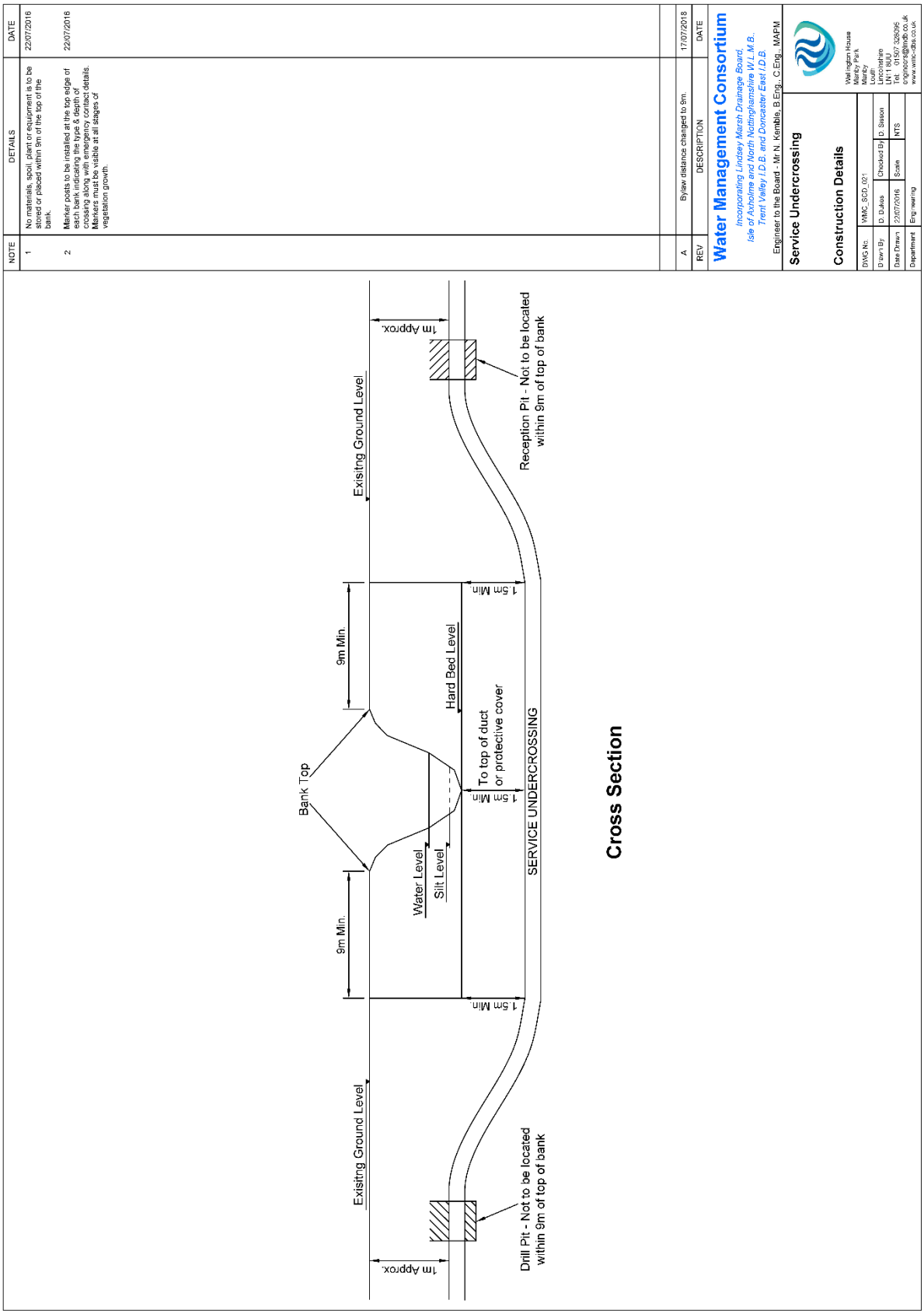
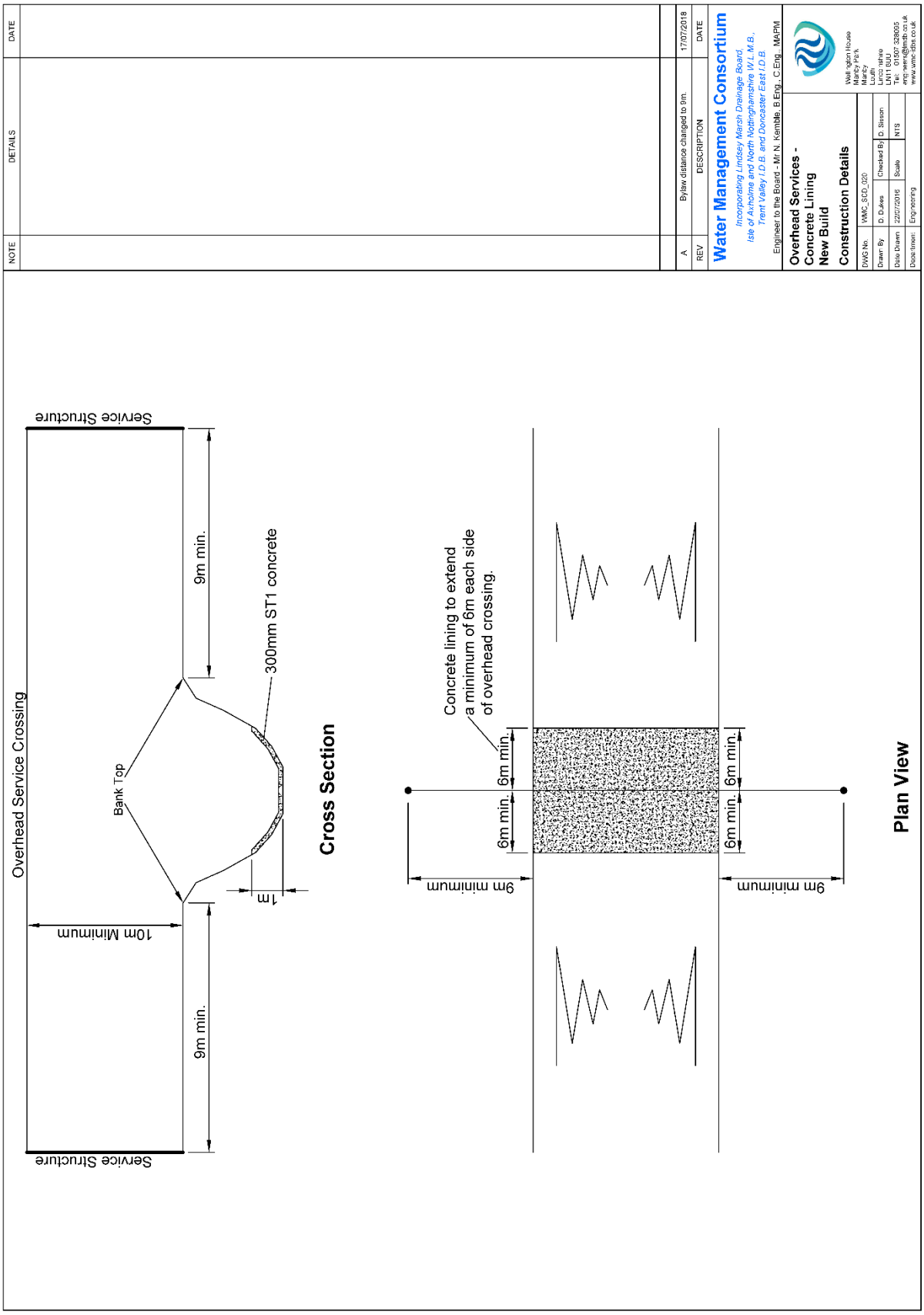
Doncaster East Internal Drainage Board – planning@deidb.co.uk

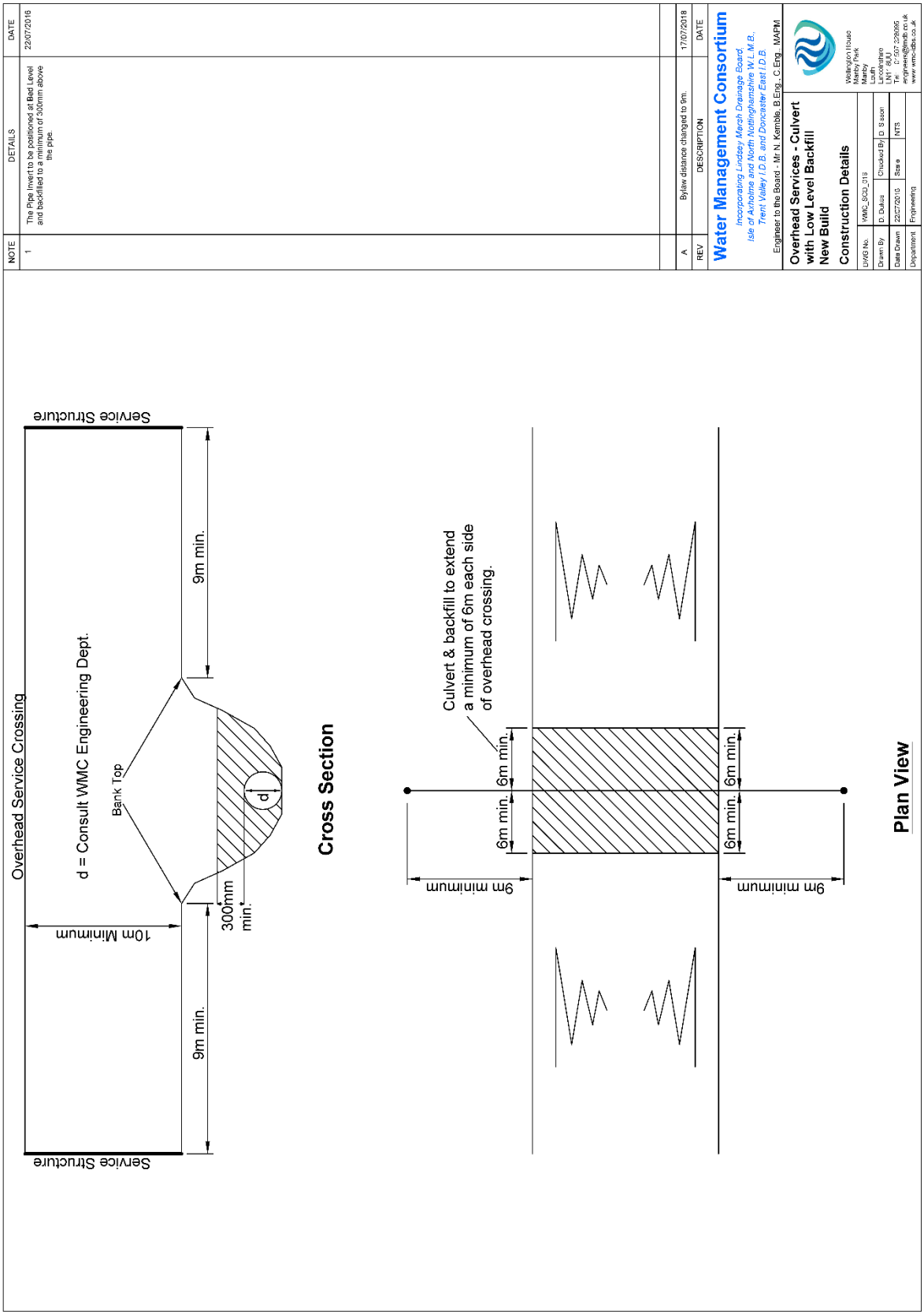
APPENDIX A – CROSS SECTION OF UNDERCROSSING



APPENDIX B – CROSS SECTION WITH CONCRETE LINING MITIGATION



APPENDIX C – CROSS SECTION WITH LOW LEVEL BACKFILL CULVERT MITIGATION



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Water Management Consortium

ADVICE NOTE
AN06:
SURFACE WATER

REVISION RECORD				
Version	**Date**	**Description**	**Originator**	**Checked**
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1	27.09.11	FINAL – BOARD APPROVAL	AMD	DJS
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4	29.04.21	Updated for WMC	LSQ	RB/DC

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BYELAW 3 - INTRODUCTION OF WATER

The Boards' Byelaw No 3 states:

"No person shall as a result of development (within the meaning of section 55 of the Town and Country Planning Act 1990 as amended ("the 1990 Act")) (whether or not such development is authorised by the 1990 Act or any regulation or order whatsoever or none of them) for any purpose by means of any channel, siphon, pipeline or sluice or by any other means whatsoever introduce any water into any watercourse in the District so as to directly or indirectly increase the flow or volume of water in any watercourse in the District (without the previous consent of the Board)."

Developers wishing to increase the flow of surface water into any open or culverted watercourse within the Boards' Districts will require the Boards' formal consent. Sites discharging to soakaways will not require the Boards' consent provided the structure is not within 9 metres of a Board maintained watercourse and no overflow is provided.

Sites discharging surface water directly to the sea or a Main River will not require the Boards' consent, but developers should contact the Environment Agency for further advice.

Agents acting for large scale developments are likely to need to consult the Boards, Lead Local Flood Authority, Environment Agency and Local Planning Authority.

The following are the Boards' general requirements in relation to the discharge of water:

DISCHARGE TO SOAKAWAYS

A method of infiltration that is only suitable in certain parts of the Boards' areas. The Boards recommend that soakaways are designed in accordance with British Research Establishment 365 (BRE Digest 365), or other recognised method. The approval of the Local Planning Authority will be required. The Boards' consent will not be required for this method of surface water disposal provided it is located a minimum of 9 metres from a Board maintained watercourse.

DISCHARGING TO A PUBLIC SURFACE WATER SEWER

Drainage systems operated by a third party that cater for surface and/or foul water. Permission will be required from the organisation responsible for the sewer, to discharge into the system at agreed rates. The Boards' consent will not be required for this type of discharge unless it will result in an increase of the flow of water within the Boards' Districts. As such, surface water development charges as detailed in the Boards' Planning and Byelaw Policy will apply.

DISCHARGING DIRECTLY TO A PRIVATE WATERCOURSE

Discharges to private watercourses within the Boards' Districts will require the prior consent of the Boards. The outfall structure itself will not require the Boards' consent but will require the landowner's permission if the land is in different ownership. The responsibility for maintaining private watercourses may rest with many individuals who will undertake maintenance to varying standards. Therefore, caution should be applied before discharging surface water from larger development sites to private watercourses.

The responsibility for future maintenance and repair of the surface water system and outfall structure must also be secured.

Increases in impermeable area within the Boards' Districts' will be subject to a surface water development charge as detailed in the Boards' Planning and Byelaw Policy.

DISCHARGING DIRECTLY TO A BOARD MAINTAINED WATERCOURSE

Discharges to Board maintained watercourses will require the prior consent of the Boards to be obtained for the discharge rate and outfall structure. Sites in close proximity to Board maintained watercourses may benefit from a direct connection to a watercourse that is assured a good standard of maintenance.

Increases in impermeable area within the Boards' Districts' will be subject to a surface water development charge as detailed in the Boards' Planning and Byelaw Policy.

SURFACE WATER DISCHARGE RATES

The Boards recognise the agricultural runoff rate of 1.4 litres per second per hectare. Developers wishing to discharge at rates in excess of this must contact the Boards' Officers at the earliest opportunity.

The Boards acknowledge a practical minimum achievable controlled discharge rate of 3.0 litres per second. Increases in discharge rates over and above the 1.4 litres per second per hectare will attract greater surface water development charges however, acceptance of discharge rates in excess of 1.4 litres per second per hectare is not guaranteed.

OUTFALL STRUCTURES

Subject to the Boards' formal consent, outfall structures will be acceptable provided:

- An approved recessed headwall and spillway are specified,
- The last 2.0 metres of conduit to the outfall are a continuous manufactured length of material. Where a connection is required, the pipes must be rigidly jointed and sealed for a distance of 2.0 metres before the outfall,
- The outfall structure must not protrude beyond the profile of the batter of the bank, and
- The position of the outfall structure is to be indicated by a suitable marker post, which is visible at all stages of vegetation growth.

DISCHARGE OF TREATED FOUL WATER

The principle of discharging treated foul water to private or Board maintained watercourses must first be agreed with the Environment Agency in consultation with the Board. If this agreement can be reached the Board is likely to accept the flows provided they do not exceed specified rates alone, or in combination with surface water discharges. The Boards require evidence of consented effluent quality characteristics including combined sewer overflow consents.

RAINFALL HARVESTING

The Boards encourage the use of rainwater harvesting. However, the storage used for rainfall shall be separate from, nor used to reduce, the storage required for attenuation. The rainwater harvesting tanks are to be no closer than 9 metres of a Board maintained watercourse.

FURTHER GUIDANCE

The Water Management Consortium Boards have the following documents available:

- Consent Application Form
- Technical Guidance Notes
- Byelaws
- Planning and Byelaw Policy

The Water Management Consortium Boards have also produced a series of other advice notes including:

- AN01: Buildings, Structures, Planting and Fencing
- AN02: Culverts and Bridges
- AN03: Environmental Considerations
- AN04: Stability of Garden Fences Close to Board Maintained Watercourses
- AN05: Service Crossings

The above documents are available from the Consortium's office during normal working hours or alternatively, can be downloaded electronically from [redacted]

If you would like to discuss any of the information in this document or associated advice notes, please do not hesitate to contact the Consortium's offices using the details provided below.

WATER MANAGEMENT CONSORTIUM
WELLINGTON HOUSE
MANBY PARK
LOUTH
LINCOLNSHIRE
LN11 8UU

Telephone: 01507 328095

Email;

Lindsey Marsh Drainage Board - planning@lmdb.co.uk
Isle of Axholme and North Nottinghamshire Water Level Management Board – planning@ioadb.co.uk
Trent Valley Internal Drainage Board – planning@tvidb.co.uk
Doncaster East Internal Drainage Board – planning@deidb.co.uk

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WATER MANAGEMENT CONSORTIUM
WELLINGTON HOUSE
MANBY PARK
LOUTH
LINCOLNSHIRE
LN11 8UU

Telephone: 01507 328095

Water Management Consortium

Office Use Only	
Reference	
Date Received	
Fee	
Fee Received	
Date Validated	
IDB	

Application for Land Drainage Consent

For assistance in completing this form please refer to our Technical Guidance Notes available online (www.wmc-idbs.org.uk) or telephone 01507 328095. Full details on application fees are included in the Boards' Planning and Byelaw Policy which is also available on the Boards' website.

1. Applications Details

Name	
Registered / Company Name	
Company Registration No	
Address	
Postcode	
Telephone	
Email	

2. Agent's Details

Name	
Address	
Postcode	
Telephone	
Email	

3. Location of Proposed Works (please include a location plan with your application)

Address		
Postcode		
Parish/Town		
District/Borough		
Grid Reference	6 Figure Easting	
	6 Figure Northing	
Postcode		
Telephone		
Email		
Watercourse Name		

4. Description of the Proposed Works (*please include a location plan with your application)*

Detailed description of the proposed works	
Are the works	Permanent ☐ Temporary ☐
If temporary, duration of consent requested	
Planning Application No.	
Planning Authority	
If the Applicant is not the owner please provide confirmation that the owner supports the application	
Are the proposed works to be undertaken at the boundary of the applicant's holding?	Yes ☐ No ☐
If the application relates to work on a riparian boundary you are advised to discuss the proposal with the adjacent land owner.	

Plans and Sections

Details of all supporting plans and sections must be provided. Continue on a separate sheet if needed.

Please see the guidance notes for further information.

Drawing Title / Description	Drawing Number	Revision Number	Date
Site Location Plan *			
Existing Site Plan *			
Cross Section Drawing *			

**These drawings are required to be supplied as part of any application.*

Do the works include (tick all that apply)		
Application under Section 23 of the Land Drainage Act 1991 to alter a riparian watercourse	☐	➔ Complete section 5 and add £50.00 to fee
Application for consent under the Boards' Byelaws (usually 4, 10 and 17)	☐	➔ Complete section 5 & 6 (as applicable) and add £100.00 to fee
Application to install land drainage outfalls into a Board maintained watercourse	☐	➔ Complete section 7 and add £100.00 to fee
Application to discharge surface water to a watercourse	☐	➔ Complete section 8 and add £200.00 to fee
Application to discharge treated foul water to a watercourse	☐	➔ Complete section 9 and add £200.00 to fee
Please note fees are charged on a per structure / watercourse basis	Total Application Fee	£

5. Works to alter a watercourse (including infilling, culvert or amending

Do the works include					
(a)	Culverting a watercourse (with a pipe)	☐	Using what diameter pipe?		Millimetres (mm)
			For what length?		Meters (m)
			Is the culvert required for access?		Yes ☐ No ☐
(b)	Infilling a watercourse (without a pipe)	☐	For what length?		Meters (m)
(c)	Other alteration to a watercourse	☐	Please explain:		
(d)	Drawing number(s) showing works	☐			

5. Works within 9 metres of a Board maintained watercourse or other drainage or flood risk management infrastructure

(a)	What is the watercourse name / code of the IDB watercourse affected (if known)?	
(b)	What is the IDB catchment code for the IDB watercourse affected?	
(c)	Drawing number(s) showing works within 9 metres:	

7. Installation of land drainage outfalls into Board maintained watercourses

(a)	What is the watercourse name / code of the IDB watercourse affected (if known)?	
(b)	Number of land drainage outfalls proposed	
(c)	Diameter of land drainage pipe/s	
(d)	Drawing numbers showing land drainage outfall/s detail and plan of proposed work	
(e)	OS Field No/s of all fields where works are to be undertaken	

8. Discharge of surface water into Board's district (directly or indirectly)

(a)	Is the proposed discharge making use of an existing outfall?	Yes ☐ No ☐	
(b)	If yes, how do you intend to connect to the existing outfall?		
(c)	If no, how do you intend to connect to the watercourse?		
(d)	Drawing number(s) showing discharge arrangement:		
(e)	What is the size (diameter) of the proposed or existing outfall		Millimetres (mm)
(f)	What is the proposed maximum rate of discharge?		Cubic metres (l/s)
(g)	What is the area of impermeable surface positively drained to the watercourse prior to development?		Square metres (m^2)
(h)	What is the proposed area of impermeable surface to be positively drained to the watercourse post development?		Square metres (m^2)

Please Note: If you are using multiple outfalls, please provide the required outfall size and location for each outfall point.

9. Discharge of treated foul water within the Board's district

(a)	Is the proposed discharge making use of an existing outfall?	Yes ☐ No ☐	
(b)	If yes, how do you intend to connect to the existing outfall? (please provide a drawing and details)		
(c)	If no, how do you intend to connect to the watercourse? (please provide a drawing and details)		
(d)	Drawing number(s) showing discharge arrangement		
(e)	What is the size (diameter) of the proposed or existing outfall?		Millimetres (mm)
(f)	What is the proposed maximum daily rate of discharge?		Cubic metres (m^3)

10. Future responsibility of the works

Details of person/organisation responsible for maintaining the works during construction

Contact Name	
Address	
Email	
Telephone	

Details of person/organisation responsible for maintaining the works following construction

Contact Name	
Address	
Email	
Telephone	

11. Environmental considerations

The Boards have a legal duty to protect and improve the environment. The effect that proposed works may have upon the environment must therefore be considered.

Please provide details of the effect the proposed works will have on the environment together with any measures you intend to implement to offset any negative environmental impacts in the box below.

Please note that works involving bank disturbance (e.g. temporary construction activities, culverting, dewatering etc) is highly likely to have an impact upon protected species and protected habitat. In these circumstances the Board recommend an environmental appraisal is undertaken by a suitably qualified ecologist.

Further information is available in the Board's Advice Note AN03: Environmental Considerations.

Please contact the Boards if you are unsure about this section or consider this section does not apply to your works.

In some cases, providing photographs may assist the Boards in determining the level of environmental appraisal necessary.

Enter text.

12. Declaration

Please read through this list and tick the items you are sending with this application

Completed Form with any other supporting documents including site plans	
Relevant Application Fee	
Environmental/Ecological Reports	

By signing below you are declaring that, as far as you know, the information given in this application, including the map and any supporting documents, is true.

SIGNATURE	
NAME	
COMPANY NAME (if applicable)	
POSITION (if on behalf of a company, group of individuals or public body)	
DATED	

13. Data Protection

Data Protection

The Board will process the information you provide in line with current legislation. A Privacy Notice is available on the Boards' website detailing how the Boards use this information, who we share it with and how long it will be kept.

Please be aware that the Boards are subject to the Freedom of Information Act 2000 and the Environmental Information Regulations 2004 and may be required to release some information if requested to do so under these acts.

14. Submitting your Application and Payment Method

All applications may be submitted by post to the Consortium's Offices, Wellington House, Manby Park, Manby, LOUTH, Lincolnshire, LN11 8UU.

Applications may also be submitted via email to the respective Board, details below;

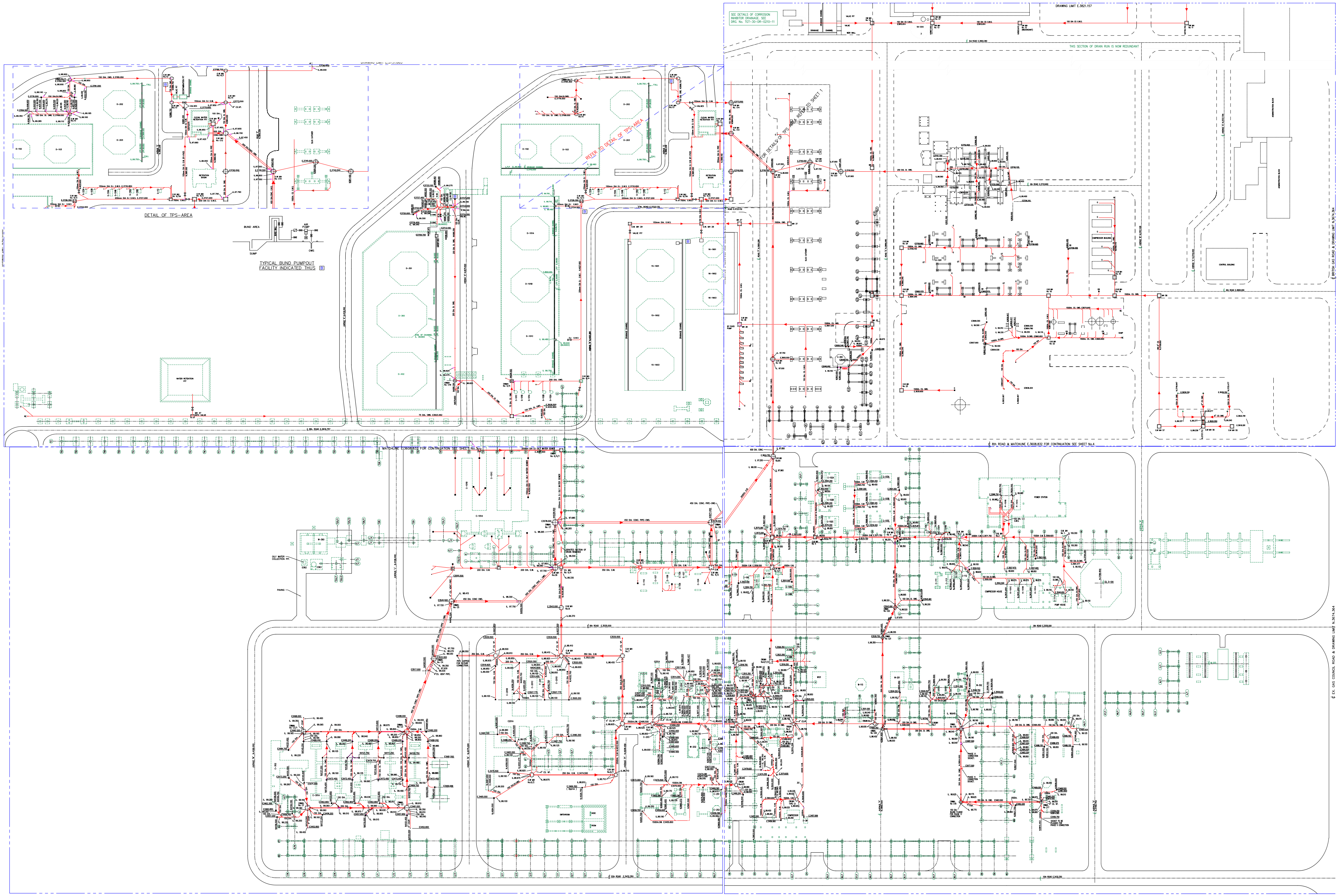
Lindsey Marsh Drainage Board – planning@lmdb.co.uk
Isle of Axholme and North Nottinghamshire Water Level Management Board – planning@ioadb.co.uk
Trent Valley Internal Drainage Board – planning@tvidb.co.uk
Doncaster East Internal Drainage Board – planning@deidb.co.uk

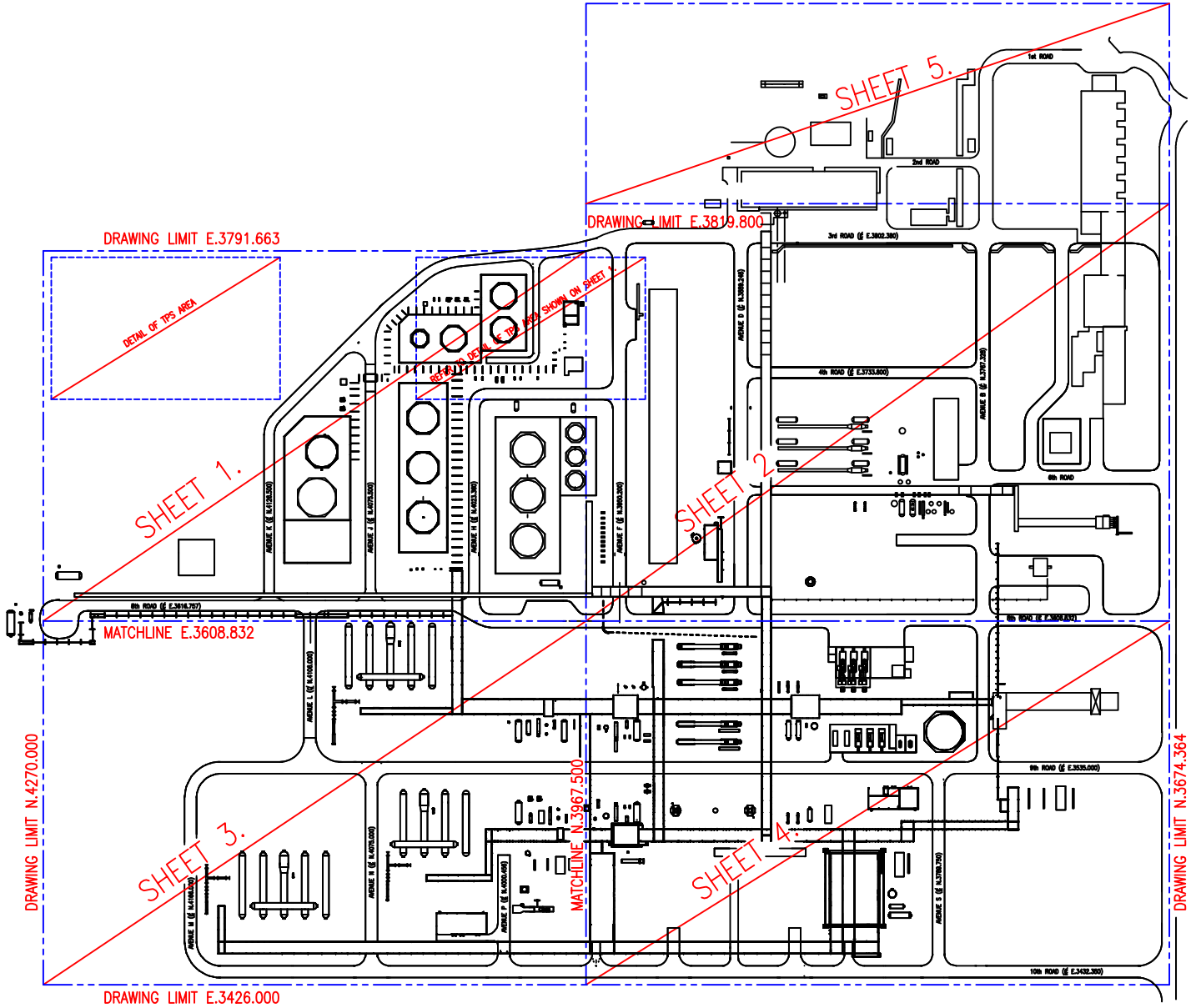
Payment Method

Cheque	☐	Payable to respective Board
Card	☐	Please telephone the Consortium's Offices on 01507 328095 – Please ensure you state the applicant/s name and the site location
BACs	☐	Please contact the Consortium's Offices on 01507 328095

Please do not attempt to make payment of your application fee until you have received an acknowledgement of your application containing a unique file reference. <u>This reference should be quoted when making payment</u>.

Annex E – Theddlethorpe Existing Drainage


DETAIL OF TPS-AREA
TYPICAL BUND PUMPOUT FACILITY INDICATED THUS
REFER TO DETAIL OF TPS-AREA



REFERENCE DRAWINGS	REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
ENTIRE SITE O.W DRAINAGE SYSTEM SHEET 1.- TGT-30-DR-112-02							
ENTIRE SITE O.W DRAINAGE SYSTEM SHEET 2.- TGT-30-DR-112-03							
ENTIRE SITE O.W DRAINAGE SYSTEM SHEET 3.- TGT-30-DR-112-04							
ENTIRE SITE O.W DRAINAGE SYSTEM SHEET 4.- TGT-30-DR-112-05							
ENTIRE SITE O.W DRAINAGE SYSTEM SHEET 5.- TGT-30-DR-112-16							
	1	JUNE/98	TD	TD	REVISED TO INCLUDE SHEET.5.		
	0	18/12/97	NZ	WRP	ISSUED FOR INFORMATION	WRP	DM

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THEDDLETHORPE GAS TERMINAL

TITLE: TGT DOCUMENTATION UPGRADE PROJECT
ENTIRE SITE OILY WATER DRAINAGE SYSTEM
KEY PLAN

Drn	Date	Scale	Chk	App
NZ	18/12/97	N.T.S.	WRP	DM

Project: 6589

Drawing No.: TGT-30-DR-114-01 | 1

(PC) CAD FILE : 6589/TGT11401

Xref: TGTBACK.DWG

DRAWING LIMIT E.3791.663

DRAWING LIMIT N.4270.000

MATCHLINE N.3967.500 FOR CONTINUATION SEE SHEET No.2

MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.3

REFER TO DETAIL OF TPS-AREA

DETAIL OF TPS-AREA

TYPICAL BUND PUMPOUT FACILITY INDICATED THUS [B]

BUND AREA
BUND WALL
AIR PUMP
SUMP
OWS

NOTES.

1. THIS DRAWING REPLACES TGT(603)-30-DR-112-02.

KEY PLAN – TGT-30-DR-114-01
SHEET 2 – TGT-30-DR-114-03
SHEET 3 – TGT-30-DR-114-04
SHEET 4 – TGT-30-DR-114-05
SHEET 5 – TGT-30-DR-114-16

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
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2	JUNE/99	TD	TD	REVISED TO INCLUDE ALL PROJECTS COMPLETED TO DATE		
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1	4/12/98	DP	WRP	REVISED AS BUILT	WRP	DM
0	13/8/97	NZ	KI	ISSUED FOR INFORMATION	KI	

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THEDDLETHORPE GAS TERMINAL

TITLE: TGT DOCUMENTATION UPGRADE PROJECT
ENTIRE SITE OILY WATER DRAINAGE SYSTEM
SHEET 1 OF 5

Drn N.Z. | Date 13/8/97 | Scale 1:400 | Chk K.I. | App

Project 6589 | Drawing No. TGT-30-DR-114-02 | 3

(PC) CAD FILE: 6589/TGT11402

SEE DETAILS OF CORROSION INHIBITOR DRAINAGE. SEE DRG. No. TGT-30-DR-0210-11

DRAWING LIMIT E.3821.157

THIS SECTION OF DRAIN RUN IS NOW REDUNDANT

MATCHLINE N.3967.500 FOR CONTINUATION SEE SHEET No.1

℄ 8th ROAD & MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.4

DRAWING LIMIT N.3674.364

FOR DETAILS OF TPS AREA REFER TO SHEET 1

NOTES.

1. THIS DRAWING REPLACES TGT(603)-30-DR-112-03

KEY PLAN – TGT-30-DR-114-01

SHEET 1 – TGT-30-DR-114-02

SHEET 3 – TGT-30-DR-114-04

SHEET 4 – TGT-30-DR-114-05

SHEET 5 – TGT-30-DR-114-16

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
3	OCT/02	PJB	KR	MODIFIED UNDER P402026.50		
2	JUNE/99	TD	TD	REVISED TO INCLUDE ALL PROJECTS TO DATE.	SFW	
1	4/12/98	DP	WRP	REVISED AS BUILT	WRP	DM
0	30/7/97	NZ	KI	ISSUED FOR INFORMATION	KI	NJH

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THEDDLETHORPE GAS TERMINAL

TITLE: TGT DOCUMENTATION UPGRADE PROJECT

ENTIRE SITE OILY WATER DRAINAGE SYSTEM SHEET 2 OF 5

Drn	Date	Scale	Chk	App
NZ	30/7/97	1:400	K.I.	NJH

Project 6589

Drawing No. TGT-30-DR-114-03

3

(PC) CAD FILE: 6589/TGT11403

SEE DETAILS OF CORROSION INHIBITOR DRAINAGE. SEE DRG. No. TGT-30-DR-0210-11

DRAWING LIMIT E.3821.157

THIS SECTION OF DRAIN RUN IS NOW REDUNDANT

MATCHLINE N.3967.500 FOR CONTINUATION SEE SHEET No.1

℄ 8th ROAD & MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.4

DRAWING LIMIT N.3674.364

FOR DETAILS OF TPS AREA REFER TO SHEET 1

NOTES.

1. THIS DRAWING REPLACES TGT(603)-30-DR-112-03

KEY PLAN – TGT-30-DR-114-01

SHEET 1 – TGT-30-DR-114-02

SHEET 3 – TGT-30-DR-114-04

SHEET 4 – TGT-30-DR-114-05

SHEET 5 – TGT-30-DR-114-16

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
3	OCT/02	PJB	KR	MODIFIED UNDER P402026.50		
2	JUNE/99	TD	TD	REVISED TO INCLUDE ALL PROJECTS TO DATE.	SFW	
1	4/12/98	DP	WRP	REVISED AS BUILT	WRP	DM
0	30/7/97	NZ	KI	ISSUED FOR INFORMATION	KI	NJH

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THEDDLETHORPE GAS TERMINAL

TITLE: TGT DOCUMENTATION UPGRADE PROJECT

ENTIRE SITE OILY WATER DRAINAGE SYSTEM SHEET 2 OF 5

Drn	Date	Scale	Chk	App
NZ	30/7/97	1:400	K.I.	NJH

Project 6589

Drawing No. TGT-30-DR-114-03

3

(PC) CAD FILE: 6589/TGT11403

MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.1

DRAWING LIMIT N.4270.000

MATCHLINE N.3967.500 FOR CONTINUATION SEE SHEET No.4

DRAWING LIMIT E.3426.000

AVENUE 'L' N.4106.000

AVENUE 'M' N.4075.000

AVENUE 'N' N.4058.586

4 9th ROAD E.3535.000

4 10th ROAD E.3432.350

200mm DIA D.I OILY WATER SEWER E.3607.500

OWMH. No 6/4/1

250mm DIA D.I OILY WATER SEWER

150mm DIA D.I OILY WATER SEWER N.4020.000

450 DIA. CONC. PIPE-OWS.

OWMH. No C7

OWMH. No C8

DENOTES SECTION OF DRAIN REMOVED

EX. MH No 6/4

O.W MH No.6/3

O.W MH No. 6/2

O.W MH No.C8

O.W MH No.9.

OWMH. No C5

OWMH. No C4

O.W MH No.8

O.W MH No.7

O.W MH No.6

O.W MH No.6/6

O.W MH No.6/2

O.W MH No.6/7

O.W MH No.5

OWMH. No C3/1

OWMH. No C3

OWMH. No C1

OWMH. No C2

W-360

OILY WATER COLLECTION PIT.

PAVING

C-101A

C-101B

C-101C

C-302

C-301A

C-201A

C-201B

C-201C

SWITCHROOM

NODE ROOM

PIPE CAPPED FOR FUTURE CONNECTION

4" CS. VENT PIPE.

4" CS. VP.

450 DIA. CONC. PIPE-OWS.

450 DIA. CONC PIPE-OWS.

450 DIA. CONC. PIPE - OWS.

450 DIA. CONC. PIPE - OWS

450 DIA. CONC OWS.

350 DIA. O.W.

350 DIA.O.W.

350 DIA.OWS.

350 DIA. O.W. E.3523.250

350 DIA. O.W. E.3474.500

350 DIA. O.W. E.3495.500

350 DIA. O.W. N.4012.500

350 DIA. O.W. N.4058.586

200 DIA. O.W.

200 DIA.

150 DIA. O.W.

150 DIA.

150 DIA.OWS

150DIA.O.W.

100 DIA.

2500A O.W. N.4058.586

2500A O.W. N.4012.500

NOTES.

1) THIS DRAWING REPLACED TGT-30-DR-112-04.

KEY PLAN - TGT-30-DR-114-01
SHEET 1 - TGT-30-DR-114-02
SHEET 2 - TGT-30-DR-114-03
SHEET 4 - TGT-30-DR-114-05
SHEET 5 - TGT-30-DR-114-16

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
1	JUNE/99	TD	TD	REVISED TO INCLUDE ALL PROJECTS TO DATE.		
0	21/8/97	NZ	KI	ISSUED FOR INFORMATION	KI	MC

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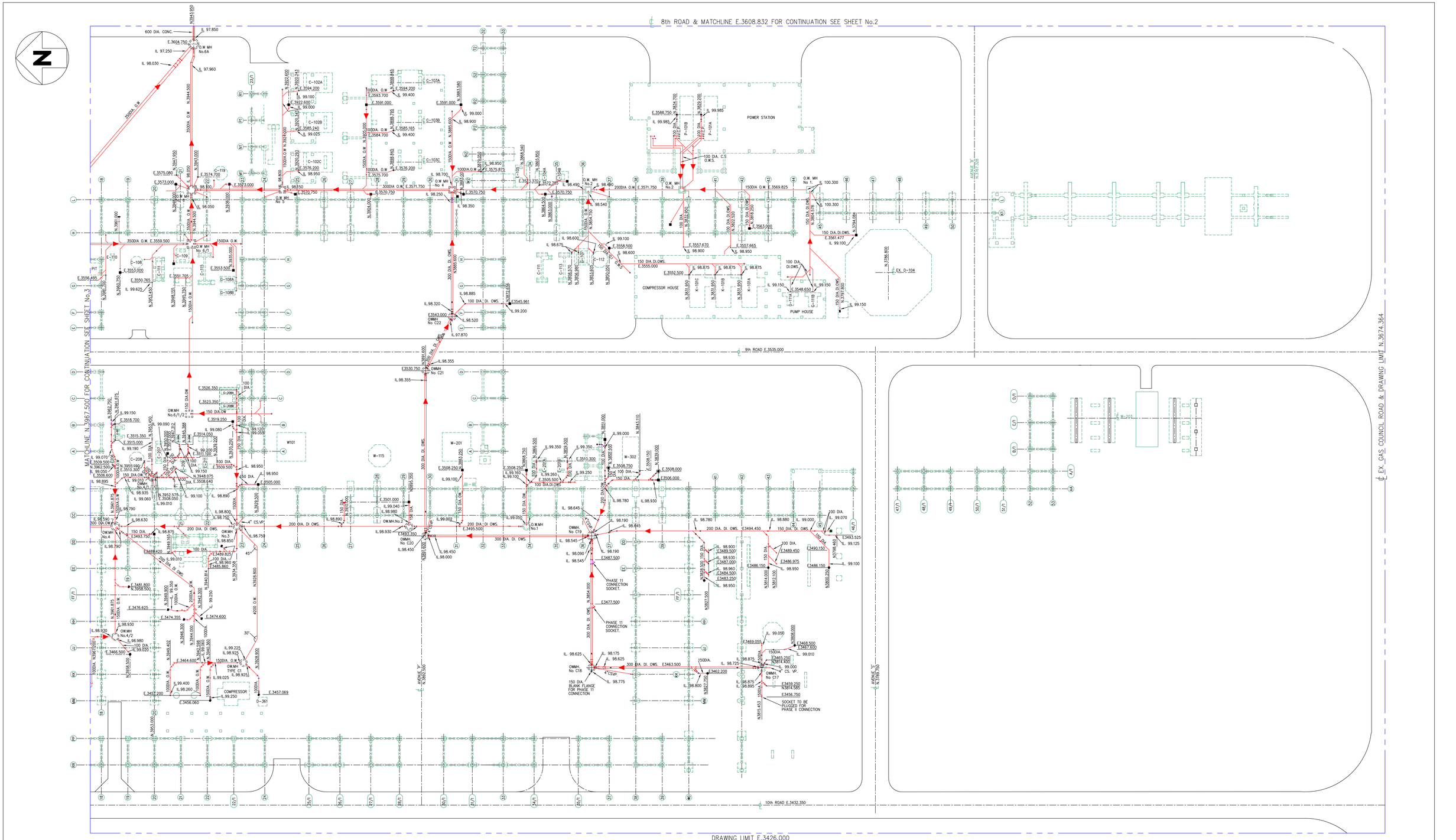
THEDDLETHORPE GAS TERMINAL

TITLE TGT DOCUMENTATION UPGRADE PROJECT

ENTIRE SITE OILY WATER DRAINAGE SYSTEM
SHEET 3 OF 5

Drn	Date	Scale	Chk	App
NZ	21/8/97	1:400	KI	MC

Project	Drawing No.	
6589	TGT-30-DR-114-04	1



NOTES.

1) THIS DRAWING REPLACES TGT-30-DR-112-05.

KEY PLAN – TGT-30-DR-114-01
SHEET 1 – TGT-30-DR-114-02
SHEET 2 – TGT-30-DR-114-03
SHEET 3 – TGT-30-DR-114-04
SHEET 5 – TGT-30-DR-114-16

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
1	JUNE/99	TD	TD	REVISED TO INCLUDE ALL PROJECTS TO DATE.		
0	21/8/97	NZ	KI	ISSUED FOR INFORMATION	KI	MC

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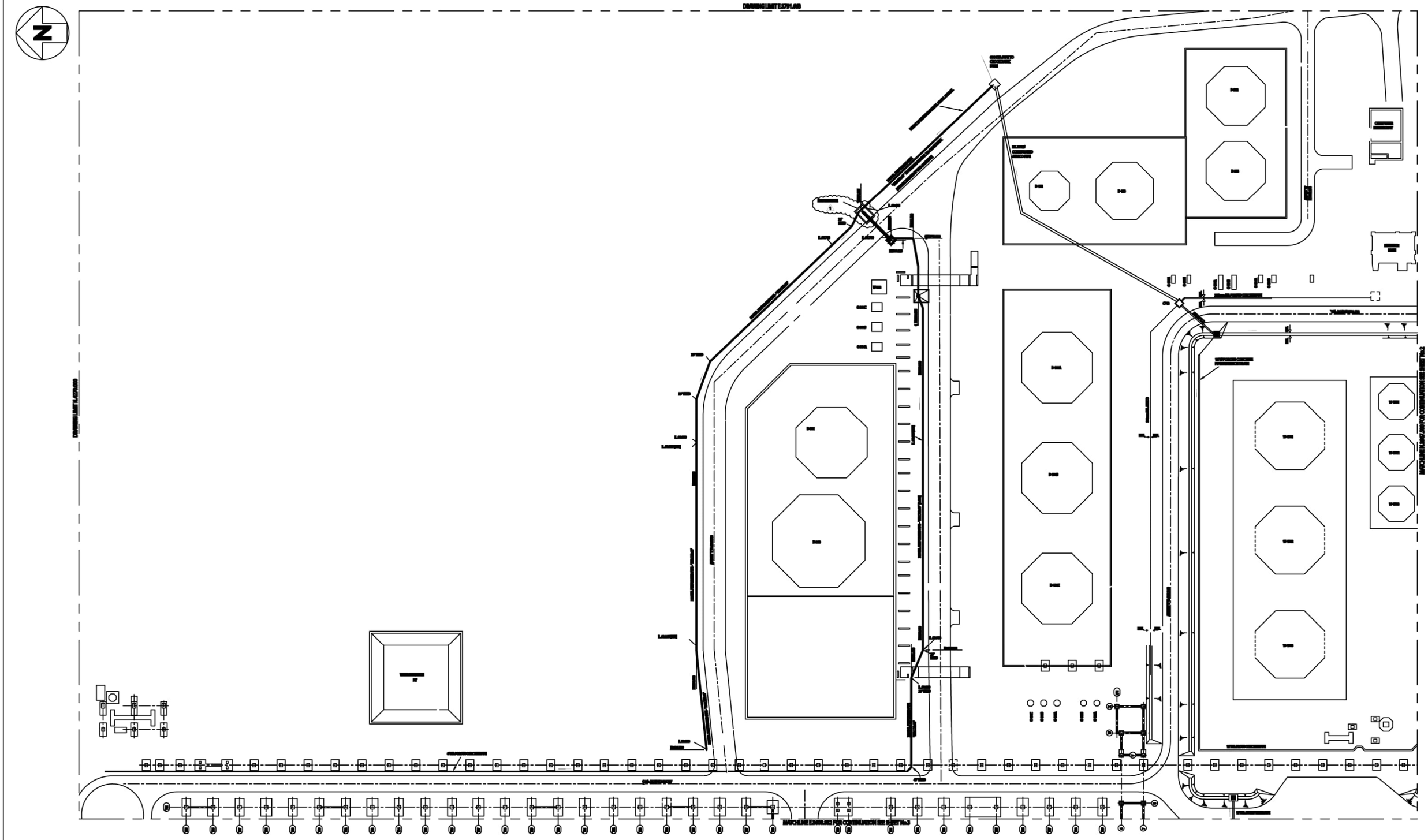
THEDDLETHORPE GAS TERMINAL

TITLE: TGT DOCUMENTATION UPGRADE PROJECT
ENTIRE SITE OILY WATER DRAINAGE SYSTEM
SHEET 4 OF 4

Drn	Date	Scale	Chk	App
NZ	21/8/97	1:400	KI	MC

Project: 6589

Drawing No.: TGT-30-DR-114-05 | 1



NOTES.

1. THIS DRAWING REPLACES TGT(90)-30-DR-113-12

KEY PLAN - TGT-30-DR-114-11
SHEET 2 - TGT-30-DR-114-13
SHEET 3 - TGT-30-DR-114-14
SHEET 4 - TGT-30-DR-114-15

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
1	26/02/98	PB	RR	OUTFALL 9 MODIFICATION UNDER P/97/02287	SPW	
0	30/11/97	JW	WRP	ISSUED FOR INFORMATION	WRP	DM

CONOCO (UK) LTD

THEDDLETHORPE GAS TERMINAL

TITLE: TGT DOCUMENTATION UPGRADE PROJECT (603)
ENTIRE SITE LAND DRAINAGE SYSTEM
SHEET 1 OF 4

Dm	JRE	Date	Sept.96	Scale	1:400	Chk	WRP	App	DM

Project: 6589
Drawing No.: TGT-30-DR-114-12
1

P:\CAD FILES\6589\TGT114-12

DRAWING LIMIT E.3819.800

MATCHLINE N.3967.500 FOR CONTINUATION SEE SHEET No.1

© BRITISH GAS ROAD & DRAWING LIMIT N.3674.364

© 8th ROAD & MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.4

NOTES:

1. THIS DRAWING REPLACES TGT(603)-30-DR-112-13

KEY PLAN - TGT-30-DR-114-11
SHEET 1 - TGT-30-DR-114-12
SHEET 3 - TGT-30-DR-114-14
SHEET 4 - TGT-30-DR-114-15

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
0	26/11/97	JW	WRP	ISSUED FOR INFORMATION	WRP	

CONOCO (UK) LTD

THEDDLETHORPE GAS TERMINAL

TITLE TGT DOCUMENTATION UPGRADE PROJECT
ENTIRE SITE LAND DRAINAGE SYSTEM
SHEET 2 OF 4

Drn	Date	Scale	Chk	App
JRE	Sept.96	1:400	WRP	

Project	Drawing No.	
6589	TGT-30-DR-114-13	0

MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.1

DRAWING LIMIT N.4270.000

MATCHLINE N.3987.500 FOR CONTINUATION SEE SHEET No.4

DRAWING LIMIT E.3426.000

NOTES.

1. THIS DRAWING REPLACES TGT(603)-30-DR-112-14

KEY PLAN - TGT-30-DR-114-11
SHEET 1 - TGT-30-DR-114-12
SHEET 2 - TGT-30-DR-114-13
SHEET 4 - TGT-30-DR-114-15

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
0	20/11/97	JW	WRP	ISSUED FOR INFORMATION	WRP	

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TITLE TGT DOCUMENTATION UPGRADE PROJECT (603)

ENTIRE SITE LAND DRAINAGE SYSTEM
SHEET 3 OF 4

Drn JRE	Date Sept 96	Scale 1:400	Chk WRP	App
Project 6589	Drawing No. TGT-30-DR-114-14			0

8th ROAD & MATCHLINE E.3608.832 FOR CONTINUATION SEE SHEET No.2

MATCHLINE N.3967.500 FOR CONTINUATION SEE SHEET No.3

EX. GAS COUNCIL ROAD & DRAWING LIMIT N.3674.364

DRAWING LIMIT E.3426.000

NOTES.

1 THIS DRAWING REPLACES TGT(603)-30-DR-112-15

KEY PLAN – TGT-30-DR-114-11
SHEET 1 – TGT-30-DR-114-12
SHEET 2 – TGT-30-DR-114-13
SHEET 3 – TGT-30-DR-114-14

REFERENCE DRAWINGS

REV	DATE	BY	CHKD	DESCRIPTION	LE APP	PE APP
0	26/6/97	JW	MRP	ISSUED FOR INFORMATION	MRP	

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TITLE TGT DOCUMENTATION UPGRADE PROJECT (603)
ENTIRE SITE LAND DRAINAGE SYSTEM
SHEET 4 OF 4

Drn JRE	Date Sept.96	Scale 1:400	Chk MRP	App

Project 6589

Drawing No. TGT-30-DR-114-15 0

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